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Remedial Investigation Report

New River Unit (RAAP-044)

BDDT, BLA, IAA, RY, WBG and Groundwater

Radford Army Ammunition Plant
Radford, Virginia

Prepared for:
Radford Army Ammunition Plant

June 2010

New River Unit Remedial Investigation
BDDT, BLA, IAA, RY, WBG, and Groundwater

Radford Army Ammunition Plant,
Radford, Virginia

June 2010

received
8-3-10
10-90

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY
Street address: 629 East Main Street, Richmond, Virginia 23219
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Douglas W. Domenech
Secretary of Natural Resources

David K. Paylor
Director

(804) 698-4000
1-800-592-5482

July 30, 2010

Mr. Jim McKenna
Radford Army Ammunition Plant
Route 114, P.O. Box 1
Radford, Virginia 24143-0100

Re: Remedial Investigation Report- NRU- Radford Army Ammunition Plant

Dear Mr. McKenna:

The Virginia Department of Environmental Quality (VDEQ) has reviewed the Final Remedial Investigation Report dated June 2010 for the New River Unit (RAAP-044) at Radford Army Ammunition Plant and approves the report as revised.

Please contact me at (804) 698-4498 if you have any questions or comments regarding the above site.

J L Cutler Jr

James L. Cutler, Jr., CPG
Federal Facilities Project Manager

cc: Paige Holt, ATK
Aziz Farahmand, VDEQ-BRRO

ATK Armament Systems
Energetic Systems
Radford Army Ammunition Plant
Route 114, P.O. Box 1
Radford, VA 24143-0100

www.atk.com

July 13, 2010

Mr. James L. Cutler, Jr.
Virginia Department of Environmental Quality
629 East Main Street
Richmond, VA 23219

Subject: Transmittal Acknowledgement,
Final Remedial Investigation Report, New River Unit (RAAP-044) BDDT, BLA, IAA, RY, WBG, and Groundwater, Volumes I and II, June 2010

Dear Mr. Cutler:

This letter is to acknowledge transmittal of the subject document that was sent to you on July7, 2010. Enclosed is a copy of the 7 July 2010 transmittal email.

Please coordinate with and provide any questions or comments to myself at (540) 639-8658, Jerry Redder ATK staff (540) 639-7536 or Jim McKenna, ACO Staff (540) 731-5782.

Sincerely,

P.W. Holt, Environmental Manager
Alliant Techsystems Inc.

c: Karen Sismour
Virginia Department of Environmental Quality
P. O. Box 1105
Richmond, VA 23218

E. A. Lohman
Virginia Department of Environmental Quality
Blue Ridge Regional Office
3019 Peters Creek Road
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Rich Mendoza
1 Rock Island Arsenal
Attn: IMAE-CDN
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Rock Island, Illinois, 61299

Tom Meyer
Corps of Engineers, Baltimore District
ATTN: CENAB-EN-HM
10 South Howard Street
Baltimore, MD 21201

10-815-101
JMcKenna

bc: Administrative File
J. McKenna, ACO Staff
Rob Davie-ACO Staff
P.W. Holt
J. J. Redder
Env. File

Coordination: J. McKenna

Joe Yeakley for
M. A. Miano

10-815-101
JMcKenna

Greene, Anne

From:	McKenna, Jim
Sent:	Wednesday, July 07, 2010 1:23 PM
To:	Greene, Anne; Cutler,Jim; dennis.druck@us.army.mil; diane.wisbeck@arcadis-us.com; durwood willis2; Redder, Jerome; jim spencer; Llewellyn, Tim; Lohman,Elizabeth; Mendoza, Rich; Meyer, Tom NAB02; Parks, Jeffrey N; Sismour,Karen; Timothy.Leahy@shawgrp.com; Tina_MacGillivray@URSCorp.com; Flint, Jeremy
Cc:	Davie, Robert; Holt, Paige
Subject:	Radford NRU Remedial Investigation Report - Final (UNCLASSIFIED)
Attachments:	RAAP44_RI Report RTC_VDEQ 2010 06 29.pdf
Importance:	High

Classification: UNCLASSIFIED
Caveats: FOUO

All,

The subject report for the NRU will be sent out today by ARCADIS to the POCs listed below with the Fed Ex tracking numbers. This report was revised per the attached response to comments.

Name:	Copies	Tracking Number
Mr. James McKenna	2 Copies and 2CDs	7988 2589 1445
Mr. Richard Mendoza	1 Copy and 1 CD	7937 0294 0956
Ms. Susan Ryan	1 CD	7937 0296 9223
Mr. Tom Meyer	1 Copy and 1CD	7988 2593 9899
Mr. Dennis Druck	1 Copy	7937 0298 8630
Mr. James Cutler	1 Copy	7937 0299 3743
Ms. Karen Sismour	1 Copy	7937 0300 2111
Ms. Elizabeth Lohman	1 CD	7937 0307 2714

Jim Cutler, from our June 2, 2010 conference call and our June 17, 2010 site visit, we anticipate DEQ concurrence on the RI report, therefore it would be helpful if we could obtain DEQ concurrence on or about July 23, 2010. As a reminder we also need to get DEQ comments on the draft FS.

Thank you all for your support of the Radford AAP Installation Restoration Program.

Jim McKenna
Classification: UNCLASSIFIED
Caveats: FOUO

Comments and Responses on the
Draft RI Report
New River Unit RFAAP 044
Radford Army Ammunition Plant
April 2010

Item No.	Report Reference	COMMENT	RESPONSE
Commenter: Ahmet Bulbulkaya (VDEQ) – HHRA Comments. Memo to Jim Cutler dated March 5, 2010			
1	Appendix A: Page 2-2, Section 2.1.1:	The criteria employed to determine whether a groundwater sample result was suitable for the risk assessment data set greatly reduced the inorganic groundwater data set available for the risk assessment. After turbidity was considered, with inorganic results rejected when turbidity was high, the inorganic groundwater data available to the risk assessment was reduced to just one round. Another round of inorganic groundwater data is recommended for all Study Areas of the site.	*Agreed. Use of dissolved sample results when turbidity levels are high is consistent with guidance provided by EPA for sites at Radford. In addition, ARCADIS collected another round of groundwater samples at RFAAP-NRU on April 6 and 7, 2010. Consistent with the 2009 sampling event, all eleven groundwater monitoring wells at the facility and four spring locations were sampled during this event. At the request of VDEQ (email from Jim Cutler to Jim McKenna dated March 25, 2010) as further clarified in a 30 April 2010 telecommunication between VDEQ (Cutler) and ARCADIS (Wisbeck), all of the groundwater samples were analyzed for VOCs, metals, PAHs, PCBs, and explosives. The three monitoring wells at the Western Burning Ground area and the two monitoring wells located at the Northern Burning Ground were also analyzed for dioxins/furans. The analytical data from this sampling event will be incorporated into the Final RI Report.*

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Item No.	Report Reference	COMMENT	RESPONSE
2	Appendix A: Page 2-3, Section 2.2	The most currently accepted method of assessing carcinogenic risk for mutagens is never discussed this section and was not used in the risk assessment. This is evidenced by the fact that the carcinogenic risk equations for mutagens are not included in the risk assessment tables that present the carcinogenic risk algorithms beginning with Table A.2-11. The effect of not using the most current USEPA recommended methodology for assessing mutgenic risk is that carcinogenic risk is underestimated to residential receptors potentially exposed to mutagens (many of the PAHs). Therefore carcinogenic residential risk totals should be revised for Study Areas that have significant levels of PAHs.	*Agreed. The human-health risk assessments (HHRA) for the sites within the New River Unit have been revised so that the residential scenarios utilize the early-life adjustment for assessing carcinogenic risk associated with mutagens. This methodology is consistent with the USEPA's Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens.* *The inclusion of this guidance resulted in a change in the conclusions and recommendations for the BDDT area. Potential risks for the residential receptor calculated using the Supplemental Guidance are greater than the USEPA's acceptable risk range of 1E-4 to 1E-6. Therefore evaluation of the response action alternatives available for the BDDT area will be presented in the FS. There were no changes to the conclusions and recommendations for any of the other Study Areas at RFAAP-NRU.*

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Item No.	Report Reference	COMMENT	RESPONSE
3	Appendix A: Page 2-6, Section 2.2.1.1, last sentence:	This sentence states that "Constituents selected as COPCs based on the protection of leaching to groundwater were evaluated through the site-wide groundwater assessment." It is not clear that COPCs were selected based on leaching to groundwater. It states in an earlier paragraph of this section that the residential and industrial RSLs were used to screen COPCs but does not mention the "Protection of Groundwater Soil Screening Levels" contained in the RSL table.	*Agreed. The HHRA has been revised to indicate more clearly that the selection of COPCs in groundwater was based on concentrations actually measured in groundwater, not using soil criteria developed for protection of groundwater.*
4	Appendix A: Page 2-14, Section 2.2.3.3.1 (and Table A.2-10):	This page (and the table) presents exposure factors for the "Site Worker". More information should be provided in the narration as to the type of worker that is being considered. Section 2.2.3.1 describes the potential current receptor as being a site commercial/industrial worker yet Section 2.2.3.3.1 also mentions cutting grass. It is also unclear how a wading scenario fits in with a typical commercial/industrial worker exposure scenario. If a landscaper type of exposure is envisioned the soil ingestion rate of 50 mg/kg is too low. A more appropriate can be obtained from the RSL table which uses 100 mg/day for its "composite worker" scenario that is used to develop default industrial soil screening values, and that is also intended to capture exposure from landscaping activities.	*The "Site Worker" is not classified as a landscaper. The Site Worker is someone who conducts maintenance or mowing activities at the Site. That person is expected to work only above ground. Very little soil contact is envisioned as none of his or her responsibilities would involve digging or planting. ARCADIS believes that the 50 mg/day soil ingestion rate would be adequately conservative for this receptor. However, to comply with VDEQ's request ARCADIS changed the soil ingestion rate from 50 mg/kg to 100 mg/kg to match the value recommended for the "composite worker" within the RSL tables. This change did not result in any changes to the conclusions or recommendations for any of the Study Areas at RFAAP-NRU.*

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Item No.	Report Reference	COMMENT	RESPONSE
5	Appendix A: Page 2-15, Section 2.2.3.3.2 (and Table A.2-10):	The exposure duration for an adult hypothetical future resident should be 24 years instead of 30 years. Adult carcinogenic risk resulting from 24 years of exposure should be added to the child carcinogenic risk from 6 years of exposure so that a resident carcinogenic risk for a total of 30 years results. Note that mutagens have their own life-stage specific algorithms that incorporate 4 life stages beginning at birth and ending at 30 years.	*Agreed. The exposure durations have been adjusted for the hypothetical future resident risk calculations.* *Please see Response to Comment No. 2..*
6	Appendix A: Page 2-16, Section 2.2.3.3.3:	What was the basis or rationale behind the statement that, *"Construction workers are not likely to come into contact with shallow groundwater during a hypothetical construction project, since the depth to shallow groundwater is at least 10 feet."* Was there any research to support the claim that trenches are not expected go deeper than 10 feet.	*Groundwater at RFAAP is generally encountered in the karst bedrock underlying the site. As indicated in Table 3-1 depth to groundwater was greater than 120 ft bgs at the BLA; greater than 30 ft at the IAA; greater than 90 ft at the NBG; and greater than 12 ft at the WBG. Standard trenching techniques would not be useful for cutting into bedrock; therefore, it is highly unlikely that construction workers would come into contact with groundwater within the bedrock. Furthermore, no reasonably foreseeable trenching activities (i.e., utility line trenches) would be expected to extend below 10 ft or within groundwater.*
7	Appendix A: Page 2-19, Section 2.2.4.3:	For the Study Areas where lead was a COPC the IEUBK results are presented without documentation. Please provide supporting information and documentation for the IEUBK model runs for these Study Areas.	*Agreed. The HHRA has been revised to include the complete documentation for the IEUBK model runs.*

Comments and Responses on the
Draft RI Report
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April 2010

Item No.	Report Reference	COMMENT	RESPONSE
8	Appendix A: Page 3-2, Section 3.3:	It is agreed that the sampling data from the riprap covered portion of the BDDT can be treated differently than other areas of the BDDT Study Area. However the usefulness of the statistical comparison between the riprap dataset to the remaining larger BDDT dataset is unclear. A more direct approach is to determine the risk associated with the riprap area data separately from the remaining BDDT area.	*Agreed. The HHRA has been revised to evaluate soil beneath the riprap both concurrently with soil (site-wide) in the remainder of the ditch and separately. This approach allows for the evaluation of potential health risks should the riprap be removed and the need for long-term controls on the site.*
9	Appendix A: Page 3-9, Section 3.4.5 and included table:	In this section it is reported that carcinogenic risk to the hypothetical future child resident at the BDDT from combined surface and subsurface soil is 1E-04 and therefore acceptable. Note that if carcinogenic risk was calculated for a combined adult/child resident using the mutagen equations discussed above the residential carcinogenic risk would be significantly greater than 1E-04.	*Agreed, with additional clarification. The HHRA was revised to include procedures requested in this and in Comment Nos. 2, 5, and 8.* *Please see Response to Comment No. 2.-NRU.*
10	Appendix A: Page 4-9, Section 4.4.4.3:	Since PAHs are driving the unacceptable hypothetical future residential risk at the BLA Study Area it is expected to be even higher when the above comment is taken into account.	*Agreed. However, this did not change the conclusions/recommendations for the BLA Study Area because potential residential risks were already greater than EPA's generally acceptable risk range and the Feasibility Study evaluated remedial alternatives for the BLA under a future residential land-use scenario. Therefore, no additional revisions to the conclusions of the RI or the Feasibility Study were required.*

Item No.	Report Reference	COMMENT	RESPONSE
11	Appendix A: Page 4-10:	More documentation of the IEUBK modeling runs should be provided. The cited table (Table A.4.HHRA-18) only provides the predicted range of blood lead levels. There should be more information on model inputs provided. This comment applies to the other study areas where lead was COPC (i.e, the IAA and WBG).	*Agreed. The HHRA has been revised to include the complete documentation for the IEUBK model runs.*

Comments and Responses on the
Draft RI Report
New River Unit RFAAP 044
Radford Army Ammunition Plant
April 2010

Item No.	Report Reference	COMMENT	RESPONSE
12	Appendix A: Page 6-10, Section 6.4.5:	Please provide more information regarding the detection of PCP of 830 mg/kg, which is the driver for the unacceptable residential carcinogenic risk reported in this section. How extensive was the follow up investigation and attempts to duplicate the elevated hit?	*Pentachlorophenol (PCP) was detected at a concentration greater than the industrial RSL (9 mg/kg) in one surface soil sample [TR-02C (830 mg/kg)] which was collected in 1998 at a former pole-mounted transformer location. The concentration of PCP in a duplicate surface soil sample collected at this location (TR-02A) was only 0.11mg/kg.* *A total of 33 soil samples (20 surface soil samples and 13 subsurface soil samples) collected during subsequent investigations at the Rail Yard were analyzed for PCP. PCP was not detected in any of these samples, nor was PCP detected in any surface water or sediment samples at the Rail Yard.* *As PCP is known to have been used as a wood preservative for utility poles, the single elevated detection of PCP at sample location TR-02C has been linked to the former utility pole at this sample location. The fact that PCP was not detected at elevated levels in the duplicate sample at this location or in any other soil samples at the site indicates that the elevated detection was limited to the area in the immediate vicinity of the utility pole.*

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Item No.	Report Reference	COMMENT	RESPONSE
13	Appendix A: Page 7-8, Section 7.4.1.5 and Table A.7.HHRA-5.	How was it determined that the fish tissue sampling would be limited to only the metals listed on the table?	*The table summarizes constituents that were detected in the fish samples and does not present the complete analyte list. A total of 16 fish tissue samples were collected from the Western Burning Ground pond. The samples were analyzed for TCL PCBs and TAL metals (see Table 9-16 of main RI Report for full-list of constituents included in the analyses). No PCBs were detected in any of the samples, nor was lead. Table A.7.HHRA-5 only lists the inorganic constituents that were detected in the samples.*
Commenter: James Cutler (VDEQ) – NRU RI Comments. Email to Jim McKenna dated March 17, 2010			
14		The soils at the BDDT appear to be adequately delineated. The level of PAH contamination in the sediments has fluctuated over time. Depending on the resolution of the HHRA comments additional sediment samples may be required to demonstrate that there is no significant continued release to the stream.	*The revised HHRA indicates potential risks greater than EPA's generally acceptable risk range for the future residential receptor. There are no unacceptable risks associated with exposure to sediment at the site. Continued impacts to the stream downgradient of the BDDT area are not expected because 1) the source area has been removed, and 2) the area downgradient of the rip rap is now heavily vegetated with grasses and the slope is fairly gentle so continued erosion of impacted soil into the stream is unlikely.*
15		Section 6.4.6.4 it is stated that 4 samples were collected around BLASB02. The text states that PAHs were detected above screening levels but this information is not indicated on Figure 6-8.	*Figure 6-8 has been corrected to display the PAH detections at sample locations BLA-SS005, BLA-SS006, BLA-SS007, and BLA-SS008. These are the sample locations that were collected around BLASB02.*

Item No.	Report Reference	COMMENT	RESPONSE
16		The further delineation of PAHs at the BLA is problematic since no specific source has been identified. Depending on the resolution of the HHRA comments additional delineation may be required.	*The revisions to the HHRA requested in Comments No. 2, 8, and 9 did not change the conclusion of the HHRA which identified PAHs as risk drivers under a hypothetical future residential land-use scenario. PAHs do not present unacceptable risks to the industrial site worker or construction worker under the current military/industrial land-use scenario. Therefore, no additional characterization and no revisions to the Feasibility Study for RFAAP-NRU are required.*
17		On page 7-32 and 7-56 it is stated that no explosives were found above RSLs in the building areas. Is this consistent with the fact that the primary risk driver in soil is 2,4-DNT?	*The text on pages 7-32 and 7-56 were revised to discuss that 2,4-dinitrotoluene (DNT) was detected in two samples from a single boring collected during the initial 1997 site investigation. This constituent was not detected during any of the subsequent investigations at the site, including samples collected near the location of the original detection. The HHRA identified 2,4-DNT as a risk driver; however, a response action is not recommended for this constituent due to the extremely limited distribution.*

Comments and Responses on the
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18		PCB's appear more prevalent at the IAA than the BLA. On page 7-12 it is reported that Aroclor 1254 was detected above industrial RSLs around buildings 504, 509, 522 and 529. On page 7-55 (last paragraph) it is stated that screening levels were exceeded adjacent to buildings 502, 504, 8101, 8102-5 and 8102-A. Were all samples included on Figure 7-8?	*Figure 7-8 does not present the results for the conductive flooring samples because the locations are unknown. The results discussed in Section 7.4.5 on page 7-12 are for samples of the conductive flooring material, that were collected from Buildings 502, 504, 509, 522, and 529 during the USACE's 2002 Conductive Flooring Assessment. Figure 7-8 only displays the results of soil samples that were collected in the southern portion of the IAA around Buildings 502, 504, 522, and 529; as well as the other Buildings in this area. The results for the Soil samples collected around Buildings 8101, 8201-5 and 8102-A are shown on Figure 7-7.*
19		Figure 9-9. Industrial exceedances should be noted.	*Agreed. Figure 9-9 has been updated to indicate concentrations that are greater than the industrial RSLs.*
20		On page 9-50 it is stated that lead was detected above tap water RSLs in 4 water samples. These samples are not indicated on Figure 9-11.	*Agreed. Figure 9-11 has been updated to show the sample locations where concentrations were greater than the RSLs.*
21		Based on the low level detections in groundwater the conceptual model presented appears to be adequate for the site area. It is recommended that an additional round of sampling be conducted to resolve any discrepancies between the previous two rounds.	*Agreed. See Response to Comment No. 1.*

From: McKenna, Jim J Mr CIV USA AMC [jim.mckenna@us.army.mil]
Sent: Friday, May 21, 2010 7:30 AM
To: Wisbeck, Diane; Redder, Jerome; Mendoza, Richard R Mr CIV USA IMCOM; Druck, Dennis E Mr CIV USA MEDCOM PHC; Ryan, Susan M Ms CIV USA IMCOM HQ; Kalinowski, Chris; Cutler,Jim
Cc: jeremy.flint@atk.com; paige.holt@atk.com; Robert Davie
Subject: NRU RAAP 44 - Response to VDEQ Comments on the Ecological Risk Assessment (UNCLASSIFIED)
Attachments: RAAP44_ERA RTC_VDEQ 2010 05 20 (3).pdf

Importance: High

Classification: UNCLASSIFIED
Caveats: FOUO

Jim C.,

Attached are the RFAAP responses to the May 5, 2010 VDEQ comments on the Ecological Risk Assessment (ERA) for RAAP-044 (New River Unit).
With these responses, all comments RFAAP has received on the Remedial Investigation (RI) Report have been addressed. (Note on April 30, 2010 RFAAP responded to DEQ comments [March 5 and 17, 2010] on the HHRA and RI Report.)

It is not anticipated that in addressing these comments there will be any required revisions to the conclusions and recommendations for the RI Report. Also, there are no anticipated revisions to the Feasibility Study (FS) Report resulting from VDEQ comments on the RI, HHRA, or ERA.

We spoke earlier about maybe meeting and going over these comments. If after reviewing our responses you still think we need to meet and discuss, I would strongly recommend the morning of Thursday, June 17, 2010 at 1000am as RFAAP and ARCADIS will be conducting a RAB site tour of the NRU later that same day. In this way we would have the opportunity to visit the NRU before the RAB tour to help clarify any remaining items.

Thanks,
Jim M.

Classification: UNCLASSIFIED
Caveats: FOUO

Comments and Responses on the
Draft RI Report
(Ecological Risk Assessment Component)
New River Unit RFAAP 044
Radford Army Ammunition Plant
May 2010

Item No.	Report Reference	COMMENT	RESPONSE
Commenter: Ahmet Bulbulkaya and Jim Cutler (VDEQ) – Eco Comments. Email dated May 5, 2010			
1	Appendix A – General Ecological Risk Assessment	Use of Background: During the refinement step of the BERA the COPECs that were determined through the SLERA were examined to determine if they warranted being carried through the remaining steps of the USEPA eight-step ecological risk assessment process. For inorganics in surface soil this often involved comparing EPCs to site background concentrations as reported in the 2001 IT Facility-Wide Background Study Report ("Background Study"). Sometimes this involved employing the range of background concentrations for a particular inorganic constituent and sometimes the reported point estimate was used. Note that the point estimate background concentration was used in the SLERA initial screening steps. Although this type of background comparison occurred earlier in the eight-step process than is typically called for by the USEPA this seemed to be an appropriate background screen and use of the Background Study. However, use of the range of background samples to define the extent of potential negative ecological impacts seemed to be an inappropriate and unintended use of the Background Study. In the conclusions of the Background Study it is stated that "The final set of point estimates for the background data set, therefore, are based on calculated 95% UTLs for a single facility-wide data set that represents surface and subsurface soil from the MMA and the NRU areas. These values are included as a point of reference for point-by-point comparisons for site screening." If background ranges from the Background Study are to be considered for the refinement of COPECs the dataset from the NRU should be segregated from the MMA dataset. Otherwise, only the 95% UTLs should be used for COPEC refinement. During the refinement of sediment COPECs inorganic sediment concentrations were sometimes compared to soil background values from the Background Study. In this case sediment concentrations should not be compared to soil background levels at all. To determine background sediment concentrations background sediment samples should be collected. If this is not practicable then sediment inorganic COPEC refinement based on background should not occur.	*Agreed. Although the use of the background data as part of the SLERA screening process was discussed with VDEQ representatives during the June 28, 2008 site visit, this level of detail was not discussed. As requested, the document has been modified to use only the point estimate (UTL) from the Background Study for screening soils as opposed to the range of background concentrations.* *In addition, in the absence of background data specific to sediment, that refinement step has been removed from the COPEC selection process for sediments. The majority of the sediment COPECs affected by this modification do not have sediment ecological screening levels (ESLs), therefore the final risk estimates are not significantly impacted. A discussion has been added to the uncertainty section.*

Comments and Responses on the
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Item No.	Report Reference	COMMENT	RESPONSE
2	Appendix A – General Ecological Risk Assessment	Bioaccumulation modeling: Bioaccumulation modeling was performed only on the constituents remaining after the BERA screening. By initiating the modeling after this step, and not after the initial SLERA screening, there is the potential for prematurely eliminating constituents that have a bioaccumulative potential from the eight-step process. Bioaccumulative constituents remaining after the initial SLERA screening steps should have been run through the terrestrial and aquatic food chain models.	*Agreed. The approach used for selection of constituents for consideration in the food web modeling was consistent with the approach used at other military installations, and is believed to effectively capture the significant bioaccumulative constituents for food chain modeling.* *However, in accordance with the RFAAP SLERA approach (Final Process for Ecological Risk Assessment-Radford AAP- September 17, 2007 revision), all bioaccumulative constituents detected in sediments and soil will be retained and evaluated in the food web modeling, regardless of the outcome of the SLERA toxicity screening. It is not anticipated that the inclusion of constituents detected at levels less than screening levels will change the overall conclusions and recommendations of the ERA because of either the low concentrations and/or infrequent detections of these compounds.*
3	Page 2-27, Section 2.3.1.1.4	Dioxins and Furans: There was no description of potential effects of these compounds as there was for the other constituent classes listed in this section. Please add a brief description.	*Agreed. A description of the potential effects associated with dioxins and furans has been added to Section 2.3.1.1.4.*

Comments and Responses on the
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4	Page 3-2, Section 3.3	It is agreed that the sampling data from the riprap covered portion of the BDDT can be treated differently than other areas of the BDDT Study Area. However the usefulness of the statistical comparison between the riprap dataset to the remaining larger BDDT dataset is unclear. A more direct approach would be to determine the ecological risk associated with the riprap area data separately from the remaining BDDT area.	*Agreed. The risk assessment has been revised to evaluate soil beneath the riprap both concurrently with soil (site-wide) in the remainder of the ditch and separately. This approach allows for the evaluation of potential ecological risks should the riprap be removed and the need for long-term controls on the site.* *The results of the revised evaluation indicate that no further evaluation of ecological risks is warranted and there is no need for long-term controls at the site. Note this revision did not change the conclusion, thus no revision to the recommendations were made.*
5	Page 7-14, Section 7.5:	It is unclear what ecological risk assessment guidance from Virginia is being referred to in this and other sections of the risk assessment. Please clarify.	*Agreed. The State of Virginia has not developed an ERA guidance document. Therefore, the reference to Virginia ecological risk assessment guidance in Section 7.5, and in other sections of the report, will be removed in the revised ERA report.* *The sentence has been changed to read as follows:* *"The ERA was conducted in a manner consistent with USEPA guidance for ecological risk assessment (USEPA 2001a; 2000b; 1997c)."*
6	Page 7-24:	The reference for the background level of antimony in Virginia is unfamiliar to this office. Please discuss and elaborate on its applicability to the NRU.	*Agreed. The cited reference of USEPA (1995) is incorrect; the correct reference is USEPA (2005b). The background antimony level of 1.2 mg/kg is the mean concentration reported in surface soil in the State of Virginia, and can be found in Table 2.3 of USEPA (2005b).*

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Item No.	**Report Reference**	**COMMENT**	**RESPONSE**
7	Page 7-25, bottom of page:	For the food chain analysis of the shrew and robin the bioaccumulative COPECS should have been selected from the 20 COPECs determined from the SLERA. In the case of the Western Burning Ground this means that arsenic, cadmium and selenium should have been included in the terrestrial food chain modeling.	*Agreed. As discussed in the response to General Comment No. 2, the approach used for selection of constituents for consideration in the food web modeling is believed to effectively capture the significant bioaccumulative constituents for food chain modeling.* *However, in accordance with the RFAAP SLERA approach (Final Process for Ecological Risk Assessment-Radford AAP- September 17, 2007 revision), all bioaccumulative constituents detected in sediments and soil will be retained and evaluated in the food web modeling, regardless of the outcome of the SLERA toxicity screening. It is not anticipated that the inclusion of constituents detected at levels less than screening levels will change the overall conclusions and recommendations of the ERA because of either the low concentrations and/or infrequent detections of these compounds.*

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May 2010

Item No.	Report Reference	COMMENT	RESPONSE
8	Page 7-36, Aquatic Food Chain Model:	There is not enough information to assume that adverse population effects are not occurring at the pond. The extremely elevated hazard quotients for lead and zinc for mink, and to a lesser degree, the elevated hazard quotients for zinc for the great blue heron, warrant additional analysis. The rationale or intent of the discussion in the last paragraph on Page 7-36 that describes excluding the maximum detect of lead and zinc is unclear. Is the intent to suggest that the highest concentration detected in the sediments will be removed in a remedial action? A data gap in the foodchain analysis is that lead was not analyzed for in fish. This data gap should be filled by additional fish sampling.	*The HQs calculated for the refined scenario were based on:* • *measured concentrations in fish tissue for those COPCs that were analyzed (e.g., lead which was analyzed but not detected in any fish tissue samples),* • *modeled concentrations in fish tissue for COPCs other than those analyzed (e.g., PAHs), and* • *modeled concentrations for other dietary items (e.g., vegetation and invertebrates).* *The modeled concentrations were based on the use of soil BAFs which in some cases predicted tissue concentrations greater than 100 percent. These overestimated tissue concentrations are falsely elevating the refined HQs. Therefore, the dose modeling and related BAFs will be revisited.* *Based on this information it is anticipated that the refined HQs will be lower, thus supporting the conclusion that the small and localized area of elevated COPC concentrations in sediment is unlikely to result in a significant exposure to ecological receptors.*

Comments and Responses on the
Draft RI Report
(Ecological Risk Assessment Component)
New River Unit RFAAP 044
Radford Army Ammunition Plant
May 2010

Item No.	Report Reference	COMMENT	RESPONSE
9	Page 7-37	Please provide more information as to the main component of the diet that is driving the elevated hazard quotients for the mink and the great blue heron. Add discussion as to why the hazard quotients went up so markedly in the refined scenario food chain modeling as compared to the maximum scenario modeling run. If the elevated hazard quotients for lead and zinc are being driven by fish consumption then it would not be appropriate to focus exclusively on the limited area of elevated sediment impacts surrounding WBGSW/SD10 as the only significantly impacted ecological habitat. If fish consumption is driving the risk then the areal extent of the whole pond would be considered impacted habitat. Note that the unnamed pond is estimated at 3.6 acres in size which would surpass the de minimis size criteria described on page 2-32. This would lead to the conclusion that, if fish consumption by the mink and great blue heron is driving the elevated hazard quotients found in Table A.7.ERA-13 and Table A.7.ERA-15 then population effects are possible and that the ecological risk assessment process should continue into the remaining steps of the USEPA eight-step process.	*The refined scenario incorporated consideration of additional dietary items in the dose modeling for aquatic species However, many of these modeled concentrations were based on the use of soil BAFs, resulting in overestimated tissue concentrations. Upon further consideration, use of these overly conservative dietary estimates seems inappropriate, particularly given the actual measured concentrations in fish tissue. Assuming that consumption of fish is the primary exposure route for piscivorous species such as the mink and great blue heron, actual exposures would be much less than estimated in the refined scenario using the overestimated tissue concentrations for other dietary components. Based on these considerations, the dose modeling has been revised to more accurately reflect actual exposures to these species.*

From: McKenna, Jim J Mr CIV USA AMC [jim.mckenna@us.army.mil]
Sent: Wednesday, May 05, 2010 10:18 AM
To: Wisbeck, Diane; Kalinowski, Chris; dennis.druck@us.army.mil; Meyer, Tom NAB02; Mendoza, Rich; jeremy.flint@atk.com; jerome.redder@atk.com
Subject: FW: NRU- Eco risk comments (UNCLASSIFIED)

Classification: UNCLASSIFIED
Caveats: FOUO

All, DEQ comments below. Please develop and internal response to comments.
Thanks, Jim

-----Original Message-----
From: Cutler, Jim (DEQ) [mailto:James.Cutler@deq.virginia.gov]
Sent: Wednesday, May 05, 2010 8:53 AM
To: McKenna, Jim J Mr CIV USA AMC
Cc: Bulbulkaya, Ahmet (DEQ)
Subject: NRU- Eco risk comments

Jim,

The following are Ahmet's comments regarding his review of the ecological risk assessment sections of Appendix A - Risk Assessment to the Draft Remedial Investigation report for the New River Unit
(RAAP-044):

General comments:

1. Use of Background: During the refinement step of the BERA the COPECs that were determined through the SLERA were examined to determine if they warranted being carried through the remaining steps of the USEPA eight-step ecological risk assessment process. For inorganics in surface soil this often involved comparing EPCs to site background concentrations as reported in the 2001 IT Facility-Wide Background Study Report ("Background Study"). Sometimes this involved employing the range of background concentrations for a particular inorganic constituent and sometimes the reported point estimate was used. Note that the point estimate background concentration was used in the SLERA initial screening steps. Although this type of background comparison occurred earlier in the eight-step process than is typically called for by the USEPA this seemed to be an appropriate background screen and use of the Background Study. However, use of the range of background samples to define the extent of potential negative ecological impacts seemed to be an inappropriate and unintended use of the Background Study.

In the conclusions of the Background Study it is stated that "The final set of point estimates for the background data set, therefore, are based on calculated 95% UTLs for a single facility-wide data set that represents surface and subsurface soil from the MMA and the NRU areas. Theses values are included as a point of reference for point-by-point comparisons for site screening."

If background ranges from the Background Study are to be considered for the refinement of COPECs the dataset from the NRU should be segregated from the MMA dataset. Otherwise, only the 95% UTLs should be used for COPEC refinement.

During the refinement of sediment COPECs inorganic sediment concentrations were sometimes compared to soil background values from the Background Study. In this case sediment concentrations should not be compared to soil background levels at all. To determine background sediment concentrations background sediment samples should be collected. If this is not practicable then sediment inorganic COPEC refinement based on background should not occur.

2. Bioaccumulation modeling: Bioaccumulation modeling was performed only on the constituents remaining after the BERA screening. By initiating the modeling after this step, and not after the initial SLERA screening, there is the potential for prematurely eliminating constituents that have a bioaccumulative potential from the eight-step process. Bioaccumulative constituents remaining after the initial SLERA screening steps should have been run through the terrestrial and aquatic food chain models.

Specific Comments:

3. Page 2-27, Section 2.3.1.1.4, Dioxins and Furans: There was no description of potential effects of these compounds as there was for the other constituent classes listed in this section. Please add a brief description.

4. Page 3-2, Section 3.3: It is agreed that the sampling data from the riprap covered portion of the BDDT can be treated differently than other areas of the BDDT Study Area. However the usefulness of the statistical comparison between the riprap dataset to the remaining larger BDDT dataset is unclear. A more direct approach would be to determine the ecological risk associated with the riprap area data separately from the remaining BDDT area.

5. Page 7-14, Section 7.5: It is unclear what ecological risk assessment guidance from Virginia is being referred to in this and other sections of the risk assessment. Please clarify.

6. Page 7-24: The reference for the background level of antimony in Virginia is unfamiliar to this office. Please discuss and elaborate on its applicability to the NRU.

7. Page 7-25, bottom of page: For the food chain analysis of the shrew and robin the bioaccumulative COPECS should have been selected from the 20 COPECs determined from the SLERA. In the case of the Western Burning Ground this means that arsenic, cadmium and selenium should have been included in the terrestrial food chain modeling.

8. Page 7-36, Aquatic Food Chain Model: There is not enough information to assume that adverse population effects are not occurring at the pond. The extremely elevated hazard quotients for lead and zinc for mink, and to a lesser degree, the elevated hazard quotients for zinc for the great blue heron, warrant additional analysis. The rationale or intent of the discussion in the last paragraph on Page 7-36 that describes excluding the maximum detect of lead and zinc is unclear. Is the intent to suggest that the highest concentration detected in the sediments will be removed in a remedial action? A data gap in the foodchain analysis is that lead was not analyzed for in fish. This data gap should be filled by additional fish sampling.

9. Page 7-37: Please provide more information as to the main component of the diet that is driving the elevated hazard quotients for the mink and the great blue heron. Add discussion as to why the hazard quotients went up so markedly in the refined scenario food chain modeling as compared to the maximum scenario modeling run. If the elevated hazard quotients for lead and zinc are being driven by fish consumption then it would not be appropriate to focus exclusively on the limited area of elevated sediment impacts surrounding WBGSW/SD10 as the only significantly impacted ecological habitat. If fish consumption is driving the risk then the areal extent of the whole pond would be considered impacted habitat. Note that the unnamed pond is estimated at 3.6 acres in size which would surpass the de minimus size criteria described on page 2-32. This would lead to the conclusion that, if fish consumption by the mink and great blue heron is driving the elevated hazard quotients found in Table A.7.ERA-13 and Table A.7.ERA-15 then population effects are possible and that the ecological risk assessment process should continue into the

remaining steps of the USEPA eight-step process.

Please feel free to contact me if you have any questions or comments.

Thanks,

Jim

James L. Cutler Jr.

Federal Facilities Project Manager

Office of Remediation Programs

Virginia Dept. of Environmental Quality

804-698-4498

Classification: UNCLASSIFIED
Caveats: FOUO

-----Original Message-----
From: Cutler, Jim (DEQ) [mailto:James.Cutler@deq.virginia.gov]
Sent: Wednesday, March 17, 2010 4:37 PM
To: McKenna, Jim J Mr CIV USA AMC
Cc: Bulbulkaya, Ahmet (DEQ)
Subject: NRU RI comments

Jim,

The following are VDEQ's comments on the RI in addition to the HHRA comments previously submitted.

In general after multiple investigations the NRU appears to be sufficiently characterized to formulate remedial options. Any additional delineation may depend on proposed removal actions and can most likely be addressed by confirmation samples.

1. The soils at the BDDT appear to be adequately delineated. The level of PAH contamination in the sediments has fluctuated over time.
Depending on the resolution of the HHRA comments additional sediment samples may be required to demonstrate that there is no significant continued release to the stream.

2. In Section 6.4.6.4 it is stated that 4 samples were collected around BLASB02. The text states that PAHs were detected above screening levels but this information is not indicated on Figure 6-8.

3. The further delineation of PAHs at the BLA is problematic since no specific source has been indentified. Depending on the resolution of the HHRA comments additional delineation may be required.

4. On page 7-32 and 7-56 it is stated that no explosives were found above RSLs in the building areas. Is this consistent with the fact that the primary risk driver in soil is 2,4-DNT?

5. PCB's appear more prevalent at the IAA than the BLA. On page 7-12 it is reported that Aroclor 1254 was detected above industrial RSLs around buildings 504, 509, 522 and 529. On page 7-55 (last paragraph) it is stated that screening levels were exceeded adjacent to buildings 502, 504, 8101, 8102-5 and 8102-A. Were all samples included on Figure 7-8?

6. Figure 9-9. Industrial exceedances should be noted.

7. On page 9-50 it is stated that lead was detected above tap water RSLs in 4 water samples. These samples are not indicated on Figure 9-11.

8. Based on the low level detections in groundwater the conceptual model presented appears to be adequate for the site area. It is recommended that an additional round of sampling be conducted to resolve any discrepancies between the previous two rounds.

Please contact me with any comments or questions regarding the above comments.
I will forward FS comments shortly.

Thanks,

Jim

James L. Cutler Jr.

Federal Facilities Project Manager

Office of Remediation Programs

Virginia Dept. of Environmental Quality

804-698-4498

Classification: UNCLASSIFIED
Caveats: FOUO

DIVISION OF WASTE PROGRAM COORDINATION

OFFICE OF REMEDIATION PROGRAMS

MEMORANDUM

TO: Jim Cutler

CC: Karen Sismour, Pat McMurray

FROM: Ahmet Bulbulkaya

DATE: March 5, 2010

SUBJECT: Human Health Risk Assessment (Appendix A) submitted as part of the Remedial Investigation for the New River Unit (NRU)

My comments on the subject document are below. Note that comments on the Ecological Risk Assessment and Feasibility Study are forthcoming.

1. Page 2-2, Section 2.1.1: The criteria employed to determine whether a groundwater sample result was suitable for the risk assessment data set greatly reduced the inorganic groundwater data set available for the risk assessment. After turbidity was considered, with inorganic results rejected when turbidity was high, the inorganic groundwater data available to the risk assessment was reduced to just one round. Another round of inorganic groundwater data is recommended for all Study Areas of the site.

2. Page 2-3, Section 2.2: The most currently accepted method of assessing carcinogenic risk for mutagens is never discussed this section and was not used in the risk assessment. This is evidenced by the fact that the carcinogenic risk equations for mutagens are not included in the risk assessment tables that present the carcinogenic risk algorithms beginning with Table A.2-11. The effect of not using the most current USEPA recommended methodology for assessing mutgenic risk is that carcinogenic risk is underestimated to residential receptors potentially exposed to mutagens (many of the PAHs). Therefore carcinogenic residential risk totals should be revised for Study Areas that have significant levels of PAHs.

   For additional information this concept is discussed in the supporting information for the current USEPA Regional Screening Level (RSL) Table. The explanation included in Section 5.14 of the RSL User's Guide states that:

   "Some of the cancer causing analytes in this tool operate by a mutagenic mode of action for carcinogenesis. There is reason to surmise that some chemicals with a mutagenic mode of action, which would be expected to cause irreversible changes to DNA, would exhibit a

greater effect in early-life versus later-life exposure. Cancer risk to children in the context of the U.S. Environmental Protection Agency's cancer guidelines (U.S. EPA, 2005) includes both early-life exposures that may result in the occurrence of cancer during childhood and early-life exposures that may contribute to cancers later in life. In keeping with this guidance, separate cancer risk equations are presented for mutagens. The mutagen vinyl chloride has a unique set of equations. Consult Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens, EPA/630/R-03/003F, March 2005 for further information. http://www.epa.gov/oswer/riskassessment/sghandbook/chemicals.htm provides more detailed information about what chemicals are considered mutagens."

3. Page 2-6, Section 2.2.1.1, last sentence: This sentence states that "Constituents selected as COPCs based on the protection of leaching to groundwater were evaluated through the site-wide groundwater assessment." It is not clear that COPCs were selected based on leaching to groundwater. It states in an earlier paragraph of this section that the residential and industrial RSLs were used to screen COPCs but does not mention the "Protection of Groundwater Soil Screening Levels" contained in the RSL table.

4. Page 2-14, Section 2.2.3.3.1 (and Table A.2-10): This page (and the table) presents exposure factors for the "Site Worker". More information should be provided in the narration as to the type of worker that is being considered. Section 2.2.3.1 describes the potential current receptor as being a site commercial/industrial worker yet Section 2.2.3.3.1 also mentions cutting grass. It is also unclear how a wading scenario fits in with a typical commercial/industrial worker exposure scenario. If a landscaper type of exposure is envisioned the soil ingestion rate of 50 mg/kg is too low. A more appropriate can be obtained from the RSL table which uses 100 mg/day for its "composite worker" scenario that is used to develop default industrial soil screening values, and that is also intended to capture exposure from landscaping activities.

5. Page 2-15, Section 2.2.3.3.2 (and Table A.2-10): The exposure duration for an adult hypothetical future resident should be 24 years instead of 30 years. Adult carcinogenic risk resulting from 24 years of exposure should be added to the child carcinogenic risk from 6 years of exposure so that a resident carcinogenic risk for a total of 30 years results. Note that mutagens have there own life-stage specific algorithms that incorporate 4 life stages beginning at birth and ending at 30 years.

6. Page 2-16, Section 2.2.3.3.3: What was the basis or rationale behind the statement that, *"Construction workers are not likely to come into contact with shallow groundwater during a hypothetical construction project, since the depth to shallow groundwater is at least 10 feet."* Was there any research to support the claim that trenches are not expected go deeper than 10 feet.

7. Page 2-19, Section 2.2.4.3: For the Study Areas where lead was a COPC the IEUBK results are presented without documentation. Please provide supporting information and documentation for the IEUBK model runs for these Study Areas.

Building Debris Disposal Trench (BDDT)

8. Page 3-2, Section 3.3: It is agreed that the sampling data from the riprap covered portion of the BDDT can be treated differently than other areas of the BDDT Study Area. However the usefulness of the statistical comparison between the riprap dataset to the remaining larger BDDT dataset is unclear. A more direct approach is to determine the risk associated with the riprap area data separately from the remaining BDDT area.

9. Page 3-9, Section 3.4.5 and included table: In this section it is reported that carcinogenic risk to the hypothetical future child resident from combined surface and subsurface soil is 1E-04 and therefore acceptable. Note that if carcinogenic risk was calculated for a combined adult/child resident using the mutagen equations discussed above the residential carcinogenic risk would be significantly greater than 1E-04.

Bag Loading Area (BLA)

10. Page 4-9, Section 4.4.4.3: Since PAHs are driving the unacceptable hypothetical future residential risk at this Study Area it is expected to be even higher when the above comment is taken into account.

11. Page 4-10: More documentation of the IEUBK modeling runs should be provided. The cited table (Table A.4.HHRA-18) only provides the predicted range of blood lead levels. There should be more information on model inputs provided. This comment applies to the other study areas where lead was COPC (i.e, the IAA and WBG).

Rail Yard (RY)

12. Page 6-10, Section 6.4.5: Please provide more information regarding the detection of PCP of 830 mg/kg, which is the driver for the unacceptable residential carcinogenic risk reported in this section. How extensive was the follow up investigation and attempts to duplicate the elevated hit?

Western Burning Ground (WBG)

13. Page 7-8, Section 7.4.1.5 and Table A.7.HHRA-5. How was it determined that the fish tissue sampling would be limited to only the metals listed on the table?

ATK Armament Systems
Energetic Systems
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Radford, VA 24143-0100

www.atk.com

November 16, 2009

Mr. James L. Cutler, Jr.
Virginia Department of Environmental Quality
629 East Main Street
Richmond, VA 24143-0100

Subject: Transmittal Acknowledgement, Draft Remedial Investigation Report, New River Unit (RAAP-044) BDDT, BLA, IAA, RY, WBG, and Groundwater, Volumes I and II, October 2009
Draft Feasibility Study Report, New River Unit (RAAP-044), Bag Loading Area, Igniter Assembly Area, and Western Burning Ground, New River Unit, October 2009

Dear Mr. Cutler:

This letter is to acknowledge transmittal of the subject document that was sent to you on November 9, 2009. Enclosed is a copy of the 9 November 2009 transmittal email.

Please coordinate with and provide any questions or comments to myself at (540) 639-8658, Jerry Redder ATK staff (540) 639-7536 or Jim McKenna, ACO Staff (540) 731-5782.

Sincerely,

Phillip Forland for

P.W. Holt, Environmental Manager
Alliant Techsystems Inc.

c: Karen Sismour
Virginia Department of Environmental Quality
P. O. Box 10009
Richmond, VA 23240-0009

E. A. Lohman
Virginia Department of Environmental Quality
Blue Ridge Regional Office
3019 Peters Creek Road
Roanoke, VA 24019

Rich Mendoza
U.S. Army Environmental Command
1 Rock Island Arsenal
Bldg 90, 3rd Floor, Room 30A
IMAE-CDN
Rock Island, Illinois 61299

Tom Meyer
Corps of Engineers, Baltimore District
ATTN: CENAB-EN-HM
10 South Howard Street
Baltimore, MD 21201

09-815-187
JMcKenna

bc: Administrative File
J. McKenna, ACO Staff
Rob Davie-ACO Staff
P.W. Holt
J. J. Redder
Env. File

Coordination: J McKenna
J. McKenna

09-815-187
JMcKenna

Greene, Anne

From: McKenna, Jim
Sent: Monday, November 09, 2009 1:37 PM
To: Greene, Anne; ealohman@deq.virginia.gov; Druck, Dennis E Mr CIV USA MEDCOM CHPPM; diane.wisbeck@arcadis-us.com; durwood willis2; Geiger.William@epamail.epa.gov; Redder, Jerome; jim spencer; jlcutler@deq.virginia.gov; kjsismour@deq.virginia.gov; Llewellyn, Tim; Mendoza, Richard R Mr CIV USA IMCOM; Meyer, Tom NAB02; Parks, Jeffrey N; Timothy.Leahy@shawgrp.com; Tina_MacGillivray@URSCorp.com
Subject: FW: Fed Ex Tracking Numbers for Radford NRU RI and FS Report (UNCLASSIFIED)

Importance: High

Classification: UNCLASSIFIED
Caveats: FOUO

All,

The following two reports for the NRU will be sent out today:

1) DRAFT Remedial Investigation Report, New River Unit (RAAP-044), 8DDT, BLA, IAA, RY, WBG, and Groundwater; and

2) DRAFT Feasibility Study Report, New River Unit (RAAP-044), Bag Loading Area, Igniter Assembly Area, and Western Burning Ground

The two documents will be sent out together in one package to the POCs and tracking numbers below:

James McKenna (2 Copies and 2 CDs of each report)	793000981440
Dennis Druck (1 Copy of each report)	793001010975
Tom Meyer (1 Copy and 1 CD of each report)	793001006300
Susan Ryan (1 CD of each report)	793001000632
Richard Mendoza (1 Copy and 1 CD of each report)	798121509560
Karen Sismour (1 Copy of each report)	793001299060
James Cutler (1 Copy of each report)	798121821683
Elizabeth Lohman (1 CD of each report)	798121829206

Thank you for your support of the Radford AAP Installation Restoration Program.

Jim McKenna

of this e-mail or any files transmitted with it is prohibited and disclaimed by ARCADIS U.S., Inc.
and its affiliates. Nothing herein is intended to constitute the offering or performance of services where otherwise restricted by law.

Classification: UNCLASSIFIED
Caveats: FOUO

DEPARTMENT OF THE ARMY
US ARMY CENTER FOR HEALTH PROMOTION AND PREVENTIVE MEDICINE
5158 BLACKHAWK ROAD
ABERDEEN PROVING GROUND MD 21010-5403

10 NOV 2009

MCHB-TS-REH

MEMORANDUM FOR Office of Environmental Quality, Radford Army Ammunition Plant (SJMRF-OP-EQ/Mr. Jim McKenna), P.O. Box 2, Radford, VA 24143-0002

SUBJECT: Draft Remedial Investigation Report for the New River Unit (RAAP-044), Radford Army Ammunition Plant, Virginia, September 2009

1. The US Army Center for Health Promotion and Preventive Medicine reviewed the subject document on behalf of the Office of The Surgeon General pursuant to Army Regulation 200-1 (Environmental Protection and Enhancement). We appreciate the opportunity to review this well written and technically comprehensive report.

2. Our previous comments have been addressed and we concur with the conclusions of the risk assessment.

3. The document was reviewed by Mr. Dennis Druck, Environmental Health Risk Assessment Program. He can be reached at DSN 584-2953, commercial (410) 436-2953 or electronic mail, dennis.druck@us.army.mil.

FOR THE COMMANDER:

JEFFREY S. KIRKPATRICK
Director, Health Risk Management

CF:
HQDA (DASG-PPM-NC)
IMCOM-NE (IMNE-PWD-E)
USACE (CEHNC-CX-ES)
USAEC (IMAE-CD/Mr. Rich Mendoza)

Christopher Kalinowski
Site Manager

Diane Wisbeck
Project Manager

New River Unit Remedial Investigation

Radford Army Ammunition Plant

Prepared for:
U.S. Army

Prepared by:
ARCADIS
1114 Benfield Boulevard Suite A
Millersville
Maryland 21108
Tel 410.987.0032
Fax 410.987.4392

Our Ref.:
GP08RAAP.0044

Date:
June 2010

Tables

Figures

Appendices

Acronyms and Abbreviations

AAL	Air Action Level
AEC	U.S. Army Environmental Command
AHERA	Asbestos Hazard Emergency Response Act
amsl	Above Mean Sea Level
ARAR	Applicable or Relevant and Appropriate Requirements
ARCS	Assessment and Remediation of Contaminated Sediments
ATSDR	Agency for Toxic Substances and Disease Registry
AUF	Area Use Factor
BCF	Backward Control Field
BCPS	Berman Crump Protocol Structures
BDDT	Building Debris Disposal Trench
BERA	Baseline Ecological Risk Assessment
bgs	Below Ground Surface
BLA	Bag Loading Area
BW	Body Weight
CARB	California Air Resource Board
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Constituent of Concern
COPC	Constituents of Potential Concern
COPEC	Constituents of Potential Environmental Concern
CSF	Cancer Slope Factor
CSM	Conceptual Site Model
CFR	Code of Federal Regulations
CY	Cubic yard
DAF	Dilution Attenuation Factor
DB	Data Base
DDD	Data Definition Language
EE/CA	Engineering Evaluation/Cost Analysis
ELCR	Excess Lifetime Cancer Risk
EPA	Environmental Protection Agency
EPC	Exposure Point concentration
EPSBTU	Equilibrium Partitioning Sediment Benchmark Toxic Unit
ERA	Ecological Risk Assessment
ESL	Ecotoxicity Screening Level
FCV	Final Chronic Value
FOD	Frequency of Detection
FS	Feasibility Study
ft	Feet
ft bgs	Feet Below Ground Surface
ft msl	Feet Above Mean Sea Level
HEAST	Health Effects Assessment Summary Tables
HHRA	Human Health Risk Assessment

HI	Hazard Index
HQ	Hazard Quotient
IAA	Igniter Assembly Area
IRIS	Integrated Risk Information System
IRP	Installation Restoration Program
LOAEL	Lowest Observed Adverse Effect Level
MMA	Main Manufacturing Area
MCL	Maximum Contaminant Level
NA	Not Applicable
NBG	Northern Burning Ground
NCP	National Contingency Plan
NOAEL	No Observed Adverse Effect Level
NROW	New River Ordinance Works
NRU	New River Unit
NTU	Nephelometric Turbidity Unit
PAH	Polycyclic Aromatic Hydrocarbon
PBC	Performance Based Contract
PCB	Polychlorinated Biphenyl
PCDF	Polychlorinated Dibenzo Furans
PCME	Phase Contrast Microscopy Equivalents
PHH	Planar Halogenated Hydrocarbon
PLM	Polarized Light Microscopy
QA/QC	Quality Assurance/Quality Control
QAPA	Draft Quality Assurance Plan Addendum
RAO	Removal Action Objective
RCRA	Resource Conservation and Recovery Act
RFAAP	Radford Army Ammunition Plant
RfD	Reference Dose
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
RSL	Regional Screening Levels
SARA	Superfund Amendments and Reauthorization Act
SLERA	Screening-Level Ecological Risk Assessment
SMDP	Scientific Management Decision Point
SSL	Soil Screening Level
SVOC	semi-volatile organic compound
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leachate Procedure
TEF	Toxicity Equivalency Factors
TEM	Transmission Electron Microscopy
TEQ	Toxic Equivalents
TOC	Total Organic Carbon
TRV	Toxicity Reference Value
TSCA	Toxic Substances Control Act

TU	Toxic Unit
UF	Uncertainty Factors
UNC	Unnamed Creek
UTL	Upper Tolerance Limit
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
VDEQ	Virginia Department of Environmental Quality
WBG	Western Burning Ground
µg/dL	Micrograms per Deciliter
µg/mL	Micrograms per Milliliter

EXECUTIVE SUMMARY

ARCADIS U.S, Inc. (ARCADIS) has been retained by the United States Army Environmental Command (AEC) to perform Installation Restoration Program (IRP) activities at the Radford Army Ammunition Plant (RFAAP). IRP activities for both the Main Manufacturing Area (RFAAP-MMA) and the New River Unit (RFAAP-NRU) of the RFAAP facility are being conducted as part of a Performance Based Contract (PBC) awarded to ARCADIS under contract W91ZLK-05-D-0015: Task 0002. The RFAAP-NRU is managed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

ARCADIS has prepared this Remedial Investigation (RI) Report to summarize the environmental investigation activities that have been performed at the RFAAP-NRU. Specifically, this report will discuss the investigation activities completed at five separate Study Areas that have been indentified at the RFAAP-NRU. The names/abbreviations for these sites are as follows:

- Building Debris Disposal Trench (BDDT)
- Bag Loading Area (BLA)
- Igniter Assembly Area (IAA)
- Rail Yard (RY)
- Western Burning Ground (WBG)

In addition to these five Study Areas, the RI report presents the findings of a facility-wide groundwater investigation conducted at the RFAAP-NRU. Potential effects to groundwater at the RFAAP-NRU are addressed on a facility-wide basis in this report instead of by individual Study Area.

A sixth Study Area at the RFAAP-NRU, the Northern Burning Ground (NBG), will not be discussed in this RI report. The investigation activities at the NBG have been completed and a removal action, which will be the final action for the site, will likely be completed in 2009 to address lead and chromium containing soil at that site. An *Engineering Evaluation/Cost Analysis* (EE/CA) for the NBG has been submitted to the Virginia Department of Environmental Quality (VDEQ). The EE/CA summarizes the historical investigations completed at the site and the results of site-specific human health and ecological risk assessments. The EE/CA also presents a summary of the removal action alternatives that were evaluated for the site prior to selection of the final remedy.

Environmental investigations have been ongoing at the five RFAAP-NRU Study Areas discussed in this report since 1997. This report presents the findings of each phase of investigation conducted at the site, including the most recent investigation activities completed by ARCADIS from 2008 to 2010. ARCADIS' 2008 investigation activities were performed in accordance with Remedial Investigation Work Plan Addendum 27 (ARCADIS 2008b). The 2009 investigation activities were completed in accordance with the June 2009 Supplemental Remedial Investigation Work Plan (ARCADIS 2009a). The 2010 groundwater investigation activities were completed in accordance with the Draft Supplemental Groundwater Investigation Work Plan (ARCADIS, 2010) In addition to summarizing the findings of the environmental investigation activities, this report includes a Human Health Risk Assessment (HHRA), Ecological Risk Assessment (ERA), and recommended path forward for each Study Area and groundwater. The major conclusions for each site are as follows:

BDDT – Residual polycyclic aromatic hydrocarbons (PAHs) that washed out of a debris disposal trench prior to 1998 site restoration activities have resulted in the presence of PAH compounds in downgradient soils. Soil sampling activities have delineated the extent of PAHs, which are confined to surface soil within an approximately 0.4-acre open area downgradient of the former disposal trench. PAHs are also present in the soils underneath a rip rap and geotextile liner installed in the disposal trench during the site restoration activities. Sediment and surface water samples collected from a creek at the downgradient end of the BDDT indicate that the PAHs present in the soils do not serve as a significant ongoing source of constituents to the creek. The HHRA performed for the site indicate that the risks were within acceptable ranges for industrial use of the site. However, benzo(a)pyrene and cobalt were found to be risk drivers under a residential land use scenario. Benzo(a)pyrene is present at concentrations above the United States Environmental Protection Agency (USEPA) Regional Screening Levels (RSLs) in many of the samples collected from the trench and downgradient areas. The cobalt risks were driven by one sample in the open area downgradient of the trench that had a cobalt concentration outside of the range of established background levels. Cobalt is a naturally occurring element present within the soils at the NRU, and there is no evidence that the isolated cobalt concentration driving the elevated risk at the BDDT is a result of human activity at the site; nor is there any evidence of elevated cobalt concentrations over a wider area. Therefore, it is unlikely that cobalt would present a true risk under hypothetical future residential land use scenarios. The ERA results indicated that no adverse effects were expected for wildlife. Based on the potential residential risks associated with the benzo(a)pyrene in surface soil located downgradient of the trench and the soil located under the rip rap covered portions of the trench, it is recommended that a FS be conducted to evaluate the available CERCLA response actions for the site. The response action alternative analysis will include an evaluation of potential actions to reduce risk to levels acceptable for residential use of the property, as well as options for maintaining the industrial use of the property.

BLA – Conductive flooring material located in site buildings has been exposed to weathering by the removal of building exteriors. As a result of weathering, the flooring material is deteriorating and washing onto surrounding soils. Sampling programs conducted at the BLA to evaluate the effects from the deteriorated conductive flooring, other building materials, and historical site operations have indicated the presence of asbestos and several inorganic constituents in soils surrounding site buildings at concentrations above applicable USEPA RSLs. PAHs and polychlorinated biphenyls (PCBs) were also detected in isolated samples from the site at concentrations above applicable screening levels. The extent of the detected inorganics, asbestos, and PCBs have been well delineated and are confined to surface soils in the immediate vicinity of the buildings, elevated walkways, and/or former transformer locations. Constituents do not appear to be migrating from the affected areas based on sediment and surface water samples collected from area drainage ditches and a nearby creek. The results of the HHRA activities indicated that predicted blood lead levels for an unborn fetus in a pregnant site worker would be the primary risk driver under an industrial land use scenario. Lead and copper were found to present unacceptable risks under the construction worker exposure scenario. Aroclor 1254, benzo(a)pyrene, cobalt, copper, and lead were also found to be risk drivers under a residential land use scenario. The ERA concluded that adverse population-level effects would not be expected due to the limited areal distribution of constituents and the low level of associated risk.

Although evaluated separately from the other constituents in the risk assessment, the asbestos identified in the degraded conductive flooring material and in soils surrounding BLA buildings could present a potential risk to current and future site workers or hypothetical future residents. Activity based sampling conducted at two of the BLA buildings (Buildings 404 and 411) has demonstrated that intensive soil disturbance activities in the areas adjacent to buildings with conductive flooring have the potential to generate airborne asbestos at concentrations above site specific Air Action Levels (AALs) for industrial receptors and hypothetical future residents. This potential appears to be limited to surface soils immediately adjacent to the buildings where conductive flooring has washed off of the building pads and asbestos concentrations in soil are highest. Although not evaluated in the risk assessment, asbestos in the remains of other building materials (e.g. pipe insulation, mastic, joint compound, etc.) could also present a risk to current and hypothetical future receptors if it becomes airborne.

An FS is recommended for the BLA to assess potential remedial alternatives to mitigate the risks and hazards associated with the site soils and conductive flooring material. While remedial actions for lead based paint and non-flooring asbestos will not be presented in the FS, land-use restrictions will be put in place to mitigate possible exposure to current and hypothetical future receptors from these materials.

IAA – The IAA site is very similar to the BLA in that conductive flooring material located in site buildings has deteriorated as a result of weathering due to the removal of building exteriors. The deteriorating flooring is contributing constituents, primarily inorganics and asbestos, to the surface soil adjacent to site buildings. PAHs and PCBs have also been detected at concentrations above USEPA RSLs next to a few site buildings and former transformer locations. Soil sampling has confirmed that the elevated concentrations are confined to surface soils throughout the majority of the site and that lateral and vertical migration is extremely limited. Sediment samples collected from dry storm water drainage ditches indicated isolated occurrences of some constituents (i.e., lead and PAHs) at concentrations above applicable screening levels. The results of the HHRA activities indicated that risks, hazards, and predicted blood lead levels were within acceptable ranges under the industrial land use scenarios. However, the HHRA indicated that under the residential land use scenarios there were risks and hazards above the generally acceptable limits, primarily due to Aroclor 1254, copper, cobalt, and 2,4-dinitrotoluene detections in soil. Lead was also found to contribute to an elevated fetal blood level under the residential land use scenario. The ERA concluded that adverse population-level effects would not be expected at the IAA due to the limited areal distribution of constituents and the low level of associated risks.

Although evaluated separately from the other constituents in the risk assessment, the asbestos identified in the degraded conductive flooring material and in soils near IAA buildings could present a potential risk to current and future site workers or hypothetical future residents. Activity based sampling conducted IAA Building 8102-1 has demonstrated that intensive soil disturbance activities in the areas where conductive flooring has washed off building pads have the potential to generate airborne asbestos at concentrations above site specific AALs for industrial receptors and hypothetical future residents. This potential appears to be limited to surface soils immediately adjacent to the buildings where conductive flooring has washed off of the building pads and asbestos concentrations in soil are highest. Although not evaluated in the risk assessment, asbestos in the remains of other building materials (e.g. pipe insulation, mastic, joint compound, etc.) could also present a risk to current and hypothetical future receptors if it becomes airborne.

An FS is recommended for the IAA to assess potential remedial alternatives to mitigate the risks and hazards associated with the site soils and conductive flooring material. While remedial actions for lead based paint and non-flooring asbestos will not be presented in the FS, land-use restrictions will be put in place to mitigate possible exposure to current and hypothetical future receptors from these materials.

RY – A limited number of constituents were detected sporadically at concentrations above applicable RSLs during the course of environmental investigation at the RY. However, the findings of the HHRA indicated that the potential health risks for the site are within or below USEPA's target risk range under both industrial and future hypothetical residential land use scenarios. Minimal ecological risks were driven by constituents that were detected sporadically in a relatively small portion of the site. Based on the results of the risk assessments there is no need to place any restriction on the current use or future development of the site. Therefore, No Action is recommended for this site.

WBG – The WBG was a former burning ground site that was used to dispose of off-spec materials and materials exposed to energetic/explosive compounds. Surface soils containing ash material, lead and other constituents were removed from the former burning area and replaced with clean fill during a 1999 test pitting program; therefore, subsequent investigations focused on areas outside of the burn area. Investigations included delineating an ashy layer of material under the pond access road, surface and subsurface soils outside of the former burning ground, pond sediments and surface water, and downgradient stream sediments and surface water. The risk assessment concluded that potential human health risks were within acceptable USEPA risk ranges under the current/future industrial land use scenario, and future recreational use of the pond including a fishing rodeo, but that chromium and lead detected in pond sediment samples contributed to potential unacceptable risk levels under a future hypothetical residential land use scenario. The chromium and lead concentrations contributing to the elevated risk levels are confined to an approximately 2,100 square foot (ft^2) area (0.05 acres) near the northern bank of the 3.5-acre pond. The ERA concluded that no adverse ecological effects would be expected on a population level due to the limited distribution of constituents of potential concern (COPCs). Based on the potential residential risks associated with the lead and chromium in the pond sediments, it is recommended that a FS be conducted to evaluate the available CERCLA response actions for the site. The response action alternative analysis will include an evaluation of potential actions to reduce risk to levels acceptable for residential use of the property, as well as options for maintaining the industrial use of the property.

Groundwater – The groundwater investigation activities at the RFAAP-NRU included the installation of 11 groundwater monitoring wells, three groundwater sampling events (2007, 2008, and 2010), and the development of a conceptual site model (CSM) based on all historical information collected from the facility. The 2008 and 2010 sampling activities included the collection of samples from four springs within the boundaries of the RFAAP-NRU in addition to the 11 groundwater monitoring wells. The 2008 groundwater investigation activities also included the attempted installation of a monitoring well at the BDDT; however, this attempt was abandoned because groundwater was not encountered in either of two borings completed to 75 feet below ground surface (ft bgs) through competent bedrock. Inorganics were detected at concentrations above tap water RSLs in groundwater samples collected from several monitoring wells. The elevated concentrations in these wells have been attributed to the presence of suspended solids in the groundwater samples and naturally occurring metals in the formation. Analysis of samples collected with low turbidity and samples that were collected after filtering did not have any inorganics at concentrations above applicable tap water RSLs. The risk assessment concluded that arsenic detected in groundwater samples in 2007, 2008, and 2010 resulted in unacceptable potential risks under the future hypothetical residential land use scenario. However, arsenic was only detected in unfiltered groundwater sample that had elevated turbidity, which is highly conservative and not reflective of conditions most likely to occur in groundwater that would be used for residential or commercial uses. Several dioxin congeners detected in groundwater samples during the 2007 sampling event also resulted in unacceptable risks under the future hypothetical residential land use scenario. However, it should be noted that 1) the dioxin concentrations reported in these groundwater samples were an order of magnitude less than the federal drinking water level; 2) dioxins were detected in a laboratory blank sample associated with the 2007 samples and the detections in groundwater are likely the result of cross contamination at the laboratory; and 3)dioxins were not detected in the confirmation groundwater samples collected in 2010.

Spring water samples were collected at the RFAAP-NRU during 2008 and 2010. Laboratory analysis results indicate that the detected constituents were present at concentrations less than applicable tap water screening levels. Spring water samples are considered to be an excellent indicator of overall groundwater quality due to the springs function as groundwater discharge points for relatively large areas. No Action is recommended for groundwater at the RFAAP- NRU.

1. Introduction

ARCADIS U.S, Inc. (ARCADIS) has been retained by the United States Army Environmental Command (AEC) to perform Installation Restoration Program (IRP) activities at the Radford Army Ammunition Plant (RFAAP). The RFAAP facility is located in Montgomery and Pulaski Counties in southwestern Virginia and consists of two noncontiguous units: the New River Unit (NRU) and the Main Manufacturing Area (MMA). The RFAAP-MMA is located approximately 5 miles northeast of the City of Radford, Virginia. The RFAAP-NRU is located about six miles southwest of the RFAAP-MMA, near the town of Dublin, Virginia (Figure 1-1). IRP activities for both the RFAAP-MMA and the RFAAP-NRU are being conducted as part of a Performance Based Contract (PBC) awarded to ARCADIS under contract W91ZLK-05-D-0015: Task 0002. The RFAAP-NRU is managed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

ARCADIS has prepared this Remedial Investigation (RI) Report to summarize the environmental investigation activities that have been performed at the RFAAP-NRU. Specifically, this report will discuss the investigation activities completed at five separate Study Areas that have been indentified at the RFAAP-NRU. The names/abbreviations for these sites are as follows:

- Building Debris Disposal Trench (BDDT),
- Bag Loading Area (BLA),
- Igniter Assembly Area (IAA),
- Rail Yard (RY), and
- Western Burning Ground (WBG).

In addition to these five Study Areas, the RI report will present the findings of a facility-wide groundwater investigation conducted at the RFAAP-NRU. Potential effects to groundwater at the RFAAP-NRU will be addressed on a facility-wide basis in this report instead of by individual Study Area.

A sixth Study Area at the RFAAP-NRU, the Northern Burning Ground (NBG), will not be discussed in this report. The investigation activities at the NBG have been completed and a removal action will be completed in 2009 to address lead and chromium containing soil at that site. An *Engineering Evaluation/Cost Analysis* (EE/CA) for the NBG has been submitted to the Virginia Department of Environmental Quality (VDEQ). The EE/CA summarizes the historical investigations completed at the site and the results of site-specific human and ecological risk assessments. The

EE/CA also presents a summary of the removal action alternatives that were evaluated for the site prior to selection of the final remedy.

1.1 Facility Overview

The RFAAP-NRU facility is located in the mountains of southwestern Virginia in the Great Valley subprovince of the Valley and Ridge Physiographic Province. The RFAAP-NRU encompasses approximately 2,813 acres of Pulaski County, Virginia, near the town of Dublin (Figure 1-1). The RFAAP-NRU was constructed in 1940 and was originally known as the New River Ordinance Works (NROW). The facility operated as a bag manufacturing and loading plant for artillery, cannon, and mortar projectiles during World War II. Active manufacturing operations ceased in 1945, at the completion of the war, and the facility was incorporated into the RFAAP. The RFAAP-NRU now serves as a storage facility for operations at the MMA.

A total of six Study Areas have been indentified at the RFAAP-NRU as having the potential for adverse environmental effects associated with historical operations at the site. Five of these Study Areas, the BDDT, BLA, IAA, RY, and WBG are discussed in this report. The sixth area, known as the NBG, has been addressed under a Non Time Critical Removal Action and a separate EE/CA has been submitted for that site. The locations of the various Study Areas at the RFAAP-NRU are depicted in Figure 1-2.

1.2 Study Areas

1.2.1 Building Debris Disposal Trench

The BDDT is a former ephemeral unlined natural drainage channel located in the southern portion of the RFAAP-NRU (Figure 1-2). The trench directs surface water runoff from the surrounding area towards an unnamed stream that flows through the southern portion of the RFAAP-NRU. The trench was previously utilized as a disposal site for miscellaneous building debris generated during the dismantling of old buildings at the RFAAP-NRU facility. The building debris and any visibly stained soil was removed from the trench in 1998, replaced with clean fill, lined with a geotextile fabric, and covered with riprap. Investigations in this Study Area have focused on characterizing and delineating the effects to environmental media (i.e., soil, sediment, and surface water) in areas within and downgradient of the former disposal area trench. The physical characteristics and history of the BDDT are discussed in greater detail within Section 5 of this report.

1.2.2 Bag Loading Area (BLA)

The BLA is located along the southwestern boundary of the RFAAP-NRU (Figure 1-2). The BLA ran two powder bag loading production lines from 1941-1943. Thirteen buildings were once located onsite; however, all process equipment, wooden roofs, and wooden walls have been removed from the buildings, leaving only concrete slabs and cinder block walls. These buildings are referenced later in this report with their former building numbers. The concrete slab floors in several of the buildings (including the second story floors of two buildings) were covered in a conductive cement-like material containing various metals and asbestos. This conductive flooring was used to prevent the build-up of static charges in areas where energetic materials were handled. Removal of the walls and roofs of the buildings has exposed the conductive flooring to weather, causing it to degrade and break away from the underlying concrete. In many cases, the flooring has degraded into a red powder-like material and washed onto the surrounding soils. Investigations in this Study Area have focused on characterizing the effects that the degrading flooring material and historical site operations have had on environmental media (i.e., soil, sediments, and surface water) in areas surrounding and downgradient of the buildings. The investigations have also included an assessment of former electrical transformers that were located at the BLA. The physical characteristics and history of the BLA are discussed in greater detail within Section 6 of this report.

1.2.3 Igniter Assembly Area (IAA)

The IAA is located in the western portion of the RFAAP-NRU (Figure 1-2). Buildings at the site were used for igniter assembly, as well as the shipping and receiving of materials related to the IAA. The area was active from approximately 1941 through 1943. Process equipment and wooden walls and roofs have been removed. The remains consist of concrete foundations and walls and are referenced later in this report with their former building numbers. The main igniter assembly buildings and multiple outparcel buildings at the IAA had a conductive flooring material similar to the BLA. The conductive flooring was exposed to the weather when the wooden roof and walls were removed from the buildings. As a result, the conductive flooring has degraded into a red powder-like substance very similar to what has been observed at the BLA. In many areas, the degraded conductive flooring material has washed off the concrete pads onto surrounding surface soils. Investigations in this Study Area have focused on characterizing the effects that the degrading flooring material and historical site operations have had on environmental media (i.e., soil, sediments, and surface water) in areas surrounding and downgradient of the buildings. The investigations have also included an assessment of former electrical transformers that were located at the IAA. The physical characteristics and history of the IAA are discussed in greater detail within Section 7 of this report.

1.2.4 Rail Yard

The RY is a former loading and unloading area for rail cars located in the southwestern portion of the RFAAP-NRU, east of the IAA and WBG (Figure 1-2). The RY consists of three sets of tracks, three open transfer platforms, and one decommissioned sewer line. Two small streams run north to south through the RY and drain into the unnamed stream immediately upstream of the BDDT. Investigations in this Study Area have focused on characterizing the potential effects that historical site operations may have had on environmental media (i.e., soil, sediments, and surface water) within and downgradient of the RY. The investigations have also included an assessment of former electrical transformers that were located at the RY. The physical characteristics and history of the RY are discussed in greater detail within Section 8 of this report.

1.2.5 Western Burning Ground

The WBG is a former burning ground located south of the IAA in the southwestern portion of the RFAAP-NRU (Figure 1-2). The WBG was used as a burning ground to decontaminate explosives contaminated material and to dispose of excess and off-spec explosives/energetics. The main burn area was approximately 170 feet (ft) long by 100 ft wide and is surrounded on three sides by an approximately 4 ft high earthen berm. A test pitting program was conducted at the site in 1998 that effectively removed all soils within the former burn area that may have been affected by the historical burning operations. The excavated soils were replaced with clean fill. Investigations at the WBG have focused on characterizing the effects that historical site operations may have had on environmental media (i.e., soil, sediments, and surface water) within and surrounding the former burning site. Extensive investigations have been conducted within a small pond, and downgradient stream, located adjacent to the WBG site that receives rain water runoff from the site and surrounding area. The physical characteristics and history of the WBG are discussed in greater detail within Section 9 of this report.

1.2.6 Northern Burning Ground

The NBG is a former burning ground located in the northwestern portion of the RFAAP-NRU near Gate 20 (Figure 1-2). The NBG appears to have been in limited use as a burning ground. No structures appear on the site, and the burning operations were apparently confined to a small area at the center of the site. Surface water at the NBG flows toward a drainage ditch that runs parallel to a paved surface road to the north of the site. The physical characteristics and results of historical investigations at the NBG are presented in a separate EE/CA that has been prepared for that site and will not be discussed further within this report.

1.3 Investigation Overview

Characterization of the environmental conditions at each of the five Study Areas discussed in this report has been ongoing since 1997. The groundwater investigation activities for the RFAAP-NRU facility began in 2007. The earliest site investigations were conducted for the sole purpose of identifying the potential presence of contaminants associated with historical land uses at the Study Areas. Subsequent site investigations were conducted to further characterize and delineate the extent of elevated constituent concentrations at each of the Study Areas. The most recent investigation activities were completed by ARCADIS in 2008, 2009, and 2010 in accordance with the June 2008 Remedial Investigation Work Plan Addendum 27 (ARCADIS 2008b), the June 2009 Supplemental Remedial Investigation Work Plan (ARCADIS 2009a), and the April 2010 Supplemental Groundwater Investigation Work Plan (ARCADIS 2010). These investigations were performed for the purpose of:

- Completing the delineation of constituents detected at concentrations above applicable screening levels;
- Indentifying potential effects to groundwater at the facility and assisting in the development of a robust conceptual site model (CSM);
- Characterizing the potential risks with asbestos in soil at the BLA and IAA Study Areas; and
- Finalizing the site characterization work so as to facilitate the completion of site specific human-health risk assessments (HHRAs) and ecological risk assessments (ERAs).

The site investigation activities at the RFAAP-NRU have identified various constituents in soil, sediment, surface water, and groundwater at the Study Areas including: volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), dioxins and furans, explosives, herbicides, pesticides, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and inorganics. The findings of the various phases of environmental investigation conducted at RFAAP-NRU are discussed on a site-by-site basis in later sections of this report.

1.4 Report Organization

This Remedial Investigation Report is divided in to the following sections:

- **Section 1 – Introduction.** This section provides background information related to the RFAAP-NRU environmental investigations.

- **Section 2 – Scope of Field Investigations.** This section provides a brief history of the site investigation activities that that have been conducted at the RFAAP-NRU; with a focus on the activities completed in 2008 and 2009 to complete the remedial investigation process for the facility.

- **Section 3 – Environmental Setting and Conceptual Site Model.** This section provides a brief discussion of the environmental setting at the RFAAP-NRU and presents the framework of the conceptual model that has guided the environmental investigations and risk assessment activities at the facility.

- **Section 4 – Methods and Procedures for Data Evaluation.** This section discusses the methods and procedures used during the evaluation of the data collected during the various phases of environmental investigation. This includes a summary of the human-health and ecological risk assessment activities, which are also presented in greater detail within Appendix A.

- **Sections 5 through 10 – Site Discussions.** These sections present the site characteristics, summaries of environmental investigations, the nature extent of contamination, the human health risk assessment (HHRA), the ecological risk assessment (ERA), and the conclusions for each of the Study Areas and for facility-wide groundwater.

- **Section 11 – Conclusions and Recommendations.** As indicated by the title, this section presents a summary of the conclusions drawn from the remedial investigation and recommended paths forward.

- **Section 12 – References**.

2. Scope of Field Investigations

2.1 Historical Investigations

As discussed in Section 1.3, characterization of the environmental conditions at the RFAAP-NRU has been on-going since 1997 and has included multiple phases of investigation. Between 1997 and 2007, extensive site investigation activities were completed at the RFAAP-NRU by several different entities, including Alliant Techsystems, Inc. (ATK); Gannett Fleming, Inc. (Gannet Fleming); ICF Kaiser Engineers, Inc. (ICF KE); Shaw Environmental, Inc. (Shaw); and the United States Army Corps of Engineers (USACE). The investigation activities conducted by these entities typically focused on surface soil, subsurface soil, sediments, surface water, and source materials at the six different Study Areas at the RFAAP-NRU (BDDT, BLA, IAA, NBG, RY, and WBG). In 2007 Shaw expanded the investigation to include facility wide groundwater through the installation and sampling of eleven groundwater monitoring wells located throughout the facility. Sample matrices that detail the environmental samples collected during each phase of investigation completed at the BDDT, BLA, IAA, RY, WBG, and for facility-wide groundwater are presented in Tables 2-1 through 2-6, respectively. The details and findings of the various phases of historical investigations conducted at the BDDT, BLA, IAA, RY, WBG, and facility-wide groundwater are discussed in further detail within in Sections 5 through 10 of this report. Appendix B provides a summary of all samples that have been collected for the BDDT, BLA, IAA, RY, WBG and groundwater investigation, which includes the sample date, depth, and location coordinates.

2.2 ARCADIS Investigation 2008

In 2008, AEC retained ARCADIS to complete the RI process for the RFAA-NRU as part of the overall IRP for the facility. ARCADIS reviewed the historical information obtained during the investigation activities completed between 1997 and 2007 and developed a work plan for finalizing the remedial investigation at each of the different Study Areas and for facility-wide groundwater. The details of this plan were submitted to VDEQ in June 2008 in the document entitled *DRAFT Remedial Investigation Work Plan Addendum 27* (ARCADIS 2008b). The field investigation activities outlined in this work plan were completed between July and October 2008. Additional investigation activities were completed at the BLA and IAA sites in July 2009 to further characterize potential risks associated with asbestos in soil. The field investigation activities for the 2009 asbestos investigation are outlined in the Supplemental Remedial Investigation Work Plan (ARCADIS 2009a). The sample locations included in the 2008 and 2009 site investigations are summarized in Appendix B. The following sections provide a brief discussion of the activities completed at each of the Study Areas.

2.2.1 Building Debris Disposal Trench

Review of the historical data sets collected at the BDDT between 1997 and 2004 indicated that soils in the open area downgradient of the former disposal trench contained PAHs at concentrations above applicable screening levels. PAHs had also been detected at concentrations above screening levels in historical sediment samples collected from the creek downgradient of the trench. In order to complete the remedial investigation activities for the BDDT, ARCADIS collected the following samples in 2008:

- Two soil borings were completed at the downgradient extent of the former disposal trench to evaluate the vertical extent of PAHs in subsurface soil. Samples were collected at depths of 0-1 feet below ground surface (ft bgs), 2-3 ft bgs, and 3-4 ft bgs, at both soil borings using dedicated hand augers. Bedrock was encountered at a depth approximately 5 ft at both borings; therefore, deeper samples were not collected. All of the samples were analyzed for PAHs by USEPA Method 8270.

- Six surface soil samples were collected from the perimeter of the open area between the disposal trench and downgradient creek to ensure that the horizontal extent of PAHs in surface soil had been defined. The surface soil samples were collected from ground surface to a depth of 0.5 ft bgs, using dedicated soil sampling scoops. All of the samples were analyzed for PAHs by USEPA Method 8270.

- Four sediment samples were collected from the creek in the proximity of historical locations that had contained PAHs. These samples were collected to evaluate concentration trends within the creek sediments and to determine if the creek was being affected by continued release of PAHs from soils in the BDDT area. The sediment samples were collected at depths of 0-0.5 ft bgs at each location using dedicated plastic soil sampling scoops and were analyzed for PAHs by USEPA Method 8270.

- Surface water samples were collected from each of the four sediment sample locations to evaluate whether surface water quality in the creek was affected by PAHs from the BDDT area. The surface water samples were all analyzed for PAHs by USEPA Method 8270.

A complete summary of the samples collected at the BDDT during the 2008 investigation is included within the historical sampling matrix presented in Table 2-1. Further details on ARCADIS' investigation activities are presented in Section 5 of this report, along with the findings of the historical investigations conducted at the site. Section 5 of this report also presents a summary of the human-health and ecological risk assessments that were conducted for the site based on the combined data sets collected throughout the course of investigation.

2.2.2 Bag Loading Area

Review of the historical data sets collected at the BLA between 1997 and 2004 indicated that surface soils in the vicinity of buildings with conductive flooring material were the primary areas of concern at the site. The data indicated that several different metals had been detected at concentrations above applicable screening levels in surface soil. Asbestos and PAHs were also identified in surface soils around buildings and former elevated walkway platforms. In addition, the PCB Aroclor 1254 was detected in two historical sample locations (one near a former transformer and one near a site building) at concentrations above applicable screening levels. The historical data did not indicate any signs of adverse effects in subsurface soil, sediment, or surface water in the vicinity of the BLA. In order to complete the remedial investigation at the BLA, ARCADIS completed the following activities in 2008:

- Performed an inventory of the buildings at the BLA to identify buildings with conductive flooring, including those that may not have appeared on historic site maps. The locations of all buildings were surveyed utilizing GPS equipment and measurements were collected of the building dimensions. The building inventory identified seven buildings with conductive flooring material. In total approximately 19,000 ft^2 of conductive flooring material is present at the site.

- Based on review of historical analytical data sets from the BLA, it was determined that lead could be used as a good indicator of where other constituents may also be present in surface soil as a result of the deteriorating conductive flooring. Therefore, ARCADIS conducted a field screening program that utilized a hand-held X-Ray Fluorescence (XRF) meter to screen surface soil samples around site buildings for lead. The field screening program included the collection of surface soil samples (0 - 0.5 ft bgs) around the perimeter of all site buildings with conductive flooring material. Samples were typically collected in rows of three screening points spaced at 1 ft, 5 ft, and 10 ft distances from the building footprint. In cases where the XRF result indicated a lead concentration above 400 mg/kg, samples were also collected further away from the building (i.e., 15 ft and 20 ft). The rows were located on approximately 25 ft centers around the perimeter of each building, with a bias towards preferential flow paths off of the building pads (i.e., where red staining was present in soil). A total of 63 rows containing 192 individual points were screened with the XRF.

- In order to evaluate the quality of the XRF screening results and to provide additional characterization data, 19 of the 192 XRF screening samples were also submitted for laboratory analysis. A minimum of one sample was collected at each building identified with conductive flooring. These samples were submitted for laboratory analysis of TAL inorganics (USEPA Method 6010B) and SVOCs (USEPA Method 8270). The samples were also analyzed for the presence of asbestos using polarized light microscopy (PLM) and USEPA Method 600/R-93 sample preparation. Five of these samples were submitted for laboratory analysis of TCLP-inorganics (USEPA Method 6010B) to assist in evaluating any potential future removal alternatives. Comparison of the XRF field screening results generally indicated a good correlation between the XRF results and the results of the laboratory reported lead concentrations, with the XRF results typically biased slightly high. Additional discussion of the correlation between the XRF data and laboratory results is presented in Section 6.

- Four surface soil samples (0 – 0.5 ft bgs) were collected from the central area of the BLA in the vicinity of a former elevated walkway. The samples were collected to evaluate historical surface soil detections of PAHs at concentrations above applicable screening criteria within this area. The 2008 surface soil samples were collected using dedicated soil sampling scoops and were analyzed for PAHs by USEPA Method 8270.

- Two surface soil samples and two subsurface soil samples were collected in the vicinity of a former sample location on the north side of Building 405 where the PCB Aroclor 1254 had been detected above applicable screening levels in 2002. These samples, which were analyzed for PCBs by USEPA Method

8082, were collected for the purpose of delineating potential PCBs associated with the historical sample.

- Two surface soil samples were collected in the vicinity of a former transformer on the east side of Building 416 where the PCB Aroclor 1254 had been detected above applicable screening levels in 2002. These samples, which were analyzed for PCBs by USEPA Method 8082, were collected for the purpose of delineating potential PCBs associated with the historical sample.

- During the 2008 site investigation at the BLA subsurface utility vaults were identified at two of the BLA Buildings (Buildings 404 and 405). These subsurface utility vaults run around the perimeter of the buildings, underneath the surrounding sidewalks. Visual inspection of the vaults indicated that they contained approximately 1 ft of standing water, but little to no sediment. A surface water grab sample was collected from the vault at Building 405 utilizing a dedicated plastic bailer and analyzed for VOCs by USEPA Method 8260, PAHs by USEPA Method 8270, and inorganics by USEPA Method 6010B, to evaluate the potential presence of contaminants in the water.

- During the 2008 investigation, surface water, degraded flooring material, and sediment were observed in a former elevator shaft pit inside Building 405. In order to evaluate if contaminants were present in this pit, one sediment sample and one surface water sample were collected. Both the sediment sample and the surface water sample were analyzed for PAHs by USEPA Method 8270 and inorganics by USEPA Method 6010B.

ARCADIS returned to the BLA in July 2009 to conduct an additional investigation designed to facilitate the evaluation of potential health risks associated with asbestos in soil. This investigation was conducted in accordance with the June 2009 Supplemental Remedial Investigation Work Plan and included the following activities:

- In order to further define the concentration and extent of the asbestos in soil, delineation soil samples were collected at select surface soil locations where asbestos had previously been detected or at buildings that lacked historical data. The samples were collected at distances of 1, 5, 10, 15, and 20 ft from buildings and analyzed sequentially. The samples were analyzed for asbestos by transmission electron microscopy (TEM) via USEPA method 600/R-93/116 with sample preparation using California Air Resources Board (CARB) Method

435 and an analytical sensitivity of 0.1% (TEM CARB Level B). This analyses allowed for a quantitative evaluation of asbestos content in soil

- In an effort to evaluate the risk of exposure to airborne asbestos fibers resulting from asbestos in soil, ARCADIS conducted an activity based sampling program at two of the BLA buildings (Buildings 404 and 411). This sampling program, which utilized the USEPA recommended general action scenario of raking, was performed in accordance with USEPA *SOP 2094: Activity-Based Air Sampling for Asbestos* (USEPA, 2007c) and *Framework for Investigating Asbestos-Contaminated Superfund Sites* (USEPA, 2008g). The sampling program included the following components:

  - Two 10 ft by 10 ft sample grids were set up at Building 404 in an area that has had historic asbestos locations. The first grid was located 0-10 ft from the edge of the building and the second was located 10-20 ft from the building.

  - A second pair of 10 ft by 10 ft sample grids was set up at Building 411 in another area that has had historic asbestos detections. These grids were also located 0-10 ft and 10-20 ft from the building edge.

  - Soil samples were collected from the centerline of each sampling grid pair at locations of 1, 5, 10, 15, and 20 feet from Buildings 404 and 411. These samples were collected from a depth of 0-3 inches. The samples were analyzed for soil moisture by ASTM Method D2216-05, Grain Size by ASTM Method D6913-04e, and asbestos by TEM CARB Level B) to establish soil conditions and asbestos concentrations in the grid.

  - Each grid was vigorously raked by a participant wearing Level C personal protection equipment, so that the soil was disturbed. During the raking activity, the participant wore a personal air monitoring pump fitted with a 0.8 µm mixed cellulose ester (MCE) filter and sampling tube mounted in the subjects breathing zone. A stationary air monitoring pump fitted with a 0.8µm filter and sampling tube mounted at a height of 5 feet was also set on the downwind perimeter of the grid to collect air samples during the raking activity. The raking activity was performed for a duration that allowed at least 750 to 1,000 liters of air to be pulled through the filters. The filters from the personal pump and stationary pump were both submitted for laboratory analysis of asbestos by TEM Method 10312. The filters from the background pumps were both submitted for laboratory analysis of asbestos by TEM Method 10312.

- Background air samples were collected at Buildings 404 and 411 during the activity based sampling events to evaluate potential background interferences. The background samples were collected from an area upwind of the activity based sampling grids using a stationary air monitoring pump fitted with at 0.8 µm MCE filter.

A complete summary of the samples collected at the BLA during the 2008 and 2009 investigations are included within the historical sampling matrix presented in Table 2-2. Further details on ARCADIS' investigation activities are presented in Section 6 of this report, along with the findings of the historical investigations conducted at the BLA. Section 6 of this report also presents a summary of the human-health and ecological risk assessments that were conducted for the BLA based on the combined data sets collected throughout the course of investigation.

2.2.3 Igniter Assembly Area

The IAA is very similar to the BLA in that the conductive flooring material present at this site appears to be the primary source of potential adverse effects to environmental media. Review of the historical data sets collected at the IAA between 1997 and 2004 indicated that surface soils in the vicinity of buildings with conductive flooring material were the primary areas of concern at the site. The data indicated that several different metals and asbestos had been detected at concentrations above applicable screening levels in surface soil around site buildings. Other areas of potential concern identified during the historical data review included undelineated PCB and PAH detections in the vicinity of Building 8101, and undelineated lead detections in two area surface water drainage ditches. In order to complete the remedial investigation at the IAA, ARCADIS completed the following activities in 2008:

- ARCADIS performed an inventory of the buildings at the IAA to identify buildings with conductive flooring, including those that may not have appeared on historic site maps. The locations of all buildings were surveyed utilizing GPS equipment and measurements were collected of the building dimensions. The building inventory identified a total of 35 buildings at the IAA, 27 of which contained conductive flooring material. In total approximately 25,000 ft^2 of conductive flooring material is present at the site.

- Based on review of historical analytical data sets from the IAA, it was determined that lead could be used as a good indicator of where other constituents may also be present in surface soil as a result of the deteriorating conductive flooring. Therefore, a field screening program was conducted that utilized a hand-held X-Ray Fluorescence (XRF) meter to screen surface soil samples around site buildings for lead. The field screening program included the collection of surface soil samples (0 - 0.5 ft bgs) around the perimeter of all site buildings with conductive flooring material. Samples were typically collected in rows of three screening points spaced at 1 ft, 5 ft, and 10 ft distances from the building footprint. In cases where the XRF result indicated a lead concentration above 400 mg/kg, samples were also collected further away from the building (i.e., 15 ft and 20 ft). The rows were located on approximately 25 ft centers around the perimeter of each building, with a bias towards preferential flow paths off of the building pads (i.e., where red staining was present in soil). A total of 157 rows containing 475 individual points were screened with the XRF.

- In order to evaluate the quality of the XRF screening results and to provide additional characterization data, samples for laboratory analysis were collected from 41 of the 475 XRF screening locations. A minimum of one sample was collected at each building identified with conductive flooring. These samples were submitted for laboratory analysis of TAL inorganics (USEPA Method 6010B) and SVOCs (USEPA Method 8270). The samples were also analyzed for the presence of asbestos by PLM. Five of these samples were also submitted for laboratory analysis of TCLP-inorganics (USEPA Method 6010) to assist in evaluating any potential future removal alternatives. Comparison of the XRF field screening results generally indicated a good correlation between the XRF results and the results of the laboratory reported lead concentrations. Additional discussion of the correlation between the XRF data and laboratory results is presented in Section 7.

- XRF field screening and laboratory analytical samples were collected from two IAA drainage ditches where lead was detected at concentrations above applicable screening levels during a site investigation in 2002. One of the drainage ditches was located in the central portion of the IAA and the other was at the outfall of a culvert in the northeastern portion of the IAA. The samples were collected for the purpose of delineating the extent of lead within the ditches. A total of 9 screening samples were collected from these drainage ditches, and four of the screening samples (two from each ditch) were also submitted for laboratory analysis of TAL inorganics by USEPA Method 6010B. All samples were collected from depths of 0 – 0.5 ft bgs using dedicated soils sampling scoops.

- Two surface soil samples and one subsurface soil sample were collected from an area near the northwest corner of Building 8101 where the PCB Aroclor 1254 and several PAHs were detected at concentrations above applicable screening levels in a surface soil sample during the 2002 site investigation. The surface soil samples were collected from depths of 0 – 0.5 ft bgs using dedicated soil sampling scoops, and the subsurface soil sample was collected from a depth of 2 – 3 ft bgs using a dedicated hand auger. These samples were collected to evaluate the areal and vertical extent of the previously detected constituents at concentrations above screening levels. The samples were all analyzed for PAHs by USEPA Method 8270 and PCBs by USEPA Method 8082.

- During the 2008 site investigation at the IAA subsurface utility vaults were identified at IAA Buildings (Buildings 502, 504, 522, and 522A). These utility vaults run around the perimeter of the buildings underneath the surrounding sidewalks. Visual inspection of the vaults indicated that they contained approximately 1 ft of standing water, but little to no sediment. A water sample was collected from the vault at Building 522 and submitted for laboratory analysis for VOCs (USEPA Method 8260), PAHs (USEPA Method 8270), and TAL inorganics (USEPA Method 6010) to determine if contaminants were present in the water.

ARCADIS returned to the IAA in July 2009 to conduct an additional investigation designed to facilitate the evaluation of potential health risks associated with asbestos in soil. This investigation was conducted in accordance with the June 2009 Supplemental Remedial Investigation Work Plan and included the following activities:

- In order to further define the concentrations and extent of the asbestos in soil, delineation soil samples were collected at select surface soil locations where asbestos had previously been detected or at buildings that lacked historical data. The samples were collected at distances of 1, 5, 10, 15, and 20 ft from buildings and analyzed sequentially until no detection was reported. The samples were analyzed for asbestos by transmission electron microscopy (TEM) via USEPA method 600/R-93/116 with sample preparation using California Air Resources Board (CARB) Method 435 and an analytical sensitivity of 0.1% (TEM CARB Level B). This analyses allowed for a quantitative evaluation of asbestos content in soil

- In an effort to evaluate the risk of exposure to airborne asbestos fibers resulting from asbestos in soil, ARCADIS conducted an activity based sampling program at two of the IAA buildings (Buildings 8102-1 and 5). This sampling program, which utilized the USEPA recommended general action scenario of raking, was performed in accordance with USEPA *SOP 2094: Activity-Based Air Sampling for Asbestos* (USEPA, 2007c) and *Framework for Investigating Asbestos-Contaminated Superfund Sites* (USEPA, 2008g). The sampling program included the following components:

    - Two 10 ft by 10 ft sample grids were set up at Building 8102-1 in an area that has had historic asbestos locations. The first grid was located 0-10 ft from the edge of the building and the second was located 10-20 ft from the building.

    - A second pair of 10 ft by 10 ft sample grids was set up at Building 5 in another area that has had historic asbestos detections. These grids were also located 0-10 ft and 10-20 ft from the building edge.

    - Soil samples were collected from the centerline of each sampling grid pair at locations of 1, 5, 10, 15, and 20 feet from Buildings 8102-1 and 5. These samples were collected from a depth of 0-3 inches. The samples were analyzed for soil moisture by ASTM Method D2216-05, Grain Size by ASTM Method D6913-04e, and asbestos by TEM CARB Level B) to establish soil conditions in the grid.

    - Each grid was vigorously raked by a participant wearing Level C personal protection equipment, so that the soil was disturbed. During the raking activity, the participant wore a personal air monitoring pump fitted with a 0.8 µm mixed cellulose ester (MCE) filter and sampling tube mounted in the subjects breathing zone. A stationary air monitoring pump fitted with a 0.8µm filter and sampling tube mounted at a height of 5 feet was also set on the downwind perimeter of the grid to collect air samples during the raking activity. The raking activity was performed for a duration that allowed at least 750 to 1,000 liters of air to be pulled through the filters. The filters from the personal pump and stationary pump were both submitted for laboratory analysis of asbestos by TEM Method 10312.

- Background air samples were collected at Buildings 8102-1 and 5 during the activity based sampling events to evaluate potential background interferences. The background samples were collected from an area upwind of the activity based sampling grids using a stationary air monitoring pump fitted with at 0.8 µm MCE filter. The filters from the background sample pumps were both submitted for laboratory analysis of asbestos by TEM Method 10312.

A complete summary of the samples collected at the IAA during the 2008 and 2009 investigations is included within the historical sampling matrix presented in Table 2-3. Further details on ARCADIS' investigation activities are presented in Section 7 of this report, along with the findings of the historical investigations conducted at the IAA. Section 7 of this report also presents a summary of the human-health and ecological risk assessments that were conducted for the IAA based on the combined data sets collected throughout the course of investigation.

2.2.4 Rail Yard

Based on the information obtained during the historical investigations at the Rail Yard it was determined that no additional investigation was warranted for that Study Area. Therefore, ARCADIS did not collect any samples at the Rail Yard during the 2008 sampling activities. The site data collected during the historical investigation activities at the Rail Yard are summarized Section 8, along with the findings of human-health and ecological risk assessments for the site.

2.2.5 Western Burning Ground

Extensive sampling activities were conducted at the WBG between 1997 and 2007 to evaluate the effects of historical burning activities at the site. The investigation activities included surface and subsurface soil sampling across the site; sediment and surface water sampling in an adjacent pond and downgradient stream; and also included fish tissue sampling. ARCADIS' review of the historical information indicated that only a few minor data gaps existed, which were primarily related to the pond and downgradient stream. In order to complete the remedial investigation at the WBG, ARCADIS completed the following activities in 2008:

- ARCADIS probed the pond in several areas to evaluate the thickness of the pond sediments; especially in the area where chromium and lead had been detected at concentrations above applicable screening criteria during past sampling events.

- ARCADIS collected co-located sediment and surface water samples from the area of the pond where lead had been detected at concentrations above applicable screening criteria during previous sampling events. These samples were collected to further evaluate lead concentrations within this area and to determine if lead in sediment was affecting surface water quality. The sediment and surface water samples were analyzed for lead by USEPA Method 6010.

- In accordance with the work plan, ARCADIS had planned to conduct vertical profiling samples of the pond sediments to evaluate the vertical distribution of lead within the sediment column. The samples were to be collected at one-foot (ft) depth intervals from four locations in the pond. This sampling was not performed because the probing activities concluded that the pond sediments were generally only 1-ft deep.

- Two co-located sediment and surface water samples were collected from the stream downgradient of the WBG pond to evaluate the presence of PAHs in the stream sediments. Several PAHs had been detected at concentrations above applicable screening levels in one stream sample during a 2002 sampling event. The sample locations were selected to evaluate if PAH concentrations in downstream samples were higher than in upstream samples, which may demonstrate that the PAHs could be attributed to sources other than the WBG (i.e., roads and railroad tracks). The sediment and surface water samples were analyzed for PAHs by USEPA Method 8270.

A complete summary of the samples collected at the WBG during the 2008 investigation is included within the historical sampling matrix presented in Table 2-5. Further details on ARCADIS' investigation activities are presented in Section 9 of this report, along with the findings of the historical investigations conducted at the WBG. Section 9 of this report also presents a summary of the human-health and ecological risk assessments that were conducted for the WBG based on the combined data sets collected throughout the course of investigation.

2.2.6 Facility-Wide Groundwater

During the 2007 groundwater sampling event, several inorganics were detected in three monitoring wells at concentrations above applicable screening criteria. In order to further evaluate inorganics concentrations in groundwater and to provide further insight into overall groundwater quality at the RFAAP-NRU, ARCADIS completed the following activities in 2008.

- ARCADIS collected samples from all eleven groundwater monitoring wells at the site to re-evaluate the inorganics concentrations present in groundwater. Several inorganics had been detected in groundwater samples collected during the 2007 sampling event and the concentrations at some of the monitoring wells were above tap water screening levels. As inorganics are known to be naturally occurring in soils and rock at the RFAAP-NRU it was theorized that the presence of inorganics in the groundwater samples may be attributed to the presence of suspended solids in the groundwater samples left over from the well installation activities. Therefore, ARCADIS utilized low-flow groundwater sampling techniques with an electric submersible pump in an effort to minimize the presence of suspended solids in the samples. All of the collected groundwater samples were submitted for laboratory analysis of total TAL metals by USEPA Method 6010. Samples were also submitted for dissolved TAL metals analysis (laboratory filtered samples) by USEPA Method 6010 for monitoring well samples that had turbidity levels greater than 10 nephelometric turbidity units (NTUs) despite the low flow sampling technique.

- In addition to the monitoring well sampling activities, ARCADIS collected grab samples from four springs located throughout the RFAAP-NRU facility. One of the springs (Wiggins Spring) was located at the head waters of the pond at the WBG, one spring was at the head waters of the pond near the RY, and the other two springs were located in the northeastern portion of the facility. The springs were sampled because they provide an excellent indicator of shallow groundwater quality due to their function as groundwater collectors for relatively large areas. The spring samples were analyzed for inorganics by USEPA Method 6010 and PAHs by USEPA Method 8270.

- In accordance with the work plan, ARCADIS attempted to install one monitoring well in the open area downgradient of the BDDT, near the unnamed stream that runs through the southern portion of the RFAAP-NRU. This well was to be installed to evaluate potential effects to groundwater from the BDDT. ARCADIS completed two borings utilizing air rotary drilling technique in this area in October 2008; one boring was completed to a depth of 75 ft bgs, the other to a depth of 50 ft bgs. Bedrock was encountered at 5 ft bgs in both boreholes. Groundwater was not encountered in either borehole; therefore, the monitoring well installation activities were discontinued. Both boreholes were abandoned with neat cement.

2.3 ARCADIS Groundwater Investigation 2010

At the request of VDEQ, a third round of groundwater samples was collected from the RFAAP-NRU monitoring well network in April 2010 to further refine the understanding of potential groundwater impacts. During the April 2010 groundwater sampling event, ARCADIS performed the following:

- ARCADIS collected samples from all eleven groundwater monitoring wells at the site to re-evaluate the presence of the following within groundwater: VOCs, PAHs, PCBs, explosives, dioxins/furans, total metals, and dissolved metals. Groundwater samples were collected using low-flow sampling techniques in an effort to minimize the presence of suspended solids in the samples.

- In addition to the monitoring well sampling activities, ARCADIS collected grab samples from each of the four springs located throughout the RFAAP-NRU facility (as discussed in Section 2.2.6). The spring samples were analyzed for the following: VOCs, PAHs, PCBs, explosives, and metals

A complete summary of the samples collected during the 2008 and 2010 facility-wide groundwater investigations is included within the historical sampling matrix presented in Table 2-6. Further details on ARCADIS' groundwater investigation activities are presented in Section 10 of this report, along with the findings of the 2007 groundwater investigation. Section 10 of this report also presents a summary of the human-health and ecological risk assessments that were conducted for groundwater based on the combined data sets collected throughout the course of investigation.

3. Environmental Setting and Conceptual Site Model

This section provides a brief discussion of the environmental setting at the RFAAP-NRU and presents the framework of the conceptual site model (CSM) that has guided the environmental investigations and risk assessment activities at the facility. The CSM provides a general overview of the potential contaminant sources, affected media and transport mechanisms, and exposure/receptor scenarios present at the RFAAP-NRU Study Areas. CSMs specific to the various Study Areas at the RFAAP-NRU are presented in Sections 5 through 10 of this report. The following sections present the various components of the general CSM.

3.1 General Site Conditions

The RFAAP-NRU facility is located in the mountains of southwestern Virginia in the Great Valley subprovince of the Valley and Ridge Physiographic Province. The RFAAP-NRU encompasses approximately 2,813 acres of Pulaski County, Virginia, near the town of Dublin (Figure 1-1). Active manufacturing operations at the facility ended in 1945, at the completion of WWII. The RFAAP-NRU currently serves as a storage facility for operations at the MMA. The storage facilities consist of bunker type buildings that are primarily located throughout the eastern portion of the RFAAP-NRU. Paved surface roads run throughout the facility to provide access to the storage bunkers and areas utilized during historical operations at the site. Rail road tracks and spurs are also located in the area of the site identified as the RY.

Despite the historical manufacturing operations that took place at the RFAAP-NRU, and its current use as a storage facility for the MMA, the majority of the land area consists of undeveloped grasslands, heavily forested areas, and agricultural tracts. A portion of the property has recently been converted for use as a military cemetery. The two areas utilized during the historical manufacturing operations, now identified as the BLA and the IAA, are reverting back to more natural conditions as trees, shrubs, and grasses have grown in the open areas of these sites. The BLA and IAA, along with the other Study Areas (BDDT, NBG, RY, and WBG) are all located in the western half of the RFAAP-NRU facility and encompass a small percentage of the total land area at the RFAAP-NRU. An aerial photograph illustrating the layout of the site is presented in Figure 1-2.

With the exception of the storage bunkers and a few maintenance/support buildings, very few active structures remain at the RFAAP-NRU. The buildings at the BLA and the IAA that were utilized during the historical manufacturing operations at the site have been largely dismantled. The wooden roofs and walls that were a part of the BLA and IAA buildings have all been removed for fire safety reasons, leaving only concrete foundations and concrete blast walls. Several open transfer platforms also remain in the RY area.

3.2 Climate

The climate of the region encompassing the RFAAP-NRU is classified as "moderate continental," and is characterized by moderately mild winters and warm summers. Prevailing winds are from the southwest, with an average yearly wind speed between 8 and 10 miles per hour (SCS 1985). Average monthly temperatures range from 29.6°F in January to 72°F in July, with an annual average temperature of about 52°F. Average monthly precipitation ranges from about 2.5 inches to 4.1 inches with an annual total precipitation between 36.9 inches and 41.5 inches (Virginia State Climatological Office 1995). Lake evaporation was measured at 32 inches per year in the same area. Potential evapotranspiration has been calculated at 30 inches/year using the Thornthwaite method (Parsons 1996). Based on these data, the net precipitation in the vicinity of RFAAP ranges between 6.9 inches and 11.5 inches annually. Snowfall in the vicinity of RFAAP averages 17 inches annually. Montgomery and Pulaski Counties lie in one of the areas of highest occurrence of dense fog in the United States. Dense fog can be expected to occur between 20 and 45 days per year.

3.3 Physiography, Geology, and Hydrogeology

3.3.1 Regional Setting

The RFAAP-NRU occupies rolling, somewhat hummocky terrain, underlain by karst carbonate bedrock. The installation lies in the New River Valley, a portion of the 700-mile-long Great Valley, which forms the eastern edge of the Valley and Ridge physiographic province. Like much of the Great Valley, the New River Valley forms a broad, relatively flat low land on the boundary between two mountain systems – Valley and Ridge to the north and the Blue Ridge to the south. The RFAAP-NRU is approximately 5 miles southeast of the foot of the first ridge of the Valley and Ridge (locally, Cloydes Mountain), and about 11 miles northwest of boundary with the Blue Ridge Terrain.

The New River drains the New River Valley, flowing in a meandering course from northwestern North Carolina. The river turns northward near the town of Radford, Virginia, passing through a water gap between Cloydes and Brush Mountains before flowing on northward to the Ohio River. The New River, being the primary drainage channel for the area, drives basin-scale surface water and groundwater flow patterns. At its closest approach, the New River is located approximately 2 miles south of the RFAAP-NRU installation boundary. This portion of the river forms Claytor Lake, which is a 21-mile long reservoir created by Claytor Dam. As a result of the dam, the water level in the lake is approximately 100-ft above the natural river channel. The water level in the New River downstream of Claytor Dam (east of the RFAAP-NRU installation boundary) is approximately 115-ft lower than the water level in Claytor Lake. The river runs in its natural channel downstream of the dam; thus, the water levels in this section of the river likely have a stronger control on regional groundwater flow patterns than the elevation in Claytor Lake. The following table presents a summary of the elevation controls:

Summary of Groundwater Elevation Controls

Location	Approximate Elevation (ft AMSL)
Range of site grade at NRU	1,975 to 2,100
Claytor Lake (2 miles south)	1,845
New River below Claytor Dam (approximately 2.5 miles east)	1,730
Range of groundwater elevations observed at NRU	1,930 to 2,080

3.3.2 Geology

The RFAAP-NRU is underlain by carbonate bedrock of the Cambrian aged Conococheague Formation, overlain by a variably thick veneer of unconsolidated residuum (Virginia Department of Mines, Minerals, and Energy, 2003). A general description of the characteristics of the regional geologic units is presented in the table below:

General Characteristics of RFAAP-NRU Regional Geologic Units

Unit	Characteristics	Thickness
Residuum	The insoluble residual material resulting from dissolution of the Conococheague Fm. Dominantly clay and silt, with occasional sand or gravel components, typically floating.	Highly variable. Zero thickness in many places (i.e., outcrops are common throughout the RFAAP-NRU). Depth to bedrock is most commonly shallow (e.g., 10 ft or less in the RY, BDDT and WBG), but ranges up to 55 ft in the NBG.
Conococheague Fm	Principally blue-gray limestone and dolomite, with occasional thin beds of sandstone, siltstone, shale. The unit is faulted, structurally complex, and karst weathered.	Unknown regionally, but inferred to be many hundreds of feet. Known to be as thick as 2,200 ft in northern Virginia, and 1,700 ft to the southwest, near Abingdon.

(Sources: Site boring data; VDMME, 2003)

Bedrock at the RFAAP-NRU is structurally complex, with at least one major thrust fault trending northeast through the installation. Lesser subsidiary and conjugate faults are inferred to be present at the site, most commonly with a southeast strike. The northeast and southeast structural alignment within the bedrock complex appears to strongly influence surface morphology in terms of stream, mountain, and valley trends, and/or alignments of sinkholes (VDMME, 2003; N. Simmons, 2008). Boring data and outcrop exposures demonstrate that the hummocky terrain of the RFAAP-NRU is bedrock controlled, reflecting both structural controls and differential solution weathering of the bedrock surface.

Bedrock at the RFAAP-NRU and surrounding area consists of a mature karst system (N. Simmons, 2008). Preferential solution weathering of the rock has generated conduit-scale solution porosity, or interconnected networks of solution cavities through which groundwater may move at rates analogous to surface streams. The karst conduit networks are similar to rivers – minor tributary conduits connect to successively larger primary conduits, ultimately converging to the master conduit, which discharges to land surface at springs. Karst features may include sinkholes, caves, and active springs.

The bedrock surface is expected to be pinnacled and grooved, causing the depth to bedrock to vary significantly over short distances. The vertical zone of pinnacles and grooves is interpreted as an epikarst, a complex zone that may variably store shallow perched water or provide rapid infiltration to deeper flow systems (Klimchouk 2004)

A conceptual representation of the geology at the RFAAP-NRU is presented within the hydrogeologic conceptual model (Figure 3-1).

3.3.3 Soil Types

Detailed descriptions of the soil types encountered at the RFAAP-NRU are presented in the *Facility-Wide Background Study Report* (IT 2001) and the *Master Work Plan* (URS 2003). The *Facility-Wide Background Study Report* also provides a summary of the naturally occurring/background inorganic constituent concentrations that can be expected at the RFAAP. The background inorganic constituent concentrations are based on calculated 95 percent Upper Tolerance Limits (95% UTLs) generated from a facility-wide data set that incorporates both surface and subsurface soil from the RFAAP-MMA and the RFAAP-NRU. The background inorganic constituent concentrations are discussed in further detail in Section 4-1.

3.3.4 Hydrogeology

The presence and flow of groundwater in the RFAAP-NRU are governed by several factors:

- Karst solution porosity dominates the facility-wide and valley-scale groundwater system. The very high transmissivity of the bedrock aquifer (imparted by solution porosity) appears to keep regional-scale aquifer groundwater elevations deep, with heads largely controlled by the location and elevation of base-level discharges on the New River or its low-elevation tributaries..

- Lithologic controls influence the vertical interconnections of solution porosity. Contrasts in lithology (likely the presence of insoluble beds) provide localized aquitards that restrict or actually separate flow vertically. This control explains the presence of shallow (potentially perched) groundwater and high-elevation springs in the northern portion of the RFAAP-NRU.

- Structural controls influence the geometry and interconnections of solution porosity. The major fault mapped by VDMME (2003) trending northeast across the RFAAP-NRU truncates the shallow flow system present on the north side the RFAAP-NRU. The fault trace corresponds with a dramatic change in the shallow potentiometric surface. For example, the head in well IAAM-04, located immediately south of the fault, is approximately 60-ft less than the head at IAAM-03, on the north side of the fault. A block diagram depicting the hydrogeologic conceptual model for the site is presented in Figure 3-1 that illustrates the location of the fault.

- Alignments of sinkholes and stream valleys with fault and bedding trends implies that the karst solution is biased by structural planes of weakness in the bedrock (N. Simmons, 2008).
- Low permeability surface soil (the clay-rich residuum) appears to inhibit diffuse groundwater recharge. Recharge is concentrated in sinkholes, where flow through the residuum is short-circuited.

In general terms, groundwater flow in karst systems occurs in convergent conduit networks that are similar in configuration to the tributary systems in streams. Infiltration enters the karst system through sinkholes, when the residuum is clay-rich like at the NRU, and flow through successively larger conduits as flow is contributed from the tributary network. Groundwater flow in karst systems is governed by the base-elevation of discharge points such as springs and the geometry of the conduit networks. From a conceptual perspective, the conduit networks act as collector systems for the groundwater and the springs provide monitoring points that integrate flow across the system.

As discussed in Section 10 of this report, a network of 11 groundwater monitoring wells was installed at the RFAAP-NRU in 2007. Four wells are located in the vicinity of the IAA (IAAMW01 through IAAMW04), three are at the WBG (WBGMW01 through WBGMW03), two at the BLA (BLAMW01 and BLAMW02). Two wells are also located at the NBG (NBGMW01 and NBGMW02). The locations of the monitor wells are depicted in Figure 3-2. The monitor well construction details and depth-to-water measurements from investigation activities completed in 2007 and 2008 are presented in Table 3-1. Groundwater level measurements have indicated that depth-to-water can vary greatly between the monitoring well locations; ranging from 13 ft bgs (WBGMW01) to 150 ft bgs (BLAMW01), and spanning an elevation difference of 150-ft. In general, hydraulic heads indicate an extreme downward gradient. For example, between the two wells in the BLA, screened 53-ft apart vertically, the head difference is 30-ft or more, with the lower head in the deeper well. The magnitude of observed head differences is indicative of poor hydraulic communication and limited groundwater flux occurring vertically across low permeability. These low permeability beds act as semi-confining or perching beds within the aquifer and likely cause groundwater to flow in the same plane as the layer until a discharge point (spring or seep), or until reaching a structural weakness within the layer that forms a vertical migration pathway.

Four springs have been identified at the RFAAP-NRU. These include Wiggins Spring, which is at the head of a pond near the WBG; an unnamed spring at the head of the pond near the WBG; and two unnamed springs in the northeastern portion of the facility (see Figures 3-1 and 3-2). These springs appear to drain a shallow groundwater system in bedrock and/or the epikarst. The elevation of the springs is comparable to shallow groundwater elevations in the NBG, IAA and WBG, which suggests that the springs discharge groundwater only from a shallow flow system, most likely local recharge occurring within the northern portions of the facility.

Though sporadically saturated, the unconsolidated residuum is not interpreted to be a distinct, laterally-extensive aquifer. Site data suggest that saturation within the overburden is localized in bedrock depressions where it functions as storage for flow occurring in the epikarst. Water-level elevation changes of 15 to 20 ft between the 2007 and 2008 measurement rounds at some of the shallower wells in the IAA and WBG, are indicative of a low-storage, slow-draining epikarst.

South of the un-named fault trace, groundwater elevations appear to drop off precipitously (on the order of 100 ft). This suggests that the fault restricts flow across the fault scarp, and effectively restricts/acts as a barrier to the shallow flow systems within the northern fault block. This function of the fault likely explains why the line of springs in the NRU are oriented parallel to the fault trace.

The streams in the NRU (the unnamed stream and Hazel Hollow Creek) are supported by baseflow from spring discharge and are clearly gaining in the northern and western portions of the RFAAP-NRU. After traversing the fault trace, the streams become losing. At the BDDT, a boring completed to approximately 70 ft below the water level in the unnamed creek was dry. This suggests that the unnamed creek is perched in this reach, prevented from drying up or losing significant flow by the low permeability of the clay-rich residuum underlying the stream bed. Infiltration occurring south of the fault trace is expected to recharge a deeper flow system, and will not discharge to surface water within the RFAAP-NRU boundaries.

3.3.5 Groundwater Recharge

The low permeability, clay-rich residuum that overlies inhibits diffuse recharge. Surface runoff is channeled to surface streams or, in some cases, to sinkholes.

Sinkholes and closed depressions are common in the vicinity and occur within the RFAAP-NRU, but are infrequent in the western portion of the facility. The structural and stratigraphic controls that promote the shallow groundwater system in the northwest portion of the RFAAP-NRU are interpreted to also inhibit major sinkhole formation. The following general conditions apply to groundwater recharge at the RFAAP-NRU:

- Infiltration that occurs in the northern portion of the RFAAP-NRU (i.e., north of the fault trace) is expected to be captured in the shallow aquifer system. This system appears to discharge to the shallow springs, wetlands and gaining reaches of the unnamed creek that flows through the southwest portion of the facility, and Hazel Hollow Creek north of the fault trace. A component of flow in this system likely leaks vertically downward into deeper flow systems.

Infiltration that occurs south of the fault trace is expected to recharge directly to deeper flow systems that discharge at springs located outside the boundaries of the installation.

3.4 Surface Water Hydrology

Surface water run-off at the RFAAP-NRU is largely controlled by drainage ditches that parallel the site roads. These drainage ditches, which remain dry except during heavy rainfall events, generally direct run-off toward two small stream networks, or tributaries thereof, located within the RFAAP-NRU. The two stream networks, shown in Figures 3-1 and 3-2, include the following.

- A small, unnamed, creek that flows through the southwestern potion of the facility drains the western portion of the RFAAP-NRU where the Study Areas discussed in this report are located. This stream, referred to as the unnamed creek throughout this report, is largely sourced from two small springs located within the facility. Wiggins Spring is the larger of the two springs and is located at the head waters of a pond at the WBG. The second spring is located at the headwaters of a pond at the RY. A component of flow in the unnamed creek originates from tributaries flowing from offsite to the west. After exiting the RFAAP-NRU, the creek flows to the south and enters Claytor Lake.

- Hazel Hollow Creek emerges in the eastern portion of the RFAAP-NRU from two unnamed springs and a wetland complex. This creek exits the RFAAP-NRU along the eastern boundary of the installation and continues to flow east to the New River, below the Claytor Lake dam.

Three small ponds are located within the boundaries of the RFAAP-NRU. The ponds are all located immediately downgradient of the springs discussed above, and were man-made by damming tributaries of the unnamed creek and Hazel Hollow Creek. The largest of these ponds is located at the Western Burning Ground and is fed by Wiggins Spring. This pond was constructed in the early 1990's.

3.5 Potential Contaminant Sources

Review of the historical land uses and site conditions at the RFAAP-NRU have identified several potential sources that could have contributed to the release of contaminants to environmental media at the site. These potential sources include building materials, electrical transformers, historical manufacturing operations, product/waste spills or leaks, burning operations, and road materials (i.e., tar). It is also possible that off site sources could have been transported to the site through precipitation, smoke deposition, surface water runoff or streams, and groundwater migration. All of these potential sources are considered above ground sources; there are no known burial sites or below ground sources present at the facility.

3.6 Potentially Affected Media and Transport Mechanisms

Potentially affected media at the RFAAP-NRU include surface soils, subsurface soils, sediments, surface water, and groundwater. As such, the site investigations at the RFAAP-NRU have been structured to characterize and delineate potential effects in each of these media.

3.6.1 Surface Soil

Considering that the potential contaminant sources at the RFAAP-NRU Study Areas are all above ground, surface soils located within, or in the immediate vicinity of, a source area would be the media most likely to exhibit effects from historical operations or materials at the site. Surface soils outside of the immediate vicinity of a source area would also have the potential to exhibit effects due to the migration of soils or affected media from the source area. The most common factor affecting surface soil migration would be erosion due to surface water runoff in areas with significant topographic relief. Prior to the completion of the 1998 site restoration activities at the BDDT, erosion in the drainage ditch is known to have transported PAH affected surface soils to a downgradient area. Based on limited topographic relief within the BLA, IAA, RY, and WBG, and the findings of comprehensive soil sampling programs, erosion does not appear to have provided a significant transport mechanism at these Study Area.

Mechanical mixing of soils during grading activities could also have contributed to migration of affected surface soils. Grading activities are known to have taken place in the Western Burning Ground during the course of site operations and when the adjacent pond was constructed in the 1990s. Based on the findings of the investigation activities at the RFAAP-NRU the identified constituents of potential concern (COPCs) generally do not appear to be laterally extensive, which indicates that contaminant migration in surface soils is limited.

3.6.2 Subsurface Soil

While there are no known subsurface source areas at the RFAAP-NRU, subsurface soils would have the potential to exhibit effects as a result of contaminant infiltration or physical mixing with surface soils. However, based on the sampling activities conducted within the various Study Areas at the RFAAP-NRU, the identified COPCs are generally confined to surface soils or shallow subsurface soil samples. This indicates that vertical migration of COPCs is limited at the NRU, which is consistent with the hydrogeologic CSM conclusions that infiltration is limited.

3.6.3 Sediments

Sediments are present within the various creeks, ponds, and drainage ditches located throughout the RFAAP-NRU. Sediments in the creeks, ponds, and drainage ditches have the potential to exhibit effects resulting from the erosion of surface soils and COPCs carried by surface water runoff. Sediments also have the potential to exhibit effects resulting from contaminants present in surface water. Sediments in the ponds would not be expected to be very mobile due to low velocity water movement. Sediments in the streams and drainage ditches are expected to be more mobile due to higher velocity water movement that would have the potential to carry sediments and COPCs downstream. Sampling conducted at the various RFAAP-NRU sites has indicated the presence of COPCs in sediments during isolated sampling events at the BDDT, BLA, IAA, RY, and WBG. Sampling conducted in 2002 has also indicated the presence of COPCs in sediment samples collected from the unnamed creek that flows through the southwest corner of the RFAAP-NRU, upstream of the RFAAP-NRU facility boundary. This indicates sediments affected by off-site and/or upstream sources could be carried onto the site. Potential upstream sources include residential and agricultural properties as well as commercial/industrial areas in the town of Dublin, Virginia.

3.6.4 Surface Water

There are two stream networks within the boundaries of the RFAAP-NRU. One of these streams, which is unnamed, flows through the southwestern portion of the facility and is fed by several small tributaries sourced within the facility boundaries. The other stream network is located in the northeastern portion of the facility and includes Hazel Hollow Creek, and tributaries thereof. There are also small ponds located at the WBG, RY, and in the northeastern portion of the RFAAP-NRU, which were formed by damming spring fed tributaries of the two creeks. The drainage ditches at the RFAAP-NRU carry surface water during heavy rainfall events and are not identified as surface water bodies.

The unnamed creek in the southwest portion of the RFAAP-NRU, and its tributaries, flows in the vicinity of several of the Study Areas, including the BDDT, BLA, RY, and WBG. As such, the creek has the potential to exhibit effects resulting from surface water runoff and sediments transported from these areas. The ponds at the RY and the WBG would also have the potential to exhibit effects resulting from those Study Areas. The unnamed creek also has the potential to carry constituents onto the facility from the upstream sources discussed in Section 3.6.3.

3.6.5 Groundwater

The COPCs that have been identified in soil at each of the Study Areas at the RFAAP-NRU are generally restricted to shallow soils and have not undergone significant lateral transport in solution, as confirmed by comprehensive soil sampling programs. Based on the hydrogeologic conceptual model for the RFAAP-NRU the potential for adverse effects to groundwater are minimal for the following reasons:

- Diffuse infiltration is not a significant pathway in the various Study Areas because of the low permeability of the clay rich soils.

- In the karst setting at the NRU, infiltration of dissolved-phase COCs would occur primarily through sinkholes. However, no evidence exists to suggest that a sinkhole pathway exists for any of the RFAAP-NRU areas under investigation.

The function of the springs as shallow groundwater collectors at the RFAAP-NRU makes them ideal locations for screening for potential groundwater quality issues, as discussed in Section 3.3.4,. As such, the four springs identified at the site were included in the 2008 and 2010 groundwater sampling programs.

3.7 Exposure Pathways

The evaluation of potential exposure scenarios under both current and potential future land use scenarios is an important component of the CSM because it provides the framework for conducting the human-health and ecological risk assessments. Exposure points are locations or “points” where exposure could potentially occur, and exposure routes include the basic pathways through which constituents detected onsite may potentially be taken up by the receptor. Within this RI report, both human and ecological exposure scenarios will be evaluated based on all available data.

3.7.1 Human Exposure

The potentially exposed receptors at the site have been identified based on both current and reasonably anticipated future land use of the areas located in the vicinity of the site. As discussed in Section 3.1, the site is currently utilized as a storage facility for operations at the RFAAP-MMA. There are no active manufacturing operations taking place and there are no residents at the site. Depth to groundwater ranges from 13 ft bgs to more than 150 ft bgs, and groundwater in the vicinity of the site is not being used as a potable water source.

Based on site characteristics discussed above, the current receptors only include a site commercial/industrial worker.

Due to the industrialized/military nature of the site, redevelopment of the site for residential purposes is highly unlikely. Remedial decisions will be based on the current and reasonably expected future use (military industrial). However, hypothetical exposure of residential receptors was evaluated in the risk assessment as a conservative measure and to assist the Army in making risk management decisions. Exposure pathways in the future could potentially include exposure to surface and subsurface soil, sediment, surface water, and groundwater used as a potable water source. Exposure to soil for the residential receptor could occur through ingestion; dermal contact; and inhalation of vapors, asbestos fibers, and/or COPCs adhered to fugitive dust. Exposure to sediment for the resident receptor could occur through ingestion and dermal contact during wading. Exposure to surface water could occur through ingestion or dermal contact during wading while exposure to groundwater could occur though all routes if groundwater is used as a domestic water supply. Further, resident receptors may also be exposed to constituents that might have accumulated in fish tissue samples collected from the unnamed pond in the WBG.

In the event of site redevelopment, construction workers may, in the future, be exposed to surface and subsurface soil if excavation activities take place.

Exposures of hypothetical current or future trespassers were not evaluated because their exposures, if any, would be of a limited frequency and duration since the site is completely fenced and access is controlled. This hypothetical receptor would have far less exposure than the receptors selected for quantitative evaluation (e.g., exposure duration of five days per year for a trespasser versus 250 days per year for the industrial site worker or 350 days per year for a residential scenario).

Likewise, exposure of hypothetical current or future angler receptors from ingestion of fish from the unnamed pond at the WBG was not evaluated because the exposure, if any, would be of a limited frequency and duration since the RFAAP-NRU is completely fenced and access is controlled. In addition, a hypothetical angler receptor would have far less exposure than the resident angler selected for quantitative evaluation.

The potential exposure pathways for human receptors at the RFAAP-NRU are presented in Figure 3-3. The human exposure components of the CSM are discussed in further detail in Appendix A and Section 4.3.3 of this report.

3.7.2 Ecological Exposure

Potential ecological receptors are designated based on the available habitat associated with the site. Terrestrial habitat and aquatic habitat is present at each of the Study Areas. The terrestrial habitat consists of mixed forest, open fields, and grassy areas. The aquatic habitat consists of various storm water drainage channels, creeks, and ponds.

The potentially exposed receptors at the RAAP-NRU include terrestrial wildlife (including mammals, birds, reptiles, and invertebrates), terrestrial plants, and aquatic biota (fish and invertebrates directly within the aquatic habitat). The potential exposure pathways for ecological receptors at the RFAAP-NRU are presented in Figure 3-4. The ecological exposure components of the CSM are discussed in further detail in Appendix A and Section 4.4 of this report.

4. Methods and Procedures for Data Evaluation

This section discusses the methods and procedures that were utilized to evaluate the environmental site conditions at each of the five Study Areas (i.e., BDDT, IAA, BLA, WBG, and RY) and site-wide groundwater at the RFAAP-NRU. Data collected during each phase of investigation were first evaluated by comparison to applicable screening criteria (See Section 4.1). The combined data sets from all investigations were then utilized to develop an assessment of the nature and extent of contamination present at each site. Once the nature and extent of contamination and constituents of potential concern were identified, a site specific HHRA and ERA was conducted for each Study Area and for facility-wide groundwater. The purpose of the risk assessments was to evaluate the potential current and future excess lifetime cancer risks and potential hazards to both human and ecological receptors at the site from exposure to constituents detected in soil, groundwater, surface water, and sediment at the RFAAP-NRU. The risk assessments were conducted in a manner consistent with the approach outlined in the Master Work Plan (URS 2003) in compliance with Comprehensive Environmental Response, Compensation, and Liability Act/ Superfund Amendments and Reauthorization Act (CERCLA/SARA). The results of the data evaluation process and risk assessments for each of the Study Areas and for facility wide groundwater are presented in Sections 5 through 10 of this report.

4.1 Initial Data Comparison Criteria

Environmental data collected from each of the Study Areas are initially discussed by comparison to screening criteria. Comparison criteria are constituent and medium specific concentrations that are used to provide a reference value for site specific analytical data. Comparison criteria are typically published values that are based on calculations which assess the increase in risk under default assumptions to a given population based on the concentrations of constituents in environmental media at a site. These values can be used to assess the risk to a human population or to an ecological population.

The Study Area assessments presented in this report utilize human health based screening levels derived from those presented in the United States Environmental Protection Agency's (USEPA's) Regional Screening Levels (RSLs) table (USEPA 2009a) as comparison criteria. Screening levels for soil and sediment were based on industrial and residential soil RSLs while screening levels for groundwater and surface water were based on tap water RSLs. The RSLs are calculated to demonstrate the concentration of a given constituent that will not result in an increase in risk to an individual beyond a hazard quotient (HQ) of 1 for non-carcinogenic compounds and an increase in cancer risk of 1 x 10^{-6} for potentially carcinogenic compounds. Because the Study Areas presented in this report are potentially contaminated with multiple constituents, and because noncarcinogenic effects can sometimes be cumulative, the RSLs based on noncarcinogenic effects were adjusted to reflect a target HQ of 0.1, where applicable (i.e., the published RSLs for non-carcinogens were divided by 10). For screening levels based on cancer effects where the noncancer screening level was less than 10 times (10x) the cancer level (tagged with c** in RSL table), the non-cancer level was used after adjustment. This adjustment was not conducted for the lead RSLs as they are based on blood lead levels rather than cancer or non-cancer endpoints. Where appropriate, surrogate RSLs were used for constituents that lack screening levels. The adjusted RSLs are referred to as industrial and residential screening levels in this report. Table 4-1 presents a summary of the RSLs utilized during the data comparison process.

It should be noted that there is no RSL available for asbestos. However, it is known that concrete slab floors in some buildings in the BLA and IAA Buildings were covered in a conductive flooring material that contained asbestos. Removal of the walls and roofs of the buildings has exposed the conductive flooring to weather, causing it to degrade and break away from the underlying concrete. In some cases, the flooring has degraded into a red powder-like material and washed onto the surrounding soils. Since it is known that asbestos is present in some portions of the site, this was carried through as a COPC. However, asbestos is evaluated somewhat differently from other constituents. Thus the general approach used to evaluate it is provided in Section 4.3.4.4.

In addition to the RSLs, inorganic constituents (i.e. inorganics) detected in soil were compared to the background inorganics concentrations presented in the Facility-Wide Background Study Report (IT 2001). The background inorganics concentrations are based on calculated 95% UTLs generated from a facility-wide data set that incorporates both surface and subsurface soil from the RFAAP-MMA and the RFAAP-NRU. The calculated background concentrations are utilized to help differentiate between naturally occurring inorganic concentrations and concentrations resulting from human influence. Inorganics are not considered to be site related contaminants unless the concentrations are above the background concentrations. Table 4-2 presents a summary of the background inorganics concentrations for the RFAAP. As indicated in this table, some of the background inorganics concentrations are higher than the soil RSLs.

4.2 Risk Assessment Data Sets

Samples collected during site investigations conducted from 1997 through 2008 were considered for inclusion in the risk assessment. The environmental data collected throughout the various phases of investigation were grouped by Study Area and medium of interest (e.g., soil, sediment, groundwater and surface water) and then evaluated to produce risk assessment datasets. Soil data were also subdivided into a surface soil for evaluating ecological receptors (0-1 ft), and surface soil (0-2 ft) and combined surface and subsurface soil for evaluating human exposure. The following components were considered in the preparation of the risk assessment datasets: data quality, sample and result type, data qualifications, vertical and spatial distribution of the data, and constituent classification (e.g., dioxins). Each of these considerations is discussed in detail within the comprehensive RFAAP-NRU Risk Assessment presented in Appendix A. Appendix A includes a discussion of the methods and procedures utilized during the risk assessment activities, as well as the findings of the human health and ecological risk assessments for all of the individual Study Areas discussed in this report.

After the risk assessment datasets were prepared, the data included in each dataset were summarized, statistically analyzed, and then tabulated by highlighting the number of detects, number of samples, frequency of detection (FOD), minimum and maximum detected concentrations, and minimum and maximum detection limits.

4.3 Human Health Risk Assessment Methods and Procedures

The purpose of the HHRA is to evaluate the potential current and future potential risks and hazards to human health associated with constituents detected in surface and subsurface soil, groundwater, sediment and surface water samples collected at the RFAAP-NRU. Methods and parameters used in the HHRA were in compliance with USEPA guidance for risk assessments (USEPA 2004a; 2000a; 1997a; 1992; 1991a; 1989) and are consistent with the approach defined in the Master Work Plan (URS 2003). The HHRA methods are discussed in detail in Appendix A and are briefly summarized in the text below.

4.3.1 Constituent Characterization

This section discusses the methods used to select chemicals of potential concern (COPCs) for the HHRA and the physical and chemical properties of the selected COPCs.

COPCs were identified for each of the Study Areas by comparing maximum detected concentrations to health based screening levels. If the maximum detected concentration was greater than the screening level, the constituent was identified as a COPC and quantitatively evaluated in the HHRA. A full discussion of the derivation of the human health based screening levels used is presented in Section 4.1 and the screening levels are presented in Table 4-1. In addition to the screening levels, inorganic constituents detected in soil and sediment were compared to the background inorganic constituent concentrations established in the Facility-Wide Background Study Report (IT 2001). The background inorganic constituent concentrations are presented in Table 4-2. Constituents present at levels within background ranges were retained as COPCs in the HHRA and potential risks and hazards were quantified. The risks associated with naturally occurring levels of inorganics also were quantified and are discussed in comparison to site related risks as part of the risk characterization consistent with USEPA (2002e) guidance. Constituents selected as COPCs based on human health protection were carried forward into the HHRA.

4.3.2 Toxicity Assessment

Toxicity values for potential non-carcinogenic (reference doses - RfDs) and carcinogenic effects (cancer slope factors - CSFs) were obtained from the following sources in order of priority following USEPA (2003b) guidance:

- USEPA Integrated Risk Information System (IRIS) database (USEPA 2008b);
- USEPA's National Center for Environmental Assessment Provisional Peer-Reviewed Toxicity Values (PPRTVs) as reported in USEPA RSL Tables (USEPA 2009a); and
- USEPA’s Health Effects Assessment Summary Tables (HEAST; USEPA 1997b).

Other sources used included the California Environmental Protection Agency (Cal EPA), the Agency for Toxic Substances and Disease Registry (ATSDR) and the World Health Organization (WHO), as referenced by USEPA (2009a).

In accordance with USEPA guidance (USEPA 2005c), PAHs were evaluated using an age-dependent adjustment factors (ADAFs) for assessing carcinogenic risk associated with early-life exposures. Chemical-specific ADAFs were calculated for the PAHs using the data specific to benzo(a)pyrene and other PAHs.

The USEPA identifies lead as a “probable human carcinogen” based on sufficient animal evidence but inadequate human evidence (USEPA 2007a). However, the USEPA does not recommend evaluating lead cancer risk using a CSF (USEPA 2003c). Instead, lead non-carcinogenic risks (identified as neurological effects) are evaluated by predicting blood-lead concentrations using toxicokinetic modeling. This is because there is a strong correlation between lead exposure and resulting blood lead levels. Thus, toxicity values were not identified for lead and exposure to lead was assessed by estimating blood lead levels.

Toxicity values are presented in Tables A.2-4 through A.2-7 within Appendix A.

4.3.3 Exposure Assessment

The exposure assessment is described in detail in Appendix A. The basic components of the exposure assessment steps are summarized below:

4.3.3.1 Receptors and Exposure Pathways

Exposure pathways were identified in Section 3.5.3.1 based on the site characterization information and the fate and transport properties of the constituents detected onsite to identify likely points where human receptors may come in contact with affected media under current or potential future conditions at the site. The following receptors and potentially complete and significant exposure pathways were identified for quantitative analysis at the site:

Current/Future Onsite Commercial/Industrial Worker Receptor

- Dermal contact with surface soil, sediment, and surface water
- Incidental ingestion of surface soil, sediment, and surface water
- Inhalation of particulates in outdoor air
- Inhalation of volatile COPCs in ambient air (if VOCs are selected as COPCs).

Hypothetical Current/Future Onsite Construction/Utility Worker Receptor

- Dermal contact with surface and subsurface soil
- Incidental ingestion of surface or subsurface soil
- Inhalation of particulates in ambient air during soil intrusive activities
- Inhalation of volatile COPCs in surface and subsurface soil in ambient air (if VOCs are selected as COPCs).

Hypothetical Future Onsite Resident

- Dermal contact with surface and subsurface soil, sediment, and surface water
- Ingestion of surface and subsurface soil, sediment, and surface water
- Inhalation of particulates (from soil) in ambient air during outdoor activities
- Inhalation of volatile COPCs in indoor air (if VOCs are selected as COPCs) either from groundwater use in the home or from vapor migration into the home
- Ingestion of fish caught for recreation (where relevant)
- Ingestion of and dermal contact with groundwater used domestically

4.3.3.2 Exposure Point Concentrations

Exposure point concentrations (EPCs) are representative constituent concentrations that a receptor may contact at an exposure point over the exposure period (USEPA 1989). Ideally, the EPC should be the true average concentration; however, because of the uncertainty associated with estimating the true average concentration based on a limited dataset, the estimated upper confidence level (UCL) on the mean (i.e., a UCL of 95 percent or higher) should be used as the EPC. The maximum concentration can be used as the EPC where the UCL cannot be calculated.

EPCs were calculated for COPCs by medium at each Study Area consistent with guidance as discussed in detail with Appendix A. The surface soil, combined surface and subsurface soil, sediment, surface water, and groundwater EPCs are presented in the Study Area-specific data summary tables discussed in later sections of this report.

4.3.3.3 Exposure Parameters

Exposure parameters are values used to quantify the assumed exposure to COPCs for each receptor. For this HHRA, exposure parameters that represent the reasonable maximum exposure scenario were selected.

The receptor-specific exposure parameters are summarized in Table A.2-10 within Appendix A, and are discussed in detail within Appendix A.

4.3.4 Risk Characterization

The equations used in the risk characterization calculations are presented in Tables A.2-11 through A.2-15 within Appendix A.

Potential risks to human health are evaluated quantitatively by combining calculated exposure levels (i.e., dose) and toxicity data. A distinction is made between non-carcinogenic and carcinogenic endpoints as discussed in the subsections below.

4.3.4.1 Non-carcinogenic Effects – Hazard Quotients and Hazard Indices

Exposure doses are averaged over the expected exposure period to evaluate non-carcinogenic effects. The HQ is the ratio of the estimated exposure dose and the RfD. An HQ greater than 1 indicates that the estimated exposure level for that constituent is greater than the RfD. This ratio does not provide the probability of an adverse effect. Although an HQ of 1 indicates that health effects should not occur, an HQ that is greater than 1 does not imply that health effects will occur, but that health effects are possible.

The sum of the HQs is the hazard index (HI). A limitation with the HI approach is the assumption of dose additivity is applied to compounds that may induce different effects by different mechanisms of action. Consequently, the summing of HIs for a number of compounds that are not expected to induce the same type of effects or that do not act by the same mechanism may overestimate the potential for toxic effects (USEPA 1989). Consistent with USEPA risk assessment guidelines for constituent mixtures, in the event that the total HI for an exposure scenario is greater than 1, it is incumbent on a risk assessor to segregate HQs by target organ/critical effect (USEPA 1989). Therefore, if the calculated HI is greater than 1 as a consequence of summing several HQs for constituents not expected to induce the same type of effects or that do not act by the same mechanism, the HIs may be segregated by effect and mechanism of action to derive separate HIs for each target-organ/critical-effect group (USEPA 1989). Where target organ HIs exceeded one, the constituents of concern contributing to those HIs were identified.

4.3.4.2 Carcinogenic Effects - Excess Lifetime Cancer Risk

The excess lifetime cancer risk (ELCR) is an estimate of the potential increased risk of cancer that results from lifetime exposure, at specified average daily dosages, to COPCs at a site. Estimated doses or intakes for each COPC are averaged over the average lifetime of 70 years. It is assumed that a large dose received over a short period is equivalent to a smaller dose received over a longer period, as long as the total doses are equal. The ELCR is calculated as the product of the exposure dose and the CSF. The use of upper percentile EPC and reasonable maximum exposure

(RME) exposure parameters result in a risk estimate that is considered to be an upper-bound estimate; in other words, the true risk is less than that predicted by the model.

The USEPA considers ELCRs within the target risk range of 10^{-6} to 10^{-4} to be generally acceptable. USEPA (1991b) generally considers remediation of sites with risks less than 1 x 10^{-4} to be unwarranted unless there are ecological affects. Where ELCR exceeded $1x10^{-4}$, the risk drivers were identified.

4.3.4.3 Evaluation of Lead Exposures

Exposure to lead is evaluated differently than the other constituents. Cancer risk and non-cancer hazard quotients are not estimated from exposure to lead because health effects from exposure to lead are better characterized by estimating the amount of lead that may reach the bloodstream following exposure.

Consistent with current USEPA guidance (USEPA 2003c), USEPA's Adult Lead Methodology (ALM) model and USEPA's Integrated Exposure Uptake Biokinetic Model for Lead in Children (IEUBK; USEPA, 2005a) were used to evaluate the potential for adverse health effects from exposure to lead by adults and children, respectively. The models were used to calculate the 95th percentile blood-lead concentrations for each receptor, which were compared to the target blood-lead concentration of 10 micrograms per deciliter (µg/dL). The ALM is used to evaluate exposure of both industrial and hypothetical future adult resident receptors. Appendix A provides a complete discussion of the input parameters used for blood lead level modeling.

Blood lead levels were estimated for the three areas where lead was identified as a COPC in soil or sediment: the IAA, the BLA, and the WBG. The model runs and the result summaries for each Study Area are discussed in the section of the report devoted to those Study Areas.

4.3.4.4 Evaluation of Asbestos Exposure

USEPA has recently developed a recommended framework for evaluating potential risks associated with asbestos in soil. This framework addresses the fact that asbestos concentrations in soil are not always good predictors of the level of exposure and risk that may be experienced by individuals who come into contact with that soil. This is because the potential risk experienced by those individuals is not a function of the concentration in the soil but is instead a function of their potential inhalation of asbestos fibers that may become airborne when and if soil is disturbed.

In recognition of this framework, a different approach was used to evaluate potential risks associated with asbestos in surface soil. This approach involved the calculation of air action levels (AALs) by combining the methodology outlined in USEPA's framework document with some of the scenario-specific exposure parameters discussed above. The AALs were then compared with airborne asbestos concentrations measured during activity-based air sampling, to determine whether asbestos might pose a potential risk to individuals who come into contact with that soil. The specific methodology for calculating the AALs is provided in Section 4.4.5 of Appendix A.

4.3.5 Uncertainties in the Human Health Risk Assessment

The risk estimates presented herein are a conservative estimate of potential risks associated with exposure to constituents detected in soil, groundwater, sediment, and surface water at the RFAAP-NRU. Uncertainty is inherent in the risk assessment process, and a discussion of these uncertainties is presented in Appendix A. Each of the three basic building blocks for risk assessment (monitoring data, exposure scenarios, and toxicity values) contributes uncertainties. Each of the uncertainties is accounted for by using conservative assumptions wherever site-specific data are unavailable so that the overall risk estimates are conservative and therefore any decision based upon the risk estimates would be health-protective.

4.4 Ecological Risk Assessment Methods and Procedures

Site-specific ERAs were conducted at each of the five Study Areas evaluated in this RI. The purpose of the ERAs was to evaluate the potential current and future risks and potential hazards to ecological receptors associated with constituents detected in surface soil, sediment, surface water, and spring water conditions at each of the Study Areas within RFAAP-NRU.

The ERAs were conducted in a manner consistent with USEPA guidance for ecological risk assessment (USEPA 2001a; 2000b; 1997c) and follow the approach in the Master Work Plan (URS 2003). The ERAs are intended to provide a conservative understanding of environmental conditions as they relate to the protection of wildlife populations and communities for risk management decision-making at the RFAAP-NRU.

In accordance with USEPA guidance, the ERAs conducted for the five Study Areas at the RFAAP-NRU are comprised of a SLERA and a baseline ERA (BERA) (USEPA

2000b; 1997c). Appendix A provides detailed information on the methods used in the ERA and they are also briefly described in the following sections. Appendix A also contains the complete ERAs for each of the five Study Areas discussed in this report.

4.4.1 Screening Level Ecological Risk Assessment

A SLERA conservatively estimates potential risks that may affect ecological receptors, including terrestrial and aquatic organisms. The SLERA typically compensates for uncertainty in a precautionary manner, by incorporating numerous conservative assumptions. The outcome of the SLERA is the conclusion that either there is a high probability that ecologically significant risks are not posed to receptors, or further investigation in the form of a BERA is warranted. Consistent with USEPA (1997c) guidance, the SLERA is comprised of the following steps:

- Step 1: Screening-Level Problem Formation,
- Step 1: Screening Level Ecological Effects Evaluation,
- Step 2: Screening Level Exposure Estimate and Risk Calculation, and
- Scientific Management Decision Point (SMDP).

For each of the five Study Areas, a modified SLERA was conducted following the typical steps in a SLERA and also incorporating some steps typically taken later in the BERA, as a BERA was anticipated in each Study Area. Methods used during those steps of the SLERA are described in details in Appendix A and are summarized below.

4.4.1.1 Step 1: Screening-Level Problem Formulation Screening Level Ecological Effects Evaluation

The screening-level problem formulation presents information that is used to develop a CSM that illustrates the potential relationships between stressors, pathways, and receptors such as:

- Environmental Setting,
- Identification of Constituents Detected,
- Description of Constituent Fate and Transport Pathways,
- Description of Constituent Mechanisms of Ecotoxicity,
- Description of Potentially Exposed Receptors,

- Identification of Potentially Complete Exposure Pathways, and
- Selection of Generic Assessment and Measurement Endpoints.

For the RFAAP-NRU, hypothetical assessment endpoints include the following:

- Sustainability of small mammal populations;
- Sustainability of avian populations;
- Sustainability of terrestrial plant communities;
- Sustainability of soil invertebrate communities; and
- Sustainability of aquatic communities (i.e., fish and invertebrates).

Because direct measurement of assessment endpoints is often difficult or impossible, surrogate endpoints called measurement endpoints are used to provide the information necessary to evaluate whether the values associated with the assessment endpoint are being protected. A measurement endpoint is defined as a measurable ecological characteristic and/or response to a stressor (USEPA 1998). HQs typically serve as the measurement endpoints for SLERAs.

4.4.1.2 Step 1: Screening-Level Ecological Effects Evaluation

The screening-level ecological effects evaluation involves the identification of ecological screening levels (ESLs) for each detected constituent detected in each environmental medium at the RFAAP-NRU. ESLs are generally based on effects such as mortality and reproductive impairment, and are assumed to be widely applicable to sites around the United States for screening purposes (USEPA 1997c). Typically in a SLERA, ESLs are gathered from one or two sources leaving constituents without ESLs to be evaluated in the BERA. In this SLERA, ESLs were gathered from several sources during the modified SLERA to preserve effort in the BERA.

The following sources were considered in identifying soil ESLs for the SLERA:

- USEPA Ecological Soil Screening Levels (EcoSSLs) (USEPA 2005b);
- Region 5 Ecological Screening Levels (USEPA 2003e); and
- Oak Ridge National Laboratory (Efroymson et. al. 1997a,b; ORNL).

The following sources were considered in identifying sediment ESLs for the SLERA:

- Region 3 Sediment Screening Levels (USEPA 2008b);
- Oak Ridge National Laboratory (Jones et al. 1997, ORNL);
- Region 5 Sediment Screening Levels (USEPA 2003e); and

- U.S. EPA Assessment and Remediation of Contaminated Sediments Program (ARCS) – used for aluminum ESLs.

The following sources were considered in identifying surface water ESLs for the SLERA:

- Region 3 Fresh Water Screening Levels (USEPA 2008c);
- Oak Ridge National Laboratory (Suter and Tsao 1996, ORNL);
- Region 5 Surface Water Screening Levels (USEPA 2003e); and
- USEPA National Ambient Water Quality Criteria (USEPA 2008e).

Where multiple values were provided by sources, the lowest values were conservatively selected as is appropriate for a SLERA (USEPA 2000b; 1998; 1997c) if they were considered to have equal relevance and technical basis and rationales for selection were discussed.

Further, in this step, constituents that have a tendency to bioaccumulate were also identified if they were designated as such by USEPA Region 3 (USEPA 2008c,d) or are included in the USEPA list of bioaccumulative compounds (USEPA 2000c).

Soil, sediment, and surface water ESLs for constituents detected onsite and their bioaccumulation potential are presented in Table A.2-18 within Appendix A.

4.4.1.3 Step 2: Screening-Level Exposure Estimate and Risk Calculation

The screening-level exposure assessment is comprised of the identification of exposure estimates, risk calculations, and the evaluation of uncertainties (USEPA 2001b; 1997c). These components form the lines of evidence necessary to support the SMDP at the conclusion of the SLERA.

Exposure estimates used for the modified SLERA were the maximum detected concentrations for each constituent (USEPA 2001d; 1997c).

Risks to ecological receptors were calculated by dividing the exposure estimates (i.e., the maximum detected concentrations) by the conservative ESLs. The resulting ratio, the “maximum HQ”, is a highly conservative surrogate for the assessment endpoints. HQs equal to or less than a value of 1 (to one significant figure) indicate that adverse or significant ecological effects are unlikely (USEPA 1997c). Maximum HQs greater than 1 indicate that further evaluation is warranted to evaluate the potential for adverse ecological effects. Therefore, the constituents with HQs greater than 1 are identified as

Constituents of Potential Ecological Concern (COPECs) and carried forward into Step 3a of the BERA, except where the constituents are inorganics with maximum concentrations that are not greater than background levels. The comparison with background is typically done in the first step of a BERA, however it was done here in the modified SLERA. Constituents were also identified as COPECs if no ESL was available or if it was identified as bioaccumulative.

4.4.1.4 Scientific Management Decision Point

SMDPs represent critical steps in the ecological risk assessment process where risk management decision-making occurs. As was previously stated, the BERA is conducted for constituents with HQs that exceed 1 and constituents that lack ESLs. Reporting occurs after either Step 2 or Step 3a, depending on the results obtained in Step 2, so that additional evaluation of risks can be evaluated if needed and reporting can be streamlined into a single report (USEPA, 2000b). Generally, the following types of decisions are considered at this SMDP:

- Whether the available information is adequate to conclude that ecological risks are negligible and, therefore, there is no need for remediation on the basis of ecological risk.
- Whether the available information is not adequate to make a decision at this point, and the ecological risk assessment process should continue.
- Whether the available information indicates a potential for adverse ecological effects, and a more thorough assessment or remediation is warranted.

The results of the screening-level risk calculations determine if the ERA should continue into the BERA.

4.4.2 Baseline Ecological Risk Assessment

The BERA is designed to more realistically identify the nature and extent of ecological risks to support informed risk management decision-making (USEPA 2000b; 1997c). This approach contrasts with the SLERA, which is designed to conservatively rule out further evaluation of constituents and media that clearly do not pose a significant ecological risk.

Methods and Procedures for Data Evaluation

This section presents Step 3a of the BERA for the RFAAP-NRU, which is a refinement of the Step 2 exposure estimates and risk characterization, and focuses only on COPECs that were not eliminated in the SLERA. The refinement of the assessment presented in Step 1 and Step 2 is necessary to help focus and streamline further risk assessment activities on the constituents that pose the greatest potential risk to ecological receptors (USEPA 2001b; 2000b; 1997c). It is intended as an "incremental iteration of exposure, effects, and risk characterization" (USEPA 2001a). The outcome of this refined screening process is a list of COPECs to be retained for further evaluation in the BERA process.

The Step 3a discussion for the RFAAP-NRU is comprised of the following:

- Refinement of the list of COPECs,
- Refinement of Risk Calculations for Direct Contact COPECs,
- Assessment and Measurements Endpoints for Bioaccumulative COPECs, and
- Uncertainties.

Step 3a is followed by a SMDP that involves the reporting of results of Steps 1 through 3a.

4.4.2.1 Step 3a: Refinement of Constituents of Potential Ecological Concern and Direct Contact Risk Estimates

The list of COPECs was refined in this BERA by refining the HQs. The refined HQs were calculated for the COPECs identified in the SLERA, using refined EPCs (i.e., the lesser of the maximum detected concentration and the UCL) which is consistent with the approach for "incremental iteration of exposure, effects, and risk characterization" (USEPA 2001a; 1997c). Constituents identified as COPECs in the BERA that were bioaccumulative were evaluated using food chain models.

Further, it is well known that sediment toxicity of a substance is related to the bioavailable fraction of that substance in the pore water of sediments. Substances that are sequestered by sediment ligands are neither bioavailable nor toxic to benthic organisms. Organic compounds typically adhere to other organics in sediment such as humic acid. Inorganics can be sequestered by both organic matter in sediment and by sulfides present in the anoxic region of sediment. Risk from organic compounds can be refined by using partitioning techniques- specifically by normalizing the concentration to the amount of organic carbon in sediment then dividing that quotient by a value that represents an acceptable limit to give what is referred to as a Toxic Unit (TU). For whole assess of compounds that might be additive, the summation of the TUs represents the HQ. If the HQ (total TUs) is equal to or less than one in a particular sediment sample, the concentration of the organic mixture in sediment is acceptable for the protection of benthic organisms. If the HQ exceeds one, the concentration of the organic mixture in the sediment may not be acceptable for the protection of benthic organisms.

When PAHs were identified as COPECs, toxic units based on PAH *Equilibrium Partitioning Sediment Benchmarks (ESBs; USEPA 2003g) referred to as* ESBTU were used to refine risk estimates. The ESBTU approach was used to calculate a total TU which was compared to the benchmark of one. Where available, sample specific total organic carbon (TOC) was used otherwise the average TOC at the site was used instead. TOC ranged between 2.2% to 5.4% at the site and averaged at 3.4 percent (Tables 5-7, 6-2, 7-7, 7-8, 9-5, 9-8, 9-10, and 9-11). This approach is discussed in detail in Appendix A.

4.4.2.2 Step 3 a: Assessment and Measurement Endpoints for Bioaccumulative COPECs

Following the identification of bioaccumulative COPECs, the assessment and measurement endpoints at the RAAFP-NRU were refined. Additional assessment and measurement endpoint are summarized in the following table:

Additional Assessment and Measurement Endpoints

Assessment Endpoint	Measurement Endpoint	Effects Measured
Survival and reproductive success of mammals exposed to bioaccumulative compounds in the terrestrial and aquatic food chain	Adverse changes in survival and reproduction as indicated by food chain modeling for short-tailed shrews and mink	NOAELs and LOAELs related to adverse chronic effects, such as reduced survival and reduced litter size
Survival and reproductive success of birds exposed to bioaccumulative compounds in the terrestrial and aquatic food chain	Adverse changes in survival and reproduction as indicated by food chain modeling for American robins and for the Great Blue Heron	NOAELs and LOAELs related to adverse chronic effects, such as eggshell thinning or reduced fledgling survival

NOAEL no observed adverse effect level.

LOAEL lowest observed adverse effect level.

A discussion of the wildlife receptors selected as measurements endpoints at the RAAF-NRU is presented in Appendix A. Wildlife receptor exposure parameters were gathered from USEPA (1993a,b) and from literature sources as applicable. Wildlife receptor exposure parameters are summarized in Table A2-19 within Appendix A.

4.4.2.3 Food chain Modeling

Bioaccumulative COPECs were identified and were assessed using food chain modeling in both the terrestrial and aquatic food chains. Food chain models predict detrimental effects to wildlife survival and reproduction. Food sources for terrestrial model include soil, vegetation, invertebrates and small mammals and food sources for aquatic food chains include sediment, surface water, vegetation, invertebrates, small mammals, and fish. Measured concentrations in the food sources were used where available (i.e., soil, sediment, and surface water in all Study Areas and whole body fish tissue concentrations in the unnamed pond in the WBG). To estimate concentrations in plants, invertebrates and small mammals, and fish, bioconcentration factors (BCFs) and bioaccumulation factors (BAFs) were used. BCFs describe the transfer (uptake) of a constituent from environmental media into tissues of vegetation and organisms in the food chain, while BAFs describe the transfer (uptake) of a constituent from dietary tissue into tissues of organisms in the food chain. The following medium-biota BCFs and BAFs were developed:

- Soil-to-Vegetation Uptake ($BCFsl_v$)
- Soil-to-Invertebrate Uptake ($BCFsl_i$)
- Soil-to-Mammal/Bird Uptake ($BAFsl_{mam}$).
- Sediment-to-Plant Uptake ($BCFsed_{plant;}$ dw)
- Sediment-to-Invertebrate ($BCFsed_{inv}$)
- Sediment-to-Mammal ($BAFsed_{mam}$)
- Sediment-to-Fish ($BAFsed_{fish}$).

The soil and sediment BCFs and BAFs for the COPECs are identified in Tables A.2-20 and A.2-21, within Appendix A, respectively. The tables include the sources where each value was obtained.

4.4.2.3.1 Intake Assessment

Daily intake represents an estimate of a COPEC dose that a receptor might receive on a daily basis, and is calculated by summing intakes for assumed exposure pathways (i.e., dietary composition types) for each receptor. Intake is calculated by combining the concentration of a COPEC in an exposure media (soil/sediment, food, and water) with applicable receptor exposure assumptions. Two types of exposure concentrations were used in the BERA. For the maximum risk estimates, maximum concentrations were used as exposure concentrations while for the refined scenario, EPCs based on the lower of the maximum and the UCL (where calculable) were used as the exposure concentrations.

To estimate the concentration of a bioaccumulative COPEC in a secondary food source (vegetation, invertebrates, small mammals, fish), bioaccumulation factors (BAFs) are used. To estimate intake in the wildlife receptor, the concentrations in the food sources were combined with wildlife receptor exposure parameters.

4.4.2.3.2 Effects Assessment

Food chain modeling requires the use of toxicity reference values (TRVs) to describe the potential toxicity of the COPECs to ecological receptors. The TRV is the assumed safe dose (in milligrams per kilogram body weight per day [mg/kg-BW-day]) to the receptor species. Calculation of TRVs generally relies on the use of laboratory toxicity benchmarks for laboratory species, as data on wildlife species usually are not available. Ecotoxicity benchmarks are typically reported as no observed adverse effect levels (NOAELs) and lowest observed adverse effect levels (LOAELs) for the laboratory species upon which testing was conducted.

For mammalian receptors, NOAELs and LOAELs are adjusted to account for the differences in body weights between the species tested and the receptor species (Sample et al. 1996). The extrapolation is based on the premise that metabolic function and toxicity are related to body size (i.e., constituents are less toxic to smaller animals because they metabolize and excrete constituents faster). Therefore, mammalian toxicity values were derived from toxicity values from laboratory studies using the Sample et al. (1996) equation. Toxicity values for birds are not adjusted to reflect the different weights of test species and wildlife receptor species (Sample et al. 1996).

Avian and mammalian TRVs used in this BERA are presented in Tables A.2-22 and A.2-23, within Appendix A, respectively.

4.4.2.4 Risk Characterization

Potential risk was estimated using HQs, which were the ratio of the concentration in a given media to the screening level in the media. For the assessment endpoint on higher trophic levels, the HQ was the ratio of the daily intake to the TRV. Equations used for risk characterization including intake equations and equation used to estimate mammalian and avian TRVs are presented in Table A.2-24.

Maximum risk estimates were calculated by combining maximum concentrations and conservative (maximum) exposure assumptions in the food chain models. Refined risk estimates were calculated by combining EPCs, based on the UCL where calculable and maximum concentrations if not, and screening levels or refined exposure assumptions in the food chain models.

4.4.2.5 Refined Uncertainties

A BERA is designed to evaluate potential risks for wildlife by incorporating iterative changes that reduce uncertainty (when possible) and provides more realistic exposure assumptions. Uncertainties associated with the BERA are summarized on Table A.2-18 within Appendix A.

4.4.2.6 Scientific Management Decision Point

As discussed previously, the SMDP represents a critical step in the ecological risk assessment process where risk management decision-making occurs (Figures 4-1 and 4-2). An SMDP occurs after Step 2 and Step 3a (if necessary based on the results of Step 2), so that additional evaluation of risks can be conducted if needed and reporting can be streamlined into a single report (USEPA 2000b). Generally, the following types of decisions are considered at this SMDP:

- Whether the available information is adequate to conclude that ecological risks are negligible and, therefore, there is no need for remediation to mitigate ecological risks.

- Whether the available information is not adequate to make a decision at this point, and the ecological risk assessment process should continue.

- Whether the available information indicates a potential for adverse ecological effects, and a more thorough assessment or remediation is warranted.

If the SMDP indicates that either information is not adequate to make a decision or information indicates a potential for adverse ecological effects, then the ERA process should continue.

5. Building Debris Disposal Trench

5.1 Site Description and History

The BDDT is located in the southern portion of the RFAAP-NRU, south of A Avenue (Figure 1-2). The trench was formerly an ephemeral unlined natural drainage channel that had eroded into the clay surficial soil. The trench channels surface water runoff from the surrounding area down the length of the trench towards an unnamed creek which passes through the area at the base of the BDDT. An approximately 600 ft long portion of the natural depression formed by the trench was previously utilized for the disposal of miscellaneous building debris derived from the dismantling of various structures at the RFAAP-NRU. The building debris consisted of concrete, wood, and rusted and broken drums of a black, tarry substance believed to be roofing tar. The building debris and any visibly stained soil were removed from the trench during a 1998 site investigation. The excavated material was replaced with clean fill and the trench was lined with a geotextile fabric and filled with riprap to minimize the potential for erosion. The open area downgradient of the trench did not contain any debris and was not addressed during the 1998 site restoration activities. However, the open area downgradient of the trench is covered with a thick grass groundcover and is a natural depositional area for any soils that would have washed out of the disposal trench prior to the site restoration. An aerial photograph of the BDDT area is included as Figure 5-1 that depicts the layout of the site.

5.2 Physical Setting

Rolling, grass-covered hills with incised drainage channels provide the setting for the BDDT. The trench runs from north to south between two hills and is approximately 650ft long by 15 ft wide. The head of the trench begins at A Avenue, at an approximate elevation of 2,000 ft above mean sea level (amsl) and slopes downward to the south ending an elevation of approximately 1970 ft amsl. The area downgradient of the trench widens into an open area between the two hills before ending at a small unnamed creek that runs through the southern portion of the RFAAP-NRU. The elevation of the creek bed downgradient of the BDDT is approximately 1960 ft amsl.

The surface soils in the BDDT area generally consist of an organic-rich silty-clay approximately 1 ft deep, which is typical of topsoil throughout the vegetated areas of the RFAAP-NRU. A silty-clay layer with a lower organic content, typical of the Carbo Unit, underlies the surface soils. This unit ranges from strong brown to brownish yellow in color and extends to approximately 4 ft bgs. Bedrock is generally encountered around 5.5 ft bgs, with a saprolitic weathering zone extending from 4 ft bgs to refusal at the bedrock surface. The reported depths are approximate, since the bedrock surface is variable and consists of weathered shale interbedded with layers of limestone and dolomite. Bedrock outcrops are visible along the length of the trench.

5.3 Conceptual Site Model

In accordance with the general CSM presented in Section 3.5, potentially affected media at this site include surface and subsurface soil in the disposal trench and the open area downgradient of the trench. Potentially affected media also include sediments and surface water in the downgradient creek. Surface and subsurface soils within the former disposal trench are known to have been affected by the debris that had been placed in the trench. These effects were mitigated by the 1998 site restoration activities. In addition to minimizing the exposure scenarios in the source area, the site restoration activities removed the potential for erosion to carry contaminants to downgradient areas.

While debris has not been detected in areas downgradient of the disposal trench, soils and COPCs from the trench were carried downslope during rainfall events prior to, and during, the restoration activities. The eroded soils collected in the heavily vegetated, open area downgradient of the trench resulting in the presence of COPCs in surface soil within this area. During heavy rainfall events eroded soils and surface water from the disposal area would have reached the unnamed creek at the downgradient reach of the BDDT, with potential effects to sediment and surface water. A heavy rainfall event is known to have occurred during the 1998 site restoration activities that resulted in the detection of PAHs in creek sediments during a subsequent sampling event.

5.4 Environmental Investigations

The BDDT was originally designated a Study Area for the RFAAP-NRU due to the disposal of construction debris in the trench. The debris included deteriorating 55-gallon drums of a black, tarry substance interpreted to be roofing tar. The presence of these drums, and other debris in a surface water drainage pathway warranted an investigation of environmental media, including soil from the trench, soil downgradient of the trench, and surface water/sediment from the unnamed creek at the base of the trench. Environmental investigations at the BDDT have been on-going since 1997 and have included:

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- 1997 – Preliminary Sampling by Alliant Techsystems, Inc. (ATK)
- 1998 – Independent Sampling by Gannett Fleming
- 1998 – Remedial Investigation by ICF Kaiser Engineers, Inc. (ICF KE)
- 2002 – Remedial Investigation by Shaw Environmental, Inc. (Shaw)
- 2004 – Additional Characterization Sampling by Shaw
- 2008 – Remedial Investigation by ARCADIS

The goals and findings of each of these investigations are summarized in the following sections. As discussed in Section 4.1 the constituent detections reported in these sections are compared to their medium specific screening criteria (i.e. 2009 RSLs), where applicable.

5.4.1 Preliminary Sampling, ATK, 1997

The initial investigation at the BDDT was conducted by ATK in October 1997. The investigation was conducted for purpose of characterizing potential effects from the building debris at the site. The following samples were collected during this event:

- One tar sample for Toxicity Characteristic Leachate Procedure (TCLP) SVOCs;
- One surface water sample from the unnamed creek downstream from the confluence with the BDDT for Target Compound List (TCL) SVOCs; and,
- One surface soil sample for TCL SVOCs.

The laboratory analytical results from these samples reportedly indicated that SVOC concentrations from the TCLP tar sample and the surface water sample were below detection limits. However, the results from the soil sample, which was collected directly downslope from a leaking drum, indicated that the following seven compounds were detected at concentrations above industrial RSLs:

- benzo(a)anthracene
- benzo(b)fluoranthene
- benzo(k)fluoranthene
- chrysene
- dibenzo(a,h)anthracene
- indeno(1,2,3-cd)pyrene
- naphthalene

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Two additional PAHs (fluoranthene and pyrene) were detected in the soil sample at concentrations between the residential and industrial RSLs. The analytical results for the soil sample are summarized in Table 5-1. The exact locations of the samples collected during this preliminary sampling event are unknown; therefore, the sample locations are not depicted on any of the figures presented in this report.

5.4.2 Independent Sampling, Gannett Fleming, 1998

Gannett Fleming conducted an independent sampling event in 1998 under the direction of the USEPA to help further characterize the site and to identify potential effects to the unnamed creek downgradient of the BDDT (Shaw 2004b). The following samples were collected during this investigation:

- One downstream surface water sample (SW-07), and
- Three downstream sediment samples (SD-06, SD-07, SD-08).

The surface water and sediment samples were analyzed for TCL VOCs, TCL SVOCs, PCBs, explosives, and TAL inorganics. The laboratory analytical results for these sediment and surface water samples are summarized in Tables 5-2 and 5-3, respectively. The sample locations are depicted in Figure 5-2. The analytical data from this event indicated the following:

TCL VOCs. No VOCs were detected in the sediment or surface water samples.

TCL SVOCs. A total of eleven SVOC/PAH compounds were detected in the sediment samples collected at locations SD-07 and SD-08 (see Table 5-2). The PAH benzo(a)pyrene was detected at a concentration above the industrial RSL in one of the sediment samples (SD08). Benzo(a)anthracene, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene were also detected at sample location SD08 at concentrations above residential RSLs. No SVOCs were detected in the surface water sample.

PCBs. No PCBs were detected in the sediment or surface water samples.

Explosives. No explosive constituents were detected in the sediment or surface water samples.

TAL Inorganics. Seventeen inorganic constituents were detected in the sediment samples collected at SD-06, SD-07, and SD-08 (Table 5-2). All of the detected concentrations were below applicable industrial and residential RSLs and/or the

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established facility-wide background concentrations. Five inorganic constituents were detected in the surface water sample collected at SW-07 (see Table 5-3); the reported concentrations were all below applicable tap water RSLs.

5.4.3 Remedial Investigation, ICF KE, 1998

ICF KE conducted an RI at the BDDT in 1998 to further assess effects that disposal activities may have had on the unnamed creek and soil underlying building debris in the trench (Shaw 2004b). Activities completed during this phase of investigation at the site included:

- A geophysical survey to identify buried debris in the disposal trench.
- Removal of debris and stained soils from the disposal trench.
- Collection of 34 soil samples along the length of the disposal trench.
- Collection of 3 soil samples from the area downgradient of the disposal trench.
- Collection of 7 co-located surface water/sediment samples from the unnamed creek.
- Site restoration activities that included the placement of clean fill and rip-rap in the former disposal area.

5.4.3.1 1998 Geophysical Survey

A Geonics EM61 bottom coil geophysical survey was conducted along the length of the disposal trench to locate potentially buried drums and other miscellaneous metallic subsurface debris. The results of the survey were used to guide the collection of subsurface soil samples and indicated that metallic debris was largely limited to the confines of the open disposal trench. The findings of the geophysical survey are summarized in a report entitled *Results of Geophysical Investigation Report* prepared by NAEVA Geophysics, Inc. (NAEVA 1998).

5.4.3.2 1998 Debris and Soil Removal Activities

The construction debris and underlying surface soils were removed from the BDDT during 1998 to allow ICF KE to evaluate the quality of the soil below the debris. The removal activities commenced at the northern end of the trench, approximately 120 ft south of the culvert that passes under A Avenue, and extended approximately 605 ft to the south. Soil and debris that had been removed from the trench were sampled and analyzed for TCLP waste characteristics. The waste characterization sample results

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indicated that the material was non-hazardous; therefore, the debris and soil were segregated and disposed off-site as nonhazardous material. No visible debris remained at the BDDT upon completion of the removal activities.

5.4.3.3 1998 Debris Area Soil Sampling

Upon completion of the debris and soil removal activities, a total of 34 soil samples (DTSB1 through DTSB23 and DTSB35 through DTSB45) were collected along the length of the trench. The samples were collected from the newly excavated trench floor to a depth of 1 ft bgs and were collected at an average spacing of 17.5 ft along the length of the trench. The sample locations were biased towards areas that had contained abundant debris or visibly stained soils. A site map depicting the sample locations is presented as Figure 5-2. All samples were analyzed for TCL VOCs, TCL SVOCs, PAHs, explosives, and TAL inorganics. The laboratory analytical results from this sampling event, which are summarized in Table 5-4, indicated the following:

TCL VOCs. Two VOCs (1,2,3-trichloropropane and methylene chloride) were detected at very low concentrations within a limited number of the soil samples (see Table 5-4). The reported concentrations of these constituents were several orders of magnitude below applicable residential and industrial screening levels.

SVOCs. A total of nine different SVOCs were detected in various debris area soil samples (Table 5-4). The detected concentrations of these constituents were all below applicable industrial and residential RSLs.

PAHs. A total of fifteen different PAH constituents were detected in the debris area soil samples using the PAH specific analytical method. A complete list of the detected constituents and sample specific concentrations is included in Table 5-4. Five of the detected constituents [benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene] were present at several sample locations at concentrations above industrial RSLs. Benzo(k)fluoranthene and chrysene were also detected in several samples at concentrations above their respective residential RSLs. The other detected PAH constituents were not detected at concentrations above applicable industrial or residential RSLs.

Explosives. No explosives were detected in the BDDT soil samples (see Table 5-4).

TAL Inorganics. Several TAL inorganics were detected in the soil samples collected from the disposal trench. Aluminum, antimony, arsenic, cobalt, iron, manganese,

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thallium, and vanadium were detected at concentrations above residential or industrial RSLs. However, the detected inorganics concentrations were all below their respective background concentrations developed in the facility-wide background study (IT 2001).

It should be noted that trench sampling locations were reportedly covered with clean fill, a geotextile membrane and riprap upon completion of the site restoration activities.

5.4.3.4 1998 Downgradient Soil Sampling

Three surface soil samples (DTSS1, DTSS2, and DTSS3) were collected from the area downgradient of the disposal trench to assess whether surface soils in this area had been affected by the downgradient transport of constituents from the disposal site. The sample locations are depicted in Figure 5-2 and the laboratory analytical results are presented in Table 5-4. All three samples were analyzed for TCL VOCs, SVOCs/PAHs, explosives, and TAL inorganics. The analytical results indicated the following:

VOCs. Two VOCs (trimethylbenzene and xylene) were detected in two of the three soil samples (see Table 5-4). The detected concentrations were several orders of magnitude below applicable RSLs.

SVOCs. Seventeen PAH constituents were detected in soil samples at DTSS1, DTSS2 and DTSS3 via the SVOC laboratory analyses (see Table 5-4). There were no non-PAH SVOCs detected in the soil samples. Benzo(a)pyrene was detected in each of the three soil samples at concentrations above the industrial RSL. Benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, benzo(k)fluoranthene, and indeno(1,2,3-cd)pyrene were also detected in each of the three samples at concentrations above residential and/or industrial RSLs.

Explosives. No explosives were detected in the soil samples (see Table 5-4).

Inorganics. Several inorganics (i.e., aluminum, arsenic, cobalt, iron, manganese, and vanadium) were detected at concentrations above residential and/or industrial RSLs. However, the majority of the detections were below the established facility-wide background concentrations for the RFAAP-NRU. The only exceptions were cobalt and manganese at sample location DTSS2, both of which were detected at concentrations above the industrial RSLs and slightly above background levels. Iron was also detected at DTSS3 at a concentration above the residential RSL and slightly above established background level.

5.4.3.5 1998 Surface Water and Sediment Sampling

Two rounds of surface water and sediment sampling were conducted during the 1998 ICF KE investigation activities to assess the presence of site related constituents in the unnamed creek downgradient of the BDDT. The first round, completed on July 17, 1998, included the collection of three co-located surface water/sediment samples. One of the sample locations (DTSW/SD3) was located approximately 70 ft upstream of the confluence of the BDDT and the unnamed stream. Sample locations DTSW/SD2 and DTSW/SD1 were located approximately 114 and 223 ft downstream from the confluence and corresponded to the Gannett Fleming sample locations SD-06 and SD-07, respectively.

The second round of sampling, conducted on August 18, 1998, included the collection of four additional co-located surface water/sediment samples following a heavy rainfall event that occurred during the site restoration activities for the disposal trench. During this rainfall event, exposed soils in the disposal trench were washed downgradient into the creek and the open area between the creek and the trench. Samples DTSW/SD1-2, DTSW/SD2-2, and DTSW/SD3-2 were collected from the same locations as the July 1998 surface water/sediment samples. Sample DTSW/SD4 was collected approximately 545 ft downstream from the confluence of the disposal trench area and the creek.

The sediment and surface water samples collected during both the July and August 2008 sampling events were submitted for laboratory analysis of VOCs, SVOCs, PAHs, explosives, and TAL inorganics. The analytical results for the sediment samples are summarized in Table 5-5. The analytical results for the surface water samples are summarized in Table 5-6. The sample locations are depicted in Figure 5-2. The results indicated the following:

VOCs. Bromodichloromethane and chloroform were detected in surface water sample DTSW3 collected in August, 1998 (See Table 5-6). The detected concentrations were above their respective tap water RSLs in this sample, but these constituents were not detected in any of the other surface water samples collected in 1998. Both constituents are common laboratory contaminants and are not believed to be related to the site. No VOCs were detected at concentrations above applicable screening criteria in any of the sediment samples (See Table 5-5).

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PAHs/SVOCs. Chrysene, fluoranthene, phenanthrene, and pyrene were detected in sediment samples collected during both the July and August sediment sampling events (see Table 5-5). However, the detected concentrations of these constituents were below applicable residential RSLs. During the August 1998 sampling event, benzo(a)pyrene was detected in two sediment samples (DTSD01 and DTSD04) at concentrations above the applicable residential RSL. This constituent was not detected in the samples collected at these locations in July 1998, indicating that the rainfall event may have washed PAH contaminated soil into the creek from the disposal area. No other PAHs were detected at concentrations above applicable screening levels in sediment. PAHs were not detected in the surface water samples (See Table 5-6).

Explosives. No explosives were detected in any of the sediment or surface water samples (see Table 5-5).

Inorganics. Several inorganics were detected in the surface water samples collected in 1998 (see Table 5-6); however, thallium was the only inorganic detected at a concentration above of the applicable tap water RSLs. Thallium was detected above the tap water RSL at sample location DTSW2 during both the July and August 1998 sampling events. It was also detected above the tap water RSL at sample location DTSW4 in August 1998. Several inorganics were also detected in all of the sediment samples (see Table 5-5). However, iron and manganese at sample location DTSD03-2 in August 1998, were the only constituents detected above background levels and applicable residential RSLs. These constituents have not been attributed to the disposal activities at the site and are believed to be naturally occurring.

5.4.3.6 1998 Site Restoration Activities

After completion of site sampling activities, the excavated portion of the BDDT was backfilled with clean fill material. A geotextile membrane and riprap was placed over the fill to provide erosion control and prevent soils in the trench with residual PAHs from washing to downgradient areas.

5.4.4 Remedial Investigation, Shaw, 2002

During 2002 Shaw completed remedial investigation activities at the BDDT to further evaluate potential effects to the soils in the open area downgradient of the BDDT and to re-evaluate constituent detections in the unnamed creek (Shaw 2004b). Although there was no evidence of any debris having been disposed in the open area

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downgradient of trench, soils from the trench were known to have washed out of the trench and into this area prior to the 1998 site restoration activities. Activities completed during the 2002 phase of the investigation included:

- Two soil borings (DTSB46 and DTSB47) to evaluate the vertical extent of site related constituents in soil downgradient of the BDDT.
- Six co-located surface water and sediment samples (DTSW/SD05, DTSW/SD06, DTSW/SD07, DTSW/SD08, DTSW/SD09, and DTSW/SD10) from the creek downgradient of the BDDT.

5.4.4.1 2002 Soil Sampling

Soil samples were collected at 0 to 0.5 ft bgs and 1 to 3 ft bgs at sample locations DTSB46 and DTSB 47. The samples were analyzed for VOCs, PAHs, PCBs, pesticides, herbicides, and TAL inorganics. The laboratory analytical results from this sampling event are summarized in Table 5-7 and the sample locations are depicted in Figure 5-2.

VOCs. VOCs were not detected in the surface or subsurface soil samples.

PAHs. A total of seventeen PAHs were detected in the surface and subsurface soil samples (see Table 5-7). However, only six of the detected PAHs [i.e., benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene] were detected at concentrations above industrial screening levels. The concentrations above the industrial screening levels all occurred in the both of the surface soil samples. No constituents were detected at concentrations above the industrial RSL in the two subsurface soil samples. Although, benzo(a)pyrene was detected in one of the subsurface soil samples (DTSB46) at a concentration above the residential RSL.

PCBs. PCBs were not detected in any of the surface or subsurface soil samples (see Table 5-7).

Pesticides. Two pesticides (4,4'-DDD and methoxylchlor) were detected in the surface soil sample at DTSB46 (see Table 5-7). The concentrations of both detected pesticides are approximately three orders of magnitude below residential RSLs.

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Herbicides. Four herbicides were detected in surface soil sample DTSB46 (see Table 5-7). Reported concentrations of three (2,4-D; dalapon; and dicamba) of the four compounds are below the residential RSL. However, MCPP was detected at a concentration of 13.5 mg/kg, which is greater than its residential screening level (6.1 mg/kg), but below the industrial screening level (62 mg/kg).

TAL Inorganics. Several inorganics were detected in both the surface and subsurface soil samples (See Table 5-7); however, the detected concentrations were either below the applicable residential and industrial screening levels or the facility-wide background inorganics concentrations.

5.4.4.2 2002 Sediment Sampling

Sediment samples were collected from six locations (DTSD05, DTSD06, DTSD07, DTSD08, DTSD09, and DTSD10) in the unnamed creek downgradient of the BDDT. The samples were analyzed for VOCs, PAHs, PCBs, pesticides, herbicides, and TAL inorganics. The laboratory analytical results from this sampling event are summarized in Table 5-8 and the sample locations are depicted in Figure 5-2.

VOCs. Three VOCs (acetone, carbon disulfide and toluene) were detected in the sediment samples (see Table 5-8). The reported concentrations were several orders of magnitude below applicable industrial and residential RSLs. The detected constituents were also detected in the laboratory method blanks for these samples; therefore, it is likely that the detections are unrelated to the BDDT.

PAHs. A total of seventeen PAHs were detected in the sediment samples from the creek (see Table 5-8). Benzo(a)pyrene was detected at concentrations above the industrial RSL at sample locations DTSD05 and DTSD10. Benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene were also detected at DTSD05 and DTSD10 at concentrations above residential RSLs. The detected PAH concentrations were less than residential screening levels in the other sediment samples.

PCBs. PCBs were not detected in any of the sediment samples (see Table 5-8).

Pesticides. Six pesticides (4,4'-DDD, 4,4"DDE, 4,4'DDT, alpha-chlordane, and delta-BHC) were detected in the sediment at sample locations DTSD05 and DTSD07 (see Table 5-8). The detected concentrations were all several orders of magnitude below their respective residential screening levels.

Herbicides. Herbicides were not detected in any of the sediment samples (see Table 5-8).

TAL Inorganics. Several inorganics were detected in the sediment samples (see Table 5-8); however, the detected concentrations were either below the applicable residential and industrial screening levels or the facility-wide background inorganics concentrations.

5.4.4.3 2002 Surface Water Sampling

Surface water samples (DTSW05, DTSW06, DTSW07, DTSW08, DTSW09, and DTSW10) were collected at each of the six 2002 sediment sample locations discussed in Section 5.4.4.2. The samples were analyzed for VOCs, PAHs, PCBs, pesticides, herbicides, perchlorate, TAL inorganics, and hardness. The laboratory analytical results from this sampling event are summarized in Table 5-9 and the sample locations are depicted in Figure 5-2.

VOCs. Two VOCs (carbon disulfide and chloroform) were detected in the surface water samples. However, the reported concentrations were below their respective tap water RSLs (See Table 5-9).

PAHs. Five PAH constituents (naphthalene, 2-methylnaphthalene, acenaphthene, acenaphthylene, and fluorine) were detected in surface water samples. The reported concentrations were below their respective tap water RSLs (See Table 5-9).

Herbicides. Herbicides were not detected in any of the surface water samples (see Table 5-9).

Pesticides. Three pesticides (4,4'-DDT, dieldrin, and endrin ketone) were detected at sample locations DTSW05 and DTSW07 (see Table 5-9). The detected concentrations of dieldrin were above the tap water RSLs at both sample locations. No other pesticides were detected in surface water.

PCBs. PCBs were not detected in any of the surface water samples (see Table 5-9).

Perchlorate. Perchlorate was not detected in any of the surface water samples (see Table 5-9).

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TAL Inorganics. Several inorganic constituents were detected in the surface water samples (see Table 5-9); however, the detected concentrations were all below applicable tap water RSLs.

Hardness. Hardness of the surface water samples ranged from 181 milligrams per liter (mg/L) to 204 mg/L (see Table 5-9). Hardness is an indicator parameter and does not have an associated RSL.

5.4.5 Additional Characterization, Shaw, 2004

Shaw completed additional soil sampling activities at the BDDT site in 2004 that were designed to assess the horizontal and vertical extent of elevated PAHs in the open area at the downgradient end of the BDDT (Shaw 2007). This investigation included:

- 42 Surface soil samples (DTSB48 through DTSB89) were collected from parallel sample lines downslope from the BDDT to complete the horizontal delineation. These samples were collected from 0-0.5 ft bgs.

- 5 Subsurface soil samples (DTSB48, DTSB55, DTSB59, DTSB67, and DTSB77) were collected to complete the vertical delineation of PAH detections. These samples were collected from 1-3 ft bgs.

All of the soil samples collected during this event were submitted for laboratory analysis of low-level PAHs. Thirty-three of the samples were also submitted for laboratory analysis of PCBs. The laboratory analytical results from this sampling event are summarized in Table 5-10, and the sampling locations are depicted in Figure 5-2.

PAHs. Similar to the 2002 Investigation, a total of seventeen different PAHs were detected in surface soil samples in the open area at the downgradient end of the BDDT (see Table 5-10). Of the detected PAHs only seven constituents [benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene] were detected at concentrations above applicable industrial and/or residential RSLs. Only 14 of the 42 sample locations contained PAHs at concentrations above industrial RSLs; while a total of 25 sample locations contained PAHs at concentrations above residential RSLs. Only two of the five subsurface soil sample locations (DTSW48 and DTSB55) contained PAHs above applicable industrial and/or residential RSLs.

PCBs. PCBs were not detected in any of the soil samples (See Table 5-10).

5.4.6 Remedial Investigation, ARCADIS, 2008

In accordance with Remedial Investigation Work Plan Addendum 27 (ARCADIS 2008b), ARCADIS completed additional RI activities at the BDDT in 2008 to finalize the characterization and delineation work at this site. This investigation included the following components:

- Two soil borings were completed in the area immediately downgradient of the disposal trench to complete the vertical delineation of PAH detections. Soil samples were collected from 0-0.5 ft bgs, 2-3 ft bgs, and 3-4 ft bgs at each location. The surface soil (0-0.5 ft bgs) samples were labeled BDDT-SS01 and BDDT-SS02. The subsurface soil samples were labeled BDDT-SB01 and BDDT-SS02.

- Six soil samples (BDDT-SS03 through BDDT-SS08) were collected from the perimeter of the open area between the two hills at the downslope end of the BDDT to confirm that the horizontal extent of PAH detections above screening levels had been fully delineated

- Four co-located surface water (BDDT-SW01 through BDDT-SW04) and sediment samples (BDDT-SE01 through BDDT-SE04) were collected from the unnamed creek downgradient of the BDDT to evaluate the potential for on-going effects to the creek.

All of the soil, sediment, and surface water samples were analyzed for low-level PAHs by USEPA Method 8270. The analytical results are summarized in Tables 5-11, 5-12, and 5-13, respectively. The sample locations are depicted in Figure 5-2. The laboratory analytical reports from ARCADIS' 2008 sampling event are included in Appendix C.

5.4.6.1 2008 Soil Sampling Results

The analytical results from the two surface soil samples (BDDT-SS001 and BDDT-SS002) and two subsurface soil borings (BDDT-SB001 and BDDT-SB002) completed immediately downgradient from the former disposal area indicated the following:

- A total of 16 different PAH constituents were detected in surface and subsurface soil samples (See Table 5-11).

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- Benzo(a)pyrene was detected at concentrations above its industrial RSL in the two surface soil samples (BDDT-SS01 and BDDT-SS02). Benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene were also detected at concentrations higher than their residential RSLs at these locations. No other PAHs were detected at concentrations above applicable RSLs.

- Benzo(a)pyrene was detected at concentrations above the residential RSL in the samples collected at 2-3 ft bgs at both BDDT-SB001 and BDDT-SB002. The sample from 3-4 ft bgs at BDDT-SB002 also contained benzo(a)pyrene at concentrations above the residential RSL.

- Bedrock was encountered at approximately 5 ft bgs at both BDDT-SB001 and BDDT-SB002.

The analytical results from the soil samples collected at the perimeter of the open area downgradient of the disposal trench (BDDT-SS03 through BDDT-SS08) indicated the following:

- A total of 8 different PAHs were detected in various soil samples (See Table 5-11). However, the detected concentrations were all below applicable residential RSLs. This confirms that the horizontal and vertical delineation of PAHs in soil at the BDDT has been completed.

5.4.6.2   2008 Sediment and Surface Water Results

The laboratory analytical results from the four sediment samples collected from the unnamed creek downgradient of the BDDT indicated the following:

- No PAHs were detected in the two sediment samples collected closest to the BDDT (BDDT-SE001 and BDDT-SE002).
- Several PAHs were detected in the two sediment samples collected downstream from the BDDT (BDDT-SE003 and BDDT-SE004) (see Table 5-12). None of the detected PAHs were at concentrations above industrial RSL; however, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene were detected at concentrations above their residential RSLs at sediment sample location BDDT-SE04.

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The laboratory analytical results from the four surface water samples collected during the 2008 sampling event indicated the following:

- No PAHs were detected in any of the surface water samples (see Table 5-13).

5.5 Nature and Extent of Constituent Detections

The analytical results presented in the previous sections indicate that soil at the BDDT site was affected by historical disposal activities that included the placement of building debris/materials in a surface water drainage pathway. Soil samples collected from the disposal area confirmed that PAHs were present in soil underneath the debris at concentrations above applicable industrial screening levels. Site restoration activities were completed in 1998 that included the removal of the building debris and stained soils, replacement of the excavated soil with clean fill, and lining the trench with geotextile fabric and rip rap to prevent erosion. It should be noted that sampling performed in 1998 prior to the placement of the clean fill, geotextile liner, and rip rap indicated that PAHs were left in place at concentrations above residential and industrial RSLs. A site map depicting the PAH detections in the disposal trench from the 1998 site investigations is presented as Figure 5-3. The site restoration activities mitigated the source area and potential exposure pathways along the trench; therefore, subsequent investigations focused on soil, sediments, and surface water, downgradient of the trench. This section summarizes the nature and extent of the constituent detections observed during the course of environmental investigation at the site.

5.5.1 Soil

A total of 55 surface soil samples and 11 subsurface soil samples have been collected from the open area between the trench and the downgradient creek to characterize and delineate the extent of constituents in soil resulting from the former disposal activities at the BDDT. Due to the physical characteristics of the site (i.e., topography and grass groundcover), this area is a natural depositional area for media (i.e., soil and debris) that may have washed out of the trench prior to the site restoration activities. The sampling results indicate that several PAHs are present in surface soils downgradient of the trench. However, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene are the only PAHs that have been detected at concentrations above residential and industrial RSLs (see SVOC and PAH analytical results presented in historical sampling tables). The horizontal extent of the PAHs at concentrations

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above industrial and residential RSLs has been fully delineated as confirmed by the samples collected in 2004 and 2008, and are contained within area of approximately 0.4-acres. A site map depicting PAH detections in soil downgradient of the restored trench is presented as Figure 5-4.

The subsurface soil samples confirmed that the PAHs are confined to surface soil (0-1 ft bgs) throughout most of the open area between the former disposal area and the downgradient creek. However, two soil borings completed immediately downgradient of the former disposal area indicated that PAHs were present at concentrations above residential RSLs at depths up to 4 ft bgs. Bedrock is present at approximately 5 ft bgs throughout the BDDT area so the elevated PAH concentrations are not expected to go any deeper. Based the findings of attempted monitoring well installation activities at the BDDT in 2008, groundwater is not present in the bedrock formations at the BDDT to at least a depth of 75 ft (see Section 2.2.6).

Although two pesticides and four herbicides were detected in one surface soil sample collected immediately downgradient of the disposal trench (DTSB46), the herbicide MCPP was the only constituent detected in this sample at a concentration above a residential RSL.

Inorganics were detected in both surface and subsurface soil samples from the BDDT area. While the detected concentrations of several of these inorganics were higher than applicable residential and or industrial RSLs, the detected concentrations were typically below the background concentrations presented in the facility-wide background study. The only exceptions were cobalt, iron, and manganese. These constituents were each detected in one sample at concentrations above background and applicable RSLs. Cobalt and manganese were detected at concentrations above the industrial RSL and established background levels at 1998 sample location DTSS2 and iron was detected at a concentration above the residential RSL and established background levels at 1998 sample location DTSS3. Both the DTSS2 and DTSS3 sample locations were in the open area downgradient of the trench. Cobalt, iron, and manganese were not detected at elevated concentrations in the former disposal trench; therefore, it is likely that these isolated detections were either laboratory anomalies or the metals are naturally occurring at higher concentrations in this area.

Explosives and PCBs have not been detected in any of the soil samples collected at the BDDT.

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A figure depicting non-PAH constituent detections at the BDDT is presented in Figure 5-5.

5.5.2 Sediment

Sediment sampling events were conducted in 1998, 2002, and 2008 within the unnamed creek downgradient of the BDDT to evaluate whether creek sediments have been affected by ongoing releases from the site. A total of seventeen sediment samples have been collected during these investigations. A site map depicting the constituents detected in sediment samples at the site is presented in Figure 5-6.

A total of 17 different PAH constituents have been detected in sediment samples from the unnamed creek. The majority of the detections occurred during the June 2002 sampling event, which was conducted approximately 4 years following the completion of the site restoration activities. During the 2002 event, PAHs were detected at varying concentrations in six separate sediment samples; including two samples collected upgradient of the BDDT (DTSD08 and DTSD09). However, only two samples during the 2002 investigation (DTSD5 and DTSD10 – both of which are located downstream of the BDDT) contained benzo(a)pyrene at concentrations above industrial RSLs. No other PAHs were detected at concentrations above industrial RSLs. Although, DTSD5 and DTSD10 did contain benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene at concentrations higher than residential RSLs.

During the 2008 sampling event no PAHs were detected at concentrations above industrial RSLs. Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene were detected at concentrations above the residential RSL in the sample collected furthest downstream from the BDDT (BDDT-SE004). The two samples collected closest to the BDDT (BDDT-SE001 and BDDT-SE002) did not have any PAH detections. These results appear to indicate the PAH concentrations in the stream sediments may be attenuating over time or are currently a result of runoff from the perimeter road affecting the results at the most downgradient sample.

The stream sediment samples have been found to contain several inorganics at concentrations similar to those observed in soil samples from the BDDT and those reported in the Facility-Wide Background Study. The only inorganics that have been detected at concentrations above established background soil levels and applicable RSLs are iron and manganese; these detections both occurred in one sample in 1998 (DTSD04). As neither of these constituents were detected above applicable screening criteria in soil from the BDDT, the detections in sediment are believed to be naturally occurring.

No explosives, herbicides, or PCBs were detected during the course of sediment sampling.

5.5.3 Surface Water

A total of 17 surface water samples have been collected from the unnamed stream downgradient of the BDDT during the course of environmental investigation at this site. The surface water samples were collected in conjunction with (i.e., co-located with) the sediment samples to aid in determining if surface water quality was being influenced by the sediments, or vice versa. A site map depicting constituents detected in surface water samples is presented in Figure 5-7.

Despite the PAH detections in surface soil and sediment at the BDDT, PAHs/SVOCs have rarely been detected in surface water in the unnamed creek. During the 2002 sampling event 2-methylnapthalene, naphthalene, acenaphthene, acenaphthylene, and fluorene were detected at low concentrations within several samples. The detected concentrations were several orders of magnitude below applicable tap water RSLs, and laboratory data validation indicated that many of these constituents were also detected in a laboratory blank samples. No PAHs were detected in surface water samples collected in 2008 which indicates that the PAHs detected in site soils and sediments are not having any adverse effects to surface water.

The pesticide dieldrin was detected in two samples during the 2002 investigation (DTSW05 and DTSW07) at concentrations above the tap water RSL. Dieldrin was also detected in the sediment samples at these locations; albeit at concentrations below applicable residential RSL. Dieldrin was not detected in soil at the BDDT, therefore, it is likely that the detection in surface water is not site related. It should also be noted that during the 2002 sampling event, dieldrin was detected at a concentration above the tap water RSL in several samples collected from the unnamed stream far upstream of the BDDT; including one sample that was collected before the stream flows onto the RFAAP-NRU facility (WBGSW14 – see Table 9-12). This further indicates that the dieldrin detection is likely due to an off-site source.

Several inorganics have been detected in all surface water samples collected both upstream and downstream of the unnamed creek's confluence with the BDDT. With the exception of thallium, which was detected in three samples during 1998

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[DTSW2(7/17/98), DTSW2(8/17/98), and DTSW4(8/17/98], the detected inorganics concentrations have been below applicable tap water RSLs. Thallium was not detected in any of the six surface water samples collected during the 2002 sampling event and thallium has not been detected at concentrations above established background concentrations in soil or sediment at the site. Therefore, the 1998 detections do not appear to be site related.

No PCBs, herbicides, explosives, or perchlorate were detected during the course of surface water sampling.

5.6 Risk Assessment Datasets

Data generated from the site characterization activities were used in the risk assessment. Risk assessment datasets for soil, sediment, and surface water for the BDDT were prepared then summarized and statistically analyzed. Risk assessment datasets summaries highlighting: the number of detects, number of samples, FOD, minimum and maximum detected concentrations, minimum and maximum detection limits, and EPC are presented in Tables 5-14 through 5-18.

Previous site restoration activities mitigated the source area and potential exposure pathways along the portion of the trench that is now covered by a geotextile liner and riprap. Although the soils in the riprap covered portion of the BDDT are not currently accessible for either human or wildlife exposures, the data from these locations were included in the soil dataset to evaluate potential risks if the rip rap was to be removed in the future so that the soils under it would become accessible. Because the source of COPCs in the rip rap covered portion of the site differed from the source in the remainder of the BDDT, an additional analysis was also conducted to determine if potential risks would differ if the soils in that portion of the BDDT were to become accessible in the future and future activities were focused on that area.

5.7 Human Health Risk Assessment

The purpose of this risk assessment is to evaluate the potential current and future risks and hazards to human health associated with constituents detected in soil, sediment and surface water samples collected at the BDDT. The risk assessment approach follows the Radford Army Ammunition Plant Final Master Work Plan (URS 2003).

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5.7.1 Selection of Constituents of Potential Concern

This section discusses the selection of COPCs for the HHRA for each medium at the BDDT.

5.7.1.1 Surface Soil

Surface soil COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for residential soil. Table 5-19 presents the selection of surface soil COPCs for the human health risk assessment. The COPCs for surface soil are:

- **SVOCs/PAHs:** carbazole, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, and naphthalene.
- **Herbicides:** MCPP
- **Inorganics:** cobalt, iron, and manganese

5.7.1.2 Combined Surface and Subsurface Soil

Combined surface and subsurface soil COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for residential soil. Table 5-20 presents the selection of the combined surface and subsurface soil COPCs for the human health risk assessment. As summarized in Table 5-20, 13 constituents were identified as COPCs in combined surface and subsurface soil. These constituents include:

- **SVOCs/PAHs:** carbazole, dibenzofuran, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, and naphthalene.
- **Herbicides:** MCPP
- **Inorganics:** cobalt, iron, and manganese

5.7.1.3 Sediment

Sediment COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for residential soil. Table 5-21 presents the selection of sediment COPCs for the human health risk assessment. As summarized in Table 5-21, the following 12 constituents were identified as COPCs in sediment:

- **SVOCs/PAHs:** benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, dibenzo[a,h]anthracene, and indeno[1,2,3-cd]pyrene.

- **Inorganics**: aluminum, arsenic, cobalt, iron, manganese, thallium, and vanadium.

5.7.1.4 Surface Water

Surface water COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for tap water. Table 5-22 presents the selection of surface water COPCs for the human health risk assessment. As summarized in Table 5-22, four constituents were identified as COPCs in surface water:

- **VOCs:** bromodichloromethane and chloroform

- **Pesticides:** dieldrin

- **Inorganics:** thallium

5.7.2 Human Health Risk Characterization

Methods used to calculate the excess lifetime cancer risks and non-cancer hazards are described in Appendix A. Tables presented in the constituent and pathway-specific risk calculations for each of the receptors at the BDDT are presented in Appendix A. The results of the risk calculations are summarized below. The excess lifetime cancer risks and non-cancer hazards for each potentially exposed receptor included in the risk assessment for the BDDT are presented in Appendix A and are summarized in the tables and subsections below.

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5.7.2.1 Site Worker

A current or future site worker could be present at the BDDT area, and could be exposed to surface soil, sediment, surface water, or combined surface and subsurface soil via vapor migration to indoor air. The ELCR and non-cancer hazard index for site worker exposure to each medium at the entire BDDT are presented in Appendix A (Tables A-HHRA-6 through A-HHRA-9), and are summarized in Table 5-24. The ELCR and non-cancer hazard index for site worker exposure to each medium at the rip rap portion only are presented in Appendix A (Tables A-HHRA-20 through A-HHRA-21), and are summarized in Table 5-24a. The following ELCRs and non-cancer hazard indices have been calculated:

Summary of Calculated ELCRs for the Site Worker Exposure Scenarios for Entire BDDT and Rip Rap Portion Only

Site Worker	ELCR at BDDT	ELCR for Rip Rap Portion
Surface Soil - Direct Contact	5E-05	2E-05
Combined Surface and Subsurface Soil - Vapor Migration to Indoor Air	NA	NA
Sediment – Wading	1E-05	NA
Surface Water – Wading	4E-07	NA
TOTAL SITE RISKS (Site Worker):	**7E-05**	**2E-05**

*See Appendix A for individual tables.

Summary of Calculated HIs for the Site Worker Exposure Scenarios for Entire BDDT and Rip Rap Portion Only

Site Worker	HI at BDDT	HI for Rip Rap Portion
Surface Soil - Direct Contact	0.5	0.1
Combined Surface and Subsurface Soil - Vapor Migration to Indoor Air	0.04	0.1
Sediment – Wading	0.02	NA
Surface Water – Wading	0.04	NA
TOTAL SITE RISKS (Site Worker):	**0.6**	**0.3**

*See Appendix A for individual tables.

The total cumulative ELCR for site workers exposed to surface soil, sediment, surface water, and air at the entire BDDT is 7×10^{-5} and 2×10^{-5} for the rip rap portion only both of which are within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for site workers is 0.6 for the entire BDDT and 0.3 for the rip rap portion only, both of which are less than the benchmark of 1.

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5.7.2.2 Hypothetical Future Construction Worker

A hypothetical future construction worker could be present at the BDDT area, and could be exposed to combined surface and subsurface soil. The ELCR and non-cancer hazard index for hypothetical future construction worker exposure to soil are summarized below.

Summary of Calculated ELCRs for the Construction Worker Exposure Scenario for Entire BDDT and Rip Rap Portion Only

Construction Worker	ELCR at BDDT	ELCR for Rip Rap Portion
Combined Surface and Subsurface Soil – Direct Contact	2E-06	2E-06
TOTAL SITE RISKS (Construction Worker):	**2E-06**	**2E-06**

*See Appendix A for individual tables.

Summary of Calculated HIs for the Construction Worker Exposure Scenario for Entire BDDT and Rip Rap Portion Only

Construction Worker	HI at BDDT	HI for Rip Rap Portion
Combined Surface and Subsurface Soil – Direct Contact	1	0.4
TOTAL SITE RISKS (Construction Worker):	**1**	**0.4**

*See Appendix A for individual tables.

The total cumulative ELCR for hypothetical future construction workers exposed to combined surface and subsurface soil at the entire BDDT or for the rip rap portion only was 2×10^{-6}, which is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for hypothetical future construction workers is 1 for the entire BDDT which is equivalent to the benchmark of 1. When the HI is segregated into target site and critical effects, all hazards are less than the benchmark. For the rip rap portion only, the HI for hypothetical future construction workers is 0.4, which is less than the benchmark.

5.7.2.3 Hypothetical Future Residents

A hypothetical future adult or child resident could be present at the BDDT area, and could be exposed to combined surface and subsurface soil, sediment, surface water or combined surface and subsurface soil via vapor migration to indoor air. The ELCR and non-cancer hazard index for hypothetical future adult or child resident exposure to each medium are summarized below.

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Summary of Calculated ELCRs for Hypothetical Future Residential Exposures for Entire BDDT and Rip Rap Portion Only.

Hypothetical Future Resident	ELCR at BDDT	ELCR for Rip Rap Portion
Combined Surface and Subsurface Soil - Direct Contact	4E-04	3E-04
Combined Surface and Subsurface Soil - Vapor Migration to Indoor Air	NA	NA
Sediment – Wading	5E-05	NA
Surface Water – Wading	2E-07	NA
TOTAL SITE RISKS (Resident):	**4E-04**	**3E-04**

*See Appendix A for individual tables.

Summary of Calculated HIs for Hypothetical Future Residential Exposures for Entire BDDT and Rip Rap Portion Only.

Hypothetical Future Adult Resident	HI at BDDT	HI for Rip Rap Portion
Combined Surface and Subsurface Soil - Direct Contact	0.5	0.2
Combined Surface and Subsurface Soil - Vapor Migration to Indoor Air	0.06	0.2
Sediment – Wading	0.04	NA
Surface Water – Wading	0.01	NA
TOTAL SITE RISKS (Adult Resident):	0.6	0.4
Hypothetical Future Child Resident		
Combined Surface and Subsurface Soil - Direct Contact	4	2
Combined Surface and Subsurface Soil - Vapor Migration to Indoor Air	0.06	0.2
Sediment – Wading	0.3	NA
Surface Water - Wading	0.04	NA
TOTAL SITE RISKS (Child Resident):	**5**	**2**

*See Appendix A for individual tables.

The total cumulative ELCR for hypothetical future residents exposed to combined surface and subsurface soil, sediment, surface water, and air for the entire BDDT is 4×10^{-4}, which is above the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. For the rip rap portion only, the ELCR for hypothetical future residents was 3×10^{-4}, which is also above the target risk range. The total cumulative HI for hypothetical future adult residents is 0.6 for the entire BDDT and 0.4 for the rip rap portion only, which are both less than the benchmark of 1.

The total cumulative HI for hypothetical future child residents is 5 for the entire BDDT and 2 for the rip rap portion only, both of which are greater than the benchmark of 1. When the HI for the entire BDDT is segregated into target site and critical effects, hazards were only greater than the benchmark of 1 in the skin due to the presence of cobalt. In the rip rap area, hazards segregated by target organ are all less than 1.

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5.7.3 Human Health Risk Summary

Tables 5-24 and 5-24a summarize the calculated cancer risks and non-cancer hazards for the site worker, construction worker, and residential exposure scenarios for the entire BDDT site and the rip rap covered portion only, respectively. As shown in the table above, the total ELCR values for all surface soil, combined surface and subsurface soil, sediment, and surface water exposures for the site worker and construction worker scenarios are below or within the generally acceptable range of 10^{-6} to 10^{-4} for cancer risk. However, the total ELCRs for the future hypothetical resident exposed to surface and subsurface soil at the BDDT site as a whole, and within the rip rap covered portions of the site only, were both above the acceptable range of 10^{-6} to 10^{-4} for cancer risk. The driver for the elevated ELCRs in both cases was benzo(a)pyrene.

The total HI values for all surface soil, combined surface and subsurface soil, sediment, and surface water exposures for each exposure scenario are below or equal to the benchmark of 1 for non-cancer hazard, with the exception of hypothetical future child residential exposures to combined surface and subsurface soil. When the HIs are segregated into target site and critical effects, hazards were only greater than the benchmark of 1 in the skin for hypothetical future child resident exposure to the entire BDDT only. Cobalt is the constituent exceeding the benchmark in all of these exposure scenarios. The cobalt risks are being driven by a single sample from the area downgradient of the trench that had a concentration above established background levels. All other cobalt detections at the site were within background levels.

The results of the risk assessment for the BDDT indicate that industrial redevelopment of the entire area would not result in risks or hazards outside the regulatory benchmarks. However, the presence of benzo(a)pyrene in surface soil at the site, and within the rip rap covered portion of the site only, resulted in slightly elevated cancer risks under residential land use scenarios. Therefore, the site is not suitable for residential development in its current state. The maximum detected concentration of cobalt at the site also resulted in slightly elevated non-cancer hazards for child residents. All of the other detections of cobalt at the BDDT were within the background range and there is no evidence that suggests cobalt was utilized or disposed of at the BDDT. Therefore, the one elevated cobalt detection is likely the result of an isolated natural anomaly.

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5.8 Ecological Risk Assessment

The purpose of the ERA is to evaluate whether ecological receptors may be adversely impacted by exposure to site-related constituents detected in surface soil, sediment, and surface water at the BDDT. The ERA approach is based on the Master Work Plan (URS 2003) in compliance with CERCLA/SARA. The ERA was conducted in a manner consistent with Virginia policy and USEPA guidance for ecological risk assessment (USEPA 2001a; 2000b; 1997c). This ERA is intended to provide input for risk management decision-making for the BDDT, while maintaining a conservative approach protective of wildlife populations and communities. In accordance with USEPA guidance, the ERA for the BDDT commenced with a SLERA and then concluded with a BERA (USEPA 1997c).

This section summarizes the occurrence of constituents in each medium and identifies COPECs at the BDDT for the ERA; identifies the potential ecological exposure scenarios relevant to the BDDT; and presents the estimated ecological risks associated with the identified COPECs and the relevant ecological exposure scenarios at the BDDT. Methodologies for data summary and selection of COPECs, exposure assessment, and toxicity assessment for the ERA were presented in Section 2.4.

5.8.1 Selection of Constituents of Potential Ecological Concern

This section discusses the selection of COPECs for each medium. HQs greater than 1 indicate that further evaluation may be warranted. Therefore, the constituents with HQs greater than 1 are carried forward as COPECs into the BERA.

5.8.1.1 Surface Soil

Surface soil COPECs were selected by comparing the analytical data with ecological screening levels (ESLs) from the following sources in order of priority: USEPA (2005b) EcoSSLs, USEPA (2003e) Region 5 Ecological Screening Levels, and ORNL values for soil (Efroymson et al. 1997a,b). Table 5-25 presents the selection of surface soil COPECs for the ecological risk assessment. As summarized in Table 5-25, a total of 30 constituents were identified as COPECs in surface soil as follows:

- **SVOCs:** carbazole and dibenzofuran

- **PAHs:** 2-methylnaphthalene, acenaphthylene, acenaphthene, anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(g,h,i)perylene

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benzo(k)fluoranthene, dibenzo(a,h)anthracene, fluorene, indeno(1,2,3-cd)pyrene, benzo(a)pyrene, chrysene, naphthalene, fluoranthene, phenanthrene, and pyrene**Inorganics*:*** cobalt, copper, iron, manganese, selenium, and lead

- **Herbicides:** dalapon, dicamba, and MCPP

- **Pesticides:** 2,4-D and methoxychlor

5.8.1.2 Sediment

Sediment COPECs were selected by comparing the analytical data with ESLs from the following sources in order of priority: USEPA (2008d) Region 3 Sediment Screening Levels; ORNL values (Jones et al. 1997); and USEPA (2003a) Region 5 Ecological Screening Levels for sediment. Table 5-26 presents the selection of sediment COPECs for the ecological risk assessment. As summarized in Table 5-26, a total of 37 constituents were identified as COPECs in sediment as follows:

- **VOCs:** acetone and carbon disulfide.

- **PAHs:** 2-methylnaphthalene; acenaphthylene, acenaphthene; anthracene; benzo(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; benzo(g,h,i)perylene; benzo(k)fluoranthene; chrysene; dibenzo(a,h)anthracene; fluoranthene; fluorene; indeno(1,2,3-cd)pyrene; phenanthrene; and pyrene.

- **Inorganics:** arsenic, barium, beryllium, chromium, copper, iron, lead, manganese, nickel, thallium, vanadium, and zinc.

5.8.1.3 Surface Water

Surface water COPECs were selected by comparing the analytical data with ESLs from the following sources in order of priority: USEPA (2008d) Region 3 Surface Water Screening Levels; ORNL values (Suter and Tsao 1996); USEPA (2003a) Region 5 Ecological Screening Levels; and USEPA (2008e) Ambient Water Quality Criteria for surface water. Table 5-27 presents the selection of surface water COPECs for the ecological risk assessment. Surface water COPECs are:

- **VOCs:** Chloroform and bromodichloromethane

- **Pesticides:** 4,4'-DDT, dieldrin

PAHs: acenaphthene, acenaphthylene, fluorene

- **Inorganics:** aluminum, barium, copper, iron; lead, nickel, silver, thallium, and zinc

5.8.2 Summary of Selected Constituents of Potential Ecological Concern

A total of 30 constituents were selected as COPECs in surface soil, 37constituents were selected as COPECs in sediment, and 16 constituents were selected as COPECs in surface water because the HQs were greater than 1, the chemical was bioaccumulative or an HQ could not be calculated because an ESL was not available.

5.8.3 Refinement of Risk Calculations for Direct Contact Constituents of Potential Ecological Concern

The list of COPECs identified in the BERA was reevaluated by calculating refined HQs. The refined HQs were calculated for the COPECs identified in the SLERA using refined EPCs. Constituents identified as COPECs in the BERA that were bioaccumulative were carried forward into food chain models. The results of the recalculation of the HQs for the BDDT are summarized in the subsections below.

5.8.3.1 Surface Soil

Thirty COPECs in surface soil were carried forward into the BERA. When refined EPCs were compared with the ESLs, only eight constituents [benzo(a)anthracene; benzo(a)pyrene; chrysene; naphthalene; cobalt; copper; manganese, and lead] had a refined HQ greater than 1. In addition, ESLs were not available for six other constituents (carbazole; dibenzofuran; dalapon; dicamba; MCPP; and iron). The BERA results for surface soil COPECs at the BDDT are presented in Table 5-28.

Of the thirty COPECs evaluated, twenty were considered bioaccumulative and were evaluated in the terrestrial food chain model presented in Section 5.8.4.1.

5.8.3.2 Sediment

A total of thirty-seven COPECs in sediment were carried forward into the BERA. When refined EPCs were compared with the ESLs, a total of 15 constituents [acetone; carbon disulfide; 2-methylnaphthlene; acenaphthene; anthracene; benzo(a)anthracene; benzo(a)pyrene; chrysene; dibenzo(a,h)anthracene; fluoranthene; indeno(1,2,3-cd)pyrene; phenanthrene; pyrene; iron; and manganese] had a refined HQ greater than 1. In addition, ESLs were not available for four other constituents (barium, beryllium, thallium, and vanadium). The BERA results for sediment COPECs at the BDDT are presented in Table 5-29.

Of the COPECs evaluated, twenty-seven were identified as bioaccumulative and evaluated in the aquatic food chain model presented in Section 5.8.4.2.

5.8.3.3 Surface Water

Sixteen COPECs in surface water were carried forward into the BERA. When refined EPCs were compared with the ESLs, only five constituents (4,4'-DDT; aluminum; barium; copper; and thallium) had a refined HQ greater than 1. In addition, an ESL was not available for bromodichloromethane. The BERA results for surface water COPECs at the BDDT are presented in Table 5-30.

Of the COPECs evaluated, eight were also identified as bioaccumulative and were evaluated in the aquatic food chain model (Section 5.8.4.2).

5.8.4 Refinement of Assessment and Measurement Endpoints for Bioaccumulative COPECs

Food chain modeling was conducted at the BDDT in order to evaluate the potential ecological effects of the bioaccumulative COPECs in soil, sediment, and surface water on the receptors identified in Appendix A. COPECs identified in soil were evaluated in the terrestrial food chain, and COPECs identified in sediment and surface water were evaluated in the aquatic food chain. The results for both the maximum and refined scenarios of these models are presented in Appendix A.

5.8.4.1 Terrestrial Food chain Model

As summarized in Table 5-31, the refined scenario LOAEL and NOAEL HQs for both the short-tailed shrew and the American robin were less than or equal to 1 for most COPECs. A few PAHs have NOAEL HQs above 1, however, with the exception of dibenzo(a,h)anthracene none has a LOAEL HQ above 1 or a NOAEL HQ above 10. The TRV for dibenzo(a,h)anthracene was conservatively extrapolated from acute toxicity values so the risks presented are likely to overestimate the actual risks. These results indicate that individual shrews and robins (or other insectivorous mammals and birds) exposed to these COPECs are not expected to experience adverse effects.

Based on the overall analysis of terrestrial food chain modeling HQs, adverse effects are not expected for wildlife exposed to bioaccumulative COPECs in soil at the BDDT.

5.8.4.2 Aquatic Food chain Model

As summarized in Table 5-32, the refined scenario LOAEL and NOAEL HQs for both the mink and the great blue heron were less than or equal to 1 for all COPECs identified in sediment and/or surface water with the exception of arsenic which had a slight exceedance of the NOAEL HQ for mink.. These results indicate that mink and herons (or other piscivorous mammals and birds) exposed to these COPECs are not expected to experience adverse effects.

Based on the overall analysis of aquatic food chain modeling HQs, adverse effects are not expected for wildlife exposed to bioaccumulative COPECs in sediment and/or surface water at the BDDT.

5.8.5 Ecological Risk Summary

Screening-level and baseline risk assessments were completed for the BDDT. After the SLERA, 30 constituents were selected as COPECs in surface soil, 37constituents were selected as COPECs in sediment, and 16 constituents were selected as COPECs in surface water because the HQs were greater than 1, the chemical was considered bioaccumulative, or an HQ could not be calculated because an ESL was not available. After the BERA, 14 constituents in surface soil, 19 constituents in sediment, and six constituents in surface water were retained because the HQs were greater than 1 or an HQ could not be calculated because an ESL was not available. In addition, food chain modeling was evaluated for all those constituents identified as bioaccumulative.

Tables 5-31 and 5-32 summarize the constituents in surface soil, sediment, and surface water carried through the BERA and evaluated in the terrestrial and/or aquatic food chain models. As shown in these tables, the majority of constituents evaluated in the terrestrial and aquatic food chain refined scenarios had LOAEL and NOAEL HQs

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less than or equal to 1. Those that exceeded 1 were below 10 with the exception of the NOAEL HQ associated with dibenzo(a,h)anthracene exposures to shrew. However, as noted previously, that chemical was detected in less than half of the samples analyzed, and the TRVs evaluated were conservatively extrapolated from acute studies, so the risks are likely overestimated. Based on the overall analysis of the ERA for the BDDT, the results indicate that adverse effects are not expected for wildlife at the site.

As discussed in Section 5.1, previous site restoration activities mitigated the source area and potential exposure pathways along the trench. Because the soils in the riprap covered portion of the BDDT were not included in the soil dataset for the ERA, the potential impact of this approach was evaluated by calculating the risks associated with the rip-rap soils, as detailed in Appendix A. Based on the results of that assessment, risks associated with the rip-rap soils are less than or very similar to those associated with the rest of BDDT.

5.9 BDDT Summary and Conclusions

The BDDT was formerly an ephemeral unlined natural drainage swale that channeled surface water runoff from the surrounding area towards the unnamed creek which passes through the southwestern portion of the RFAAP-NRU. An approximately 600-ft long section of the drainage swale was utilized for the disposal of miscellaneous building debris derived from the dismantling of various structures at the RFAAP-NRU. The building debris consisted of concrete, wood, and rusted and broken drums of a black, tarry substance believed to be roofing tar. Samples collected from the trench indicated that PAHs were present in soils underlying the debris at concentrations above applicable screening levels. Site restoration activities were performed at the BDDT in 1998 as part of a remedial investigation that included the removal of all building debris and any visibly stained soil from the trench. The excavated material was replaced with clean fill and the trench was lined with a geotextile fabric and filled with riprap to minimize the potential for erosion. The site restoration activities mitigated the source area and potential exposure pathways along the trench; therefore, subsequent investigations focused on soil, sediments, and surface water, downgradient of the trench.

Sampling activities performed at the BDDT between 1998 and 2008 focused on the areas downslope of the trench that may have been affected by the transport of constituents prior to the site restoration activities. These areas included an open area between two hills at the downgradient reach of the trench and an unnamed stream located further downslope. Based on the physical characteristics of the site, the

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stream and the open area downgradient of the disposal area would have been natural depositional areas for media (i.e., soil and debris particles) that may have washed out of the trench prior to the site restoration activities. The open area downgradient of the trench is heavily vegetated with tall grasses and has a gentle slope towards the downgradient stream. Bedrock is present at approximately 5 ft bgs throughout the BDDT Analyte classes included during the various phases of investigation at the BDDT have included VOCs, SVOCs, PAHs, PCBs, pesticides, herbicides, explosives, and inorganics.

A total of 55 surface soil samples and 11 subsurface soil samples were collected from the open area between the trench and the downgradient creek to characterize and delineate the extent of constituents in soil resulting from the former disposal activities at the BDDT. The sampling results indicated that several PAHs were present in surface soils (i.e., 0 to 1 ft bgs). The detected concentrations of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene were present at concentrations above initial screening levels. Other constituents detected at concentrations above initial screening levels included the herbicide MCPP; and the metals cobalt, iron, and manganese. Cobalt, iron, manganese, and MCPP were each only detected in one surface soil sample at concentrations above the applicable screening criteria. No other constituents were detected at concentrations above the initial screening levels.

Soils: The delineation of the PAHs was completed during the 2008 sampling event which defined the outer edges of the PAH detections in surface soil. PAHs were detected at concentrations above initial screening levels in 34 of the 55 surface soil samples and in 6 subsurface soil samples. The 2008 sampling event also confirmed that the subsurface PAH detections are confined to a small area immediately downgradient of the end of the formal disposal area and only extend to a depth of approximately 4 ft bgs. PAH detections are not expected to extend any deeper due to the presence of shallow bedrock throughout the BDDT area.

Sediments: A total of 17 sediment and surface water samples were collected from the unnamed stream downslope of the BDDT area during environmental investigations conducted in 1998, 2002, and 2008. The sediment samples indicated that the PAHs benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cdpyrene) were present at concentrations above applicable screening criteria in two samples collected downstream of the BDDT in 2002. PAH concentrations

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decreased in the samples collected during 2008, with only the furthest downstream sample (BDDT-SD4) containing PAHs at concentrations above applicable screening levels. These results appear to indicate that the residual PAHs present in the surface soils within the open area downslope of the BDDT are not resulting in continued releases of PAHs to the stream. The only other constituents detected in sediment at concentrations above applicable screening levels were iron and manganese, which were only detected at concentrations above screening criteria in one sample DTSD3 in 1998.

Surface Water: The surface water data from the un-named stream have indicated that no PAHs have been detected at concentrations above tap water RSLs. The pesticide dieldrin was detected at a concentration above the tap water RSL in two samples collected in 2002. The VOCs bromodichloromethane and chloroform were detected above the tap water RSL in one sample in 1998. The inorganic constituent thallium was also detected above the tap water RSL in two samples collected in 1998 (thallium was not detected in any samples collected in 2002). The isolated occurrences of these detections, and the fact that dieldrin, bromodichloromethane, chloroform, and thallium were not identified as COPCs for the BDDT soils indicate that the BDDT area is not resulting in continued releases of these constituents. It should also be noted that during the 2002 sampling event, dieldrin was detected at a concentration above the tap water RSL in several samples collected from the unnamed stream, far upstream of the BDDT; including one sample that was collected before the stream flows onto the RFAAP-NRU facility (WBGSW14 – see Table 9-12). This indicates that the dieldrin detection is likely due to an off-site source.

An HHRA was conducted to evaluate exposure to COCPs in surface soil, combined surface and subsurface soil, sediment, and surface water for site workers, construction workers, hypothetical residents under both current and future land-use conditions. The HHRA considered data collected from the entire BDDT site as well as a second scenario that only included data collected from the rip rap covered portion of the site. The calculated excess lifetime cancer risks and hazards were within the USEPA's target risk range of 1×10^{-6} to 1×10^{-4}, or less than or equal to the hazard index of 1,with the exception of the future residential scenario. The ELCR for the hypothetical future resident exceeded 1×10^{-4} primarily due to the presence of benzo(a)pyrene in surface soils. The hazard index exceeded 1 for the hypothetical future resident due to potential exposure to the maximum concentration of cobalt in subsurface soil. However, it should be noted that with the exception of the single maximum detection of cobalt, all other cobalt detections were within established backgroundd levels for the

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RFAAP facility. Therefore, it is likely that the isolated elevated cobalt detection is related to natural conditions rather than historical activities at the BDDT or would pose a chronic heath hazard.

A SLERA and BERA were completed for the BDDT, to evaluate surface soil, sediment, and surface water for ecological receptors, and food chain modeling was evaluated for all those constituents identified as bioaccumulative. The results of the evaluation of the SLERA and BERA for direct contact and the constituents evaluated in the terrestrial and aquatic food chain models indicate that adverse effects are not expected for wildlife at the BDDT.

Based on the results of the combined investigation activities completed at the BDDT between 1997 and 2008, the extent of soils affected by the former disposal activities at the site have been defined and delineated. The results from the 2008 sediment and surface water sampling event indicate that the residual PAHs present in the surface soils within the open area downslope of the BDDT are not resulting in continued releases of PAHs to the creek. The results of the HHRA and ERA indicate that potential risks associated with the site are within generally acceptable ranges for current and future industrial use of the site. However, elevated risks are present under the hypothetical residential land use scenario due to the presence of benzo(a)pyrene in soil under the rip rap covered portion of the site, as well as the downslope area. While the maximum concentration of cobalt at the BDDT also contributed to an elevated HI under the resident child exposure scenario, cobalt is not considered to be a real threat for hypothetical future residents or a driver for remediation. Based upon the location of the detection and the lack of cobalt in the ditch area, its presence is unlikely the result of disposal activities at the site and is likely naturally occurring.

Due to the potential residential risk associated with the benzo(a)pyrene in surface soil located downgradient of the trench and the soil located under the rip rap covered portions of the trench, it is recommended that a FS be conducted to evaluate the available CERCLA response actions for the site. The response action alternative analysis will include an evaluation of potential actions to reduce risk to levels acceptable for residential use of the property, as well as options for maintaining the industrial use of the property.

6. Bag Loading Area

6.1 Site Description and History

The BLA is located along the southwestern boundary of the RFAAP-NRU, to the south of the RY (Figure 1-2). The BLA ran two smokeless powder bag loading lines from 1941-1943. The propelling charge that was loaded in the bags consisted of smokeless powder and an igniter charge consisting of black powder. The bags loaded at the BLA were used for artillery, cannon, and mortar projectiles. A total of ten buildings were once located at the BLA. These buildings included those that were used for the loading operations, storage buildings, shipping and receiving buildings, as well as a changehouse/canteen. However, all process equipment, wooden roofs, and wooden walls have been removed from all of the buildings, leaving only concrete slabs and walls. The concrete slab floors in Buildings 404 through 413 (including the second story floors of Buildings 404 and 407) were covered in a conductive flooring material that contained various metals and asbestos. The BLA site layout depicting locations of building and conductive flooring is presented as Figure 6-1. This conductive flooring was used to prevent the build-up of static charges in areas where energetic materials were handled. Removal of the walls and roofs of the buildings has exposed the conductive flooring to weather, causing it to degrade and break away from the underlying concrete. In some cases, the flooring has degraded into a red powder-like material and washed onto the surrounding soils. The concrete walls of these buildings were also painted with lead-based paint. Deterioration of the paint may have provided a potential source of lead to the soils immediately surrounding the former building areas. Buildings 414 through 416 were not utilized for handling the propellant materials and did not contain conductive flooring or concrete walls, and thus are not considered an environmental concern at BLA. Surface water at the BLA generally drains to the unnamed stream located to the north of the BLA via overland flow and through series of drainage ditches/culverts.

6.2 Physical Setting

Topography in the vicinity of the BLA buildings is generally flat. Vegetation is mostly limited to grass and small shrubs. Surface water is drained through a series of drainage ditches and culverts. Surface soil at the BLA consists of tan to dark brown silty clay and clay. The BLA is located on a hilltop and the soil is typical of the Lowell Silt Loam which forms from the weathering of limestone and interbedded shale. The Lowell Silt Loam is found on the hills and ridges throughout the NRU.

6.3 Conceptual Site Model

In accordance with the general CSM, presented in Section 3.5, potentially affected media at this site would include surface soil, subsurface soil, sediment, and surface water. Potential sources of adverse environmental effects at this site are historical manufacturing operations, deteriorating conductive flooring material, deteriorating lead based paint, and PCB containing electrical transformers that were formerly located at the site. It is also possible that residual asbestos containing materials (i.e., pipe insulation, mastic, joint compounds, etc.) are present in the BLA buildings that could be released to the environment, or could have been released during historic building demolition activities.

Surface soils in the areas surrounding the buildings with conductive flooring material appear to have the greatest potential to exhibit effects from historical operations and from the conductive flooring material. Surface soils located next to the buildings show signs of staining as a result of deteriorated conductive flooring material washing off of the building pads. Due to the composition of the flooring material, soils next to the buildings are expected to exhibit elevated concentrations of metals and asbestos. Soil sampling at the BLA has indicated that the COPCs at the site are generally confined to surface soils. Therefore, contaminant infiltration into subsurface soils does not appear to be a major pathway.

The majority of the BLA area is relatively flat, therefore erosion and/or migration of surface soils is expected to be fairly minimal. However, during heavy rainfall events surface water run-off has the potential to carry COPCs and affected soils to area drainage ditches which eventually direct the surface water to the unnamed creek that flows to the north of the BLA.

6.4 Environmental Investigations

The BLA was designated a Study Area for the RFAAP-NRU site due to the presence of deteriorating conductive flooring in site buildings that are composed of various inorganics and asbestos. In addition to the conductive flooring there were PCB-containing transformers at the site. The presence of these materials at the site warranted investigations of site media including soil surrounding building and former transformer locations, as well as sediment from drainage ditches in the vicinity of these locations. Environmental investigations at the BLA have been on-going since 1997 and have included:

- 1997 – Preliminary Sampling by Dames and Moore, Inc.
- 1997 and 1998 – Independent Sampling by Gannett Fleming
- 2002 – Conductive Flooring Assessment by USACE
- 2002 – Remedial Investigation by Shaw
- 2005 – Asbestos and Lead Investigation by Shaw
- 2008 – Remedial Investigation by ARCADIS
- 2009 – Supplemental Remedial Investigation by ARCADIS

The goals and findings of each of these investigations are summarized in the following sections. As discussed in Section 4.1, the constituent detections reported in these sections are discussed in terms relative to their medium specific screening criteria (i.e., RSLs), where applicable.

6.4.1 Preliminary Sampling, Dames and Moore, 1997

An initial December 1997 soil sampling effort was conducted by Dames and Moore, Inc. to provide an assessment of the lateral and vertical distribution of organic and inorganic constituents in soil around Buildings 407 at the BLA, resulting from the weathering of the conductive flooring. Three soil boring locations were positioned in a line perpendicular to the building at distances of 12, 36, and 60 inches from the building pad. Three samples were collected from depths of 0-1, 1-2, and 2-3 ft bgs at the location 12 inches away from the sidewalk. For the sampling locations 36 and 60 inches away from the sidewalk, two samples were collected at depths of 0-1 and 1-2 ft bgs. Sample identifications include the sample location code followed by the sample depth in parentheses. The following samples were collected during this investigation:

- Three surface soil samples (407712 (0-1), 407736 (0-1), and 407760 (0-1))
- Four subsurface soil samples (407712 (1-2), 407712 (2-3), 407736 (1-2), and 407760 (1-2))

All soil samples were analyzed for TAL inorganics. The laboratory analytical results for the soil samples are summarized in Table 6-1 and the sample locations are depicted in Figure 6-2. The results indicated the following:

Inorganics. Several inorganic constituents were detected in the surface and subsurface soil samples (see Table 6-1). With the exception of cobalt and aluminum, all of the detected constituents were below applicable RSLs and/or the established facility-wide background levels. Cobalt was detected in one subsurface soil sample [407712 (2-3 ft bgs)] at a concentration above the industrial RSL and slightly above background levels. Cobalt was not detected in any of the other subsurface or surface soil samples at concentrations above the established background level. Aluminum was also detected in subsurface soil sample 407712 (2-3) at a concentration between the residential soil and industrial soil RSLs and slightly above the established background level.

6.4.2 Independent Sampling, Gannett Fleming, 1997 and 1998

The objective of the independent sampling was to further characterize soil at the BLA. Initial investigation activities included the collection of one surface soil sample (SS-09) from the north side of Building 405 and one sample of the conductive flooring (WS-01) from Building 405. In 1998 two additional soil samples (SS-14 and TR-03E) were collected from areas northeast and northwest of Building 405 and two additional conductive flooring samples (WS-04 and WS-05) were collected. A total of three surface soil samples were collected and analyzed as follows:

- One surface soil sample for explosives and pesticides analysis (SS-09);
- Three surface soil samples for PCBs and SVOCs analysis (SS-09, SS-14, and TR-03E);
- Two surface soil samples for VOCs and TAL inorganics analysis (SS-09 and SS-14);

A total of three conductive flooring samples were collected and analyzed as follows:

- One conductive flooring sample for VOCs, SVOCs, PCBs, and pesticides analysis (WS-01);
- Three conductive flooring samples for TAL inorganics analysis (WS-01, WS-04 and WS-05)
- Two conductive flooring sample for asbestos analysis (WS-04 and WS-05)

The laboratory analytical results for soil and conductive flooring samples are summarized in Table 6-2 and 6-3, respectively. The sample locations are depicted in Figure 6-2.

6.4.2.1 Soil Sampling

The results of the soil sampling activities indicated the following:

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VOCs. One VOC (methylene chloride) was detected in two of the three soil samples (see Table 6-2). However, the detected concentrations were several orders of magnitude below applicable industrial and residential RSLs.

SVOCs. A total of 26 different SVOC constituents were detected in the surface soil samples collected during this phase of investigation as indicated in Table 6-2. However, benzo(a)pyrene at sample location SS-09 was the only constituent detected at a concentration above an applicable industrial RSL. Six other SVOC analytes [i.e., benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, dinitrotoluene mix, and indeno(1,2,3-cd)pyrene] were also detected in sample SS-09 at concentrations above residential RSLs. Benzo(a)pyrene was also detected in sample TR-03E at a concentration above the residential RSL. SVOCs were not detected above industrial or residential soil RSLs in any other soil samples.

PCBs. One PCB (Aroclor 1254) was detected in the soil samples (see Table 6-2). Aroclor 1254 was detected above the industrial RSL in sample SS-09. PCBs were not detected at concentrations above industrial or residential RSLs in any other soil samples.

Pesticides. Five different pesticides (4,4'DDD, alpha-chlordane, Endosulfan I, gamma-chlordane, and heptachlor epoxide) were detected in the soil sample collected at sample location SS-09 (see Table 6-2). The detected concentrations were all below applicable industrial and residential RSLs.

Explosives. One explosive constituent (2,4-dinitrotoluene) was detected at sample location SS-09. The detected concentration was below the reported industrial and residential soil RSL for 2,4-dinitrotoluene; however, the reported concentration was above the residential RSL for dinitrotoluene mix.

Inorganics. Several inorganic constituents were detected in the soil samples (see Table 6-2). However, copper and lead at sample location SS-09 were the only constituents detected at concentrations above applicable industrial RSLs and established background levels. Barium and zinc were also detected at sample location SS-09 at concentrations above the residential RSL and established background levels. No other inorganics were detected at concentrations above background and residential RSLs.

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6.4.2.2 Conductive Flooring Samples

VOCs. Two VOCs (acetone and methylene chloride) were detected in flooring sample WS-01 (see Table 6-3). The detected concentrations of both constituents were several orders of magnitude below applicable industrial and residential soil RSLs.

SVOCs. Seventeen different SVOC constituents were detected in flooring sample WS-01 (see Table 6-3 for complete list). Five of the SVOCs [Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, and Indeno(1,2,3-cd)pyrene] were detected at concentrations above industrial RSLs. One SVOC, benzo(k)fluoranthene, was also detected at a concentration between the residential and industrial soil RSLs. The other SVOCs were all detected at concentrations below applicable industrial and residential RSLs.

PCBs. Aroclor 1254 was the only PCB detected in flooring sample WS-01 (see Table 6-3). The detected concentration of Aroclor 1254 (2.80 mg/kg) was above the industrial RSL of 0.74 mg/kg.

Pesticides. A total of eight pesticides were detected in flooring sample WS-01 (see Table 6-3). However, heptachlor epoxide was the only pesticide detected at a concentration above the industrial soil RSL. No other pesticides were detected at concentrations above respective industrial or residential soil RSLs.

Inorganics. Several inorganic constituents were detected in flooring samples WS-01, WS-04 and WS-05 (see Table 6-3). Copper was detected in all three samples at concentrations above industrial RSLs and established background levels. Barium, lead and zinc were also detected in flooring sample WS-01 at concentrations above background levels and residential RSLs; as was nickel in flooring sample WS-04.

Asbestos. Asbestos (Chrysotile) was detected in both conductive flooring samples WS-04 and WS-05 at a concentration of 1.6 percent. Sample WS01 was not analyzed for asbestos.

6.4.3 Conductive Flooring Assessment, USACE, 2002

The USACE completed a conductive flooring assessment in 2002 to further evaluate the composition of the conductive flooring material at the IAA and the BLA. The results of this investigation are summarized in the 2003 report entitled *Site Screening Report of Conductive Flooring at the Igniter Assembly Area and Bag Loading Area in the New*

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River Unit (USACE, 2003). The sampling activities at the BLA included the collection of flooring samples from three buildings (Buildings 405, 407 and 413).

Three conductive floor samples (one from each building) were collected from buildings in the BLA to verify floor material composition and assess transport and mobility. A small chunk of the red conductive flooring material was collected from the surface of the building foundation. The flooring appeared as a dry, dull red colored material containing white fibers. The samples were analyzed for TCL VOCs, TCL SVOCs, PCBs, TCL pesticides, explosives, inorganics, and asbestos. The laboratory analytical results are summarized in Table 6-4 and the sample locations are depicted in Figure 6-2. The results indicated the following:

VOCs. Methylene chloride was the only VOC detected in the three flooring samples (see Table 6-4). The detected concentrations were all below the residential soil RSL.

SVOCs. Two SVOCs [bis(2-Ethylhexyl)phthalate and Di-n-Butylphthalate] were detected in all three conductive flooring samples (see Table 6-4). The detected concentrations were all below residential soil RSLs.

PCBs. The PCB Aroclor 1254 was detected at concentrations below the residential RSL in three conductive flooring samples (see Table 6-4). No other PCBs were detected in any of the conductive flooring samples.

Pesticides. A total of four pesticides (4,4'DDE, 4,4'-DDT, dieldrin, and endrin) were detected in the flooring samples (see Table 6-4). The detected concentrations were all below applicable industrial and residential soil RSLs.

Explosives. Explosives were not detected in any of the conductive flooring samples (see Table 6-4).

Inorganics. Several inorganic constituents were detected in the conductive flooring samples (see Table 6-4). Copper was detected at concentrations above both industrial RSLs and established background concentrations in all three conductive flooring samples (RFAAP-405, RFAAP-407, and RFAAP-413). No other inorganics were detected at concentrations above industrial RSLs; however, cadmium and nickel were detected at concentrations above residential RSLs and background levels at samples RFAAP-413 and RFAAP-405, respectively.

Asbestos. The asbestos constituent chrysotile was detected in all three conductive flooring samples RFAAP-405, RFAAP-407, and RFAAP-413 at a concentration of 2 percent in each sample.

6.4.4 Remedial Investigation, Shaw 2002

The objective of the 2002 remedial investigation was to further characterize soil, sediment, and surface water at the BLA. This section is intended to provide a brief summary of the field activities conducted at the BLA by Shaw during the 2002 field investigation. The following samples were collected during this investigation:

- Eleven surface soil samples [BLASS01 (0-0.5) through BLASS11 (0-0.5)] were collected from areas adjacent to BLA buildings containing conductive flooring.
- Three additional soil borings (BLASB01 through BLASB03) were also advanced in the vicinity of buildings with conductive flooring material to collect both surface and subsurface soil samples.
- Three soil samples (BLATR01 through BLATR03) were collected from three former transformer locations.
- Two sediment samples (BLASD01 and BLASD02), were collected from dry stormwater drainage ditches that channel runoff from the BLA.
- Two co-located sediment (BLASD04 and BLASD05) and surface water (BLASW04 and BLASW05) samples were collected from the unnamed creek located to the north of the BLA buildings.

6.4.4.1 Soil Sampling

A total of 14 surface soil samples and three subsurface soil samples were collected next to the BLA buildings during the 2002 investigation. All of the soil samples were analyzed for TAL inorganics. Other analyte classes sampled for in this investigation included VOCs, SVOCs, PAHs, PCBs, pesticides, herbicides, explosives, pH, and grain size; however, not all analytes were included at every location. The laboratory analytical results from this sampling event are summarized in Table 6-5 and the sample locations are depicted in Figure 6-2. The results indicated the following:

VOCs. Six VOCs (3-octanone, acetone, carbon disulfide, d-Limonene, tetrachloroethene, and toluene) were detected in a limited number of the soil samples during the 2002 investigation (see Table 6-5). The detected concentrations were all below applicable residential RSLs.

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SVOCs. A total of 25 SVOCs were detected in the soil samples collected during Shaw's 2002 investigation. A complete breakdown of the detected constituents is included in Table 6-5. The analytical results indicated that five of the SVOCs were detected at concentrations above industrial soil RSLs, including:

- Benzo(a)anthracene in two samples (BLASB02A and BLASB03A);
- Benzo(a)pyrene in eight samples (BLASB02A, BLASB03A, BLASS05, BLASS06, BLASS07, BLASS09, BLASS10, and BLASS11);
- Benzo(b)fluoranthene in three samples (BLASB02A, BLASB03A, and BLASS07);
- Dibenzo(a,h)anthracene in two samples (BLASB02A and BLASB03A); and
- Indeno(1,2,3-cd)pyrene in two samples (BLASB02A and BLASB03A).

Several SVOCs, including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, 2,4-dinitrotoluene, and 2,6-dinitrotoluene were also detected in at least one soil sample at concentrations above applicable residential soil RSLs.

PAHs. A total of 17 PAHs were detected in the samples analyzed for PAHs (see Table 6-5). The analytical results indicated that no constituents were present at concentrations above industrial RSLs. Benzo(a)pyrene was detected at concentrations above the residential RSL in three surface soil samples (BLASB01, BLASS01, and BLASS02). No other PAHs were detected at concentrations above residential RSLs in any of the surface or subsurface soil samples.

PCBs. Aroclor 1254 was the only PCB detected in soil during the 2002 investigation (see Table 6-5). Aroclor 1254 was detected above the industrial RSL in one of the surface soil samples (BLASS01) located next to Building 405 and in one of the former transformer sample locations (BLATR02). PCBs were not detected at concentrations above industrial or residential RSLs in any other surface or subsurface soil samples during this phase of the investigation.

Pesticides. 4,4'-DDD and methoxychlor were the only pesticides detected in soil during this phase of investigation. Both constituents were only detected in individual samples and the reported concentrations were below applicable industrial and residential RSLs (See Table 6-5).

Herbicides. No herbicides were detected in any of the soil samples collected during this phase of investigation.

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Explosives. A total of nine different explosive constituents were detected in a limited number of surface soil samples collected adjacent to BLA buildings. The detected constituents and concentrations are outlined in Table 6-5. The concentrations of all of the detected constituents were below applicable residential and industrial RSLs; however, the cumulative concentration of 2,4-dinitrotoluene and 2,6-dinitrotoluene at sample location BLASS03 was above the industrial RSL for dinitrotoluene mix. These two constituents were also detected at sample location BLASS03 via the explosives laboratory analysis.

Inorganics. Several inorganic constituents were detected in all of the surface and subsurface soil samples collected during this phase of the investigation (see Table 6-5). Four inorganics were detected at concentrations above both industrial RSLs and established background concentrations in soil samples, including:

- Cobalt in one sample (BLASS11);
- Lead in three samples (BLASB03, BLASS03, and BLASS08);
- Manganese in one sample (BLASS11); and
- Mercury in one sample (BLASS03).

In addition to the above, the following six inorganics were detected at concentrations above residential RSLs and established background concentrations in soil samples, including:

- Aluminum in two samples (BLASB01B and BLASB02B);
- Barium in two samples (BLASB03A and BLASS03);
- Cadmium in three samples (BLASB03A, BLASS03, and BLASS08);
- Copper in seven samples (BLASB03A, BLASS03, BLASS05, BLASS06, BLASS07, BLASS08, BLASS09);
- Iron in one sample (BLASB01B); and
- Zinc in one sample (BLASS08).

6.4.4.2 Sediment Sampling

Two sediment samples (BLASD01 and BLASD02) were collected from BLA area drainage ditches during the 2002 investigation. The ditches were all dry during the sampling event and only carry water during heavy rainfall events. Two additional sediment samples (BLASD04 and BLASD05) were collected from the unnamed creek located to the north of the BLA buildings. The samples were analyzed for VOCs, PAHs/SVOCs, PCBs, pesticides, herbicides, explosives, and TAL inorganics. The laboratory analytical results from this sampling event are summarized in Table 6-6, and the sample locations are depicted in Figure 6-2. The results indicated the following:

VOCs. VOCs were not detected in any of the sediment samples (see Table 6-6).

SVOCs. Five SVOCs were detected between the four sediment samples [bis(2-ethylhexyl)phthalate, fluoranthene, phenanthrene, pyrene, and benzoic acid]. As presented in Table 6-6, all of the detected concentrations were below applicable residential and industrial RSLs.

PAHs. A total of sixteen PAHs were detected between the four sediment samples (see Table 6-6). The detected concentrations were all below applicable residential and industrial RSLs.

PCBs. PCBs were not detected in any of the sediment samples (see Table 6-6).

Pesticides. A total of 11 different pesticides were detected between the four sediment samples included in this event. These constituents, and their detected concentrations, are outlined in Table 6-6. The detected concentrations were all below applicable industrial and residential RSLs. .

Herbicides. Herbicides were not detected in any of the sediment samples (see Table 6-6).

Explosives. Explosives were not detected in any of the sediment samples (see Table 6-6).

Inorganics. Several inorganic constituents were detected in all of the sediment samples (see Table 6-6); however, all of the detected concentrations were below applicable RSLs (residential and industrial) and/or established background levels.

6.4.4.3 Surface Water Sampling

Two surface water samples (BLASW04 and BLASW05) were collected from the unnamed creek located to the north of the BLA buildings. The laboratory analytical results from the surface water samples are summarized in Table 6-7, and the sample locations are depicted in Figure 6-2. The results indicated the following:

VOCs. Carbon disulfide and chloroform were the only VOCs detected in the surface water samples from the unnamed creek. The detected concentrations were lower than the tap water RSLs (see Table 6-7).

SVOCs. Butylbenzylphthalate and di-n-butylphthalate were the only SVOCs detected in the surface water samples (see Table 6-7). The detected concentrations of these constituents were lower than tap water RSLs.

PAHs. PAHs were not detected in either of the surface water samples.

PCBs. PCBs were not detected in either of the surface water samples.

Pesticides: Dieldrin was the only pesticide detected in the surface water samples (see Table 6-7). The detected concentration of dieldrin in surface water sample BLASW05 was higher than the tap water RSL. It should be noted that during this sampling event, dieldrin was also detected at a concentration above the tap water RSL in an upstream surface water sample collected for the WBG (see Table 9-11). This sample (WBGSW14) was collected upstream of where the stream first enters the RFAAP-NRU indicating a potential off-site source.

Herbicides. 2,4-D was detected on one surface water sample (BLASW04) during this sampling event (see Table 6-7). The detected concentration was several orders of magnitude below the tap water RSL.

Explosives. m-Nitrotoluene was detected in both of the surface water samples during this event (see Table 6-7). There is not an established tap water RSL for this constituent. No other explosives were detected in the surface water samples.

Inorganics. Several inorganics were detected in both of the surface water samples (see Table 6-7). However, the detected concentrations were all lower than established tap water RSLs.

6.4.5 Asbestos and Lead Investigation, Shaw, 2005.

Shaw completed an asbestos and lead based paint survey at the BLA during 2005. This event included the collection of the following samples:

- Six soil samples (BLASS12 through BLASS17) were collected for asbestos analysis

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- Two samples of deteriorated conductive flooring material (BLADF01 and BLADF02) were collected for asbestos analysis
- Two samples of intact conductive flooring (BLAIF01, and BLAIF02) were collected for asbestos analysis
- Three wipe samples (BLAW01, BLAW02 and WB01) for asbestos analysis
- One paint chip sample (BLAPC01) from BLA Building 405 for lead analysis

The exact locations of the samples collected during this investigation were not recorded by Shaw. According to a February 2005 Draft Field Sampling Plan, three soil samples would be collected adjacent to each of two previous sample locations (BLASB03 and BLASS03), flooring and wipe samples would be collected from Buildings 404 and 405 adjacent to previous soil samples BLASB03 and BLASS03 and a paint chip sample would be collected from Building 405 adjacent to previous soil sample BLASS03. The laboratory analytical results for the soil samples, conductive flooring samples, wipe samples, and paint chip sample are presented in Table 6-8.

The results of the asbestos analysis indicated that the chrysotile was the only asbestos type detected. Total asbestos concentrations detected in the soil samples ranged from 3.2 to 14.2%. Asbestos concentrations in the intact flooring material ranged from 16.5 to 20.8% and from 10.5% to 11.3% in the deteriorated flooring. Asbestos was detected at a concentration ranging from 2,820 to 225,000,000 structures per cm^2 (s/cm^2) in the three wipe samples collected from red-stained walls.

The results from the paint chip sample indicated that the lead concentration was 306 mg/kg. Very little paint remains on the BLA buildings.

6.4.6 RI Investigation, ARCADIS 2008

In accordance with Remedial Investigation Work Plan Addendum 27 (ARCADIS 2008b), ARCADIS completed additional investigation activities at the BLA in 2008 to finalize the characterization and delineation work at this site. The primary goal of the 2008 investigation was to complete the delineation of inorganics, PAHs, and asbestos in surface soils around buildings containing conductive flooring. The investigation also included the collection of soil samples to delineate historical PCB and PAH detections at previous transformer locations near Buildings 405 and 416, and lead detections in sediments from area drainage pathways. One ponded water sample was collected from an elevator shaft in Building 405 and one water sample was also collected from a utility vault below Building 405. The investigation activities and results for these areas are discussed in the following sections.

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6.4.6.1 2008 Building Area Inorganics and Asbestos Investigation

The primary goal of ARCADIS' 2008 investigation was to delineate the extent of PAHs, inorganics, and asbestos detections in surface soil surrounding buildings with conductive flooring material. Following is a summary of the investigation activities performed to complete this assessment:

- ARCADIS performed an inventory of the buildings at the BLA to identify buildings with conductive flooring, including those that may not have appeared on historic site maps. The locations of all buildings were surveyed utilizing GPS equipment and measurements were collected of the building dimensions. All buildings at the BLA are depicted in Figure 6-1. The building inventory identified seven buildings with conductive flooring material. In total approximately 19,000 ft^2 of conductive flooring material is present at the site.

- Review of the analytical data collected during the previous investigations of the BLA indicated that lead could be used as a good predictor of where other constituents may also be present in surface soil at concentrations above applicable screening criteria as a result of the deteriorating conductive flooring. Therefore, ARCADIS developed a field screening program that utilized a hand-held X-Ray Fluorescence (XRF) meter to screen surface soil samples for lead. Samples were typically collected in rows of three screening points spaced at 1 ft, 5 ft, and 10ft distances from the building footprint. In cases where the XRF result indicated a lead concentration above 400 mg/kg, the samples were also collected further away from the building (i.e., 15 ft and 20 ft). The rows were located on approximately 25 ft centers around the perimeter of each building, with a bias towards preferential flow paths off of the building pads (i.e., where red staining was present in soil). A total of 63 rows containing 192 individual points (BLA-R1A through BLA-R63C) were screened with the XRF around the perimeters of buildings identified with conductive flooring. The field screening locations are depicted in Figure 6-3. The screening points were identified with the letter R for Row followed by a number (001 through 63) representing the row number where the screening point was located, followed by a letter (A, B, C, or D) representing the distance from the building pad to the sample location (1, 5, 10, 15ft, respectively).

- In order to evaluate the results of the XRF screening results and to provide additional characterization data, samples for laboratory analysis were collected from 19 of the 192 XRF screening locations. A minimum of one sample was collected at each building identified with conductive flooring. These samples (BLA-SS001 through BLA-SS019) were submitted for laboratory analysis of TAL inorganics, SVOCs, and asbestos. Five of these samples (BLA-SS003, BLA-SS008, BLA-SS010, BLA-SS017, and BLA-SS019) were also submitted for laboratory analysis of TCLP-inorganics. The sample locations are depicted in Figure 6-2.

6.4.6.2 XRF Lead Screening Results

The results of the XRF lead screening activities at the BLA buildings are summarized in Table 6-9. The locations and results of the XRF screening are also presented in Figure 6-3. The XRF screening activities indicated the following:

- The XRF screening results indicated that lead concentrations were above industrial RSL in 30 of the 192 field screening locations. In addition, there were 20 locations where the detected lead concentrations were between the residential and industrial RSL. Figure 6-4 illustrates the distribution of the detected lead concentrations during the XRF field screening program. All of the screening locations that had lead concentrations above the RSLs occurred at four site buildings (Buildings 404, 405, 406, and 407) located in the central portion of the BLA. Field observations indicated that these buildings were surrounded by a significant amount of gravel debris that may have influenced the XRF results. The XRF screening results at Buildings 411, 412, and 413 were all below the residential RSL.

- Following is a summary of the XRF detected lead concentrations at each of the BLA buildings:

    - **Building 404 –** 14 of 65 screening locations at Building 404 had lead detections above the industrial RSL. The detected lead concentrations in these samples, ten of which were collected 1-ft away from the building pad, three at 5 ft and one at 10 ft, ranged from 773 mg/kg to 4,640 mg/kg. All but two of the screening points above the industrial RSL were located on the southern and eastern sides of Building 404. Nine locations at Building 404 had lead detections between the residential and industrial RSLs. The detections above the residential RSL extended up to 15-ft from the building pad in one location on the south side of the building. See Table 6-9 for a complete summary of the XRF results.

- **Building 405** – Six of 58 screening locations at Building 405 had lead detections above the industrial RSL. The detected lead concentrations in these samples, four of which were collected 1-ft away from the building pad, one at 5 ft and one at 10 ft, ranged from 808 mg/kg to 1,294 mg/kg. All of the six screening points above the industrial RSL were located on the northern and eastern sides of Building 405. Eight locations at Building 404 had lead detections between the residential and industrial RSLs. See Table 6-9 for a complete summary of the XRF results.

- **Building 406** – Building 406 is a small building located to the west of Building 404 in the southern portion of the BLA. Five of the six screening locations at Building 406 had lead detections above the industrial RSL. The detected lead concentrations in these samples, two of which were collected 1-ft away from the building pad, two at 5 ft and one at 10 ft, ranged from 1,940 mg/kg to 12,799 mg/kg. One screening point at Building 406 had lead detections between the residential and industrial RSLs. All screening points were located on the southeast and southwest sides of the building. See Table 6-9 for a complete summary of the XRF results.

- **Building 407** – Building 407 is a small building located to the west of Building 405 in the northern portion of the BLA. Like Building 406, many of the XRF readings collected around this building were elevated in comparison to other areas of the site. Five of the seven screening locations resulted in lead concentrations above the industrial RSL. The detected lead concentrations in these samples, two of which were collected 1-ft away from the building pad, two at 5 ft and one at 10 ft, ranged from 2,055 mg/kg to 12,843 mg/kg. The other two screening points contained lead concentrations below residential soils RSLs at 10 and 15 ft from the building. The detections above the industrial RSL were confined to soils within five to ten ft of the building pad. See Table 6-9 for a complete summary of the XRF results.

- **Buildings 411, 412, and 413** – Buildings 411, 412, and 413 are located in the western portion of the BLA. All screening locations at these three buildings had reported lead concentrations below the residential RSL. See Table 6-9 for a complete summary of the XRF results.

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6.4.6.3 BLA Inorganics and Asbestos Sampling

ARCADIS collected soil samples at 19 of the 192 XRF field screening locations to evaluate the results of the XRF field screening and to provide additional characterization of the surface soils. At least one sample was collected at each of the seven conductive flooring buildings at the BLA. These samples (BLA-SS001 through BLA-SS019) were submitted for laboratory analysis of TAL inorganics and asbestos. The sample locations are depicted in Figure 6-2, and the laboratory analytical results are summarized in Table 6-10. The laboratory analytical reports for the 2008 sampling activities are included in Appendix D**.** The laboratory analytical results indicated the following:

- Lead was the inorganic most frequently detected inorganic at concentrations above the industrial soil RSLs and established background concentrations. Lead was detected at concentrations above the industrial RSL in 10 of the 19 samples, and between the residential and industrial RSLs in 2 other samples (see Table 6-10). The maximum lead concentration (58,000 mg/kg) was detected in sample BLA-SS013 located 1-ft away from Building 406. Of the ten samples at concentrations above industrial soil RSLs, eight were located 1-ft from the building pads (Buildings 404 through 407), one was located 5-ft and one located 10-ft from building pads. Figure 6-5 illustrates the distribution of the lead concentrations detected in the laboratory samples during the 2008 sampling event.

- In general, the detected lead concentrations were very comparable with the XRF readings; although, the XRF readings were typically biased slightly high compared to the laboratory detected concentration. These data indicate that the XRF field analysis was a good screening tool for identifying areas with lead concentrations above applicable RSLs. See Table 6-10 for comparison between the XRF screening results and the laboratory analytical results. Figure 6-6 also presents a graphical comparison of the XRF and laboratory lead results.

- Arsenic was detected above the established background concentration (15.8 mg/kg) and above the industrial RSL (1.6 mg/kg) in 2 of the 19 soil samples collected in 2008 from the BLA (see Table 6-10). The two samples with lead concentrations above the industrial RSL were collected at 1-foot distance from Buildings 404 and 406. The maximum arsenic concentration (47.2 mg/kg) was detected in sample BLA-SS014 located adjacent to Building 404.

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- Barium was not detected above the industrial soil RSL (190,000 mg/kg) in any samples, but was detected above the established background concentration (209 mg/kg) and above the residential soil RSL (1,500 mg/kg) in seven of the 19 soil samples collected in 2008 from the BLA (see Table 6-10). The maximum barium concentration (11,100 mg/kg) was detected in sample BLA-SS008 located 1-ft from Building 405. Five of the seven samples with lead concentrations above residential RSL were collected at 1-foot distance from Buildings 404 and 405, while one was collected 5 ft and one collected 10 ft from Building 405.

- Cadmium was detected above the established background concentration (0.69 mg/kg) and above the residential soil RSL (7 mg/kg) in seven of the 19 soil samples collected in 2008 from the BLA (see Table 6-10); however, cadmium was not detected above the industrial soil RSL (81 mg/kg) in any samples. The maximum cadmium concentration (44.8 mg/kg) was detected in sample BLA-SS013 located adjacent to Building 406. Five of the seven samples with cadmium concentrations above residential RSL were collected at 1-ft distance from Buildings 404, 405, and 406, while one was collected 5 ft and one collected 10 ft from Building 405.

- Copper was detected above the established background concentration (53.5 mg/kg) and above the industrial soil RSL (4,100 mg/kg) in five of the 19 samples collected in 2008 from the BLA (see Table 6-10). In addition, copper was detected between the residential and industrial soil RSLs in eight other samples. The maximum copper concentration (72,000 mg/kg) was detected in sample BLA-SS013 located 1 ft from Building 406. Of the 13 samples with copper concentrations above residential or industrial RSLs, nine were located at 1 ft, three at 5 ft and one at 10 ft distance from Buildings 404, 405, 406 and 407.

- Iron was detected above the established background concentration (50,962 mg/kg) and above the residential soil RSL (5,500 mg/kg) in two of the 19 soil samples collected in 2008 from the BLA, but was not detected above the industrial soil RSL (720,000 mg/kg) in any samples (see Table 6-10). The maximum iron concentration (61,500 mg/kg) was detected in sample BLA-SS012 located 5 ft distance from Building 405. The other sample with iron concentration above the residential RSL was located 5 ft distance from Building 412, which had no other inorganics at concentrations above both residential RSLs and established background concentrations.

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- Mercury was detected above the established background concentration (0.13 mg/kg) and above the residential and industrial soil RSL (3.1 mg/kg, each) in two of the 19 soil samples collected in 2008 from the BLA (see Table 6-10). The two samples with mercury concentrations above RSLs were collected at 1 ft distance from Buildings 404 and 405.

- Zinc was detected above the site-wide natural background concentration (202 mg/kg) and above the residential soil RSL (2,300 mg/kg) in six of the 19 soil samples collected in 2008 from the BLA (see Table 6-10); however, zinc was not detected above the industrial soil RSL (310,000 mg/kg) in any samples. The maximum zinc concentration (12,500 mg/kg) was detected in sample BLA-SS013 located 1 ft distance from Building 406. Of the six samples with zinc concentrations above residential RSLs, five were located at 1 ft distance and one at 5 ft distance from Buildings 404, 405, and 406.

- Asbestos was detected in all 19 of the surface soil samples collected at the BLA in 2008 (see Table 6-10). These samples were generally collected from sample locations where XRF screening and laboratory analytical results also indicated the presence of elevated metals.

- TCLP analysis of soil samples collected in 2008 indicated that no inorganics were present in soil at concentrations above TCLP disposal standards (see Table 6-10).

6.4.6.4 BLA PAH Sampling

Each of the 19 soil samples (BLA-SS001 through BLA-SS019) collected adjacent to BLA buildings containing conductive flooring were also submitted for laboratory analysis of PAHs. Four additional samples (BLA-SS005 through BLA-SS008) collected from the central area of the BLA were also analyzed for PAHs. The sample locations are depicted in Figure 6-2, and the laboratory analytical results are summarized in Table 6-10. The laboratory analytical reports for the 2008 sampling activities are included in Appendix D. The laboratory analytical results indicated the following:

Central BLA Area

ARCADIS collected four surface soil samples surrounding the location of a sample collected near the center of the BLA in 2002 (BLASB02) that contained PAHs above

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industrial RSLs. Laboratory analytical results from the four surface soil samples collected near the center of the BLA indicated that five PAHs were detected at concentrations above the industrial soil RSLs, including: Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, and Indeno(1,2,3-cd)pyrene. One PAH constituent (Benzo(k)fluoranthene) was also detected in all four samples at a concentration between the residential and industrial RSLs.

BLA Conductive Flooring Buildings

Laboratory analytical results from the 19 surface soil samples collected in the vicinity of the BLA conductive flooring buildings indicated that six PAHs were detected at concentrations above the industrial soil RSLs, including:

- Benzo(a)anthracene in four soil samples (BLA-SS005, BLA-SS007, BLA-SS009, and BLA-SS017)
- Benzo(a)pyrene in 14 soil samples (BLA-SS001, BLA-SS004, BLA-SS005, BLA-SS007, BLA-SS009, BLA-SS010, BLA-SS011, BLA-SS012, BLA-SS013, BLA-SS014, BLA-SS016, BLA-SS017, BLA-SS018, and BLA-SS019)
- Benzo(b)fluoranthene in five soil samples (BLA-SS005, BLA-SS007, BLA-SS009, BLA-SS010, and BLA-SS017)
- Benzo(k)fluoranthene in one soil sample (BLA-SS005)
- Dibenzo(a,h)anthracene in seven soil samples (BLA-SS001, BLA-SS005, BLA-SS007, BLA-SS009, BLA-SS010, BLA-SS017, and BLA-SS018), and
- Indeno(1,2,3-cd)pyrene in three samples (BLA-SS005, BLA-SS009, and BLA-SS017)

These six PAH constituents plus Chrysene were also detected at concentrations between the residential and industrial soil RSLs in many of the soil samples collected in the vicinity of the BLA buildings with conductive flooring. PAHs appeared to be present equally in samples collected at distances 1 ft, 5 ft, and 10 ft from the buildings.

6.4.6.5 Former Transformer Area Sampling

The analytical results from samples collected north of Building 405 in 2002 (BLASS01) indicated that Aroclor 1254 was present in surface soil at concentrations above the industrial RSL. Additionally, sample BLATR02 collected in 2002 at the location of a former transformer east of Building 416 also contained Aroclor 1254 at a concentration above the industrial RSL. In order to complete the delineation of these two areas,

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ARCADIS collected two surface soil samples (BLASS001 and BLASS002) and two subsurface soil samples [BLA-SB001 (1-2), and BLA-SB001 (2-3)] near 2002 sample BLASS01 and two surface soil samples (BLA-SS003 and BLA-SS004) near the 2002 IBLATR02 sample location (see sample locations in Figure 6-2). The surface and subsurface samples were analyzed for PCBs. The analytical results from these samples are summarized in Table 6-10. The results indicated that PCBs were not detected above residential RSLs in any of the soil samples.

6.4.6.6 Utility Vault and Elevator Shaft Water Samples

Underground, concrete, utility vaults were identified at Buildings 404 and 405 that appear to extend around the perimeter of the buildings. Standing water was present in the vaults with a depth of approximately 1 ft. No sediment was visible at the bottom of the vaults. A sample of the vault water (BLA-VLTW01) was collected from the Building 405 vault for laboratory analysis of VOCs, PAHs, and TAL metals (see Figure 6-2 for sample location).

Ponded water along with sediment material were also observed at the base of an elevator shaft in Building 405. A sample of the ponded water (BLA-SPSW01) was collected from the elevator shaft for analysis of PAHs and TAL metals (see Figure 6-2 for sample location). The analytical results from the ponded water sample are summarized in Table 6-11. The ponded water results indicated that no constituents were detected at concentrations above tap water RSLs except for arsenic which was detected at concentrations within expected background levels.

6.4.6.7 Elevator Shaft Sediment Samples

Sediment material was observed at the base of an elevator shaft in Building 405 along with the ponded water discussed above. This material appeared to be composed of degraded flooring material along with soil and miscellaneous debris. A sample of the sediment material (BLA-SPSD01) was collected from the elevator shaft for analysis of PAHs and TAL metals (see Figure 6-2 for sample location). The analytical results are summarized in Table 6-12. The results indicated the following:

PAHs. Seventeen different PAHs were detected in the elevator shaft sediment sample (see Table 6-12). Three of the PAHs [benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene] were detected at concentrations above industrial soil RSLs. Two other PAHs [Benzo(a)anthracene and Indeno(1,2,3-cd)pyrene] were also detected at concentrations between residential and industrial soil RSLs. No other PAHs were detected above residential soil RSLs.

Inorganics. Several inorganics were detected in the elevator shaft sediment samples (see Table 6-12). None of the detected constituents were detected at concentrations above both industrial soil RSLs and established background concentrations. However, copper was detected at a concentration above the established background concentration and the residential soil RSL. Copper is known to be a major component of the degrading conductive flooring material in Building 405. No other inorganics were detected at concentrations above both the established background concentrations and residential soil RSLs.

6.4.7 Supplemental RI Investigation, ARCADIS 2009

In accordance with the June 2009 Supplemental Remedial Investigation Work Plan (ARCADIS 2009b), ARCADIS completed additional investigation activities at the BLA in 2009. The goals of the 2009 investigation were to: 1) enhance the delineation of asbestos in surface soils around buildings containing conductive flooring; and 2) to evaluate potential airborne asbestos exposure risks associated with the asbestos in soil. Both soil and air samples were collected and analyzed for asbestos during this investigation. The investigation activities and results for these areas are discussed in the following sections.

6.4.7.1 Asbestos Delineation Sampling

ARCADIS' 2008 sampling activities at the BLA indicated that asbestos was present in surface soil adjacent to buildings with conductive flooring. However, the analytical method utilized during the 2008 event was only able to provide a qualitative evaluation of whether or not asbestos fibers were present in the samples. In order to conduct a quantitative risk evaluation of asbestos in surface soil, and to further define how far the asbestos extends from the buildings, ARCADIS collected additional soil samples from the site in 2009. These surface soil samples were collected at locations where asbestos was detected during the 2008 sampling event and where there was visible evidence that degraded flooring material has washed off of the building pads. The samples were collected at step out distances of 1 ft, 5 ft, 10 ft, 15 ft, and 20 ft from the building at each sample location. A total of 10 rows of samples were collected for this evaluation (BLA-SS020 through BLA-SS029) and a minimum of one row of samples was collected at each of the seven BLA Buildings with conductive flooring. Note that the suffixes A, B, C, D, and E were used to designate whether the sample was

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collected 1, 5, 10, 15, or 20 ft from the building, respectively. The samples were analyzed for asbestos by TEM CARB Level B in sequence by distance from building until the reported concentration was at or below 0.1% by weight. Once concentrations were at or below this level, samples that were collected at further distances were not analyzed. The sample locations from the 2009 investigation are depicted in Figure 6-2 and the analytical results are summarized in Table 6-13. The laboratory analytical reports are presented in Appendix D. The analytical results from the delineation sampling indicated the following:

- Asbestos fibers were detected in all of the analyzed samples. However, the detected concentrations were less than 0.1% asbestos by weight in 11 of the 19 analyzed samples. Only one sample (9.4 % at BLA-SS026A) had a reported asbestos concentration greater than 0.2%. This sample was collected 1-ft from Building 406. The sample collected 5 ft from Building 406 (BLA-SS026B) had a reported concentration of <0.1%, indicating that the asbestos is limited to the soil immediately adjacent to the building.

- Chrysotile was the only asbestos type detected in the 18 of the 19 analyzed soil samples. The only other asbestos type detected was crocidolite; one fiber of which was detected in soil sample BLA-SS023C. This sample was collected 10 ft from Building 405 and the total asbestos concentration at this sample was 0.1%.

6.4.7.2 Activity Based Sampling

In an effort to facilitate an evaluation of the potential risk of exposure to airborne asbestos fibers resulting from asbestos in soil, ARCADIS conducted an activity based sampling program at two of the BLA buildings where asbestos had historically been detected in soil (Buildings 404 and 411). This sampling program, which utilized the USEPA recommended generic action scenario of raking, was performed in accordance with USEPA *SOP 2094: Activity-Based Air Sampling for Asbestos* (USEPA, 2007c) and *Framework for Investigating Asbestos-Contaminated Superfund Sites* (USEPA, 2008g). The following subsections discuss the sample locations and analytical results.

6.4.7.2.1 Sample Locations

Buildings 404 and 411 were selected for the 2009 activity based sampling programs based on the presence of asbestos detections during the 2008 sampling event and visible evidence of conductive flooring material having washed off the building pads

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onto surrounding soils. The following sample locations were established at each building:

- Two 10 ft by 10 ft sample grids were set up near the southwest corner of Building 404 in an area that has had historic asbestos detections. The first grid was located 0-10 ft from the edge of the building pad. The second grid was located adjacent to the first, but at a distance of 10-20 ft from the edge of the building. The grid locations are depicted in Figure 6-2.

- Two 10 ft by 10 ft sample grids were also established at the southwest corner of Building 411. Like at Building 404, the first grid was located 0-10 ft from the edge of the building and the second grid was located 10-20 ft from the building. The grid locations are depicted in Figure 6-2.

- Soil samples were collected from the centerline of each sampling grid pair at both buildings. The samples were collected at distances of 1, 5, 10, 15, and 20 feet from Building 404 (BLA404-SS001A through BLA404-SS001E) and Building 411 (BLA411-SS001A through BLA411-SS001E). These samples were collected from a depth of 0-3 inches. The samples were analyzed for soil moisture by ASTM Method D2216-05, grain size by ASTM Method D6913-04e, and asbestos by TEM CARB Level B) to establish soil conditions and asbestos levels in the soil within the grids. The analytical results for the soil samples are presented in Table 6-13. The laboratory analytical reports are presented in Appendix D.

6.4.7.2.2 Activity Based Sampling Technique

This section presents a brief discussion of the sampling technique for the activity based sampling activities.

- Starting at the grid located furthest from Building 404, each 10ft by 10 ft grid was vigorously raked by a participant wearing Level C person protection equipment to simulate an aggressive soil disturbance activity. During the raking activity, the participant wore a personal air monitoring pump fitted with a 0.8 µm mixed cellulose ester (MCE) filter and sampling tube mounted in the subjects breathing zone. A stationary air monitoring pump fitted with a 0.8µm filter and sampling tube mounted at a height of 5 feet was also set on the downwind perimeter of the grid to collect air samples during the raking activity. The raking activity was performed for a duration that allowed a minimum of

750 to 1,000 liters of air to be pulled through each filter (approximately 2 hours).

- The personal air monitoring pump samples collected at each grid were identified as follows:
    - Building 404, 0-10 ft Grid: BLA404-AA1
    - Building 404, 10-20 ft Grid: BLA404-AA2
    - Building 411, 0-10 ft Grid: BLA411-AA1
    - Building 411, 10-20 ft Grid: BLA411-AA2

- The stationary perimeter air monitoring pump samples collected at each grid were identified as follows:
    - Building 404, 0-10 ft Grid: BLA404-AP1
    - Building 404, 10-20 ft Grid: BLA404-AP2
    - Building 411, 0-10 ft Grid: BLA411-AP1
    - Building 411, 10-20 ft Grid: BLA411-AP2

- In addition to the air samples collected at the sample grids, background air samples were collected near Building 404 and 411 to evaluate the potential for background interferences. Stationary air monitoring pumps were set up at upwind locations at both buildings in a fashion similar to the stationary air monitoring pumps at the sampling grids. The background sample at Buildings 404 and 411 were labeled BLA404-BK2 and BLA411-BK1, respectively.

- All of the personal air monitoring pump samples, stationary perimeter pump samples, and background samples were submitted for laboratory analysis of asbestos by TEM Method 10312. The analytical results for all of the air samples are presented in Table 6-14. The laboratory analytical reports are presented in Appendix D. The analytical results from the TEM Method 10312 report the asbestos concentrations in air using several different methods, including: 1) the Asbestos Hazard Emergency Response Act (AHERA) counting method; 2) Phase Contrast Microscopy- equivalents (PCME); 3) Berman Crump Protocol Structures (BCPS) (i.e. structures that are greater than 10 µm long and less than or equal to 0.4 µm in width); and 4) total structures by Transmission Electron Microscopy (TEM).

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6.4.7.2.3 Laboratory Analytical Results

This subsection presents a summary of the analytical results from the 2009 activity based sampling areas:

- **Building 404 Soil Samples:** Asbestos concentrations in soil ranged from 0.2% asbestos by weight at 1 ft from the edge of the building to <0.1% asbestos in the samples collected 5, 10, 15, and 20 ft from the Building 404. Chrysotile was the only type of asbestos present in the samples. Although not sampled, it should be noted that red staining from the degraded flooring material was observed in soil located approx 0-8 inches from the edge of Building 404.

- **Building 404 Personal Air Monitoring Pump Samples:** No asbestos fibers were detected in the personal air monitoring pump sample collected in the grid located 10-20 ft from the edge of Building 404 (BLA404-AA2). Asbestos was detected in the personal air monitoring pump sample collected from the grid located 0-10 ft from Building 404 (BLA404-AA1). The results indicated that all of the detected fibers were chrysotile. The asbestos concentrations reported via the various counting methods ranged from 0.0019 structures per cubic centimeter (s/cc) using PCME to 0.022 s/cc using TEM.

- **Building 404 Perimeter Air Monitoring Pump Samples:** No asbestos fibers were detected in the perimeter air monitoring pump sample collected from the grid located 10-20 ft from the edge of Building 404 (BLA404-AP2). Asbestos was detected in the perimeter air monitoring pump sample collected 0-10 ft from Building 404 (BLA404-AP1). The results indicated that all of the detected fibers were chrysotile. The asbestos concentrations reported via the various counting methods ranged from 0.0018 s/cc using PCME to 0.090 s/cc using TEM.

- **Building 404 Background Air Monitoring Pump Sample:** No asbestos fibers were detected in the background air monitoring sample from Building 404 (BKG404-BK2).

- **Building 411 Soil**: Asbestos concentrations in soil ranged from <0.1 % to 0.6% asbestos by weight. Chrysotile was the only type of asbestos present in the samples. Although not sampled, it should be noted that red staining from the degraded flooring material was observed in soil located approx 0-6 inches from the edge of Building 411.

- **Building 411 Personal Air Monitoring Pump Samples:** No asbestos fibers were detected in the personal air monitoring pump sample collected in the grid located 10-20 ft from the edge of Building 411 (BLA411-AA2). Asbestos was detected in the personal air monitoring pump sample collected from the grid located 0-10 ft from Building 411 (BLA411-AA1). The results indicated that all of the detected fibers were chrysotile. The asbestos concentrations reported via the various counting methods ranged from 0.014 s/cc using PCME to 0.078 s/cc using TEM.

- **Building 411 Perimeter Air Monitoring Pump Samples:** No asbestos fibers were detected in the perimeter air monitoring pump sample collected from the grid located 10-20 ft from the edge of Building 411 (BLA411-AP2). Asbestos was detected in the perimeter air monitoring pump sample collected 0-10 ft from Building 411 (BLA411-AP1). The results indicated that all of the detected fibers were chrysotile. The asbestos concentrations reported via the various counting methods were all the same, 0.034 s/cc.

- **Building 411 Background Air Monitoring Pump Sample:** No asbestos fibers were detected in the background air monitoring sample from Building 411 (BKG-411BK1).

6.5 Nature and Extent of Constituent Detections

The analytical results presented in the previous sections indicate that constituents have been detected at concentrations above applicable screening criteria at the BLA. The majority of the detections appear to be the result of degrading conductive flooring material in site buildings. Areas that have been investigated at the BLA include: soil surrounding all buildings that contain conductive flooring, soil surrounding the locations of former transformers, sediment from drainage ditches in the vicinity of buildings that contain conductive flooring, ponded water from within a subsurface concrete vault adjacent to Building 522, surface water and sediment from a small unnamed stream located to the north of the BLA buildings, and building materials, including conductive flooring and paint samples.

6.5.1 Soil

6.5.1.1 Building Area Assessment

The primary focus of the environmental investigations at the BLA was to identify potential adverse affects to soil quality as a result of historical operations at the site and from degrading flooring material in site buildings. To this affect, approximately 57 surface soil samples and 9 subsurface soil samples were collected around the various BLA buildings between 1997 and 2008. A total of 192 surface soil samples were also collected around the BLA buildings for lead field screening using XRF. During 2009 approximately 29 additional surface soil samples and 10 air filter samples were collected for an activity based sampling effort designed to evaluate potential risks associated with asbestos in surface soil. Site maps depicting the inorganic constituents detected in soil samples during the BLA investigation are presented in Figure 6-7. Figure 6-8 displays the organic constituents that were detected in the soil samples. Figure 6-9 displays the results of the 2009 asbestos investigation. Figure 6-3 displays the results of the 2008 XRF field screening activities.

As illustrated by the figures, the results of the investigation activities indicated the following:

- No VOCs, pesticides, or herbicides were detected in surface soil or subsurface soil samples at concentrations above residential RSLs.

- Dinitrotoluene Mix was the only explosive detected above residential soil RSLs. Historical samples SS-09 and BLASS03 contained Dinitrotoluene Mix above the residential and industrial soil RSLs, respectively. Both samples were adjacent to Building 405.

- Aroclor 1254 was the only PCBs detected in soil at the site. A limited number of the PCB detections were above applicable RSLs.

    - Aroclor 1254 was detected in 1997 at sample location SS-09 (8.3 mg/kg) next to Building 405. Aroclor 1254 was detected in 2002 at sample location BLASS01 (3.2 mg/kg) next to Building 405 and previous sample SS-09. These concentrations were above the industrial RSL for Aroclor-1254 of 0.74 mg/kg. Aroclor 1254 was not detected above the residential RSL in two surface soil samples (BLASB01 and BLASS02) and one subsurface soil sample (BLASB01

(2-4) collected in 2002 in the vicinity of the previous detects. Aroclor 1254 was also not detected above the residential RSL in one surface soil sample (BLA-SS001) and two subsurface soil samples (BLA-SB001 (1-2) and BLA-SB001 (2-3) collected in 2008 in the vicinity of the previous detects. Therefore, the detections at BLASS01 and SS-09 north of Building 405 appear to be isolated.

- o No other surface soil or subsurface soil samples collected adjacent to BLA buildings contained PCBs at concentrations above applicable residential RSLs.

- Several SVOC/PAH compounds were detected at concentrations above applicable RSLs in five soil samples collected near the center of the BLA site and sporadically in surface soil samples collected around the perimeter of buildings containing conductive flooring. PAH compounds detected above RSLs included: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

- Several inorganics were detected in soil samples collected around the BLA buildings at concentrations above applicable RSLs. In most cases the concentrations above the applicable RSLs were detected in surface soil samples collected immediately adjacent to buildings with conductive flooring material. Inorganics concentrations typically decreased considerably with depth and distance from the buildings. Inorganics concentrations also varied along the length of the buildings; likely due to the presence of preferential flow paths that would have carried the degraded flooring materials from the buildings. Inorganics that were detected above RSLs included:

  - o **Aluminum** – Aluminum was detected at concentrations above the residential RSL and slightly above the established background level (40,041 mg/kg) in three subsurface soil samples [407712 (2-3 ft bgs), BLASB01 (2-4 ft bgs), and BLASB02 (2-4 ft bgs]. Aluminum was not detected at concentrations above background in any surface soil or other subsurface soil samples at the BLA.

  - o **Arsenic –** Arsenic was detected above the background level and industrial RSL in two surface soil samples (BLA-SS013 and BLA-SS014). The maximum detected arsenic concentration (47.2 mg/kg) occurred in sample BLA-SS014 collected 1-ft from Building 404 in

2008. The other sample (BLA-SS013) contained arsenic at a concentration only slightly higher than background.

- **Barium** - Barium was detected above the residential RSL and established background level in ten surface soil samples. Three of the samples with detections above the residential RSL were collected adjacent to Building 404 (BLASB03, BLA-SS014, and BLA-SS019). Seven of the samples with detections above the residential RSL were collected adjacent to Building 405 (SS-09, BLASS03, BLA-SS007, BLA-SS008, BLA-SS009, BLA-SS011, and BLA-SS012). The maximum detected barium concentration of 11,100 mg/kg at sample location BLA- SS008 was also collected 1 ft from Building 405. The other samples that had barium concentrations above residential RSLs were collected with 1-10 ft of buildings with conductive flooring. Barium was not detected above RSLs in any subsurface soil samples.

- **Cadmium** – Cadmium was detected above background levels and the residential RSL in ten surface soil samples collected within 10-ft of BLA buildings. Three of the samples with detections above the residential RSL were collected adjacent to Building 404 (BLASB03, BLA-SS014, and BLA-SS016). Five of the samples with detections above the residential RSL were collected adjacent to Building 405 (BLASS03, BLA-SS007, BLA-SS008, BLA-SS011, and BLA-SS012). Two of the samples with detections above the residential RSL were collected adjacent to Building 406 (BLASS08 and BLA-SS013). Cadmium was not detected above the industrial RSL in any samples.

- **Cobalt** –Cobalt was detected above both the established background concentration and the industrial RSL in one surface soil sample near Building 406 (BLA-SS11) and one subsurface soil sample next to Building 407 [407712 (2-3 ft bgs)]. Cobalt was not detected above background levels in any other soil samples at the site.

- **Copper** – Copper, which is thought to have been a major component of the conductive flooring material, was the inorganic most frequently detected at concentrations above applicable RSLs.

  - Copper concentrations were detected above the industrial RSL of 4,100 mg/kg in six surface soil samples (SS-09, BLA-

SS001, BLA-SS008, BLA-SS013, BLA-SS014, and BLA-SS017) at the BLA. The samples with concentrations above industrial RSLs were all collected within 1-5 ft of buildings with conductive flooring material.

§ Copper was detected above both the established background concentration and between the residential RSL (310 mg/kg) and the industrial RSL in 15 surface soil samples surrounding BLA buildings with conductive flooring.

§ The highest detected concentration of copper (72,000 mg/kg) occurred at sample location BLA-SS013, next to Building 406 during the 2008 sampling event. Each of the seven BLA buildings containing conductive flooring had at least one adjacent soil sample with copper concentrations above RSLs and background concentrations.

o **Lead** – Lead is also believed to have been a major component of the conductive flooring material, and was the inorganic second most frequently detected at concentrations above applicable RSLs.

§ Lead was detected at concentrations above the residential RSL (400 mg/kg) in 16 surface soil samples collected at the BLA. Of these detections, 14 surface soil samples were also above the industrial RSL of 800 mg/kg. No subsurface soil samples contained lead at concentrations above the residential RSL.

§ All of the surface soil samples with concentrations above residential RSLs were collected within 10 ft of Buildings 404, 405, 406, and 407. The results of the XRF sampling also indicated that lead concentrations above RSLs were confined to surface soils within 10 ft of BLA Buildings 404, 405, 406, and 407.

o **Iron** – Iron was detected above the residential RSL and background levels in two surface soil samples (BLA-SS002 and BLA-SS012) and one subsurface soil sample BLASB01. The maximum detected

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concentration was 61,500 mg/kg at sample location BLA-SS012, which was collected 5 ft from Building 405.

- **Manganese**– Manganese was detected at a concentration above the industrial RSL in one surface soil sample (BLASS11) collected approximately 20 ft from Building 405. Manganese was not detected above established background concentrations in any subsurface or in other surface soil samples at the BLA. The concentration of manganese in sample BLASS11 appears to be an anomaly, unrelated to site activities, and therefore manganese is not considered a COC at the BLA.

- **Mercury** – Mercury was detected in three surface soil samples (BLASS03, BLA-SS009, and BLA-SS016) at concentrations above industrial RSLs. Two of the surface soil samples were collected adjacent to Building 405 and one was collected adjacent to Building 404.

- **Zinc** – Zinc was detected above both the established background level of 202 mg/kg and the residential RSL in 8 surface soil samples at the BLA. Zinc was not detected above the industrial RSL in any surface or subsurface soil samples. The samples with zinc concentrations above residential RSLs typically occurred with 1-5 ft of Buildings 404, 405, and 406.

During ARCADIS' 2008 site investigation, asbestos was detected in all of the surface soil samples collected within 1-10 ft of the BLA buildings where conductive flooring material has washed off of the building pads (Buildings 404, 405, 406, 407, 411, 412, and 413). However, during the 2009 investigation it was demonstrated that while chrysotile asbestos fibers are present in the surface soil around these buildings, the concentrations are generally very low (i.e., 0.1% by weight or less) at distances of 1-ft and greater from the building pad. Only one sample during the 2009 investigation contained asbestos at a concentration above 1%; that was BLA-SS026A (9.4% asbestos by weight), which was collected 1 ft from Building 406. The sample collected 5 ft from Building 406 (BLA-SS026B) had a reported concentration of <0.1%, which demonstrates that the asbestos fibers are not migrating at high concentrations from the edge of the building. Visual observation of the degraded flooring material that has washed off the building pads indicates that it is generally confined to the soil immediately adjacent to the buildings.

While asbestos in soil is not inherently hazardous, the activity based sampling event conducted at the BLA demonstrated that intensive soil disturbance activities in areas located immediately adjacent to the buildings has the potential to result in measureable concentrations of asbestos in air. Asbestos can pose a potential hazard to human receptors in an airborne state. TEM analysis conducted on personal air monitoring pump and perimeter air monitoring pump filter samples associated with activity based sampling in a grid located within 0-10 ft of BLA Building 404 indicated asbestos concentrations in air of 0.0218 s/cc and 0.0899 s/cc, respectively. Likewise, activity based sampling conducted within 0-10 ft of Building 411 resulted in airborne asbestos concentrations of 0.0783 s/cc and 0.0345 s/cc in the personal air monitoring pump and perimeter air monitoring pump samples, respectively. Activity based sampling conducted in grids located 10-20 ft from Buildings 404 and 411 did not generate airborne asbestos.

6.5.1.2 Former Transformer Area Assessment

The PCB Aroclor 1254 was detected in surface soils near two former transformer locations at the BLA. One sample collected from a former transformer location east of Building 416 (BLATR01) contained Aroclor 1254 at a concentration above the industrial RSL. Two samples (SS09 and BLASS01) collected near a former transformer at the northwest corner of Building 405 also contained Aroclor 1254 at concentrations above the industrial RSL. Additional samples collected in the vicinity of these two locations did not contain any PCBs at concentrations above applicable screening levels indicating that the detections of Aroclor 1254 were isolated. PCBs were not detected at other former transformer locations at the site and PCBs have not been detected in sediments or surface water samples at the BLA.

6.5.1.3 Summary of Soil Investigation

In summary, the environmental investigations at the BLA have confirmed that soils surrounding four of the buildings (Buildings 404, 405, 406, and 407) have been affected by asbestos and inorganics from the deteriorating conductive flooring material. Inorganics, primarily copper and lead, and to a lesser extent arsenic, barium, cadmium, mercury and zinc have been detected at concentrations above applicable RSLs. The elevated metals and asbestos concentrations are typically confined to soils in the immediate vicinity of the buildings (i.e., less than 5-ft distance from building footprint) with the exception of one or two discrete areas around each of four BLA buildings (Buildings 404, 405, 406, and 407), where the elevated metals concentrations extend from 10 to 15-ft from the buildings. Subsurface sampling has confirmed that the elevated concentrations affected by site activities are confined to surface soil, as no samples deeper than 2-ft bgs contained target inorganics at concentrations above background levels and residential RSLs. Aluminum and iron were detected in subsurface samples at concentrations above residential RSLs, but these inorganics do not appear related to site activities, as they were generally not detected at elevated concentrations in surface soils surrounding BLA buildings.

The PCB compounds that were detected above applicable RSLs in samples collected adjacent to BLA buildings and transformers have been delineated and are isolated to a small area north of Building 405.

PAHs were detected above applicable soil RSLs in surface soil samples collected in the center of the BLA and sporadically around the BLA buildings. PAHs do not appear to be more concentrated in areas closer to buildings and therefore are likely due to the presence of asphalt roads and other building materials through the BLA rather than related to conductive flooring or other site activities.

6.5.2 Surface Water

There is one small unnamed stream to the north of the BLA. Two surface water samples were collected from the stream in 2002. The pesticide dieldrin was detected above the tap water screening value (0.0042 µg/kg) in one of the two samples (BLASW05) at a concentration of 0.0058 µg/kg. No other constituents were detected in either sample at concentrations above tap water screening values. A site map depicting the constituents detected in surface water samples during the BLA investigation is presented as Figure 6-10.

Two water samples were collected from ponded water within an elevator shaft and a concrete subsurface vault at Building 405 during the 2008 investigation. Arsenic was detected at concentrations above the tap water screening value in both samples. No other constituents were detected above respective tap water screening values.

6.5.3 Sediment

There is one small unnamed stream to the north of the BLA. No constituents were detected above soil RSLs and established background concentrations (inorganics only) in sediment samples collected from the stream. There are also several drainage ditches located within the boundaries, and on the perimeter, of the BLA. During the course of environmental investigation at the BLA, samples have been collected from the drainage pathways to evaluate the potential for runoff from the buildings and other areas of the site to have transported constituents into the ditches. The samples collected from the drainage ditches have been called sediment samples due to the loose nature of some of the material, but would be more accurately classified as surface soil. The drainage ditches were all dry at the time of sampling. No constituents were detected at concentrations above applicable soil RSLs and established background concentrations (inorganics only) in any of the sediment samples collected from drainage ditches at the BLA. A site map depicting the constituents detected in sediment samples during the BLA investigation is presented as Figure 6-10.

One sample was also collected of solid material that had accumulated at the bottom of the elevator shaft discussed above. Copper was detected at a concentration above both the established background concentration for soil and the residential soil RSL. No other inorganics were detected above both of these criteria. Three PAHs (Benzo(a)pyrene, Benzo(b)fluoranthene, and Dibenzo(a,h)anthracene) were detected at concentrations above respective industrial soil RSLs and two PAHs (Benzo(a)anthracene and Indeno(1,2,3-cd)pyrene) were detected at concentrations above residential soil RSLs.

6.5.4 Conductive Flooring and Building Materials

Conductive flooring material is present on seven of the ten building pads at the BLA. Results of the conductive flooring survey indicate that there is approximately 19,000 ft^2 of conductive flooring present on building pads at the BLA. The condition of the flooring during the 2008 investigation ranged from mostly intact to highly deteriorated. Based on the flooring characterization sampling events, the flooring is known to contain aluminum, barium, cadmium, chromium, copper, iron, lead, and zinc; as well as several other inorganics that have been identified in soils at the BLA. The flooring material is also known to contain asbestos, which could pose a potential hazard to human receptors in a degraded, friable state.

While very little paint remains on the concrete walls of the BLA buildings, one paint chip sample collected in 2005 and analyzed for lead indicated that the paint does contain lead. However, the reported lead concentration (306 mg/kg) was below 0.5% by weight (i.e., 5,000 mg/kg) which is the minimum concentration that the federal government uses to define lead based paint in residences (40 CFR 745.223).

6.6 Risk Assessment Datasets

Data generated from the site characterization activities were used in the risk assessment. Risk assessment datasets for soil, sediment, and surface water for the BLA were prepared then summarized and statistically analyzed per methods described in Appendix A. Risk assessment dataset summaries highlighting the number of detects, number of samples, FOD, minimum and maximum detected concentrations, minimum and maximum detection limits, and EPC are presented in Tables 6-15 through 6-19.

6.7 Human Health Risk Assessment

The purpose of this risk assessment is to evaluate the potential current and future risks and hazards to human health associated with constituents detected in soil, sediment, and surface water samples collected at the BLA. The general risk assessment approach follows the Radford Army Ammunition Plant Final Master Work Plan (URS 2003). The approach for evaluating the risks associated with asbestos is somewhat different than the other constituents at the site. The approach for evaluating asbestos is presented in detail in Section 4.4.5 of Appendix A.

6.7.1 Selection of Constituents of Potential Concern

This section discusses the selection of COPCs for each medium.

6.7.1.1 Surface Soil

Surface soil COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for residential soil. Table 6-20 presents the selection of surface soil COPCs for the HHRA. The following twenty-three constituents were identified as COPCs in surface soil:

- **VOCs:** 3-octanone and d-limonene;
- **SVOCs/PAHs:** carbazole, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene;
- **Explosives:** pentaerythritol tetranitrate;

- **PCBs:** Aroclor 1254; and

- **Inorganics:** antimony, arsenic, barium, cadmium, cobalt, copper, iron, lead, manganese, mercury and zinc.

In addition to the constituents listed above, asbestos has been identified as a COPC for surface soil at the BLA. Soil sampling conducted at the site has confirmed the presence of asbestos in soil immediately adjacent to site buildings where conductive flooring has washed off the building pads. While asbestos fibers in soil are not inherently hazardous, activity based sampling has indicated that intensive soil disturbance activities in the areas located immediately adjacent to the buildings, where soil asbestos concentrations are highest, have the potential to generate measureable concentrations of asbestos in air.

6.7.1.2 Combined Surface and Subsurface Soil

Combined surface and subsurface soil COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for residential soil. Table 6-21 presents the selection of combined surface and subsurface soil COPCs for the HHRA. Twenty-four constituents were identified as COPCs in combined surface and subsurface soil, including:

- **VOCs:** 3-octanone and d-limonene;

- **SVOCs:** carbazole, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene;

- **Explosives:** pentaerythritol tetranitrate;

- **PCBs:** Aroclor 1254; and

- **Inorganics:** aluminum, antimony, arsenic, barium, cadmium, cobalt, copper, iron, lead, manganese, mercury and zinc.

6.7.1.3 Sediment

Sediment COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for residential soil. Table 6-22 presents the selection of sediment COPCs for the

HHRA. As summarized in Table 6-22, five constituents were identified as COPCs in sediment:

- **Inorganics:** aluminum, arsenic, cobalt, iron, and manganese.

6.7.1.4 Surface Water

Surface water COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for tap water. Table 6-23 presents the selection of surface water COPCs for the HHRA. As summarized in Table 6-23, six constituents were identified as COPCs in surface water:

- **Pesticides:** dieldrin; and

- **Inorganics:** arsenic, copper, lead, manganese, and mercury.

6.7.2 Human Health Risk Characterization

Although not currently occupied, under current land use conditions, site workers were identified as a potential receptor due to the industrial use of the BLA and surrounding area. Assuming hypothetical redevelopment of the area for residential land use, construction workers, adult and child residents were identified as potential receptors.

Exposure via direct contact to COPCs in soil, sediment, and surface water were evaluated. Exposure via inhalation of indoor air to VOCs identified as COPCs in soil at the BLA were also evaluated. Two VOCs, 3-octanone and d-limonene, were identified as COPCs in soil at the BLA. Those two COPCs do not have identified inhalation toxicity values; therefore, the indoor vapor intrusion pathway could not be assessed at this Study Area. In addition, potential risks associated with inhalation of asbestos becoming airborne from soil were estimated. These are summarized in Section 6.7.3. The uncertainty associated with the lack of toxicity values is presented In Appendix A. The EPCs for the BLA are presented in Table 6-24.

The excess lifetime cancer risks and non-cancer hazards and the blood lead level model estimates for each potentially exposed receptor included in the risk assessment for the BLA are presented in Appendix A. These results are presented in the tables below and are discussed by receptor in following subsections.

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Summary of Calculated ELCRs and HIs for Receptor Exposure Scenarios.

RECEPTOR/ EXPOSURE MEDIUM - SCENARIO	ELCR	HI
Site Worker		
Surface Soil - Direct Contact	1E-04	0.7
Sediment – Wading	4E-07	0.007
Surface Water – Wading	2E-06	0.05
TOTAL SITE RISKS (Site Worker):	**1E-04**	**0.8**
Hypothetical Future Construction Worker		
Combined Surface and Subsurface Soil - Direct Contact	7E-06	3
TOTAL SITE RISKS (Construction Worker):	**7E-06**	**3**
Hypothetical Future Adult Resident		
Combined Surface and Subsurface Soil - Direct Contact	-	1
Sediment – Wading	-	0.01
Surface Water – Wading	-	0.01
TOTAL SITE RISKS (Adult Resident):	**-**	**1**
Hypothetical Future Child Resident		
Combined Surface and Subsurface Soil - Direct Contact	-	12
Sediment – Wading	-	0.09
Surface Water – Wading	-	0.04
TOTAL SITE RISKS (Child Resident):	-	**12**
Hypothetical Future Resident (Adult and Child)		
Combined Surface and Subsurface Soil - Direct Contact	1E-03	-
Sediment – Wading	1E-06	-
Surface Water – Wading	1E-06	-
TOTAL SITE RISKS (Child Resident):	**1E-03**	**-**

Summary of Estimated Blood Lead Levels for Receptor Exposure Scenarios.

RECEPTOR	Estimated Blood Lead Level (µg/dL)		
	Adult	**Child**	**Fetus**
	50th percentile	**Range**	**95th percentile**
Site Worker	4.9	–	17
Hypothetical Future Construction Worker	5.2	–	18
Hypothetical Future Child Resident	–	11 – 18	–
Hypothetical Future Adult Resident	6.5	–	23

*See Appendix A for individual tables.

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Levels of asbestos measured in air during the activity based sampling were greater than the AALs developed for the site worker and resident. Thus, asbestos in soil also poses an unacceptable risk under both industrial and residential land uses.

6.7.2.1 Site Worker

A current or future site worker could be present at the BLA area, and could be exposed to surface soil, sediment, and surface water. The ELCR and non-cancer hazard index for site worker exposure to each medium are presented in Appendix A, and are summarized in Table 6-25. As presented in the table above, the ELCRs for surface soil, sediment, and surface water are all within or equal to the high end of the USEPA target risk range, and the HIs for each medium are all below the benchmark value of 1.

The total cumulative ELCR for site workers exposed to surface soil, sediment, and surface water at the BLA is 1×10^{-4}, which is equal to the high end of the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. This is due to the presence of benzo(a)pyrene in surface soil. The total cumulative HI for site workers is 0.8, which is less than the benchmark of 1.

The 50^{th} percentile blood lead level estimates for the site worker receptor was at 4.9 micrograms per deciliter (µg/dL), below the benchmark of 10 µg/dL; however the 95^{th} percentile fetal blood lead level was 17 µg/dL which exceeds the benchmark.

6.7.2.2 Hypothetical Future Construction Worker

A hypothetical future construction worker could be present at the BLA area, and could be exposed to combined surface and subsurface soil. The ELCR and non-cancer hazard index for hypothetical future construction worker exposure to soil are presented in Appendix A, and are summarized in Table 6-25. As presented in the table above, the ELCR for combined surface and subsurface soil is within the USEPA target risk range, and the HI is above the benchmark value of 1.

The total cumulative ELCR for hypothetical future construction workers exposed to combined surface and subsurface soil at the BLA is 7×10^{-6}, which is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for hypothetical future construction worker is 3, which is above the benchmark of 1. When the HI is segregated into target site and critical effects, hazards were above the benchmark of 1 in the gastrointestinal tract due to the presence of copper.

The 50th percentile blood lead level estimates for the construction worker receptor was at 5.2 µg/dL below the target level of 10 µg/dL; however the 95th percentile fetal blood lead level was calculated to be 18 µg/dL which exceeds the benchmark.

6.7.2.3 Hypothetical Future Residents

A hypothetical future resident could be present at the BLA area, and could be exposed to surface soil, sediment, or surface water. The ELCR and non-cancer hazard index for hypothetical future adult or child resident exposure to each medium are presented in Appendix A, and are summarized in Table 6-25.

The total cumulative ELCR for hypothetical future residents exposed to combined surface and subsurface soil, sediment, and surface water at the BLA is 1×10^{-3}, which is greater than the USEPA target risk range of 1×10^{-6} to 1×10^{-4}, due to the presence of benzo(a)pyrene. The ELCRs for hypothetical future residential exposure to sediment and surface water are both equal to the low end of the USEPA target risk range; however, the ELCR for combined surface and subsurface soil was above the USEPA risk range. The HIs for each medium are all below the benchmark value of 1, with the exception of the child resident exposure to combined surface and subsurface soil.

The total cumulative HI for hypothetical future adult residents is equal to the benchmark of 1. The total cumulative HI for hypothetical future child residents is 12, which is greater than the benchmark of 1. When the HI is segregated into target site and critical effects, hazards exceed the benchmark of 1 for the GI tract, due to copper; the eyes, nails hair and skin, due to cobalt and Aroclor 1254; and the immune system, due to Aroclor 1254.

The 50th percentile blood lead level estimates for the hypothetical adult resident receptor was 6.5 µg/dL which is well below the benchmark of 10 µg/dL; however the 95th percentile fetal blood lead level was predicted to be 23 µg/dL, which is greater than the benchmark. The range of blood lead level estimates for the child receptor was 11 µg/dL to 18 µg/dL looking at annual predicted blood lead levels which is greater than the benchmark of 10 µg/dL. The predicted exposure of a child over a seven year period resulted in a geometric mean blood lead concentration of 14.9 µg/dL, also above the 10 µg/dL benchmark and a prediction of 80 percent of the population having blood lead concentrations above the 10 µg/dL benchmark.

6.7.3 Asbestos Evaluation

As discussed in Appendix A, the risks and hazards associated with asbestos in soil cannot be evaluated utilizing traditional risk assessment techniques. This is because the measurement of asbestos in soils may not be a good indicator of potential for exposure due to the fact that the main route of asbestos toxicity is through inhalation of fibers. Thus, the important metric in defining potential risk is the measurement of asbestos fibers in air within a breathable zone. Based on this information, USEPA recommends that the results of activity-based air sampling be utilized to determine whether disturbance of soils in areas known to contain asbestos can result in the mobilization of asbestos into air at potential hazardous levels where it may be inhaled by the individuals engaged in activities there.

To evaluate the results of the activity based sampling conducted at the BLA in 2009, risk based Air Action Level (AALs) for relevant, site-specific exposure scenarios have been developed in accordance with the methods outlined in the USEPA's Framework for Investigating Asbestos-Contaminated Superfund Sites (2008f). AALs were calculated for all of the exposure scenarios identified at the BLA including the current and future site worker, the hypothetical future construction worker, the hypothetical future adult resident, and the hypothetical future child resident. AALs were also calculated for each potential receptor group at the 1E-06 and 1E-04 risk levels, representing the lower and upper ends of USEPA's acceptable risk range. The calculation of the AALs is presented in detail within Section 4.4.5 of Appendix A. The calculated AALs are presented in the following table.

	Calculated AAL (s/cc) at Indicated Target Risk Level	
Receptor Group	**Target Risk = 1E-06**	**Target Risk = 1E-04**
Current/Future Site Worker	0.00007	0.007
Hypothetical Future Construction Worker	0.002	0.2
Hypothetical Future Child Resident	0.00002	0.002
Hypothetical Future Adult Resident	0.00001	0.001

The total asbestos concentration measured in air at Building 404 was non-detect in samples taken from the activity based sampling grid located 10-20 feet from the building edge (sample IDs: BLA404-AA2 and BLA404-AP2). However, asbestos was detected in air samples taken from the activity based sampling grid located immediately adjacent to the building (0-10 feet from building edge) (sample IDs: BLA404-AA1 and BLA404-AP1). At BLA404-AA1, the total asbestos structures (specifically chrysotile) measured by Total TEM were 0.022 s/cc; total asbestos structures (i.e., chrysotile) measured at BLA404-AP1 were 0.090 s/cc. The average of all airborne asbestos samples at Building 404, including the two samples where it was non-detect, was 0.028 s/cc. All of these exceed the AAL of 0.007 s/cc (based on a 1E-04 risk level) calculated for the current and future site worker, as well as the AALs of 0.001 and 0.002 s/cc calculated for the hypothetical future child and adult residents, respectively. None of these exceed the AAL of 0.2 calculated for the hypothetical future construction worker.

The total asbestos concentration measured in air during the activity based sampling at Building 411 was similar to Building 404. The total asbestos concentrations measured in air during the activity based sampling conducted in the grid located nearest the building (sample IDs: BLA411-AA1 and BLA411-AP1) were 0.078 and 0.034 s/cc, respectively. The activity based air samples collected from the grid located 10-20 ft from Building 411 (sample IDs BLA411-AA2 and BLA411-AP2) were non-detect for asbestos. For all four samples at Building 411, the average concentration is 0.028 s/cc. The samples from the 0-10 ft grid and the building average exceed the calculated AALs for the current/future site worker and the hypothetical future residents, but do not exceed the calculated AAL for the hypothetical future construction worker.

This comparison indicates that the presence of asbestos in the soils closest to Buildings 404 and 411, and other buildings with conductive flooring at the BLA may result in unacceptable air concentrations if those soils are subject to intensive disturbance. These unacceptable risks would be expected under the current/future industrial scenario and hypothetical future residential exposure scenarios.

6.7.4 Human Health Risk Summary

Table 6-25 summarizes the calculated cancer risks and non-cancer hazards for each potentially exposed receptor included in the risk assessment for the BLA. As shown in the table above, the total ELCR values for all surface soil, combined surface and subsurface soil, sediment, and surface water exposures for each exposure scenario are below or within the benchmark range of 10^{-6} to 10^{-4} for cancer risk, with the exception of hypothetical future resident exposure to combined surface and subsurface soil. The risk driver in this exposure scenario is benzo(a)pyrene.

The total HI values for all surface soil, combined surface and subsurface soil, sediment, and surface water exposures for each exposure scenario are below the benchmark of 1 for non-cancer hazard, with the exception of hypothetical future construction worker and hypothetical future child resident exposure to combined surface and subsurface soil. When the HIs are segregated into target site and critical effects, hazards were only greater than the benchmark of 1 in the gastrointestinal (GI) tract for the hypothetical future construction worker, due to copper. For the hypothetical future child resident exposure to surface soil, hazards exceed the benchmark of 1 for the GI tract, due to copper; the eyes, nails hair and skin, due to cobalt and Aroclor 1254; and the immune system, due to Aroclor 1254.

The results of the risk assessment indicate that under industrial exposure scenarios, exposure to lead may pose an unacceptable risk. The predicted blood lead levels for the worker were below the benchmark, but the fetal blood lead levels were above the benchmark. In addition, predicted blood lead levels for a future hypothetical child resident were also greater than the benchmark.

As discussed in Section 6.5, removal of the walls and roofs of the buildings has exposed the conductive flooring to weather, causing it to degrade and wash onto the surrounding soils. Activity based sampling conducted at the BLA has demonstrated that intensive disturbance of the soils located immediately adjacent to the buildings where the flooring has washed off the building pads has the potential to generate airborne asbestos concentrations that may present an unacceptable risk to human receptors under current and hypothetical future industrial and/or residential land use scenarios. Soil sampling at the BLA has indicated that the elevated concentrations of asbestos in soil that have the potential to generate the airborne asbestos concentrations are primarily located immediately adjacent to the site buildings, which is the same general area where the inorganic risk drivers are located.

While not evaluated in the risk assessment any residual lead based paint on the concrete walls at the BLA or other possible asbestos containing building materials (i.e., pipe insulation, joint compounds, mastic, etc.) could also present a risk for current and future site workers, construction workers, or residents.

6.8 Ecological Risk Assessment

The purpose of the ERA is to evaluate whether ecological receptors may be adversely impacted by exposure to site-related constituents detected in surface soil, sediment, and surface water at the BLA. This section summarizes the occurrence of constituents in each medium and identifies COPECs at the BLA for the ecological risk assessment; identifies the potential ecological exposure scenarios relevant to the BLA; and presents the estimated ecological risks associated with the identified COPECs and the relevant ecological exposure scenarios at the BLA. Methodologies for data summary and selection of COPECs, exposure assessment, and toxicity assessment for the ERA are presented in Appendix A.

6.8.1 Selection of Constituents of Potential Ecological Concern

This section discusses the selection of COPECs for each medium. Risks to ecological receptors are calculated by dividing the exposure estimates (i.e., the maximum detected concentrations) by the conservative ESLs. The resulting ratio, the hazard quotient (HQ), is a highly conservative surrogate for the assessment endpoints identified in Appendix A. HQs equal to or less than a value of 1 (to one significant figure) indicate that adverse ecological effects are unlikely (USEPA 1997c). HQs greater than 1 indicate that further evaluation is warranted. Therefore, the constituents with HQs greater than 1 or that are identified as bioaccumulative are carried forward as COPECs into the BERA. Maximum HQs greater than 1 for the BLA area are summarized in the subsections below.

6.8.1.1 Surface Soil

Surface soil COPECs were selected by comparing the analytical data with USEPA (2005b) EcoSSLs, USEPA (2003e) Region 5 ESLs, and ORNL values (Efroymson et al. 1997a,b) for surface soil. Table 6-27 presents the selection of surface soil COPECs for the ERA. As summarized in Table 6-27, 53 constituents were identified as COPECs in surface soil:

- **VOCs:** 3-octanone and d-limonene;

- **SVOCs:** 2,4-dinitrotoluene,2,6-dinitrotoluene, benzoic acid, carbazole, dibenzofuran, di-n-butylphthalate, and n-nitrosodiphenylamine;

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- **Explosives:** 2,4,6-trinitrotoluene, m-nitrotoluene, nitroglycerine, and pentaerythritol tetranitrate;

- **Pesticides:** 4,4'-DDD, 4,4'-DDE, Endosulfan, beta-BHC, alpha-chlordane, endrin, heptachlor epoxide, and methoxychlor;

- **PAHs:** acenaphthene, acenaphthylene, anthracene, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[g,h,i]perylene, benzo[k]fluoranthene, chrysene, dibenzo[a,h]anthracene, fluoranthene, fluorene, indeno[1,2,3-cd]pyrene, naphthalene, phenanthrene, and pyrene

- **PCB:** Aroclor 1254;

- **Inorganics:** antimony, arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, selenium, silver, and zinc.

6.8.1.2 Sediment

Sediment COPECs were selected by comparing the analytical data with ESLs from the following sources in order of priority: USEPA (2008c) Region 3 Sediment Screening Levels; ORNL values (Jones et al. 1997); and USEPA (2003e) Region 5 Ecological Screening Levels for sediment. Table 6-28 presents the selection of sediment COPECs for the ERA. As summarized in Table 6-28, thirty constituents were identified as COPECs in sediment:

- **VOCs:** acetone

- **Pesticides:** 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, beta-BHC, alpha-chlordane, and dieldrin

- **PAHs:** anthracene, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[g,h,i]perylene, benzo[k]fluoranthene, chrysene, dibenzo[a,h]anthracene, fluoranthene, fluorene, indeno[1,2,3-cd]pyrene, phenanthrene, and pyrene

- **Inorganics:** arsenic, barium, beryllium, chromium, copper, lead, nickel, thallium, vanadium and zinc.

6.8.1.3 Surface Water

Surface water COPECs were selected by comparing the analytical data with ESLs from the following sources in order of priority: USEPA (2008d) Region 3 Surface Water Screening Levels; ORNL values (Suter and Tsao 1996); USEPA (2003a) Region 5 Ecological Screening Levels; and USEPA (2008e) Ambient Water Quality Criteria for surface water. Table 6-29 presents the selection of surface water COPECs for the ERA. As summarized in Table 6-29, 18 constituents were identified as COPECs in surface water:

- **Pesticides**: dieldrin
- **PAHs:** benzo[a]anthracene, benzo[b]fluoranthene, chrysene, fluoranthene, phenanthrene, and pyrene

- **Inorganics:** aluminum, arsenic, barium, chromium, copper, iron, lead, manganese, mercury, selenium, and zinc.

6.8.2 Summary of Selected Constituents of Potential Ecological Concern

Fifty-three constituents were selected as COPECs in surface soil, thirty constituents were selected as COPECs in sediment, and eighteen constituents were selected as COPECs in surface water because the HQs were greater than 1, the chemical was identified as bioaccumulative, or an HQ couldn't be calculated because an ESL was not available.

6.8.3 Refinement of Risk Calculations for Direct Contact COPECs

The list of COPECs identified in the BERA was reevaluated by calculating refined HQs. The refined HQs were calculated for the COPECs identified in the SLERA using refined EPCs. Constituents identified as COPECs in the BERA that were bioaccumulative were carried forward into food chain models. The results of the recalculation of the HQs for the BDDT are summarized in the subsections below.

6.8.3.1 Surface Soil

Fifty-three COPECs in surface soil were carried forward into the BERA. When refined EPCs were compared with the ESLs, 20 constituents [2,6-dinitrotoluene, di-n-butylphthalate, n-nitrosodiphenylamine, 4,4'-DDD, methoxychlor, benzo(a)anthracene, benzo(a)pyrene, chrysene, naphthalene, antimony, barium, cadmium, chromium, cobalt, copper, lead, mercury, selenium, and zinc] had a refined HQ greater than 1. In addition, ESLs were not available for 12 other constituents (3-octanone, d-limonene, benzoic acid, carbazole, dibenzofuran, 2,4,6-trinitrotoluene, m-nitrotoluene, nitroglycerine, pentaerythritol tetranitrate, Endosulfan, Aroclor 1254, and iron). The BERA results for surface soil COPECs at the BLA are presented in Table 6-30 and are discussed in Appendix A. The refined analysis indicated that adverse impacts are not expected to occur.

Thirty-two of the soil COPECs were identified as bioaccumulative and were also evaluated in the terrestrial food chain model.

6.8.3.2 Sediment

Thirty COPECs in sediment were carried forward into the BERA. When refined EPCs were compared with the ESLs, only one constituent (acetone) had a refined HQ greater than 1. In addition, ESLs were not available for four other constituents (barium, beryllium, thallium, and vanadium). However, six pesticides, thirteen PAHs, and five inorganics were evaluated in the aquatic food chain model. The BERA results for sediment COPECs at the BLA are presented in Table 6-31 and discussed in Appendix A.

6.8.3.3 Surface Water

Eighteen COPECs in surface water were carried forward into the BERA. All but chromium were identified as bioaccumulative and evaluated in the aquatic food chain model. When refined EPCs were compared with the ESLs, 10 constituents (fluoranthene, pyrene, aluminum, arsenic, barium, copper, iron, lead, manganese, and mercury) had a refined HQ greater than 1. The BERA results for surface water COPECs at the BLA are presented in Table 6-32 and are discussed in detail in Appendix A. Based on the results of the BERA indicated that adverse impacts to aquatic life are not expected to occur.

6.8.4 Refinement of Assessment and Measurement Endpoints for Bioaccumulative COPECs

Food chain modeling was conducted at the BLA in order to evaluate the potential ecological effects of the bioaccumulative COPEC in soil, sediment, and surface water on the receptors identified in Appendix A. COPECs identified in soil were evaluated in the terrestrial food chain, and COPECs identified in sediment and surface water were evaluated in the aquatic food chain. The results for both the maximum and refined scenarios of these models are presented in Appendix A, and the results of each of the refined scenarios are discussed in the subsections below.

6.8.4.1 Terrestrial Food chain Model

As summarized in Table 6-33, the refined scenario LOAEL and NOAEL HQs for most COPECs were below 1 for both the short-tailed shrew and the American robin. Based on the overall analysis of terrestrial food chain modeling HQs, as presented in Appendix A, and consideration of the limited spatial extent of affected soils, adverse effects are not expected for short-tailed shrews (and other insectivorous mammals) and American robins (and other insectivorous birds) populations exposed to bioaccumulative COPECs in soil at the BLA.

6.8.4.2 Aquatic Food chain Model

As summarized in Table 6-34, the refined scenario LOAEL and NOAEL HQs for both the mink and the great blue heron were less than or equal to 1 for all bioaccumulative COPECs identified in sediment and/or surface water. These results indicate that mink and herons (or other piscivorous mammals and birds) exposed to these COPECs are not expected to experience adverse effects.

Based on the overall analysis of aquatic food chain modeling HQs, adverse effects are not expected for mink (and other piscivorous mammals) and great blue herons (and other piscivorous birds) populations exposed to bioaccumulative COPECs in sediment and/or surface water at the BLA.

6.8.5 Ecological Risk Summary

Screening-level and baseline risk assessments were completed for the BLA. After the SLERA, 53 constituents were selected as COPECs in surface soil, 30 constituents were selected as COPECs in sediment, and 18 constituents were selected as COPECs in surface water because the HQs were greater than 1, the chemical was bioaccumulative, or an HQ could not be calculated because an ESL was not available. After the BERA, 52 constituents in surface soil, 39 constituents in sediment, and 17 constituents in surface water were retained because the HQs were greater than 1, the chemical was bioaccumulative or an HQ could not be calculated because an ESL was not available. Food chain modeling was evaluated for all those constituents identified as bioaccumulative.

Tables 6-33 and 6-34 summarize the constituents in surface soil, sediment, and surface water carried through the BERA and evaluated in the terrestrial and/or aquatic food chain model. Although there are a few HQs that exceed 1, when these results are considered in conjunction with pertinent site information on the limited spatial distribution and extent of these constituents in surface soil, the potential for population-level effects is low (Appendix A, Figure 6-5). As shown in Table 6-34, all constituents evaluated in the aquatic food chain refined scenarios had LOAEL and NOAEL HQs less than or equal to 1. These results indicate that individual mink and herons (or other piscivorous mammals and birds) potentially exposed to these COPECs are not expected to experience adverse effects.

Based on the overall analysis of the ERA for the BLA, the results indicate that adverse effects are not expected for wildlife at the site.

6.9 BLA Summary and Conclusions

The BLA is a former powder bag loading facility that operated from 1941 through 1943. The facility included a total of ten buildings that were connected by elevated walkway platforms. Seven of the buildings (Buildings 404, 405, 406, 407, 411, 412, and 413), contained a conductive flooring material that covered the concrete slab floors (including the second story of Buildings 404 and 405). Samples of the conductive flooring material indicate that it contained asbestos and several different metals. All process equipment, wooden roofs, and wooden walls have been removed from the buildings, leaving only concrete slabs and walls in place. Removal of the building wall and roofs has exposed the conductive flooring to weather, causing it to degrade and begin to break away from the underlying concrete. In many cases, the flooring has degraded into a red powder-like material and washed onto the surrounding soils.

Environmental investigations conducted at the BLA between 1997 and 2008 focused on evaluating the effects that the deteriorating conductive flooring material and historical site operations have had on the soils surrounding the BLA buildings. Soil samples were also collected at former electrical transformer locations, near area walkways, and from area drainage ditches. Sediment and surface water samples were collected from the unnamed stream located to the north of the BLA to evaluate the potential for constituents to have migrated from the site. Water and sediment samples were also collected from an underground utility vault and former elevator shaft in Building 405. Laboratory analyte classes varied between the investigation activities but have included explosives, herbicides, pesticides, PAHs, PCBs, VOCs, SVOCs, TAL inorganics, asbestos, TCLP-inorganics, and lead-based paint analysis. An extensive soil sampling program was also conducted in 2008 that included screening 192 soil samples around BLA buildings for lead using XRF.

The primary constituents of concern identified during the investigation at the BLA are associated with the deteriorating conductive flooring in the existing structures. Inorganics, including arsenic, barium, cadmium, cobalt, copper, lead, and zinc have been detected in surface soil samples collected around the buildings. Lead and copper, which are believed to have been the primary components of the conductive flooring material, were the most frequently detected constituents at concentrations above applicable industrial and residential RSLs. The 2008 sampling activities confirmed that the inorganics concentrations above applicable RSLs and/or background levels are generally limited to surface soils immediately adjacent (i.e. within 1 to 5 ft) to buildings with conductive flooring material; although, the elevated concentrations extend up to 10 ft from buildings in a few isolated areas. Subsurface soil sampling activities at the BLA have not identified any of the inorganics associated with the flooring material at concentrations above the applicable RSLs. Samples collected from BLA drainage ditches have also indicated that the concentrations of inorganic constituents were within background levels. The subsurface soil and drainage ditch sampling results indicate that the mobility of these constituents is very limited. The only inorganics detected at concentrations above applicable RSLs and background inorganics concentrations in subsurface soil were aluminum (2 samples) and iron (1 sample).

PAHs, which are possibly associated with the flooring material and other building materials used at the BLA are also present in surface soils around the BLA buildings and former elevated walkway corridors. Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene were detected in several surface soil samples at concentrations above industrial and residential RSLs. Concentrations of PAHs did not exceed residential RSLs in subsurface soil samples at the BLA or in drainage ditch samples.

Asbestos, another component of the conductive flooring and other BLA building materials, has been identified in surface soils surrounding the various BLA buildings.

The PCB Aroclor 1254 was detected in surface soils near two former transformer locations at the BLA. One sample collected from a former transformer location east of Building 416 (BLATR01) contained Aroclor 1254 at a concentration above the industrial RSL. Two samples (SS09 and BLASS01) collected near a former transformer at the northwest corner of Building 405 also contained Aroclor 1254 at concentrations above the industrial RSL. Additional samples collected in the vicinity of these two locations did not contain any PCBs at concentrations above applicable residential screening levels indicating that the detections of Aroclor 1254 were isolated. PCBs have not been detected in sediments or surface water samples at the BLA, further supporting the theory that constituents are not migrating from the BLA.

Sediment and surface water samples were collected from two locations in the unnamed stream that passes to the north of the BLA during the 2002 site investigation. While the data indicated that several pesticides, and PAHs were present at low concentrations in the sediment, no constituents were detected at concentrations above applicable RSLs. The pesticide dieldrin was detected in one surface water sample (BLASW05) from the unnamed creek north of the BLA, at a concentration above the tap water RSL; however, dieldrin was also detected in other surface water samples collected from the unnamed stream in 2002, upstream of the BLA; including a sample where the unnamed stream first enters the RFAAP-NRU (WBGSW14). No other constituents were detected in stream surface water at concentrations above applicable tap water RSLs.

Water samples collected from two utility vaults identified at the BLA (at Building 405) in 2008 contained arsenic at concentrations above the tap water RSL. No other constituents were identified in the vault water samples at concentrations above applicable RSLs.

For the purposes of the HHRA, surface soil, total soil, surface water and sediment were evaluated for both current and future land-use conditions. Under current land-use conditions, site worker exposures to surface soil, surface water, and sediment were evaluated. Under future conditions, the site worker exposures remained the same as the current exposures and construction or excavation worker, adult resident and child resident exposures to total soil, surface water, and sediment were evaluated.

The potential cumulative cancer risks for site workers and hypothetical construction workers under current and future land-use conditions at the BLA were within the generally acceptable ELCR target risk range of 1×10^{-6} to 1×10^{-4} for health protectiveness at Superfund sites (USEPA, 1990). The cumulative ELCRs for hypothetical future residents was greater than the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The risk driver under for the residential scenario is benzo(a)pyrene.

Bag Loading Area

The total HI values for all surface soil, combined surface and subsurface soil, sediment, and surface water exposures for each exposure scenario are below the benchmark of 1 for non-cancer hazard, with the exception of hypothetical future construction worker and hypothetical future child resident exposure to combined surface and subsurface soil. When the HIs are segregated into target site and critical effects, hazards were only greater than the benchmark of 1 in the gastrointestinal (GI) tract for the hypothetical future construction worker, due to copper. For the hypothetical future child resident exposure to surface soil, hazards exceed the benchmark of 1 for the GI tract, due to copper; the eyes, nails hair and skin, due to cobalt and Aroclor 1254; and the immune system, due to Aroclor 1254.

Lead was also a constituent of potential concern for each of the receptors considered in the BLA risk assessment. For the current industrial and future hypothetical residential land use scenarios, exposure to lead resulted in predicted blood lead levels greater than the benchmark.

Removal of the walls and roofs of the buildings has exposed the conductive flooring to weather, causing it to degrade and wash onto the surrounding soils. Activity based sampling conducted at the BLA has demonstrated that intensive disturbance of the soils located immediately adjacent to the buildings where the flooring has washed off the building pads has the potential to generate airborne asbestos concentrations that may present an unacceptable risk to human receptors under current/future industrial exposure scenarios and hypothetical future residential land use scenarios. Activity based sampling has also indicated that airborne asbestos fibers are not generated at distance from the buildings where asbestos concentrations in soil are low. Soil sampling at the BLA has indicated that the elevated concentrations of asbestos in soil that have the potential to generate the airborne asbestos concentrations are primarily located immediately adjacent to the site buildings, which is the same general area where the inorganic risk drivers are located.

While not evaluated in the risk assessment any residual lead based paint on the concrete walls at the BLA or other possible asbestos containing building materials (i.e., pipe insulation, joint compounds, mastic, etc.) could also present a small risk to current and future receptors. However, it should be noted that the overall extent of these materials at the site is limited. It should also be noted that the one paint chip sample collected at the BLA during the RI activities contained lead at a concentration below the federal standard for lead based paint of 5,000 mg/kg.

Bag Loading Area

A SLERA and BERA were completed for the BLA, to evaluate surface soil, sediment, and surface water for ecological receptors, and food chain modeling was evaluated for all those constituents identified as bioaccumulative. The results of the evaluation of the SLERA and BERA for direct contact and the constituents evaluated in the terrestrial food chain models indicate that some of the NOAEL and LOAEL HQs were greater than 1, which suggests the potential for risk to some individual insectivorous mammals and birds exposed to surface soils. However, when these results are considered in conjunction with pertinent site information on the limited spatial distribution and extent of these constituents, affects of these COPECs at the population-level are unlikely at the BLA. All constituents evaluated in the aquatic food chain refined scenarios had LOAEL and NOAEL HQs less than or equal to 1, indicating that individual mink and herons (or other piscivorous mammals and birds) potentially exposed to COPECs are not expected to experience adverse effects.

The environmental investigations completed at the BLA have successfully defined and delineated the extent of effects that historical operations and degrading flooring material have had on environmental media at the site. The investigations have confirmed that the effects are generally limited to surface soils located immediately adjacent to buildings with conductive flooring, former elevated walkways, and two former transformer locations. The results of the HHRA activities indicated that lead, copper, and asbestos would be the primary risk drivers under the industrial site worker and construction worker exposure scenarios. Under the hypothetical future residential land use scenario, benzo(a)pyrene, Aroclor 1254, cobalt, copper, lead and asbestos were also found to be potential risk drivers. The ERA activities indicated the potential for risk to individual ecological receptors (i.e., short-tailed shrew and the American robin) due to Hazard Quotients (HQs) greater than 1 for Aroclor 1254, cadmium, copper, lead, and zinc; although no adverse population-level effects would be expected due to the limited areal distribution of these constituents.

An FS is recommended for the BLA to assess potential remedial alternatives to mitigate the unacceptable risks and hazards associated with the site soils, conductive flooring material, and other building materials.

7. Igniter Assembly Area

7.1 Site Description and History

The IAA is located in the western portion of the RFAAP-NRU (Figure 1-2). Many of the buildings in this area were used for the assembly of igniter charges used for artillery, cannon, and mortar projectiles. To support the igniter assembly operations there were also several outparcel buildings that were used to store and prepare the black powder used in the igniters. There were also buildings used for the shipping and receiving of materials related to the IAA as well as offices, change houses, and break rooms. The main igniter assembly buildings (Buildings 8102-1 through 8102-8, and Buildings 502, 504, 522 and 522A), and many of the outparcel buildings that handled the igniter materials contained, conductive flooring material similar to the BLA buildings. This conductive flooring was used to prevent the buildup of static electrical charges which could have potentially ignited explosive materials during assembly operations. The buildings with conductive flooring at the IAA are depicted on Figure 7-1. This flooring material contains various heavy metals and asbestos and was exposed to the weather when the wooden roof and walls were removed from the buildings. As a result, the conductive flooring has degraded into a red powder-like substance very similar to what has been observed at the BLA. In many areas, the degraded conductive flooring material has washed off the concrete pads onto surrounding surface soils. The concrete walls of many buildings were also painted with lead-based paint. Deterioration of the paint may have provided a potential source of lead to the soils immediately surrounding the former building areas

7.2 Physical Setting

The areas surrounding the main assembly buildings and multiple outparcel buildings are generally flat and vegetated with tall grass, shrubs, and pine trees. Previously maintained grassy areas have been allowed to revert to more natural conditions. Raised concrete sidewalks connect the assembly buildings with various outbuildings; however, none of these sidewalks were constructed with conductive flooring. A change-house/canteen (Building 8101) has been removed to its foundation. Building 8101 also contains no conductive flooring material. An engineered drainage system around the IAA consists of a series of culverts to divert water under the sidewalks to ditches which eventually drain into the unnamed creek that provides drainage for much of the RFAAP-NRU. However, the length of the unlined ditches suggests that runoff from normal rain events would infiltrate prior to arriving at the creek.

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The soil at the site varies from fill material to native soil. Generally, native soil at the IAA belongs to the Groseclose Urban Land Complex soil grouping. Stratigraphic characterization indicates that the soil consists of yellowish-red to dark yellowish-brown to strong brown silt and silty clay. Below this lies a layer of mottled, moderately hard to soft clay with intermixed quartz gravel and weathered bedrock (saprolite). This material grades downward to a tight, saprolitic clay at approximately 25 ft bgs (IT 2001).

7.3 Conceptual Site Model

In accordance with the general CSM, presented in Section 3.5, potentially affected media at this site would include surface soil, subsurface soil, sediment, and surface water. Potential sources of adverse environmental effects at this site are historical manufacturing and storage operations, deteriorating conductive flooring material, deteriorating lead based paint, and PCB containing electrical transformers that were formerly located at the site. It is also possible that residual asbestos containing materials (i.e., pipe insulation, mastic, joint compounds, etc.) are present in some IAA buildings that could be released to the environment, or could have been released during historic building demolition activities.

Surface soils in the areas surrounding the buildings with conductive flooring material appear to have the greatest potential to exhibit effects from historical operations and from the conductive flooring material. Surface soils located next to the buildings show signs of staining as a result of deteriorated conductive flooring material washing off of the building pads. Due to the composition of the flooring material, soils next to the buildings are expected to exhibit elevated concentrations of metals and asbestos. Soil sampling at the IAA has indicated that the COPCs at the site are generally confined to surface soils. Therefore, contaminant infiltration into subsurface soils does not appear to be a major pathway.

The majority of the IAA area is relatively flat, therefore erosion and/or migration of surface soils is expected to be fairly minimal. However, during heavy rainfall events surface water run-off has the potential to carry COPCs and affected soils to area drainage ditches. These drainage ditches remain dry except during heavy rainfall events .

7.4 Environmental Investigations

The IAA was designated a Study Area for the RFAAP-NRU site due to the former manufacturing activities at the site and the presence of deteriorating conductive flooring in site buildings that are composed of various inorganics and asbestos. In addition to the conductive flooring there were PCB-containing transformers at the site. The presence of these materials at the site warranted investigations of site media including soil surrounding building and former transformer locations, as well as sediment from drainage ditches in the vicinity of these locations. Environmental investigations at the IAA have been on-going since 1997 and have included:

- 1997 – Preliminary Sampling by Dames and Moore, Inc.
- 1998 – Additional Characterization Sampling by Dames and Moore, Inc.
- 1997 and 1998 – Independent Sampling by Gannett Fleming
- 1998 – Remedial Investigation by ICF Kaiser Engineers, Inc. (ICF KE)
- 2002 – Conductive Flooring Assessment by USACE
- 2002 – Remedial Investigation by Shaw
- 2005 – Additional Characterization Sampling by Shaw
- 2008 – Remedial Investigation by ARCADIS
- 2009 – Supplemental Remedial Investigation by ARCADIS

The goals and findings of each of these investigations are summarized in the following sections. As discussed in Section 4.1, the constituent detections reported in these sections are compared to their medium specific screening criteria (i.e., RSLs), where applicable.

7.4.1 Preliminary Sampling, Dames and Moore, 1997

An initial December 1997 soil sampling effort was conducted by Dames and Moore, Inc., to provide an assessment of the lateral and vertical distribution of organic and inorganic constituents in soil around Buildings 8102-2, 8102-7, 502 and 504 at the IAA, resulting from historical operations and the weathering of the conductive flooring in the buildings. At each building, three soil boring locations were positioned in a line perpendicular to the building at distances of 1 ft, 3 ft, and 5 ft out from the sidewalk. Sample locations are shown on Figure 7-2. Three samples were collected from depths of 0 to 1, 1 to 2, and 2 to 3 ft bgs at the location 1 ft away from the sidewalk. For the sampling locations 3 ft and 5 ft away from the sidewalk, samples were collected at depths of 0 to 1 and 1 to 2 ft bgs. In total 15 surface soil samples and 20 subsurface soil samples were collected:

- 15 surface soil samples [50240 (0-1) through 81027260 (0-1)]
- 20 subsurface soil samples [50240 (1-2) through 8102727 (2-3)]

The surface and subsurface soil samples were analyzed as follows:

- Four surface and seven subsurface soil samples for SVOC analysis
- Seven surface and 11 subsurface soil samples for PCB analysis
- One surface and three subsurface soil samples for pesticides
- 15 surface and 20 subsurface soil samples for TAL metals;

The laboratory analytical results for the soil samples are summarized in Table 7-1 and the sample locations are depicted in Figure 7-2. The results indicated the following.

SVOCs. A total of seven different SVOC compounds were detected in soil samples during this phase of investigation (see Table 7-1). Two SVOCs, were detected at concentrations above industrial RSLs including:

- 2,4-Dinitrotoluene in sample 504360 (1-2); and
- Bis(2-ethylhexyl)phthalate in samples 504312 (0-1) and 504360 (1-2)

Three SVOCs were also detected at concentrations between the residential and industrial RSLs, including:

- 2,4-Dinitrotoluene in sample 504360 (0-1);
- bis(2-Ethylhexyl)phthalate in samples 504312 (2-3), 504336 (0-1), and 504360 (0-1); and
- Chrysene in sample 504360 (1-2).

No other SVOCs were detected at concentrations above residential RSLs.

PCBs. Aroclor 1254 was the only PCB detected in soil samples collected from the IAA (See Table 7-1). Aroclor 1254 was detected above the industrial soil RSL in two soil samples [504312 (0-1) and 504360 (1-2)] and at concentrations between the residential and industrial RSL in three samples [50240 (0-1), 504336 (0-1), and 504360 (0-1)].

Pesticides. Four pesticides (4,4'-DDT, Endosulfan II, endrin, and methyoxychlor) were detected in soil samples collected at Building 8102-7 (see Table 7-1). The detected concentrations were below residential RSLs. Pesticides were not detected in samples collected at the other buildings.

Inorganics. Several inorganics were detected in all of the soil samples collected from the IAA (see Table 7-1). Three inorganics were detected at concentrations above industrial RSLs and established background concentrations in at least one soil sample, Including:

- Chromium in surface soil sample 504360 (1-2 ft bgs)
- Lead in surface and subsurface soil samples 504312 (0-1 ft bgs), 504336 (0-1 ft bgs), 504336 (1-2 ft bgs), 504360 (0-1 ft bgs), and 504360 (1-2 ft bgs)
- Mercury in surface soil sample 503460 (0-1 ft bgs)

Four inorganics were also detected at concentrations between the residential and industrial RSLs and above established background concentrations in at least one soil sample, including:

- Aluminum in sample 81027160 (1-2 ft bgs)
- Copper in samples 504312 (0-1 ft bgs), 504336 (0-1 ft bgs), 504360 (0-1 ft bgs), and 504360 (1-2 ft bgs)
- Chromium in surface soil samples 504312(0-1 ft bgs), 504336(0-1 ft bgs), and 504360 (0-1 ft bgs).
- Lead in surface soil sample 8102727 (0-1 ft bgs)
- Iron in samples 504312 (0-1 ft bgs) and 504360 (1-2 ft bgs),
- Zinc in sample 504360 (1-2 ft bgs)

While several other naturally occurring inorganics were detected in the soil samples, none were detected at concentrations above both residential RSLs and established background concentrations.

7.4.2 Additional Characterization Sampling, Dames and Moore, 1998

Additional characterization sampling in February 1998 was conducted by Dames and Moore, Inc. to enhance delineation of organic and inorganic constituents in soil around Building 8102-7 at the IAA. Three borings were advanced in locations of previous borings (81027112, 81027136, and 81027160) at Building 8102-7 from the 1997 investigation. The borings were advanced at locations that previously had only been analyzed for TAL metals. The following samples were collected during this investigation:

- Three surface soil samples were collected for SVOCs, PCB, and pesticides analyses.
- Four subsurface soil samples were collected for SVOCs, PCBs, and pesticides analyses.

The laboratory analytical results for the soil samples are summarized in Table 7-2 and the sample locations are depicted in Figure 7-2. The results indicated the following.

SVOCs. Only one SVOC [bis(2-ethylhexyl)phthalate] was detected during the February 1998 investigation (see Table 7-2). The detected concentration was below the residential RSL.

PCBs. No PCBs were detected in any of the surface or subsurface soil samples.

Pesticides. A total of two pesticides (4,4'-DDT and endrin) were detected during the February 1998 investigation (see Table 7-2). 4,4'-DDT was detected at a concentration above the residential RSL but below the industrial soil RSL in one surface soil sample (81027112 (0-1).

7.4.3 Independent Sampling, Gannett Fleming, 1997 & 1998

The objective of the independent sampling was to characterize surface soil at areas in the IAA that were not investigated previously. Initial investigation activities included the collection of two surface soil samples from the vicinity of IAA Buildings 8102-8 and 8102-5 in 1997 and five more soil samples collected from borings or test pits in 1998. In 1998, six additional soil samples (SS- 11a, SS-11b, SS-12, SS-12c, TR-01a, and TR-01b) were collected from borings and test pits at three locations at the IAA. Samples SS-11a and SS-11b were collected adjacent to Building 8102-5, samples SS-12 and SS-12c were collected adjacent to Building 8102-6 and Samples TR-01a and TR-01b were collected adjacent to the former transformer located north of Building 8102-4. A total of seven surface soil samples were collected and analyzed as follows:

- Two surface soil samples for VOCs
- Four surface soil samples for SVOCs
- Four surface soil samples for PCBs
- Four surface soil samples for Pesticides
- Five surface soil samples for TAL inorganics;
- One surface soil sample for asbestos

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Additionally, one paint chip sample (WS-03) from the conductive flooring was collected and analyzed for TAL inorganics.

The laboratory analytical results are summarized in Table 7-3 and the sample locations are depicted in Figure 7-2. The results indicated the following:

VOCs. Acetone, methylene chloride, and naphthalene were detected in two surface soil samples (SS-03 and SS-11). The detected concentrations were several orders of magnitude below applicable residential RSLs (see Table 7-3). No other VOCs were detected during this event.

SVOCs. A total of nineteen SVOCs were detected in various soil samples during this event (see Table 7-3). Five of the SVOCs [benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene] were detected at concentrations above industrial RSLs at soil sample TR-01A. Soil sample TR-01b, which was collected immediately adjacent to TR-01a only contained benzo(a)pyrene at a concentration above the residential RSL. Benzo(a)pyrene and benzo(b)fluoranthene were also detected at concentrations above the residential RSL at sample location SS-11. The other SVOCs detected during this event were at concentrations below applicable industrial and residential RSLs.

PCBs. Aroclor 1260 was the only PCB detected during this sampling event. Aroclor 1260 was detected at a concentration above the industrial RSL in one soil sample (SS-03) and between the residential and industrial RSLs in one soil sample (SS-03) (see Table 7-3). PCBs were not detected in samples TR-01A and TR-01B collected adjacent to the former transformer location.

Pesticides. One pesticide (Endrin) was detected at sample location TR-01 (see Table 7-3). The detected concentration was below the residential RSL. No other pesticides were detected in the soil samples.

Inorganics. Several inorganic constituents were detected in all of the soil samples collected during this investigation (see Table 7-3). Three inorganics were detected at concentrations above both industrial RSLs and established background concentrations in at least one soil sample, including:

- Arsenic in all soil samples analyzed for TAL metals (SS-03, SS-11, SS-11a, SS-11b, and SS-12) and in the paint chip sample WS-03

- Copper in all soil samples analyzed for TAL metals and in the paint chip sample WS-03
- Cobalt in soil samples SS-11 and SS-12
- Lead in soil samples SS-11 and SS-11a

Five inorganics were also detected at concentrations between the residential and industrial screening levels and natural background concentrations in at least one soil sample, including:

- Barium in soil samples SS-11, SS-11a, SS-11b, and SS-12
- Cadmium in soil sample SS-11
- Nickel in soil sample SS-12
- Zinc in soil samples SS-11, SS-11a, SS-11b, and SS-12 and the paint chip sample WS-03

Asbestos. Asbestos (chrysotile) was detected in one soil sample (SS-12) at 2.1% (see Table 7-3).

7.4.4 Remedial Investigation, ICF KE, 1998

The purpose of the 1998 RI was to further characterize the nature and extent of target constituents at the IAA through the investigation of surface/subsurface soil and conductive flooring. Activities completed during this investigation included:

- The advancement of test pits adjacent to Buildings 8101-1 and 8101-7 to characterize the soil profile and assess the nature and extent of contamination due to the runoff of conductive flooring material from the buildings. Four surface soil samples and four subsurface soil samples were collected as part of the test pitting activities.

- Five soil borings (IASB1 through IASB5) in various areas of the IAA. Five surface soil samples [IASB1 (0.5-1), IASB2 (0-2), IASB3 (0.5-1), IASB4 (0.5-1.5), and IASB5 (0.5-1)] and five subsurface soil samples [IASB1 (5-6), IASB2 (4-6), IASB2 (26-28), IASB3 (5-6), IASB4 (5-6), IASB5 (0.5-6)] were collected from these soil borings.

- One conductive floor sample (IACF2) was collected from the northeast corner of Building 8102-1.

7.4.4.1 1998 Test Pitting Activities

Two 6 x 2 ft test pits (IATP1 and IATP2) were advanced to a depth of 4 ft on the northeast corner of Buildings 8102-1 and 8102-7, respectively. These test pits were advanced to characterize the soil profile and assess the nature and extent of constituent detections due to the runoff of conductive flooring material from the buildings. A substantial quantity of red-stained surface soil was encountered in the immediate vicinity of both buildings. Field observations during the advancement of test pit IATP1 indicated that red-stained soil was visible to a distance of 2.5 ft from the building foundation and to a depth of approximately 1.2 ft bgs. Field observations at test pit IATP2 indicated that the red-stained soil extended to nearly 3 ft from the building foundation to a depth of 0.5 ft bgs. The soil physical characteristics and the discovery of fill material, encountered during the advancement of IATP2, indicated that soil directly surrounding Building 8102-7 is not native. However, the soil physical characteristics encountered during the advancement of test pit IATP1 were indicative of native soil.

Samples were collected from both test pits. Test pit samples IATP1A and IATP1C were collected a distance of approximately 1 ft and 5 ft from the foundation of Building 8102-1, respectively, at a depth of 0.5-1.0 ft bgs. Samples IATP1B and IATP1D were collected at the same locations as IATP1A and IATP1C at depths of 4.0-4.5 ft bgs. The same strategy was utilized for soil samples (IATP2A through IATP2D) collected from test pit IATP2. The soil samples from both test pits were analyzed for explosives and TAL inorganics. The surface soil samples were also analyzed for TCL SVOCs. The analytical results from the test pit samples are summarized in Table 7-4 and the sample locations are depicted in Figure 7-2.

SVOCs. A total of eleven different SVOCs were detected in various test pit soil samples (See Table 7-4). Benzo(a)pyrene was detected at a concentration of 0.080 mg/kg at IATP1A, which is above the residential RSL but below the industrial RSL. No other SVOC/PAH constituents were detected at concentrations above applicable RSLs.

Explosives. No explosives were detected in any of the test pit samples.

Inorganics. As with all samples at the RFAAP-NRU, several inorganics were detected in all of the test pit soil samples (see Table 7-4). Arsenic (28.8 mg/kg) and copper (7,070 mg/kg) were detected in surface soil sample IATP2A at concentrations above established background concentrations and industrial RSLs. The other surface soil sample from test pit ITAP2 (IATP2B) had copper present at a concentration of 1,440 mg/kg, which is above the residential RSL and background. The subsurface soil samples from the IATP2 test pit did not have any inorganics detected at concentrations above background levels. The only constituent detected above background in the IATP1 test pit was copper in surface soil sample IATP1A. Copper was detected in this sample at a concentration of 1,280 mg/kg, which is above the residential RSL.

7.4.4.2 1998 Soil Borings

In addition to the test pit samples, eleven soil samples were collected from five borings (IASB1, IASB2, IASB3, IASB4, and IASB5) located adjacent to Buildings 8102-2, 8102-3, 8102-4, 8102-6, and 8102-7 respectively. Boring IASB4 was located at previous location SS-12, where the highest concentrations of copper and arsenic were detected by Gannett Fleming in 1998. A shallow sample (0-2 ft bgs) and a medium depth sample (4-6 ft bgs) were collected from each boring. Additionally, one deep sample [IASB2C] was collected from a depth of 26-28 ft bgs to characterize the lower subsurface region. All eleven samples were analyzed for SVOCs and inorganics. One sample [IASB5B (4-6 ft bgs)] was also analyzed for explosives. The analytical results from these samples are also summarized in Table 7-4 and the sample locations are depicted in Figure 7-2. The results indicated the following:

SVOCs. Seven different SVOCs/PAHs were detected in isolated soil samples during this event (See Table 7-4). The detected constituents were all at concentrations lower than applicable industrial and residential RSLs.

Explosives. No explosive compounds were detected in soil sample IASB5B (4-6 ft bgs).

Inorganics. Several inorganics were detected in all of the soil samples collected during this event (see Table 7-4). Iron was detected in surface soil sample IASB3 (0.5-1 ft bgs) at a concentration of 52,600 mg/kg, which is above the residential RSL, and slightly above the background level of 50,962 mg/kg. No other inorganics were detected in surface or subsurface soil at concentrations above background and residential RSLs.

7.4.4.3 1998 Conductive Flooring Sample

One conductive floor sample (IACF2) was collected from the northeast corner of Building 8102-1 to verify floor material composition and assess transport and mobility.

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A small chunk of the red conductive flooring material was collected from the surface of the building foundation and was considered representative of the material found in each of the buildings. The flooring was a dry, dull red colored material containing white fibers. The sample was analyzed for TCL SVOCs, TCLP inorganics, and asbestos. Results of the conductive flooring analysis are summarized in Table 7-5. TCLP results indicate that barium, cadmium, chromium, lead, and selenium were present in leachable forms in the conductive floor sample. None of the detected inorganics were at concentrations above their respective TCLP regulatory guidelines. Asbestos and TCL SVOCs were not detected in the flooring sample.

7.4.5 Conductive Flooring Assessment, USACE, 2002

The USACE completed a conductive flooring assessment in 2002 to further evaluate the composition of the conductive flooring material at the IAA and the BLA. The results of this investigation are summarized in the 2003 report entitled *Site Screening Report of Conductive Flooring at the Igniter Assembly Area and Bag Loading Area in the New River Unit* (USACE, 2003). The sampling activities at the IAA included the collection of flooring samples from 14 buildings [Buildings 502, 504, 509, 522, 529, 8102-A (a loading dock located to the north of Building 8102-8), 8102-2, 8102-7, Building XXXX (located between Buildings 522 and 529), 1, 562, 565, and 571].

Fifteen conductive flooring samples (two from Building 8102-7, one from each of the remaining buildings) were collected from buildings in the IAA to verify floor material composition and assess transport and mobility. A small chunk of the red conductive flooring material was collected from the surface of the building foundation. The flooring is a dry, dull red colored material containing white fibers. The samples were analyzed for TCL VOCs, TCL SVOCs, PCBs, TCL pesticides, explosives, and asbestos. In addition, one sample, was analyzed for TCLP VOCs and TCLP metals. The laboratory analytical results are summarized in Table 7-6. The results indicated the following:

VOCs. Two VOCs (acetone and methylene chloride) were detected in conductive flooring samples. The detected concentrations were all below applicable industrial and residential soil RSLs.

SVOCs. Fourteen different SVOCs/PAHs were detected in the conductive flooring samples (see Table 7-6). However, the detected concentration of the PAH benzo(a)pyrene in the sample from Building 509, was the only constituent detected at a concentration above the industrial RSL. Two other PAHs [benzo(a)anthracene and benzo(b)fluoranthene] were also detected above the residential RSL in the sample from Building 509, No other PAHs were detected at concentrations above residential RSLs in any of the conductive flooring samples.

PCBs. The PCB Aroclor 1254 was detected in samples from Buildings 504, 509, 522, and 529 at concentrations above industrial soil RSLs. Aroclor 1254 was also detected in samples from Buildings 502 and XXXX at concentrations between the residential and industrial soil RSLs. With the exception of Aroclor 1232 at Building 502, which was detected at a concentration below the residential RSL, no other PCBs were detected during this sampling event.

Pesticides. Six different pesticides (4,4'DDE, 4,4'DDT, dieldrin, endrin, lindane, and gamma chlordane) were detected in isolated samples during this event (see Table 7-6). Dieldrin was detected at concentrations above the residential RSL in three of the conductive flooring samples (RFAAP-502, RFAAP-522, and RFAAP-529. No other pesticides were detected above residential RSLs in the conductive flooring samples.

Explosives. No explosives were detected in any of the conductive flooring samples.

Inorganics. Several inorganics were detected in all of the flooring samples collected during this sampling event (see Table 6-6). Arsenic, copper, and lead were all detected in several samples at concentrations above background soil concentrations and industrial soil RSLs. Chromium, nickel, and zinc were also detected in several samples at concentrations above background and residential soil RSLs.

Asbestos. Asbestos (chrysotile) was detected at low concentrations (approximately 2 percent) in all of the conductive flooring samples (see Table 7-6).

TCLP VOCs and TCLP Metals. The VOC tetrachloroethylene (PCE) was the only constituent detected in leachable form in the sample analyzed for TCLP VOCs and TCLP metals. The detected concentration was lower than the TCLP disposal standard of 700 µg/L (see Table 7-6).

The conclusions of the investigation indicated that the composition of the conductive flooring was generally consistent among all buildings at the IAA.

7.4.6 Site Investigation, Shaw, 2002.

This section is intended to provide a brief summary of the field activities conducted at the IAA by Shaw during the 2002 field investigation. The field activities included the following:

- Five surface soil samples (IASS01 through IASS05) were collected from areas located adjacent to IAA buildings.
- Ten additional surface soil samples and 15 subsurface soil samples were collected from ten borings (IASB06 through IASB15) located adjacent to buildings with conductive flooring.
- Eight surface soil samples (IATR01 through IATR08) were collected from test pits completed at former transformer locations.
- Nine sediment samples (IASD04 through IASD12) were collected from area drainage ditches.

7.4.6.1 Soil Sampling

A total of 15 surface soil samples and 15 subsurface soil samples were collected next to the IAA buildings during the 2002 investigation. All of the soil samples were analyzed for TAL inorganics. Other analyte classes sampled for in this investigation included VOCs, PAHs/SVOCs, PCBs, pesticides, herbicides, explosives, pH, and grain size; however, not all analytes were included at every location. The laboratory analytical results from this sampling event are summarized in Table 7-7, and the sample locations are depicted in Figure 7-2. The results indicated the following:

VOCs. Two VOCs (acetone and toluene) were detected in isolated samples at concentrations several orders of magnitude below applicable residential RSLs (see Table 7-7).

SVOCs. Twenty different SVOC/PAH constituents were detected in the surface soil sample at sample location IAASS05 (see Table 7-7). The analytical results indicated that the concentration of benzo(a)pyrene was higher than the industrial RSL at this location. Benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene were also detected at this location at concentrations above the residential RSL. The other detected constituents were at concentrations lower than residential RSLs.

PAHs. A total of 17 PAH constituents were detected in isolated surface and subsurface soil samples (see Table 7-7). The analytical results indicated that no constituents were at concentrations higher than industrial RSLs. Benzo(a)pyrene was detected at a concentration higher the residential RSL at sample location IASS05 (this is the same sample location that had several PAH constituents at concentrations above applicable RSLs in the SVOC analysis). No other PAHs were detected at concentrations above applicable RSLs.

PCBs. The PCB Aroclor 1254 was detected above the industrial RSL in sample IASS05, which was collected adjacent to Building 8101 (this building did not contain conductive flooring). PCBs were not detected in any of the other surface or subsurface soil samples collected next to IAA buildings during this event (see Table 7-7).

Pesticides. Pesticides were not detected in the one surface soil sample (IASB06) collected for pesticide analysis.

Herbicides. No herbicides were detected the one surface soil sample (IASB06) collected for herbicide analysis.

Explosives. The explosive nitroglycerine was detected at soil sample location IASS05 at a concentration of 0.57 mg/kg (see Table 7-7). The detected concentration was below the residential RSL of 0.61 mg/kg. No other explosives were detected.

Inorganics. Several inorganic constituents were detected in all of the soil samples collected during this sampling event (see Table 7-7). Arsenic at IASB12 (4-6 ft bgs), lead at IASB14 (0-0.5 ft bgs), and cobalt at IASB07 (0-0.5 ft bgs)were the only constituents detected at concentrations above background levels and industrial RSLs. Aluminum, copper, iron and lead were also detected in various samples at concentrations above background levels and residential RSLs.

The eight surface soil samples collected from the former transformer locations (IATR01 through IATR08) were analyzed for PCBs. The analytical results for these samples are summarized in Table 7-7 and the sample locations are depicted in Figure 7-2. The results indicated that sample location IATR07 was the only location that contained a PCB detection. Aroclor 1260 was detected at a concentration of 0.40 mg/kg at IATR07, which is above the residential RSL of 0.24 mg/kg.

7.4.6.2 Sediment Sampling

Nine sediment samples (IASD04 through IASD12) were collected from IAA area drainage ditches during the 2002 investigation. The ditches were all dry during the sampling event and only carry water during heavy rainfall events. The samples were analyzed for VOCs, PAHs/SVOCs, PCBs, pesticides, herbicides, explosives, and TAL inorganics. One sediment sample (IASD12) was also analyzed for TOC and pH. The laboratory analytical results from this sampling event are summarized in Table 7-8, and the sample locations are depicted in Figure 7-2. The results indicated the following:

VOCs. Two VOCs (acetone and toluene) were detected in a limited number of sediment samples (see Table 7-8). The detected concentrations were several orders of magnitude below applicable industrial and residential RSLs. No other VOCs were detected in any of the samples.

SVOCs/PAHs. Twenty one SVOCs were detected in sediment samples (see Table 7-8). Five SVOCs [benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene] were detected at concentrations above their respective industrial RSL in sample IASD09. Benzo(a)pyrene was also detected above its industrial RSL at IASD10. These samples (IASD9 and IASD10) were not analyzed by the more sensitive PAH method. The IASD09 and IASD10 samples were collected from culverts that pass under a paved road in the southern portion of the IAA. Benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene were also detected in a limited number of samples at concentrations above applicable residential RSLs.

PCBs. PCBs were not detected in any of the sediment samples.

Pesticides. Thirteen different pesticides were detected in various sediment samples (see Table 7-8). However, all of the detected concentrations were below applicable residential RSLs.

Herbicides. No herbicides were detected in any of the sediment samples.

Explosives. The explosive 1,3,5-trinitrobenzene was detected at a concentration of 0.07 mg/kg at IASD11 and 4-amino-2,6-dinitrotoluene was detected at a concentration of 0.04 mg/kg at IASD05. Neither of the detected concentrations were above applicable residential RSLs. No other explosives were detected in any of the samples.

Inorganics. Several inorganics were detected in all of the sediment samples included in the event (see Table 7-8). However, lead was the only inorganic detected at concentrations above applicable RSLs and established background levels. The sediment sample collected at IASD06 contained lead at a concentration of 884 mg/kg, which is above the industrial RSL of 800 mg/kg. The sediment sample collected at IASD12 contained lead at a concentration of 643 mg/kg, which is above the residential RSL of 400 mg/kg. These sample locations were both in culverts that receive rain water runoff from the central portion of the IAA.

7.4.7 Asbestos and Lead Investigation, Shaw, 2005

Shaw completed an asbestos and lead based paint survey at the IAA during 2005. This event included the collection of the following samples:

- Nine soil samples (BPASS01, BPASS02, BPASS03, and IASS06 through IASS11) were collected for asbestos analysis
- Three samples of deteriorated conductive flooring material (BPADF01, IADF01, and IADF02) for asbestos analysis
- Three samples of intact conductive flooring material (BPAIF01, IAIF01, and IAIF02) for asbestos analysis
- One sample of the building wall material (IAWM01) for asbestos analysis
- Three wipe samples (IAW01, IAW02 and IAW03) for total asbestos analysis
- Three paint chip samples (IAPC01, IAPC02, and IAPC03) from IAA buildings for lead analysis

The exact locations of the samples collected during this event were not recorded. However, sample locations as described in this report have been inferred based on a February 2005 Draft Field Sampling Plan by Shaw. Sample labels starting with BPA were collected at, or in the vicinity of, Building 570 in the black powder area of the IAA. The soil samples (IASS06 through IASS11) were collected in the vicinity of previous soil samples SS-11 and 504312012 (0-1 ft bgs). The conductive flooring samples (IADF02, IADF01, IAIF01, and IAIF02) were collected from Buildings 8102-5 and 504. The laboratory analytical results for the soil samples are presented in Table 7-9**.** The laboratory analytical results for the conductive flooring samples and paint chip samples are presented in Table 7-10.

The results of the asbestos analysis indicated that the chrysotile was the only asbestos type detected. Total asbestos concentrations detected in the soil samples ranged from non-detect to 1.9% in the samples collected around Building 507. The asbestos concentrations detected in the soil samples in other areas of the IAA ranged from 0.1 % to15%. Asbestos concentrations in the intact flooring material ranged from 13.6% to 23.7% and from 7.1% to 16% in the deteriorated flooring.

The results from the paint chip samples indicated that lead concentrations ranged from 1,100 mg/kg to 49,500 mg/kg. Very little paint remains on the IAA buildings.

7.4.8 RI Investigation, ARCADIS 2008

In accordance with Remedial Investigation Work Plan Addendum 27 (ARCADIS 2008b), ARCADIS completed additional investigation activities at the IAA in 2008 to finalize the characterization and delineation work at this site. The primary goal of the 2008 investigation was to complete the delineation of inorganics and asbestos in surface soils around buildings containing conductive flooring. The investigation also included the collection of samples to delineate historical PCB and PAH detections near Building 8101, and lead detections in area drainage pathways. One water sample was also collected from a utility vault below Building 522. The investigation activities and results for these areas are discussed in the following sections

7.4.8.1 2008 Building Area Investigation Activities

The primary goal of ARCADIS' 2008 investigation was to delineate the extent of inorganics and asbestos detections in surface soil surrounding buildings with conductive flooring material. Following is a summary of the investigation activities performed to complete this assessment:

- ARCADIS performed an inventory of the buildings at the IAA to identify buildings with conductive flooring, including those that may not have appeared on historic site maps. The locations of all buildings were surveyed utilizing GPS equipment and measurements were collected of the building dimensions. All buildings at the IAA are depicted in Figure 7-1. The building inventory identified 29 buildings with conductive flooring material. In total approximately 25,000 ft^2 of conductive flooring material is present at the site.

- Review of the analytical data collected during the previous investigations of the IAA indicated that lead could be used as a good predictor of where other constituents may also be present in surface soil at concentrations above applicable screening criteria as a result of the deteriorating conductive flooring. Therefore, ARCADIS developed a field screening program that utilized a hand-held XRF meter to screen surface soil samples for lead. Samples were typically collected in rows of three screening points spaced at 1 ft, 5 ft, and 10ft distances from the building footprint. In cases where the XRF result indicated a lead concentration above 400 mg/kg, the samples were also collected further away from the building (i.e., 15 ft and 20 ft). The rows were located on approximately 25 ft centers around the perimeter of each building, with a bias towards preferential flow paths off of the building pads (i.e., where red staining was present in soil). A total of 157 rows containing 475 individual points (IAA-R1A through IAA-R157C) were screened with the XRF around the perimeters of buildings identified with conductive flooring. The field screening locations are depicted in Figure 7-3. The screening points were identified with the letter R for Row followed by a number (001 through 157) representing the row number where the screening point was located, followed by a letter (A, B, C, D, or E) representing the distance from the building pad to the sample location (1, 5, 10, 15, 20 ft, respectively).

- In order to evaluate the results of the XRF screening results and to provide additional characterization data, duplicate samples were collected from 41 of the 475 XRF screening locations. A minimum of one sample was collected at each building identified with conductive flooring. These samples (IAA-SS003 through IAA-SS043) were submitted for laboratory analysis of TAL inorganics and asbestos. Five of these samples (IAA-SS009, IAA-SS021, IAA-SS028, IAA-SS033, and IAA-SS043) were also submitted for laboratory analysis of TCLP-inorganics. The sample locations are depicted in Figure 7-2. Comparison of the XRF field screening results generally indicated a positive correlation between the XRF results and the results of the laboratory reported lead concentrations; with the XRF results typically biased slightly high. Figure 7-7 presents a graphical comparison between the XRF and laboratory results.

7.4.8.2 XRF Lead Screening Results

The results of the XRF lead screening activities at the IAA buildings are summarized in Table 7-11. The results of the XRF screening are also presented in Figure 7-3A and 7-3B. The XRF screening activities indicated the following:

- The XRF screening results indicated that lead concentrations were above industrial RSLs in 49 of the 475 field screening locations. There were also 11 locations where the detected lead concentration was between the residential and industrial RSL. Figure 7-4 illustrates the distribution of the detected lead concentrations during the XRF field screening program. A total of 49 of the 60 screening locations that had lead concentrations above the RSLs occurred at 4 site buildings (Buildings 502, 504,522, and 522A) located in the southern portion of the IAA. Field observations indicated that these buildings were surrounded by a significant amount of gravel debris that may have influenced the XRF results.

- Lead was detected at the following buildings at concentrations above applicable RSLs
    - **Building 8102-3 –** Three screening locations at Building 8102-3 (IAA-R45A, IAA-R46A, and IAA-R51A) had lead detections above the industrial RSL. The detected lead concentrations in these samples, all of which were collected 1-ft away from the building pad, ranged from 970 mg/kg to 1,340 mg/kg (see Table 7-11). All of the other screening locations at this building had lead concentrations below the residential screening level.
    - **Building 8102-4** – Lead was detected at a concentration of 1,185 mg/kg screening location IAA-R39A and 487 mg/kg at screening location IAA-R38A. Both samples were collected 1-ft away from the building pad (see Table 7-11). All of the other screening locations at this building had lead concentrations below the residential screening level.
    - **Building 502** – Building 502 is located in the southern portion of the IAA. The field screening results for the samples collected around this building indicated that lead concentrations were above the industrial RSL in 21 separate sample locations on the northeast (IAA-R112A through IAA-R113C), southeast (IAA-R114A through IAA-R114C), and southwest (IAA-R115A through IAA-R117C) sides of the building. The detections above the RSL extended up to 15-ft from the building pad. XRF reported lead concentrations ranged from 291 mg/kg to 50,000 mg/kg on these sides of the building (see Table 7-11). The XRF reported lead concentrations around this building may have been influenced by the presence of a large amount of gravel debris in the soil.
    - **Building 504** – Building 504 is located adjacent to Building 502 in the southern portion of the IAA. Like Building 502, many of the XRF

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readings collected around this building were elevated in comparison to other areas of the site. Eleven of the 24 screening locations resulted in lead concentrations above the industrial RSL (see Table 7-11). The XRF lead concentrations in these eleven samples ranged from 857 mg/kg to 16,597 mg/kg. Three additional locations had lead concentrations reported between the residential RSL and the industrial RSL. Unlike Building 502, the detections above the RSL generally were confined to soils within 5-ft of the building pad. The XRF reported lead concentrations around this building may also have been influenced by the presence of a large amount of gravel debris in the soil.

- **Building 522** – Building 522 is located in the southern portion of the IAA, north of Building 504. Four screening locations (IAA-R83A and IAA-R85A through IAA-R85C) had reported lead concentrations above the industrial RSL. Four other samples (IAA-R80A, IAA-R81A, IAA-R82A, and IAA-R86A), all collected within 1-ft of the building pad, contained lead concentrations above the residential RSL (see Table 7-11).

- **Building 522A** – Building 522A is located adjacent to Building 522A. Four of the samples collected from a distance of 1-ft from the building pad (IAA-R88A, IAA-R89A, IAA-R90A, and IAA-R93A) contained XRF reported lead concentrations above industrial RSL. In addition, two samples (IAA-R90B and IAA-R92A) had concentrations reported above the residential RSL (see Table 7-11).

- **Building 4** – Building 4 is located in northwest portion of the IAA. One screening location at this building (IAA-R123A) resulted in a lead concentration above the residential RSL (see Table 7-11). All of the other screening locations at this building were below the residential RSL. .

- **Building 5** – Building 5 is also located in northwest portion of the IAA. Three screening locations at this building, IAA-R126A, IAA-126B, and IAA-126C resulted in lead concentrations of 1,046 mg/kg, 885 mg/kg, and 1,425 mg/kg, respectively. These samples were all collected from one row on the southwest side of the building, at a distance extending out to 10-ft from the building pad. A fourth sample from this row, collected 15-ft from the building resulted in a concentration of 121 mg/kg, which is below the residential RSL. None of the other screening locations at this building contained lead at concentrations above the residential RSL (see Table 7-11).

- **Building 562** – Building 562 is located in northeast portion of the IAA. One screening location at this building (IAA-R137A) resulted in a lead concentration of 2,695 mg/kg. This sample was collected 1-ft away from the building pad. All of the other screening samples collected at this building had lead concentrations below the residential RSL (see Table 7-11).

- **Building 565B** – Building 565B is located in northeast portion of the IAA. One screening location at this building (IAA-R149A) resulted in a lead concentration of 945 mg/kg. This sample was collected 1-ft away from the building pad. All of the other screening samples collected at this building had lead concentrations below the residential RSL (see Table 7-11).

7.4.8.3 IAA Inorganics and Asbestos Sampling

ARCADIS collected soil samples at 41 of the 475 XRF field screening locations to evaluate the results of the XRF field screening and to provide additional characterization of the surface soils. At least one sample was collected at each of the 29 conductive flooring buildings at the IAA. These samples (IAA-SS003 through IAA-SS043) were submitted for laboratory analysis of TAL inorganics and asbestos. Five of these samples (IAA-SS009, IAA-SS021, IAA-SS028, IAA-SS033, and IAA-SS043) were also submitted for laboratory analysis of TCLP-inorganics. The sample locations are depicted in Figure 7-2, and the laboratory analytical results are summarized in Table 7-12. The laboratory analytical reports for the 2008 sampling activities are included in Appendix E. The laboratory analytical results indicated the following:

- Lead was detected at concentrations above the industrial RSL in eight of the 41 samples, and above the residential RSL in two other samples. Figure 7-5 illustrates the distribution of the lead concentrations detected in the laboratory samples during the 2008 sampling event. All but one of the samples that had a concentration above an applicable RSL (IAA-SS014) corresponded with an XRF reading that was also above the industrial RSL.

- In general, the detected lead concentrations were very comparable with the XRF readings; although, the XRF readings were typically biased slightly high compared to the laboratory detected concentration. These data indicate that the XRF field analysis was a good screening tool for identifying areas with lead concentrations above applicable RSLs. See Table 7-12 for comparison between the XRF screening results and the laboratory analytical results. Figure 7-6 also presents a graphical comparison of the XRF and laboratory lead results..

- Six of the samples (IAASS026, IAA-SS027, IAA-SS028, IAA-SS029, IAA-SS032, and IAA-SS033) that had lead detections above applicable RSL were collected in the southern portion of the IAA, near Buildings 502, 504, and 522. The XRF readings had also indicated that elevated lead concentrations were present in this area. The other samples that had lead detections above applicable RSLs included:

    - IAA-SS009 (1,170 mg/kg) was collected in the sample location spaced 1-ft from Building 8102-3

    - IAA-SS012 (14,400 mg/kg) was collected in the sample location spaced 1-ft from Building 8102-4

    - IAA0SS014 (567 mg/kg) was collected in the sample location spaced 5-ft from Building 8102-5

    - IAA-SS017 (6,160 mg/kg) was collected in the sample location spaced 5-ft from Building 8102-6

- Copper was the inorganic most frequently detected at concentrations above applicable RSLs (see Table 7-12). Of the 41 samples collected during this event, 20 samples had copper detected at concentrations above the residential RSL (310 mg/kg) and background levels (53.5 mg/kg). The concentrations in six of these samples also were above the industrial RSL (4,100 mg/kg). The maximum copper concentration (14,600 mg/kg) was detected in sample IAA-SS022 located approximately 5-ft from Building 8102-8. Lead was also detected above the RSL at this location. The samples that had copper detections above the industrial RSL (IAA-SS006, IAA-SS009, IAA-SS022, IAASS025, IAA-SS033, and IAA-SS041) were all located within 1-ft of a building foundation. The results indicate that copper concentrations were generally lower in the samples collected 5-ft and 10-ft away from buildings.

- Arsenic was detected above the established background concentration (15.8 mg/kg) and above the industrial RSL (1.6 mg/kg) in ten of the 41 soil samples collected in 2008 from the IAA (see Table 7-12). The maximum arsenic concentration (62.9 mg/kg) was detected in sample IAA-SS029 located approximately 5-ft from Building 502.

- Barium was detected above the established background concentration of 209 mg/kg in 15 of the 41 sample locations (see Table 7-12). However, the detected concentrations were only above the residential RSL of 1,500 mg/kg in five of the samples (IAA-SS009, IAA-SS012, IAA-SS022, IAA-SS025, and IAA-SS033). The maximum detected barium concentration (5,740 mg/kg) occurred in sample IAA-SS009 located approximately 1-ft from Building 8102-3. All of the barium concentrations above the residential RSL were collected within 1-ft of a building foundation.

- Cadmium was detected above the established background concentration (0.69 mg/kg) and above the residential soil RSL (7 mg/kg) in two of the 41 soil samples collected in 2008 from the IAA (see Table 7-12). Cadmium was not detected above the industrial soil RSL (81 mg/kg) in any samples. Both locations that had cadmium detections above the residential RSL, IAA-SS015 (15.2 mg/kg) and IAA-SS033 (9.20 mg/kg), were located within 1-ft of a building foundation.

- Chromium was detected above the established background concentration (65.3 mg/kg) and above the residential soil RSL (23 mg/kg) in two samples (IAA-SS026 and IAA-SS028) (see Table 7-12). These samples were collected in the southern portion of the IAA, near buildings 502 and 504,. The maximum chromium concentration (1,110 mg/kg) was detected in sample IAA-SS026, located approximately 5 ft from Building 504. This sample also contained elevated concentrations of copper, iron, lead, and zinc.

- Iron was detected above the established background concentration (50,962 mg/kg) and above the residential soil RSL (5,500 mg/kg) in three of the 41 soil samples collected in 2008 from the IAA (see Table 7-12). However iron was not detected above the industrial soil RSL (720,000 mg/kg) in any samples.

The maximum iron concentration (328,000 mg/kg) was detected in sample IAA-SS028 located approximately 5-ft from Building 502.

- Mercury was detected at concentrations above the background level (0.13 mg/kg) in 7 of the 41 samples from the IAA area (see Table 7-12). However, sample IAA-SS022 (79.5 mg/kg) was the only sample that contained mercury at a concentration above the industrial RSL. IAA-SS022 was located approximately 1-ft from the building pad at Building 8102-8. None of the other detected mercury concentrations were above applicable RSLs.

- Nickel was detected at a concentration of 213 mg/kg at sample location IAA-SS028, which was collected 5-ft away from Building 502 (see Table 7-12). This concentration was above the established background nickel concentration of 62.8 mg/kg and the residential RSL of 160 mg/kg. Arsenic, chromium, copper, iron, and lead were also detected above applicable RSLs and background at this location. Nickel was not detected above the background level in any of the other soil samples collected at the IAA in 2008.

- Zinc was detected above the established background concentration of 202 mg/kg in 21 of the 41 sample locations (see Table 7-12). However, the detected zinc concentrations were only above the residential RSL in 4 of the 41 samples (IAA-SS006, IAA-SS009, IAA-SS012, and IAA-SS022). These samples were all collected from locations approximately 1-ft away from buildings in the central portion of the IAA. The maximum zinc concentration (6,430 mg/kg) was detected in sample IAA-SS009 located adjacent to Building 8102-3.

- Previous sampling efforts at the IAA had identified the type of asbestos at the site to be chrysotile. The soil samples collected during ARCADIS 2008 sampling event only identified whether or not asbestos was present in the soil. (i.e., yes/no). The results of the 2008 investigation indicated that 20 of the 41 soil sample locations contained asbestos (see Table 7-12). Fifteen of the samples that contained asbestos were collected within 1-ft of buildings containing conductive flooring material. The other samples containing asbestos were collected within 5-ft of a building.

- The results of the TCLP analysis performed on the five soil samples indicated that arsenic, barium, cadmium, chromium, and lead were detected (see Table

7-12). However, the detected concentrations were all below applicable TCLP screening levels.

7.4.8.4 Building 8101 Area Sampling

The analytical results from a sample collected near Building 8101 in 2002 (IASS05) indicated that Aroclor 1254 and benzo(a)pyrene were present in surface soil at concentrations above industrial RSLs. In order to complete the delineation of these constituents, ARCADIS collected two surface soil samples (IAA-SS001 and IAA-SS002) and one subsurface soil sample (IAA-SB001) near the historical IASS05 sample location (see sample locations in Figure 7-2). The surface and subsurface samples were analyzed for PCBs and SVOCs. The analytical results from these samples are summarized in Table 7-12. The results indicated that surface soil sample IAA-SS002 contained benzo(a)pyrene, benzo(a)anthracene, and benzo(b)fluoranthene at concentrations above residential RSLs. The results also indicated that the Aroclor 1254 was detected at IAA-SS002 (0.090 mg/kg), but that the concentration was below residential RSLs. PAHs and PCBs were not detected at sample locations IAA-SB001 or IAA-SS001.

7.4.8.5 Drainage Ditch Sampling

Laboratory analytical results from Shaw's 2002 sampling event indicated that lead was detected at concentrations above applicable RSLs in samples collected from two IAA area drainage ditches Lead was detected at IASD06 (northeast of Building 8102-1) at a concentration of 884 mg/kg, which is above the industrial RSL. Lead was also detected at sample location IASD12 (northeast of Building 8102-5) at a concentration of 643 mg/kg which is above the residential RSL. In an effort to evaluate the extent of the elevated lead concentrations in the two IAA drainage pathways, ARCADIS collected the following samples for field screening and laboratory analysis during 2008.

- Three samples were selected for field screening using XRF near the 2002 IASD06 sample location (IAA-SE007X through IAA-SE009X). Two samples (IAA-SE001 and IAA-SE002) were also submitted for laboratory analysis of inorganics from this drainage pathway.

- Six samples were collected from the drainage pathway downgradient of the 2002 IASD06 sample location (IAA-SE001X through IAA-SE006X) for field screening using XRF. Two samples (IAA-SE003 and IAA-SE004) were also submitted for laboratory analysis of inorganics from this drainage pathway.

The results of the field screening and laboratory analytical samples are summarized in Tables 7-11 and 7-13, respectively. The field screening sample locations are depicted in Figures 7-3A and 7-3B and the samples submitted for laboratory analysis are depicted in Figure 7-2. The results of both the field screening and laboratory samples indicated that the lead concentrations in both drainage pathways were only slightly above background and were well below residential RSLs. No other inorganics were detected in the samples at concentrations above background levels. The sample results appear to indicate that lead is not a concern in the drainage pathways.

7.4.8.6 Utility Vault Sampling

An underground, concrete, utility vault was identified at Building 522 that appears to run around the perimeter of the building. Standing water was present in this vault that was approximately 2 ft deep. No sediment was present at the bottom of the vault. A sample of the vault water (IAA-VLTW01) was collected for laboratory analysis of VOCs, PAHs, and TAL metals (see Figure 7-2 for sample location). The analytical results from this sample are summarized in Table 7-14. The results indicated that no constituents were detected at concentrations above tap water RSLs.

7.4.9 Supplemental RI Investigation, ARCADIS 2009

In accordance with the June 2009 Supplemental Remedial Investigation Work Plan (ARCADIS 2009b), ARCADIS completed additional investigation activities at the IAA in 2009. The goals of the 2009 investigation were to: 1) enhance the delineation of asbestos in surface soils around buildings containing conductive flooring; and 2) to evaluate potential airborne asbestos exposure risks associated with the asbestos in soil. Both soil and air samples were collected and analyzed for asbestos during this investigation. The investigation activities and results for these areas are discussed in the following sections.

7.4.9.1 Asbestos Delineation Sampling

ARCADIS' 2008 sampling activities at the IAA indicated that asbestos was present in surface soil adjacent to several buildings with conductive flooring. However, the analytical method utilized during the 2008 event was only able to provide a qualitative evaluation of whether or not asbestos was present in the sample. In order to conduct a quantitative evaluation of the asbestos concentrations in surface soil, and to further define how far the asbestos impacts extend from the buildings, ARCADIS collected additional samples from the site in 2009. These surface soil samples were collected at

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representative locations where asbestos was detected during the 2008 sampling event. The samples were collected at distances of 1 ft, 5 ft, 10 ft, 15 ft, and 20 ft distances from the building at each sample location. A total of 6 rows of samples were collected for this evaluation (IAA-SS044 through IAA-SS049) and a minimum of one row of samples was collected at each of the IAA building types with conductive flooring. Note that the suffixes A, B, C, D, and E were used to designate whether the sample was collected 1, 5, 10, 15, or 20 ft from the building, respectively (e.g., IAA-SS044A). The samples were analyzed for asbestos by TEM CARB Level B in sequence by distance from building until the reported concentration was below 0.2% by weight. Once a low-detect result was achieved for a sample row, samples collected at further distances in the row were not analyzed. The sample locations from the 2009 investigation are depicted in Figure 7-2 and the analytical results are summarized in Table 7-15. The laboratory analytical reports are presented in Appendix E. The analytical results from the delineation sampling indicated the following:

- Asbestos fibers were detected in all 12 of the analyzed samples. However, the detected concentrations were less than 0.1% asbestos by weight in 7 of the 12 samples. Only two samples (IAA-SS044A and IAA-SS045A) had reported asbestos concentrations above 0.2%. The asbestos concentrations in samples IAA-SS044A (collected 1-ft from Building 8102-3) and IAA-SS045A (collected 1 ft from Building 8102-7) were 2.2% and 2.4%, respectively. The sample collected 5 ft from Buildings 8102-3 and 8102-7 had a reported concentrations of 0.1% and <0.1%, respectively. This indicates that the higher asbestos concentrations were confined to the soil immediately adjacent to the buildings.

- Chrysotile was the only asbestos type detected in the analyzed soil samples.

7.4.9.2 Activity Based Sampling

In an effort to facilitate an evaluation of the risk of exposure to airborne asbestos fibers resulting from asbestos in soil, ARCADIS conducted an activity based sampling program at two of the IAA buildings where asbestos had historical been detected in soil (Buildings 8102-1 and 5). This sampling program, which utilized the USEPA recommended generic action scenario of raking, was performed in accordance with USEPA *SOP 2094: Activity-Based Air Sampling for Asbestos* (USEPA, 2007c) and *Framework for Investigating Asbestos-Contaminated Superfund Sites* (USEPA, 2008g). The following subsections discuss the sample locations and analytical results.

7.4.9.2.1 Sample Locations

Building 8102-1 and Building 5 were selected for the 2009 activity based sampling programs based on the presence of asbestos detections during the 2008 sampling event and visible evidence of conductive flooring material having washed off the building pads onto surrounding soils. The following sample locations were established at each building:

- Two 10 ft by 10 ft sample grids were set up on the northeast side of Building 8102-1 in an area that has had historic asbestos detections. The first grid was located 0-10 ft from the edge of the building pad. The second grid was located adjacent to the first, but at a distance of 10-20 ft from the edge of the building. The grid locations are depicted in Figure 7-2.

- Two 10 ft by 10 ft sample grids were also established at the northeast side of Building 5. Like at Building 8102-1, the first grid was located 0-10 ft from the edge of the building and the second grid was located 10-20 ft from the building. The grid locations are depicted in Figure 7-2.

- Soil samples were collected from the centerline of each sampling grid pair at both buildings. The samples were collected at distances of 1, 5, 10, 15, and 20 feet from Building 8102-1 (IAA8102-SS001A through IAA8102-SS001E) and Building 5 (IAA5-SS001A through IAA5-SS001E). These samples were collected from a depth of 0-3 inches. The samples were analyzed for soil moisture by ASTM Method D2216-05, grain size by ASTM Method D6913-04e, and asbestos by TEM CARB Level B) to establish soil conditions and asbestos levels in the soil within the grids. The analytical results for the soil samples are presented in Table 7-15. The laboratory analytical reports are presented in Appendix E.

7.4.9.2.2 Activity Based Sampling Technique

This section presents a brief discussion of the sampling technique for the activity based sampling activities.

- Starting at the grid located furthest from Building 8102-1, each 10ft by 10 ft grid was vigorously raked by a participant wearing Level C person protection equipment to simulate an aggressive soil disturbance activity. During the raking activity, the participant wore a personal air monitoring pump fitted with a 0.8 µm MCE filter and sampling tube mounted in the subjects breathing zone.

A stationary air monitoring pump fitted with a 0.8 µm filter and sampling tube mounted at a height of 5 feet was also set on the downwind perimeter of the grid to collect air samples during the raking activity. The raking activity was performed for a duration that allowed a minimum of 750 to 1,000 liters of air to be pulled through each filter (approximately 2 hours).

- The personal air monitoring pump samples collected at each grid were identified as follows:
    - Building 8102-1, 0-10 ft Grid: IAA8102-AA1
    - Building 8102-1, 10-20 ft Grid: IAA8102-AA2
    - Building 5, 0-10 ft Grid: IAA5-AA1
    - Building 5, 10-20 ft Grid: IAA5-AA2

- The stationary perimeter air monitoring pump samples collected at each grid were identified as follows:
    - Building 8102-1, 0-10 ft Grid: IAA8102-AP1
    - Building 8102-1, 10-20 ft Grid: IAA8102-AP2
    - Building 5, 0-10 ft Grid: IAA5-AP1
    - Building 5, 10-20 ft Grid: IAA5-AP2

- In addition to the air samples collected at the sample grids, background air samples were collected near Building 8102-1 and 5 to evaluate the potential for background interferences. Stationary air monitoring pumps were set up at upwind locations at both buildings in a fashion similar to the stationary air monitoring pumps at the sampling grids. The background samples at Buildings 8102-1 and 5 were labeled IAA8102-BK2 and IAA5-BK2, respectively.

- All of the personal air monitoring pump samples, stationary perimeter pump samples, and background samples were submitted for laboratory analysis of asbestos by TEM Method 10312. The analytical results for all of the air samples are presented in Table 6-14. The laboratory analytical reports are presented in Appendix D. The analytical results from the TEM Method 10312 report the asbestos concentrations in air using several different methods, including: 1) the AHERA counting method; 2) PCME; and 3) total structures by TEM.

7.4.9.2.3 Laboratory Analytical Results

This subsection presents a summary of the analytical results from the 2009 activity based sampling areas:

Building 8102-1 Soil Samples: Asbestos concentrations in soil ranged from 17.2% asbestos by weight at 1 ft from the edge of the building to 0.1% asbestos or less in the samples collected 5, 10, 15, and 20 ft from the Building 8102-1. Chrysotile was the only type of asbestos fiber present in the samples. It should be noted that abundant red staining from the degraded flooring material was observed in the sample collected from the 1-ft interval.

Building 8102-1 Personal Air Monitoring Pump Samples: No asbestos fibers were detected in the personal air monitoring pump sample collected in the grid located 10-20 ft from the edge of Building 8102-1 (IAA8102-AA2). However, asbestos was detected in the personal air monitoring pump sample collected from the grid located 0-10 ft from Building 8102-1 (IAA8102-AA1). The results from this sample indicated that all of the detected fibers were chrysotile. The total asbestos concentrations in air reported via the various counting methods ranged from 0.00098 s/cc using PCME to 0.00783 s/cc using TEM.

Building 8102-1 Perimeter Air Monitoring Pump Samples: No asbestos fibers were detected in the perimeter air monitoring pump sample collected from the grid located 10-20 ft from the edge of Building 8102-1 (IAA8102-AP2). Asbestos was detected in the perimeter air monitoring pump sample collected 0-10 ft from Building 8102-1 (IAA8102-AP1). The results from this sample indicated that while the majority of the detected asbestos was chrysotile, single fibers of tremolite and amphibole asbestos were also detected in air. The total asbestos concentrations in air reported via the various counting methods ranged from 0 s/cc using PCME to 0.0534 s/cc using TEM.

Building 8102-1 Background Air Monitoring Pump Sample: No asbestos fibers were detected in the background air monitoring sample from Building 8102-1 (BKG8102-BK2).

Building 5 Soil: Chrysotile asbestos fibers were detected in each of the soil samples collected from grid centerline locations at Building 5. However, the reported concentrations of asbestos by weight in these samples were all less than 0.1%.

Building 5 Personal Air Monitoring Pump Samples: No asbestos fibers were detected in either of the personal air monitoring pump samples collected from the two sample grids located at Building 5 (IAA5-AA1 and IAA5-AA2).

Building 5 Perimeter Air Monitoring Pump Samples: No asbestos fibers were detected in either of the perimeter air monitoring pump samples collected from the two sample grids located at Building 5 (IAA5-AP1 and IAA5-AP2).

Building 5 Background Air Monitoring Pump Sample: No asbestos fibers were detected in the background air monitoring sample from Building 5 (IAA5-BK2).

7.5 Nature and Extent of Constituent Detections

The analytical results presented in the previous sections indicate that constituents have been detected at concentrations above applicable screening criteria at the IAA. The majority of the detections appear to be the result of degrading conductive flooring material in site buildings. Areas that have been investigated at the IAA include: soil surrounding all buildings that contain conductive flooring, soil surrounding the locations of former transformers, sediment from drainage ditches in the vicinity of buildings that contain conductive flooring, ponded water from within a subsurface concrete vault adjacent to Building 522, and building materials, including conductive flooring and paint samples.

7.5.1 Soil

7.5.1.1 Building Area Assessment

The primary focus of the environmental investigations at the IAA was to identify potential adverse affects to soil quality as a result of historical operations at the site or from degrading flooring material in site buildings. To this affect, approximately 98 surface soil samples and 50 subsurface soil samples were collected around the various IAA buildings between 1997 and 2008. An additional 475 surface soil sample were collected around the IAA buildings in 2008 for lead field screening using XRF. During 2009 approximately 22 additional surface soil samples and 10 air filter samples were collected for an activity based sampling effort designed to evaluate potential risks associated with asbestos in surface soil. Site maps depicting constituents detected above applicable RSLs in soil samples during the IAA investigation are presented in Figures 7-7 through 7-9. A site map depicting the results of the 2009 asbestos investigation is presented in Figure 7-10. Figures 7-3A and 7-3B display the results of the XRF field screening activities.

As illustrated by the figures, the results of the investigation activities indicated the following:

- No herbicides, or pesticides were detected in surface soil or subsurface soil samples at concentrations above residential RSLs.

- The explosive compound 2,4-dinitrotoluene (DNT) was detected at concentrations above the soil RSL in two samples from a single boring location near Building 504 during the 1997 site investigation. This constituent was not detected during any of the subsequent investigations, including samples collected near the location of the original 1997 detection.

Aroclor 1254 and Aroclor 1260 were the only PCBs detected in soil at the site. A limited number of the PCB detections were above applicable RSLs.

- o Aroclor 1254 was detected at 2002 sample location IASS05 (12/mg/kg) next to Building 8101. This concentration was above the industrial RSL for Aroclor 1254 of 0.74 mg/kg. Aroclor 1254 was not detected above the residential RSL in two surface soil samples (IAA-SS01 and IAA-SS002) and one subsurface soil sample (IAA-SB001) that were collected next to Building 8101 in 2008; therefore, the detection at IASS005 is believed to be isolated.

- o Aroclor 1254 was also detected at concentrations above the residential RSL in surface soil samples collected adjacent to Building 502 [50240 (0-1 ft bgs] and Building 504 [504312 (0-1 ft bgs), 504336 (0-1 ft bgs) and 504360(0-1 ft bgs)] during the 1997 investigation. Aroclor 1254 was also detected above the industrial RSL in one subsurface soil sample [504360 mg/kg (1-2 ft bgs)] next to Building 504. No other surface soil or subsurface soil samples in this area contained PCBs at concentrations above applicable residential RSLs.

- o Aroclor 1260 was detected in one surface soil sample (SS-11) next to Building 8102-5 at a concentration above the industrial RSL; and in one surface soil sample next to Building 8102-A at a concentration above the residential RSL during the 1997 investigation. Aroclor 1260 was not detected in any other samples around IAA buildings.

- Several SVOC/PAH compounds were detected in isolated surface soil samples at concentrations above applicable RSLs, including: bis(2-ethylhexyl)phthalate, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

- Several inorganics were detected in soil samples collected around the IAA buildings at concentrations above applicable RSLs. In most cases the concentrations above the applicable RSLs were detected in surface soil samples collected immediately adjacent to buildings with conductive flooring material. Inorganics concentrations typically decreased considerably with depth and distance from the buildings. Inorganics that were detected above RSLs included:

  - **Aluminum** – Aluminum was detected at concentrations above the residential RSL and slightly above the established background level (40,041 mg/kg) in two subsurface soil samples [81027160 (1-2 ft bgs) and IASB13 (2-4 ft bgs)]. Aluminum was not detected at concentrations above background in any other surface soil or subsurface soil samples at the IAA.

  - **Arsenic –** Arsenic was detected above the background level and industrial RSL in 16 surface soil samples and 1 subsurface soil sample. The detected concentrations in these samples were typically only slightly above the established background level of 15.8 mg/kg. The maximum detected arsenic concentration (164 mg/kg) occurred in 1998 sample SS-12 next to Building 8102-6. During a later 1998 investigation, soil boring IASB4 was advanced at the SS-12 sample location. The results from surface soil and subsurface soil samples indicated that arsenic concentrations were below background.

  - **Barium** - Barium was detected above the residential RSL and established background level in nine surface soil samples. Three of the samples with detections above the residential RSL were collected adjacent to Building 8102-5 (SS-11, SS-11A, and SS-11b). The maximum detected barium concentration of 11,800 mg/kg at sample location SS-11A was also collected adjacent to Building 8102-5. The other samples that had barium concentrations above residential RSLs were collected with 1-3 ft of buildings with conductive flooring. Barium was not detected above RSLs in any subsurface soil samples.

- **Cadmium** – Cadmium was detected above background levels and the residential RSL in three surface soil samples collected within 1-ft of IAA buildings. Soil samples SS-011 (7.8 mg/kg) and IAA-SS015 (15.2 mg/kg) were collected adjacent to Building 8102-5, and soil sample IAA-SS033 (9.20 mg/kg) was collected adjacent to Building 522A. Cadmium was not detected above the industrial RSL in any samples

- **Chromium** – Chromium was detected above the residential RSL in 5 surface soil samples and above the industrial RSL in one subsurface soil sample [504360(1-2 ft bgs)]. All of the samples with chromium concentrations above applicable RSLs were collected in the vicinity of Buildings 502 and 504. The chromium concentrations in this area were above the residential RSL in samples collected up to 10-ft from the buildings.

- **Cobalt** – Cobalt was detected above the industrial RSL and above established background levels in three surface soil samples SS-11, SS-12, and IASB07 in the central portion of the IAA. No other surface soil samples or subsurface soil samples contained cobalt at concentrations above background.

- **Copper** – Copper, which is thought to have been a major component of the conductive flooring material, was the inorganic most frequently detected at concentrations above applicable RSLs.

    - Copper was detected above the residential RSL (310 mg/kg) in 34 surface soil samples and one subsurface soil sample collected during the course of investigation. The one subsurface soil sample that had a concentration above the residential RSL [504360 (1-2 ft bgs)] was collected from approx 1 to 2 ft bgs near Building 504. Copper was not detected above background levels in deeper samples collected in this area or any other area of the IAA.

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- § The detected copper concentrations in 12 surface soil samples were above the industrial RSL of 4,100 mg/kg. The samples with concentrations above industrial RSLs were all collected within 1 to 3 ft of buildings with conductive flooring material.

- § The highest detected concentration of copper (56,500 mg/kg) occurred at sample location SS-12, next to Building 8102-6 during a 1998 sampling event. Soil boring IASB4 was advanced at the SS-12 location later in 1998. The surface soil sample from IASB4 resulted in a copper concentration slightly above background, but below the residential RSL and the subsurface soil sample (collected from 5-6 ft bgs) had a copper concentration below the background level. Copper concentrations were also below residential RSLs in surface soil samples collected in this area during the 2002 investigation (IASS01 and IASS03).

- § The most widespread copper detections were found in soil samples collected around Buildings 502, 504, 522, and 522A in the southern portion of the IAA. Copper was detected above the residential RSL in 8 of the 34 soil samples collected in this area and included one sample (IAA-SS029) collected 10-ft from Building 502. The results of the XRF analysis indicated that this area also contained the most widespread lead concentrations above applicable RSLs.

o **Lead** – Lead is also believed to have been a major component of the conductive flooring material, and was the inorganic second most frequently detected at concentrations above applicable RSLs.

- § Lead was detected at concentrations above the residential RSL in 20 surface soil samples and 2 subsurface soil samples. Of these detections, 14 surface soil samples and both subsurface soil samples were also above the industrial RSL of 800 mg/kg. The maximum detected lead concentration (16,200 mg/kg) was detected at sample location 504360, which was collected near Building 504.

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- § Nine of the surface soil samples with concentrations above industrial RSLs were collected near Buildings 502, 504, 522, and 522A in the southern portion of the IAA (504312, 504336, 504360, IASB14, IAA-SS026, IAA-SS028, IAA-SS0029, IAA-SS032, and IAA-SS033). Two of the samples with concentrations above the residential RSL were also collected next to Building 504 (IASB15 and IAA-SS027). These samples were collected at distances up to 10-ft from the buildings in this area. The results of the XRF sampling also indicated that lead concentrations were highest in this area of the site.

- § The two subsurface soil samples with concentrations above the industrial RSL [504336 (1-2 ft bgs) and 504360 (1-2 ft bgs)] were collected adjacent to Building 504 at a depth of 1-2 ft bgs. Additional sampling conducted in this area indicated that lead concentrations in deeper soils were below residential RSLs. Lead was not detected above applicable RSLs in any other subsurface soil samples collected at the IAA.

- § Eleven surface soils collected from the central portion of the IAA also had lead concentrations above applicable RSLs. In general these samples were collected from distances of less than 5-ft from the main igniter assembly buildings. The XRF sampling from this area confirmed that the lead concentrations around these buildings were generally below residential RSLs.

- o **Iron** – Iron was detected above the residential RSL and background levels in five surface soil samples and three subsurface soil samples. The maximum detected concentration was 328,000 mg/kg at sample location IAA-SS028, which was collected 5 ft from Building 502.

- o **Mercury** – Mercury was detected in two surface soil samples at concentrations above industrial RSLs. Mercury was detected at a concentration of 3.30 mg/kg at 1997 sample location 502460 (0-1 ft bgs) next to Building 502. It was also detected at a concentration of 79.5 mg/kg in 2008 sample location IAA-SS022 next to Building 8102-

8. Mercury was not detected above residential RSLs in any other surface or subsurface soil samples at the IAA.

- **Nickel** – The nickel concentrations detected at the IAA were typically below the established background concentration of 62.8 mg/kg. However, the concentration in one surface soil sample collected adjacent to Building 504 [IAA-SS028 (213 mg/kg)] was above background and the residential RSL. Several other inorganics (arsenic, chromium, copper, iron, lead) were also detected at concentrations above screening levels at this location.

- **Zinc** – Zinc was detected above the established background level of 202 mg/kg in 38 surface soil samples and 2 subsurface soil samples. However, the detected concentrations were only higher than the residential RSL in 9 surface soil samples and 1 subsurface soil sample. Zinc was not detected above the industrial RSL in any surface or subsurface soil samples. The samples with elevated zinc concentrations typically occurred with 1 to 5 ft of buildings.

During the 2008 investigation, asbestos was detected in 20 of the 41 surface soil samples collected within 1-10 ft of the IAA buildings with conductive flooring. However, during the 2009 investigation it was demonstrated that while chrysotile asbestos fibers are present in the surface soil around IAA buildings, the concentrations are generally very low (i.e., 0.1% by weight or less). Only three samples during the 2009 investigation contained asbestos at a concentration above 1%. These samples, IAA8102-SS001 (17.2% asbestos by weight), IAA-SS044A (2.2% by weight), and IAA-SS045A (2.4% by weight) were all collected within 1 ft of IAA buildings where degraded conductive flooring material had washed off site buildings. Samples collected 5 ft away from the buildings at these locations all had asbestos concentrations of 0.1% by weight or less, which confirms that the asbestos impacts are largely confined to the surface soils located immediately adjacent to the buildings. Visual observation of the degraded flooring material that has washed off the building pads further indicates that it is generally confined to the soil immediately adjacent to the buildings.

While asbestos in soil is not inherently hazardous, the activity based sampling event conducted at the IAA demonstrated that intensive soil disturbance activities in areas located immediately adjacent to the buildings (i.e., areas where high concentrations of asbestos may be present in soil) has the potential to result in measureable concentrations of asbestos in air. TEM analysis conducted on personal air monitoring

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pump and perimeter air monitoring pump filter samples associated with activity based sampling in a grid located within 0-10 ft of IAA Building 8102-1 (where asbestos was detected in soil at a concentration of 17.2% by weight 1-ft from the building) indicated asbestos concentrations in air of 0.00783 s/cc and 0.0534 s/cc, respectively. Activity based sampling conducted in a grid located 10-20 ft from Building 8102-1, where asbestos concentrations in soil were below 0.1% by weight did not generate any measureable asbestos concentration in air. Similarly, activity based sampling at Building 5 at the IAA, where asbestos concentrations in soil were below 0.1% by weight, did not generate any airborne asbestos fibers.

In summary, the environmental investigations at the IAA have confirmed that soils surrounding several of the buildings have been affected by asbestos and the leaching of inorganics from the deteriorating conductive flooring material. Inorganics, primarily lead, arsenic, chromium, copper, and zinc have been detected at concentrations above applicable RSLs. The elevated inorganics concentrations are typically confined to soils in the immediate vicinity of the buildings (i.e., less than 5-ft distance from building footprint) with the exception of the area around Buildings 502, 504, 522, and 522A, where the elevated inorganics concentrations extend up to 15-ft from the buildings in some locations. Subsurface sampling has confirmed that the elevated concentrations are confined to surface soil, as no samples deeper than 2-ft bgs contained inorganics at concentrations above background levels and residential RSLs. Elevated asbestos concentrations are also confined to surface soils located immediately adjacent to the buildings with conductive flooring. The PCBs and PAH compounds that were detected above applicable RSLs have been delineated and are isolated to very small areas.

7.5.1.2 Former Transformer Area Assessment

Eight samples were collected from locations of former pole mounted transformers in 2002 (IATR01 through IATR08). With the exception of the transformer at the IATR04 sample location, the transformers are no longer present at the site and little to no physical evidence (i.e., pole stumps, staining, or stressed vegetation) of the transformer locations remain. Therefore, the sample locations, depicted in Figure 7-2, were selected based on a base utility drawing dated April 1942. The analytical results for the transformer area samples are presented in Table 7-12. The analytical results indicated that the PCB Aroclor 1260 was detected at a concentration of 0.40 mg/kg at sample location IATR07. This concentration is slightly higher than the residential RSL for Aroclor 1260 of 0.24 mg/kg. No other PCBs were detected at any of the other transformer area sample locations. A site map depicting the sample results at the transformer sample locations is presented in Figure 7-7 through Figure 7-9.

7.5.2 Sediment

There are no surface water bodies or aquatic habitats in the immediate vicinity of the IAA. However, there are several drainage ditches located within the boundaries, and on the perimeter, of the IAA. During the course of environmental investigation at the IAA, samples have been collected from the drainage pathways to evaluate the potential for runoff from the buildings and other areas of the site to have transported constituents into the ditches. The samples collected from the drainage ditches have been called sediment samples due to the loose nature of some of the material, but would be more accurately classified as surface soil. The drainage ditches were all dry at the time of sampling.

Two samples (IASD11 and IASD12) were collected during a 2002 site investigation from the storm water drainage swales that capture runoff from around the main igniter assembly buildings. These swales were designed to capture runoff from the central portion of the IAA that does not infiltrate into the flat grassy areas between the buildings; therefore, the swales would be a likely depositional point for any constituents of concern transported from the buildings by rain water runoff. These sample were analyzed for a full suite of analytes, including explosives, pesticides, PAHs, PCBs, VOCs, SVOCs, and inorganics. The analytical results from these samples indicated that no explosives, pesticides, herbicides, PCBs, or VOCs were detected at concentrations above applicable residential RSLs. Several PAHs were detected in both samples; however, only benzo(a)pyrene was detected in both samples at concentrations above residential RSLs. Inorganics analysis indicated that lead and zinc were detected at concentrations above applicable background levels in IASD12, but that only lead (643 mg/kg) was present at concentrations above the residential RSL. Lead was also detected at a concentration slightly above background in IASD11, but below the residential RSL.

During the 2008 site investigation, samples were collected from the drainage ditch downgradient of the IASD12 sample location. The samples were field screened for lead using XRF (IAA-SE001X through IAA-SE006X). Two samples (IAA-SE003 and IAA-SE004) were also submitted for laboratory analysis of TAL metals. The results of both the field screening and laboratory analysis indicated that lead was present at concentrations slightly above background, but below residential RSLs. No other inorganics were detected at concentrations above background levels.

Seven sediment samples (IASD4 through IASD10) were also collected during the 2002 site investigation from drainage pathways or culverts that control surface water runoff

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in the vicinity of the expanded IAA. These samples were spaced around the perimeter of the IAA, further away from the assembly buildings than IASD11 and IASD12. The samples were analyzed for a full suite of analytes, including explosives, pesticides, PCBs, VOCs, SVOCs, and TAL metals. The analytical results indicated the following:

- No explosives, pesticides, PCBs, or VOCs were detected at concentrations above applicable residential RSLs.

- Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene were detected at concentrations above the industrial RSL at sample location IASD09. This sample was collected from a drainage culvert that passes under Cameron Road in the southern portion of the IAA.

- Benzo(a)pyrene was detected at a concentration above the industrial RSL at sample location IASD10. Benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene were also detected at concentrations above the residential RSL at IASD10. This sample location was also collected from a drainage culvert that passes under Cameron Road in the southern portion of the IAA.

- Benzo(a)pyrene was also detected at concentrations above the residential RSL at samples IASD05, and IASD06.

- Lead was detected at a concentration above the industrial RSL at sample location IASD06 (884 mg/kg). No other inorganics were detected at concentrations above applicable RSL and background levels.

During the 2008 site investigation, samples were collected from the drainage ditch downgradient of the IASD6 sample location. The samples were field screened for lead using XRF (IAA-SE007X through IAA-SE009X). Two samples (IAA-SE001 and IAA-SE002) were also submitted for laboratory analysis of TAL inorganics. The results of both the field screening and laboratory analysis indicated that lead was present at concentrations slightly above background, but below residential RSLs. No other inorganics were detected at concentrations above background levels.

A site map depicting the analytical results from the sediment sampling activities is presented in Figure 7-11.

7.5.3 Surface Water

There are no surface water bodies (i.e. streams or ponds) in the vicinity of the IAA, and the area drainage ditches only carry surface water runoff during very heavy rainfall events; therefore, no true surface water samples were collected during the investigation of the IAA. However, one water sample (IAA-VTLW01) was collected at the IAA from ponded water within a subsurface concrete vault located below a sidewalk adjacent to Building 522. The sample location is depicted in Figure 7-11. Sample IAA-VTLW01 was submitted for laboratory analysis of VOCs, SVOCs/PAHs, and TAL inorganics. Acetone was detected at an estimated concentration of 0.0051 mg/L which is below the tap water RSL of 22 mg/L. No other VOCs and no SVOCs (PAHs) were detected in the sample. Inorganics detected in the sample were all at concentrations below respective tap water RSLs.

7.5.4 Conductive Flooring and Building Materials

Conductive flooring material is present on 27 of the 35 building pads at the IAA. Results of the conductive flooring survey indicate that there is approximately 25,000 ft^2 of conductive flooring present on building pads at the IAA. The condition of the flooring during the 2008 investigation ranged from mostly intact to highly deteriorated. Based on the flooring characterization sampling events, the flooring is known contain aluminum, arsenic, barium, chromium, copper, iron, lead, and zinc; as well as several other inorganics that have been identified in soils at the IAA. The flooring material is also known to contain asbestos.

While very little paint remains on the concrete walls of the IAA buildings, the two paint chip samples collected in 2005 and analyzed for lead did indicate that the paint contained lead. The reported lead concentrations in both of the samples (e.g., IAPC02 [37,200 mg/kg) and IAPC03 [49,500 mg/kg]) were greater than 0.5% by weight (i.e., 5,000 mg/kg) which is the minimum concentration that the federal government uses to define lead based paint in residences (40 CFR 745.223).

7.6 Risk Assessment Datasets

Data generated from the site characterization activities were used in the risk assessment. Risk assessment datasets for soil, sediment, and surface water for the IAA were prepared then summarized and statistically analyzed per methods described in Appendix A. Risk assessment datasets summaries highlighting the number of detects, number of samples, FOD, minimum and maximum detected concentrations, minimum and maximum detection limits, and EPC are presented in Tables 7-17 through Table 7-20.

7.7 Human Health Risk Assessment

The purpose of this risk assessment is to evaluate the potential current and future risks and hazards to human health associated with constituents detected in soil and sediment samples collected at the IAA. No surface water samples were collected at the IAA; as a result, this medium was not evaluated. The general risk assessment approach follows the Radford Army Ammunition Plant Final Master Work Plan (URS 2003) as presented in Appendix A. The approach for evaluating the risks associated with asbestos in soil is somewhat different than the other constituents at the site. The approach for evaluating asbestos is presented in detail in Section 4.4.5 of Appendix A.

7.7.1 Selection of Constituents of Potential Concern

This section discusses the selection of COPCs for the HHRA for each medium at the IAA.

7.7.1.1 Surface Soil

Surface soil COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for residential soil. Table 7-21 presents the selection of surface COPCs for the HHRA. As summarized in Table 7-21, 27 constituents were identified as COPCs in surface soil:

- **VOCs:** 3-octanone and d-limonene;
- **SVOCs:** carbazole, 2,4-dinitrotoluene, and bis(2-ethylhexyl)phthalate
- **PAHs:** benzo[a]anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene;
- **PCBs:** Aroclor 1254 and Aroclor 1260; and
- **Inorganics:** aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, mercury, nickel, and zinc.

In addition to the constituents listed above, asbestos has been identified as a COPC for surface soil at the IAA. Soil sampling conducted at the site has confirmed the presence of asbestos in soil immediately adjacent to site buildings where conductive flooring has washed off the building pads. While asbestos fibers in soil are not inherently hazardous, activity based sampling has indicated that intensive soil disturbance activities in the areas located immediately adjacent to the buildings, where soil asbestos concentrations are highest, have the potential to generate measureable concentrations of asbestos in air.

7.7.1.2 Combined Surface and Subsurface Soil

Combined surface and subsurface soil COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for residential soil. Table 7-22 presents the selection of combined surface and subsurface soil COPCs for the HHRA. As summarized in Table 7-22, 27 constituents were identified as COPCs in combined surface and subsurface soil:

- **VOCs:** 3-octanone and d-limonene;
- **SVOCs:** carbazole, 2,4-dinitrotoluene, and bis(2-ethylhexyl)phthalate;
- **PAHs:** benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene;
- **PCBs:** Aroclor 1254 and Aroclor 1260; and
- **Inorganics:** aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, mercury, and nickel.

7.7.1.3 Sediment

Sediment COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for residential soil. Table 7-23 presents the selection of sediment COPCs for the HHRA. As summarized in Table 7-23, six constituents were identified as COPCs in sediment: aluminum, arsenic, cobalt, iron, manganese, and vanadium.

7.7.2 Human Health Risk Characterization

Although not currently occupied, under current land use conditions, site workers were identified as a potential receptor due to the industrial use of the IAA and surrounding area. Assuming hypothetical redevelopment of the area for residential land use, construction workers, adult and child residents were identified as potential receptors.

Exposure to COPCs in soil and sediment were evaluated for direct contact. VOCs identified as COPCs in the IAA were also evaluated for inhalation via vapor migration into buildings. Two VOCs, 3-octanone and d-limonene, were identified as soil COPCs at the IAA. Those two COPCs do not have identified inhalation toxicity values; therefore, the indoor vapor intrusion pathway could not be assessed at this Study Area. In addition, potential risks associated with inhalation of asbestos becoming airborne from soil were estimated. These are summarized in Section 7.7.3. Uncertainties associated with potential risk from exposure to 3-octanone and d-limonene were discussed in Appendix A. The EPCs for the IAA are provided in Table 7-24.

The ELCRs and non-cancer hazards and the estimated blood lead levels for each potentially exposed receptor included in the risk assessment for the IAA are presented in Appendix A and are summarized in Tables 7-25 and 7-26, respectively. These results are presented in the tables below and are discussed by receptor in following subsections.

Summary of Calculated ELCRs and HIs for Receptor Exposure Scenarios

RECEPTOR/ EXPOSURE MEDIUM – SCENARIO	ELCR	HI
Site Worker		
Surface Soil - Direct Contact	1E-04	1
Sediment – Wading	8E-07	0.01
TOTAL SITE RISKS (Site Worker):	**1E-04**	**1**
Hypothetical Future Construction Worker		
Combined Surface and Subsurface Soil - Direct Contact	6E-06	3
TOTAL SITE RISKS (Construction Worker):	**6E-06**	**3**
Hypothetical Future Adult Resident		
Combined Surface and Subsurface Soil - Direct Contact	**-**	1
Sediment – Wading	-	0.02
TOTAL SITE RISKS (Adult Resident):	-	**1**

Summary of Calculated ELCRs and HIs for Receptor Exposure Scenarios (continued)

RECEPTOR/ EXPOSURE MEDIUM – SCENARIO	ELCR	HI
Hypothetical Future Child Resident		
Combined Surface and Subsurface Soil - Direct Contact	-	13
Sediment – Wading	-	0.1
TOTAL SITE RISKS (Child Resident):	**-**	**13**
Hypothetical Future Resident (Adult and Child)		
Combined Surface and Subsurface Soil - Direct Contact	5E-04	-
Sediment – Wading	3E-06	-
TOTAL SITE RISKS (Resident):	**5E-04**	**-**

Summary of Estimated Blood Lead Levels for Receptor Exposure Scenarios.

RECEPTOR	**Estimated Blood Lead Level (µg/dL)**		
	Adult	**Child**	**Fetus**
	50th percentile	**Range**	**95th percentile**
Site Worker	2.8	–	10
Hypothetical Future Construction Worker	2.8	–	10
Hypothetical Future Child Resident	–	4.4 – 8.2	–
Hypothetical Future Adult Resident	3.2	–	11

*See Appendix A for individual tables.

7.7.2.1 Site Worker

A current or future site worker could be present at the IAA area, and could be exposed to surface soil or sediment. The ELCR and non-cancer hazard index for site worker exposure to each medium are presented in Appendix A, and are summarized in Table 7-25. As presented in the table above, the ELCRs for surface soil and sediment are all below or equal to the high end of the USEPA target risk range, and the HIs for each medium are all below or equal to the benchmark value of 1.

The total cumulative ELCR for site workers exposed to surface soil and sediment at the IAA is 1×10^{-4}, which is at the high end of the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for site workers is 1, which is at the benchmark of 1. The 50th percentile blood lead level estimates for the site worker receptor was at 2.8

µg/dL which is well below the benchmark of 10 µg/dL. The 95th percentile fetal blood lead levels (9.9 µg/dL) was equivalent to the benchmark of 10 µg/dL.

7.7.2.2 Hypothetical Future Construction Worker

A hypothetical future construction worker could be present at the IAA area, and could be exposed to combined surface and subsurface soil. The total cumulative ELCR for hypothetical future construction workers exposed to combined surface and subsurface soil at the IAA was 6×10^{-6}, which is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for hypothetical future construction workers is 3, which is above the benchmark of 1. When the HI is segregated into target site and critical effects, hazards were all below or equal to the benchmark of 1. The 50th percentile blood lead level estimates for the construction worker receptor was at 2.8 µg/dL which is well below the benchmark of 10 µg/dL. The 95th percentile fetal blood lead levels estimated (9.9 µg/dL) was equivalent to the benchmark of 10 µg/dL.

7.7.2.3 Hypothetical Future Residents

A hypothetical future resident could be present at the IAA area, and could be exposed to combined surface and subsurface soil and sediment. The ELCR and non-cancer hazard index for hypothetical future adult and child resident exposure to each medium are presented in Appendix A and are summarized in Table 7-25.

The ELCR for sediment is within the USEPA target risk range; however, the ELCR for combined surface and subsurface soil is greater than the USEPA risk range. The HIs for each medium are all at or below the benchmark value of 1, with the exception of child resident exposure to combined surface and subsurface soil.

The total cumulative ELCR for hypothetical future residents exposed to combined surface and subsurface soil and sediment at the IAA is 5×10^{-4}, which is slightly above the USEPA target risk range of 1×10^{-6} to 1×10^{-4}.The primary risk driver is 2,4-dinitrotoluene in soil. Other contributors to the excess lifetime cancer risks were benzo(a)pyrene, Aroclor 1254, and arsenic.

The total cumulative HI for hypothetical future adult residents is 1, which is equal to the benchmark. When the hazards were segregated by target organ or critical effect, all of the HIs were less than 1. The total cumulative HI for hypothetical future child residents is 13, which is above the benchmark of 1. When the HI is segregated into target site and critical effects, hazards were greater than the benchmark of 1 in the central nervous system, whole body, and immune system, in the blood, in the gastrointestinal tract, and in the eyes, nails, hair, and skin. The risk drivers for non-cancer hazard are Aroclor 1254, copper, 2,4-dinitrotoluene, and cobalt.

The 50th percentile blood lead level estimates for the hypothetical adult resident receptor was calculated to be 3.2 µg/dL which is well below the benchmark of 10 µg/dL, and the 95th percentile fetal blood lead levels was calculated to be 11 µg/dL slightly above the benchmark of 10 µg/dL, as seen in Table 7-26. The range of annual mean blood lead level estimates over seven years for the child receptor was 4.4µg/dL to 8.2 µg/dL, which is below the benchmark of10 µg/dL. However, exposure of a child over a seven year period resulted in a geometric mean blood lead concentration of 6.4 µg/dL, below the 10 µg/dL benchmark, but a prediction of 17 percent of the population having blood lead concentrations above the 10 µg/dL benchmark.

7.7.3 Asbestos Evaluation

As discussed in Appendix A, the risks and hazards associated with asbestos in soil cannot be evaluated utilizing traditional risk assessment techniques. This is because the measurement of asbestos in soils may not be a good indicator of potential for exposure due to the fact that the main route of asbestos toxicity is through inhalation of fibers. Thus, the important metric in defining potential risk is the measurement of asbestos fibers in air within a breathable zone. Based on this information, USEPA recommends that the results of activity-based air sampling be utilized to determine whether disturbance of soils in areas known to contain asbestos can result in the mobilization of asbestos into air at potential hazardous levels where it may be inhaled by the individuals engaged in activities there.

To evaluate the results of the activity based sampling conducted at the IAA in 2009, AALs have been developed for relevant, site-specific, exposure scenarios in accordance with the methods outlined in the USEPA's Framework for Investigating Asbestos-Contaminated Superfund Sites (2008f). AALs were calculated for all of the exposure scenarios identified at the IAA including the current and future site worker, the hypothetical future construction worker, the hypothetical future adult resident, and the hypothetical future child resident. The AALs were calculated for each potential receptor group at the 1E-06 and 1E-04 risk levels, representing the lower and upper ends of USEPA's acceptable risk range. The calculation of the AALs is presented in detail within Section 4.4.5 of Appendix A. The calculated AALs are presented in the following table.

	Calculated AAL (s/cc) at Indicated Target Risk Level	
Receptor Group	Target Risk = 1E-06	Target Risk = 1E-04
Current/Future Site Worker	0.00007	0.007
Hypothetical Future Construction Worker	0.002	0.2
Hypothetical Future Child Resident	0.00002	0.002
Hypothetical Future Adult Resident	0.00001	0.001

The results of the activity based sampling conducted at IAA Building 5 indicated that no airborne asbestos fibers were detected for either of the two sampling grids at this building. The results of the activity based sampling event at IAA Building 8102-1 also indicated that no airborne asbestos fibers were detected in the sampling grid located 10-20 ft from the edge of the buildings, where asbestos concentrations in soil were <0.1%. However, airborne asbestos fibers were detected in both the personal air monitoring pump sample (IAA8102-AA1) and the perimeter air monitoring pump sample (IAA8102-AP1) collected from the activity based sampling grid located 0-10 ft from Building 8102-1 (asbestos had been detected in soil within the grid at a concentration of 17.2% by weight 1-ft from the edge of the building). The airborne concentrations were 0.00783 s/cc and 0.0534 s/cc for the personal air monitoring pump and perimeter air monitoring pump sample, respectively. The average concentration in air at Building 8102-1 was 0.015 s/cc using the two detections and two non-detect results. The detected concentrations in the two samples collected adjacent to Building 8102 and the overall average for Building 8102 exceed the AAL of 0.007 s/cc (based on a 1E-04 risk level) calculated for the current and future site worker, as well as the range of AALs calculated for hypothetical future residents. They do not exceed the AAL of 0.2 calculated for the hypothetical future construction worker.

These results indicate that the presence of high asbestos concentrations in soils adjacent to Building 8102, and other IAA buildings where conductive flooring may have contributed to elevated asbestos concentrations in soil, may result in unacceptable air concentrations if those soils are subject to intensive disturbance. These unacceptable risks would be expected under the current/future industrial scenario and hypothetical future residential exposure scenarios.

7.7.4 Human Health Risk Summary

Table 7-25 summarizes the calculated cancer risks and non-cancer hazards for each potential exposure scenario included in the risk assessment for the IAA. The total ELCR values for all surface soil, combined surface and subsurface soil and sediment exposures for each exposure scenario are below or within the benchmark range of 10^{-6} to 10^{-4} for cancer risk, with the exception of hypothetical future adult and child resident exposure to combined surface and subsurface soil. The primary risk driver is 2,4-dinitrotoluene. However, benzo(a)pyrene, Aroclor 1254, and arsenic also contributed to the elevated residential risks.

The total HI values for all surface soil, combined surface and subsurface soil, and sediment exposures for each exposure scenario are below or equal to the benchmark of 1 for non-cancer hazard, with the exception of hypothetical future construction worker and hypothetical future child resident exposure to combined surface and subsurface soil. When the HI is segregated into target site and critical effects for the hypothetical future construction worker, hazards were all below or equal to the benchmark of 1. The primary contributors to the hazards above 1 for the hypothetical future child resident are 2,4-dinitrotoluene, Aroclor 1254, copper, and cobalt.

The results of the risk assessment indicate that under industrial exposure scenarios the calculated excess lifetime cancer risks, noncancer hazards, and predicted blood lead levels were all within target risk ranges or less than or equal to benchmarks.

The results of the risk assessment for hypothetical future residential receptors indicated that 2,4-dinitrotoluene, Aroclor 1254, cobalt, and lead were COCs for both adult and child residents due to detections in soil. While 2,4-dinitrotolune was identified as a potential risk driver in soil for the residential scenario, it should be noted that this compound was detected in only two samples at the IAA. These samples were from the same location during the initial sampling event at the site, and no other detections occurred in subsequent events. Similarly, cobalt was only detected outside of the background range in one sample. As such, cobalt and 2,4-dinitrotoluene are not considered drivers for remediation at the site. Aroclor 1254 was detected in 18 of 61 surface soil samples with concentrations ranging from 0.03 to 12 mg/kg. Only three samples exceeded the industrial RSL of 0.74 mg/kg and six samples exceeded the residential RSL of 0.22 mg/kg.

As discussed in Section 7.5, removal of the walls and roofs of the buildings has exposed the conductive flooring to weather, causing it to degrade and wash onto the surrounding soils. Activity based sampling conducted at the IAA has demonstrated that intensive disturbance of the soils located immediately adjacent to the buildings where the flooring has washed off the building pads has the potential to generate airborne asbestos concentrations that may present an unacceptable risk to human receptors under current and hypothetical future industrial and/or residential land use scenarios. Soil sampling at the IAA has indicated that the elevated concentrations of asbestos in soil that have the potential to generate the airborne asbestos concentrations are primarily located immediately adjacent to (i.e. within 1-ft) the site buildings, which is the same general area where the elevated inorganics concentrations are located.

While not evaluated in the risk assessment any residual lead based paint on the concrete walls at the IAA or other possible asbestos containing building materials (i.e., pipe insulation, joint compounds, mastic, etc.) could also present a risk for current and future site workers, construction workers, or residents.

7.8 Ecological Risk Assessment

The purpose of the ERA is to evaluate whether ecological receptors may be adversely impacted by exposure to site-related constituents detected in surface soil, sediment, and surface water at the IAA. This section summarizes the occurrence of constituents in each medium and identifies COPECs at the IAA for the ERA; identifies the potential ecological exposure scenarios relevant to the IAA; and presents the estimated ecological risks associated with the identified COPECs and the relevant ecological exposure scenarios at the IAA. Methodologies for data summary and selection of COPECs, exposure assessment, and toxicity assessment for the ERA are presented in Appendix A.

7.8.1 Selection of Constituents of Potential Ecological Concern

This section discusses the selection of COPECs for each medium. Risks to ecological receptors are calculated by dividing the exposure estimates (i.e., the maximum detected concentrations) by the conservative ESLs. The resulting ratio, the hazard quotient (HQ), is a conservative surrogate for the assessment endpoints identified in

Appendix A. HQs equal to or less than a value of 1 (to one significant figure) indicate that adverse ecological effects are unlikely (USEPA 1997c). HQs greater than 1 indicate that further evaluation is warranted. Therefore, the constituents with HQs greater than 1 or that are bioaccumulative are carried forward as COPECs into the BERA. Maximum HQs greater than 1 for the IAA are summarized in the subsections below.

7.8.1.1 Surface Soil

Surface soil COPECs were selected by comparing the analytical data with USEPA (2005b) EcoSSLs, USEPA (2003e) Region 5 ESLs, and ORNL values (Efroymson et al. 1997a,b) for surface soil. Table 7-27 presents the selection of surface soil COPECs for the ERA. As summarized in Table 7-27, 53 constituents were identified as COPECs in surface soil:

- **VOCs:** 3-octanone and d-limonene;
- **SVOCs:** 2,4-dinitrotoluene, benzoic acid, bis(2-ethylhexyl)phthalate, carbazole, dibenzofuran, diethylphthalate, and di-n-butylphthalate;
- **Explosives:** nitroglycerine;
- **Pesticides:** 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, beta-BHC, delta-BHC, alpha-chlordane, dieldrin, endosulfan II, endrin, heptachlor epoxide, and methoxyclor,
- **PAHs:** acenaphthene, acenaphthylene, anthracene, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[g,h,i]perylene, benzo[k]fluoranthene, chrysene, dibenzo[a,h]anthracene, fluoranthene, fluorene, indeno[1,2,3-cd]pyrene, naphthalene, phenanthrene, and pyrene
- **PCBs:** Aroclor 1254 and Aroclor 1260; and
- **Inorganics:** antimony, arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, mercury, nickel, selenium, silver, and zinc.

7.8.1.2 Sediment

Sediment COPECs were selected by comparing the analytical data with ESLs from the following sources in order of priority: USEPA (2009a) Region 3 Sediment Screening Levels; ORNL values (Jones et al. 1997); and USEPA (2003e) Region 5 Ecological Screening Levels for sediment. Table 7-28 presents the selection of sediment COPECs for the ERA. The following constituents were selected as COPECs in sediment:

- **Inorganics:** arsenic, barium, beryllium, cadmium, chromium, copper, iron, lead, nickel, vanadium, and zinc

7.8.2 Summary of Selected Constituents of Potential Ecological Concern

Fifty-three constituents were selected as COPECs in surface soil and eleven constituents were selected as COPECs in sediment because the HQs were greater than 1, the chemical was bioaccumulative, or an HQ could not be calculated because an ESL was not available.

7.8.3 Refinement of Risk Calculations for Direct Contact COPECs

The list of COPECs identified in the BERA was reevaluated by calculating refined HQs. The refined HQs were calculated for the COPECs identified in the SLERA using refined EPCs. Constituents identified as COPECs in the BERA that were bioaccumulative were carried forward into food chain models. The results of the recalculation of the HQs for the BDDT are summarized in the subsections below.

7.8.3.1 Surface Soil

Fifty-three COPECs in surface soil were carried forward into the BERA. When refined EPCs were compared with the ESLs, 15 constituents [2,4-dinitrotoluene, bis(2-ethylhexyl)phthalate, diethylphthalate, di-n-butylphthalate, benzo(a)pyrene, naphthalene, antimony, barium, cadmium, chromium, cobalt, copper, lead, mercury, and zinc] had a refined HQ greater than 1. In addition, ESLs were not available for 9 other constituents (3-octanone, d-limonene, benzoic acid, carbazole, dibenzofuran, nitroglycerine, Aroclor 1254, Aroclor 1260, , and iron). The BERA results for surface soil COPECs at the IAA are presented in Table 7-29 and are discussed in Appendix A. The results of the refined analysis indicate that adverse effects to wildlife due to potential COPEC exposure are considered unlikely.

Of the COPECs thirty-six were identified as bioaccumulative and were evaluated in the terrestrial food chain model.

7.8.3.2 Sediment

Eleven COPECs in sediment were carried forward into the BERA. When refined EPCs were compared with the ESLs, only one constituent, iron, had a refined HQ greater than 1. In addition, ESLs were not available for three other constituents (barium, beryllium, and vanadium). The BERA results for sediment COPECs at the IAA are presented in Table 7-30 and are discussed in Appendix A in detail. The inorganics, barium, iron, and vanadium, were present at background levels. Six constituents were also defined as bioaccumulative.

7.8.4 Refinement of Assessment and Measurement Endpoints for Bioaccumulative COPECs

Food chain modeling was conducted at the IAA in order to evaluate the potential ecological effects of the bioaccumulative COPEC in soil on the receptors identified in Appendix A. COPECs identified in soil and sediment were evaluated in the terrestrial and aquatic food chains, respectively. The results for both the maximum and refined scenarios of the food chain models are presented in Appendix A, and the results of each of the refined scenarios are discussed in detail in Appendix A.

7.8.4.1 Terrestrial Food chain Model

As summarized in Table 7-31, the refined scenario NOAEL and LOAEL HQs for the short-tailed shrew were generally low, but there were a few values above 1. These results are discussed in more detail in Appendix A. Based on the overall analysis of terrestrial food chain modeling HQs and consideration of the limited spatial extent of affected soils, adverse effects are not expected for short-tailed shrew (and other insectivorous mammals) and American robin (and other insectivorous birds) populations exposed to bioaccumulative COPECs in soil at the IAA.

7.8.4.2 Aquatic Food Chain Model

The results of the aquatic food chain model indicate that all HQs were below 1 for both great blue heron and mink (see Appendix A) with the exception of the zinc NOAEL HQ for mink which was 2. Given the very low exceedance and the conservatism inherent in the assessment, it was concluded that the area was unlikely to pose a significant adverse ecological impact to ecological receptors at the population-level.

7.8.5 Ecological Risk Summary

Screening-level and baseline risk assessments were completed for the IAA. After the SLERA, 53 constituents were selected as COPECs in surface soil, and 11constituents were selected as COPECs in sediment because the HQs were greater than 1, the chemical was bioaccumulative, or an HQ could not be calculated because an ESL was not available. After the BERA, all constituents in surface soil, and 10 constituents in sediment were retained. Food chain modeling was evaluated for all those constituents identified as bioaccumulative.

Tables 7-31 and 7-32 summarize the results of the food chain models, indicating a few exceedances. However, when these results are considered in conjunction with pertinent site information on the limited spatial distribution and extent of these constituents in surface soil, the potential for population-level effects is low.

Based on the overall analysis of the ERA for the IAA, the results indicate that adverse population-level effects are not expected for wildlife at the site.

7.9 IAA Summary and Conclusions

The IAA was formerly used for igniter assembly operations and the shipping and receiving of materials. Approximately 36 buildings located within the IAA were connected by raised concrete walkways, gravel paths, and paved roads. Site reconnaissance activities concluded that 29 of the buildings at the IAA contained a conductive flooring material similar to that used at the BLA. Like the BLA, all wooden roofs and walls have been removed from the IAA buildings. Exposure to the weather has caused the conductive flooring material to deteriorate into a red powder like substance and wash off onto surrounding soils.

Environmental investigations conducted at the IAA between 1997 and 2008 focused on evaluating the effects that the deteriorating conductive flooring material and historical site operations have had on the soils surrounding the IAA buildings. Soil samples were also collected at former electrical transformer locations, and from area drainage ditches. A water sample was also collected from an underground utility vault at Building 522. Laboratory analyte classes varied between the investigation activities but have included explosives, herbicides, pesticides, PAHs, PCBs, VOCs, SVOCs, TAL inorganics, asbestos, TCLP-inorganics, and lead-based paint analysis. An extensive soil sampling program was also conducted in 2008 that included screening 475 soil samples around IAA buildings for lead using XRF.

Igniter Assembly Area

The primary constituents of concern identified during the investigation at the IAA are associated with the deteriorating conductive flooring in the remains of the former IAA buildings. Inorganics, including, arsenic, barium, cadmium, cobalt, copper, iron, lead, mercury, nickel, and zinc have been detected in surface soil samples collected around the IAA buildings. Lead and copper, which are believed to have been the primary components of the conductive flooring material were the most frequently detected constituents at elevated concentrations. The 2008 sampling activities confirmed that the elevated inorganics concentrations are generally limited to surface soils (i.e., 0-1 ft bgs) immediately adjacent to (i.e. within 1 to 5 ft of) buildings with conductive flooring material; although, the elevated concentrations extend up to 15 ft from Buildings 502, 504, 522, and 522A in the southern portion of the IAA. Subsurface soil sampling activities at the IAA have indicated that the elevated inorganics concentrations associated with the flooring material are generally confined to the interval from 0 to 1 ft bgs. Only two subsurface soil samples collected from 1 to 2 ft bgs next to Building 504 had flooring related inorganics constituents (i.e., chromium, copper, lead, and zinc) at concentrations above applicable screening levels and background concentrations. Deeper samples collected from this and other areas of the site did not contain any flooring related inorganics at concentrations above applicable RSLs and background levels. Aluminum, which is not related to the flooring material was detected in two subsurface soil samples at concentrations above the residential RSL and slightly above background levels. The results of TCLP analysis of soil samples collected around IAA buildings in 2008 indicated that no constituents were present at concentrations above applicable TCLP screening levels.

Asbestos, another component of the conductive flooring and possibly other IAA building materials (e.g., pipe insulation, joint compounds, mastic, roofing materials), has been identified in surface soils surrounding the various IAA buildings. The results of the 2008 investigation indicated that the asbestos is confined to surface soils located within 1 to 5 ft of the buildings with the conductive flooring material.

The PCBs Aroclor 1254 and Aroclor 1260 were detected at concentrations above applicable screening levels in a few isolated surface soil samples collected adjacent to IAA Buildings 502, 504, 8101, 8102-5, and 8102-A. Several SVOC/PAH compounds were also detected in isolated surface soil samples at concentrations above applicable RSLs, including: bis(2-ethylhexyl)phthalate, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

Igniter Assembly Area

The 2002 investigation at the IAA included the collection of samples from eight former transformer locations to identify potential PCB releases. The results indicated that Aroclor 1260 was detected at a concentration slightly above the residential RSL at one location (IATR07) in the southeast portion of the IAA. PCBs were not detected above applicable screening criteria at any of the other sample locations.

No herbicides, pesticides, or VOCs were detected in IAA soils at concentrations above applicable RSLs.

The explosive compound 2,4-dinitrotoluene (DNT) was detected at concentrations above the soil RSL in two samples from a single boring location near Building 504 during the 1997 site investigation. This constituent was not detected during any of the subsequent investigations, including samples collected near the location of the original 1997 detection.

Soil/sediment samples were collected from IAA drainage ditches during the 2002 site investigation to evaluate whether constituents were being transported from the building areas. The analytical data indicated that several of the samples collected adjacent to area roadways contained PAHs, including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene at concentrations approaching, and in some cases above applicable RSLs. As PAHs were only present in isolated surface soil samples at the IAA, these detections can likely be attributed to the asphalt from the paved road. Lead was also detected at concentrations above applicable RSLs in two samples collected from ditches that transport water from the main building area of the IAA. Additional sampling conducted in these drainage ditches during the 2008 site investigation indicated that the lead concentrations were only slightly above background and were below applicable screening levels; therefore, the previous lead detections in these areas were likely isolated and not indicative of transport within the ditches.

One water sample collected from an underground utility vault at Building 522 in 2008 did not contain any constituents at concentrations above tap water RSLs. No other surface water samples were collected during the IAA investigation, as there are no surface water bodies in the vicinity of the IAA. The drainage ditches at the IAA only carry water during heavy rainfall events.

An HHRA was conducted at the IAA to evaluate potential exposures associated with site constituents to humans. Site worker exposures to surface soil and sediment were evaluated under current and future land-use conditions; and construction worker, adult resident, and child resident exposures to total soil and sediment were evaluated under future land-use conditions.

The soil and sediment COPCs were evaluated for direct contact. VOCs identified as COPCs in the IAA were also evaluated for inhalation via vapor migration into buildings. Two VOCs, 3-octanone and d-limonene, do not have identified inhalation toxicity values; therefore, the indoor vapor intrusion pathway could not be assessed at this Study Area.

A current or future site worker could be present at the IAA area, and could be exposed to surface soil or sediment. The total cumulative ELCR for site workers exposed to surface soil and sediment at the IAA is 1×10^{-4}, which is at the high end of the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for site workers is 1, which is equal to the benchmark of 1. Lead was also evaluated as a COPC for the site worker scenario, although the results are reported differently than those for the other COPCs. The predicted worker blood lead levels were below the benchmark and the predicted fetal lead level was equal to the benchmark.

A hypothetical future construction worker could be present at the IAA area, and could be exposed to combined surface and subsurface soil. The total cumulative ELCR for hypothetical future construction workers exposed to combined surface and subsurface soil at the IAA was 6×10^{-6}, which is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for hypothetical future construction workers is 3, which is above the benchmark of 1. The predicted worker blood lead levels were below the benchmark and the predicted fetal lead level was equal to the benchmark.

The total cumulative ELCR for hypothetical future residents exposed to combined surface and subsurface soil and sediment at the IAA is 5×10^{-4}, which is slightly above the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The primary contributor to risk estimates is 2,4-dinitrotoluene in soil. Other contributors to the excess lifetime cancer risks were benzo(a)pyrene, Aroclor 1254, and arsenic.

The total cumulative HI for hypothetical future adult residents is 1, which is equal to the benchmark. The predicted adult resident blood lead levels were below the benchmark of 10 µg/dl, and the predicted fetal lead level was slightly greater than the benchmark.

The total cumulative HI for hypothetical future child residents is 13, which is above the benchmark of 1. When the HI was is segregated by target site and critical effects, hazards were greater than the benchmark of 1 due to the presence of Aroclor 1254, cobalt, and 2,4-dinitrotoluene. The predicted blood lead levels were all below the benchmark.

Although 2,4-dinitrotoluene and cobalt contributed to the elevated HI for the child resident, it should be noted that 2,4-Dinitrotoluene was detected in two of thirty samples with the two detections collected from two depths at sampling location 504360 during the December 1997 sampling event. No other detections of this constituent were confirmed during the subsequent sampling events. As for cobalt, only the maximum detected concentration (422 mg/kg) fell outside of the background concentration range of 5.9 mg/kg to 130 mg/kg. As such 2,4-dinitrotoluene and cobalt are not considered drivers for remediation at the site.

Removal of the walls and roofs of the buildings has exposed the conductive flooring to weather, causing it to degrade and wash onto the surrounding soils. Activity based sampling conducted at the IAA has demonstrated that intensive disturbance of the soils located immediately adjacent to the buildings where the flooring has washed off the building pads has the potential to generate airborne asbestos concentrations that may present an unacceptable risk to human receptors under current/future industrial exposure scenarios and hypothetical future residential land use scenarios. Activity based sampling has also indicated that airborne asbestos fibers are not generated at distance from the buildings or where asbestos concentrations in soil are low. Soil sampling at the IAA has indicated that the elevated concentrations of asbestos in soil that have the potential to generate the airborne asbestos concentrations are primarily located immediately adjacent to the site buildings, which is the same general area where the inorganic risk drivers are located.

While not evaluated in the risk assessment any residual lead based paint on the concrete walls at the IAA or other possible asbestos containing building materials (i.e., pipe insulation, joint compounds, mastic, etc.) could also present a small risk to current and future receptors. However, it should be noted that the overall extent of these materials at the site is limited.

A SLERA and BERA were completed for the IAA, to evaluate surface soil and sediment for ecological receptors, and food chain modeling was evaluated for all those constituents identified as bioaccumulative. The results of the evaluation of the SLERA and BERA for direct contact and the constituents evaluated in the terrestrial food chain models indicate that some of the NOAEL and LOAEL HQs were greater than 1, which suggests the potential for risk to some individual insectivorous mammals and birds exposed to surface soils and some individual piscivorous mammals and birds exposed to sediment and/or surface water. However, when these results are considered in conjunction with pertinent site information on the limited spatial distribution and extent of these constituents, effects of these COPECs at the population-level are unlikely at the IAA.

The environmental investigations completed at the IAA have successfully defined and delineated the extent of impacts that historical operations and degrading flooring material have had on environmental media at the site. The investigations have confirmed that the effects are generally limited to surface soils located immediately adjacent to buildings with conductive flooring; and in some cases near former transformers. The results of the HHRA activities indicated that asbestos in soil is the only risk driver for the industrial exposure scenario. Under the hypothetical future residential exposure scenarios, asbestos, lead and Aroclor 1254 were all identified as potential risk drivers. There is also an active source (conductive flooring) that still has the potential to release constituents into the environment. The ERA concluded that the potential adverse effects to ecological receptors is limited. .

An FS is recommended to assess potential remedial alternatives to mitigate the risks and hazards associated with the site soils, conductive flooring material, and other building materials at the IAA.

8. Rail Yard

8.1 Site Description and History

The RY encompasses an open area approximately 3,200 ft long by 350 ft wide (approximately 39 acres) in the central portion of the RFAAP-NRU (Figure 1-2). The RY was used for loading and unloading rail cars and the temporary storage of rail cars. The area contained three parallel sets of tracks and several spurs so that cars could be rearranged. Four of the spurs at the north end of the site were surrounded by earthen berms. Three open transfer platforms and one bermed transfer platform are located along the southernmost track for loading and unloading the trains. A decommissioned sewer line runs southwest from a building foundation to a branch of the RFAAP-NRU sewer system that is no longer in use.

8.2 Physical Setting

The RY area is relatively flat at an elevation of approximately 2,100 ft amsl. The area is very open with much of the site being covered with asphalt roadways, gravel, and grass groundcover (Figure 8-1). Surface water runoff from the RY is directed to two tributaries to the unnamed creek that flows through the southwest portion of the RFAAP-NRU. Engineered drainage control ditches channel runoff in the areas between the tracks, ultimately draining into one of the two tributaries.

Stratigraphic characterization of the area indicates that the subsurface consists of a layer of mostly strong brown clay with some silt to a depth of 1–2 ft below ground surface (bgs). Beneath this layer, to a depth of at least 23 ft bgs, the soil is predominantly strong brown with some yellowish-brown to yellowish-red soft to very hard clay. A surficial gravel layer to a depth of approximately 1 ft bgs exists between Track A and the four transfer platforms. The soil at the RY has been extensively reworked and is considered part of the Groseclose Urban Land Complex. The reader is referred to the *Facility-Wide Background Study Report* (IT, 2001) for detailed description of the geology and soil types for the RFAAP-NRU.

8.3 Conceptual Site Model

In accordance with the general CSM presented in Section 3.5, potentially affected media at the RY include surface soil, subsurface soil, sediment, and surface water. The most likely sources of potential contaminant releases at the site include historical train loading, unloading, and maintenance activities. Raw materials used in the historical manufacturing activities at the RFAAP-NRU and packaged explosives/propellants manufactured at the facility were unloaded/loaded onto train cars from four transfer platforms. Routine maintenance was likely performed on trains in the yard as well. Explosives, propellants, degreasers, cleaning agents, and lubricants would be included among the potential contaminants to have been released at the site. These releases would most likely have occurred along the tracks, spurs, and at the transfer platforms present at the site. PCB containing electrical transformers formerly located at the site could also have contributed to releases at the site.

Surface and subsurface soils located adjacent to the tracks, transfer platforms, and spurs are the most likely media to exhibit potential effects from historical operations. Historical sampling activities at the RY have thoroughly investigated these areas as discussed in Section 8.4.

Surface water and sediments in RY area drainage ditches, tributaries to the unnamed creek, RY area pond, and vaults under the transfer platforms would also have the potential to exhibit effects resulting from migration of contaminated media from the source areas. These areas were all included in the RY area investigations.

It should be noted that the southern tributary of the unnamed creek at the RY flows onto the RFAAP-NRU installation from off-site, and thus has the potential to carry contaminants from off-site, upstream sources.

8.4 Environmental Investigations

The RY was originally designated a Study Area for the RFAAP-NRU due to the potential for releases to have occurred from the former train loading, unloading, and storage operations conducted at the site. Environmental investigations at the RY have been on-going since 1997 and have included:

- 1997 and 1998 – Independent Sampling by Gannett Fleming
- 1998 – Remedial Investigation by ICF KE
- 2002 – Baseline Investigation by Shaw
- 2002 – Remedial Investigation by Shaw

The goals and findings of each of these investigations are summarized in the following sections. As discussed in Section 4.1, the constituent detections reported in these sections are compared to their medium specific screening criteria, where applicable.

8.4.1 Independent Sampling, Gannett Fleming, 1997 and 1998

Gannett Fleming conducted independent sampling events in 1997 and 1998 under the direction of the USEPA to evaluate the potential for contamination at the site resulting from the former rail yard operations. The following samples were collected during this investigation:

1997

- Two surface soil samples (SS-07 and SS-08)
- One sludge/sediment sample (SL-05) from a sewer system manhole

1998

- One surface soil sample (SS-08A) to confirm detections at previous sample location SS-08
- Two surface soil samples (TR-02A and TR-02C) collected near a former transformer location
- One sludge/sediment sample (SL-08) and one water sample (WW-04) from the crawlspace inside transfer platform 602
- Three sediment samples (SD-03, SD-04, and SD-05) from the tributaries to the unnamed creek

The samples from the 1997 and 1998 investigation activities were analyzed for TCL VOCs, TCL SVOCs, PCBs, pesticides, explosives, and TAL inorganics. The detected analytes for the soil samples are summarized in Table 8-1, the sludge/sediment samples are summarized in Table 8-2, and the surface water results are presented in Table 8-3. Sample locations are depicted in Figure 8-2.

8.4.1.1 1997 and 1998 Soil Sampling

The soil data from the 1997 and 1998 investigations are summarized as follows:

VOCs. One VOC, methylene chloride, was detected in soil samples SS-07, SS-08, and SS-08A (see Table 8-1). The detected concentrations were below the residential RSL. Methylene chloride was also detected in a laboratory blank sample during analysis of the sample so the detection may be associated with laboratory contamination. No other VOCs were detected in the soil samples.

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SVOCs. Several SVOCs were detected in the various soil samples collected during 1997 and 1998 (see Table 8-1). However, only benzo(a)pyrene at TR-02A and pentachlorophenol at TR-02C were detected a concentrations above applicable industrial RSLs. Benzo(a)anthracene, benzo(a)pyrene, and dibenzo(a,h)anthracene at TR-02A and benzo(a)pyrene at SS-08 were also detected at concentrations above residential RSLs.

PCBs*.* Aroclor 1254 was the only PCB detected in the RY soil samples (see Table 8-1). Aroclor 1254 was detected in 1997 at soil sample location SS-08 at a concentration of 1.7 mg/kg, which is above the industrial RSL of 0.74 mg/kg. This sample location was re-sampled in 1998 (SS-08a) and the analytical results indicated an Arochlor-1254 concentration of 1.0 mg/kg, which is also above the industrial RSL. No other PCBs were detected during this investigation.

Pesticides. Four pesticides (4,4'-DDE, alpha chlordane, dieldrin, and endrin aldehyde) were detected in various RY soil samples during this phase of the investigation (see Table 8-1). Dieldrin detected in sample TR-02C was the only pesticide detected at a concentration above the industrial RSL of 0.11 mg/kg. Dieldrin was not detected at any of the other sample locations. The pesticides 4,4'-DDE, alpha-chlordane and endrin aldehyde were all detected at concentrations below residential RSLs.

Explosives. The explosive 2,6-Dinitrotoluene was detected at a concentration of 0.32 mg/kg in soil sample SS-08 during the 1997 investigation (see Table 8-1). This concentration was an order of magnitude lower than the residential RSL for this compound. No other explosives were detected in the soil samples.

Inorganics. Several inorganics were detected in all of the RY soil samples (see Table 8-1). However, arsenic at sample location SS-08 was the only inorganic detected at a concentration above applicable industrial RSLs and established background concentrations. Barium at sample location SS-07 was the only constituent detected at a concentration above a residential RSL and established background concentration. The arsenic concentration was below the background level in sample SS-08a collected in 1998, which indicates the arsenic concentration detected at SS-08 in 1997 was isolated.

8.4.1.2 1997 and 1998 Sediment Sampling

The sediment samples collected from the creek tributaries during the 1998 sampling event are summarized in Table 8-2. The results indicated the following:

VOCs. Three VOCs (Acetone, 2-butanone, and methylene chloride) were detected in various sediment samples collected during the 1997-1998 investigation (see Table 8-2). However, the detected concentrations were several orders of magnitude below applicable residential RSLs. The methylene chloride detections were also qualified as having also been detected in a laboratory blank sample.

SVOCs. Several SVOCs were detected in sludge sample SL-05 and a few isolated detections were also observed in the other sediment/sludge samples. The detected constituents and concentrations are presented in Table 8-2. The analytical results indicated that benzo(a)pyrene at SL-05 was the only constituent detected above an applicable residential RSL. No other SVOCs were detected at concentrations above industrial or residential RSLs.

Pesticides. The pesticide endrin aldehyde was detected in sludge sample SL-05 and sediment sample SD-03 (see Table 8-2). The detected concentrations were orders of magnitude below industrial and residential RSLs.

Inorganics. Several inorganics were detected in all of the sediment samples (see Table 8-2). Arsenic and iron were detected in the sludge/sediment sample from SL-05 at concentrations above the industrial and residential RSLs, respectively. The detected concentrations of these constituents were also slightly above the established background levels. No other inorganics were detected at concentrations above established background levels at any of the sample locations.

8.4.1.3 1998 Surface Water Sampling

The analytical data from surface water sample (WW-04), which was collected from the crawl space of Transfer Platform 602, is presented in Table 8-3. No analytes were detected above the tap water RSLs.

8.4.2 Remedial Investigation, ICF KE, 1998

ICF KE conducted an RI at the RY in 1998 to further investigate the site. This investigation consisted of the following tasks:

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- Review of historical aerial photographs to assess past use patterns
- A site reconnaissance to assess current site conditions; and
- Collection of 3 surface soil samples 12 subsurface soil samples from seven soil borings (RYSB1 through RYSB7)

Aerial photographs and site reconnaissance were used to select areas where railroad cars were loaded and unloaded, and areas where rail cars were stored. These types of areas were thought to be the most likely to have been affected by historical site operations. A total of 3 surface soil and 12 subsurface soil samples were collected from seven soil borings (RYSB1 through RYSB7) during the investigation. The sample locations are depicted in Figure 8-2.

The samples collected during this investigation were analyzed for SVOCs, explosives, and TAL inorganics. The analytical results from these samples are summarized in Table 8-4. The results indicated the following:

SVOCs. There were a few isolated detections of diethylphthalate and di-n-butylphthalate in both surface and subsurface soils. However, all of the detected concentrations were several orders of magnitude below applicable industrial and residential RSLs (see Table 8-4).

Explosives. No explosives were detected in any of the samples.

Inorganics. Several inorganic constituents were detected in all of the soil samples collected during this phase of the investigation (see Table 8-4). However, the analytical results indicated that the detected concentrations were generally below established background levels and/or applicable RSLs. The only exceptions was cobalt, which was detected at a concentration of 74.9 mg/kg in surface soil (0-4 ft bgs) and 74.5 mg/kg in subsurface soil (4-6 ft bgs) at soil boring RYSB4. These concentrations were above the industrial RSL and slightly above the background level of 72.3 mg/kg. As the detected cobalt concentrations at RYSB4 were only slightly above background levels, it is likely that cobalt is naturally occurring at this location.

8.4.3 Baseline Study, Shaw, 2002

On July 25 and 26, 2002 Shaw conducted a baseline study at the RY for ATK. This sampling program was conducted to provide baseline concentrations for constituents in soil so that effects from possible future uses at the RY could be separated from existing conditions. The sampling event included the collection of thirteen surface soil samples (RYSS04 through RYSS16). The sample locations are depicted in Figure 8-2.

All of the samples collected during the baseline study sampling event were analyzed for VOCs, SVOCs, PAHs, PCBs, explosives, and TAL inorganics. Four of the 13 samples (RYSS05, RYSS09, RYSS10, and RYSS15) were also analyzed for pesticides and herbicides. The laboratory analytical results from this sampling event are summarized in Table 8-5. The results indicated the following:

VOCs. Five VOCs (acetone, ethanol, methylene chloride, 2-butanone and 3-octanone) were detected sporadically in the surface soil samples. However, all of the detected concentrations were several orders of magnitude below residential RSLs (see Table 8-5).

SVOCs/PAHs. Seventeen different PAH compounds were detected via SVOC analyses and PAH analyses (see Table 8-5). The SVOC analysis at sample location RYSS07 indicated that the PAH benzo(a)pyrene was detected at a concentration above the industrial RSL and the PAHs benzo(a)anthracene, benzo(b)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene were detected at concentrations above residential RSLs. However, the more sensitive PAH analysis at this location indicated that only benzo(a)pyrene was present at a concentration above residential RSL. Benzo(a)pyrene was also detected above the residential RSL at RYSS05. No other PAHs or SVOCs were detected at concentrations higher than residential RSLs.

PCBs. Aroclor 1254 was detected in three samples (RYSS05, RYSS07, and RYSS11). The detected concentration at RYSS07 was above the industrial RSL for this constituent, while the other detections were below the residential RSL (see Table 8-5).

Pesticides. Alpha-BHC was detected at sample locations RYSS05, RYSS09, RYSS10, and RYSS15. Beta-BHC was detected at sample locations RYSS05 and RYSS10. All of the detected concentrations were several orders of magnitude below the residential RSLs (see Table 8-5). No other pesticides were detected in the samples.

Herbicides. No herbicides were detected in any of the surface soil samples.

Explosives. No explosives were detected in any of the surface soil samples.

***Inorganics*.** Several inorganics were detected in all of the soil samples. However, the detected concentrations were all below established background levels or the applicable industrial and residential RSLs (see Table 8-5). .

8.4.4 Remedial Investigation, Shaw, 2002

During 2002 Shaw completed remedial investigation activities at the RY to further evaluate potential effects from historical operations at the site. The sampling strategy was primarily designed to collect samples in uncharacterized portions of the site, in drainage pathways leading from the site, and for analysis of analyte classes for which the site had not previously been tested. The sampling activities included:

- Eight surface soil samples (RYSS01, RYSS02, RYSS03, RYSB08, RYSB09, RYTR01, RYTR02, and RYTR03).
- Three subsurface soil samples from two borings (RYSB08 and RYSB09)
- Five sediment samples (RYSD01, RYSD07, RYSD08, RYSD09, and RYSD10) from area drainage ditches.
- Five sediment samples from the tributaries of the unnamed creek (RYSD03, RYSD05, RYSD06, RYSD12, and RYSD13)
- One sediment sample (RYSD04)and one surface water sample (RYSW04) from the RY pond.
- Five surface water samples (RYSW03, RYSW05, RYSW12, and RYSW13) from the tributaries of the unnamed creek
- One surface water sample (RYSW02)collected from the spring at the north end of the RY pond.
- One surface water sample (RYSW15) from transfer platform 602.

8.4.4.1 2002 Soil Sampling

The soil samples collected during Shaw's 2002 RI investigation were analyzed for VOCs, SVOCs/PAHs, PCBs, pesticides, herbicides, explosives, and TAL inorganics. The analytical results, which are summarized in Table 8-6, indicated the following:

VOCs. VOCs were not detected in any of the surface or subsurface soil samples.

***SVOCs/PAHs*.** Several SVOCs and PAHs were detected at various sampling locations (see Table 8-6); however, all of the detected constituents were at concentrations lower than the residential RSLs.

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PCBs. Aroclor 1254 was detected in surface soil samples RYSS03 and RYTR02 at concentrations slightly above the residential RSL of 0.22 mg/kg. Sample RYTR02 was collected specifically to check a former transformer location identified on a utility map of the RY. Sample RYSS03 was collected to confirm a PCB detection in historical sample SS-08. PCBs were not detected at any of the other sample locations.

Pesticides. Pesticides were not detected in any of the surface or subsurface soil samples.

Herbicides. Herbicides were not detected in any of the surface or subsurface soil samples.

Explosives. 2,4-Dinitrotoluenne was detected in one surface soil sample (RYSS03) and 4-Amino-2,6-Dinitrotoluene was detected in the subsurface soil (4-6 ft bgs) sample at RYSS08. The detected concentrations of both constituents were several orders of magnitude below residential RSLs (see Table 8-6). No other explosives were detected in any of the surface or subsurface soil samples.

Inorganics. Several inorganics were detected in all of the surface and subsurface soil samples (see Table 8-6). All of the detected inorganics were at concentrations that were either below established background levels and/or applicable industrial and residential RSLs.

8.4.4.2 2002 Sediment Sampling

Sediment samples were collected from the northern tributary to the unnamed creek (RYSD03, RYSD05, and RYSD06), southern tributary to the unnamed creek (RYSD12 and RYSD13), RY pond (RYSD04), and RY area drainage ditches (RYSD01, RYSD07, RYSD08, RYSD09, and RYSD10). The sediment samples were analyzed for VOCs, SVOCs, PAHs, PCBs, pesticides, herbicides, explosives, and TAL inorganics. The analytical results for these samples are summarized in Table 8-7.

VOCs. Acetone, 2-butanone, and carbon disulfide were detected in sediment samples RYSD03, RYSD04 from the northern tributary to the unnamed creek and RYSD05 from the RY pond. All of the detected concentrations were several orders of magnitude less than residential RSLs (see Table 8-7). It is likely that these constituents are related to laboratory contamination as the sample results were qualified due to laboratory blank detections.

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SVOCs/PAHs. Seventeen PAHs were detected as a result of the PAH and SVOC laboratory analyses (see Table 8-7). Benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene were the only constituents detected at concentrations above residential RSLs. No PAHs were detected above industrial RSLs.

PCBs. No PCBs were detected in the sediment samples.

Pesticides. Fifteen different pesticides were detected in various sediment samples (see Table 8-7). None of the detected constituent concentrations were above residential RSLs.

Herbicides. Seven herbicides (1,4,5-T, 2,4,5-TP, 2,4-D, dalapon, dicamba, dichlroprop, and MCPP) were detected sporadically in the sediment samples. All of the detected concentrations were several orders of magnitude below residential RSLs (see Table 8-7).

Explosives. The explosive pentaerythritol tetranitrate was detected in two of the sediment samples collected from site drainage ditches (RYSD08 and RYSD09). Nitroglycerine was detected in two samples (RYSD03 and RYSD05) collected from the northern tributary to the unnamed creek. The detected concentrations of both constituents were below residential RSLs. No other explosives were detected in any of the samples.

Inorganics. As with all soil and sediment samples collected at the RY and across the RFAAP-NRU, several inorganics were detected in the sediment samples collected during this investigation (see Table 8-7). All of the detected inorganics were at concentrations that were either below established background levels and/or applicable industrial and residential RSLs.

8.4.4.3 2002 Surface Water Sampling

During the 2002 investigation, surface water samples were collected from the northern tributary to the unnamed creek (RYSW03 RYSW05, and RYSW06), the southern tributary to the unnamed creek (RYSW12 and RYSW13), the pond at the RY (RYSW04), the spring at the RY (RYSW02) and from underneath transfer platform 602 (RYSW15). The samples collected during this event were analyzed for VOCs, SVOCs, PAHs, PCBs, pesticides, herbicides, explosives, inorganics, perchlorate, and hardness. The laboratory analytical results for these samples are summarized in Table 8-8.

VOCs. Chloroform was detected at a concentration greater than the tap water RSL in the surface water samples collected from the southern tributary (RYSW12 and RYSW13). Carbon disulfide was also detected in RYSW12 and RYSW05. The concentrations of carbon disulfide were below the tap water RSL. No other VOCs were detected in surface water.

SVOCs. Five SVOCs [benzoic acid, bis(2-ethylhexyl)phthalate, butylbenzylphthalate, diethylphthalate, and di-n-butylphthalate] were detected sporadically in the surface water samples (see Table 8-8). Bis(2-ethylhexyl)phthalate was detected at a concentration above the tap water RSL at sample locations RYSW04 as a result of the SVOC analysis. No other SVOCs/PAHs were detected above tap water RSLs.

PAHs. Three PAHs (2-methylnaphthalene, naphthalene, and phenanthrene) were detected in a limited number of the surface water samples (see Table 8-8). The detected concentrations were all below applicable tap water RSLs.

PCBs. PCBs were not detected in any of the surface water samples.

Pesticides. The pesticide dieldrin was detected at a concentration above the tap water RSL in the two of the surface water samples (RYSW12 and RYSW13) collected from the southern tributary of the unnamed creek. It should be noted that dieldrin was also detected in an upstream sample (WBGSW14; see Table 9-12) at a concentration above the tap water RSL. The WBGSW14 sample was collected from the stream before it enters the RFAAP-NRU facility; which indicates that dieldrin was likely from an off-site source.

Herbicides. MCPA and MCPP were detected at sample location RYSW12 at concentrations above their applicable tap water RSLs (see Table 8-8). These constituents were not detected in any other surface water samples at the RY.

Explosives. Nitroglycerine, nitrobenzene, and m-nitrotoluene were detected in surface water samples. The detected concentrations were all lower than the tap water RSLs (see Table 8-8).

Inorganics. Several inorganics were detected in the surface water samples, but no constituents were detected at concentrations above the tap water RSLs (see Table 8-8).

Perchlorate. Perchlorate was not detected in any of the surface water samples.

8.5 Nature and Extent of Constituent Detections

The sampling programs conducted at the RY were designed to provide a thorough assessment on whether environmental media was affected by historical operations at the site. The sampling activities discussed in the previous sections included a total of 32 surface soil samples, 12 subsurface soil samples, 16 sediment samples, and 8 surface water samples. Based on the results of the sampling activities, there do not appear to be any significant elevated concentrations present at the RY.

8.5.1 Soil

The soil sampling activities at the RY focused on areas near the rail lines, rail spurs, transfer platforms, building egress points, transformer locations, and other areas that may have been affected by historical operations at the RY. Laboratory analytes varied between the sampling events but included explosives, herbicides, pesticides, PAHs/SVOCs, PCBs, VOCs, and inorganics. Comparison of the collected data with the RSLs and background inorganic concentrations indicated that very few of the detected constituents were above applicable screening criteria. A site map depicting the inorganic constituents detected in the RY soils is presented in Figure 8-3. A second site map depicting the organic constituents detected in the RY soils is presented in Figure 8-4.

Arsenic, barium, and cobalt were each detected in one location at concentrations above applicable RSLs and established background levels. Arsenic was detected in 1997 soil sample SS-08 at a concentration of 20.8 mg/kg, which is above the industrial RSL of 1.6 mg/kg and slightly above the background concentration of 15.8 mg/kg. A second sample collected at this location in 1998 (SS-08A) did not have any inorganics detected above background concentrations. Barium was detected at a concentration of 1,770 mg/kg in surface soil sample SS-07 in 1997, which is higher than the residential RSL of 1,500 mg/kg and the established background level of 209 mg/kg. When this location was sampled again in 2002 (RYSS02) no inorganics were detected above established background levels. As the elevated concentrations of arsenic and barium could not be confirmed, they are both considered to be anomalies. Cobalt was detected in surface and subsurface soil at 1998 soil boring RYSB4 at concentrations slightly above the established background and the industrial RSL. No other inorganics were detected at the site at concentrations above applicable RSLs and/or background levels.

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The PCB Aroclor 1254 was detected in three surface soil samples (SS-08, SS-08A,and RYSS03) collected adjacent to transfer platform 602. The concentrations detected at SS-08 (1.7 mg/kg) and SS-08A (1.0 mg/kg), which were at identical locations, were above the industrial RSL of 1.0. The concentration of Aroclor 1254 detected at RYSS03 (0.37 mg/kg), which was collected adjacent to the SS-08 samples, was slightly above the residential RSL of 0.22 mg/kg. Aroclor 1254 was not detected in other soil samples collected in this area.

Aroclor 1254 was detected in one other soil sample at the RY (RYSS07) which was near a bermed transfer platform in the northeast portion of the site. The detected concentration (1.2 mg/kg) was above the industrial RSL. Other samples collected in this area did not contain any PCB detections. PCBs were not detected above applicable residential RSLs at any of the three former transformer locations sampled in 2002 (RYTR01 through RYTR03).

The pesticide dieldrin and the SVOC pentachlorophenol were detected in one sample (TR-02C) located next to a former pole mounted transformer. The concentrations of dieldrin (0.27 mg/kg) and pentachlorophenol (830 mg/kg) were both above the industrial RSL. These constituents, which are typically associated with wood preservatives and pesticides used on utility poles, were not present in a second sample (TR02A) at this location or within any other soil samples at the RY. Therefore, neither of these constituents is considered an environmental concern at this site.

Seventeen different PAH compounds were detected in soil samples at the RY using both general SVOC analysis methods and the more specific PAH analysis method. The PAH analyses indicated that benzo(a)pyrene was the only PAH constituent detected above applicable residential RSLs. Benzo(a)pyrene was detected in two samples (RYSS05 and RYSS07) at concentrations slightly above the residential RSL of 0.015 mg/kg. The SVOC analyses indicated that benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene were present in one sample (TR-02A) at concentrations above applicable RSLs; however, a second sample collected adjacent to this sample TR-02C had no PAHs detected. The PAHs that were detected at the majority of the soil sampling locations were several orders of magnitude below applicable residential RSLs.

8.5.2 Sediment

A total of 16 sediment samples were collected during the course of the investigation activities at the RY. The sample locations included surface water drainage pathways, tributaries of the unnamed creek that pass near the RY, a small pond located downgradient of the RY, a spring that feeds the pond, and sludge from the sewer system. These sample locations were selected to identify constituents that may have been transported from the RY. A site map depicting inorganic constituents detected in sediment is presented as Figure 8-5. A site maps depicting organic constituents detected in sediment is presented as Figure 8-6.

A total of seventeen different PAHs were detected at four of the sediment sample locations(RYSD01, RYSD03, RYSD04, and RYSD06); however only four of these constituents [benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene] were detected at concentrations above residential RSLs. Sample location RYSD01, which was from a RY area drainage ditch, contained benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene at concentrations slightly above residential RSLs. Sample locations RYSD03 and RYSD06, which were from the northern tributary of the unnamed creek, contained benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene at concentrations above residential RSLs. PAHs were not detected above residential RSLs at any of the other sample locations.

The analytical results indicated that herbicides, pesticides, explosives were detected at low concentrations in some of the sediment samples from the RY. Where detected, the constituent concentrations were generally several orders of magnitude below applicable residential RSLs. Many of the detected constituents were not detected in soil at the RY suggesting that the constituents are not migrating from the RY.

Several inorganics were detected in all of the sediment samples collected at the RY. The majority of the detected inorganics were at concentrations below the established background concentrations for the facility and/or tap water RSLs. However, iron and vanadium were detected in one sample (RYSD08) at concentrations slightly above background and residential RSLs. These constituents were not detected at elevated concentrations in soil at the RY, and the detected concentrations in the sediment are only slightly above background; therefore, the detections are not considered to be site related.

8.5.3 Surface Water

A total of 8 surface water samples were collected during the course of the investigation activities at the RY. The sample locations generally corresponded with sediment sample locations and included tributaries of the unnamed creek that pass near the RY,

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a small pond located downgradient of the RY, and a spring that feeds the pond. Two water samples were also collected from a crawl space under transfer platform 602. These sample locations were selected to identify constituents that may have been transported from the RY. A site map depicting inorganic constituents detected in surface water is presented as Figure 8-7. A site map depicting organic constituents detected in surface water is presented as Figure 8-8.

Two herbicides (MCPA and MCPP) and one pesticide (dieldrin) were detected in a surface water sample (RYSW12) from the southern tributary of the unnamed creek at concentrations above the tap water RSLs. These constituents were also detected in a surface water sample collected upstream of the RY, at the WBG (WBGSW08) on the same date (June 25, 2002). Therefore, these constituent detections are not attributed to the RY.

Chloroform and bis(2-ethylhexyl)phthalate were detected in two surface water samples each. These constituents were not detected in soil at the site and are common laboratory contaminants; as such, the detections in surface water are not believed to be site related.

Several inorganics were detected in the surface water samples; however, all of the detected concentrations were below applicable tap water RSLs.

Surface Water samples WW-04 and RYSW15 were collected from the crawl space underneath transfer platform 602. The analytical results did not indicate the presence of any constituents at concentrations above tap water RSLs.

8.6 Risk Assessment Datasets

Data generated from the site characterization activities were used in the risk assessment. Risk assessment datasets for soil, sediment, and surface water for the RY were prepared then summarized and statistically analyzed. Risk assessment datasets summaries highlighting the number of detects, number of samples, FOD, minimum and maximum detected concentrations, minimum and maximum detection limits, and EPC are presented in Tables 8-9 through 8-13.

8.7 Human Health Risk Assessment

The purpose of this risk assessment is to evaluate the potential current and future risks and hazards to human health associated with constituents detected in soil, sediment and surface water samples collected at the RY. The risk assessment approach follows the Radford Army Ammunition Plant Final Master Work Plan (URS 2003). This section summarizes the occurrence of constituents in each medium and identifies COPCs at the RY for the human health risk assessment; identifies the potential human exposure scenarios relevant to the RY; and presents the estimated human health risks associated with the identified COPCs and the relevant human exposure scenarios at the RY. Methodologies for data summary and selection of COPCs, exposure assessment, and toxicity assessment for the HHRA were presented in Appendix A.

8.7.1 Selection of Constituents of Potential Concern

This section discusses the selection of COPCs for the HHRA for each medium at the RY.

8.7.1.1 Surface Soil

Surface soil COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for residential soil. Table 8-14 presents the selection of surface soil COPCs for the HHRA. As summarized in Table 8-14, 14 constituents were identified as COPCs in surface soil:

- **VOCs:** 3-octanone and ethanol;
- **SVOCs:** carbazole and pentachlorophenol;
- **Pesticides:** dieldrin;
- **PAHs:** benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene;
- **PCB:** Aroclor 1254; and
- **Inorganics:** aluminum, arsenic, barium, and cobalt.

8.7.1.2 Combined Surface and Subsurface Soil

Combined surface and subsurface soil COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for residential soil. Table 8-15 presents the selection of combined surface and subsurface soil COPCs for the HHRA. As summarized in Table 8-15, 14 constituents were identified as COPCs in combined surface and subsurface soil:

- **VOCs:** 3-octanone and ethanol;
- **SVOCs:** carbazole and pentachlorophenol;
- **Pesticides:** dieldrin;
- **PAHs:** benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene;
- **PCB:** Aroclor 1254; and
- **Inorganics:** aluminum, arsenic, barium, and cobalt.

8.7.1.3 Sediment

Sediment COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for residential soil. Table 8-16 presents the selection of sediment COPCs for the HHRA. As summarized in Table 8-16, 12 constituents were identified as COPCs in sediment:

- **Explosives:** pentaerythritol tetranitrate;
- **Herbicides:** dichlorprop;
- **PAHs:** benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene; and
- **Inorganics:** aluminum, arsenic, cobalt, iron, manganese, and vanadium.

8.7.1.4 Surface Water

Surface water COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for tap water. Table 8-17 presents the selection of surface water COPCs for the HHRA. As summarized in Table 8-17, 9 constituents were identified as COPCs in surface water:

- **VOCs:** chloroform;
- **SVOCs:** bis(2-ethylhexyl)phthalate.;
- **Explosives:** nitroglycerine;
- **Herbicides:** MCPA and MCPP;
- **Pesticides:** dieldrin; and

Inorganics: iron, lead, and manganese.

8.7.2 Human Health Risk Characterization

The physical and chemical properties and toxicity values used to evaluate excess lifetime cancer risks and non-cancer hazards are presented in Appendix A. The exposure assumptions used to evaluate potentially exposed receptors are presented in Appendix A. The equations used in the risk characterization calculations are also presented in Appendix A. The EPCs are provided in Table 8-18.

Exposure to the soil, sediment, and surface water COPCs were evaluated for direct contact. VOCs identified as COPCs in the RY were also evaluated for inhalation via vapor migration into buildings. Two VOCs, 3-octanone and ethanol, were identified as soil COPCs at the RY. These COPCs do not have identified inhalation toxicity values; therefore, the indoor vapor intrusion pathway could not be assessed at this Study Area.

The excess lifetime cancer risks and non-cancer hazards for each potentially exposed receptor included in the risk assessment for the RY are presented in Appendix A and are summarized in the table and subsections below.

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Summary of Calculated ELCRs and HIs for Receptor Exposure Scenarios

RECEPTOR/ EXPOSURE MEDIUM – SCENARIO	Total ELCR	HI
Site Worker		
Surface Soil - Direct Contact	1E-04	0.3
Sediment – Wading	8E-07	0.01
Surface Water – Wading	2E-07	0.1
TOTAL SITE RISKS (Site Worker):	**1E-04**	**0.4**
Hypothetical Future Construction Worker		
Combined Surface and Subsurface Soil - Direct Contact	5E-06	0.7
TOTAL SITE RISKS (Construction Worker):	**5E-06**	**0.7**
Hypothetical Future Adult Resident		
Combined Surface and Subsurface Soil - Direct Contact	-	0.3
Sediment – Wading	-	0.02
Surface Water – Wading	-	0.2
TOTAL SITE RISKS (Adult Resident):	**-**	**0.6**
Hypothetical Future Child Resident		
Combined Surface and Subsurface Soil - Direct Contact	**-**	**3**
Sediment – Wading	-	0.1
Surface Water – Wading	-	0.1
TOTAL SITE RISKS (Child Resident):	**-**	**3**
Hypothetical Future Resident (Adult and Child)		
Combined Surface and Subsurface Soil - Direct Contact	3E-04	**-**
Sediment – Wading	3E-06	-
Surface Water – Wading	1E-06	-
TOTAL SITE RISKS (Resident):	**3E-04**	**-**

*See Appendix A for individual tables.

8.7.2.1 Site Worker

A current or future site worker could be present at the RY area, and could be exposed to surface soil, sediment, or surface water. The ELCR and non-cancer hazard index for site worker exposure to each medium are presented in Appendix A, and are summarized in Table 8-19. As presented in the table above, the ELCRs for surface soil, sediment, and surface water are all below or within the USEPA target risk range, and the HIs for each medium are all below the benchmark value of 1.

The total cumulative ELCR for site workers exposed to surface soil, sediment, and surface water at the RY is 1×10^{-4}, which is at the high end of the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for site workers is 0.4, which is less than the benchmark of 1.

8.7.2.2 Hypothetical Future Construction Worker

A hypothetical future construction worker could be present at the RY area, and could be exposed to combined surface and subsurface soil. The ELCR and non-cancer hazard index for hypothetical future construction worker exposure to soil are presented in Appendix A, and are summarized in Table 8-19. As presented in the table above, the ELCR for combined surface and subsurface soil is within the USEPA target risk range, and the HI is below the benchmark value of 1.

The total cumulative ELCR for hypothetical future construction workers exposed to combined surface and subsurface soil at the RY was 5×10^{-6}, which is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for hypothetical future construction workers is 0.7, which is less than the benchmark of 1.

8.7.2.3 Hypothetical Future Residents

A hypothetical future resident could be present at the RY area, and could be exposed to combined surface and subsurface soil, sediment, or surface water. The ELCR and non-cancer hazard index for hypothetical future resident exposure to each medium are presented in Appendix A, and are summarized in Table 8-19. The ELCRs are all below or within the USEPA target risk range, with the exception of hypothetical future residential exposure to combined surface and subsurface soil. Similarly, the HIs for each medium are all below the benchmark value of 1, with the exception of child resident exposure to combined surface and subsurface soil.

The total cumulative ELCR for hypothetical future residents exposed to combined surface and subsurface soil, sediment, and surface water at the RY is 3×10^{-4}, which is slightly above the high end of the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The primary risk driver is pentachlorophenol (PCP) in soil. PCP was detected at a concentration greater than the industrial RSL (9 mg/kg) in one surface soil sample [TR-02C (830 mg/kg)] which was collected in 1998 at a former pole-mounted transformer location. The concentration of PCP in a duplicate surface soil sample collected at this location (TR-02A) was only 0.11mg/kg. A total of 33 soil samples (20 surface soil samples and 13 subsurface soil samples) collected during subsequent investigations at the Rail Yard were analyzed for PCP. PCP was not detected in any of these samples, nor was PCP detected in any surface water or sediment samples at the Rail Yard. As PCP is known to have been used as a wood preservative for utility poles, the single elevated detection of PCP at sample location TR-02C has been linked to the former utility pole at this sample location. The observation that PCP was not detected at elevated levels in the duplicate sample at this location, or in any other soil samples at the site, indicates that the elevated detection was limited to the area in the immediate vicinity of the utility pole.

The total cumulative HI for hypothetical future adult residents is 0.6, which is less than the benchmark of 1.

The total cumulative HI for hypothetical future child residents is 3, which is greater than the benchmark of 1. When the HI is segregated into target site and critical effects, hazards were only above the benchmark of 1 in the eyes, nails, hair, and skin. The primary contributor to the non-cancer hazard above 1 is cobalt. The maximum cobalt concentration of 74.9 mg/kg is only slightly greater than the background concentration of 72.3 mg/kg and is well within the range of background levels. Therefore, it is likely that cobalt is present due to naturally occurring sources rather than due to activities at the RY.

8.7.3 Human Health Risk Summary

Table 8-19 summarizes the calculated cancer risks and non-cancer hazards for each potentially exposed receptor included in the risk assessment for the RY. As shown in the table above, the total ELCR values for all surface soil, combined surface and subsurface soil, sediment, and surface water exposures for each exposure scenario are below or within the benchmark range of 10^{-6} to 10^{-4} for cancer risk, with the exception of hypothetical future residential exposure to combined surface and subsurface soil. This is due to the presence of pentachlorophenol, which was detected in two samples, one at an estimated value of 0.11 mg/kg and one at a maximum concentration of 830 mg/kg. The one high detection was from a sample collected in April 1998, and the results have not been duplicated in subsequent sampling. The risk assessment was based on the maximum detected concentration at this single sample location and thus may overestimate potential exposures. Without pentachlorophenol as a risk driver, the ELCR would be 3×10^{-5} which is within the target range for cancer risk.

The total HI values for all surface soil, combined surface and subsurface soil, sediment, and surface water exposures for each exposure scenario are below the benchmark of 1 for non-cancer hazard, with the exception of hypothetical future child resident exposure to combined surface and subsurface soil. The risk driver for non-cancer hazard is cobalt. The maximum cobalt concentration of 74.9 mg/kg is only slightly greater than the background concentration of 72.3 mg/kg and is well within the range of background levels. Therefore, it is likely that cobalt is present due to naturally occurring sources rather than due to activities at the RY.

The results of the human health risk assessment indicate that use of the RY for industrial or residential uses should not result in unacceptable risks to potential receptors.

8.8 Ecological Risk Assessment

The purpose of the ERA is to evaluate whether ecological receptors may be adversely impacted by exposure to site-related constituents detected in surface soil, sediment, and surface water at the RY. This ERA is intended to provide input for risk management decision-making for the RY, while maintaining a conservative approach protective of wildlife populations and communities. In accordance with USEPA guidance, the ERA for the RY commenced with a SLERA and then concluded with BERA (USEPA 1997c).

This section summarizes the occurrence of constituents in each medium and identifies COPECs at the RY for the ecological risk assessment; identifies the potential ecological exposure scenarios relevant to the RY; and presents the estimated ecological risks associated with the identified COPECs and the relevant ecological exposure scenarios at the RY. Methodologies for data summary and selection of COPECs, exposure assessment, and toxicity assessment for the ERA were presented in Appendix A.

8.8.1 Selection of Constituents of Potential Ecological Concern

This section discusses the selection of COPECs for each medium. Risks to ecological receptors are calculated by dividing the exposure estimates (i.e., the maximum detected concentrations) by the conservative ESLs. The resulting ratio, the hazard quotient (HQ), is a highly conservative surrogate for the assessment endpoints identified in Appendix A. HQs equal to or less than a value of 1 (to one significant figure) indicate that adverse ecological effects are unlikely (USEPA 1997c). HQs greater than 1 indicate that further evaluation is warranted. Therefore, the constituents with HQs greater than 1 or that are bioaccumulative, are carried forward as COPECs into the BERA. Maximum HQs greater than 1 for the RY are summarized in the subsections below.

8.8.1.1 Surface Soil

Surface soil COPECs were selected by comparing the analytical data with USEPA (2005b) EcoSSLs, USEPA (2003e) Region 5 ESLs, and ORNL values (Efroymson et al. 1997a,b) for surface soil. Table 8-20 presents the selection of surface soil COPECs for the ERA. As summarized in Table 8-20, 42 constituents were identified as COPECs in surface soil:

- **VOCs:** 3-octanone and ethanol;
- **SVOCs:** 2,6-dinitrotoluene, benzoic acid, bis[2-ethylhexyl[phthalate, carbazole, dibenzofuran, di-n-butylphthalate, and pentachlorophenol;
- **Explosive:** 4-amino-2,6-dinitrotoluene;
- **Pesticides:** 4,4'-DDE, alpha-BHC, beta-BHC, alpha-chlordane, dieldrin, and endrin aldehyde;
- **PAHs:** acenaphthene, acenaphthylene, anthracene, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[g,h,i]perylene, benzo[k]fluoranthene, chrysene, dibenzo[a,h]anthracene, fluoranthene, fluorene, indeno[1,2,3-cd]pyrene, phenanthrene, and pyrene
- **PCB:** Aroclor 1254;
- **Inorganics:** aluminum, antimony, arsenic, barium, cadmium, cobalt, copper, lead, mercury, selenium, and zinc.

8.8.1.2 Sediment

Sediment COPECs were selected by comparing the analytical data with ESLs from the following sources in order of priority: USEPA (2008c) Region 3 Sediment Screening Levels; ORNL values (Jones et al. 1997); and USEPA (2003e) Region 5 Ecological Screening Levels for sediment. Table 8-21 presents the selection of COPECs for the HHRA. As summarized in Table 8-21, 54 constituents were identified as COPECs in sediment:

- **VOCs:** 2-butanone, acetone, and carbon disulfide;

- **SVOCs:** bis(2-ethylhexyl)phthalate;

- **Explosives:** nitroglycerine and pentaerythritol tetranitrate;

- **Herbicides:** dalapon, dicamba, dichlorprop, and MCPP;

- **Pesticides:** 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, alpha-BHC, delta-BHC, gamma-BHC, alpha-chlordane, gamma-chlordane, dieldrin, endosulfan II, endrin, heptachlor, heptachlor epoxide, and methoxyclor,

- **PAHs:** 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[g,h,i]perylene, benzo[k]fluoranthene, chrysene, dibenzo[a,h]anthracene, fluoranthene, fluorene, indeno[1,2,3-cd]pyrene, phenanthrene, and pyrene,

- **Inorganics:** arsenic, cadmium, lead, nickel, selenium, zinc, barium, beryllium, chromium, copper, iron, manganese, thallium, and vanadium.

8.8.1.3 Surface Water

Surface water COPECs were selected by comparing the analytical data with ESLs from the following sources in order of priority: USEPA (2008d) Region 3 Surface Water Screening Levels; ORNL values (Suter and Tsao 1996); USEPA (2003e) Region 5 Ecological Screening Levels; and USEPA (2008e) Ambient Water Quality Criteria for surface water. Table 8-22 presents the selection of COPECs for the HHRA. As summarized in Table 8-22, 17 constituents were identified as COPECs in surface water:

- **Herbicides:** 2,4-DB, MCPA, and MCPP;

- **Pesticides:** 4,4'-DDT, delta-BHC, dieldrin;

- **PAHs:** Phenanthrene

- **Inorganics:** aluminum, barium, cadmium, chromium, copper, iron, lead, selenium, silver, and zinc.

One spring sample (RY_SPRING00Y) was also evaluated for surface water COPECs by comparing the analytical data with background spring data as well as ESLs. As shown in the table below, two PAHs and nine inorganics were detected in the spring sample. Four of the inorganics are vital electrolytes and/or essential nutrients (calcium, magnesium, potassium, and sodium) and therefore were identified as non-toxic and not evaluated further. Only two of the inorganics, aluminum and iron, were detected above the background concentrations or were above the corresponding ESL as discussed below.

Aluminum and iron were both detected above the ESL and the background spring sample concentrations. While the detected concentration of aluminum was above the ESL, the ESL used is from USEPA (2009) Region 3 and is based on a water quality criterion protective of salmonids (i.e., coldwater habitat species of fish such as trout and salmon) which is likely overly conservative for the type of warm-water habitat (and associated aquatic species) that is prevalent in this locale. When an alternative screening value for aluminum of 0.46 mg/L from Sample et al. 1996 was used, an HQ of less than 1 was calculated. This alternative screening value is based on the lowest chronic value for aquatic life, and is considered to be a more representative screening value for aluminum at the RY than the Region 3 ESL.

For iron, although the detected concentration was above the ESL, the spring water sample was not filtered, and as such the results represent total iron. Therefore, it is not known what portion, if any, of the iron is in the dissolved (i.e., filtered) form. It is possible that even though the total iron concentrations exceed the ESL, the dissolved (and therefore bioavailable) iron concentrations may in actuality not exceed the ESL. Based on these considerations, adverse effects to aquatic life potentially exposed to inorganics at the RY are unlikely.

Comparison of ELs and Background Spring Data

Constituent	ESL (µg/L)	Background Spring Data NSPRING003 09/24/08	NSPRING004 09/24/08	RY_SPRING002 09/24/08	Does Max Exceed ESL or BKG?
PAHs					
Naphthalene	**1.1**	<0.092	<0.092	0.044	no
Phenanthrene	**0.4**	<0.092	<0.092	0.038	no
Inorganics					
Aluminum	**87**	<200	<200	496	yes
Barium	**4**	49.8	66.1	48.7	no
Calcium	**116,000**	65900	59000	63400	NT
Iron	**300**	<100	<100	635	yes
Magnesium	**82,000**	11,900	19,000	27,600	NT
Manganese	**120**	<15.0	<15.0	28.1	no
Potassium	**NA**	1670	1820	1970	NT
Sodium	**680,000**	1430	<5,000	1420	NT
Zinc	**120**	9	7	15.4	no

µg/L Micrograms per liter.
NT Non-toxic.

8.8.2 Summary of Selected Constituents of Potential Ecological Concern

Forty-two constituents were selected as COPECs in surface soil, fifty-four constituents were selected as COPECs in sediment, and seventeen constituents were selected as COPECs in surface water because the HQs were greater than 1, the chemical was bioaccumulative, or an HQ could not be calculated because an ESL was not available.

8.8.3 Refinement of Risk Calculations for Direct Contact COPECs

The list of COPECs identified in the BERA was reevaluated by calculating refined HQs. The refined HQs were calculated for the COPECs identified in the SLERA using refined EPCs. Constituents identified as COPECs in the BERA that were bioaccumulative were carried forward into food chain models. The results of the recalculation of the HQs for the RY are summarized in the subsections below.

8.8.3.1 Surface Soil

Forty-two COPECs in surface soil were carried forward into the BERA. When refined EPCs were compared with the ESLs, 10 constituents (2,6-dinitrotoluene, pentachlorophenol, 4,4'-DDE, dieldrin, endrin aldehyde, cobalt, lead, selenium, and zinc) had a refined HQ greater than 1. In addition, ESLs were not available for seven other constituents (3-octanone, ethanol, benzoic acid, carbazole, dibenzofuran, Aroclor 1254, and lead). The BERA results for surface soil COPECs at the RY are presented in Table 8-23 and are discussed in Appendix A in detail.

Of the COPECs, twenty were also identified as bioaccumulative and were evaluated in the terrestrial food chain model.

8.8.3.2 Sediment

Fifty-four COPECs in sediment were carried forward into the BERA. When refined EPCs were compared with the ESLs, 12 constituents [2-butanone, acetone, carbon disulfide, alpha-chlordane, gamma-chlordane, dieldrin, endrin, heptachlor epoxide, acenaphthene, acenaphthylene, indeno(1,2,3-cd)pyrene, and iron], had a refined HQ greater than 1. In addition, ESLs were not available for 10 other constituents (nitroglycerine, pentaerythritol tetranitrate, dalapon, dicamba, dichlorprop, MCPP, barium, beryllium, and vanadium). The BERA results for sediment COPECs at the RY are presented in Table 8-24 and are discussed in Appendix A in detail. The results of the BERA indicate that adverse effects to aquatic life due to potential explosive exposure are considered unlikely. Of the COPECs twenty-eight were identified as bioaccumulative and were evaluated in the aquatic food chain model.

8.8.3.3 Surface Water

Seventeen COPECs in surface water were carried forward into the BERA. When refined EPCs were compared with the ESLs, eight constituents (4,4'-DDT, aluminum, barium, copper, iron, lead, silver, and zinc) had a refined HQ greater than 1. In addition, ESLs were not available for three other constituents (2,4-DB, MCPA, and MCPP). The BERA results for surface water COPECs at the RY are presented in Table 8-25 and are discussed in Appendix A. It is unlikely that adverse effects to aquatic life would occur due to the low frequency of detection, the low detected concentrations, and comparison to available screening levels (for the inorganics).

Of the COPECs 10 were identified as bioaccumulative and were evaluated in the aquatic food chain model.

8.8.4 Refinement of Assessment and Measurement Endpoints for Bioaccumulative COPECs

Food chain modeling was conducted at the RY in order to evaluate the potential ecological effects of the bioaccumulative COPECs in soil, sediment, and surface water on the receptors identified in Appendix A. COPECs identified in soil were evaluated in the terrestrial food chain, and COPECs identified in sediment and surface water were evaluated in the aquatic food chain. The results for both the maximum and refined scenarios of these models are presented in Appendix A and the results of each of the refined scenarios are discussed in the subsections below.

8.8.4.1 Terrestrial Food chain Model

As summarized in Table 8-26, the refined scenario NOAEL and LOAEL HQs for both the short-tailed shrew and the American robin were less than or equal to 1 for most of the bioaccumulative COPECs identified at the RY. Based on the overall analysis of terrestrial food chain modeling HQs and consideration of the limited spatial extent of impacted soils, adverse effects are not expected for short-tailed shrews (and other insectivorous mammals) and American robins (and other insectivorous birds) populations exposed to bioaccumulative COPECs in soil at the RY.

8.8.4.2 Aquatic Food chain Model

As summarized in Table 8-27, the refined scenario NOAEL and LOAEL HQs for both the mink and the great blue heron were less than or equal to 1 for all of the bioaccumulative COPECs identified in sediment and/or surface water, with the exception of the mink NOAEL (HQ=40) and LOAEL (HQ=4) for zinc. This inorganic was not identified as a direct contact COPEC for sediment following the refined evaluation because it had a refined direct contact HQ of less than 1. However, because zinc was identified as a bioaccumulative COPEC in surface water, it was included in the food chain modeling.

As previously discussed, the NOAEL, is a very conservative screening criterion, while the LOAEL indicates a concentration above which adverse impacts to individual mammals may occur. Based on this information and considering the low frequency of detection of this constituent these results indicate that individual mink and herons (or other piscivorous mammals and birds) exposed to these COPECs are not expected to experience adverse effects.

Based on the overall analysis of aquatic food chain modeling HQs, adverse effects are not expected for mink (and other piscivorous mammals) and great blue herons (and other piscivorous birds) populations potentially exposed to bioaccumulative COPECs in sediment and/or surface water at the RY.

8.8.5 Ecological Risk Summary

Screening-level and baseline risk assessments were completed for the RY. After the SLERA, 42 constituents were selected as COPECs in surface soil, 54 constituents were selected as COPECs in sediment, and 17 constituents were selected as COPECs in surface water because the HQs were greater than 1, the chemical was bioaccumulative, or an HQ could not be calculated because an ESL was not available. After the BERA, 36 constituents in surface soil, 50 constituents in sediment, and 16 constituents in surface water were retained because the HQs were greater than 1, the chemical was bioaccumulative, or an HQ could not be calculated because an ESL was not available. Food chain modeling was evaluated for all those constituents identified as bioaccumulative.

Tables 8-28 and 8-29 summarize the constituents in surface soil, sediment, and surface water carried through the BERA and evaluated in the terrestrial and/or aquatic food chain models. As shown in these tables, all constituents evaluated in the terrestrial and aquatic food chain refined scenarios had LOAEL and NOAEL HQs less than or equal to 1, with the exception of shrew HQs for pentachlorophenol and zinc and mink HQs for zinc. However, these HQs are based on the very conservative screening criterion of the NOAEL. In addition, there was a low frequency of detection of pentachlorophenol in surface soil and the EPC for zinc is very similar to its established site background concentration. Furthermore, zinc was not identified as a direct contact COPEC for sediment, indicating that direct contact of ecological receptors with zinc in the sediment is not expected to result in any adverse effects. These results indicate that individual shrews (or other insectivorous mammals) and individual minks (or other piscivorous mammals) potentially exposed to these COPECs are not expected to experience adverse effects.

Based on the overall analysis of the ERA for the RY, the results indicate that adverse effects are not expected for wildlife at the site.

8.9 RY Summary and Conclusions

The RY encompasses an open area approximately 3,200 ft long by 350 ft wide (approximately 39 acres) in the central portion of the RFAAP-NRU. The RY was used for loading and unloading rail cars and the temporary storage of rail cars. Environmental investigations conducted at the RY between 1997 and 2002 included the collection of surface soil and subsurface soil samples from various areas of the site, including: along the railroad tracks and spurs; adjacent to transfer platforms and former building locations; near former electrical transformer locations; and in area drainage pathways. Surface water and sediment samples were also collected from the pond and streams located in the vicinity of the RY. Laboratory analyte classes varied between the investigation activities but have included explosives, herbicides, pesticides, PAHs, PCBs, VOCs, SVOCs, and TAL inorganics. The investigation activities were conducted to evaluate whether the RY was affected by historical operations at the site, and if so were constituents of concern migrating away from the site.

The extensive soil sampling activities at the RY indicated that there were limited sporadic detections of compounds at concentrations above applicable screening levels. However, there was no pattern of spatial distribution or indication of source areas. PCBs were not detected at any of the former transformer locations. Subsurface soil sampling activities also indicated no evidence of significant constituent concentrations in the subsurface. Offsite surface water and sediment gave no indication of being affected by constituents migrating from the site. Based on the

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compiled data from the various phases of investigation at the site, there do not appear to be significant elevated concentrations of contaminants at the RY.

The HHRA for the RY evaluated current and future land-use conditions for site workers and hypothetical future use for construction workers and adult and child residents. Exposure of these receptors to the soil, sediment, and surface water COPCs was evaluated in the risk assessment. Although exposure to VOCs in soil migrating into buildings was identified as a potential exposure pathway, inhalation toxicity values were not available for the two VOCs, 3-octanone and ethanol, identified as soil COPCs at the RY. Therefore, this exposure pathway was not evaluated quantitatively.

A current or future site worker could be present at the RY area, and could be exposed to surface soil, sediment, or surface water. The total cumulative ELCR for site workers exposed to surface soil, sediment, and surface water at the RY is 1×10^{-4}, which is equal to the high end of the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for site workers is 0.4, which is less than the benchmark of 1.

A hypothetical future construction worker could be present at the RY area, and could be exposed to combined surface and subsurface soil. The total cumulative ELCR for hypothetical future construction workers exposed to combined surface and subsurface soil at the RY is 5×10^{-6}, which is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for hypothetical future construction workers is 0.7, which is less than the benchmark of 1.

A hypothetical future resident could be present at the RY area, and could be exposed to combined surface and subsurface soil, sediment, or surface water. The total cumulative ELCR for hypothetical future residents exposed to combined surface and subsurface soil, sediment, and surface water at the RY is 3×10^{-4}, which is slightly above the high end of the USEPA target risk range of 10^{-6} to 10^{-4}. This risk driver for cancer risk is pentachlorophenol, which was detected in two samples, one at an estimated value of 0.11 mg/kg and one at a maximum concentration of 830 mg/kg. The one high detection was from a sample collected in April of 1998 and the results were not duplicated in subsequent sampling. The risk assessment was based on the maximum detected concentration and thus likely overestimates potential exposures.

The total cumulative HI for hypothetical future adult residents is 0.6, which is less than the benchmark of 1.

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The total cumulative HI for hypothetical future child residents is 3, which is greater than the benchmark of 1. The primary contributor to the non-cancer hazard above 1 is cobalt. The maximum cobalt concentration of 74.9 mg/kg is only slightly greater than the background concentration of 72.3 mg/kg and is well within the range of background levels. Therefore, it is likely that cobalt is present due to naturally occurring sources rather than due to activities at the RY.

A SLERA and BERA were completed for the RY, to evaluate surface soil, sediment, and surface water for ecological receptors, and food chain modeling was evaluated for all those constituents identified as bioaccumulative. The results of the evaluation of the SLERA and BERA for direct contact and the constituents evaluated in the terrestrial and aquatic food chain models indicate that a few of the NOAEL and LOAEL HQs were greater than 1, which suggests the potential for risk to some individual insectivorous mammals and birds exposed to surface soils and some individual piscivorous mammals and birds exposed to sediment and/or surface water, if all exposure assumptions are met. However, when these results are considered in conjunction with pertinent site information on the limited spatial distribution and extent of these constituents, adverse impacts at the population level are considered unlikely for the shrew (or other insectivorous mammals) and the robin (or other insectivorous birds) exposed to the constituents at the RY.

The investigation activities performed at the Rail Yard did not identify any significant evidence of potential adverse affects to environmental media at the site as a result of historic operations. The results of the human health risk assessment indicate that use of the Rail Yard for residential or industrial uses should not result in unacceptable risks to potential receptors. The ERA also indicated that no adverse impacts would be expected to ecological receptors on a population level. Therefore, No Action is recommended for this site.

9. Western Burning Ground

9.1 Site Description and History

The WBG is a former burning ground located in the southwestern portion of the RFAAP-NRU, south of the IAA (Figure 1-2). The WBG was used during historical operations and during the subsequent facility decommissioning process as a burning ground to decontaminate explosives contaminated material and to dispose of excess and off-spec explosives/energetics. The main burn area was approximately 170 ft long by 100 ft wide and is surrounded on three sides by an approximately 4 ft high earthen berm. A dirt road runs parallel to the open side of the former burn area, leading north to Alger Road, and south to the top of a steep slope above an unnamed pond. The dirt road was reportedly constructed on top of an ashy layer of material extending from the burning ground at the time of the pond construction. The pond was constructed during the early 1990s and is fed by Wiggins Spring at the northwest (upgradient) end of the pond. The pond also collects runoff from the surrounding area through a series of storm water ditches/culverts. The WBG is no longer active. A site map depicting the relevant features of the WBG site is presented as Figure 9-1.

9.2 Physical Setting

The WBG area is generally flat at an elevation of approximately 2,050 ft amsl but slopes increase to the south and southwest towards Wiggins Spring and an unnamed pond. Surface water runoff from the former burn area is expected to flow to the southwest. A small, unlined drainage ditch captures some runoff, channeling flow to the northwest before intersecting a second ditch that drains into the pond. The site is surrounded with wooded areas.

The unnamed pond, which is approximately 3.6 acres in size, was constructed south of the WBG during the early 1990s. The pond is fed by Wiggins Spring, a natural spring located at the head (i.e., northwest corner) of the pond. The pond also collects surface water drainage from the surrounding area. The pond drains under an earthen dam via a constant level drain on the southeastern side of the pond. The effluent flows into a tributary of the unnamed creek that flows through the southwest portion of the RFAAP-NRU.

Stratigraphic characterization within the area generally indicates that the subsurface consists of a layer of brownish-yellow, hard to very hard, clay that is variably mixed with gray gravel, to a depth of approximately 6 ft. An approximately 3.5 ft thick brownish-yellow soft clay seam underlies the hard clay. Below this layer, the soil grades to a gray, hard saprolitic clay (weathered bedrock product). Within the bermed burn area, the depth to bedrock was slightly shallower, ranging from1 ft at the northern end to 4 ft at the southern end, as measured during a test pitting program conducted during 1999 RI activities. Based on the Facility-Wide Background Study Report (IT 2001), soils at the site have been characterized as Lodi loam. The Lodi loam is a member of the Wurno-Newbern-Faywodd Silt Loam complex and is characterized by a moderate permeability and typical depth to bedrock of 4 to 6 ft.

9.3 Conceptual Site Model

In accordance with the general CSM presented in Section 3.5, media that could potentially have been affected by the historical burning ground operations performed at the WBG include surface soil, subsurface soil, sediments, and surface water. Based on the results of historical sampling activities at the site, surface soils within the bermed area where the burning activates were performed are known to have contained several COPCs at concentrations above applicable screening criteria. Site restoration activities completed in this area in 1999 included the removal of surface and subsurface soils and the placement of clean backfill; therefore, the former burn area is no longer considered an area of potential concern.

During site investigation activities a layer of ashy material was identified underneath a dirt road than runs along the open side of the former burning area. This road was constructed during the 1990s to provide access to the newly constructed pond. The ashy material is believed to be material that was pushed out of the burning ground area during historical operations and was subsequently buried during road construction activities. Historical subsurface and surface soil samples from this area have delineated the extent of the ashy layer in the subsurface and sampling has not identified evidence of COPCs at concentrations above screening levels; therefore, this area is not considered to be an area of potential concern.

Surface water and sediment are present in the man-made pond and the unnamed creek that received drainage from the pond at the WBG. Historical sampling conducted in both the pond and the creek have identified the presence of COPCs. Both of these resources could have been affected by COPCs that migrated from the source area due to surface water runoff prior to the site restoration activities. It is also possible that grading activities conducted during the pond and access road construction activities in the 1990s moved soils and COPCs from the source area.

9.4 Environmental Investigations

The WBG was originally designated a Study Area for the RFAAP-NRU due to the former burning ground operations conducted at the site. Environmental investigations at the WBG have been on-going since 1997 and have included:

- 1997 – Independent Sampling by Gannett Fleming
- 1998 and 1999 – Remedial Investigation by ICF KE
- 2002 – Remedial Investigation by Shaw
- 2004 – Additional Characterization Sampling by Shaw
- 2008 – Remedial Investigation by ARCADIS

The goals and findings of each of these investigations are summarized in the following sections. As discussed in Section 4.1, the constituent detections reported in the investigation summaries are compared to their medium specific screening criteria, where applicable.

9.4.1 Independent Sampling, Gannett Fleming, 1997

Gannett Fleming conducted an independent sampling event in 1997 under the direction of the USEPA to evaluate the potential contamination at the site resulting from the former burning ground operations. The following samples were collected during this investigation:

- Three surface soil samples (SS-04, SS-04a, SS-05)
- Two co-located surface water/sediment samples (SW/SD-01 and SW/SD02)

The three soil samples were analyzed for TCL VOCs, TCL SVOCs, PCBs, explosives, dioxins/furans, and TAL inorganics. The laboratory analytical results for the soil samples are summarized in Table 9-1 and the sample locations are depicted in Figure 9-2. The results indicated the following.

VOCs. Three VOCs (acetone, carbon disulfide, and methylene chloride) were detected in the soil samples. The detected concentrations of these constituents were all several orders of magnitude lower than residential RSLs.

SVOCs. Two SVOCs [Bis(2-ethylhexyl)phthalate and di-n-butylphthalate] were detected in soil samples (see Table 9-1). The detected concentrations were several orders of magnitude below the residential RSLs.

PCBs. Aroclor 1254 was the detected at sample locations SS-04 and SS-04a (see Table 9-1). The detected concentrations were lower than the residential RSL. No other PCBs were detected in the soil samples.

Explosives. No explosives were detected in the soil samples.

Dioxins/Furans. Several dioxin/furan compounds were detected in the soil samples (see Table 9-1 for complete list). The detected concentrations were all below applicable residential RSLs.

Inorganics. Several inorganic constituents were detected in all of the soil samples. However, the detected concentrations were all below established background levels and/or applicable RSLs (see Table 9-1).

The sediment samples (SD-01 and SD-02) and surface water samples (SW-01 and SW-02) were collected from the northeastern portion of the unnamed pond. The sample locations are depicted in Figure 9-2 and the laboratory analytical results are presented in Tables 9-2 and 9-3, respectively. The sediment and surface water results indicated the following:

VOCs. Four VOCs (2-butanone, acetone, methylene chloride and toluene) were detected in the two sediment samples (see Table 9-2). The detected concentrations were all lower than applicable residential RSLs.

SVOCs. Ten VOCs were detected in the sediment samples (see Table 9-2 for complete list). Benzo(a)pyrene was detected at SD-01 at a concentration above the residential RSL. No other constituents were detected at concentrations above applicable RSLs.

PCBs. No PCBs were detected in the sediment samples.

Pesticides. No pesticides were detected in the sediment samples.

Inorganics. Several inorganic constituents were detected in the sediment samples. However, the detected concentrations were all below established background levels and/or applicable RSLs (see Table 9-2). Inorganics detected in surface water samples were all below applicable tap water RSLs (see Table 9-3).

9.4.2 Remedial Investigation, ICF KE, 1998 and 1999

ICF KE conducted an RI at the WBG in 1998 and 1999 to characterize the site. The first phase of this RI included:

- A bottom coil Geonics EM61 geophysical survey to identify buried debris
- The collection of five surface soil samples and three subsurface soil samples from five soil borings (WBG-SB1 through WBG-SB5) in the former burn area.
- The collection of three co-located surface water (WBGSW1, WBGSW2, and WBGSW3) and sediment samples (WBGSD1, WBGSD2, and WBGSD3).

The second phase of the RI included the following activities:

- Collection of 27 soil samples from 17 soil borings in and around the former burning area, including
    - o Six soil samples from the berm area surrounding the former burning area (WBGSB6 through WBGSB11):
    - o 19 soil samples from 10 borings (WBGSB12 through WBGSB21) along the access road to the unnamed pond).
    - o Two soil samples from the location of a burn cage stored at the WBG (WBGBC1A, WBGBC1B)
- Excavation of 19 test pits to characterize the subsurface in the burning area
- Collection of 43 confirmatory samples to ensure that the test pits were excavated to a sufficient depth
- Advancement of 9 soil borings to determine the extent of the ashy layer extending from the burn area.
- Collection of three co-located surface water (WBGSW4, WBGSW5, and WBGSW6) and sediment samples (WBGSD4, WBGSD5, and WBGSD6) from the unnamed pond.

9.4.2.1 Geophysical Survey *and 1998 Soil Sampling Activities*

A Geonics EM61 bottom coil geophysical survey was conducted within the former burn area to identify areas that contained elevated concentrations of buried metallic debris. The results of the survey identified five geophysical anomalies that were selected for further investigation through the collection of soil samples The findings of the geophysical survey are summarized in the *Results of Geophysical Investigation Report (ICF KE, 1998)*.

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Five soil borings were completed (WBGSB1 through WBGSB5) in the former burn area using direct-push sampling technology to investigate the anomalies identified in the geophysical survey. A thin ashy layer of material was encountered at approximately 0.5 – 2 ft bgs during advancement of the soil borings. Surface soil samples (0-2 ft bgs) were collected at each of the boring locations to characterize the ashy material. Subsurface soil samples were also collected at the WBGSB1 boring (2-4 ft bgs) and the WBGSB2 boring (6-8 ft bgs and 9-11 ft bgs). All samples were analyzed for TCL VOCs, TCL SVOCs, explosives, and TAL inorganics,. The analytical results from these samples are summarized in Table 9-4. The results indicated the following:

VOCs. Methylene chloride was detected in the surface soil samples at WBGSB2 and WBGSB4. The detected concentrations were several orders of magnitude below residential RSLs (See Table 9-4). Methylene chloride is a common laboratory contaminant.

SVOCs. As indicated in Table 9-4, several SVOCs were detected in a limited number of the soil samples. Benzo(a)pyrene was detected above the industrial RSL in the near surface soil samples at WBGSB3 and WBGSB4. Benzo(a)anthracene and benzo(b)fluoranthene were also detected at concentrations above residential RSLs at these locations. No other PAH compounds were detected at concentrations above applicable RSLs.

Explosives. No explosives were detected in any of the soil samples.

Inorganics. Several inorganics were detected in all of the soil samples (See Table 9-4). A limited number of the inorganic constituents (antimony, arsenic, barium, copper, lead, and zinc) were detected at concentrations above background levels and applicable RSLs.

- Lead was detected in the surface soil samples at WBGSB1 (2,070mg/kg) WBGSB2 (2,450 mg/kg), WBGSB3 (3,990 mg/kg) and WBGSB4 (2,480 mg/kg) at concentrations higher than industrial RSLs and background levels. The lead concentrations in all of the subsurface samples were below residential RSLs.
- Antimony, arsenic, barium, copper, and zinc concentrations were also elevated compared to background concentrations in several of the surface soil samples and were higher than residential screening levels in at least one of the samples. The inorganics concentrations in the subsurface samples were less than established background levels.

9.4.2.2   1999 Soil Sampling Activities

Nine soil borings (WBGPB1 through WBGPB6 and WBGQSB1 through WBGQSB3) were advanced in 1999 to evaluate the extent of the subsurface ash layer identified in the burn area during the 1998 sampling event. The findings from this investigation indicated that ash was present in five of six borings (WBGPB1 through WBGPB5) advanced along the dirt road leading to the unnamed pond. Ash was not encountered in the boring located furthest from the burn area along the road (WPGWB6) or in three borings (WBGQSB1 through WBGQSB3) advanced south of southern berm around the burn area. The ash layer was reported to have ranged in thickness from approximately 2 inches to 1 ft in the areas it was detected. The ash layer was generally encountered from 2 to 4 ft bgs. The ashy layer appears to have been buried when the pond access road was constructed. The boring locations are depicted in Figures 9-2 and 9-3.

Based on the presence of the ashy layer underneath the road, an additional 10 soil borings (WBGSB12 through WBGSB21) were advanced along the unpaved road to further evaluate soil quality. The boring locations are depicted in Figures 9-2 and 9-3. Surface soil samples (0-2 ft bgs) and subsurface soil samples (2-4 ft bgs) were collected from the WBGSB13 through WBGSB21 borings. The sample at WBGSB12 was collected from 0-4 ft bgs. All of the soil samples collected during this investigation were analyzed for TCL SVOCs and TAL inorganics. The laboratory analytical results are summarized in Table 9-5. The results indicated the following:

SVOCs. SVOCs were not detected in any of the surface or subsurface soil samples.

Inorganics. Several inorganic constituents were detected in all of the surface and subsurface soil samples (see Table 9-5). However, the detected concentrations were all below established background levels and/or applicable industrial and residential RSLs.

Six surface soil samples (WBGSB6 through WBGSB11) were collected from soil borings competed on the berm surrounding the former burning area. The samples were collected from 0-2 ft bgs; deeper samples were not collected at these locations due to refusal on shallow bedrock. The samples were analyzed for TCL VOCs, TCL SVOCs, PAHs, explosives, TAL inorganics, pH, and TOC (one sample). The sample locations are depicted in Figures 9-2 and 9-3 and the analytical results are summarized in Table 9-5.

VOCs. Two VOCs were detected in the soil samples (see Table 9-5). Acetone was detected at WBGSB10 and p-isopropyltoluene was detected at WBGSB8. The detected concentrations were several orders of magnitude below applicable RSLs.

SVOCs. Di-n-butylphthalate was the only SVOC detected in the berm area samples (see Table 9-5). The detected concentrations were all several orders of magnitude below applicable RSLs.

PAHs. Three PAHs (acenaphthylene, benzo(b)fluoranthene, and pyrene) were detected at concentrations below residential RSLs at WBGSB9 (see Table 9-5). No other PAHs were detected at any of the sample locations.

Explosives. No explosives were detected in any of the samples.

Inorganics. Several inorganics were detected in all of the berm area soil samples (see Table 9-5). The detected concentrations were all below established background levels and/or applicable RSLs with the exception of arsenic at sample location WBGSB8. Arsenic was detected at a concentration higher than the industrial RSL and slightly above the established background at WBGSB8. It should be noted that the arsenic concentration in a duplicate sample collected at WBGSB8 was 15.8 mg/kg, which is equal to the established background concentration.

These results suggest that ash from the burning activities was not mixed with the soil in the berm. The berm was likely constructed from native soil in the area prior to the initiation of burning activities at the WBG.

Two soil samples [WBGBC1A (0-2 ft bgs) and WBGBC1B (5-7 ft bgs)] were collected from a soil boring located underneath a former burn cage at the WBG. These samples were analyzed for TCL SVOCs and TAL inorganics. The analytical results from these samples, which are presented in Table 9-5, indicated that inorganics concentrations were within normal background levels. The only SVOC detected, bis(2-ethylhexyl)phthalate, was detected at a concentration (0.040 mg/kg) several orders of magnitude less than the residential RSL of 35 mg/kg. The results suggest that the burn cage had been moved to this location and was not actually used at this sample location.

9.4.2.3 1999 Test Pitting and Confirmatory Sampling

In 1999, 19 test pits were advanced in the former burn area to characterize the subsurface conditions. Because of elevated inorganics concentrations, soils excavated during the test pitting activities was disposed off-site. The excavation of the test pits effectively removed soils containing elevated constituent concentrations inside the bermed area where the burning operations were conducted. A total of 19 samples (WBGDW1 through WBGDW7 and WBGDW15 through WBGDW26) were collected from the excavated material and submitted for laboratory analysis of TCLP-inorganics. None of the detected analytes were above applicable TCLP standards. The analytical results from the excavated/stockpiled soils are summarized in Table 9-6.

A total of 43 confirmatory soil samples (WBGTP1A through WBGTP19S) were collected from the base of the test pits to verify that the excavation activities were effective at removing the soils affected by the former burning activities. All of the samples were analyzed for TAL inorganics. Seven of the samples (WBGTP2B, WBGTP7A, WBGTP10B, WBGTP12A, WBGTP12S, WBGTP18A, and WBGTP19A) were also analyzed for TCL SVOCs, pH, and dioxins/furans. The sample locations are depicted in Figure 9-3 and the laboratory analytical results are summarized in Table 9-7. The results indicate the following:

SVOCs. Several SVOCs were detected in isolated samples collected during the test pit confirmation sampling program (see Table 9-7). Benzo(a)pyrene was detected at sample locations WBGTP3A and WBGTP9A at concentrations above the residential RSL. Dibenzo(a,h)anthracene also was detected at a concentration above the residential RSL at WBGTP9A (0.20 mg/kg). No other SVOCs were detected at concentrations above applicable industrial or residential RSLs.

Dioxins/Furans. As indicated in Table 9-7, several dioxins and furans were detected in the soil samples analyzed for this group of constituents. However, the dioxin 1,2,3,7,8-PeCDD at sample location WBGTP2B was the only constituent detected at a concentration above an applicable residential RSL.

Inorganics. The inorganics concentrations detected in 42 of the 43 confirmation samples were either below the residential RSLs or established background levels (see Table 9-7). Lead was detected at a concentration of 808 mg/kg at sample location WBGTP1B (3.5 - 4 ft bgs) which is above the industrial RSL of 800 mg/kg. The test pitting activities had removed all soil to top of bedrock at this location, therefore no additional soil was excavated.

9.4.2.4 1998 and 1999 Sediment and Surface Water Sampling

Three co-located surface water/sediment samples were collected from the WBG in 1998. Two of these samples (WBGSD/SW2 and WBGSD/SW3) were collected from the unnamed pond and one (WBGSD/SW1) was collected from the unnamed creek downstream from the pond. These samples were analyzed for TCL VOCs, TCL SVOCs, explosives, and TAL inorganics,. Three additional co-located sediment and surface water samples were collected from the unnamed pond (WBGSD/SW4, WBGSD/SW5, and WBGSD/SW6) in 1999. These samples were analyzed for TCL SVOCs, TAL inorganics, perchlorate (surface water), and total organic carbon. The sample locations are depicted in Figure 9-2. The analytical results for the sediment samples are summarized in Table 9-8, and the analytical results for the surface water samples are summarized in Table 9-9.

The analytical results for the sediment samples indicated:

VOCs. Two VOCs (acetone and toluene) were detected at low concentrations in 1998 samples WBGSD1, WBGSD2, and WBGSD3 (see Table 9-8). The detected concentrations were several of orders of magnitude below residential RSLs. No VOCs were detected in the 1999 sediment samples.

SVOCs. 4-Methylphenol at WBGSD2 and bis(2-ethylhexyl)phthalate at WBGSD5 were the only SVOCs detected in the sediment samples (See Table 9-8). The detected concentrations were below applicable residential RSLs.

Explosives. No explosives were detected in the sediment samples.

Inorganics. The detected inorganics concentrations generally corresponded with background inorganics concentrations for the site. However, lead was detected at sample location WBGSD5 at a concentration of 347 mg/kg, which is greater than the established background of 26.8 mg/kg. A second sample was collected at the WBGSD5 location in 1999 that resulted in a lead concentration of 899 mg/kg, which is higher than the industrial RSL of 800 mg/kg.

The analytical results for the surface water samples indicate:

VOCs. Chloroform and 2-butanone were detected at sample location WBGDW2 and were the only VOCs detected in the surface water samples (see Table 9-9). The concentration of chloroform at WBGSW2 was above the tap water RSL.

SVOCs. Diethylphthalate at WBGSW1 and di-n-butylphthalate at WBGSW6 were the only SVOCs detected in the surface water samples (see Table 9-9). The detected concentrations were several orders of magnitude below applicable tap water RSLs.

Explosives. No explosives were detected in any of the surface water samples.

Inorganics. Several inorganic constituents were detected in the surface water samples (See Table 9-9). However, arsenic at WBGSW5 and WBGSW6 and thallium at WBGSW1 were the only constituents detected at concentrations above tap water RSLs.

Perchlorate. Perchlorate was not detected in any of the surface water samples.

9.4.3 Remedial Investigation, Shaw, 2002

During 2002 Shaw completed remedial investigation activities at the WBG to further evaluate soil quality to the north and west of the former burn area, and near a former transformer location, Surface water and sediment samples were also collected from the unnamed pond, downstream creek, and area drainage pathways. Activities completed during this phase of the investigation included:

- Four soil borings (WBGSB22 through WBGSB25) to evaluate surface and subsurface soil quality to the west and northwest of the former burn area. Samples were collected at 0-0.5 ft bgs, 2-4 ft bgs, and 6-8 ft bgs at each boring.
- Collection of one surface soil sample (WBGTR01) near a former transformer location to evaluate whether PCBs were present.
- Nine co-located surface water/sediment samples (WBGSW/SD07 through WBGSW/SD15) to further evaluate sediment and surface water quality in the unnamed pond, downgradient stream, and area drainage pathways.

The sample locations from this investigation are depicted in Figure 9-2.

9.4.3.1 2002 Soil Sampling

The soil samples collected from the four soil borings (WBGSB22 through WBGSB25) were analyzed for VOCs, SVOCs/PAHs, PCBs, explosives, dioxins/furans, and inorganics. The surface soil samples collected at each boring location were also analyzed for herbicides and pesticides. The surface soil sample at the former transformer location was only analyzed for PCBs. The analytical results from the 2002 soil sampling activities are summarized in Table 9-10. The results of the sampling activities indicated:

VOCs. Acetone, carbon disulfide, d-limonene, and toluene were detected in a limited number of the soil samples (see Table 9-10). However, the detected concentrations were several orders of magnitude below applicable residential RSLs.

SVOCs/PAHs. Seventeen PAHs and five non-PAH SVOCs were detected in various soil samples (see Table 9-10). One PAH, benzo(a)pyrene, was detected in surface soil at WBGSB24 and WBGSB25 at concentrations above the industrial RSL. Benzo(a)pyrene was also detected above the industrial RSL in the 2-4 ft bgs sample at WBGSB22. The PAHs, benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene were also detected in surface soil at WBGSB24 and WBGSB25, and subsurface soil at WBGSB22, at concentrations above residential RSLs. No other PAH/SVOC constituents were detected at concentrations above residential RSLs.

PCBs. One PCB, Aroclor 1254 was detected in the 2-4 ft bgs sample collected at soil boring WBGSB22. The detected concentration 0.87 mg/kg is higher than the industrial RSL of 0.74 mg/kg. Aroclor 1254 was not detected in the surface soil sample or the 6-8 ft bgs sample at WBGSB22. PCBs were not detected in any of the other soil samples, including at the former transformer location (WBGTR01).

Pesticides. 4,4'-DDD was detected in surface soil at WBGSB25 (0.0019 mg/kg) and dieldrin was detected in surface soil at WBGSB24 (0.00472 mg/kg). The detected concentrations of both constituents were below residential RSLs. No other pesticides were detected in the soil samples.

Herbicides. Four herbicides (2,4,5-TP, 2,4-D, dalapon, and MCPP) were detected in the surface soil samples. The detected concentrations were all lower than residential RSLs.

Explosives. Pentaerythritol Tetranitrate was detected at a concentration of 0.11 mg/kg in the surface soil sample at WBGSB24 (see Table 9-10). There is not an established RSL for this constituent. No other explosives were detected in any of the soil samples.

Dioxins/Furans. Several dioxins/furans were detected in both the surface and subsurface soil samples at WBGSB22 through WBGSB25 (see Table 9-10). 1,2,3,7,8-

PeCDD, detected in the 2-4 ft bgs sample at WBGSB22, was the only compound detected at a concentration above residential RSLs.

Inorganics. Several inorganics were detected in all of the soil samples (see Table 9-10). The 2-4 ft bgs sample from WBGSB22 contained lead (965 mg/kg) and arsenic (29 mg/kg) at concentrations above industrial RSLs and background levels. Iron (61,800 mg/kg) was also detected in this sample at a concentration above the residential RSL and background. This sample location corresponds with a subsurface layer of ashy material detected underneath the pond access road. The surface soil sample and the 6-8 ft bgs sample at WBGSB22 did not contain arsenic, iron, or lead at concentrations above residential RSLs and background. The other soil borings did not contain inorganics at concentrations above residential RSLs and background levels, with the exception aluminum in subsurface soil (6-8 ft bgs) at WBGSB23. The concentrations of aluminum was only slightly above the established background concentrations at the referenced location.

9.4.3.2 2002 Sediment Sampling

A total of 9 sediment samples were collected in 2002 (WBGSB07 through WBGSB15). Four of the samples (WBGSD07, WBGSD10, WBGSD11, and WBGSD12) were collected from the unnamed pond. Three of the samples (WBGSD08, WBGSD09, and WBGSD13) were collected from the stream downgradient of the pond. Sample WBGSD14 was collected from the unnamed creek that runs through the southwest portion of the RFAAP-NRU, upstream of the confluence with the pond effluent stream. WBGSB15 was collected from a drainage pathway located upgradient (west) of the pond. The samples were analyzed for VOCs, SVOCs/PAHs, PCBs, pesticides, herbicides, explosives, dioxins/furans, inorganics, and total organic carbon. The analytical results from these samples are presented in Table 9-11. The results indicated:

VOCs. Four VOCs (2-butanone, acetone, carbon disulfide, and toluene) were detected in sediment samples (see Table 9-11). However, the detected concentrations were several orders of magnitude below applicable residential RSLs. These constituents were also detected in laboratory blank samples; therefore, it is likely that the reported concentrations are due to laboratory contamination.

SVOCs/PAHs. Seventeen PAHS and six non-PAH SVOCs were detected in sediment samples (see Table 9-11). Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene were detected at WBGSD09 at concentrations above industrial RSLs. Benzo(a)pyrene was also detected at WBGSD07 and WBGSD14 at concentrations above the industrial RSL. Benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene were detected at concentrations above residential RSLs at WBGSD07 and WBGSD14.

PCBs. No PCBs were detected in the sediment samples.

Pesticides. The pesticides 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, alpha-chlordane, delta-BHC, dieldrin, Endosulfan, endrin aldehyde, endrin ketone, gamma-chlordane, and methoxychlor were detected in several sediment samples (see Table 9-11). All of the detected constituents were below applicable residential RSLs. It should also be noted that pesticides were also detected in WBGSD14 and WBGSD15 which were collected from an unnamed stream outside the boundaries of the RFAA-NRU. These samples were collected from an upstream location and were outside the influence of the RFAAP-NRU, therefore it is likely that the detected pesticides can be attributed to an off-site source.

Herbicides. Four herbicides (2,4,5-TP, 2,4-D, dicamba, and MCPP) were detected in sediment samples (see Table 9-11). The detections, all of which were below residential RSLs, occurred in WBGSD8 and WBGSD14.

Explosives. 1,3,5-trinitrobenzene and nitroglycerine were detected at WBGSD12 at concentrations of 0.41 mg/kg and 0.96 mg/kg, respectively. The nitroglycerine concentration was above the residential RSL. No other explosives were detected in sediment samples.

Dioxins/Furans. Several dioxins/furans were detected in the sediment samples from the pond and downgradient stream (see Table 9-11). All of the detected concentrations were below applicable residential RSLs.

Inorganics. Several inorganics were detected in all of the sediment samples (see Table 9-11). Chromium (15,400 mg/kg), cobalt (84.1 mg/kg), lead (109,000 mg/kg) and zinc (17,300 mg/kg) were detected in pond sediment sample WBGSD10 at concentrations above both residential and/or industrial RSLs, as well as background levels. Arsenic was detected in stream samples WBGSD9 (16.6 mg/kg) and WBGSD13 (30.4 mg/kg) at concentrations above industrial RSLs and slightly above established background levels. Iron was also detected in stream sample WBGSD13 (293,000 mg/kg) at a concentration above the residential RSL and background level.

9.4.3.3 2002 Surface Water Sampling

Surface water samples were collected in conjunction with the nine sediment samples discussed in the previous section. The surface water samples were analyzed for VOCs, SVOCs/PAHs, PCBs, pesticides, herbicides, explosives, dioxins/furans, inorganics, and perchlorate. The laboratory analytical results from these samples are summarized in Table 9-12.

VOCs. Seven VOCs [acetone, carbon disulfide, chloroform, cis-1,2-dichloroethene (cis-1,2-DCE), tetrachloroethene (PCE), toluene, and trichloroethene (TCE)] were detected in surface water samples during this phase of investigation (see Table 9-12). Three of these constituents (cis-1,2-DCE, PCE, and TCE) were only detected in sample WBGSW14, which was collected from the unnamed stream that runs through the southwest portion of the RFAAP-NRU, prior to the confluence with the WBG stream and upstream of the RFAAP-NRU facility boundary. The concentration of PCE in this sample was higher than the tap water RSL. Chloroform was also detected at a concentration greater than the tap water RSLs at WBGSW08 , WBGSW09, and WBGSW10.

SVOCs/PAHs. Six PAHS and seven non-PAH SVOCs were detected in surface water samples (see Table 9-12). None of the detected constituents were at concentrations above their respective tap water RSL.

PCBs. No PCBs were detected in the surface water samples.

Pesticides. Dieldrin was detected at WBGSW08, WBGSW13, and WBGSW14 (see Table 9-12). The concentrations detected at WBGSW08 and WBGSW14 were higher than the tap water RSL. No other pesticides were detected in surface water.

Herbicides. The herbicide MCPP was detected at WBGSW08 at a concentration above the tap water RSL (see Table 9-12). The herbicide 2,4-D was also detected at WBGSW08 and WBGSW14, although the concentrations were below tap water RSLs.

Explosives. The explosive m-nitrotoluene was detected at WBGSW08 and WBGSW09 (see Table 9-12). There is no tap water RSL for this constituent.

Dioxins/Furans. The dioxin OCDD was detected at WBGSD07, WBGSW08, WBWSW09, and WBGSW10 (see Table 9-12). The detected concentrations were below the tap water RSL. No other dioxins or furans were detected in surface water samples.

Inorganics. Iron (50,900 µg/L) and manganese (1,470 µg/L) were detected at concentrations higher than the tap water RSL at WBGSW13. No other inorganics were detected at concentrations above the tap water RSLs (see Table 9-12).

Perchlorate. Perchlorate was detected in surface water sample WBGSW14 (see Table 9-12). The detected concentration was below the tap water RSL.

9.4.4 Additional Characterization, Shaw, 2004

Shaw completed additional sampling activities at the WBG site in 2004 that were designed to further assess the horizontal and vertical extent of constituents detected in surface and subsurface soil extending from the burning ground. The investigation also included additional assessment activities for the unnamed pond. Activities completed during this investigation included:

- Collection of 54 surface soil samples, 27 subsurface soil samples and 14 pond sediment samples for lead field screening using XRF technology.
- Collection of 21 surface soil samples and 10 subsurface soil samples from 28 soil borings (WBGSB26 through WBGSB53) for laboratory analysis.
- Collection of 10 sediment samples (WBGSD16 through WBGSD25) from the unnamed pond for laboratory analysis.
- A fish tissue/bioaccumulation sampling event for the unnamed pond.

9.4.4.1 2004 Soil Sampling

Shaw conducted soil sampling activities at the WBG in 2004 to further evaluate surface soil and subsurface soil quality outside of the former burn area. Samples were collected from the pond access road, the drainage ditch on the northwest side of the pond access road, a drainage swale to the southwest of the burn area, and from the slope leading from the former burn area to the pond.

The investigation in the pond access road area included the advancement of 30 soil borings (SB1 through SB25, SB28, SB29, and SB32 through SB35). The borings were performed along the centerline and on each side of the dirt road. A total of 30 surface soil samples and 27 subsurface soil samples from these borings were field screened for lead using XRF. Thirteen of these samples [WBGSB43(0-0.5 ft bgs), WBGSB43(4-

5 ft bgs), WBGSB44(0-0.5), WBGSB44(1-2 ft bgs), WBGSB45(0-0.5 ft bgs), WBGSB45(4-5 ft bgs), WBGSB46(4-5 ft bgs), WBGSB47(5-6 ft bgs), WBGSB48(4-5 ft bgs), WBGSB49(1-2 ft bgs), WBGSB50(3-4 ft bgs), WBGSB51(3-4 ft bgs), and WBGSB52(3-4ft bgs)] were also submitted for laboratory analysis of PCBs and TAL inorganics. The subsurface soil samples corresponded to the layer of ashy material underlying the road as identified in previous investigations. The field screening results and laboratory analytical results from these samples are summarized in Table 9-13, and 9-14, respectively. The sample locations are depicted in Figures 9-2, 9-3, and 9-4. The results indicated:

XRF Field Screening Results. The XRF field screening results indicated that two of the surface soil samples (SB2 and SB34) and four of the subsurface soil samples (SB5, SB8, SB11, and SB14) contained lead at concentrations above the industrial and/or residential RSLs (see Table 9-13). These sample locations were all collected along the centerline of pond access road. The 28 other surface soil samples and 23 subsurface samples all had concentrations below applicable RSLs, which indicates that the extent of lead in the surface soils and subsurface soils is very limited.

PCBs. PCBs were not detected in any of the surface or subsurface soil samples (see Table 9-14).

TAL Inorganics. Several inorganics were detected in the surface and subsurface soil samples from the pond access road area (see Table 9-14). None of the detected constituents were at concentrations above background and industrial screening levels. However, aluminum was detected in one subsurface soil sample at a concentration above background levels and in the residential RSL. Iron was also detected in two subsurface soil samples at concentrations above background levels and the residential RSL.

Shaw's XRF field screening program also included the collection of 24 surface soil samples from the drainage ditch north of the pond access road, the sloped area between the former burn area and the pond, and a drainage swale leading into the pond. Seventeen of the field screened locations (WBGSB26 through WBGSB42) were also submitted for laboratory analysis of PCBs and TAL inorganics. In addition to TAL inorganics and PCBs, samples WBGSB26, WBGSB27, and WBGSB28, were analyzed for PAHs. The XRF field screening results and the laboratory analytical results from these samples are summarized in Tables 9-13 and 9-14. The XRF sample locations are depicted in Figure 9-4. The results indicated:

XRF Field Screening Results. The XRF Field screening results indicated that none of the 24 field screened surface soil samples contained lead at concentrations above the residential RSL (see Table 9-13). The XRF field screening results were typically biased high in comparison to the laboratory analyses where duplicate soil samples were collected.

PAHs. Thirteen PAH constituents were detected in the three soil samples submitted for laboratory analysis (see Table 9-14). The results indicated that benzo(a)pyrene was present at a concentration above the industrial RSL at sample location WBGSB27. This sample was located in the unlined drainage ditch located northwest of the pond access road. Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene were also detected at concentrations above residential RSLs in the surface soil samples.

TAL Inorganics. Several inorganics were detected in the surface soil samples (see Table 9-14). However, none of the detected constituents were present at concentrations above applicable RSLs and background levels.

9.4.4.2 2004 Sediment Sampling

Shaw collected sediment samples from the unnamed pond for field screening and laboratory analysis to assess the extent of elevated inorganic constituent concentrations. The investigation activities focused on the northeastern side of the pond where lead and chromium had been detected at concentrations above industrial RSLs in 2002 sample location WBGSD10. Fourteen sediment samples (SD1 through SD14) were collected for field screening of lead using XRF. Ten samples (WBGSD16 through WBGSD25) were also submitted for laboratory analysis of PCBs and TAL inorganics. Sample location WBGSD16, which was collected where a drainage ditch enters the pond, was also analyzed for PAHs. XRF sample locations SD9 through SD14 correspond with lab sample locations WBGSD17 through WBGSD22, respectively. The XRF field screening results are presented in Table 9-13 and the laboratory analytical results are presented in Table 9-15. The sample locations are depicted in Figures 9-2 and 9-4. The results indicated the following.

XRF Field Screening Results. The XRF results indicated that 3 of the 14 sediment samples contained lead at concentrations above industrial RSLs. One additional sample also contained lead at a concentration above the residential RSL (see Table 9-13). All of the samples with concentrations above applicable screening levels were collected within a small area near the northern bank of the pond. The lead concentrations were below applicable screening levels in samples collected further from the shore of the pond.

PAHs. Several PAHs were detected in the WBGSD16 sediment sample collected where the drainage ditch enters the pond. However, benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene were the only constituents detected at concentrations above residential RSLs. No PAHs were detected above industrial RSLs.

PCBs. No PCBs were detected in any of the sediment samples during this event.

TAL Inorganics. Several inorganics were detected in all of the sediment samples. However, lead was the only constituent detected at a concentration above background levels and an applicable RSL (see Table 9-15). Lead was detected in one sediment sample (WBGSD17) at a concentration above the residential RSL. This sample was collected along the northern bank of the pond in the area where previous sampling had indicated elevated concentrations of lead and chromium. No inorganics were detected at concentrations above industrial RSLs.

9.4.4.3 2004 Fish Tissue/Bioaccumulation Study

Shaw performed electrofishing activities in the unnamed WBG pond in 2004. Fish species that were captured included: bluegill (*Lepomis macrochirus*), green sunfish (*Lepomis cyanellus*), common carp (*Cyprinus carpio*), and white sucker (*Catostomus commersoni*). Bluegills were the most abundant fish in the pond and were selected to represent water column dwelling fish in the pond. Only one common carp and one white sucker were collected and were used to represent bottom dwelling fish in the pond.

Seven bluegill ranging from 168 to 186 mm in length and 90 to 143 grams in weight were selected for whole body analysis(WBGTS01 through WBGTS07), while seven bluegill ranging from 190 to 222 mm in length and 140 to 233 grams in weight were selected for fillet analysis (WBGTS15 through WBGTS21). Due to the fact that only two bottom dwelling fish were collected, the single white sucker (410 mm in length and weighed 1 lb 15 oz) was selected for whole body analysis (WBGTS08) and the single common carp (670 mm in length and 10 lbs 8 oz) was selected for fillet analysis WBGTS22).

All fish tissue samples were sent to GPL Laboratories and analyzed for TCL PCBs, TAL inorganics, and percent lipids. Detected constituent are presented in Table 9-16.

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The results indicated that PCBs were not present in any of the fish tissue samples. Aluminum, barium, calcium, chromium, copper, iron, magnesium, manganese, mercury, potassium, sodium, and zinc were detected at varying concentrations in the samples (see Table 9-16). All of these constituents are naturally occurring in soils at the facility. Lead, which is the primary COPC in sediment at the WBG was not detected in any of the fish tissue samples.

9.4.5 Remedial Investigation, ARCADIS, 2008

In accordance with Remedial Investigation Work Plan Addendum 27 (ARCADIS 2008b), ARCADIS completed additional RI activities at the WBG in 2008 to finalize the characterization and delineation work at this site. This investigation included the following components:

- The pond was probed in several areas to determine the depth of the bottom sediments.
- Four sediment samples (WBG-SE001 through WBG-SE004) were collected from the area of the pond where elevated lead and chromium concentrations had been detected during the 2002 investigations. Three co-located surface water samples (WBG-SW002 through WBG-SW004) were also collected at these locations.
- Two co-located sediment (WBG-SE005 and WBG-SE006) and surface water (WBG-SW005 and WBG-SW006) samples were collected from the unnamed creek downgradient of the WBG pond to evaluate PAH detections that had been observed during previous sampling events.

The pond sediment gauging activities indicated that the sediments range in thickness from approximately 8 to 20 inches. Several large boulders are located in northeastern portion of the pond where the elevated lead concentration had been detected during previous sampling events.

The sediment samples collected from the pond (WBG-SE01 through WBG-SE04) were analyzed for lead by USEPA Method 6010B. The surface water samples were analyzed for TAL inorganics by USEPA Method 6010B. The laboratory analytical results for the sediment samples are summarized in Table 9-17 and the laboratory analytical reports are in Appendix F. The surface water analytical results are summarized in Table 9-18. The sample locations are depicted in Figure 9-2. The results of the sampling activities indicated:

- Lead concentrations ranged from 255 mg/kg (WBG-SE004) to 1,550 mg/kg (WBG-SE001) in the samples submitted for laboratory analysis. The lead concentrations at WBG-SE001 and WBG-SE003 were above the industrial RSL, while the concentration at WBGSE002 was only higher than the residential RSL (Table 9-17).
- The sediment sampling results confirm the presence of lead concentrations above applicable RSLs detected during previous sampling events.
- Lead concentrations in surface water ranged from 20.5 µg/l (WBG-SW002) to 106 µg/L (WBG-SW004) (see Table 9-18).

Two sediment (WBG-SE005 and WBG-SE006) and surface water samples (WBG-SW005 and WBG-SW006) were collected from the unnamed stream downgradient of the pond. The co-located WBG-SE005 and WBG-SW005 samples were collected approximately 120 ft downstream of the ponds earthen dam. The co-located WBG-SE006 and WBG-W006 samples were collected approximately 210 ft further downstream, near where the creek passes underneath a railroad bridge. The sediment and surface water samples were analyzed for PAHs by USEPA method 8270. The laboratory analytical results are summarized in Tables 9-17 and 9-18, respectively, and the laboratory analytical reports are in Appendix F. The sample locations are depicted in Figure 9-2. The results indicated the following:

- A total of 16 PAHs were detected in the two sediment samples from the creek. The detected constituents were all at concentrations below industrial RSLs. However, benzo(a)pyrene was detected above the residential RSL in sediment sample WBG-SE006 (see Table 9-17).
- No PAHs were detected at concentrations above tap water RSLs in either of the surface water samples. The PAHs that were detected were several orders of magnitude below applicable tap water RSLs (see Table 9-18).

9.5 Nature and Extent of Constituent Detections

The analytical results presented in the previous sections indicate that constituents have been detected at the WBG site as a result of historical burning ground operations. Site characterization activities performed at the WBG from 1997 through 1999 indicated the presence of an ashy layer of material throughout the burn area and elevated concentrations of inorganics and PAHs in burn area soils. A test pitting program completed in 1999 effectively removed all of the soils containing elevated constituent concentrations from the former burn area; therefore, the burn area is no longer a concern. Subsequent investigation activities at the site have focused on characterizing and delineating constituent detections outside of the burn area. Areas that have been investigated have included the access road on the northwest side of the burn area (underneath which an ashy layer of material has been identified); surface and subsurface soils located downgradient from the burn area; the berms surrounding the burn area; sediments and surface water in the unnamed pond; sediments and surface water in the unnamed creek downgradient of the pond; and a former transformer location.

9.5.1 Soil

Prior to the 1999 test pitting program, the soil sampling activities at the WBG primarily focused on the rectangular (170 ft by 100 ft) area where the former burning operations were conducted. The sampling and other investigation activities indicated that an ashy layer of material was present in surface and subsurface soils throughout the burn area as a result of the former burning operations. Analytical data from soil samples also indicated that dioxins/furans, PAHs, inorganics, and the PCB Aroclor 1254 were detected in soil within the burn area. Based on initial review of the data, lead appeared to be the primary concern within the burning area soil based on detections at concentrations above industrial RSLs. The burn area soils were removed during the 1999 test pitting program. A total of 43 confirmation samples were collected to verify that inorganics, PAHs, and dioxins/furans were no longer present at concentrations above applicable RSLs upon completion of the excavation activities. A site map depicting the confirmation soil sampling results is presented in Figures 9-5 and 9-6.

Outside of the burning area, one of the primary areas of investigation at the WBG has been the dirt access road which runs along the open side (northwestern side) of the former burn area. During the course of investigation at the site, an ashy layer of material was identified in the subsurface (approximately 2-4 ft bgs) under the road that was very similar to the ashy soils that had been present in the burn area. It is believed that this ashy layer of material was likely pushed out of the former burn area during regrading activities that would have been performed between burning events. This ashy layer was likely buried when the dirt road was constructed to the pond. The extent of the ashy layer was delineated by extensive soil boring activities completed in 1994 and 2004 and is confined to the subsurface soils underneath the road.

Surface soil and subsurface soil samples collected from the road area have been analyzed for SVOCs, PAHs, PCBs, and inorganics Samples have also been field screened for lead using XRF. The laboratory analytical results indicated that aluminum and iron were detected in isolated subsurface soil samples at concentrations above residential RSLs and slightly above the established background levels. Lead, which had been the main COPC in the former burial area was present in surface and subsurface soils in the access road area at concentrations above established background concentrations but below residential RSLs. XRF field screening results also indicated that lead concentrations were below screening levels in 53 of the 58 samples; however, the XRF results did indicate that lead was present at concentrations above industrial RSLs in 3 of the 58 samples and above residential RSLs in 2 others. SVOCs/PAHs and PCBs were not detected in surface or subsurface soils in the road area.

Six soil samples (WBGSB6 through WBGSB11) were collected from the berms surrounding the burn area in 1999. The samples were analyzed for TCL VOCs, TCL SVOCs, PAHs, explosives, TAL inorganics and pH. The results indicated that inorganics concentrations within the berm were comparable to the established background levels for the facility and that no other constituents were detected above applicable RSLs. These results suggest that ash from the burning activities was not mixed with the soil in the berm and that the berm was likely constructed from native soil in the area prior to the initiation of burning activities at the WBG.

Surface and subsurface soil samples were collected downgradient (northwest, west, and south) of the burning ground and road to evaluate the potential for constituents to have migrated outside the burn area. Samples were analyzed for VOCs, SVOCs/PAHs, pesticides, herbicides, dioxins/furans, explosives, and inorganics. The results from these areas indicated:

- No VOCs were detected at concentrations above applicable industrial or residential RSLs.

- Seventeen different PAHs were detected in surface and subsurface soil outside of the former burn area. Benzo(a)pyrene was detected at a concentration above the industrial RSL in two surface soil samples (WBGSB24 and WBGSB25) and one subsurface soil sample [WSBGSB22(2-4 ft bgs]. Benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene were also detected in these samples at concentrations above residential RSLs. The WBGSB22 sample location is at the end of the dirt pond access road, and the WBGSB24 and WBGSB25 sample locations are in a small drainage pathway located west, and downslope, from the former burn area. This area receives runoff from the former burn area and from the surrounding RFAAP-NRU roads and flows into the pond.

- No PCBs were detected in the soil sample collected at the former transformer location; however, the PCB Aroclor 1254 was detected in one subsurface soil sample [WBGSB22(2-4 ft bgs)] located at the end of the pond access road. This constituent was not detected in surface soil or deeper (6-8 ft bgs) samples collected at the WBGSB22 boring location. PCBs were not detected in any other samples at the site. Therefore, the one detection appears to be isolated.

- Four herbicides (2,4,5-TP, 2,4-D, dalapon, and MCPP) and two pesticides (4,4'-DDD, and dieldrin) were detected at low concentrations in four surface soil samples (WBGSB22 through WBGSB25). The detected concentrations were several orders of magnitude below residential RSLs.

- The dioxin 1,2,3,7,8 PeCDD was detected in one subsurface soil sample [WBGSB22(2-4 ft bgs)] at a concentration above the residential RSL. Several other dioxins/furans were detected in surface and subsurface samples, but the concentrations were all lower than residential RSLs.

- Despite the fact that the former burning ground operations were used to decontaminate and dispose of materials that had been in contact in explosive/energetic compounds, explosives were not found to be a concern at the site. Only one explosive compound was ever detected during the course of sampling at a single location. Penterythritol tetranitrate was detected at a concentration of 0.11 mg/kg at surface soil at WBGSB24.

A site map is presented in Figure 9-7 that displays inorganic constituents detected in soil outside of the burn area at concentrations above background levels. Figure 9-8 displays the organic constituents detected in soil outside of the burn area.

9.5.2 Sediment

The unnamed pond located at the WBG was another area of focus during the environmental investigations at the site due to the potential for affected media (i.e., soils and ashy material) to have been transported from the former burn area. A total of 26 sediment samples were collected from the pond between 1997 and 2008. These samples were primarily collected along the northern side of the pond, closest to the former burning area and in areas that appeared to be in preferential flow paths from the surrounding area. The laboratory analytes varied between the sampling events but have included VOCs, SVOCs, PAHs, PCBs, pesticides, herbicides, explosives, dioxins/furans, and inorganics. The results indicated the following:

- Five different VOCs were detected in pond sediment samples (2-butanone, acetone, carbon disulfide, methylene chloride, and toluene). The detections are generally attributed to laboratory instrument contamination. The detected concentrations were all several orders of magnitude below applicable residential RSLs.

- The PAH benzo(a)pyrene was detected above the residential RSL in 3 pond sediment samples (SD-01, WBGSD12, and WGSD16). Benzo(a)anthracene and benzo(b)fluoranthene were also detected at WBGSD16 at concentrations above residential RSLs. Sample locations WBGSD12 and WBGSD16 are located near where a surface water drainage ditch enters the pond. Sample location SD-01 is located at the head waters of the pond (near Wiggins Spring). Surface water runoff from the surrounding area also enters the pond near SD-01.

- PCBs were not detected in the pond sediment samples.

- Seven different pesticides were detected in one pond sediment sample (WBGSD10). However, the detected concentrations were several orders of magnitude below residential RSLs.

- No herbicides were detected in pond sediments.

- The explosives nitroglycerine and 1,3,5-trinitrobenzene were detected in one sediment sample collected in the vicinity of where a drainage feature enters the pond (WBGSD12). The concentration of nitroglycerine was above the residential RSL. Explosives were not detected in any other sediment samples from the pond.

- Several dioxins/furans were detected in pond sediment samples; however, all detected constituents were below residential RSLs.

- Lead was detected in pond sediments at concentrations ranging from 20.6 mg/kg to 109,000 mg/kg. The lead concentrations were above the industrial RSL in 4 of the 26 sediment samples, and above the residential RSL in 2 other samples. The samples with lead concentrations above the RSLs (WBGSD5,

WBGSD10, WBGSD17, WBG-SE001, WBG-SE002, and WBG-SE003) were generally confined to a 2,100 ft^2 area along the north-central bank of the pond in an area that may have been a preferential flow path before the road was constructed. Several large boulders are present in the pond in this area Delineation sampling using both laboratory analytical samples and XRF field screening confirmed that lead concentrations decrease with distance from the northern edge of the pond.

- Chromium and cobalt were the only other inorganics detected at concentrations above established background levels and applicable RSLs Chromium was detected in five of 24 samples at concentrations above background and residential RSLs; although the majority of the detected concentrations were only slightly above background. The highest detected concentration of chromium (15,400 mg/kg) occurred at sample location WBGSD10, which also had the highest concentration of lead. Cobalt was also detected at a concentration above background and the industrial RSL at WBGSD10. The elevated chromium and cobalt detections were confined to the same area where lead was detected above the RSLs.

A gauging program conducted in 2008 indicated that the pond sediments range in thickness from 8 to 20 inches.

A total of six sediment sample (WBGSD1, WBGSD08, WBGSD09, WBGSD13, WBG-SE005, and WBG-SE006) have been collected from the stream downgradient of the pond's earthen dam. This stream receives outfall water from the pond. The analytical results from the various sampling events indicated the following:

- Benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene were detected above the industrial RSL at sample location WBGSD09 in 2002. This sample is located approximately 300 ft downstream from the ponds earthen dam, near where the stream passes under a railroad bridge. A second sample (WBG-SE006) was collected in 2008 near the WBGSD09 sample location. This sample indicated that only benzo(a)pyrene was present at a concentration above residential RSLs. No other PAHs were detected above applicable RSLs at WBG-SE006. Sediment samples collected upstream have not had PAH detections above applicable RSLs.

- Arsenic and iron were detected at sample location WBGSD13 in 2002 at concentrations above background levels and RSLs.. These constituents were within background levels in the other sediment samples from the stream.

- Pesticides, herbicides, and dioxins/furans detected in sediment samples from the stream were below applicable RSLs.

One sediment sample (WBSD14) was collected from the unnamed creek that flows through the southwest portion of the RFAAP-NRU. This sample was collected upstream of where the unnamed creek first flows onto the installation, prior to the confluence with the tributary flowing out of the WBG pond. This sample location is outside the range of influence of the WBG. The results from this sample indicated that several PAHs were present at concentrations above applicable RSLs [benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene]. Pesticides and herbicides were also detected in this sample; albeit at concentrations below applicable RSLs.

A sediment sample was collected from a surface water drainage feature on the western side of the pond (WBGSD15) to identify whether or not other sources were present for the constituents detected in the pond. The results from this sample indicated the presence of pesticides, PAHs, and inorganics, but at concentrations below applicable RSLs and/or background levels.

A site map depicting the inorganic constituents detected in sediment samples during the WBG investigation is presented in Figure 9-9. Figure 9-10 displays the organic constituents that were detected in the sediment samples.

9.5.3 Surface Water

A total of 20 surface water samples were collected during the course of the WBG investigation. In general, the samples were collected in conjunction with the sediment samples discussed earlier. Surface water samples were collected from the WBG pond, the tributary to the unnamed creek that accepts the outfall from the pond, the unnamed creek upstream of the confluence with the WBG stream, and a drainage feature located to the west of the pond. The results indicated the following:

- The herbicide MCPP was detected in surface water sample WBGSW08 at a concentration of 54.1 µg/L which is above the tap water RSL of 37 µg/L. This sample was located in the stream that accepts the outfall from the WBG pond. This constituent was also detected in the sediment sample at this location (WBGSD08), but was not present in pond sediments or surface water.

- The pesticide dieldrin was detected in two samples (WBGSW08 and WBGSW14) at concentrations above tap water RSLs. Sample location WBGSW14 was in the unnamed stream that flows through the RFAAP-NRU (, upstream of where the stream first enters the RFAAP-NRU installation boundary and prior to the confluence with the stream from the WBG. This indicates the possible presence of a dieldrin source somewhere off of the facility.

- Perchlorate and tetrachloroethene were also detected in the WBGSW14 sample at concentrations above tap water RSLs. This constituent was not detected in any other surface water, sediment, or soil samples at the WBG.

- Lead was detected at elevated concentrations (i.e., above 5.0 µg/L) in four surface water samples from the pond (WBGSD10, WBG-SW002, WBG-SW003, and WBG-SW004). These samples were all located in the area of the pond where the elevated lead concentrations were detected in sediment.

- Arsenic, iron, manganese, and thallium were each detected in one surface water sample at concentrations above tap water RSLs.

A site map depicting the inorganic constituents detected in surface water is presented as Figure 9-11. Figure 9-12 presents the organic constituents detected at the surface water sample locations.

9.6 Risk Assessment Datasets

Data generated from the site characterization activities were used in the risk assessment. Risk assessment datasets for soil, sediment, surface water, and fish tissue for the WBG were prepared then summarized and statistically analyzed per methods described in Appendix A. Risk assessment dataset summaries were prepared highlighting the number of detects, number of samples, FOD, minimum and maximum detected concentrations, minimum and maximum detection limits, and EPCs. To prepare a dataset representing what site conditions might be should the pond at the WBG be drained, data from soils and sediment were combined to calculate an EPC representing the merged samples. This information is presented in Tables 9-19 through 9-25.

Data for fish fillets and whole body fish (Tables 9-24 and 9-25, respectively) were each presented for use in the risk assessment datasets. The fish filets data were used in the HHRA and the whole body data were used in the ERA.

9.7 Human Health Risk Assessment

The purpose of this risk assessment is to evaluate the potential current and future risks and hazards to human health associated with constituents detected in soil, sediment, surface water, and fish tissue samples collected at the WBG. The risk assessment approach follows the Radford Army Ammunition Plant Final Master Work Plan (URS 2003).

This section summarizes the occurrence of constituents in each medium and identifies COPCs at the WBG for the human health risk assessment; identifies the potential human exposure scenarios relevant to the WBG; and presents the estimated human health risks associated with the identified COPCs and the relevant human exposure scenarios at the WBG. Methodologies for data summary and selection of COPCs, exposure assessment, and toxicity assessment for the HHRA were presented in Appendix A.

9.7.1 Selection of Constituents of Potential Concern

This section discusses the selection of COPCs for the HHRA for each medium at the WBG.

9.7.1.1 Surface Soil

Surface soil COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for residential soil. Table 9-26 presents the selection of surface soil COPCs for the HHRA. As summarized in Table 9-26, 14 constituents were identified as COPCs in surface soil:

- **VOCs:** d-limonene;
- **SVOCs:** carbazole;

- **Explosive:** pentaerythritol tetranitrate;
- **PAHs:** benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene; and
- **Inorganics:** antimony, arsenic, copper, iron, lead, and zinc.

9.7.1.2 Combined Surface and Subsurface Soil

Combined surface and subsurface soil COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for residential soil. Table 9-27 presents the selection of combined surface and subsurface soil COPCs for the HHRA. As summarized in Table 9-27, 17 constituents were identified as COPCs in combined surface and subsurface soil:

- **VOCs:** d-limonene;
- **SVOCs:** carbazole;
- **Dioxin/Furans:** 1,2,3,7,8-PeCDD;
- **Explosive:** pentaerythritol tetranitrate;
- **PAHs:** benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene;
- **PCB:** Aroclor 1254; and
- **Inorganics:** aluminum, antimony, arsenic, copper, iron, lead, and zinc.

9.7.1.3 Sediment

Sediment COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for residential soil. Table 9-28 presents the selection of sediment COPCs for the HHRA. As summarized in Table 9-28, 17 constituents were identified as COPCs in sediment:

- **SVOCs:** carbazole;

- **Explosives:** nitroglycerine;

- **PAHs:** benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene; and

- **Inorganics:** aluminum, arsenic, chromium, cobalt, iron, lead, manganese, thallium, vanadium, and zinc.

9.7.1.4 Surface Water

Surface water COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for tap water. Table 9-29 presents the selection of surface water COPCs for the HHRA. As summarized in Table 9-29, 10 constituents were identified as COPCs in surface water:

- **VOCs:** chloroform and tetrachloroethene;

- **Herbicides:** MCPP;

- **Pesticides:** dieldrin; and

- **Inorganics:** arsenic, iron, lead, manganese, thallium, and vanadium.

9.7.1.5 Fish Tissue

Fish tissue COPCs were to be selected by comparison to acceptable consumption levels (USEPA, 2000); however, none of the constituents detected had identified acceptable consumption levels. As a result, all constituents detected with the exception of essential nutrients were selected as fish tissue COPCs. Table 9-30 presents the selection fish tissue COPCs for the HHRA. As a conservative measure, maximum concentrations were used as EPCs for fish ingestion. As summarized in Table 9-30, the following constituents were identified as COPCs in fish tissue for the HHRA: barium; chromium; copper; iron; manganese; mercury; and zinc.

9.7.2 Human Health Risk Characterization

The EPCs for the WBG are summarized in Table 9-31.

Exposure to soil, sediment, and surface water COPCs was evaluated for direct contact. Ingestion of fish caught at the WBG was evaluated as well. VOCs identified as COPCs in the WBG were also evaluated for inhalation via vapor migration into buildings. One VOC, d-limonene, was identified as a soil COPC at the WBG. This COPC does not have identified inhalation toxicity values; therefore, the indoor vapor intrusion pathway could not be assessed at this Study Area.

The excess lifetime cancer risks and non-cancer hazards and the estimated blood lead levels for each potentially exposed receptor included in the risk assessment for the WBG are presented in Appendix A and are summarized in Tables 9-32 and 9-33 and in the tables below. Results are discussed by receptor in following subsections. In addition to the site worker, construction worker, and resident scenarios evaluated for all areas, two additional sets of exposures were evaluated for the WBG area: exposures to participants (adults and children) who might be exposed to sediment via wading during the annual two-day fish rodeo; and exposures to site workers, hypothetical construction workers, and hypothetical future residents (adults and children) for whom soil exposure would encompass both current soil and sediment in the event that the pond at the WBG were drained.

Summary of Calculated ELCRs and HIs for Receptor Exposure Scenarios

RECEPTOR/ EXPOSURE MEDIUM - SCENARIO	ELCR	HI
Site Worker		
Surface Soil - Direct Contact	1E-05	0.1
Sediment – Wading	2E-06	0.1
Surface Water - Wading	3E-06	0.2
TOTAL SITE RISKS (Site Worker):	**1E-05**	**0.4**
Hypothetical Future Construction Worker		
Combined Surface and Subsurface Soil - Direct Contact	5E-07	0.5
TOTAL SITE RISKS (Construction Worker):	**5E-07**	**0.5**
Hypothetical Future Adult Resident		
Combined Surface and Subsurface Soil - Direct Contact		0.2
Sediment – Wading		0.2
Surface Water - Wading		0.04
Fish Consumption		0.3
TOTAL SITE RISKS (Adult Resident):		**0.8**
Hypothetical Future Child Resident		
Combined Surface and Subsurface Soil - Direct Contact		2
Sediment – Wading		2
Surface Water - Wading		0.1
Fish Consumption		1
TOTAL SITE RISKS (Child Resident):		**6**

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Summary of Calculated ELCRs and HIs for Receptor Exposure Scenarios (continued)

RECEPTOR/ EXPOSURE MEDIUM - SCENARIO	ELCR	HI
Hypothetical Future Resident (Adult and Child)		
Combined Surface and Subsurface Soil - Direct Contact	4E-05	
Sediment – Wading	1E-05	
Surface Water - Wading	1E-06	
Fish Consumption	NA	
TOTAL SITE RISKS (Resident):	**5E-05**	
Hypothetical Future Adult Resident (Fishing Rodeo)		
Sediment - Wading	2E-07	0.009
Hypothetical Future Child Resident (Fishing Rodeo)		
Sediment - Wading	2E-07	0.08
Site Worker (Drained Pond)		
Combined Surface Soil and Sediment	1E-05	0.5
Hypothetical Future Construction Worker (Drained Pond)		
Combined Surface Soil and Sediment	6E-07	0.8
Hypothetical Future Adult Resident (Drained Pond)		
Combined Surface Soil and Sediment	1E-05	0.7
Hypothetical Future Child Resident (Drained Pond)		
Combined Surface Soil and Sediment	3E-05	6

Summary of Estimated Blood Lead Levels for Receptor Exposure Scenarios

RECEPTOR	Estimated Blood Lead Level (µg/dL)		
	Adult	**Child**	**Fetus**
	50th percentile	**Range**	**95th percentile**
SOIL			
Site Worker	2.0	–	7
Hypothetical Future Construction Worker	2.0	–	7
SOIL AND SEDIMENT			
Hypothetical Future Child Resident	–	2.9 – 5.5	–
Hypothetical Future Adult Resident	2.8	–	10

9.7.2.1 Site Worker

A current or future site worker could be present at the WBG area, and could be exposed to surface soil, sediment, and surface water. The ELCR and non-cancer hazard index for site worker exposure to each medium are presented in Appendix A and are summarized in Table 9-32. As presented in the table above, the ELCRs for surface soil, sediment, and surface water are all within the USEPA target risk range, and the HIs for each medium are all below the benchmark value of 1.

The total cumulative ELCR for site workers exposed to surface soil, sediment, and surface water at the WBG is 1×10^{-5}, which is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for site workers is 0.4, which is less than the benchmark of 1.

The 50th percentile blood lead level estimates for the site worker receptor from exposure to lead in soil was calculated to be 2 µg/dL, and the 95th percentile blood lead levels estimated for the fetus of the receptor was at 7 µg/dL. Both of these estimated blood lead levels are below the benchmark of 10 µg/dL.

9.7.2.2 Hypothetical Future Construction Worker

A hypothetical future construction worker could be present at the WBG area, and could be exposed to combined surface and subsurface soil. The ELCR and non-cancer hazard index for hypothetical future construction worker exposure to soil are presented in Appendix A and are summarized in Table 9-32. As presented in the table above, the ELCR for combined surface and subsurface soil is below the USEPA target risk range, and the HI is below the benchmark value of 1.

The total cumulative ELCR for hypothetical future construction workers exposed to combined surface and subsurface soil at the WBG was 5×10^{-7}, which is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for hypothetical future construction workers is 0.5, which is less than the benchmark of 1. The 50th percentile blood lead level estimates for the site worker receptor from exposure to lead in soil was calculated to be 2 µg/dL, and the 95th percentile blood lead levels estimated for the fetus of the receptor was at 7 µg/dL. Both of these estimated blood lead levels are below the benchmark of 10 µg/dL.

9.7.2.3 Hypothetical Future Residents

A hypothetical future resident could be present at the WBG area, and could be exposed to combined surface and subsurface soil, sediment, or surface water. The ELCR and non-cancer hazard index for hypothetical future resident exposure to each medium are presented in Appendix A, and are summarized in Table 9-32.

The total cumulative ELCR for hypothetical future residents exposed to combined surface and subsurface soil, sediment, surface water, and ingestion of fish at the WBG is 5×10^{-5} , which is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}.

The total cumulative HI for hypothetical future adult residents is 0.8, which is less than the benchmark of 1.

The total cumulative HI for hypothetical future child residents is 6, which is above the benchmark of 1. When the HI for combined surface and subsurface soil is segregated into target site and critical effects, none of the hazards are above the benchmark of 1. When the HI for sediment is segregated into target site and critical effects, only the HI for chromium (which is based on a toxicological study in which no effects were observed) exceeded the benchmark of 1.

Lead was a COPC in both soil and sediments at the WBG. Exposure to the sediments is intermittent, but exposure to sediments needs to be combined with the exposure to soil to calculate a cumulative exposure to lead for each receptor. As a result, a time-weighted average lead concentration was calculated assuming 350 days/year exposure to lead in soil and 48 days/year exposure to lead in sediments. This resulted in an EPC of 623 mg/kg of lead. The 50^{th} percentile blood lead level estimates for the adult resident receptor from exposure to lead in soil and sediment was calculated to be 2.8 µg/dL and the 95^{th} percentile fetal blood lead level was 10 µg/dL. The adult level is well below the benchmark and the fetal level is at the benchmark.

The IEUBK model for childhood exposure to lead includes the contribution of exposure to lead in dust. The time-weighted exposure point concentration included both soil and sediment contributions. However, soil is more likely to contribute to dust exposure than would sediment. As a result, the dust concentration was based on the soil EPC and was set at 70 mg/kg for the entire exposure period. The blood lead level estimates for the hypothetical child resident receptor from exposure to lead in soil and sediment were evaluated and the predicted annual blood lead levels ranged from 2.9 µg/dL to 5.5 µg/dL. Exposure of a child over a seven year period resulted in a geometric mean blood lead concentration of 4.26 µg/dL, below the 10 µg/dL benchmark, and a prediction of 3 percent of the population having blood lead concentrations above the 10 µg/dL benchmark.

9.7.2.4 Fish Rodeo Participants

Potential risks were evaluated for participants in the semi-annual fishing rodeo held at the WBG pond. The fishing rodeo would occur two days per year. Individuals who catch fish would be allowed to retain them. However, as the pond would be stocked with fish just before the rodeo begins, it is not likely that they would accumulate any COPCs during that time. Thus, the only potential risk to adults and children who participate in the rodeo would be through direct contact with sediments. Accordingly, ELCRs and HIs for this potential sediment exposure were calculated by using exposure factors for the residential scenario modified to replace the exposure frequency from 48 days/year to 2 days/year. The ELCRs and non-cancer hazard index for hypothetical adult and child participants in the fish rodeo are presented in Appendix A.

The ELCR for the hypothetical fish rodeo participants exposed to sediments at the WBG was 4×10^{-7} which is below the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for adult participants was 0.009, which is substantially less than the benchmark of 1. The total cumulative HI for child participants was 0.08, which is also less than the benchmark.

9.7.2.5 Site Worker, Hypothetical Future Construction Worker, and Hypothetical Resident – Drained Pond

The HHRA for the WBG area also estimated hypothetical risks to current and future site workers, hypothetical future construction workers, and hypothetical future residents if the pond is drained in the future, which could result in current sediments becoming part of the soil to which these residents might be exposed. To complete this evaluation, the EPCs were modified to represent combined soil and sediment samples. Exposure factor values were otherwise identical to those used in the evaluation of exposure to soils for these receptors. If the pond were to be drained, wading and fishing would no longer be possible, so exposures by those pathways were not included when characterizing risks if the pond were drained in the future. The ELCRs and HIs for potential receptors under a future drained pond scenario are presented in Appendix A.

The total cumulative ELCR for future site workers exposed to combined surface soil, subsurface soil, and current sediment at the WBG was 1×10^{-5}, which is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for hypothetical site construction workers is 0.5, which is less than the benchmark of 1.

The total cumulative ELCR for hypothetical future construction workers exposed to combined surface soil, subsurface soil, and current sediment at the WBG was 6×10^{-7}, which is below the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for hypothetical future construction workers is 0.8, which is less than the benchmark of 1.

The total cumulative ELCR for hypothetical future residents exposed to combined surface soil, subsurface soil, and current sediment at the WBG was 5×10^{-5}, which is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for hypothetical adult residents is 0.7, which is below the benchmark. The total cumulative HI for hypothetical child residents is 6, which is greater than the benchmark value of 1. When the HI is segregated into target site and critical effects, only the HI for chromium (which is based on a toxicological study in which no effects were observed) exceeded the benchmark of 1.

These results indicate that risks to future site workers, hypothetical future construction workers, or hypothetical future adult residents would be acceptable if the pond at the WBG were drained in the future, thereby adding current sediment to the material to which direct contact soil exposures might occur. There is a slightly elevated potential hazard to child residentsassociated with the presence of chromium in soil.

9.7.3 Human Health Risk Summary

Table 9-32 summarizes the calculated cancer risks and non-cancer hazards for each potentially exposed receptor included in the risk assessment for the WBG. The total ELCR values for all surface soil, combined surface and subsurface soil, sediment, and surface water exposures for each exposure scenario are below or within the benchmark range of 10^{-6} to 10^{-4} for cancer risk. Under the current industrial land use, the total HI values for all surface soil, combined surface and subsurface soil, sediment, and surface water exposures for each exposure scenario are below the benchmark of 1 for non-cancer hazard.

Under the future hypothetical residential scenario, the ELCR values for the resident are within the generally accepted target risk range. However, the target organ specific HI for the child resident exposure to sediment was greater than 1, due to the presence of chromium.

Exposure to lead in soil by site workers or construction workers would not result in a predicted blood lead level greater than the benchmark of 10 µg/dL. Exposure of residents to lead in soil and sediment, however, resulted in a predicted fetal blood lead level above the benchmark. Exposure to lead in soil and sediment by a child resulted in a geometric mean blood lead level below the benchmark, but also a prediction of 3 percent of the population with blood lead levels above the benchmark.

Based on the results of the risk assessment, it is unlikely that industrial use of the property would result in adverse health effects. Likewise, no adverse effects would be expected for participants in the semi-annual fish rodeo. For the residential exposure scenarios, exposure to lead in sediments may pose an adverse health effect. Also, exposure to chromium in sediments may pose a slightly elevated hazard to children wading in surface water and sediments. Several (four) of the chromium detections in sediment were greater than the background chromium soil range. The maximum chromium sediment concentration of 15,400 mg/kg is well above the background range.

If the pond were drained in the future, it is unlikely that industrial or residential use of the property would result in adverse health effects with the exception of a slightly elevated hazard to children resulting from direct contact exposures to existing soils combined with sediment that would become soil.

9.8 Ecological Risk Assessment

The purpose of the ERA is to evaluate whether ecological receptors may be adversely impacted by exposure to site-related constituents detected in surface soil, sediment, surface water, and fish tissue at the WBG. This section summarizes the occurrence of constituents in each medium and identifies COPECs at the WBG for the ecological risk assessment; identifies the potential ecological exposure scenarios relevant to the WBG; and presents the estimated ecological risks associated with the identified COPECs and the relevant ecological exposure scenarios at the WBG. Methodologies for data summary and selection of COPECs, exposure assessment, and toxicity assessment for the ERA were presented in Appendix A.

9.8.1 Selection of Constituent of Potential Ecological Concern

This section discusses the selection of COPECs for each medium. Risks to ecological receptors are calculated by dividing the exposure estimates (i.e., the maximum detected concentrations) by the conservative ESLs. The resulting ratio, the hazard quotient (HQ), is a highly conservative surrogate for the assessment endpoints identified in Appendix A. HQs equal to or less than a value of 1 (to one significant figure) indicate that adverse ecological effects are unlikely (USEPA 1997c). HQs greater than 1 indicate that further evaluation is warranted. Therefore, the constituents with HQs greater than 1 or bioaccumulative are carried forward as COPECs into the BERA. Maximum HQs greater than 1 for the WBG area are summarized in the subsections below.

9.8.1.1 Surface Soil

Surface soil COPECs were selected by comparing the analytical data with USEPA (2005b) EcoSSLs, USEPA (2003e) Region 5 ESLs, and ORNL values (Efroymson et al. 1997a,b) for surface soil. Table 9-34 presents the selection of surface soil COPECs for the ERA. As summarized in Table 9-34, 38 constituents were identified as COPECs in surface soil:

- **VOCs:** d-limonene and p-isopropyltoluene;
- **SVOCs:** carbazole and dibenzofuran;
- **Dioxin/furans:** dioxin toxicity equivalent;
- **Explosive:** pentaerythritol tetranitrate;
- **Herbicides:** dalapon and MCPP;
- **Pesticides:** 4,4’-DDD and dieldrin;
- **PCBs:** Aroclor 1254;
- **PAHs:** acenaphthene, acenaphthylene, anthracene, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[g,h,i]perylene, benzo[k]fluoranthene, chrysene, dibenzo[a,h]anthracene, fluoranthene, fluorene, indeno[1,2,3-cd]pyrene, phenanthrene, and pyrene
- **Inorganics:** antimony, arsenic, barium, cadmium, chromium, copper, iron, lead, mercury, selenium, silver, and zinc.

9.8.1.2 Sediment

Sediment COPECs were selected by comparing the analytical data with ESLs from the following sources in order of priority: USEPA (2008d) Region 3 Sediment Screening Levels; ORNL values (Jones et al. 1997); and USEPA (2003e) Region 5 Ecological Screening Levels for sediment. Table 9-35 presents the selection of sediment COPECs for the ERA. As summarized in Table 9-35, 55 constituents were identified as COPECs in sediment:

- **VOCs:** 2-butanone, acetone, and carbon disulfide;
- **SVOCs:** 1,2,4-trichlorobenzene, 1,4-dichlorobenzene, 4-methylphenol, bis[2-ethylhexyl]phthalate, and carbazole; ,
- **Dioxin/furans:** dioxin toxicity equivalent;
- **Explosives:** 1,3,5-trinitrobenzene and nitroglycerine;
- **Herbicides:** 2,4-D, dicamba, and MCPP;
- **Pesticides:** 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, delta-BHC, alpha-chlordane, dieldrin, endosulfan II, and methoxyclor;
- **PAHs:** 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[g,h,i]perylene, benzo[k]fluoranthene, chrysene, dibenzo[a,h]anthracene, fluoranthene, fluorene, indeno[1,2,3-cd]pyrene, phenanthrene, and pyrene; and
- **Inorganics:** antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, nickel, selenium, silver, thallium, vanadium, and zinc.

9.8.1.3 Surface Water

Surface water COPECs were selected by comparing the analytical data with ESLs from the following sources in order of priority: USEPA (2008d) Region 3 Surface Water Screening Levels; ORNL values (Suter and Tsao 1996); USEPA (2003e) Region 5 Ecological Screening Levels; and USEPA (2008e) Ambient Water Quality Criteria for surface water. Table 9-36 presents the selection of surface water COPECs for the ERA. As summarized in Table 9-36, 25 constituents were identified as COPECs in surface water:

- **VOCs:** chloroform;
- **SVOCs:** 1,2-dichlorobenzene; 1,3-dichlorobenzene; 1,4-dichlorobenzene
- **Herbicides:** MCPP;
- **Dioxin/furans:** dioxin toxicity equivalent;
- **Pesticides:** dieldrin

  PAHs: anthracene, acenaphthene, fluorene, and phenanthrene;
- **Inorganics:** aluminum, arsenic, barium, beryllium, copper, iron, lead, nickel, manganese, silver, selenium, thallium, zinc, and vanadium.

One spring sample (WBG_SPRING001) was also evaluated for surface water COPECs by comparing the analytical data with background spring data as well as ESLs. As shown in the table below, one PAH and six inorganics were detected in the spring sample. Four of the inorganics are vital electrolytes and/or essential nutrients (calcium, magnesium, potassium, and sodium) and therefore were identified as non-toxic and not evaluated further. The remaining constituents detected in the spring sample were within or below the background concentrations or were below the corresponding ESL, and as a result, were not evaluated further.

Detected Constituents in Spring Sample – Rail Yard

Constituent	ESL (µg/L)	Background Spring Data NSPRING003 09/24/08	NSPRING004 09/24/08	WBG_SPRING001 09/24/08	Does Max Exceed ESL or BKG?
PAHs					
Naphthalene	**1.1**	<0.092	<0.092	0.032	no
Inorganics					
Barium	**4**	49.8	66.1	57.2	no
Calcium	**116,000**	65900	59000	70,200	NT
Magnesium	**82,000**	11,900	19,000	11,800	NT
Potassium	**NA**	1670	1820	2,200	NT
Sodium	**680,000**	1430	<5,000	8750	NT
Zinc	**120**	9	7	9.3	no

µg/L Micrograms per liter. NT Non-toxic.

9.8.2 Summary of Selected Constituents of Potential Ecological Concern

Thirty-eight constituents were selected as COPECs in surface soil, fifty-five constituents were selected as COPECs in sediment, and twenty-five constituents were selected as COPECs in surface water because the HQs were greater than 1, the chemical was bioaccumulative, or an HQ couldn't be calculated because an ESL was not available.

9.8.3 Refinement of Risk Calculations for Direct Contact COPECs

The list of COPECs identified in the BERA was reevaluated by calculating refined HQs. The refined HQs were calculated for the COPECs identified in the SLERA using refined EPCs. Constituents identified as COPECs in the BERA that were bioaccumulative were carried forward into food chain models. The results of the recalculation of the HQs for the WBG are summarized in the subsections below.

9.8.3.1 Surface Soil

Thirty-eight COPECs in surface soil were carried forward into the BERA. When refined EPCs were compared with the ESLs, six constituents (PCDDs/PCDFs, antimony, chromium, copper, lead, and zinc) had a refined HQ greater than 1. In addition, ESLs were not available for 9 other constituents (d-limonene, p-isopropyltoluene, carbazole, dibenzofuran, pentaerythritol tetranitrate, dalapon, MCPP, Aroclor 1254, and iron). The BERA results for surface soil COPECs at the WBG are presented in Table 9-37 and are discussed in Appendix A.

Of the COPECs, 26 were evaluated in the terrestrial food chain model.

9.8.3.2 Sediment

Fifty-five COPECs in sediment were carried forward into the BERA. When refined EPCs were compared with the ESLs, 27 constituents [2-butanone, acetone, carbon disulfide, 4-methylphenol, dioxin TEQ, 2,4-D, dieldrin, 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, pyrene, chromium, copper, iron, lead, manganese, silver, and zinc], had a refined HQ greater than 1. In addition, ESLs were not available for nine other constituents [carbazole, 1,3,5-trinitrobenzene, nitroglycerine, dicamba, MCPP, barium, beryllium, thallium, and vanadium]. The BERA results for sediment COPECs at the WBG are presented in Table 9-38 and are discussed in Appendix A.

Thirty-four of the constituents in sediment were identified as bioaccumulaive and evaluated in the aquatic food chain model.

9.8.3.3 Surface Water

Twenty-five COPECs in surface water were carried forward into the BERA. When refined EPCs were compared with the ESLs, 10 constituents (anthracene, aluminum, arsenic, barium, beryllium, copper, iron, lead, manganese, and thallium) had a refined HQ greater than 1. In addition, an ESL was not available for MCPP. The BERA results for surface water COPECs at the WBG are presented in Table 9-39 and are discussed in Appendix A.

Twelve surface water COPECs were identified as bioaccumulative and evaluated in the aquatic food chain model.

9.8.4 Refinement of Assessment and Measurement Endpoints for Bioaccumulative COPECs

Food chain modeling was conducted at the WBG in order to evaluate the potential ecological effects of the bioaccumulative COPEC in soil, sediment, and surface water on the receptors identified in Appendix A. COPECs identified in soil were evaluated in the terrestrial food chain, and COPECs identified in sediment and surface water were evaluated in the aquatic food chain. The results for both the maximum and refined scenarios of these models are presented in Appendix A, and the results of each of the refined scenarios are summarized in the subsections below.

9.8.4.1 Terrestrial Food chain Model

As summarized in Table 9-40, the refined scenario NOAEL HQs and LOAEL HQs for the short-tailed shrew were less than 1 for all of the bioaccumulative COPECs, with the exception of dibenzo(a,h)anthracene and zinc. The dibenzo(a,h)anthracene NOAEL HQ was 4 and the LOAEL HQ was 0.4 and the zinc NOAEL HQ was 8 and the LOAEL was 0.8. The NOAEL is a very conservative screening criterion while the LOAEL indicates a concentration above which adverse impacts to individual mammals and birds may occur. For the American robin, the refined scenario NOAEL HQs and LOAEL HQs were less than 1 for all of the bioaccumulative COPECs, with the exception of lead; however, the NOAEL is a very conservative toxicity screening value, and the HQs for the more realistic LOAEL are less than 1. These results indicate that individual short-tailed shrews and American robins (or other insectivorous mammals and birds) exposed to these COPECs are not expected to experience adverse effects.

Based on the overall analysis of terrestrial food chain modeling HQs and consideration of the limited spatial extent of impacted soils, adverse effects are not expected for short-tailed shrews (and other insectivorous mammals) and American robins (and other insectivorous birds) populations exposed to bioaccumulative COPECs in soil at the WBG.

9.8.4.2 Aquatic Food chain Model

As summarized in Table 9-41, the refined scenario NOAEL HQs and LOAEL HQs for both the mink and the great blue heron were less than or equal to 1 for all of the bioaccumulative COPECs identified in sediment and/or surface water indicating no adverse impacts to mink (or other piscivorous mammals) or heron (or other piscivorous birds) at a population level. .

9.8.5 Ecological Risk Summary

Screening-level and baseline risk assessments were completed for the WBG. After the SLERA, 38 constituents were selected as COPECs in surface soil, 55constituents were selected as COPECs in sediment, and 25 constituents were selected as COPECs in surface water because the HQs were greater than 1 or an HQ could not be calculated because an ESL was not available. For the BERA, 36 constituents in surface soil, 52 constituents in sediment, and 23 constituents in surface water were retained because the HQs were greater than 1, the chemical was bioaccumulative, or an HQ could not be calculated because an ESL was not available. Food chain modeling was evaluated for those constituents identified as bioaccumulative.

Tables 9-40 and 9-41 summarize the constituents in surface soil, sediment, and surface water carried through the BERA and evaluated in the terrestrial and/or aquatic food chain model. As shown in Table 9-40, the refined scenario NOAEL HQ for zinc was greater than 1 for the short-tailed shrew, and the refined scenario NOAEL HQs for lead and zinc were greater than 1 for the American robin. However, when these results are considered in conjunction with pertinent site information on the limited spatial distribution and extent of lead and zinc in surface soil, while the potential does exist for unacceptable risk to individual insectivorous mammals and birds exposed to surface soils containing affected concentrations of lead and zinc, population-level effects are considered unlikely.

As shown in Table 9-41, the refined scenario NOAEL HQ for the mink and great blue heron were all below 1, indicating no risk to piscivorous species. Therefore, effects are not expected for aquatic life exposed to bioaccumulative COPECs in sediment and/or surface water at the WBG.

9.9 WBG Summary and Conclusions

The WBG was formerly used as a burning ground to decontaminate explosives contaminated material and to dispose of excess and off-spec explosives/energetics during historical site operations. The main burn area was approximately 170 ft long by 100 ft wide and is surrounded on three sides by an approximately 4 ft high earthen berm. A dirt road runs parallel to the open side of the former burn area, leading north to Alger Road, and south to the top of a steep slope above an unnamed pond. The dirt road was reportedly constructed on top of an ashy layer of material extending from the burning ground at the time of the pond construction. The pond was constructed during the early 1990s and is fed by Wiggins Spring at the northwest (upgradient) end of the pond. The pond also collects runoff from the surrounding area through a series of storm water ditches/culverts. The WBG is no longer active.

Site characterization activities performed at the WBG from 1997 through 1999 indicated the presence of an ashy layer of material throughout the burn area and elevated concentrations of inorganics and PAHs in burn area soils. A test pitting program completed in 1999 effectively removed all of the soils containing elevated constituent concentrations from the former burn area; therefore, the burn area no longer poses an environmental concern. Samples collected in 1999 from the berms surrounding the former burn area had no constituents above applicable screening levels or background inorganics concentrations; therefore, the berms do not appear to have been affected by operations at the site.

Investigations performed at the WBG between 1998 and 2008 have focused on characterizing and delineating constituent detections outside of the former burn area. Areas that have been investigated have included the access road on the northwest side of the burn area; surface and subsurface soils located downgradient from the burn area; sediments and surface water in the unnamed pond; sediments and surface water in the unnamed creek downgradient of the pond; and a former transformer location.

Analyte classes included in the WBG investigation have included VOCs, SVOCs, PAHs, PCBs, pesticides, herbicides, dioxins/furans, explosives, and inorganics.

One of the primary areas of investigation at the WBG has been the dirt access road which runs along the open side (northwestern side) of the former burn area. During the course of investigation at the site, an ashy layer of material was identified in the subsurface (approximately 2-4 ft bgs) under the road that was very similar to the ashy soils that had been present in the burn area. It is believed that this ashy layer of material was likely pushed out of the former burn area during regrading activities that would have been performed between burning events. This ashy layer was likely buried when the dirt road was constructed to the pond. The extent of the ashy layer was delineated by extensive soil boring activities completed in 1994 and 2004 and is confined to the subsurface soils underneath the road.

With the exception of one subsurface soil sample at the end of the access road [WBGSB22(2-4 ft bgs)] no constituents were detected above applicable screening levels in any of the surface or subsurface soil samples in this area (including within the ashy layer of material). The sample collected from 2 to 4 ft bgs at soil boring WBGSB22 contained inorganics (arsenic, chromium, iron, lead), one PCB (Aroclor 1254), PAHs [benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene], and one dioxin (1,2,3,7,8 PeCDD) at concentrations above applicable screening levels. Samples collected from 0 to 0.5 ft bgs and 6 to 8 ft bgs at soil boring did not contain any constituents above applicable screening levels; nor did any other soil boring collected around WBGSB22. Therefore, the detections appear to be isolated to a very small area. Aluminum was also detected in one other subsurface soil sample in the road area [WBGSB23(6-8 ft bgs)] at a concentration slightly above background and the residential screening level.

Surface and subsurface soil samples were also collected downgradient (northwest, west, and south) of the burning ground and road to evaluate the potential for constituents to have migrated outside the burn area. The results from these areas indicated:

- Despite the fact that the former burning ground operations were used to decontaminate and dispose of materials that had been in contact in explosive/energetic compounds, explosives were not found to be a concern at the site. Only one explosive compound was ever detected during the course of sampling at a single location. Penterythritol tetranitrate was detected at a concentration of 0.11 mg/kg at surface soil at WBGSB24.

- Seventeen different PAHs were detected in surface and subsurface soil outside of the former burn area. Benzo(a)pyrene was detected at a concentration above the industrial RSL in two surface soil samples (WBGSB24 and WBGSB25). Benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene were also detected in these samples at concentrations above residential RSLs. The WBGSB24 and WBGSB25 sample locations are in a small drainage pathway located west, and downslope, from the former burn area. This area receives runoff from the former burn area and from the surrounding RFAAP-NRU roads and flows into the pond.

- No PCBs were detected in the soil sample collected at the former transformer location.

The pond sediment sampling activities indicated that lead and chromium were present at concentrations above background levels and surface soil RSLs in samples collected in an isolated 2,100 ft^2 area near the northern bank of the pond. The outer perimeter of the area containing the lead and chromium concentrations above applicable screening levels has been delineated through the collection of multiple samples for both laboratory analysis and XRF field screening. The PAHs benzo(a)pyrene, benzo(a)anthracene and benzo(b)fluoranthene were detected at concentrations above residential RSLs in three samples located in the northwestern portion of the pond (SD-01, WBGSD12, and WGSD16). These samples were located near points where surface water drainage ditches enter the pond. The explosive nitroglycerine was detected in one pond sediment sample at a concentration above the residential RSL. Several dioxins/furans were also detected in pond sediment samples; however the all detected constituents were below residential RSLs.

A total of six sediment samples were collected from the stream downgradient of the outfall of the unnamed pond. Arsenic and iron were detected in one sample (WBGSD13) in 2002 at concentrations above background and applicable screening levels. The PAHs benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene were also detected at concentration above applicable screening levels in one sediment sample collected in 2002 (WBGSD09). A second sample collected at this location in 2008 (WBG-SE006) indicated that only benzo(a)pyrene was present at a concentration above a residential screening level. No other constituents were detected at concentrations above applicable RSLs.

Surface water samples collected from the pond and the unnamed stream indicated the following:

- Lead was detected at concentrations above the USEPA tap water RSL and ecological screening levels in four surface water samples from the pond. These samples were all collected in the area where the elevated concentrations of lead were detected in sediment. Lead was not detected above applicable screening levels in any samples from the stream.

- Arsenic was detected above the tap water RSL in two samples collected from the pond in 1999. Arsenic was not detected in any other samples collected from the pond or from the stream throughout the remainder of the investigation.

- Iron, manganese, and thallium were detected above the tap water RSL values in single samples collected from the stream near the pond outfall. The herbicide MCPP was also detected in one sample from the stream at a concentration above the tap water RSL.

- The pesticide dieldrin was detected in two samples (WBGSW08 and WBGSW14) at concentrations above tap water RSLs. Sample location WBGSW14 was in the unnamed stream that flows through the RFAAP-NRU, upstream of the confluence with the stream from the WBG. This indicates the possible presence of a dieldrin source somewhere off of the facility.

- Perchlorate and tetrachloroethene were also detected in the WBGSW14 sample at concentrations above tap water RSLs. These constituents were not detected in any other surface water, sediment, or soil samples at the WBG.

- The VOC chloroform was detected in two pond water samples and two stream samples during the 2002 investigation at concentrations above the tap water RSL.

The HHRA evaluated potential current exposure of site workers to surface soil, surface water, and sediment, potential future exposures of construction workers to total soil and potential future adult and child resident exposure to total soil, surface water, sediment, and fish caught in the pond at the WBG. The soil, sediment, and surface water COPCs were evaluated for direct contact. In addition, the HHRA evaluated potential exposures to participants in the semi-annual fish rodeo and exposures to hypothetical workers and hypothetical residents under future conditions if the pond were drained.

Potential risks and hazards for site workers and construction workers, including exposure to lead, under current industrial land use conditions were within generally acceptable levels or below benchmarks. Similarly, exposures to participants in the fish rodeo were within acceptable levels and below benchmarks. Under a hypothetical future residential land use, including merged soil and sediment to represent conditions were the pond to be drained, potential hazards associated with chromium in sediment were slightly greater than 1 for the child resident. Potential risks associated with residential exposure to lead in soil and sediment could also result in adverse health effects. The predication of elevated blood lead levels was driven by the concentration of lead in the pond sediment, primarily at one location. No other scenarios evaluated resulted in an unacceptable risk levels.

A SLERA and BERA were completed for the WBG, to evaluate surface soil, sediment, and surface water for ecological receptors, and food chain modeling was evaluated for all those constituents identified as bioaccumulative. The results of the evaluation of the SLERA and BERA for direct contact and the constituents evaluated in the terrestrial food chain model indicate that while some of the NOAEL and LOAEL HQs were greater than 1, when these results are considered in conjunction with pertinent site information on the limited spatial distribution and extent of these constituents, adverse effects of these COPECs at the population-level are unlikely at the WBG.

Similarly, the results of the sediment and surface water evaluation of the SLERA and BERA for direct contact and the constituents evaluated in the aquatic food chain model indicate adverse effects are not expected for aquatic life exposed to bioaccumulative COPECs in sediment and/or surface water at the WBG.

The environmental investigations completed at the WBG have successfully delineated the nature and extent of elevated constituent concentrations in soils, sediments, and surface water. The results of the investigation and the corresponding human health and ecological risk assessments indicated that the potential risks associated with the site are within acceptable ranges for industrial use of the site. Under a potential future residential use scenario, the potential hazard was above the acceptable range due to the presence of chromium and lead in a small area of pond sediments. Based on the potential residential risks associated with the lead and chromium in the pond sediments, it is recommended that a FS be conducted to evaluate potential remedial options for the pond sediments. This remedial alternative analysis will include a no-action alternative which may be viable for the site based on the very limited distribution of lead and chromium in the pond sediments.

10. RFAAP-NRU Groundwater

Groundwater at the RFAAP-NRU is considered on a facility-wide basis, rather than specific to any of the individual Study Areas. The groundwater site conceptual model that has been developed for the facility is presented in Section 3. A summary of the investigation activities that have been performed to assess groundwater quality is presented within this section. As with the individual Study Areas discussed in the previous sections, human health and ecological risk assessments are also presented for groundwater.

10.1 Environmental Setting and Conceptual Site Model

The geologic and hydrogeologic setting of the RFAAP-NRU are presented in Section 3 of this report along with the groundwater site conceptual model.

10.2 Environmental Investigations

The groundwater investigation activities at the RFAAP-NRU commenced in 2007 and have included:

- 2007 – Groundwater Investigation by Shaw;
- 2008 – Remedial Investigation by ARCADIS; and
- 2010 – Remedial Investigation by ARCADIS.

The goals and findings of these investigations are summarized in the following sections. As discussed in Section 4.1, the constituent detections reported in the investigation summaries are compared to the tap water RSLs.

10.2.1 June 2007 Groundwater Investigation

Shaw's 2007 groundwater investigation activities included the installation of 11 groundwater monitoring wells at the RFAAP-NRU. The wells were all installed at the Study Areas in western portion of the facility. The well installation activities at each of the Study Areas are presented below.

- Bag Loading Area - Two monitoring wells were installed at the BLA to provide an assessment of groundwater quality at and downgradient of the site. One of the wells (BLAMW01) was installed near the center of the site, within the "L" formed by Building 405. The second well (BLAMW02) was installed

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downgradient from Building 405, on the hillside sloping down to the unnamed creek. Bedrock was encountered at a shallow depth in both borings (i.e. approximately 2 ft bgs at BLAMW02 and 31 ft bgs at BLAMW01). Both wells were installed in the bedrock at the first encountered water, at depths of 221 ft bgs (BLAMW-01) and 151 ft bgs (BLAMW-02). A site map of the BLA depicting the monitoring well locations is presented in Figure 6-2

- Igniter Assembly Area – Four groundwater monitoring wells were installed at the IAA in areas suspected to be down gradient from the site. One of these wells (IAAMW-01) was installed near the buildings in the central portion of the site that are known to contain conductive flooring. This well was installed at the bedrock-overburden interface (34 ft bgs). One well (IAAMW02) was installed downgradient from the site to the southwest, near a photolineament trending to the southwest. This well was installed in the bedrock at a total depth of 160 ft bgs. A third well (IAAMW03) was installed near the southeast corner of the IAA at a depth of 77 ft bgs. The fourth well (IAAMW04) was installed near the Rail Yard and the unnamed creek that drains the western portion of the RFAAP-NRU. This well was installed to a depth of 88 ft bgs. Site maps of the IAA and the RY that depict the monitoring well locations are presented in Figure 7-2 and 8-2.

- Northern Burning Ground – Two wells (NBGMW01 and NBGMW02) were installed at the NBG to assess whether groundwater quality had been affected by the historical burning ground activities conducted at this site. As discussed in the EE/CA prepared for the NBG (ARCADIS 2009b) lead and chromium were identified as COCs in surface soil at the NBG. Monitoring well NBGMW01 is located in the central portion of the NBG, where the highest concentrations of lead and chromium were detected in surface soil. Monitoring well NBGMW02 was installed to the north of NBGMW01, near the RFAAP-NRU boundary fence. A site map of the NBG depicting the monitoring well locations is presented in Figure 10-1.

- Western Burning Ground – Three wells were installed at the WBG to assess whether groundwater quality had been affected by the historical burning ground activities conducted at this site. One monitoring well (WBGMW01) was installed near the center of the former burning area, where 1998 test pitting/soil excavation activities were completed. The other two monitoring wells (WBGMW02 and WBGMW03) at this site were located between the former burning ground and the unnamed pond located to the south. A site map of the

WBG depicting the monitoring well locations is presented in Figures 9-2 and 9-3.

The well installation activities completed at the RFAAP-NRU are discussed in further detail in Shaw's 2007 report entitled NRU Additional Characterization Sampling and Groundwater Investigation Data Report (Shaw 2007). A summary of the well construction details is presented in Table 3-1. A site map of the RFAAP-NRU facility that depicts the locations of the monitoring wells is presented in Figure 3-2.

Shaw completed the first groundwater sampling event at the RFAAP-NRU between June 18 and June 21, 2007. The groundwater monitoring event included all eleven monitoring wells at the facility. The wells were sampled for VOCs, SVOCs, PAHs, PCBs, pesticides, herbicides, explosives, dioxins/furans, inorganics, total organic carbon, and total organic halides. The laboratory analytical results for the 2007 groundwater samples are summarized in Table 10-1.

VOCs. Three VOCs (acetone, toluene, and chloroform) were detected in isolated groundwater samples (see Table 10-1). Acetone was detected in two monitoring wells (BLAMW02 and WBGMW01) and toluene was detected in one monitoring well (BLAMW01). The laboratory validation process indicated that both of these constituents were also detected in an associated laboratory blank sample, therefore, the reported detections are not believed to be site related. It should also be noted that the detected concentrations of acetone and toluene, were several orders of magnitude below tap water RSLs. Chloroform was detected in one sample (WBGMW01) at a concentration above the tap water RSL of 0.19 µg/L but below the MCL of 70 µg/L. Chloroform is a common laboratory contaminant and this detection is not believed to be site related. Chloroform was not a COPC for soil at the WBG.

SVOCs. There were no detections of SVOC's in any of the groundwater samples.

PAH's. There were no detections of PAH's in any of the groundwater samples.

PCBs. There were no detections of PCB's in any of the groundwater samples.

Pesticides. There were no pesticides detected in any of the groundwater samples.

Herbicides. There were no herbicides detected in any of the groundwater samples.

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Explosives. Perchlorate was detected in several samples (IAAMW01, IAAMW02, IAAMW04, NBGMW01, NBGMW02, WBGMW02, and WBGMW03). All of the reported concentrations were several orders of magnitude below the tap water RSL of 26 µg/L (see Table 10-1). Laboratory data validation also indicated that perchlorate was detected in a laboratory blank associated with these samples; therefore, the detections are not believed to be site related. No other explosives were detected in any of the samples.

Dioxins/Furans. Several dioxin/furan compounds were detected in the groundwater samples (see Table 10-1). However, the majority of the detected constituents were present at concentrations that were quantified as estimated by the laboratory (i.e., J-flagged) or were also detected in a laboratory blank sample associated with the analyses. The reported concentrations of 1,2,3,7,8-PeCDF, 2,3,4,7,8-PeCDF, 2,3,7,8-TCDD, 2,3,7,8-TCDF were above the tap water RSLs in several of the groundwater samples.

Inorganics. Several inorganics were detected in the groundwater samples from all of the RFAAP-NRU monitoring wells (see Table 10-1). The analytical results indicated that the concentrations of arsenic at IAAMW01 (20.9 µg/L) NBGMW01 (6.3 µg/L), and WBGMW01 (8.20 µg/L), were above the tap water RSL. Iron (83,300 µg/L) and manganese (1,790 µg/L) were also detected at concentrations above the tap water RSL at IAAMW01. None of the other detected inorganics were present at concentrations above tap water RSLs.

Total Organic Carbon. Total organic carbon was found to range from less than 1,000 µg/L to 80,700 µg/L at BLAMW02 (see Table 10-1).

Total Organic Halides. The total organic halides analysis indicated resulted in no detections.

10.2.2 October 2008 Groundwater Investigation

In accordance with Remedial Investigation Work Plan Addendum 27 (ARCADIS 2008b), ARCADIS completed a second groundwater sampling event at the RFAAP-NRU on September 24, 25, and October 3, 2008. This event included collecting groundwater samples from all eleven monitoring wells at the facility. Samples were also collected from four springs that have been identified at the RFAAP-NRU. One spring water sample (WBG_Spring001) was collected from Wiggin's Spring at the WBG. A second spring water sample (RY_Spring002) was collected at the unnamed spring at the RY pond. Two spring water samples (NSpring003 and NSpring004) were also collected at unnamed springs located in the northeast corner of the RFAAP-NRU. The groundwater monitoring wells were all sampled for total TAL inorganics. Where low flow sampling techniques were unable to reduce turbidity to below 40 NTUs samples were also collected for dissolved TAL inorganics analysis. The spring water samples were analyzed for TAL inorganics and PAHs. The results of the field parameter analyses and the laboratory analytical results for the groundwater and spring water samples are summarized in Table 10-2 and the sample locations are depicted in Figure 3-2. The laboratory analytical reports for the 2008 groundwater sampling event are in Appendix G.

The analytical results from the spring water samples indicated that several inorganics were present, but that the detected concentrations were all below tap water RSLs. The PAH naphthalene was detected in the spring water samples from RY_Spring002 (0.044 µg/L) and WBG_Spring_001 (0.032 µg/L). Phenanthrene was also detected in the RY_Spring002 sample at a concentration of 0.038 µg/L. The detected concentrations of naphthalene and phenanthrene were below tap water RSLs.

The low flow sampling techniques utilized during the groundwater sampling activities were unsuccessful at lowering the turbidity below 40 NTUs at monitoring wells BLAMW02, IAAMW01, IAAMW03, IAAMW04, NBGMW01, and NBGMW02. Therefore, these wells were sampled for both total and dissolved (filtered) TAL inorganics. The laboratory analytical results indicated that the two wells with the highest turbidity readings (IAAMW01 and NBGMW02) had the highest detected concentrations of total inorganics, and the only inorganics detected at concentrations above tap water RSLs. The concentrations of arsenic (24.1 µg/L) and iron (51,000 µg/L) were above tap water RSLs at IAAMW01. The detected concentrations of aluminum (38,700 µg/L), arsenic (20.6 µg/L) and iron (44,400 µg/L) at NBGMW02 were also above tap water RSLs. These inorganics were not detected in the dissolved inorganics analysis at IAAMW01 and NBGMW02. In general the far fewer inorganics were detected in the dissolved inorganics analysis in comparison to the total inorganics analysis. Total inorganics concentrations were also much lower in the monitoring wells with lower turbidity readings.

In conformance with the Remedial Investigation Work Plan Addendum 27 (ARCADIS 2008b), ARCADIS attempted to install a groundwater monitoring well at the BDDT to evaluate the potential transport of PAH compounds to groundwater from the surface soils. Two borings were completed at the BDDT, one to 50 ft bgs and a second to 75 ft bgs. Bedrock was encountered at approximately 5 ft bgs in both borings. Groundwater was not encountered in either boring; therefore no wells were installed at the BDDT.

10.2.3 April 2010 Groundwater Investigation

ARCADIS completed a third groundwater sampling event at RFAAP-NRU during 2010 to supplement the existing data set at the request of VDEQ. This sampling event was conducted on April 6-7, 2010 and included collection of groundwater samples from all eleven monitoring wells at the facility. In addition, the four springs that were sampled during the October 2008 sampling event were also sampled during the 2010 event.

As in the 2008 sample event, one spring water sample (WBG_Spring001) was collected from Wiggin's Spring at the WBG. A second spring water sample (RY_Spring002) was collected at the unnamed spring at the RY pond. Two spring water samples (NSpring003 and NSpring004) were also collected at unnamed springs located in the northeast corner of the RFAAP-NRU.

The groundwater monitoring wells were all sampled for the following analytes: VOCs, PAHs, PCBs, explosives, total TAL inorganics, and dissolved TAL inorganics. Where low flow sampling techniques were unable to reduce turbidity to below 40 NTUs, the dissolved TAL inorganics data was used preferentially over the total inorganics data for the risk assessment. The five monitoring wells located at the two former burning ground sites (NBG and WBG) were also analyzed for dioxins/furans. The spring water samples were analyzed for the following: VOCs, PAHs, PCBs, explosives, and total TAL inorganics.

The results of the field parameter analyses and the laboratory analytical results for the groundwater and spring water samples are summarized in Table 10-3 and the sample locations are depicted in Figure 3-2. The laboratory analytical reports for the 2010 groundwater sampling event are in Appendix G.

VOCs. Five VOCs (acetone, carbon disulfide, chloroform, chloromethane, and MTBE) were detected in groundwater samples (see Table 10-3). Acetone was detected in 4 of the 15 following sample locations: IAA-MW002, IAA-MW004, BLA-MW002, and WBG-MW002. The highest acetone concentration occurred at WBG-MW002 with a reported value of 41.4 µg/L. Chloromethane was detected in a majority of the samples (i.e., 13 of the 15 sample locations) with a minimum concentration of 0.93 µg/L at sample location IAA-MW004 and a maximum concentration of 1.7 µg/L at sample location WBG-MW001. Detects of both carbon disulfide and MTBE were isolated to sample location IAA-MW002 with a concentration of 0.448 µg/L and 11.4 µg/L, respectively. Chloroform was also detected in a single sample (WBG Spring001) at a concentration of 0.85 µg/L, which is higher than the tap water screening value of 0.19 µg/L. It should be noted that other than the single chloroform detection, all of the detected concentrations of VOCs within the groundwater were below the tap water RSLs.

PAH's. There were only three sample locations (two monitoring wells and one spring sample) that had detections for PAHs (Table 10-3). Of the monitoring wells, BLA-MW001 had detects of phenanthrene (0.0223 µg/L) and pyrene (0.0194 µg/L). Monitoring well IAA-MW002 had a detection for fluoranthere with a concentration of 0.0189 µg/L. Finally, spring location RY-SPRING002 had a detection for anthracene with a reported concentration of 0.0213 µg/L. All of these PAH detections are several orders of magnitude below the tap water RSLs.

PCBs. There were no detections of PCB's in any of the groundwater samples (Table 10-3).

Explosives. The following five explosive constituents were detected: nitrobenzene, PETN, tetryl, p-nitrotoluene, and 2,6-dinitrotoluene (Table 10-3). Nitrobenzene was detected in monitoring well NBG-MW003 at a concentration of 0.512 µg/L, which is greater than the tap water RSL of 0.012 µg/L. PETN was detected in monitoring well IAA-MW002 with a concentration of 1.39 µg/L. Tetryl was detected in both the monitoring well NBG-MW002 and within the spring samples RY-SPRING002 with a respective concentration of 0.450 µg/L and 0.302 µg/L. 2-Nitrotoluene was detected in monitoring well BLA-MW002 with a concentration of 0.293 µg/L. Finally, 2,6-dinitrotoluene was detected in NBG-MW002 with a concentration of 0.393 µg/L. With the exception of the single nitrobenzene detection, the explosive detections were lower than their respective tap water RSLs.

Dioxins/Furans. The only dioxin compound detected was OCDD within sample WBG-MW001. The OCDD concentration at this location was 0.249 ng/L, which is below the tap water RSL of 1.7 ng/L (Table 10-3).

Inorganics. The groundwater monitoring wells were analyzed for both total metals and dissolved metals. Six of the eleven monitoring wells had total metals detections of one or more of the following six constituents at concentrations at or above the tapwater RSL: arsenic, aluminum, cobalt, iron, lead, and manganese. Arsenic was detected at a concentration above the tap water RSL of 0.045 µg/L at Monitoring Wells IAA-MW001, IAA-MW002, IAA-MW004, WBG-MW001, WBG-MW002, and WBG-MW003.

Aluminum was detected above the RSL of 37,000 µg/L at Monitoring Well IAA-MW004. Cobalt and lead were detected above their respective RSL of 11 µg/L and 15 µg/L at IAA-MW004 and WBG-MW001. Iron and manganese were both detected above their respective RSLs of 26,000 µg/L and 3,500 µg/L at Monitoring Well IAA-MW004. No inorganics were detected at concentrations above tap water RSL in Monitoring Wells BLA-MW001, BLA-MW002, IAA-MW003, NBG-MW001, and NBG-MW002 or in any of the spring water samples.

As demonstrated during the 2008 sampling event, the presence of suspended solids (i.e., high turbidity values) in the groundwater samples is known to result in higher concentrations of the detected metals in the total inorganics analyses. This was again confirmed during the 2010 sampling event as the concentrations of the detected metals were much lower in the samples analyzed for dissolved inorganics analyses versus the total inorganics analyses. The only constituent detected above tap water RSLs in the dissolved inorganics samples was arsenic, which was detected at a single monitoring well location (IAA-MW002) at a concentration of 1.83 µg/L.

10.3 Nature and Extent of Constituent Detections

A total of three groundwater sampling events have been completed at the RFAAP-NRU and have included a total of eleven monitoring wells installed at the BLA, IAA, NBG, and WBG sites. The monitoring activities have also included the collection of spring water samples from four springs located throughout the facility. The analytical results from the monitoring activities have indicated that metals are present in groundwater at RFAAP-NRU (see analytical results for groundwater and spring samples in Tables 10-1, 10-2, and 10-3). All of the detected metals are naturally occurring in soil at the facility (see background inorganics concentrations in Table 4-2) and the detected concentrations were generally below tap water RSLs. During the course of monitoring arsenic, aluminum, cobalt, iron, lead, and manganese have been detected at concentrations above their respective RSLs in isolated monitoring wells. These detections have been demonstrated to be the result of suspended solids (i.e., elevated turbidity levels) in the groundwater samples. The metals concentrations detected in the monitoring wells decreased when the samples were collected using low-flow sampling techniques. The concentrations of metals detected in dissolved (i.e., filtered) groundwater samples were also far lower than corresponding samples analyzed for total metals. The only inorganic constituent detected above applicable tap water RSLs in samples analyzed for dissolved metals was arsenic. Arsenic was detected in a single groundwater sample (IAA-MW002) during the 2010 sampling event at a concentration above the tap water RSL of 0.045 µg/L.

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During the 2007 groundwater sampling event, several dioxin/furan compounds were reportedly detected in the samples from many of the monitoring wells. However, the majority of the detected constituents were present at concentrations that were qualified as estimated by the laboratory (i.e., J-flagged) or were also detected in a laboratory blank sample associated with the analyses. The reported concentrations of 1,2,3,7,8-PeCDF, 2,3,4,7,8-PeCDF, 2,3,7,8-TCDD, 2,3,7,8-TCDF were above the tap water RSLs at several of the groundwater monitoring wells. When the monitoring wells and spring locations were sampled during the 2010 groundwater sampling event the only dioxin compound detected was OCDD. OCDD was detected in a single monitoring well (WBW-MW001) at a concentration that was an order of magnitude less than the tapwater RSL. There were no issues with laboratory blank contamination during the 2010 sampling event, indicating that the results from the 2010 sampling event are more indicative of actual groundwater quality at the site.

A few explosive compounds (PETN, tetryl, p-nitrotoluene, 2,6-dinitrotoluene, and nitrobenzene) were detected at low concentrations in isolated groundwater samples during the 2010 sampling event. The detected concentrations of these constituents were several orders of magnitude below their respective RSLs, with the exception of nitrobenzene. Nitrobenzene was detected in one monitoring well (WBG-MW003) at a concentration of 0.512 µg/L, which is slightly higher than the tap water RSL of 0.12 µg/L. No explosives were detected in groundwater during the 2007 sampling event.

Samples collected from the four springs during the 2008 and 2010 groundwater sampling event did not contain any constituents at levels above applicable RSLs, with the exception of one chloroform detection at WBG-Spring001 during the 2010 sampling event. It should be noted that the chloroform detection at WBG-Spring001 was J-flagged by the laboratory. The results of the spring samples indicate there are no large scale water quality issues at the RFAAP-NRU.

10.4 Risk Assessment Datasets

Data generated from the site characterization activities were used in the risk assessment. The groundwater risk assessment dataset was prepared then summarized and statistically analyzed per methods described in Appendix A. The groundwater risk assessment dataset summary highlighting: the number of detects, number of samples, FOD, minimum and maximum detected concentrations, minimum and maximum detection limits, and EPC is presented in Table 10-3.

While the spring samples were evaluated for both human health and ecological risk, the remaining groundwater samples were only evaluated for human health risk, as exposure to groundwater by ecological receptors is unlikely. Among the three sampling events (2007, 2008, and 2010), adequate data were available to exclusively use data from filtered samples for assessing risk through exposure to dissolved phase inorganic constituents in groundwater used as a potable water supply. The ecological risks for the spring samples collected at the RY and the WBG were evaluated as part of the surface water data sets collected at those sites, and are discussed in Sections 6 and 7, respectively. Due to the Karst formation and the localized presence of iron in some groundwater samples, the presence of colloidal particles measured as turbidity in the groundwater samples resulted in elevated levels of trace metals. Therefore, when the turbidity could not be reduced below 10 NTUs by low flow sampling techniques, following USEPA (USEPA 2002e) guidance both filtered and unfiltered groundwater samples were collected. For the purposes of assessing risk through exposure to dissolved phase constituents in groundwater used as a potable water supply, if the turbidity was elevated, metals data from the filtered samples were quantitatively evaluated; however, if the turbidity was less than 10 NTUs, the metals data from the unfiltered sample was quantitatively evaluated.

10.5 Human Health Risk Assessment

The purpose of this risk assessment is to evaluate the potential current and future risks and hazards to human health associated with potential exposure to constituents detected in groundwater samples collected at the RFAAP-NRU. This section summarizes the occurrence of constituents in groundwater, identifies groundwater COPCs, and presents the estimated human health risks associated with the relevant human exposure scenarios. The methodologies for the selection of COPCs, the exposure assessment, and the toxicity assessment for the HHRA are presented in Appendix A. The results are summarized below.

10.5.1 Selection of Constituents of Potential Concern

Groundwater COPCs were selected by comparing the analytical data with USEPA (2009a) adjusted tap-water RSLs. Table 10-4 presents the selection of groundwater COPCs for the HHRA. As summarized in Table 10-5, chloroform and dioxin/furan compounds were the main organic constituents that were identified as groundwater COPCs. Two explosive compounds were also detected and selected as COPCs. The inorganic constituents identified as groundwater COPCs were: arsenic, iron, and manganese. Exposure point concentrations for COPCs are presented in Table 10-5.

10.5.2 Human Health Risk Characterization

Although groundwater is not currently used at the NRU, a site worker exposure to groundwater used as a potable water supply was evaluated along with exposure to volatile COPCs migrating to indoor air. In addition, a future hypothetical residential exposure to groundwater used as a potable water supply was evaluated. Potential future residential groundwater exposure pathways include direct contact pathways if groundwater were used as a potable water supply and inhalation of volatile COPCs in groundwater. The inhalation pathway is potentially complete under two scenarios. Volatile COPCs can be present in ambient air from water used as a potable water supply (e.g., during showering). Volatile COPCs can also migrate to indoor air through subsurface vapor intrusion.

The excess lifetime cancer risks and non-cancer hazards for each potentially exposed receptor included in the risk assessment for the RFAAP-NRU are presented in Appendix A and are summarized in the table and subsections below.

10.5.2.1 Hypothetical Future Residents

Residential development of the NRU is not expected to occur and the current land use associated with the site is not expected to change. As a result, future use of the site for residential purposes is considered unlikely, but was considered as a conservative measure. Risk to the potential future resident receptor from exposure to groundwater was evaluated. Risks were estimated for all COPCs. For inorganic COPCs, risks were calculated using EPCs based on both the filtered and unfiltered groundwater samples.

The ELCR and non-cancer hazard index for hypothetical future adult or child resident exposure to groundwater are presented in Appendix A, and are summarized in Table 10-6.

The total cumulative ELCR for hypothetical future residents exposed to groundwater is 2×10^{-4}, which is above the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for hypothetical future adult residents is 0.6, which is below the benchmark of 1. The total cumulative HI for hypothetical future child residents is 1, which is equal to the benchmark of 1. The risk drivers for cancer risk were arsenic and the combined dioxin and furan congeners. During the 2010 sampling event, arsenic was only detected in one filtered sample (IAA-MW02) at a concentration (1.83 µg/L) that was below the Federal maximum contaminant level (MCL) of 10 µg/L. Arsenic was not detected in any of the filtered samples during the 2008 sampling event. The dioxin and furan congeners that are driving the cancer risks were detected in several groundwater samples during the 2007 sampling event at concentrations greater than the USEPA RSLs. However, most of these constituents were also detected in the rinse blank associated with those samples, which indicated a potential cross contamination issue with the sampling or laboratory equipment. All of the detections during the 2007 sampling event were also below the reporting limit and were qualified as "estimated". During the 2010 sampling event, only one dioxin constituent was detected in a single monitoring well, and the concentration was well below the USEPA RSL, which further indicates dioxin/furan detections from the 2007 sampling event are likely not indicative of groundwater quality at RFAAP-NRU.

10.5.2.2 Site Worker

A current or future site worker could be present at the NRU, and could be exposed to groundwater as a potable source or via inhalation of vapors due to subsurface vapor intrusion into a building. Risks to commercial/industrial receptor exposed to vapors indoors due to subsurface vapor intrusion were assessed using the USEPA vapor intrusion model. The ELCR and non-cancer hazard index for site worker exposure to groundwater are presented in Appendix A. For inorganic COPCs, risks were calculated using EPCs based on combined filtered and unfiltered groundwater samples.

The ELCR for site workers potentially exposed to potable groundwater is 4×10^{-5}, which is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The HI for site workers is 0.4, which is below the benchmark of 1.

The ELCR for a site worker exposure to vapors in indoor air due to subsurface vapor intrusion was 2×10^{-8} and is well below the generally accepted USEPA target risk range of 1×10^{-6} to 1×10^{-4}.

As previously stated, including unfiltered data for calculating EPCs for inorganic COPCs is highly conservative and not reflective of conditions most likely to occur in the unlikely event that groundwater is used as a potable water supply in the future.

10.6 RFAAP-NRU Groundwater Summary and Conclusions

The groundwater investigation activities at the RFAAP-NRU have included the installation of 11 groundwater monitoring wells and groundwater sampling events in 2007, 2008, and 2010. In addition to sampling all of the monitoring wells, the 2008 and

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2010 events also included the collection of samples from 4 springs located within the boundaries of the RFAAP-NRU. The spring samples were collected because the function of springs as groundwater collectors makes them ideal locations for screening for groundwater quality.

The 2007 groundwater sampling event included the collection of groundwater samples from 11 monitoring wells located throughout the RFAAP-NRU. The wells were installed at, or in the vicinity of, the Study Areas at the RFAAP-NRU due to the known historical operations conducted at them. Four wells (IAA-MW01 through IAA-MW04) are located in the vicinity of the IAA, three wells (WBG-MW01 through WBG-MW03) are located at the WBG, two wells (BLA-MW01 and BLA-MW02) are located at the BLA, and two wells (NBG-MW01 and NBG-MW02) are located at the NBG. The monitoring wells were analyzed for a full suite of parameters including dioxins/furans, explosives, herbicides, pesticides, PAHs, PCBs, SVOCs, VOCs, and inorganics. The results indicated the following:

- No SVOCs, PAHs, PCBs, pesticides, or herbicides were detected in any of the groundwater samples.

- The VOC chloroform was detected in one sample (WBGMW01) at a concentration above the tap water RSL. Chloroform was not detected at any other sample locations

- Several dioxin/furan related compounds were reported at low concentrations in all of the groundwater samples. Despite the low concentration, some of these constituents were above the tap water RSLs. However, the detected constituents were qualified due to the detection of dioxins and furans in laboratory blank samples. Dioxins and furans were not identified as primary COCs in soil at any of the Study Areas, therefore, it is unlikely that the reported detections in groundwater are associated with RFAAP-NRU.

- Several inorganic constituents were detected in all of the groundwater samples collected during the 2007 investigation. In most cases the detected concentrations were below applicable tap water RSLs; however three samples contained constituents at concentrations above the tap water RSLs. The sample from Monitoring Well IAA-MW01 had arsenic, iron, lead, and manganese at concentrations above applicable RSLs. Monitoring Well NBG-MW01 had arsenic at a concentration above the tap water RSL (note that arsenic was also detected in a laboratory blank sample associated with this sample). Monitoring Well WBG-MW01 had arsenic and lead at concentrations above the RSLs (again note that arsenic was detected in a laboratory blank sample associated with this sample).

ARCADIS conducted a groundwater sampling event at the RFAAP-NRU in 2008 to evaluate whether suspended solids and naturally occurring inorganics in soils could have contributed to the elevated inorganics concentrations observed during the 2007 groundwater sampling event. ARCADIS utilized low flow sampling techniques to sample all eleven groundwater monitoring wells at the facility to reduce the presence of suspended solids in the groundwater samples. When the low flow sampling techniques were unable to lower turbidity readings below a threshold of 40 NTUs, samples were collected for both total and filtered laboratory analysis. The results of this sampling event indicated the following:

- There was a strong correlation between the presence of suspended solids and elevated inorganics concentrations. Inorganics concentrations were typically lower in samples with lower turbidity readings. Samples that were analyzed after filtering also illustrated a large drop in inorganics concentrations.

- The unfiltered samples collected at monitoring wells IAA-MW01 and NBG-MW02 had concentrations of aluminum, arsenic, iron, lead and manganese at concentrations above applicable tap water RSLs. These samples, which were the only wells sampled with inorganics concentrations above applicable RSLs, both had turbidity readings above 1,000 NTU. The analytical results from the filtered samples at these locations indicated a significant drop in inorganics concentrations and no constituents were detected at concentrations above applicable RSLs.

The 2008 groundwater sampling event also included the collection of four spring water samples. One sample (WBG-Spring001) was collected from Wiggin's Spring at the head of the WBG pond, one sample (RY-Spring002) was collected from the unnamed spring at the head of the RY pond; the other two spring samples (NSpring003, and NSpring004) were collected from unnamed springs located in the northeastern portion of the RFAAP-NRU. The samples were analyzed for inorganics and PAHs. The samples had very low turbidity and indicated that several inorganics were present at concentrations below applicable tap water RSLs. The presence of these metals in groundwater should be expected due to naturally occurring inorganics in soil at the RFAAP-NRU. The PAH naphthalene was detected in the samples from the WBG and RY springs. Phenanthrene was also detected at the RY spring. The concentrations of naphthalene and phenanthrene were several orders of magnitude below applicable tap water RSLs.

ARCADIS completed a third round of groundwater sampling at RFAAP-NRU during 2010 at the request of the VDEQ. This event included collecting groundwater samples from all eleven monitoring wells at the facility in addition to the four springs that were sampled during the October 2008 sampling event. The groundwater monitoring wells were all sampled for the following analytes: VOCs, PAHs, PCBs, explosives, dissolved metals, total TAL inorganics, and dissolved TAL inorganics. The five monitoring wells located at the two former burning ground sites (NBG and WBG) were also analyzed for dioxins/furans. The spring water samples were analyzed for the following: VOCs, PAHs, PCBs, explosives, and total TAL inorganics. The results indicated the following:

- Similar to the 2008 sampling event, there was a strong correlation between the presence of suspended solids and elevated inorganics concentrations. The results from filtered samples indicated that arsenic at Monitoring Well IAA-MW002 (1.83 µg/l) was the only inorganic constituent detected at a concentration above the tap water RSLs.

- The only dioxin/furan compound detected was OCDD within sample WBG-MW001. The OCDD concentration at this location was 0.249 ng/L, which is below the tap water RSL of 1.7 ng/L. These results support the hypothesis that the multiple dioxin/furan compounds detected during the 2007 sampling event were due to laboratory contamination and were not indicative of groundwater quality at the site.

- A total of five VOCs (acetone, carbon disulfide, chloroform, chloromethane, and MTBE) were detected in isolated ground water samples. The detections were generally at very low concentrations. Chloroform detected at WBG-Spring001 was the only VOC detected at a concentration above the tap water RSL.

- Five explosive constituents (nitrobenzene, PETN, tetryl, p-nitrotoluene, and 2,6-dinitrotoluene) were detected in isolated groundwater samples. Nitrobenzene detected in Monitoring Well NBG-MW003 (0.512 µg/L) was the only explosive detected at a concentration higher than the tap water RSL .

- There were no detections of PCBs in any of the groundwater samples.

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- Four PAH constituents (anthracene, fluoranthene, phenanthrene, and pyrene) were detected in isolated groundwater samples. All of the PAH detections were several orders of magnitude below the tap water RSLs.

An HHRA was conducted to evaluate potential exposure to constituents detected in groundwater. Potential exposure of site workers was evaluated for the vapor migration pathway. The calculated risks were well below the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. Exposure of hypothetical future adult and child residents through the vapor intrusion exposure pathway yielded similar, very low results.

Exposure of hypothetical future residents and site workers to constituents in groundwater assuming the groundwater were used as a potable water supply also was evaluated in the risk assessment. These exposure scenarios were evaluated using unfiltered and filtered groundwater data to evaluate the influence of metals present as suspended solids. This assessment was performed because the groundwater at the NRU was turbid.

The excess lifetime cancer risks calculated for hypothetical future resident exposure to groundwater used as a potable water supply was 2×10^{-4}. This is slightly above the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The risk drivers for cancer risk are arsenic and the dioxin and furan congeners.

The hazard index for a hypothetical adult resident was calculated to be 0.6, which was below the benchmark of 1. The hazard index or a hypothetical child resident was calculated to be 1, which is equal to the benchmark of 1.

The risk drivers for the excess lifetime cancer risk associated with the residential land use scenario are arsenic and the dioxin and furan congeners. Arsenic was detected in 1 out of the 18 filtered samples collected; and, this detection was below the MCL. The dioxin congeners were detected in several groundwater samples during the 2007 sampling event at concentrations greater than the USEPA RSLs. However, it should be noted that many of the dioxin compounds were also detected in the rinse blank associated with the 2007 sampling event which indicates a potential cross contamination issue associated with the sampling or laboratory equipment. All of the detections during the 2007 event were below the reporting limit and were qualified as estimated. The dioxin and furan congeners were not detected during the 2010 groundwater sampling event at the RFAAP-NRU which provides further evidence that the detections driving the elevated risk levels are not indicative of actual groundwater quality at the facility.

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It is recommended that No Action be selected for groundwater at the RFAAP-NRU.

RFAAP-NRU Summary and Conclusions

11. RFAAP-NRU Summary and Conclusions

Human health and ecological risk assessments were performed for the areas of the RFAAP-NRU. The purpose of the risk assessments was to evaluate the potential current and future excess lifetime cancer risks and potential hazards to both human and ecological receptors at the site from exposure to constituents detected in soil, groundwater, surface water, and sediment at the RFAAP-NRU. Results of the assessment are summarized in table below and discussed in the following sections.

Summary of Calculated Total ELCRs and HIs for All Constituents Except Lead

Exposure Area	Receptor	ELCR	HI	Risk/Hazard Drivers
BDDT	Current Site Worker	7E-05	0.6	-
	Future Construction Worker	2E-06	1	-
	Future Resident	4E-04	0.6 adult, 5 child	Benzo(a)pyrene, Cobalt
BLA	Current Site Worker	1E-04	0.8	-
	Future Construction Worker	7E-06	3	Copper
	Future Resident	1E-03	1 adult, 12 child	Benzo(a)pyrene, Aroclor 1254, Copper, Cobalt
IAA	Current Site Worker	1E-04	1	-
	Future Construction Worker	6E-06	3	*
	Future Adult Resident	5E-04	1 adult, 13 child	2,4-DNT, Aroclor 1254, copper, cobalt
RY	Current Site Worker	1E-04	0.4	-
	Future Construction Worker	5E-06	0.7	-
	Future Resident	3E-04	0.6 adult, 3 child	Pentachlorophenol, cobalt
WBG	Current Site Worker	1E-05	0.4	-
	Future Construction Worker	5E-07	0.5	-
	Future Resident	5E-05	0.8 adult, 6 child	Chromium
GW	Site Worker	4E-05	0.4	-
	Future Resident	2E-04	0.6 adult, 1 child	Arsenic, Dioxins/Furans

*When segregated by target organ/critical effect, HI did not exceed 1.

Summary of Estimated Blood Lead Levels

Exposure Area	Receptor	Estimated Blood Lead Level (µg/dL)		
		Adult	Child	Fetus
		50th percentile	Range	95th percentile
BDDT	Not a COPC in this area			
BLA	Current Site Worker	4.9	–	17
	Future Construction worker	5.2	–	18
	Future Adult Resident	6.5	–	23
	Future Child Resident	–	11 - 18	–
IAA	Current Site Worker	2.8	–	10
	Future Construction	2.8	–	10
	Future Adult Resident	3.2	–	11
	Future Child Resident	–	4.4 - 8.2	–
RY	Not a COPC in this area			
WBG	Current Site Worker	2	–	7
	Future Construction	2	–	7
	Future Adult Resident	2.8	–	10
	Future Child Resident	–	2.9 – 5.5	–
GW	Not a COPC in groundwater			

In addition to the constituents identified in the tables above, asbestos present in conductive flooring material and surface soils at the BLA and IAA could potentially present a risk to current and future site workers, construction workers, and hypothetical future residents. Although asbestos as not inherently hazardous, if asbestos fibers are released to air, fibers can be inhaled and pose a risk to human health. Activity based sampling at the BLA and IAA has demonstrated that intensive soil disturbance activities in areas with high asbestos concentrations have the potential to generate levels of asbestos in air that could present potential risks to current/ future industrial receptors and hypothetical future residential receptors.

11.1 Building Debris Disposal Trench

The BDDT was formerly an ephemeral unlined natural drainage swale that channeled surface water runoff from the surrounding area towards the unnamed creek which passes through the southwestern portion of the RFAAP-NRU. An approximately 600-ft long section of the drainage swale was utilized for the disposal of miscellaneous building debris derived from the dismantling of various structures at the RFAAP-NRU. The building debris consisted of concrete, wood, and rusted and broken drums of a black, tarry substance believed to be roofing tar.

RFAAP-NRU Summary and Conclusions

Samples collected from the trench indicated that PAHs were present in soils underlying the debris at concentrations above applicable screening levels. Site restoration activities were performed at the BDDT in 1998 as part of a remedial investigation that included the removal of all building debris and any visibly stained soil from the trench. The excavated material was replaced with clean fill and the trench was lined with a geotextile fabric and filled with riprap to minimize the potential for erosion. The site restoration activities mitigated the source area and potential exposure pathways along the trench; therefore, subsequent investigations focused on soil, sediments, and surface water, downgradient of the trench.

Sampling activities performed at the BDDT between 1998 and 2008 focused on the areas downslope of the trench that may have been affected by the transport of constituents prior to the site restoration activities. These areas included an open area between two hills at the downgradient reach of the trench and an unnamed stream located further downslope. Based on the physical characteristics of the site, the stream and the open area downgradient of the former disposal area would have been natural depositional areas for media (i.e., soil and debris particles) that may have washed out of the trench prior to the site restoration activities. The open area is heavily vegetated with tall grasses and has a gentle slope towards the downgradient stream. Bedrock is present at approximately 5 ft bgs throughout the BDDT Analyte classes included during the various phases of investigation at the BDDT have included explosives, pesticides, herbicides, PCBs, PAHs, SVOCs, VOCs, and inorganics.

PAHs were the most frequently detected constituents in soil within the open area downgradient of the former disposal area. PAHs were detected at concentrations above initial screening levels in 34 of the 55 surface soil samples and in 6 subsurface soil samples. The delineation of the PAHs was completed during the 2008 sampling event which defined the outer edges of the PAH detections in surface soil. The 2008 sampling event also confirmed that the subsurface PAH detections are confined to a small area immediately downgradient of the end of the former disposal area and only extend to a depth of approximately 4 ft bgs. PAH detections are not expected to extend any deeper due to the presence of shallow bedrock throughout the BDDT area.

Sediment sampling indicates that the residual PAHs present in the surface soils within the open area downslope of the BDDT are not resulting in continued releases of PAHs to the creek. The only other constituents detected in sediment at concentrations above applicable screening levels were iron and manganese, which were only detected at elevated concentrations in one sample in 1998.

The surface water data from the stream have indicated that no PAHs have been detected at concentrations above tap water RSLs. The pesticide dieldrin was detected at a concentration above the tap water RSL in two samples. The VOCs bromodichloromethane and chloroform were detected above the tap water RSL in one sample. Thallium was also detected above the tap water RSL in two samples. The isolated occurrences of these detections, and the fact that dieldrin, bromodichloromethane, chloroform, and thallium were not identified as COCs for the BDDT soils indicate that the BDDT area is not resulting in continued releases of these constituents. It should also be noted that dieldrin was also detected in surface water samples collected from the unnamed stream in 2002, far upstream of the BDDT; including, a sample collected where the stream first enters the RFAAP-NRU.

An HHRA was conducted to evaluate exposure to COCPs in surface soil, combined surface and subsurface soil, sediment, and surface water for site workers, construction workers, hypothetical adult residents, and hypothetical child residents under both current and future land-use conditions. The HHRA considered data collected from the entire BDDT site as well as a second scenario that only included data collected from the rip rap covered portion of the site. The calculated excess lifetime cancer risks and hazards were within the USEPA's target risk range of 1×10^{-6} to 1×10^{-4}, and less than or equal to the hazard index of 1,for the industrial land use scenarios. Under the future resident scenarios the ELCR was found to exceed 1×10^{-4} due to benzo(a)pyrene in surface soils. Hazards also exceeded 1 for the child resident due to exposure to the maximum concentration of cobalt in subsurface soil. However, it should be noted that with the exception of the single maximum detection of cobalt, all other cobalt detections were within established background levels for the RFAAP facility. Therefore, it is likely that the isolated elevated cobalt detection is related to natural conditions rather than historical activities at the BDDT.

A SLERA and BERA were completed for the BDDT, to evaluate surface soil, sediment, and surface water for ecological receptors, and food chain modeling was evaluated for all those constituents identified as bioaccumulative. The results of the evaluation of the SLERA and BERA for direct contact and the constituents evaluated in the terrestrial and aquatic food chain models indicate that adverse effects are not expected for wildlife at the BDDT.

Based on the potential residential risks associated with the benzo(a)pyrene in surface soil located downgradient of the trench and in the soil located under the rip rap covered portions of the trench, it is recommended that a FS be conducted to evaluate the available CERCLA response actions for the site. The response action alternative analysis will include an evaluation of potential actions to reduce risk to levels acceptable for residential use of the property, as well as options for maintaining the industrial use of the property.

11.2 Bag Loading Area

The BLA is a former powder bag loading facility that operated from 1941 through 1943. The facility included a total of ten buildings that were connected by elevated walkway platforms. Seven of the buildings contained a conductive flooring material that covered the concrete slab floors. Samples of the conductive flooring material indicate that it contained asbestos and several different metals. All process equipment, wooden roofs, and wooden walls have been removed from the buildings, leaving only concrete slabs and walls in place. Removal of the building wall and roofs has exposed the conductive flooring to weather, causing it to degrade and begin to break away from the underlying concrete. In many cases, the flooring has degraded into a red powder-like material and washed onto the surrounding soils.

Environmental investigations conducted at the BLA between 1997 and 2009 focused on evaluating the effects that the deteriorating conductive flooring material and historical site operations have had on the soils surrounding the BLA buildings. Soil samples were also collected at former electrical transformer locations, near area walkways, and from area drainage ditches. Sediment and surface water samples were collected from the unnamed stream located to the north of the BLA to evaluate the potential for constituents to have migrated from the site. Water and sediment samples were also collected from an underground utility vault and former elevator shaft in Building 405. Laboratory analyte classes varied between the investigation activities but have included explosives, herbicides, pesticides, PAHs, PCBs, VOCs, SVOCs, TAL inorganics, asbestos, TCLP-inorganics, and lead-based paint analysis. An extensive soil sampling program was also conducted in 2008 that included screening 192 soil samples around BLA buildings for lead using XRF. An activity-based sampling program was also conducted in 2009 to characterize potential risks associated with asbestos in soil.

The primary constituents of concern identified during the investigation at the BLA are associated with the deteriorating conductive flooring in the existing structures. Inorganics, including arsenic, barium, cadmium, cobalt, copper, lead, and zinc have been detected in surface soil samples collected around the buildings. Lead and copper, which are believed to have been primary components of the conductive flooring material, were the most frequently detected constituents at concentrations above applicable industrial and residential RSLs. The 2008 sampling activities confirmed that the inorganics concentrations above applicable RSLs and/or background levels are generally limited to surface soils immediately adjacent (i.e. within 1 to 5 ft) to buildings with conductive flooring material; although, the elevated concentrations extend up to 10 ft from buildings in a few isolated areas. Subsurface soil sampling activities at the BLA have not identified any of the inorganics associated with the flooring material at concentrations above the applicable RSLs. Samples collected from BLA drainage ditches have also indicated that the concentrations of inorganic constituents were within background levels. The subsurface soil and drainage ditch sampling results indicate that the mobility of these constituents is very limited. The only inorganics detected at concentrations above applicable RSLs and background inorganics concentrations in subsurface soil were aluminum (2 samples) and iron (1 sample).

PAHs, which are possibly associated with the flooring material and other building materials used at the BLA, are also present at concentrations above RSLs in surface soils around the BLA buildings and former elevated walkway corridors. Concentrations of PAHs did not exceed residential RSLs in subsurface soil samples at the BLA or in drainage ditch samples.

Asbestos, another component of the conductive flooring and other BLA building materials, has been identified in surface soils surrounding the BLA buildings. The highest concentrations of asbestos in soil are confined to surface soils located immediately adjacent to the buildings with conductive flooring (i.e., within 1-ft of the building pads). The asbestos concentrations in some of the areas adjacent to the buildings are above 1% by weight. While asbestos fibers were detected in surface soil samples collected at distances greater than 5-ft from site buildings, the concentrations were typically less than 0.1% by weight. Activity based air sampling conducted adjacent to Buildings 404 and 411 confirmed that intensive disturbance of the soils immediately adjacent to the buildings has the potential to generate measureable airborne asbestos at concentrations above industrial and residential AALs.

Isolated detections of Aroclor 1254 were detected in surface soils near two former pole-mounted transformer locations at the BLA. PCBs have not been detected in sediments or surface water samples at the BLA, further supporting the theory that constituents are not migrating from the BLA.

Sediment and surface water samples were collected from two locations in the unnamed stream that passes to the north of the BLA during the 2002 site investigation.

Dieldrin was detected at a concentration above the tap water RSL in one surface water sample from the unnamed creek. However, dieldrin was also detected in other surface water samples collected from the unnamed stream in 2002, upstream of the BLA; including a sample where the unnamed stream first enters the RFAAP-NRU. No other constituents were detected in stream surface water at concentrations above applicable tap water RSLs.

Water samples collected from two utility vaults identified at the BLA contained arsenic at concentrations above the tap water RSL. No other constituents were identified in the vault water samples at concentrations above applicable RSLs.

An HHRA was conducted to evaluate exposure pathways for site (maintenance) workers, construction workers, adult residents, and child residents under both current (maintenance workers) and hypothetical future land-use conditions.

The potential cumulative risk for site workers exposed to surface soil and sediment at the BLA under current and future land-use conditions was at the high end of USEPA's target risk range of 1×10^{-6} to 1×10^{-4} for health protectiveness at Superfund sites (USEPA, 1990). The potential cumulative HI for site workers was less than the benchmark of 1.

The potential cumulative risk for construction workers were within the USEPA's target risk range of 1×10^{-6} to 1×10^{-4} for health protectiveness at Superfund sites (USEPA, 1990). However, the potential cumulative HI for construction workers was above the benchmark of 1. When the HI was segregated into target site and critical effects, hazards were above the benchmark of 1 for the gastrointestinal tract due to the presence of copper.

The total cumulative ELCR for hypothetical future residents exposed to combined surface and subsurface soil, sediment, and surface water was greater than the USEPA target risk range of 1×10^{-6} to 1×10^{-4}, due to the presence of benzo(a)pyrene. The total cumulative HI for hypothetical future adult residents is 1, which is equal to the benchmark of 1. The total cumulative HI for hypothetical future child residents is 12, which is greater than the benchmark of 1. When the HI is segregated into target site and critical effects, hazards were above the benchmark of 1 in the central nervous system, whole body, and immune system, in the gastrointestinal tract, and in the eyes, nails, hair, and skin, due to the presence of Aroclor 1254, copper and cobalt.

Lead was also a constituent of potential concern for each of the receptors considered in the BLA risk assessment. For the potential future industrial and residential land use scenarios, exposure to lead resulted in predicted elevated blood lead levels. Therefore, exposure to lead could result in an unacceptable risk.

Removal of the walls and roofs of the buildings has exposed the conductive flooring to weather, causing it to degrade and wash onto the surrounding soils. Activity based sampling at the BLA has demonstrated that the soils located immediately adjacent to site buildings, where asbestos concentrations are highest (i.e., within 1 foot of building pad), have the potential to generate airborne asbestos when disturbed. The levels of airborne asbestos generated by intensive soil disturbance activities have the potential to be above AALs for the industrial exposure scenario and the hypothetical future residential exposure scenarios.

Any residual lead based paint on the concrete walls at the BLA or other possible asbestos containing building materials (i.e., pipe insulation, joint compounds, mastic, etc.) could also present a small risk for current and future site workers, construction workers, or residents. However, it should be noted that the overall extent of these materials at the site is limited.

A SLERA and BERA were completed for the BLA, to evaluate surface soil, sediment, and surface water for ecological receptors, and food chain modeling was evaluated for all those constituents identified as bioaccumulative. The results of the evaluation of the SLERA and BERA for direct contact and the constituents evaluated in the terrestrial and aquatic food chain models indicate that while some of the NOAEL and LOAEL HQs were greater than 1, which suggests the potential for risk to some individual insectivorous mammals and birds exposed to surface soils and some individual piscivorous mammals and birds exposed to sediment and/or surface water. However, when these results are considered in conjunction with pertinent site information on the limited spatial distribution and extent of these constituents, affects of these COPECs at the population-level are unlikely at the BLA.

The environmental investigations completed at the BLA have successfully defined and delineated the extent of effects that historical operations and degrading flooring material have had on environmental media at the site with the exception of asbestos. The investigations have confirmed that the effects are generally limited to surface soils located immediately adjacent to buildings with conductive flooring, former elevated walkways, and two former transformer locations. The results of the HHRA activities indicated that unacceptable risks and hazards are present for the industrial site worker, construction worker, and hypothetical future residential under current and future land use scenarios. The ERA activities indicated the potential for risks to individual ecological receptors, although no adverse population-level effects would be expected due to the limited areal distribution of these constituents. Although not evaluated in the risk assessment, asbestos in the remains of other building materials (e.g. pipe insulation, mastic, joint compound, etc.) and residual lead -based paint on the concrete walls could also present a potential risk to current and hypothetical future receptors. An FS is recommended to assess potential remedial alternatives to mitigate the risks and hazards associated with the site soils, conductive flooring material, and other building materials.

11.3 Igniter Assembly Area

The IAA was formerly used for igniter assembly operations and the shipping and receiving of materials. Approximately 36 buildings were located within the IAA which were connected by raised concrete walkways, gravel paths, and paved roads. Site reconnaissance activities have concluded that 29 of the buildings at the IAA contained a conductive flooring material similar to that used at the BLA. Like the BLA, all wooden roofs and walls have been removed from the IAA buildings. Exposure to the weather has caused the conductive flooring material to deteriorate into a red powder like substance and wash off onto surrounding soils.

Environmental investigations conducted at the IAA between 1997 and 2008 focused on evaluating the effects that the deteriorating conductive flooring material and historical site operations have had on the soils surrounding the IAA buildings. Soil samples were also collected at former electrical transformer locations, and from area drainage ditches. A water sample was also collected from an underground utility vault. Laboratory analyte classes varied between the investigation activities but have included explosives, herbicides, pesticides, PAHs, PCBs, VOCs, SVOCs, TAL inorganics, asbestos, TCLP-inorganics, and lead-based paint analysis. An extensive soil sampling program was also conducted in 2008 that included screening 475 soil samples around IAA buildings for lead using XRF. An activity-based sampling program was also conducted in 2009 to characterize potential risks associated with asbestos in soil.

The primary constituents of concern identified during the investigation at the IAA are associated with the deteriorating conductive flooring in the remains of the former IAA buildings. Inorganics, including, arsenic, barium, cadmium, cobalt, copper, iron, lead, mercury, nickel, and zinc have been detected in surface soil samples collected around the IAA buildings. Lead and copper, which are believed to have been the primary components of the conductive flooring material, were the most frequently detected constituents at elevated concentrations. The 2008 sampling activities confirmed that the elevated inorganics concentrations are generally limited to surface soils (i.e., 0-1 ft bgs) immediately adjacent to (i.e. within 1 to 5 ft of) buildings with conductive flooring material; although, the elevated concentrations extend up to 15 ft from several buildings in the southern portion of the IAA. Subsurface soil sampling activities at the IAA have indicated that the elevated inorganics concentrations associated with the flooring material are generally confined to the interval from 0 to 1 ft bgs. Only two subsurface soil samples collected from 1 to 2 ft bgs next to Building 504 had flooring related inorganics constituents at concentrations above applicable screening levels and background concentrations. Deeper samples collected from this and other areas of the site did not contain any flooring related inorganics at concentrations above applicable RSLs and background levels. Aluminum, which is not related to the flooring material, was detected in two subsurface soil samples at concentrations above the residential RSL and slightly above background levels. The results of TCLP analysis of soil samples collected around IAA buildings in 2008 indicated that no constituents were present at concentrations above applicable TCLP screening levels.

Asbestos, another component of the conductive flooring and other IAA building materials, has been identified in surface soils surrounding IAA buildings. The highest concentrations of asbestos in soil are confined to surface soils located immediately adjacent to the buildings with conductive flooring (i.e., within 1 foot of building pad). While asbestos fibers were detected in surface soil samples collected at distances greater than 5-ft from site buildings, the concentrations were typically less than 0.1% by weight.

Aroclor 1254 and Aroclor 1260 were detected at concentrations above applicable screening levels in a few isolated surface soil samples collected adjacent to several buildings in the IAA. Several SVOC/PAH compounds were also detected in isolated surface soil samples at concentrations above applicable RSLs.

No explosives, herbicides, pesticides, or VOCs were detected in IAA soils at concentrations above applicable RSLs.

Soil/sediment samples were collected from IAA drainage ditches to evaluate whether constituents were being transported from the building areas. The analytical data indicated that several of the samples collected adjacent to area roadways contained PAHs at concentrations approaching, and in some cases above, applicable RSLs. As

PAHs were only present in isolated surface soil samples at the IAA, these detections can likely be attributed to the asphalt from the paved road. Lead was also detected at concentrations above applicable RSLs in two samples collected from ditches that transport water from the main building area of the IAA. Additional sampling conducted in these drainage ditches during the 2008 site investigation indicated that the lead concentrations were only slightly above background and were below applicable screening levels; therefore, the previous lead detections in these areas were likely isolated and not indicative of transport from the conductive floors.

One water sample collected from an underground utility vault did not contain any constituents at concentrations above tap water RSLs. No other surface water samples were collected during the IAA investigation, as there are no surface water bodies in the vicinity of the IAA. The drainage ditches at the IAA only carry water during heavy rainfall events.

An HHRA was conducted at the IAA to evaluate potential exposures associated with site constituents to humans. Site worker exposures to surface soil and sediment were evaluated under current and future land-use conditions; and construction worker, adult resident, and child resident exposures to total soil and sediment were evaluated under future land-use conditions.

The soil and sediment COPCs were evaluated for direct contact. VOCs identified as COPCs in the IAA were also evaluated for inhalation via vapor migration into buildings. Two VOCs, 3-octanone and d-limonene, do not have identified inhalation toxicity values; therefore, the indoor vapor intrusion pathway could not be assessed at this Study Area.

A current or future site worker could be present at the IAA area, and could be exposed to surface soil or sediment. The total cumulative ELCR for site workers exposed to surface soil and sediment is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for site workers is equal to the benchmark of 1. Lead was also evaluated as a COPC, although the results are reported differently than those for the other COPCs. The predicted worker blood lead levels were below the benchmark and the predicted fetal lead level was equal to the benchmark.

A hypothetical future construction worker could be present at the IAA area, and could be exposed to combined surface and subsurface soil. The total cumulative ELCR for hypothetical future construction workers exposed to combined surface and subsurface soil at the IAA was within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for hypothetical future construction workers is greater than the benchmark of 1. However, when the hazard index was segregated by target organ or critical effect, all of the HIs were below the benchmark. The predicted worker blood lead levels were below the benchmark and the predicted fetal lead level was equal to the benchmark.

The total cumulative ELCR for hypothetical future residents exposed to combined surface and subsurface soil and sediment at the IAA is 5×10^{-4}, which is slightly above the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The primary contributor to risk estimates is 2,4-dinitrotoluene in soil. The total cumulative HI for hypothetical future adult residents is 1, which is equal to the benchmark. The total cumulative HI for hypothetical future child residents is 13, which is above the benchmark of 1. When the HI was is segregated by target site and critical effects, hazards were greater than the benchmark of 1 due to the presence of Aroclor 1254, cobalt, and 2,4-dinitrotoluene. The predicted adult resident blood lead levels were below the benchmark of 10 µg/dl, and the predicted fetal lead level was slightly greater than the benchmark.

The majority of the risk drivers for the IAA were only sporadically detected. One surface soil sample and one subsurface soil sample had Aroclor 1254 concentrations greater than 1 mg/kg, which is the Toxic Substances Control Act (TSCA) soil concentration for residential exposure. 2,4-Dinitrotoluene was detected in only two of thirty-six samples with the two detections collected from two depths at the same boring location. No other detections of this constituent were confirmed during subsequent sampling events. Finally, only the single maximum concentration of cobalt (422 mg/kg) fell outside of the background concentration range of 5.9 mg/kg to 130 mg/kg. As such 2,4-dinitrotoluene, cobalt and Aroclor 1254 are not considered primary drivers for remediation at the site.

Removal of the walls and roofs of the buildings has exposed the conductive flooring to weather, causing it to degrade and wash onto the surrounding soils. Activity based air sampling conducted at IAA Building 8102-1 has demonstrated that intensive soil disturbance activities in areas with high asbestos concentrations (i.e., immediately adjacent to buildings where conductive flooring has washed off the building pads) have the potential to generate measurable concentrations of asbestos in air. In fact the concentrations in air for the activity based sampling adjacent to Building 8102-1 were above the AALs for the industrial exposure scenario and the hypothetical future residential exposure scenarios.

While not evaluated in the risk assessment any residual lead based paint on the concrete walls at the IAA or other possible asbestos containing building materials (i.e., pipe insulation, joint compounds, mastic, etc.) could also present a small risk to current and future receptors. However, it should be noted that the overall extent of these materials at the site is limited.

A SLERA and BERA were completed for the IAA, to evaluate surface soil and sediment for ecological receptors, and food chain modeling was evaluated for all those constituents identified as bioaccumulative. The results of the evaluation of the SLERA and BERA for direct contact and the constituents evaluated in the aquatic and terrestrial food chain models indicate that some of the NOAEL and LOAEL HQs were greater than 1, which suggests the potential for risk to some individual insectivorous mammals and birds exposed to surface soils and some individual piscivorous mammals and birds exposed to sediment and/or surface water. However, when these results are considered in conjunction with pertinent site information on the limited spatial distribution and extent of these constituents, effects of these COPECs at the population-level are unlikely at the IAA.

The environmental investigations completed at the IAA have successfully defined and delineated the extent of impacts that historical operations and degrading flooring material have had on environmental media at the site. The investigations have confirmed that the effects are generally limited to surface soils located immediately adjacent to buildings with conductive flooring. The results of the HHRA activities indicated that asbestos in soil is the only risk driver for the industrial exposure scenario. Under the hypothetical future residential exposure scenarios, asbestos, lead and Aroclor 1254 were all identified as potential risk drivers. There is also an active source (conductive flooring) that still has the potential to release constituents into the environment. The ERA concluded that the potential adverse affects to ecological receptors is limited due to the limited spatial distribution of constituents.

An FS is recommended to assess potential remedial alternatives to mitigate the risks and hazards associated with the site soils, conductive flooring material, and other building materials at the IAA.

11.4 Rail Yard

The RY encompasses an open area approximately 3,200 ft long by 350 ft wide (approximately 39 acres) in the central portion of the RFAAP-NRU. The RY was used for loading and unloading rail cars and the temporary storage of rail cars.

Environmental investigations conducted at the RY between 1997 and 2002 included the collection of surface soil and subsurface soil samples from various areas of the site, including: along the railroad tracks and spurs; adjacent to transfer platforms and former building locations; near former electrical transformer locations; and in area drainage pathways. Surface water and sediment samples were also collected from the pond and streams located in the vicinity of the RY. Laboratory analyte classes varied between the investigation activities but have included explosives, herbicides, pesticides, PAHs, PCBs, VOCs, SVOCs, and TAL inorganics. The investigation activities were conducted to evaluate whether the RY was affected by historical operations at the site, and if so were constituents of concern migrating away from the site.

The extensive soil sampling activities at the RY indicated that there were limited sporadic detections of compounds at concentrations above applicable screening levels. However, there was no pattern of spatial distribution or indication of source areas. PCBs were not detected at any of the former transformer locations. Subsurface soil sampling activities also indicated no evidence of significant constituent concentrations in the subsurface. Offsite surface water and sediment gave no indication of being affected by constituents migrating from the site. Based on the compiled data from the various phases of investigation at the site, there do not appear to be significant elevated concentrations of contaminants at the RY.

The results of the human health risk assessment indicate that use of the RY for industrial use should not result in unacceptable risks to potential receptors. Although the calculated ELCR and HI for the residential land use scenarios were above the applicable thresholds, the risks and hazards were due to pentachlorophenol and cobalt, respectively. Pentachlorophenol, which is known to be a wood preservative used in utility poles, was detected in a single sample at a concentration above applicable screening levels. This sample was collected at a former utility pole location and was not detected in samples collected from other areas of the site. Due to the extremely limited extent of the detection, this constituent is not considered to be of any risk to site receptors. Likewise the elevated HI was attributed to a single cobalt detection with a concentration slightly above background levels. Therefore, cobalt is not considered to be a risk to any site receptors.

A SLERA and BERA were completed for the RY, to evaluate surface soil, sediment, and surface water for ecological receptors, and food chain modeling was evaluated for all those constituents identified as bioaccumulative. The results of the evaluation of the SLERA and BERA for direct contact and the constituents evaluated in the terrestrial and aquatic food chain models indicate that a few of the NOAEL and LOAEL HQs were greater than 1, which suggests the potential for risk to some individual insectivorous mammals and birds exposed to surface soils and some individual piscivorous mammals and birds exposed to sediment and/or surface water, if all exposure assumptions are met. However, when these results are considered in conjunction with pertinent site information on the limited spatial distribution and extent of these constituents, adverse affects at the population level are considered unlikely for the shrew (or other insectivorous mammals) and the robin (or other insectivorous birds) exposed to the constituents at the RY.

The investigation activities performed at the Rail Yard did not identify any significant evidence of potential adverse affects to environmental media at the site as a result of historic operations. The results of the human health risk assessment indicate that use of the Rail Yard for residential or industrial uses should not result in unacceptable risks to potential receptors. The ERA also indicated that no adverse impacts would be expected to ecological receptors on a population level. Therefore, no action is recommended for this site.

11.5 Western Burning Ground

The WBG was formerly used as a burning ground to decontaminate explosives contaminated material and to dispose of excess and off-spec explosives/energetics during historical site operations. The main burn area was approximately 170 ft long by 100 ft wide and is surrounded on three sides by an approximately 4 ft high earthen berm. A dirt road runs parallel to the open side of the former burn area, leading north to Alger Road, and south to the top of a steep slope above an unnamed pond. The dirt road was reportedly constructed on top of an ashy layer of material extending from the burning ground at the time of the pond construction. The pond was constructed during the early 1990s and is fed by Wiggins Spring at the northwest (upgradient) end of the pond. The pond also collects runoff from the surrounding area through a series of storm water ditches/culverts. The WBG is no longer active.

Site characterization activities performed at the WBG from 1997 through 1999 indicated the presence of an ashy layer of material throughout the burn area and elevated concentrations of inorganics and PAHs in burn area soils. A test pitting program completed in 1999 effectively removed all of the soils containing elevated constituent concentrations from the former burn area; therefore, the burn area no longer poses an environmental concern. Samples collected in 1999 from the berms surrounding the former burn area had no constituents above applicable screening levels or background inorganics concentrations; therefore, the berms do not appear to have been affected by operations at the site.

Investigations performed at the WBG between 1998 and 2008 have focused on characterizing and delineating constituent detections outside of the former burn area. Areas that have been investigated have included the access road on the northwest side of the burn area; surface and subsurface soils located downgradient from the burn area; sediments and surface water in the unnamed pond; sediments and surface water in the unnamed creek downgradient of the pond; and a former transformer location. Analyte classes included in the WBG investigation have included VOCs, SVOCs, PAHs, PCBs, pesticides, herbicides, dioxins/furans, explosives, and inorganics.

One of the primary areas of investigation at the WBG has been the dirt access road which runs along the open side (northwestern side) of the former burn area. During the course of investigation at the site, an ashy layer of material was identified in the subsurface (approximately 2-4 ft bgs) under the road that was very similar to the ashy soils that had been present in the burn area. With the exception of one subsurface soil sample at the end of the access road no constituents were detected above applicable screening levels in any of the surface or subsurface soil samples in this area (including within the ashy layer of material).

Surface and subsurface soil samples were also collected downgradient (northwest, west, and south) of the burning ground and road to evaluate the potential for constituents to have migrated outside the burn area. The results from these areas indicated:

- Despite the fact that the former burning ground operations were used to decontaminate and dispose of materials that had been in contact in explosive/energetic compounds, explosives were not found to be a concern at the site. Only one explosive compound was ever detected during the course of sampling at a single location. Penterythritol tetranitrate was detected at a concentration of 0.11 mg/kg at surface soil at WBGSB24.

- Seventeen different PAHs were detected in surface and subsurface soil outside of the former burn area. PAHs were detected at concentrations above applicable RSLs in two surface soil samples collected from a small drainage pathway located to the west of the former burn area. This drainage pathway receives runoff from the surrounding area and paved roads, and the PAHs detected in these samples are very similar to those observed in samples collected from drainage ditches located near roadways throughout the RFAAP-NRU.

- No PCBs were detected in the soil sample collected at the former transformer location.

The pond sediment sampling activities indicated that lead and chromium were present at concentrations above background levels and applicable RSLs in samples collected in an isolated 2,100 ft^2 area near the northern bank of the pond. The outer perimeter of the area containing the lead and chromium concentrations above applicable screening levels has been delineated through the collection of multiple samples for both laboratory analysis and XRF field screening. PAHs were detected at concentrations above residential RSLs in three samples located in the northwestern portion of the pond. These samples were located near points where surface water drainage ditches enter the pond. The explosive nitroglycerine was detected in one pond sediment sample at a concentration above the residential RSL. Several dioxins/furans were also detected in pond sediment samples; however the all detected constituents were below residential RSLs.

A total of six sediment samples were collected from the stream downgradient of the outfall of the unnamed pond. Arsenic and iron were detected in one sample at concentrations above background and applicable screening levels. PAHs were also detected at concentrations above applicable screening levels in one sediment sample. A second sample collected at this location in 2008 indicated that only benzo(a)pyrene was present at a concentration above a residential screening level. No other constituents were detected at concentrations above applicable RSLs.

Surface water samples collected from the pond and the unnamed stream indicated the following:

- Lead was detected at concentrations above the USEPA tap water RSL in four surface water samples from the pond. These samples were all collected in the area where the elevated concentrations of lead were detected in sediment. Lead was not detected above applicable screening levels in any samples from the stream.

- Arsenic was detected above the tap water RSL in two samples collected from the pond in 1999. Arsenic was not detected in any other samples collected from the pond or from the stream throughout the remainder of the investigation.

- Iron, manganese, and thallium were detected above the tap water RSL values in single samples collected from the stream near the pond outfall. The herbicide MCPP was also detected in one sample from the stream at a concentration above the tap water RSL.

- The pesticide dieldrin was detected in two samples at concentrations above tap water RSLs. One sample was in the unnamed stream that flows through the RFAAP-NRU, upstream of the confluence with the stream from the WBG. This indicates the possible presence of a dieldrin source somewhere off of the facility.

- Perchlorate and tetrachloroethene were also detected in one sample at concentrations above tap water RSLs. These constituents were not detected in any other surface water, sediment, or soil samples at the WBG.

- The VOC chloroform was detected in two pond water samples and two stream samples during the 2002 investigation at concentrations above the tap water RSL but well below its MCL.

The HHRA evaluated potential current exposure of site workers to surface soil, surface water, and sediment, potential future exposures of construction workers to total soil and potential future adult and child resident exposure to total soil, surface water, sediment, and fish caught in the pond at the WBG. The soil, sediment, and surface water COPCs were evaluated for direct contact. In addition, a scenario was evaluated that specifically considered exposure to sediment during participation in the semi-annual fishing rodeo, and risks to all potential future receptors were evaluated in the event that the pond were drained and current sediments became eligible for direct contact in the same frequency, intensity, and duration as soils.

VOCs identified as COPCs in the WBG were also evaluated for inhalation via vapor migration into buildings. One VOC, d-limonene, was identified as a soil COPC at the WBG, but since it does not have identified inhalation toxicity value, this exposure pathway was not evaluated quantitatively. Potential risks and hazards for site workers and construction workers, including exposure to lead, under current industrial land use conditions were within generally acceptable levels and benchmarks. Under a hypothetical future residential land use, potential hazards associated with chromium in sediment were slightly greater than the benchmark for the child resident. Potential risks associated with exposure to lead in the pond sediments could result in adverse health effects. No other scenarios evaluated resulted in an unacceptable risk level. The residential risk findings are applicable to both current land use conditions and those that would result if the pond were drained and current sediments became part of the soil eligible for direct contact exposures.

Based on the results of the risk assessment, it is unlikely that industrial use of the property would result in adverse health effects. For the residential exposure scenarios, exposure to lead in sediments may pose an adverse health effect if the exposure assumptions are different than actual exposures. Also, exposure to chromium in sediments may pose a slightly elevated hazard to children wading in the pond. The maximum chromium sediment concentration of 15,400 mg/kg is well above the background range.

A SLERA and BERA were completed for the WBG, to evaluate surface soil, sediment, and surface water for ecological receptors, and food chain modeling was evaluated for all those constituents identified as bioaccumulative. The results of the evaluation of the SLERA and BERA for direct contact and the constituents evaluated in the terrestrial food chain model indicate that some of the NOAEL and LOAEL HQs were greater than 1, which suggests the potential for risk to some individual insectivorous mammals and birds exposed to surface soils and some individual piscivorous mammals and birds exposed to sediment and/or surface water. However, when these results are considered in conjunction with pertinent site information on the limited spatial distribution and extent of these constituents, adverse affects of these COPECs at the population-level are unlikely at the WBG.

Similarly, the results of the sediment and surface water evaluation of the SLERA and BERA for direct contact and the constituents evaluated in the aquatic food chain model indicate that adverse effects are not expected for aquatic life exposed to bioaccumulative COPECs in sediment and/or surface water at the WBG.

The environmental investigations completed at the WBG have successfully delineated the nature and extent of elevated constituent concentrations in soils, sediments, and surface water. The results of the investigation and the corresponding risk assessment activities indicated that the potential risks associated with the site are within acceptable ranges for industrial use of the site. Under a potential future residential use scenario, risks were slightly above the acceptable range due to the presence of chromium and lead in a small area of pond sediments. Based on the potential residential risks associated with the lead and chromium in the pond sediments, it is recommended that a FS be conducted to evaluate potential remedial options for the pond sediments.

11.6 Groundwater

The groundwater investigation activities at the RFAAP-NRU have included the installation of 11 groundwater monitoring wells and groundwater sampling events in 2007, 2008, and 2010. In addition to sampling all of the monitoring wells, the 2008 and 2010 events also included the collection of samples from 4 springs located within the boundaries of the RFAAP-NRU. The spring samples were collected because the function of springs as groundwater discharge points for convergent conduit networks in the karst system makes them ideal locations for screening for groundwater quality.

The 2007 groundwater sampling event included the collection of groundwater samples from 11 monitoring wells located throughout the RFAAP-NRU. The wells were installed at, or in the vicinity of, the Study Areas at the RFAAP-NRU due to the known presence of constituents in surface soil. Four wells are located in the vicinity of the IAA, three wells are located at the WBG, two wells are located at the BLA, and two wells are located at the NBG. The monitoring wells were analyzed for a full suite of parameters including dioxins/furans, explosives, herbicides, pesticides, PAHs, PCBs, SVOCs, VOCs, and inorganics. The results indicated the following:

- No herbicides, pesticides, PCBs, SVOCs, or PAHs were detected in any of the groundwater samples.

- The VOC chloroform was detected in one sample (WBGMW01) at a concentration above the tap water RSL, but well below its MCL. Chloroform was not detected at any other sample locations

- Several dioxin/furan related compound were reported at low concentrations in all of the groundwater samples. Despite the low concentration, some of these constituents were above the tap water RSLs. However, the detected constituents were qualified due to the detection of dioxins and furans in laboratory blank samples. Dioxins and furans were not identified as primary COCs in soil at any of the Study Areas, therefore, it is unlikely that the reported detections in groundwater are associated with RFAAP-NRU.

- Several inorganic constituents were detected in all of the groundwater samples collected during the 2007 investigation. In most cases the detected concentrations were below applicable tap water RSLs; however three samples contained constituents at concentrations above the tap water RSLs. The sample from Monitoring Well IAA-MW01had arsenic, iron, lead, and manganese at concentrations above applicable RSLs. Monitoring Well NBG-MW01 had arsenic at a concentration above the tap water RSL (note that arsenic was also detected in a laboratory blank sample associated with this sample). Monitoring Well WBG-MW01 had arsenic and lead at concentrations above the RSLs (again note that arsenic was detected in a laboratory blank sample associated with this sample).

ARCADIS conducted a groundwater sampling event at the RFAAP-NRU in 2008 to evaluate whether suspended solids and naturally occurring inorganics in soils could have contributed to the elevated inorganics concentrations observed during the 2007 groundwater sampling event. ARCADIS utilized low flow sampling techniques to sample all eleven groundwater monitoring wells at the facility to reduce the presence of suspended solids in the groundwater samples. When the low flow sampling techniques were unable to lower turbidity readings below a threshold of 40 NTU, samples were collected for both total and filtered laboratory analysis. The results of this sampling event indicated the following:

- There was a strong correlation between the presence of suspended solids and elevated inorganics concentrations. Inorganics concentrations were typically lower in samples with lower turbidity readings. Samples that were analyzed after filtering also illustrated a large drop in inorganics concentrations.

- The unfiltered samples collected at monitoring wells IAA-MW01 and NBG-MW02 had concentrations of aluminum, arsenic, iron, lead and manganese at concentrations above applicable tap water RSLs. These samples, which were the only wells sampled with inorganics concentrations above applicable RSLs, both had turbidity readings above 1,000 NTU. The analytical results from the filtered samples at these locations indicated a significant drop in inorganics concentrations and no constituents were detected at concentrations above applicable RSLs.

The 2008 groundwater sampling event also included the collection of four spring water samples. One sample was collected from Wiggin's Spring at the head of the WBG pond, one sample was collected from the unnamed spring at the head of the RY pond; the other two spring samples were collected from unnamed springs located in the northeastern portion of the RFAAP-NRU. The samples were analyzed for inorganics and PAHs. The samples had very low turbidity and indicated that several inorganics were present at concentrations below applicable tap water RSLs. The presence of these metals in groundwater should be expected due to naturally occurring inorganics in soil at the RFAAP-NRU. The PAH naphthalene was detected in the samples from the WBG and RY springs. Phenanthrene was also detected at the RY spring. The concentrations of naphthalene and phenanthrene were several orders of magnitude below applicable tap water RSLs.

The 2010 groundwater sampling event was conducted at the request of VDEQ to provide an additional data set for risk assessment purposes. This sampling event was similar to the 2008 sampling activities in that all eleven groundwater monitoring wells and four spring water sample locations were sampled using low-flow sampling techniques. The samples were analyzed for VOCs, PAHs, total metals, dissolved metals, explosives, PCBs, and dioxins/furans. The results from the 2010 sampling event indicated the following:

- Only one dioxin compound, OCDD, was detected in the samples. This constituent was detected in a single monitoring well, WBG-MW001, at a concentration well below the tap water screening RSL. This result confirms that dioxins and furans detected during the 2007 sampling event were likely due to laboratory blank contamination and should not be considered constituents of concern for groundwater at RFAAP-NRU.

- As with the 2008 sampling event, there was a good correlation between the presence of suspended solids and elevated metals concentrations in the groundwater samples. Arsenic, a naturally occurring metal at the site, was the only inorganic constituent detected in the filtered groundwater samples that was present at a concentration above tap water RSLs. This detection occurred a single monitoring well (IAA-MW002)

- One explosive, nitrobenzene, was detected in a single monitoring well (WBG-MW003) at a concentration (0.512 µg/L) above the tap water RSL of 0.12 µg/L. This constituent was not detected in any other monitoring well or spring water samples during the 2010 or 2007 sampling events. No other explosives were detected at concentrations above tap water RSLs.

- Chloroform was detected in a single spring water sample (WBG-Spring001) at a concentration below the laboratory reporting limit, but above the tapwater

RSL of 0.19 µg/L. No other VOCs were detected at concentrations above applicable RSLs.

- A few PAHs (phenanthrene, pyrene, fluoranthene, and anthracene) were detected in isolated monitoring samples; however, the concentrations were several orders of magnitude lower than tap water RSLs.

- No PCBs were detected in any of the samples.

An HHRA was conducted to evaluate potential exposure to constituents detected in groundwater at RFAAP-NRU. The HHRA utilized the data collected during all three sampling events completed at the facility. The risk assessment for groundwater evaluated exposure under both industrial/site worker scenarios and residential use scenarios.

Potential exposure of site workers was evaluated for the vapor migration pathway. The calculated risks were well below the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. Exposure of hypothetical future adult and child residents through the vapor intrusion exposure pathway yielded similar, very low results.

Exposure of hypothetical future residents and site workers to constituents in groundwater assuming the groundwater were used as a potable water supply also was evaluated in the risk assessment. These exposure scenarios were evaluated using unfiltered and filtered groundwater data to evaluate the influence of metals present as suspended solids. This assessment was performed because the groundwater at the NRU was turbid.

The excess lifetime cancer risks calculated for hypothetical future resident exposure to groundwater used as a potable water supply was 2×10^{-4}. This is slightly above the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The risk drivers for cancer risk are arsenic and the dioxin and furan congeners. The hazard index for a hypothetical adult resident was calculated to be 0.6, which was below the benchmark of 1. The hazard index or a hypothetical child resident was calculated to be 1, which is equal to the benchmark of 1.

The risk drivers for the excess lifetime cancer risk associated with the residential land use scenario are arsenic (which is naturally occurring) and the dioxin and furan congeners. Arsenic was detected in 1 out of the 18 filtered groundwater samples collected; and, this detection was below the federal drinking water MCL. The apparent risks associated with the dioxin/furan congeners are due to the detections within the 2007 data set. However, as mentioned earlier, the dioxins/furans are not believed to be indicative of actual groundwater quality at the site because the constituents were also detected in blank samples during the 2007 sampling event and are likely due to laboratory contamination. This was confirmed by the lack of dioxins and furan detections during the 2010 groundwater sampling event. In summary, arsenic and the dioxin/furan constituents are not considered to be drivers for remediation at the site.

No Action is recommended for groundwater at the RFAAP- NRU.

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Table 2-1. Summary of Samples Collected at the Building Debris Disposal Trench, 1997 through 2008, Radford Army Ammunition Plant, Radford, Virginia.

Sample Name	Matrix	Date Collected	Depth Start (ft)	Depth End (ft)	Explosives	Herbicides	Inorganics	Organochlorine Pesticides	PAHs	PCBs	Perchlorate	SVOCs	VOCs
ATK Preliminary Sampling, 1997													
Soil Samples													
SOIL/CREOSOTE	Soil	10/17/1997										X	
Gannett Flemming Independent Sampling, 1998													
Sediment Samples													
SD-06	SE	3/31/1998					X					X	
SD-07	SE	3/31/1998					X					X	
SD-08	SE	3/31/1998					X					X	
Surface Water Samples													
SW-07	SW	3/31/1998					X						
ICF KE Remedial Investigation, 1998													
Soil Samples													
DTSS1	Soil	8/11/1998	0	0.5	X		X					X	X
DTSS2	Soil	8/11/1998	0	0.5	X		X					X	X
DTSS3	Soil	8/11/1998	0	0.5	X		X					X	X
DTSB1	Soil	8/12/1998	0.5	1	X		X		X			X	X
DTSB2	Soil	8/12/1998	2.5	3	X		X		X			X	X
DTSB3	Soil	8/12/1998	2.5	3	X		X		X			X	X
DTSB4	Soil	8/12/1998	2.5	3	X		X		X			X	X
DTSB5	Soil	8/12/1998	0.5	1	X		X		X			X	X
DTSB6	Soil	8/12/1998	1	1.5	X		X		X			X	X
DTSB7	Soil	8/12/1998	2	2.5	X		X		X			X	X
DTSB8	Soil	8/12/1998	1	1.5	X		X		X			X	X
DTSB9	Soil	8/12/1998	3	3.5	X		X		X			X	X
DTSB10	Soil	8/12/1998	3.5	4	X		X		X			X	X
DTSB11	Soil	8/12/1998	3.5	4	X		X		X			X	X
DTSB12	Soil	8/12/1998	3.5	4	X		X		X			X	X
DTSB13	Soil	8/12/1998	0.5	1	X		X		X			X	X
DTSB14	Soil	8/12/1998	3.5	4	X		X		X			X	X
DTSB15	Soil	8/13/1998	2	2.5	X		X		X			X	X
DTSB16	Soil	8/18/1998	2	2.5	X		X		X			X	X
DTSB17	Soil	8/18/1998	3	3.5	X		X		X			X	X
DTSB18	Soil	8/18/1998	2	2.5	X		X		X			X	X
DTSB19	Soil	8/18/1998	2	2.5	X		X		X			X	X
DTSB20	Soil	8/18/1998	2	2.5	X		X		X			X	X
DTSB21	Soil	8/18/1998	2	2.5	X		X		X			X	X
DTSB22	Soil	8/18/1998	2	2.5	X		X		X			X	X
DTSB23	Soil	8/18/1998	2	2.5	X		X		X			X	X
DTSB35	Soil	8/18/1998	0.5	1	X		X		X			X	X
DTSB36	Soil	8/18/1998	0.5	1	X		X		X			X	X
DTSB37	Soil	8/18/1998	0.5	1	X		X		X			X	X
DTSB38	Soil	8/18/1998	0.5	1	X		X		X			X	X
DTSB39	Soil	8/18/1998	0.5	1	X		X		X			X	X
DTSB40	Soil	8/18/1998	0.5	1	X		X		X			X	X
DTSB41	Soil	8/18/1998	0.5	1	X		X		X			X	X
DTSB42	Soil	8/18/1998	0.5	1	X		X		X			X	X
DTSB43	Soil	8/18/1998	0.5	1	X		X		X			X	X
DTSB44	Soil	8/18/1998	0.5	1	X		X		X			X	X
DTSB45	Soil	8/18/1998	0.5	1	X		X		X			X	X
Sediment Samples													
DTSD1	SE	7/17/1998	0	0.5	X		X		X			X	X
DTSD1-2	SE	8/17/1998	0	0.5	X		X		X			X	X
DTSD2	SE	7/17/1998	0	0.5	X		X		X			X	X
DTSD2-2	SE	8/17/1998	0	0.5	X		X		X			X	X
DTSD3	SE	7/17/1998	0	0.5	X		X		X			X	X
DTSD3-2	SE	8/17/1998	0	0.5	X		X		X			X	X
DTSD4	SE	8/17/1998	0	0.5	X		X		X			X	X
Surface Water Samples													
DTSW1	SW	7/17/1998	-	-	X		X		X			X	X
DTSW1-2	SW	8/17/1998	-	-	X		X		X			X	X
DTSW2	SW	7/17/1998	-	-	X		X		X			X	X
DTSW2-2	SW	8/17/1998	-	-	X		X		X			X	X
DTSW3	SW	7/17/1998	-	-	X		X		X			X	X
DTSW3-2	SW	8/17/1998	-	-			X					X	X
DTSW4	SW	8/17/1998	-	-	X		X		X			X	X

Notes found at end of table.

Table 2-1. Summary of Samples Collected at the Building Debris Disposal Trench, 1997 through 2008, Radford Army Ammunition Plant, Radford, Virginia.

Sample Name	Matrix	Date Collected	Depth Start (ft)	Depth End (ft)	Explosives	Herbicides	Inorganics	Organochlorine Pesticides	PAHs	PCBs	Perchlorate	SVOCs	VOCs
Shaw Remedial Investigation, 2002													
Soil Samples													
DTSB46A	Soil	6/12/2002	0	0.5		X	X	X	X	X			X
DTSB46B	Soil	6/12/2002	1	3			X		X	X			X
DTSB47A	Soil	6/12/2002	0	0.5			X		X	X			X
DTSB47B	Soil	6/12/2002	1	3			X		X	X			X
Sediment Samples													
DTSD05	SE	6/20/2002	0	0.5		X	X	X	X	X			X
DTSD06	SE	6/20/2002	0	0.5			X		X	X			X
DTSD07	SE	6/20/2002	0	0.5		X	X	X	X	X			X
DTSD08	SE	6/20/2002	0	0.5			X		X	X			X
DTSD09	SE	6/20/2002	0	0.5			X		X	X			X
DTSD10	SE	6/20/2002	0	0.5			X		X	X			X
Surface Water Samples													
DTSW05	SW	6/20/2002	-	-		X	X	X	X	X	X		X
DTSW06	SW	6/20/2002	-	-			X		X	X	X		X
DTSW07	SW	6/20/2002	-	-		X	X	X	X	X	X		X
DTSW08	SW	6/20/2002	-	-			X		X	X	X		X
DTSW09	SW	6/20/2002	-	-			X		X	X	X		X
DTSW10	SW	6/20/2002	-	-			X		X	X	X		X
Shaw Additional Characterization Sampling, 2004													
Soil Samples													
DTSB48A	Soil	7/13/2004	0	0.5					X	X			
DTSB50A	Soil	7/13/2004	0	0.5					X	X			
DTSB51A	Soil	7/13/2004	0	0.5					X	X			
DTSB52A	Soil	7/13/2004	0	0.5					X	X			
DTSB54A	Soil	7/13/2004	0	0.5					X	X			
DTSB55A	Soil	7/13/2004	0	0.5					X	X			
DTSB56A	Soil	7/13/2004	0	0.5					X	X			
DTSB57A	Soil	7/13/2004	0	0.5					X	X			
DTSB58A	Soil	7/13/2004	0	0.5					X	X			
DTSB59A	Soil	7/13/2004	0	0.5					X	X			
DTSB60A	Soil	7/13/2004	0	0.5					X	X			
DTSB62A	Soil	7/13/2004	0	0.5					X	X			
DTSB63A	Soil	7/13/2004	0	0.5					X	X			
DTSB64A	Soil	7/13/2004	0	0.5					X	X			
DTSB65A	Soil	7/13/2004	0	0.5					X	X			
DTSB66A	Soil	7/13/2004	0	0.5					X	X			
DTSB67A	Soil	7/13/2004	0	0.5					X	X			
DTSB68A	Soil	7/13/2004	0	0.5					X	X			
DTSB69A	Soil	7/13/2004	0	0.5					X	X			
DTSB70A	Soil	7/13/2004	0	0.5					X	X			
DTSB71A	Soil	7/13/2004	0	0.5					X	X			
DTSB72A	Soil	7/13/2004	0	0.5					X	X			
DTSB73A	Soil	7/13/2004	0	0.5					X	X			
DTSB74A	Soil	7/13/2004	0	0.5					X	X			
DTSB75A	Soil	7/13/2004	0	0.5					X	X			
DTSB76A	Soil	7/13/2004	0	0.5					X	X			
DTSB77A	Soil	7/13/2004	0	0.5					X	X			
DTSB78A	Soil	7/13/2004	0	0.5					X	X			
DTSB48B	Soil	7/20/2004	1	3					X	X			
DTSB55B	Soil	7/20/2004	1	3					X	X			
DTSB59B	Soil	7/20/2004	1	3					X	X			
DTSB67B	Soil	7/20/2004	1	3					X	X			
DTSB77B	Soil	7/20/2004	1	3					X	X			
DTSB80A	Soil	7/20/2004	0	0.5					X				
DTSB81A	Soil	7/20/2004	0	0.5					X				
DTSB82A	Soil	7/20/2004	0	0.5					X				
DTSB83A	Soil	7/20/2004	0	0.5					X				
DTSB84A	Soil	7/20/2004	0	0.5					X				
DTSB85A	Soil	7/20/2004	0	0.5					X				
DTSB86A	Soil	7/20/2004	0	0.5					X				
DTSB87A	Soil	7/20/2004	0	0.5					X				
DTSB88A	Soil	7/20/2004	0	0.5					X				
DTSB89A	Soil	7/23/2004	0	0.5					X	X			

Notes found at end of table.

Table 2-1. Summary of Samples Collected at the Building Debris Disposal Trench, 1997 through 2008, Radford Army Ammunition Plant, Radford, Virginia.

Sample Name	Matrix	Date Collected	Depth Start (ft)	Depth End (ft)	Explosives	Herbicides	Inorganics	Organochlorine Pesticides	PAHs	PCBs	Perchlorate	SVOCs	VOCs
ARCADIS Remedial Investigation, 2008													
Soil Samples													
BDDT-SS001 (0-1)	Soil	7/28/2008	0	1								X	
BDDT-SB001 (2-3)	Soil	7/28/2008	2	3								X	
BDDT-SB001 (3-4)	Soil	7/28/2008	3	4								X	
BDDT-SS002 (0-1)	Soil	7/28/2008	0	1								X	
BDDT-SB002 (2-3)	Soil	7/28/2008	2	3								X	
BDDT-SB002 (3-4)	Soil	7/28/2008	3	4								X	
BDDT-SS003 (0-1)	Soil	7/28/2008	0	1								X	
BDDT-SS004 (0-1)	Soil	7/28/2008	0	1								X	
BDDT-SS005 (0-1)	Soil	7/28/2008	0	1								X	
BDDT-SS006 (0-1)	Soil	7/28/2008	0	1								X	
BDDT-SS007 (0-1)	Soil	7/28/2008	0	1								X	
BDDT-SS008 (0-1)	Soil	7/28/2008	0	1								X	
Sediment Samples													
BDDT-SE001 (0-0.5)	SE	7/28/2008	0	0.5								X	
BDDT-SE002 (0-0.5)	SE	7/28/2008	0	0.5								X	
BDDT-SE003 (0-0.5)	SE	7/28/2008	0	0.5								X	
BDDT-SE004 (0-0.5)	SE	7/28/2008	0	0.5								X	
Surface Water Samples													
BDDT-SW001 (2008072	SW	7/28/2008	-	-								X	
BDDT-SW002 (2008072	SW	7/28/2008	-	-								X	
BDDT-SW003 (2008072	SW	7/28/2008	-	-								X	
BDDT-SW004 (2008072	SW	7/28/2008	-	-								X	

SE Sediment.
SW Surface Water.
ft Feet.
PAHs Polycyclic Aromatic Hydrocarbons.
PCBs Polychlorinated biphenyls.
SVOCs Semivolatile Organic Compounds.
VOCs Volatile Organic Compounds.

Table 2-2. Summary of Samples Collected at the Bag Loading Area, 1997 through 2009, Radford Army Ammunition Plant, Radford, Virginia.

Sample Name	Matrix	Date Collected	Depth Start (ft)	Depth End (ft)	Asbestos	Dioxin/Furan	Explosives	Herbicides	Inorganics	Inorganics-Filtered	Inorganics-TCLP	Organochlorine Pesticides	PAHs	PCBs	Perchlorate	SVOCs	VOCs
Dames & Moore Soil Sampling, 1997																	
Soil Samples																	
407712012	Soil	12/9/1997	0	1					X								
4077121224	Soil	12/9/1997	1	2					X								
4077122436	Soil	12/9/1997	2	3					X								
407736012	Soil	12/9/1997	0	1					X								
4077361224	Soil	12/9/1997	1	2					X								
407760012	Soil	12/9/1997	0	1					X								
4077601224	Soil	12/9/1997	1	2					X								
Gannett Flemming Independent Sampling, 1997 and 1998																	
Soil Samples																	
SS-09	Soil	6/4/1997	0	0.5			X		X			X		X		X	X
SS-14	Soil	3/31/1998	0	0.16					X					X		X	X
TR-03E	Soil	4/2/1998	0.04	0.16										X		X	
Conductive Flooring Samples																	
WS-01	Floor	6/5/1997	-	-					X			X		X		X	X
WS-04	Floor	3/3/1998	-	-	X				X								
WS-05	Floor	3/3/1998	-	-	X				X								
Shaw Remedial Investigation, 2002																	
Soil Samples																	
BLASB01A	Soil	6/11/2002	0	0.5			X		X				X	X			X
BLASB01B	Soil	6/20/2002	2	4			X		X				X	X			X
TMSB01B	Soil	6/20/2002	2	4			X		X				X	X			X
BLASB02A	Soil	6/11/2002	0	0.5			X	X	X			X		X		X	X
BLASB02B	Soil	6/20/2002	2	4			X		X							X	X
BLASB03A	Soil	6/11/2002	0	0.5			X		X							X	X
BLASB03B	Soil	6/20/2002	2	4			X		X							X	X
BLASS01	Soil	6/11/2002	0	0.5			X		X				X	X			X
BLASS02	Soil	6/11/2002	0	0.5			X		X				X	X			X
BLASS03	Soil	6/11/2002	0	0.5			X		X							X	X
BLASS04	Soil	6/11/2002	0	0.5			X										
BLASS05	Soil	6/11/2002	0	0.5			X		X							X	X
BLASS06	Soil	6/11/2002	0	0.5			X		X							X	X
BLASS07	Soil	6/11/2002	0	0.5			X		X							X	X
BLASS08	Soil	6/11/2002	0	0.5			X		X								
BLASS09	Soil	6/11/2002	0	0.5			X		X							X	X
BLASS10	Soil	6/11/2002	0	0.5			X	X	X			X		X		X	X
TMSS10	Soil	6/11/2002	0	0.5			X	X	X			X		X		X	X
BLASS11	Soil	6/11/2002	0	0.5			X		X							X	X
BLATR01	Soil	6/20/2002	0	0.5										X			
BLATR02	Soil	6/20/2002	0	0.5										X			
BLATR03	Soil	6/20/2002	0	0.5										X			
Sediment Samples																	
BLASD01	SE	6/18/2002	0	0.5			X	X	X			X	X	X		X	X
BLASD02	SE	6/18/2002	0	0.5			X	X	X			X	X	X		X	X
BLASD04	SE	6/24/2002	0	0.5			X	X	X			X	X	X		X	X
BLASD05	SE	6/24/2002	0	0.5			X	X	X			X	X	X		X	X
Surface Water Samples																	
BLASW04	SW	6/24/2002	-	-			X	X	X			X	X	X	X	X	X
BLASW05	SW	6/24/2002	-	-			X	X	X			X	X	X	X	X	X
Shaw Soil Sampling, 2005																	
Soil Samples																	
BLASS12	Soil	1/26/2005	0	0.5	X												
BLASS13	Soil	1/26/2005	0	0.5	X												
BLASS14	Soil	1/26/2005	0	0.5	X												
BLASS15	Soil	1/26/2005	0	0.5	X												
BLASS16	Soil	1/26/2005	0	0.5	X												
BLASS17	Soil	1/26/2005	0	0.5	X												
Conductive Flooring Samples																	
BLADF01	Floor	1/26/2005	-	-	X												
BLADF02	Floor	1/26/2005	-	-	X												
BLAIF01	Floor	1/26/2005	-	-	X												
BLAIF02	Floor	1/26/2005	-	-	X												
Paint Samples																	
BLAPC01	Paint	1/26/2005	-	-					X								
Wipe Samples																	
BLAW01	Wipe	1/26/2005	-	-	X												
BLAW02	Wipe	1/26/2005	-	-	X												
WB01	Wipe	1/26/2005	-	-	X												

Notes found at end of table.

Table 2-2. Summary of Samples Collected at the Bag Loading Area, 1997 through 2009, Radford Army Ammunition Plant, Radford, Virginia.

Sample Name	Matrix	Date Collected	Depth Start (ft)	Depth End (ft)	Asbestos	Dioxin/Furan	Explosives	Herbicides	Inorganics	Inorganics-Filtered	Inorganics-TCLP	Organochlorine Pesticides	PAHs	PCBs	Perchlorate	SVOCs	VOCs
ARCADIS Remedial Investigation, 2008																	
Soil Samples																	
BLA-SB001 (1-2)	Soil	7/29/2008	1	2										X			
BLA-SB001 (2-3)	Soil	7/29/2008	2	3										X			
BLA-SS001 (0-0.5)	Soil	7/29/2008	0	0.5										X			
BLA-SS002 (0-0.5)	Soil	7/29/2008	0	0.5										X			
BLA-SS003 (0-0.5)	Soil	7/29/2008	0	0.5										X			
BLA-SS004 (0-0.5)	Soil	7/29/2008	0	0.5										X			
BLA-SS005 (0-0.5)	Soil	7/29/2008	0	0.5												X	
BLA-SS006 (0-0.5)	Soil	7/29/2008	0	0.5												X	
BLA-SS007 (0-0.5)	Soil	7/29/2008	0	0.5												X	
BLA-SS008 (0-0.5)	Soil	7/29/2008	0	0.5												X	
BLA-SS001 (0-0.5)A	Soil	8/5/2008	0	0.5	X				X							X	
BLA-SS002 (0-0.5)A	Soil	8/5/2008	0	0.5	X				X							X	
BLA-SS003 (0-0.5)A	Soil	8/5/2008	0	0.5	X				X							X	
BLA-SS003 (0-0.5)ATCLP	Soil	8/5/2008	0	0.5							X						
BLA-SS004 (0-0.5)A	Soil	8/5/2008	0	0.5	X				X							X	
BLA-SS005 (0-0.5)A	Soil	8/5/2008	0	0.5	X				X							X	
BLA-SS006 (0-0.5)A	Soil	8/5/2008	0	0.5	X				X							X	
BLA-SS007 (0-0.5)A	Soil	8/5/2008	0	0.5	X				X							X	
BLA-SS008 (0-0.5)A	Soil	8/5/2008	0	0.5	X				X							X	
BLA-SS008 (0-0.5)ATCLP	Soil	8/5/2008	0	0.5							X						
BLA-SS009 (0-0.5)A	Soil	8/5/2008	0	0.5	X				X							X	
BLA-SS010 (0-0.5)	Soil	8/5/2008	0	0.5	X				X							X	
BLA-SS010 (0-0.5)TCLP	Soil	8/5/2008	0	0.5							X						
BLA-SS011 (0-0.5)	Soil	8/5/2008	0	0.5	X				X							X	
BLA-SS012 (0-0.5)	Soil	8/5/2008	0	0.5	X				X							X	
BLA-SS013 (0-0.5)	Soil	8/5/2008	0	0.5	X				X							X	
BLA-SS014 (0-0.5)	Soil	8/5/2008	0	0.5	X				X							X	
BLA-SS015 (0-0.5)	Soil	8/5/2008	0	0.5	X				X							X	
BLA-SS016 (0-0.5)	Soil	8/5/2008	0	0.5	X				X							X	
BLA-SS017 (0-0.5)	Soil	8/5/2008	0	0.5	X				X							X	
BLA-SS017 (0-0.5)TCLP	Soil	8/5/2008	0	0.5							X						
BLA-SS018 (0-0.5)	Soil	8/5/2008	0	0.5	X				X							X	
BLA-SS019 (0-0.5)	Soil	8/5/2008	0	0.5	X				X							X	
BLA-SS019 (0-0.5)TCLP	Soil	8/5/2008	0	0.5							X						
Sediment Samples																	
BLA-SPSD01 (0-0.5)	SE	8/1/2008	0	0.5					X							X	X
Surface Water Samples																	
BLA-SPSW01 (20080801)	SW	8/1/2008	-	-					X							X	
BLA-VLTW01 (20080801)	SW	8/1/2008	-	-					X							X	X
ARCADIS Supplemental Remedial Investigation, 2009																	
Soil Samples																	
BLA404-SS001A	Soil	7/22/2009	0	0.5	X												
BLA404-SS001B	Soil	7/22/2009	0	0.5	X												
BLA404-SS001C	Soil	7/22/2009	0	0.5	X												
BLA404-SS001D	Soil	7/22/2009	0	0.5	X												
BLA404-SS001E	Soil	7/22/2009	0	0.5	X												
BLA411-SS001A	Soil	7/22/2009	0	0.5	X												
BLA411-SS001B	Soil	7/22/2009	0	0.5	X												
BLA411-SS001C	Soil	7/22/2009	0	0.5	X												
BLA411-SS001D	Soil	7/22/2009	0	0.5	X												
BLA411-SS001E	Soil	7/22/2009	0	0.5	X												
BLA-SS020A	Soil	7/14/2009	0	0.5	X												
BLA-SS020B	Soil	7/14/2009	0	0.5	X												
BLA-SS021A	Soil	7/14/2009	0	0.5	X												
BLA-SS021B	Soil	7/14/2009	0	0.5	X												
BLA-SS022A	Soil	7/15/2009	0	0.5	X												
BLA-SS022B	Soil	7/15/2009	0	0.5	X												
BLA-SS023C	Soil	7/15/2009	0	0.5	X												
BLA-SS024A	Soil	7/15/2009	0	0.5	X												
BLA-SS024B	Soil	7/15/2009	0	0.5	X												
BLA-SS025A	Soil	7/15/2009	0	0.5	X												
BLA-SS025B	Soil	7/15/2009	0	0.5	X												
BLA-SS026A	Soil	7/15/2009	0	0.5	X												
BLA-SS026B	Soil	7/15/2009	0	0.5	X												
BLA-SS027B	Soil	7/15/2009	0	0.5	X												
BLA-SS027C	Soil	7/15/2009	0	0.5	X												
BLA-SS028B	Soil	7/15/2009	0	0.5	X												

Notes found at end of table.

Table 2-2. Summary of Samples Collected at the Bag Loading Area, 1997 through 2009, Radford Army Ammunition Plant, Radford, Virginia.

Sample Name	Matrix	Date Collected	Depth Start (ft)	Depth End (ft)	Asbestos	Dioxin/Furan	Explosives	Herbicides	Inorganics	Inorganics-Filtered	Inorganics-TCLP	Organochlorine Pesticides	PAHs	PCBs	Perchlorate	SVOCs	VOCs
BLA-SS028C	Soil	7/15/2009	0	-	X												
BLA-SS029B	Soil	7/15/2009	0	-	X												
BLA-SS029C	Soil	7/15/2009	0	-	X												
Activity Based Air Samples																	
BLA411-AP1	Air	7/22/2009	-	-	X												
BLA411-AP2	Air	7/22/2009	-	-	X												
BLA411-AA2	Air	7/22/2009	-	-	X												
BLA411-AA1	Air	7/22/2009	-	-	X												
BLA404-AP2	Air	7/22/2009	-	-	X												
BLA404-AP1	Air	7/22/2009	-	-	X												
BLA404-AA2	Air	7/22/2009	-	-	X												
BLA404-AA1	Air	7/22/2009	-	-	X												
BLA411-BK1	Air	7/22/2009	-	-	X												
BLA404-BK2	Air	7/22/2009	-	-	X												

SE Sediment.
SW Surface Water.
ft Feet.
TCLP Toxicity Characteristic Leaching Procedure.
PAHs Polycyclic Aromatic Hydrocarbons.
PCBs Polychlorinated biphenyls.
SVOCs Semivolatile Organic Compounds.
VOCs Volatile Organic Compounds.

Table 2-3. Summary of Samples Collected at the Igniter Assembly Area, 1997 through 2009, Radford Army Ammunition Plant, Radford, Virginia.

Sample Name	Matrix	Date Collected	Depth Start (ft)	Depth End (ft)	Asbestos	Dioxin/Furan	Explosives	Herbicides	Inorganics	Inorganics-Filtered	Inorganics-TCLP	Organochlorine Pesticides	PAHs	PCBs	SVOCs	VOCs
Dames & Moore Soil Sampling, 1997																
Soil Samples																
50240012	Soil	12/8/1997	0	1					X					X		
502401224	Soil	12/11/1997	1	2					X					X		
502402436	Soil	12/11/1997	2	3					X					X		
502436012	Soil	12/11/1997	0	1					X					X		
5024361224	Soil	12/11/1997	1	2					X					X		
502460012	Soil	12/11/1997	0	1					X					X		
5024601224	Soil	12/11/1997	1	2					X					X		
504312012	Soil	12/11/1997	0	1					X					X	X	
5043121224	Soil	12/9/1997	1	2					X					X	X	
5043122436	Soil	12/9/1997	2	3					X					X	X	
504336012	Soil	12/9/1997	0	1					X					X	X	
5043361224	Soil	12/9/1997	1	2					X					X	X	
504360012	Soil	12/9/1997	0	1					X					X	X	
5043601224	Soil	12/9/1997	1	2					X					X	X	
8102727012	Soil	12/8/1997	0	1					X			X		X	X	
81027271224	Soil	12/8/1997	1	2					X			X		X	X	
81027272436	Soil	12/8/1997	2	3					X			X		X	X	
81022612012	Soil	12/11/1997	0	1					X							
810226121224	Soil	12/11/1997	1	2					X							
810226122436	Soil	12/11/1997	2	3					X							
81022636012	Soil	12/11/1997	0	1					X							
810226361224	Soil	12/11/1997	1	2					X							
81022660012	Soil	12/11/1997	0	1					X							
810226601224	Soil	12/11/1997	1	2					X							
81027112012_19971208	Soil	12/8/1997	0	1					X							
810271121224_19971208	Soil	12/8/1997	1	2					X							
810271122436_19971208	Soil	12/8/1997	2	3					X							
81027136012_19971208	Soil	12/8/1997	0	1					X							
810271361224_19971208	Soil	12/8/1997	1	2					X							
81027160012_19971208	Soil	12/8/1997	0	1					X							
810271601224_19971208	Soil	12/8/1997	1	2					X							
81027236012	Soil	12/8/1997	0	1					X							
810272361224	Soil	12/8/1997	1	2					X							
81027260012	Soil	12/8/1997	0	1					X							
810272601224	Soil	12/8/1997	1	2					X			X		X	X	
Dames & Moore Soil Sampling, 1998																
Soil Samples																
81027112012_19980219	Soil	2/19/1998	0	1								X		X	X	
810271121224_19980219	Soil	2/19/1998	1	2								X		X	X	
810271122436_19980218	Soil	2/18/1998	2	3								X		X	X	
81027136012_19980218	Soil	2/18/1998	0	1								X		X	X	
810271361224_19980218	Soil	2/18/1998	1	2								X		X	X	
81027160012_19980218	Soil	2/18/1998	0	1								X		X	X	
810271601224_19980218	Soil	2/18/1998	1	2								X		X	X	
Gannett Fleming Independent Sampling, 1997, 1998, and 1999																
Soil Samples																
SS-03	Soil	6/3/1997	0	0.5					X			X		X	X	X
SS-11	Soil	6/3/1997	0	0.5					X			X		X	X	X
SS-11a	Soil	3/30/1998	0	0.2					X							
SS-11b	Soil	3/30/1998	0	0.2					X							
SS-12	Soil	3/30/1998	0	0.2	X				X							
TR-01A	Soil	4/2/1998	0	0.2								X		X	X	
TR-01B	Soil	4/2/1998	0	0.2								X		X	X	
Conductive Flooring Samples																
WS-03	Floor	3/30/1998	-	-	X				X							
IACF2	Floor	7/20/1998	-	-							X				X	
CF-1	Floor	6/24/1999	-	-		X			X						X	
ICF KE Remedial Investigation, 1998																
Soil Samples																
IASB1A	Soil	8/5/1998	0.5	1					X						X	
IASB1B	Soil	8/5/1998	5	6					X						X	
IASB2A	Soil	8/5/1998	0	2					X						X	
IASB2B	Soil	8/5/1998	4	6					X						X	
IASB2C	Soil	8/5/1998	26	28					X						X	
IASB3A	Soil	8/5/1998	0.5	1					X						X	
IASB3B	Soil	8/5/1998	5	6					X						X	

Notes found at end of table.

Table 2-3. Summary of Samples Collected at the Igniter Assembly Area, 1997 through 2009, Radford Army Ammunition Plant, Radford, Virginia.

Sample Name	Matrix	Date Collected	Depth Start (ft)	Depth End (ft)	Asbestos	Dioxin/Furan	Explosives	Herbicides	Inorganics	Inorganics-Filtered	Inorganics-TCLP	Organochlorine Pesticides	PAHs	PCBs	SVOCs	VOCs
IASB4A	Soil	8/5/1998	0.5	1.5					X						X	
IASB4B	Soil	8/5/1998	5	6					X						X	
IASB5A	Soil	8/5/1998	0.5	1					X						X	
IASB5B	Soil	8/5/1998	0.5	6			X		X						X	
IATP1A	Soil	8/4/1998	0.5	1			X		X						X	
IATP1B	Soil	8/4/1998	0.5	1			X		X						X	
IATP1C	Soil	8/4/1998	0.5	4.5			X		X							
IATP1D	Soil	8/4/1998	0.5	4.5			X		X							
IATP2A	Soil	8/4/1998	0.5	1			X		X						X	
IATP2B	Soil	8/4/1998	0.5	1			X		X						X	
IATP2C	Soil	8/4/1998	0.5	4.5			X		X							
IATP2D	Soil	8/4/1998	0.5	4.5			X		X							
Shaw Remedial Investigation, 2002																
Soil Samples																
IASS01	Soil	6/10/2002	0	0.5					X							
IASS02	Soil	6/10/2002	0	0.5					X							
IASS03	Soil	6/10/2002	0	0.5					X				X			
IASS04	Soil	6/10/2002	0	0.5					X				X			
IASS05	Soil	6/10/2002	0	0.5			X		X				X	X	X	X
IASB06A	Soil	6/10/2002	0	0.5				X	X			X	X	X		X
IASB06B	Soil	6/18/2002	4	6					X				X	X		X
IASB06C	Soil	6/18/2002	8	10					X				X	X		X
IASB07A	Soil	6/10/2002	0	0.5					X							
IASB07B	Soil	6/18/2002	4	6					X							
IASB08A	Soil	6/10/2002	0	0.5					X							
IASB08B	Soil	6/18/2002	4	6					X							
IASB09A	Soil	6/10/2002	0	0.5					X							
IASB09B	Soil	6/18/2002	4	6					X							
IASB10A	Soil	6/10/2002	0	0.5					X							
IASB10B	Soil	6/18/2002	2	4					X							
IASB11A	Soil	6/10/2002	0	0.5					X				X			
IASB11B	Soil	6/18/2002	2	4					X				X			
IASB12A	Soil	6/10/2002	0	0.5					X				X	X		X
IASB12B	Soil	6/18/2002	4	6					X				X	X		X
IASB12C	Soil	6/18/2002	8	10					X				X	X		X
IASB13A	Soil	6/11/2002	0	0.5					X					X		
IASB13B	Soil	6/18/2002	1	2					X					X		
IASB13C	Soil	6/18/2002	2	4					X					X		
IASB14A	Soil	6/11/2002	0	0.5					X					X		
IASB14B	Soil	6/18/2002	1	2					X					X		
IASB14C	Soil	6/18/2002	2	4					X					X		
IASB15A	Soil	6/11/2002	0	0.5					X					X		
IASB15B	Soil	6/18/2002	1	2					X					X		
IASB15C	Soil	6/18/2002	2	4					X					X		
IATR01	Soil	6/20/2002	0	0.5										X		
IATR02	Soil	6/20/2002	0	0.5										X		
IATR03	Soil	6/20/2002	0	0.5										X		
IATR04	Soil	6/20/2002	0	0.5										X		
IATR05	Soil	6/20/2002	0	0.5										X		
IATR06	Soil	6/20/2002	0	0.5										X		
IATR07	Soil	6/20/2002	0	0.5										X		
IATR08	Soil	6/20/2002	0	0.5										X		
Shaw Remedial Investigation, 2002																
Sediment Samples																
IASD04	SE	6/18/2002	0	0.5			X	X	X			X		X	X	X
IASD05	SE	6/19/2002	0	0.5			X	X	X			X		X	X	X
IASD06	SE	6/19/2002	0	0.5			X	X	X			X		X	X	X
IASD07	SE	6/19/2002	0	0.5			X	X	X			X		X	X	X
IASD08	SE	6/19/2002	0	0.5			X	X	X			X		X	X	X
IASD09	SE	6/19/2002	0	0.5			X	X	X			X		X	X	X
IASD10	SE	6/19/2002	0	0.5			X	X	X			X		X	X	X
IASD11	SE	6/19/2002	0	0.5			X		X				X	X	X	X
IASD12	SE	6/19/2002	0	0.5			X	X	X			X	X	X	X	X
Shaw Soil Sampling, 2005																
Soil Samples																
BPASS01	Soil	1/26/2005	0	0.5	X											
BPASS02	Soil	1/26/2005	0	0.5	X											
BPASS03	Soil	1/26/2005	0	0.5	X											

Notes found at end of table.

Table 2-3. Summary of Samples Collected at the Igniter Assembly Area, 1997 through 2009, Radford Army Ammunition Plant, Radford, Virginia.

Sample Name	Matrix	Date Collected	Depth Start (ft)	Depth End (ft)	Asbestos	Dioxin/Furan	Explosives	Herbicides	Inorganics	Inorganics-Filtered	Inorganics-TCLP	Organochlorine Pesticides	PAHs	PCBs	SVOCs	VOCs
IASS06	Soil	1/26/2005	0	0.5	X											
IASS07	Soil	1/26/2005	0	0.5	X											
IASS08	Soil	1/26/2005	0	0.5	X											
IASS09	Soil	1/26/2005	0	0.5	X											
IASS10	Soil	1/26/2005	0	0.5	X											
IASS11	Soil	1/26/2005	0	0.5	X											
Conductive Flooring Samples																
IADF01	Floor	1/26/2005	-	-	X											
IADF02	Floor	1/26/2005	-	-	X											
IAIF01	Floor	1/26/2005	-	-	X											
IAIF02	Floor	1/26/2005	-	-	X											
Paint and Wall Samples																
IAPC01	Paint	1/26/2005	-	-					X							
IAPC02	Paint	1/26/2005	-	-					X							
IAPC03	Paint	1/26/2005	-	-					X							
IAWM01	Wall	1/26/2005	-	-	X											
Wipe Samples																
IAW01	Wipe	1/26/2005	-	-	X											
IAW02	Wipe	1/26/2005	-	-	X											
WB01	Wipe	1/26/2005	-	-	X											
ARCADIS Remedial Investigation, 2008																
Soil Samples																
IAA-SB001 (2-3)	Soil	7/29/2008	2	3										X	X	
IAA-SS001 (0-0.5)	Soil	7/29/2008	0	0.5										X	X	
IAA-SS002 (0-0.5)	Soil	7/29/2008	0	0.5										X	X	
IAA-SS003 (0-0.5)	Soil	7/31/2008	0	0.5	X				X							
IAA-SS004 (0-0.5)	Soil	7/31/2008	0	0.5	X				X							
IAA-SS005 (0-0.5)	Soil	7/31/2008	0	0.5	X				X							
IAA-SS006 (0-0.5)	Soil	7/31/2008	0	0.5	X				X							
IAA-SS007 (0-0.5)	Soil	7/31/2008	0	0.5	X				X							
IAA-SS008 (0-0.5)	Soil	7/31/2008	0	0.5	X				X							
IAA-SS009 (0-0.5)	Soil	7/31/2008	0	0.5	X				X							
IAA-SS009(0-0.5)TCLP	Soil	8/5/2008	0	0.5							X					
IAA-SS010 (0-0.5)	Soil	7/31/2008	0	0.5	X				X							
IAA-SS011 (0-0.5)	Soil	7/31/2008	0	0.5	X				X							
IAA-SS012 (0-0.5)	Soil	7/31/2008	0	0.5	X				X							
IAA-SS013 (0-0.5)	Soil	7/31/2008	0	0.5	X				X							
IAA-SS014 (0-0.5)	Soil	7/31/2008	0	0.5	X				X							
IAA-SS015 (0-0.5)	Soil	7/31/2008	0	0.5	X				X							
IAA-SS016 (0-0.5)	Soil	7/31/2008	0	0.5	X				X							
IAA-SS017 (0-0.5)	Soil	7/31/2008	0	0.5	X				X							
IAA-SS018 (0-0.5)	Soil	7/31/2008	0	0.5	X				X							
IAA-SS019 (0-0.5)	Soil	7/31/2008	0	0.5	X				X							
IAA-SS020 (0-0.5)	Soil	7/31/2008	0	0.5	X				X							
IAA-SS021 (0-0.5)	Soil	7/31/2008	0	0.5	X				X							
IAA-SS021(0-0.5)TCLP	Soil	8/5/2008	0	0.5							X					
IAA-SS022 (0-0.5)	Soil	7/31/2008	0	0.5	X				X							
IAA-SS023 (0-0.5)	Soil	8/1/2008	0	0.5	X				X							
IAA-SS024 (0-0.5)	Soil	8/1/2008	0	0.5	X				X							
IAA-SS025 (0-0.5)	Soil	8/1/2008	0	0.5	X				X							
ARCADIS Remedial Investigation, 2008																
Soil Samples																
IAA-SS026 (0-0.5)	Soil	8/1/2008	0	0.5	X				X							
IAA-SS027 (0-0.5)	Soil	8/1/2008	0	0.5	X				X							
IAA-SS028 (0-0.5)	Soil	8/1/2008	0	0.5	X				X							
IAA-SS028(0-0.5)TCLP	Soil	8/5/2008	0	0.5							X					
IAA-SS029 (0-0.5)	Soil	8/1/2008	0	0.5	X				X							
IAA-SS030 (0-0.5)	Soil	8/1/2008	0	0.5	X				X							
IAA-SS031 (0-0.5)	Soil	8/1/2008	0	0.5	X				X							
IAA-SS032 (0-0.5)	Soil	8/1/2008	0	0.5	X				X							
IAA-SS033 (0-0.5)	Soil	8/1/2008	0	0.5	X				X							
IAA-SS033(0-0.5)TCLP	Soil	8/5/2008	0	0.5							X					
IAA-SS034 (0-0.5)	Soil	8/1/2008	0	0.5	X				X							
IAA-SS035(0-0.5)	Soil	8/5/2008	0	0.5	X				X							
IAA-SS036(0-0.5)	Soil	8/5/2008	0	0.5	X				X							
IAA-SS037(0-0.5)	Soil	8/5/2008	0	0.5	X				X							
IAA-SS038(0-0.5)	Soil	8/5/2008	0	0.5	X				X							
IAA-SS039(0-0.5)	Soil	8/5/2008	0	0.5	X				X							
IAA-SS040(0-0.5)	Soil	8/5/2008	0	0.5	X				X							

Notes found at end of table.

Table 2-3. Summary of Samples Collected at the Igniter Assembly Area, 1997 through 2009, Radford Army Ammunition Plant, Radford, Virginia.

Sample Name	Matrix	Date Collected	Depth Start (ft)	Depth End (ft)	Asbestos	Dioxin/Furan	Explosives	Herbicides	Inorganics	Inorganics-Filtered	Inorganics-TCLP	Organochlorine Pesticides	PAHs	PCBs	SVOCs	VOCs
IAA-SS041(0-0.5)	Soil	8/5/2008	0	0.5	X				X							
IAA-SS042(0-0.5)	Soil	8/5/2008	0	0.5	X				X							
IAA-SS043(0-0.5)	Soil	8/5/2008	0	0.5	X				X							
IAA-SS043(0-0.5)TCLP	Soil	8/5/2008	0	0.5							X					
Sediment Samples																
IAA-SE001 (0-0.5)	SE	8/1/2008	0	0.5	X				X							
IAA-SE002 (0-0.5)	SE	8/1/2008	0	0.5					X							
IAA-SE003 (0-0.5)	SE	8/1/2008	0	0.5					X							
IAA-SE004 (0-0.5)	SE	8/1/2008	0	0.5					X							
Surface Water Samples																
IAA-VLTW01 (20080801)	SW	8/1/2008	-	-					X						X	X
ARCADIS Supplemental Remedial Investigation, 2009																
Soil Samples																
IAA5-SS001A	Soil	7/15/2009	0	0.5	X											
IAA5-SS001B	Soil	7/15/2009	0	0.5	X											
IAA5-SS001C	Soil	7/15/2009	0	0.5	X											
IAA5-SS001D	Soil	7/15/2009	0	0.5	X											
IAA5-SS001E	Soil	7/15/2009	0	0.5	X											
IAA8102-SS001B	Soil	7/13/2009	0	0.5	X											
IAA8102-SS001C	Soil	7/13/2009	0	0.5	X											
IAA8102-SS001D	Soil	7/13/2009	0	0.5	X											
IAA8102-SS001E	Soil	7/13/2009	0	0.5	X											
IAA8102-SS001A	Soil	7/13/2009	0	0.5	X											
IAA8102-DUP001E	Soil	7/13/2009	0	0.5	X											
IAA-SS044B	Soil	7/14/2009	0	0.5	X											
IAA-SS044A	Soil	7/14/2009	0	0.5	X											
IAA-SS045B	Soil	7/14/2009	0	0.5	X											
IAA-SS045A	Soil	7/14/2009	0	0.5	X											
IAA-SS046A	Soil	7/14/2009	0	0.5	X											
IAA-SS046B	Soil	7/14/2009	0	0.5	X											
IAA-SS047A	Soil	7/14/2009	0	0.5	X											
IAA-SS047B	Soil	7/14/2009	0	0.5	X											
IAA-SS048A	Soil	7/14/2009	0	0.5	X											
IAA-SS048B	Soil	7/14/2009	0	0.5	X											
IAA-SS049A	Soil	7/14/2009	0	0.5	X											
IAA-SS049B	Soil	7/14/2009	0	0.5	X											
Activity Based Air Samples																
IAA5-AA1	AIR	7/15/2009	-	-	X											
IAA5-AA2	AIR	7/15/2009	-	-	X											
IAA5-AP1	AIR	7/15/2009	-	-	X											
IAA5-AP2	AIR	7/15/2009	-	-	X											
IAA8102-AA1	AIR	7/14/2009	-	-	X											
IAA8102-AA2	AIR	7/13/2009	-	-	X											
IAA8102-AP1	AIR	7/14/2009	-	-	X											
IAA8102-AP2	AIR	7/13/2009	-	-	X											
IAA5-BK2	AIR	7/15/2009	-	-	X											
IAA8102-BK2	AIR	7/13/02009	-	-	X											

SE Sediment.
SW Surface Water.
ft Feet.
TCLP Toxicity Characteristic Leaching Procedure.
PAHs Polycyclic Aromatic Hydrocarbons.
PCBs Polychlorinated biphenyls.
SVOCs Semivolatile Organic Compounds.
VOCs Volatile Organic Compounds.

Table 2-4. Summary of Samples Collected at the Rail Yard, 1997 through 2002, Radford Army Ammunition Plant, Radford, Virginia.

Sample Name	Matrix	Date Collected	Depth Start (ft)	Depth End (ft)	Explosives	Herbicides	Inorganics	Organochlorine Pesticides	PAHs	PCBs	Perchlorate	SVOCs	VOCs
Gannett Fleming Independent Sampling, 1997 and 1998													
Soil Samples													
SS-07	Soil	6/4/1997	0	0.5	X		X	X		X		X	X
SS-08	Soil	6/4/1997	0	0.5	X		X	X		X		X	X
SS-08a	Soil	3/30/1998	0.25	0.5			X	X		X		X	X
TR-02A	Soil	4/2/1998	0	0.16				X		X		X	X
TR-02C	Soil	4/2/1998	0	0.16				X		X		X	X
Sediment and Sludge Samples													
SL-05	SE	6/4/1997	-	-			X	X				X	X
SL-08	SE	3/30/1998	-	-			X			X		X	X
SD-03	SE	4/1/1998	0	0.5			X	X				X	X
SD-04	SE	4/1/1998	0	0.5			X	X				X	X
SD-05	SE	4/1/1998	0	0.5			X	X				X	X
Surface Water Samples													
WW-04	SW	3/30/1998	-	-			X						
ICF KE Remedial Investigation, 1998													
Soil Samples													
RYSB1A	Soil	8/3/1998	0	2	X		X					X	
RYSB1B	Soil	8/3/1998	4	8	X		X					X	
RYSB1C	Soil	8/3/1998	19	23	X		X					X	
RYSB2A	Soil	8/3/1998	0	2	X		X					X	
RYSB2B	Soil	8/3/1998	4	6	X		X					X	
RYSB3A	Soil	8/3/1998	1	3	X		X					X	
RYSB3B	Soil	8/3/1998	3	4.2	X		X					X	
RYSB4A	Soil	8/3/1998	0	4	X		X					X	
RYSB4B	Soil	8/3/1998	4	6	X		X					X	
RYSB5A	Soil	8/3/1998	0	4	X		X					X	
RYSB5B	Soil	8/3/1998	4	6	X		X					X	
RYSB6A	Soil	8/3/1998	0	4	X		X					X	
RYSB6B	Soil	8/3/1998	4	6	X		X					X	
RYSB7A	Soil	8/3/1998	0	4	X		X					X	
RYSB7B	Soil	8/3/1998	4	6	X		X					X	
Shaw Baseline Investigation, 2002													
Soil Samples													
RYSS04	Soil	7/25/2002	0	0.5	X		X		X	X		X	X
RYSS05	Soil	7/25/2002	0	0.5	X	X	X	X	X	X		X	X
RYSS06	Soil	7/25/2002	0	0.5	X		X		X	X		X	X
RYSS07	Soil	7/25/2002	0	0.5	X		X		X	X		X	X
RYSS08	Soil	7/25/2002	0	0.5	X		X		X	X		X	X
RYSS09	Soil	7/25/2002	0	0.5	X	X	X	X	X	X		X	X
RYSS10	Soil	7/25/2002	0	0.5	X	X	X	X	X	X		X	X
RYSS11	Soil	7/25/2002	0	0.5	X		X		X	X		X	X
RYSS12	Soil	7/25/2002	0	0.5	X		X		X	X		X	X
RYSS13	Soil	7/25/2002	0	0.5	X		X		X	X		X	X
RYSS14	Soil	7/25/2002	0	0.5	X		X		X	X		X	X
RYSS15	Soil	7/25/2002	0	0.5	X	X	X	X	X	X		X	X
RYSS16	Soil	7/25/2002	0	0.5	X		X		X	X		X	X

Notes found at end of table.

Table 2-4. Summary of Samples Collected at the Rail Yard, 1997 through 2002, Radford Army Ammunition Plant, Radford, Virginia.

Sample Name	Matrix	Date Collected	Depth Start (ft)	Depth End (ft)	Explosives	Herbicides	Inorganics	Organochlorine Pesticides	PAHs	PCBs	Perchlorate	SVOCs	VOCs
Shaw Remedial Investigation, 2002													
Soil Samples													
RYSB08A	Soil	6/17/2002	0	0.5	X	X	X	X	X	X		X	X
RYSB08B	Soil	6/17/2002	4	6	X		X		X	X		X	X
RYSB09A	Soil	6/17/2002	0	0.5		X		X		X			X
RYSB09B	Soil	6/17/2002	4	6						X			X
RYSB09C	Soil	6/17/2002	8	10						X			X
RYSS01	Soil	6/17/2002	0	0.5	X		X		X	X		X	X
RYSS02	Soil	6/17/2002	0	0.5			X			X			
RYSS03	Soil	6/17/2002	0	0.5	X					X			
RYTR01	Soil	6/18/2002	0	0.5						X			
RYTR02	Soil	6/18/2002	0	0.5						X			
RYTR03	Soil	6/18/2002	0	0.5						X			
Sediment Samples													
RYSD01	SE	6/17/2002	0	0.5	X	X	X	X	X	X		X	X
RYSD03	SE	7/8/2002	0	0.5	X	X	X	X	X	X		X	X
RYSD04	SE	7/8/2002	0	0.5	X	X	X	X	X	X		X	X
RYSD05	SE	6/27/2002	0	0.5	X	X	X	X	X	X		X	X
RYSD06	SE	6/18/2002	0	0.5	X	X	X	X	X	X		X	X
RYSD07	SE	6/17/2002	0	0.5	X	X	X	X		X		X	X
RYSD08	SE	6/18/2002	0	0.5	X	X	X	X		X		X	X
RYSD09	SE	6/18/2002	0	0.5	X	X	X	X		X		X	X
RYSD10	SE	6/18/2002	0	0.5	X	X	X	X		X		X	X
RYSD12	SE	6/25/2002	0	0.5	X	X	X	X		X		X	X
RYSD13	SE	6/25/2002	0	0.5	X	X	X	X		X		X	X
Surface Water Samples													
RYSW02	SW	6/27/2002	0	0	X	X	X	X	X	X	X	X	X
RYSW03	SW	7/15/2002	0	0	X	X	X	X	X	X	X	X	
RYSW04	SW	7/15/2002	0	0	X	X	X	X	X	X	X	X	
RYSW05	SW	6/27/2002	0	0	X	X	X	X	X	X	X	X	X
RYSW12	SW	6/25/2002	0	0	X	X	X	X		X	X	X	X
RYSW13	SW	6/25/2002	0	0	X	X	X	X		X	X	X	X
RYSW15	SW	7/11/2002	0	0							X		

SE	Sediment.
SW	Surface Water.
ft	Feet.
PAHs	Polycyclic Aromatic Hydrocarbons.
PCBs	Polychlorinated biphenyls.
SVOCs	Semivolatile Organic Compounds.
VOCs	Volatile Organic Compounds.

Table 2-5. Summary of Samples Collected at the Western Burning Ground, 1997 through 2008, Radford Army Ammunition Plant, Radford, Virginia.

Sample Name	Matrix	Date Collected	Depth Start (ft)	Depth End (ft)	Dioxin/Furan	Explosives	Herbicides	Inorganics	Inorganics-Filtered	Inorganics-TCLP	Organochlorine Pesticides	PAHs	PCBs	Perchlorate	SVOCs	VOCs
Gannett Fleming Independent Sampling, 1997																
Soil Samples																
SS-04	Soil	6/3/1997	0	0.5	X			X					X		X	X
SS-04a	Soil	6/3/1997	0	0.5	X			X					X		X	X
SS-05	Soil	6/3/1997	0	0.5	X			X					X		X	X
Sediment Samples																
SD-01	SE	6/4/1997	0	0.5				X			X		X		X	X
SD-02	SE	6/4/1997	0	0.5				X			X		X		X	X
Surface Water Samples																
SW-01	SW	6/5/1997	-	-				X								
SW-02	SW	6/4/1997	-	-				X								
ICF KE Remedial Investigation, 1998																
Soil Samples																
WBGSB1A	Soil	8/5/1998	0	2		X		X							X	X
WBGSB1B	Soil	8/5/1998	2	4		X		X							X	X
WBGSB2A	Soil	8/5/1998	0	2		X		X							X	X
WBGSB2B	Soil	8/5/1998	6	8		X		X							X	X
WBGSB2C	Soil	8/5/1998	9	11		X		X							X	X
WBGSB3A	Soil	8/5/1998	0	1		X		X							X	X
WBGSB4A	Soil	8/5/1998	0	1.5		X		X							X	X
WBGSB5A	Soil	8/5/1998	0	2		X		X							X	X
ICF KE Remedial Investigation, 1999																
Soil Samples																
WBGSB6A	Soil	5/26/1999	0	2		X		X				X			X	X
WBGSB7A	Soil	5/26/1999	0	2		X		X				X			X	X
WBGSB8A	Soil	5/26/1999	0	2		X		X				X			X	X
WBGSB9A	Soil	5/26/1999	0	2		X		X		X		X			X	X
WBGSB10A	Soil	5/26/1999	0	2		X		X				X			X	X
WBGSB11A	Soil	5/26/1999	0	2		X		X				X			X	X
WBGSB12	Soil	8/18/1999	0	4				X							X	
WBGSB13	Soil	10/6/1999	0	2				X							X	
WBGSB13A	Soil	10/6/1999	2	4				X							X	
WBGSB13D	Soil	10/6/1999	0	2				X							X	
WBGSB14	Soil	10/6/1999	0	2				X								
WBGSB14A	Soil	10/6/1999	2	4				X								
WBGSB15	Soil	10/6/1999	0	2				X							X	
WBGSB15A	Soil	10/6/1999	2	4				X							X	
WBGSB16	Soil	10/6/1999	0	2				X								
WBGSB16A	Soil	10/6/1999	2	4				X								
WBGSB17	Soil	10/6/1999	0	2				X								
WBGSB17A	Soil	10/6/1999	2	4				X								
WBGSB18	Soil	10/6/1999	0	2				X								
WBGSB18A	Soil	10/6/1999	2	4				X								
WBGSB19	Soil	10/6/1999	0	2				X							X	
WBGSB19A	Soil	10/6/1999	2	4				X							X	
WBGSB20	Soil	10/6/1999	0	2				X								
WBGSB20A	Soil	10/6/1999	2	4				X								
WBGSB21	Soil	10/6/1999	0	2				X							X	
WBGSB21A	Soil	10/6/1999	2	4				X							X	
WBGBC1A	Soil	8/18/1999	0	2				X							X	
WBGBC1B	Soil	8/18/1999	5	7				X							X	
Stockpiled Soil Samples																
WBGDW1	Stockpiled Soil	5/26/1999	0	2						X						
WBGDW2	Stockpiled Soil	5/26/1999	0	2						X						
WBGDW3	Stockpiled Soil	5/26/1999	0	2						X						
WBGDW4	Stockpiled Soil	5/26/1999	0	2						X						
WBGDW5	Stockpiled Soil	5/26/1999	0	2						X						
WBGDW6	Stockpiled Soil	5/26/1999	0	2						X						
WBGDW7	Stockpiled Soil	6/21/1999	-	-						X						
WBGDW15	Stockpiled Soil	6/28/1999	-	-						X						
WBGDW16	Stockpiled Soil	7/13/1999	-	-						X						
WBGDW17	Stockpiled Soil	7/14/1999	-	-						X						
WBGDW18	Stockpiled Soil	7/15/1999	-	-						X						
WBGDW19	Stockpiled Soil	7/15/1999	-	-						X						
WBGDW20	Stockpiled Soil	7/15/1999	-	-						X						
WBGDW21	Stockpiled Soil	7/15/1999	-	-						X						
WBGDW22	Stockpiled Soil	7/22/1999	-	-						X						
WBGDW23	Stockpiled Soil	7/22/1999	-	-						X						
WBGDW23A	Stockpiled Soil	7/29/1999	-	-						X						
WBGDW24	Stockpiled Soil	7/23/1999	-	-						X						
WBGDW25	Stockpiled Soil	7/23/1999	-	-						X						
WBGDW26	Stockpiled Soil	10/6/1999	-	-						X						

Notes found at end of table.

Table 2-5. Summary of Samples Collected at the Western Burning Ground, 1997 through 2008, Radford Army Ammunition Plant, Radford, Virginia.

Sample Name	Matrix	Date Collected	Depth Start (ft)	Depth End (ft)	Dioxin/Furan	Explosives	Herbicides	Inorganics	Inorganics-Filtered	Inorganics-TCLP	Organochlorine Pesticides	PAHs	PCBs	Perchlorate	SVOCs	VOCs
ICF KE Remedial Investigation, 1999																
Test Pit Confirmation Soil Samples																
WBGTP1A	Soil	6/22/1999	2.5	3				X							X	
WBGTP1B	Soil	6/23/1999	3	3.5				X							X	
WBGTP1B2	Soil	7/23/1999	3.5	4				X								
WBGTP1S	Soil	6/22/1999	1	1.5				X							X	
WBGTP1SB	Soil	6/23/1999	1	1.5				X							X	
WBGTP2A	Soil	6/22/1999	2.5	3				X							X	
WBGTP2B	Soil	6/22/1999	3	3.5	X			X							X	
WBGTP2S	Soil	6/22/1999	1	1.5				X							X	
WBGTP3A	Soil	6/23/1999	2.5	3				X							X	
WBGTP3S	Soil	6/23/1999	1	1.5				X							X	
WBGTP4A	Soil	6/24/1999	2.5	3				X							X	
WBGTP4B	Soil	6/24/1999	2	2.5				X							X	
WBGTP4S	Soil	6/24/1999	0.5	1				X							X	
WBGTP5A	Soil	6/24/1999	2.5	3				X							X	
WBGTP5B	Soil	6/24/1999	2.5	3				X							X	
WBGTP6A	Soil	6/23/1999	2.5	3				X							X	
WBGTP7A	Soil	7/13/1999	2.5	3	X			X							X	
WBGTP7B	Soil	7/14/1999	2.5	3				X							X	
WBGTP7S	Soil	7/14/1999	1	1.5				X							X	
WBGTP8A	Soil	7/13/1999	3	3.5				X							X	
WBGTP8B	Soil	7/13/1999	3	3.5				X							X	
WBGTP9A	Soil	6/24/1999	2.5	3				X							X	
WBGTP9S	Soil	6/24/1999	1	1.5				X							X	
WBGTP10A	Soil	7/15/1999	2.5	3				X							X	
WBGTP10B	Soil	7/15/1999	2.5	3	X			X							X	
WBGTP10S	Soil	7/15/1999	0.5	1				X							X	
WBGTP11A	Soil	7/15/1999	2.5	3				X							X	
WBGTP11B	Soil	7/15/1999	2.5	3				X							X	
WBGTP12A	Soil	7/15/1999	2.5	3	X			X							X	
WBGTP12S	Soil	7/15/1999	0.5	1	X			X							X	
WBGTP13A	Soil	7/22/1999	1.5	2				X							X	
WBGTP13B	Soil	7/22/1999	1	1.5				X							X	
WBGTP13S	Soil	7/22/1999	1.5	2				X							X	
WBGTP14A	Soil	7/22/1999	2	2.5				X							X	
WBGTP14B	Soil	7/22/1999	1.5	2				X							X	
WBGTP15A	Soil	7/15/1999	1.5	2				X							X	
WBGTP16A	Soil	7/22/1999	0.5	1				X							X	
WBGTP16A2	Soil	9/14/1999	0.5	1				X								
WBGTP17A	Soil	7/22/1999	0.5	1				X							X	
WBGTP18A	Soil	7/22/1999	1	1.5	X			X							X	
WBGTP18S	Soil	7/22/1999	1	1.5				X							X	
WBGTP19A	Soil	7/29/1999	2.5	3	X			X							X	
WBGTP19S	Soil	7/29/1999	2.5	3				X							X	
Sediment Samples																
WBGSD1	SE	7/16/1998	0	0.5		X		X							X	X
WBGSD2	SE	7/16/1998	0	0.5		X		X							X	X
WBGSD3	SE	7/16/1998	0	0.5		X		X							X	X
WBGSD4	SE	5/27/1999	0	0.5				X							X	
WBGSD5	SE	5/27/1999	0	0.5				X							X	
WBGSD5-2	SE	6/16/1999	0	0.5				X								
WBGSD6	SE	5/27/1999	0	0.5				X							X	
Surface Water Samples																
WBGSW1	SW	7/16/1998	-	-		X		X							X	X
WBGSW2	SW	7/16/1998	-	-		X		X							X	X
WBGSW3	SW	7/16/1998	-	-		X		X				X			X	X
WBGSW4	SW	5/27/1999	-	-				X						X	X	
WBGSW5	SW	5/27/1999	-	-				X						X	X	
WBGSW6	SW	5/27/1999	-	-				X						X	X	
Shaw Remedial Investigation, 2002																
Soil Samples																
WBGSB22A	Soil	6/18/2002	0	0.5	X	X	X	X			X	X	X		X	X
WBGSB22B	Soil	6/19/2002	2	4	X	X		X				X	X		X	X
WBGSB22C	Soil	6/19/2002	6	8	X	X		X				X	X		X	X
WBGSB23A	Soil	6/18/2002	0	0.5	X	X	X	X			X	X	X		X	X
WBGSB23B	Soil	6/19/2002	2	4	X	X		X				X	X		X	X
WBGSB23C	Soil	6/19/2002	6	8	X	X		X				X	X		X	X
WBGSB24A	Soil	6/18/2002	0	0.5	X	X	X	X			X	X	X		X	X
WBGSB24B	Soil	6/19/2002	2	4	X	X		X				X	X		X	X
WBGSB24C	Soil	6/19/2002	6	8	X	X		X				X	X		X	X
WBGSB25A	Soil	6/18/2002	0	0.5	X	X	X	X			X	X	X		X	X
WBGSB25B	Soil	6/19/2002	2	4	X	X		X				X	X		X	X
WBGSB25C	Soil	6/19/2002	6	8	X	X		X				X	X		X	X
WBGTR01	Soil	6/18/2002	0	0.5									X			

Notes found at end of table.

Table 2-5. Summary of Samples Collected at the Western Burning Ground, 1997 through 2008, Radford Army Ammunition Plant, Radford, Virginia.

Sample Name	Matrix	Date Collected	Depth Start (ft)	Depth End (ft)	Dioxin/Furan	Explosives	Herbicides	Inorganics	Inorganics-Filtered	Inorganics-TCLP	Organochlorine Pesticides	PAHs	PCBs	Perchlorate	SVOCs	VOCs
Shaw Remedial Investigation, 2002																
Sediment Samples																
WBGSD07	SE	6/26/2002	0	0.5	X			X				X	X		X	X
WBGSD08	SE	6/25/2002	0	0.5	X	X	X	X			X	X	X		X	X
WBGSD09	SE	6/25/2002	0	0.5	X	X		X				X	X		X	X
WBGSD10	SE	6/26/2002	0	0.5	X	X	X	X			X	X	X		X	X
WBGSD11	SE	6/27/2002	0	0.5	X	X		X				X	X		X	X
WBGSD12	SE	6/26/2002	0	0.5	X	X		X					X		X	X
WBGSD13	SE	6/26/2002	0	0.5			X	X			X		X		X	X
WBGSD14	SE	6/25/2002	0	0.5			X	X			X		X		X	X
WBGSD15	SE	6/27/2002	0	0.5			X	X			X		X		X	X
Surface Water Samples																
WBGSW07	SW	6/26/2002	-	-	X	X		X				X	X	X	X	X
WBGSW08	SW	6/25/2002	-	-	X	X	X	X			X	X	X	X	X	X
WBGSW09	SW	6/25/2002	-	-	X	X		X				X	X	X	X	X
WBGSW10	SW	6/26/2002	-	-	X	X	X	X			X	X	X	X	X	X
WBGSW13	SW	6/26/2002	-	-			X	X			X		X	X	X	X
WBGSW14	SW	6/25/2002	-	-			X	X			X		X	X	X	X
WBGSW15	SW	6/27/2002	-	-			X	X			X		X	X	X	X
Shaw Additional Characterization Sampling, 2004																
Soil Samples																
WBGSB26A	Soil	7/16/2004	0	0.5				X				X	X			
WBGSB27A	Soil	7/16/2004	0	0.5				X				X	X			
WBGSB28A	Soil	7/16/2004	0	0.5				X				X	X			
WBGSB29A	Soil	7/19/2004	0	0.5				X					X			
WBGSB30A	Soil	7/19/2004	0	0.5				X					X			
WBGSB31A	Soil	7/19/2004	0	0.5				X					X			
WBGSB32A	Soil	7/19/2004	0	0.5				X					X			
WBGSB33A	Soil	7/19/2004	0	0.5				X					X			
WBGSB34A	Soil	7/19/2004	0	0.5				X					X			
WBGSB35A	Soil	7/20/2004	0	0.5				X					X			
WBGSB36A	Soil	7/20/2004	0	0.5				X					X			
WBGSB37A	Soil	7/20/2004	0	0.5				X					X			
WBGSB38A	Soil	7/19/2004	0	0.5				X					X			
WBGSB39A	Soil	7/19/2004	0	0.5				X					X			
WBGSB40A	Soil	7/19/2004	0	0.5				X					X			
WBGSB41A	Soil	7/19/2004	0	0.5				X					X			
WBGSB42A	Soil	7/19/2004	0	0.5				X					X			
WBGSB43A	Soil	7/19/2004	0	0.5				X					X			
WBGSB43B	Soil	7/19/2004	4	5				X					X			
WBGSB44A	Soil	7/19/2004	0	0.5				X					X			
WBGSB44B	Soil	7/19/2004	1	2				X					X			
WBGSB45A	Soil	7/19/2004	0	0.5				X					X			
WBGSB45B	Soil	7/19/2004	4	5				X					X			
WBGSB46C	Soil	7/19/2004	4	5				X					X			
WBGSB47C	Soil	7/19/2004	5	6				X					X			
WBGSB48C	Soil	7/19/2004	4	5				X					X			
WBGSB49B	Soil	7/19/2004	1	2				X					X			
WBGSB50B	Soil	7/19/2004	3	4				X					X			
WBGSB51B	Soil	7/19/2004	3	4				X					X			
WBGSB52B	Soil	7/19/2004	3	4				X					X			
WBGSB53A	Soil	9/14/2004	0	0.5				X								
Sediment Samples																
WBGSD16	SE	7/16/2004	0	0.5				X				X	X			
WBGSD17	SE	7/22/2004	0	0.5				X					X			
WBGSD18	SE	7/22/2004	0	0.5				X					X			
WBGSD19	SE	7/22/2004	0	0.5				X					X			
WBGSD20	SE	7/22/2004	0	0.5				X					X			
WBGSD21	SE	7/22/2004	0	0.5				X					X			
WBGSD22	SE	7/22/2004	0	0.5				X					X			
WBGSD23	SE	9/14/2004	0	0.5				X								
WBGSD24	SE	9/14/2004	0	0.5				X								
WBGSD25	SE	9/14/2004	0	0.5				X								

Notes found at end of table.

Table 2-5. Summary of Samples Collected at the Western Burning Ground, 1997 through 2008, Radford Army Ammunition Plant, Radford, Virginia.

Sample Name	Matrix	Date Collected	Depth Start (ft)	Depth End (ft)	Dioxin/Furan	Explosives	Herbicides	Inorganics	Inorganics-Filtered	Inorganics-TCLP	Organochlorine Pesticides	PAHs	PCBs	Perchlorate	SVOCs	VOCs
Shaw Additional Characterization Sampling, 2004																
Fish Tissue Samples																
WBGTS01	TI	7/21/2004	-	-				X					X			
WBGTS02	TI	7/21/2004	-	-				X					X			
WBGTS03	TI	7/21/2004	-	-				X					X			
WBGTS04	TI	7/21/2004	-	-				X					X			
WBGTS05	TI	7/21/2004	-	-				X					X			
WBGTS06	TI	7/21/2004	-	-				X					X			
WBGTS07	TI	7/21/2004	-	-				X					X			
WBGTS08	TI	7/21/2004	-	-				X					X			
WBGTS15	TI	7/21/2004	-	-				X					X			
WBGTS16	TI	7/21/2004	-	-				X					X			
WBGTS17	TI	7/21/2004	-	-				X					X			
WBGTS18	TI	7/21/2004	-	-				X					X			
WBGTS19	TI	7/21/2004	-	-				X					X			
WBGTS20	TI	7/21/2004	-	-				X					X			
WBGTS21	TI	7/21/2004	-	-				X					X			
WBGTS22	TI	7/21/2004	-	-				X					X			
ARCADIS Remedial Investigation, 2008																
Soil Samples																
WBG-SE001(0-1)	SE	7/30/2008	0	1				X								
WBG-SE002(0-1)	SE	7/30/2008	0	1				X								
WBG-SE003(0-1)	SE	7/30/2008	0	1				X								
WBG-SE004(0-1)	SE	7/30/2008	0	1				X								
WBG-SE005(0-0.5)	SE	7/31/2008	0	0.5											X	
WBG-SE006 (0-0.5)	SE	7/31/2008	0	0.5											X	
Surface Water Samples																
WBG-SW002(073008)	SW	7/30/2008	-	-				X								
WBG-SW003(073008)	SW	7/30/2008	-	-				X								
WBG-SW004(073008)	SW	7/30/2008	-	-				X								
WBG-SW005 (20080731)	SW	7/31/2008	-	-											X	
WBG-SW006 (20080731)	SW	7/31/2008	-	-											X	

SE	Sediment.
SW	Surface Water.
ft	Feet.
TCLP	Toxicity Characteristic Leachaing Procedure.
PAHs	Polycyclic Aromatic Hydrocarbons.
PCBs	Polychlorinated biphenyls.
SVOCs	Semivolatile Organic Compounds.
VOCs	Volatile Organic Compounds.

Table 2-6. Summary of Facility-Wide Groundwater Investigation Samples, 2007, 2008, and 2010, Radford Army Ammunition Plant, Radford, Virginia.

Sample Name	Matrix	Date Collected	Dioxin/Furan	Explosives	Herbicides	Inorganics	Inorganics-Filtered	Organochlorine Pesticides	PAHs	PCBs	SVOCs	Total Organic Carbon	Total Organic Halides	VOCs
Shaw Groundwater Sampling Event, 2007														
Groundwater Samples														
BLAMW01	GW	6/20/2007	X	X	X	X		X	X	X	X	X	X	X
BLAMW02	GW	6/21/2007	X	X	X	X		X	X	X	X	X	X	X
IAAMW01	GW	6/21/2007		X		X								X
IAAMW02	GW	6/20/2007	X	X	X	X		X	X	X	X	X	X	X
IAAMW03	GW	6/20/2007	X	X	X	X		X	X	X	X	X	X	X
IAAMW04	GW	6/21/2007	X	X	X	X		X	X	X	X	X	X	X
NBGMW01	GW	6/19/2007	X	X	X	X		X	X	X	X	X	X	X
NBGMW02	GW	6/19/2007	X	X	X	X		X	X	X	X	X	X	X
WBGMW01	GW	6/18/2007	X	X		X			X		X	X	X	X
WBGMW02	GW	6/18/2007	X	X	X	X		X	X	X	X	X	X	X
WBGMW03	GW	6/19/2007	X	X	X	X		X	X	X	X	X	X	X
ARCADIS Remedial Investigation, 2008														
Groundwater Samples														
BLA-MW01 (20080930)	GW	10/3/2008				X								
BLA-MW02 (20080930)	GW	10/3/2008				X	X							
IAAMW01(20080924)	GW	9/24/2008				X								
IAAMW01(20080925)	GW	9/25/2008					X							
IAAMW02(20080924)	GW	9/24/2008				X								
IAAMW03(20080924)	GW	9/24/2008				X	X							
IAAMW04(20080924)	GW	9/24/2008				X	X							
NBGMW01(20080925)	GW	9/25/2008				X	X							
NBGMW02(20080925)	GW	9/25/2008				X	X							
WBGMW01(20080925)	GW	9/25/2008				X	X							
WBGMW02(20080925)	GW	9/25/2008				X								
WBGMW03(20080925)	GW	9/25/2008				X								
NSPRING03(20080924)	GW	9/24/2008				X			X					
NSPRING04(20080924)	GW	9/24/2008				X			X					
RY_SPRING002 (20080924)	GW	9/24/2008				X			X					
WBG_SPRING001 (20080924)	GW	9/24/2008				X			X					
ARCADIS Remedial Investigation, 2010														
Groundwater Samples														
BLA-MW01 (20100406)	GW			x		X	X		X	X				X
BLA-MW02 (20100407)	GW			x		X	X		X	X				X
IAAMW01(20100406)	GW			x		X	X		X	X				X
IAAMW02(20100406)	GW			x		X	X		X	X				X
IAAMW03(20100406)	GW			x		X	X		X	X				X
IAAMW04(20100406)	GW			x		X	X		X	X				X
NBGMW01(20100407)	GW		x	x		X	X		X	X				X
NBGMW02(20100407)	GW		x	x		X	X		X	X				X
WBGMW01(20100407)	GW		x	x		X	X		X	X				X
WBGMW02(20100407)	GW		x	x		X	X		X	X				X
WBGMW03(20100407)	GW		x	x		X	X		X	X				X
NSPRING03(20100407)	GW			x		X			X	X				X
NSPRING04(20100407)	GW			x		X			X	X				X
RY-SPRING002 (20100406)	GW			x		X			X	X				X
WBG_SPRING001 (20100406)	GW			x		X			X	X				X

GW Groundwater
PAHs Polycyclic Aromatic Hydrocarbons.
PCBs Polychlorinated biphenyls.
SVOCs Semivolatile Organic Compounds.
VOCs Volatile Organic Compounds.

Table 3-1. Groundwater Monitoring Well Construction Details and Water-Level Measurements, RFAAP-NRU, Radford Army Ammunition Plant, Radford, Virginia.

									6/27/2007[2]		9/25/2008[3]		4/5/2010[4]	
Monitor Well	General Well Location	Northing[1] (ft)	Easting[1] (ft)	Ground Elevation (ft amsl)	Total Depth (ft bls)	Well Bottom (ft amsl)	TOC Elevation (ft amsl)	Depth to Water (ft btoc)	Depth to Water (ft btoc)	Water Level Elevation (ft amsl)	Depth to Water (ft btoc)	Water Level Elevation (ft amsl)	Depth to Water (ft btoc)	Water Level Elevation (ft amsl)
BLAMW01	Downgradient and proximal to buildings with conductive flooring	3564530.07	10851995.99	2088.35	223.5	1862.25	2090.92	127.60	122.99	1967.93	127.60	1963.32	120.95	1969.97
BLAMW02	Downgradient of BLA	3564814.00	10851807.48	2073.70	154.8	1915.53	2077.07	143.70	146.46	1930.61	143.70	1933.37	138.14	1938.93
IAAMW01	Downgradient and proximal to buildings with conductive flooring	3568011.29	10850394.64	2116.17	36.2	2077.23	2118.90	36.18	35.95	2082.95	36.18	2082.72	33.87	2085.03
IAAMW02	Downgradient of IAA	3567399.30	10849464.83	2123.96	162.6	1958.69	2126.63	76.15	91.26	2035.37	76.15	2050.48	68.71	2057.92
IAAMW03	Downgradient of IAA	3566913.67	10850758.28	2091.77	80.7	2008.36	2094.51	76.60	67.12	2027.39	76.60	2017.91	54.41	2040.10
IAAMW04	Downgradient of IAA, near unnamed stream	3565504.32	10851159.66	2020.70	90.5	1927.31	2023.64	64.74	63.00	1960.64	64.74	1958.90	56.81	1966.83
NBGMW01	Near the center of former burning area, in area with highest lead concentrations in soil	3569777.80	10851810.48	2115.79	98.0	2015.24	2118.34	94.20	93.58	2024.76	94.20	2024.14	79.50	2038.84
NBGMW02	North of former burning area, near NRU installation boundary	3569872.47	10851804.11	2110.05	103.4	2004.08	2112.67	98.54	97.65	2015.02	98.54	2014.13	80.51	2032.16
WBGMW01	Center of former burning area	3565783.83	10849309.86	2057.85	28.8	2026.52	2060.38	12.42	26.97	2033.41	12.42	2047.96	10.21	2050.17
WBGMW02	Between former burning area and pond	3565612.88	10849437.23	2060.85	52.0	2006.39	2063.35	21.95	40.51	2022.84	21.95	2041.40	20.25	2043.10
WBGMW03	Between former burning area and pond	3565596.35	10849266.40	2050.87	51.5	1997.04	2053.18	15.18	13.16	2040.02	15.18	2038.00	8.50	2044.68

[1] Coordinates in NAD 1983, US State Plane (Virginia South).
[2] Depth to Water Measurements collected by Shaw.
[3] Depth to Water Measurements collected by ARCADIS.
[4] Depth to Water Measurements collected by ARCADIS.
ft Feet.
ft bls Feet below land surface.
ft amsl Feet above mean sea level.
ft btoc Feet below top of casing.

Table 4-1
Screening Levels for the Protection of Human Health
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Adjusted Soil Risk Screening Level [a,b] Residential Scenario (mg/kg)		Industrial Scenario (mg/kg)		Surrogate	Adjusted Tap Water Regional Screening Level (RSL) [a,c] (mg/L)		Surrogate
Volatile Organic Compounds									
1,2,3-Trichloropropane	96-18-4	9.10E-02	c	4.10E-01	c		9.60E-06	c	
1,2,4-Trimethylbenzene	95-63-6	6.70E+00	n	2.80E+01	ns		1.50E-03	n	
2-Butanone	78-93-3	2.80E+03	ns	1.90E+04	nms		7.10E-01	n	
3-Octanone	106-68-3	NA		NA			NA		
4-Methyl-2-pentanone	108-10-1	5.30E+02	ns	5.20E+03	ns		2.00E-01	n	
Acetone	67-64-1	6.10E+03	n	6.10E+04	nms		2.20E+00	n	
Bromodichloromethane	75-27-4	1.00E+01	c	4.60E+01	c		1.10E-03	c	
Carbon Disulfide	75-15-0	6.70E+01	ns	3.00E+02	ns		1.00E-01	n	
Chloroform	67-66-3	3.00E-01	c	1.50E+00	c		1.90E-04	c	
cis-1,2-Dichloroethene	156-59-2	7.80E+01	n	1.00E+03	ns		3.70E-02	n	
d-Limonene	5989-27-5	NA		NA			NA		
Ethanol	64-17-5	NA		NA			NA		
m,p-Xylene	136777612	6.00E+01	ns	2.60E+02	ns	p-Xylene	2.00E-02	n	p-Xylene
Methylene Chloride	75-09-2	1.10E+01	c	5.40E+01	c		4.80E-03	c	
p-Isopropyltoluene	99-87-6	2.20E+02	ns	1.10E+03	ns	Isopropylbenzene	6.80E-02	n	Isopropylbenzene
Tetrachloroethene	127-18-4	5.70E-01	c	2.70E+00	c		1.10E-04	c	
Toluene	108-88-3	5.00E+02	ns	4.60E+03	ns		2.30E-01	n	
Trichloroethene	79-01-6	2.80E+00	c	1.40E+01	c		1.70E-03	c	
Xylenes (total)	1330-20-7	6.00E+01	ns	2.60E+02	ns		2.00E-02	n	
Semi-Volatile Organic Compounds									
1,2,4-Trichlorobenzene	120-82-1	8.70E+00	n	4.00E+01	ns		8.20E-04	n	
1,2-Dichlorobenzene	95-50-1	2.00E+02	ns	1.00E+03	ns		3.70E-02	n	
1,3-Dichlorobenzene	541-73-1	2.00E+02	ns	1.00E+03	ns	1,2-Dichlorobenzene	3.70E-02	n	1,2-Dichlorobenzene
1,4-Dichlorobenzene	106-46-7	2.60E+00	c	1.30E+01	c		4.30E-04	c	
2,4-Dinitrotoluene	121-14-2	1.20E+01	n	1.20E+02	n		7.30E-03	n	
2,6-Dinitrotoluene	606-20-2	6.10E+00	n	6.20E+01	n		3.70E-03	n	
3,3'-Dichlorobenzidine	91-94-1	1.10E+00	c	3.80E+00	c		1.50E-04	c	
4-Methylphenol	106-44-5	3.10E+01	n	3.10E+02	n		1.80E-02	n	
Benzoic Acid	65-85-0	2.40E+04	nm	2.50E+05	nm		1.50E+01	n	
bis(2-Ethylhexyl)phthalate	117-81-7	3.50E+01	c*	1.20E+02	c*		4.80E-03	c	
Butylbenzylphthalate	85-68-7	2.60E+02	c*	9.10E+02	c		3.50E-02	c	
Carbazole	86-74-8	NA		NA			NA		
Dibenzofuran	132-64-9	7.80E+00	n	1.00E+02	n	Furan	3.70E-03	n	Furan
Diethylphthalate	84-66-2	4.90E+03	n	4.90E+04	nm		2.90E+00	n	
Di-n-Butylphthalate	84-74-2	6.10E+02	n	6.20E+03	n		3.70E-01	n	
Di-n-Octylphthalate	117-84-0	6.10E+02	n	6.20E+03	n	di-n-Butylphthalate	3.70E-01	n	di-n-Butylphthalate
N-Nitrosodiphenylamine	86-30-6	9.90E+01	c	3.50E+02	c		1.40E-02	c	
Pentachlorophenol	87-86-5	3.00E+00	c	9.00E+00	c		5.60E-04	c	
Phenol	108-95-2	1.80E+03	n	1.80E+04	nm		1.10E+00	n	
Dioxin/Furan Compounds									
1,2,3,4,6,7,8-HpCDD	35822-46-9	4.50E-04	c	1.80E-03	c	Total HpCDD	5.20E-08	c	Total HpCDD
1,2,3,4,6,7,8-HpCDF	67562-39-4	3.70E-04	c	1.30E-03	c	Total HpCDF	5.20E-08	c	Total HpCDF
1,2,3,4,7,8,9-HpCDF	55673-89-7	3.70E-04	c	1.30E-03	c	Total HpCDF	5.20E-08	c	Total HpCDF
1,2,3,4,7,8-HxCDD	39227-28-6	4.50E-05	c	1.80E-04	c	Total HxCDD	5.20E-09	c	Total HxCDD
1,2,3,4,7,8-HxCDF	70648-26-9	3.70E-05	c	1.30E-04	c	Total HxCDF	5.20E-09	c	Total HxCDF
1,2,3,6,7,8-HxCDD	57653-85-7	4.50E-05	c	1.80E-04	c	Total HxCDD	5.20E-09	c	Total HxCDD
1,2,3,6,7,8-HxCDF	57117-44-9	3.70E-05	c	1.30E-04	c	Total HxCDF	5.20E-09	c	Total HxCDF
1,2,3,7,8,9-HxCDD	19408-74-3	4.50E-05	c	1.80E-04	c	Total HxCDD	5.20E-09	c	Total HxCDD
1,2,3,7,8,9-HxCDF	72918-21-9	3.70E-05	c	1.30E-04	c	Total HxCDF	5.20E-09	c	Total HxCDF
1,2,3,7,8-PeCDD	40321-76-4	4.50E-06	c	1.80E-05	c	Total PeCDD	5.20E-10	c	Total PeCDD
1,2,3,7,8-PeCDF	57117-41-6	1.20E-04	c	4.40E-04	c		1.70E-08	c	
2,3,4,6,7,8-HxCDF	60851-34-5	3.70E-05	c	1.30E-04	c	Total HxCDF	5.20E-09	c	Total HxCDF
2,3,4,7,8-PeCDF	57117-31-4	1.20E-05	c	4.40E-05	c		1.70E-09	c	
2,3,7,8-TCDD	1746-01-6	4.50E-06	c*	1.80E-05	c*		5.20E-10	c*	
2,3,7,8-TCDF	51207-31-9	3.70E-05	c	1.30E-04	c		5.20E-09	c	
OCDD	3268-87-9	1.50E-02	c	6.10E-02	c		1.70E-06	c	
OCDF	39001-02-0	1.20E-02	c	4.40E-02	c		1.70E-06	c	
Explosives									
1,3,5-Trinitrobenzene	99-35-4	2.20E+02	n	2.70E+03	n		1.10E-01	n	
1,3-Dinitrobenzene	99-65-0	6.10E-01	n	6.20E+00	n		3.70E-04	n	
2,4,6-Trinitrotoluene	118-96-7	3.60E+00	c**	4.20E+01	c**		1.80E-03	c**	
4-Amino-2,6-Dinitrotoluene	19406-51-0	1.50E+01	n	1.90E+02	n		7.30E-03	n	
m-Nitrotoluene	99-08-1	1.20E+02	n	1.20E+03	n		7.30E-02	n	
Nitrobenzene	98-95-3	3.10E+00	n	2.80E+01	n		3.40E-04	n	
Nitroglycerine	55-63-0	6.10E-01	n	6.20E+00	n		3.70E-04	n	
Pentaerythritol Tetranitrate	78-11-5	NA		NA			NA		

Table 4-1
Screening Levels for the Protection of Human Health
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Adjusted Soil Risk Screening Level [a,b] Residential Scenario (mg/kg)		Industrial Scenario (mg/kg)		Surrogate	Adjusted Tap Water Regional Screening Level (RSL) [a,c] (mg/L)		Surrogate
Perchlorate	14797-73-0	5.50E+00	n	7.20E+01	n		2.60E-03	n	
Herbicides									
2,4,5-T	93-76-5	6.10E+01	n	6.20E+02	n		3.70E-02	n	
2,4,5-TP	93-72-1	4.90E+01	n	4.90E+02	n		2.90E-02	n	
2,4-D	94-75-7	6.90E+01	n	7.70E+02	n		3.70E-02	n	
2,4-DB	94-82-6	4.90E+01	n	4.90E+02	n		2.90E-02	n	
Dalapon	75-99-0	1.80E+02	n	1.80E+03	n		1.10E-01	n	
Dicamba	1918-00-9	1.80E+02	n	1.80E+03	n		1.10E-01	n	
Dichlorprop	120-36-5	NA		NA			NA		
MCPA	94-74-6	3.10E+00	n	3.10E+01	n		1.80E-03	n	
MCPP	93-65-2	6.10E+00	n	6.20E+01	n		3.70E-03	n	
Pesticides									
4,4'-DDD	72-54-8	2.00E+00	c	7.20E+00	c		2.80E-04	c	
4,4'-DDE	72-55-9	1.40E+00	c	5.10E+00	c		2.00E-04	c	
4,4'-DDT	50-29-3	1.70E+00	c*	7.00E+00	c*		2.00E-04	c*	
Alpha-BHC	319-84-6	7.70E-02	c	2.70E-01	c		1.10E-05	c	
Alpha-Chlordane	5103-71-9	1.60E+00	c*	6.50E+00	c*	Chlordane	1.90E-04	c*	Chlordane
Beta-BHC	319-85-7	2.70E-01	c	9.60E-01	c		3.70E-05	c	
Delta-BHC	319-86-8	5.20E-01	c*	2.10E+00	c	gamma-BHC	6.10E-05	c	gamma-BHC
Dieldrin	60-57-1	3.00E-02	c	1.10E-01	c		4.20E-06	c	
Endosulfan I	115-29-7	3.70E+01	n	3.70E+02	n		2.20E-02	n	
Endosulfan II	33213-65-9	3.70E+01	n	3.70E+02	n	Endosulfan	2.20E-02	n	Endosulfan
Endosulfan Sulfate	1031-07-8	3.70E+01	n	3.70E+02	n	Endosulfan	2.20E-02	n	Endosulfan
Endrin	72-20-8	1.80E+00	n	1.80E+01	n		1.10E-03	n	
Endrin Aldehyde	7421-93-4	1.80E+00	n	1.80E+01	n	Endrin	1.10E-03	n	Endrin
Endrin Ketone	53494-70-5	1.80E+00	n	1.80E+01	n	Endrin	1.10E-03	n	Endrin
Gamma-BHC (Lindane)	58-89-9	5.20E-01	c*	2.10E+00	c		6.10E-05	c	
Gamma-Chlordane	5566-34-7	1.60E+00	c*	6.50E+00	c*	Chlordane	1.90E-04	c*	Chlordane
Heptachlor	76-44-8	1.10E-01	c	3.80E-01	c		1.50E-05	c	
Heptachlor Epoxide	1024-57-3	5.30E-02	c*	1.90E-01	c*		7.40E-06	c*	
Methoxychlor	72-43-5	3.10E+01	n	3.10E+02	n		1.80E-02	n	
Polycyclic Aromatic Hydrocarbons									
2-Methylnaphthalene	91-57-6	3.10E+01	n	4.10E+02	ns		1.50E-02	n	
Acenaphthene	83-32-9	3.40E+02	n	3.30E+03	n		2.20E-01	n	
Acenaphthylene	208-96-8	3.40E+02	n	3.30E+03	n	Acenaphthene	2.20E-01	n	Acenaphthene
Anthracene	120-12-7	1.70E+03	n	1.70E+04	nm		1.10E+00	n	
Benzo(a)anthracene	56-55-3	1.50E-01	c	2.10E+00	c		2.90E-05	c	
Benzo(a)pyrene	50-32-8	1.50E-02	c	2.10E-01	c		2.90E-06	c	
Benzo(b)fluoranthene	205-99-2	1.50E-01	c	2.10E+00	c		2.90E-05	c	
Benzo(g,h,i)perylene	191-24-2	1.70E+02	n	1.70E+03	n	Pyrene	1.10E-01	n	Pyrene
Benzo(k)fluoranthene	207-08-9	1.50E+00	c	2.10E+01	c		2.90E-04	c	
Chrysene	218-01-9	1.50E+01	c	2.10E+02	c		2.90E-03	c	
Dibenzo(a,h)anthracene	53-70-3	1.50E-02	c	2.10E-01	c		2.90E-06	c	
Fluoranthene	206-44-0	2.30E+02	n	2.20E+03	n		1.50E-01	n	
Fluorene	86-73-7	2.30E+02	n	2.20E+03	n		1.50E-01	n	
Indeno(1,2,3-cd)pyrene	193-39-5	1.50E-01	c	2.10E+00	c		2.90E-05	c	
Naphthalene	91-20-3	3.90E+00	c*	2.00E+01	c*		1.40E-04	c*	
Phenanthrene	85-01-8	1.70E+03	n	1.70E+04	nm	Anthracene	1.10E+00	n	Anthracene
Pyrene	129-00-0	1.70E+02	n	1.70E+03	n		1.10E-01	n	
Polychlorinated Biphenyls									
Aroclor 1254	11097-69-1	1.10E-01	c**	7.40E-01	c*		3.40E-05	c*	
Aroclor 1260	11096-82-5	2.20E-01	c	7.40E-01	c		3.40E-05	c	
Inorganics									
Aluminum	7429-90-5	7.70E+03	n	9.90E+04	nm		3.70E+00	n	
Antimony	7440-36-0	3.10E+00	n	4.10E+01	n		1.50E-03	n	
Arsenic	7440-38-2	3.90E-01	c*	1.60E+00	c		4.50E-05	c	
Barium	7440-39-3	1.50E+03	n	1.90E+04	nm		7.30E-01	n	
Beryllium	7440-41-7	1.60E+01	n	2.00E+02	n		7.30E-03	n	
Cadmium	7440-43-9	7.00E+00	n	8.10E+01	n		1.80E-03	n	
Calcium	7440-70-2	NA		NA			NA		
Chromium	7440-47-3	2.80E+02	c	1.40E+03	c		5.50E+00	n	
Cobalt	7440-48-4	2.30E+00	n	3.00E+01	n		1.10E-03	n	
Copper	7440-50-8	3.10E+02	n	4.10E+03	n		1.50E-01	n	
Iron	7439-89-6	5.50E+03	n	7.20E+04	nm		2.60E+00	n	
Lead	7439-92-1	4.00E+02	n<	8.00E+02	n<		1.50E-02	n<	
Magnesium	7439-95-4	NA		NA			NA		
Manganese	7439-96-5	1.80E+02	n	2.30E+03	n		8.80E-02	n	

Table 4-1
Screening Levels for the Protection of Human Health
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Adjusted Soil Risk Screening Level [a,b] Residential Scenario (mg/kg)		Industrial Scenario (mg/kg)		Surrogate	Adjusted Tap Water Regional Screening Level (RSL) [a,c] (mg/L)		Surrogate
Mercury	7439-97-6	6.70E-01	ns	2.80E+00	ns		6.30E-05	n	
Nickel	7440-02-0	1.60E+02	n	2.00E+03	n		7.30E-02	n	
Potassium	7440-09-7	NA		NA			NA		
Selenium	7782-49-2	3.90E+01	n	5.10E+02	n		1.80E-02	n	
Silver	7440-22-4	3.90E+01	n	5.10E+02	n		1.80E-02	n	
Sodium	7440-23-5	NA		NA			NA		
Thallium	7440-28-0	5.10E-01	n	6.60E+00	n		2.40E-04	n	
Vanadium	7440-62-2	5.50E+01	n	7.20E+02	n		2.60E-02	n	
Zinc	7440-66-6	2.30E+03	n	3.10E+04	nm		1.10E+00	n	

Notes:
COPC = Constituent of Potential Concern
mg/kg = Milligrams per kilogram.
mg/L = Milligrams per liter.

[a] Regional screening levels were from USEPA (2008a).

The screening levels used were risk screening levels for the residential scenario from USEPA (2008a). Screening levels based on non-cancer effects were adjusted by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit;
s = Concentration may exceed saturation concentration (Csat).
< The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.

[b] Adjusted soil screening levels were used to assess soil and sediment at the NRU.
[c] Adjusted tap-water screening levels were used to assess surface water and groundwater at the NRU.

Table 4-2. Facility Wide Background Inorganics Concentrations, Radford Army Ammunition Plant, Radford, Virginia.

	Range of Data (mg/kg)			Background Concentration 95% UTL (mg/kg)
Inorganics				
Aluminum	3,620	-	47,900	40,041
Arsenic	1.2	-	35.9	15.8
Barium	23.4	-	174	209
Beryllium	0.61	-	5.4	1.02
Cadmium	0.62	-	2.5	0.69
Chromium	6.3	-	75.8	65.3
Cobalt	5.9	-	130	72.3
Copper	1.6	-	38.7	53.5
Iron	7,250	-	67,700	50,962
Lead	2.1	-	256	26.8
Manganese	16.7	-	2,040	2,543
Mercury	0.038	-	1.2	0.13
Nickel	4.6	-	94.2	62.8
Thallium	1.3	-	5.0	2.11
Vanadium	12.2	-	114	108
Zinc	4.7	-	598	202

mg/kg Milligrams per kilogram.
UTL Upper Tolerance Limit.

Table 5-1. Soil Analytical Results, Building Debris Disposal Trench, 1997 ATK Preliminary Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background	Units	SOIL/CREOSOTE SAMPLE 0-1 10/17/97
PAHs					
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	200
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	491
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	330
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	168
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	96
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	314
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	76.7
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	1,302
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	183
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	160
Naphthalene	3.9 {nc}	20 {nc}	- -	mg/kg	57.2
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	1,336
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	930

mg/kg	Milligrams per kilogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{max}	Concentration may exceed ceiling limit.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).

Table 5-2. Sediment Analytical Results, Building Debris Disposal Trench, 1998 Gannett Flemming Independent Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	SD-06 3/31/98 -	SD-07 3/31/98 -	SD-08 3/31/98 -
TCL SVOCs							
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	ND	ND	0.4
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	ND	ND	1.02
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}		mg/kg	ND	ND	0.98
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	ND	ND	1.36
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	ND	ND	0.95
Bis(2-Ethylhexyl)phthalate	35 {ca*}	120 {ca*}		mg/kg	ND	0.07	ND
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	ND	ND	1.32
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	ND	ND	3.49
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	ND	ND	0.42
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	ND	ND	2.68
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	ND	ND	2.23
TAL Inorganics							
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	21,800	19,000	13,100
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	4.6	5	2.9
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	113	112	55.7
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	**1.2**	**1.2**	0.9
Calcium	- -	- -	- -		26,800	95,300	1,220
Chromium	280 {ca}	1,460 {ca}	65.3	mg/kg	39.2	49.3	27.2
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	19.1	15.8	16.1
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	16.6	32.1	45.5
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	31,700	31,200	22,400
Lead	400 {++}	800 {++}	26.8	mg/kg	16.5	**33**	**58.7**
Magnesium	- -	- -	- -	mg/kg	10,400	7,540	4,400
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	1,250	960	815
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	20.4	16.7	16.6
Potassium	- -	- -	- -	mg/kg	2,870	2,280	1,360
Sodium	- -	- -	- -	mg/kg	ND	120	ND
Vanadium	55 {nc}	720 {nc}	108	mg/kg	60.5	56.6	42.4
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	43.4	47.3	74.6

mg/kg	Milligrams per kilogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
ND	Not Detected.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 5-3. Surface Water Analytical Results, Building Debris Disposal Trench, 1998 Gannett Flemming Independent Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Date Collected:	Adjusted Tapwater Screening Values [a]	Units	SW-07 03/31/98
Inorganics			
Calcium	- -	µg/L	60,300
Iron	26,000 {nc}	µg/L	165
Magnesium	- -	µg/L	14,800
Potassium	- -	µg/L	2,800
Sodium	- -	µg/L	32,400

µg/L	Micrograms per liter.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
	Adjusted tap-water screening levels used to assess surface water at the NRU.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
28,000	Highlighted value indicates constituent concentration is above adjusted tap water RSL.

Table 5-4. Soil Analytical Results, Building Debris Disposal Trench, 1998 ICF KE Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	DTSS1 0 - 0.5 08/11/98	DTSS2 0 - 0.5 08/11/98	DTSS3 0 - 0.5 08/11/98	DTSB1 0.5 - 1 08/12/98	DTSB2 2.5 - 3 08/12/98
Explosives									
1,3,5-Trinitrobenzene	220 {nc}	2,700 {nc}	- -	mg/kg	<0.2	<0.3	<0.3	<0.2	<0.3
1,3-Dinitrobenzene	0.61 {nc}	6.2 {nc}	- -	mg/kg	<0.2	<0.3	<0.3	<0.2	<0.3
2,4,6-Trinitrotoluene	3.6 {ca**}	42 {ca**}	- -	mg/kg	<0.2	<0.3	<0.3	<0.2	<0.3
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.2	<0.3	<0.3	<0.2	<0.3
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	<0.2	<0.3	<0.3	<0.2	<0.3
2-Amino-4,6-Dinitrotoluene	15 {nc}	190 {nc}	- -	mg/kg	<0.2	<0.3	<0.3	<0.2	<0.3
4-Amino-2,6-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.2	<0.3	<0.3	<0.2	<0.3
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	<0.2	<0.3	<0.3	<0.2	<0.3
HMX	310 {nc}	3,100 {nc}	- -	mg/kg	<2.4	<2.5	<2.5	<2.4	<2.5
m-Nitrotoluene	- -	- -	- -	mg/kg	<0.2	<0.3	<0.3	<0.2	<0.3
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	<0.2	<0.3	<0.3	<0.2	<0.3
Nitroglycerine	0.61 {nc}	6.2 {nc}	- -	mg/kg	<1.2	<1.3	<1.3	<1.2	<1.3
o-Nitrotoluene	78 {nc}	1,300 {sat}	- -	mg/kg	<0.2	<0.3	<0.3	<0.2	<0.3
Pentaerythritol Tetranitrate	- -	- -	- -	mg/kg	<1.2	<1.3	<1.3	<1.2	<1.3
p-Nitrotoluene	30 {ca**}	110 {ca*}	- -	mg/kg	<0.2	<0.3	<0.3	<0.2	<0.3
RDX	4.4 {ca*}	16 {ca}	- -	mg/kg	<0.2	<0.3	<0.3	<0.2	<0.3
Tetryl	24 {nc}	250 {nc}	- -	mg/kg	<0.2	<0.3	<0.3	<0.2	<0.3
PAHs									
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	NA	NA	NA	<0.020	<0.020
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	NA	NA	NA	<0.040	<0.040
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	NA	NA	NA	0.0087	<0.0022
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	0.020	<0.0022
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	NA	NA	NA	0.030	<0.0022
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	0.040	<0.0044
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	NA	NA	NA	0.0098 J	<0.0044
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	NA	NA	NA	0.020	<0.0022
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	NA	NA	NA	0.030	<0.0022
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	NA	NA	NA	0.0018 J	<0.0044 J
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	NA	NA	NA	0.070	0.0025 J
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	NA	NA	NA	<0.0043	<0.0044
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	0.020	<0.0022
Naphthalene	3.9 {nc}	20 {nc}	- -	mg/kg	NA	NA	NA	<0.020	<0.020
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	NA	NA	NA	0.040	<0.0022
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	NA	NA	NA	0.070	0.0026
Volatile Organics									
1,1,1,2-Tetrachloroethane	2 {ca}	9.8 {ca}	- -	mg/kg	<0.0020	<0.0020 J	R	<0.0020	<0.0010
1,1,1-Trichloroethane	680 {sat}	680 {sat}	- -	mg/kg	<0.0010	<0.0010 J	R	<0.0010	<0.0010
1,1,2,2-Tetrachloroethane	0.59 {ca**}	2.9 {ca**}	- -	mg/kg	<0.0020	<0.0020 J	R	<0.0020	<0.0020
1,1,2-Trichloroethane	1.1 {ca}	5.5 {ca}	- -	mg/kg	<0.0020	<0.0020 J	R	<0.0020	<0.0020
1,1-Dichloroethane	3.4 {ca}	17 {ca}	- -	mg/kg	<0.0020	<0.0020 J	R	<0.0020	<0.0020
1,1-Dichloroethene	25 {nc}	110 {nc}	- -	mg/kg	<0.0020	<0.0020 J	R	<0.0030	<0.0020
1,1-Dichloropropene	- -	- -	- -	mg/kg	<0.0010	<0.0020 J	R	<0.0020	<0.0010
1,2,3-Trichlorobenzene	- -	- -	- -	mg/kg	<0.0020	<0.0020 J	R	<0.0020	<0.0020
1,2,3-Trichloropropane	0.091 {ca}	0.41 {ca}	- -	mg/kg	<0.0030	<0.0030 J	R	<0.0040	<0.0030
1,2,4-Trichlorobenzene	180 {ca**}	220 {sat}	- -	mg/kg	<0.0020	<0.0020 J	NA	<0.0020	<0.0010
1,2,4-Trimethylbenzene	6.7 {nc}	28 {nc}	- -	mg/kg	0.0040	<0.0020 J	0.0030 J	<0.0020	<0.0020
1,2-Dibromo-3-chloropropane	0.0056 {ca}	0.073 {ca}	- -	mg/kg	<0.0060	<0.0070 J	R	<0.0070	<0.0060
1,2-Dibromoethane	0.034 {ca}	0.17 {ca}	- -	mg/kg	<0.0020	<0.0020 J	R	<0.0020	<0.0020
1,2-Dichlorobenzene	220 {sat}	220 {sat}	- -	mg/kg	<0.0010	<0.0010 J	NA	<0.0010	<0.0010
1,2-Dichloroethane	0.45 {ca}	2.2 {ca}	- -	mg/kg	<0.0010	<0.0010 J	R	<0.0010	<0.0010
1,2-Dichloropropane	0.93 {ca*}	4.7 {ca*}	- -	mg/kg	<0.0040	<0.0040 J	R	<0.0050	<0.0040
1,3,5-Trimethylbenzene	- -	- -	- -	mg/kg	<0.0020	<0.0020 J	R	<0.0020	<0.0020
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	<0.0020	<0.0020 J	NA	<0.0020	<0.0010
1,3-Dichloropropane	160 {nc}	1,600 {sat}	- -	mg/kg	<0.0020	<0.0020 J	R	<0.0020	<0.0010
1,4-Dichlorobenzene	2.6 {ca}	13 {ca}	- -	mg/kg	<0.0020	<0.0020 J	NA	<0.0020	<0.0010
2,2-Dichloropropane	- -	- -	- -	mg/kg	<0.0010	<0.0010 J	R	<0.0010	<0.0010
2-Butanone	2,800 {nc}	19,000 {nc}	- -	mg/kg	<0.0060 J	<0.0070 J	R	<0.0070 J	<0.0060 J
2-Chloroethyl Vinyl Ether	- -	- -	- -	mg/kg	<0.0060	<0.0070 J	R	<0.0070	<0.0060
2-Chlorotoluene	1,000 {sat}	1,000 {sat}	- -	mg/kg	<0.0010	<0.0010 J	R	<0.0020	<0.0010
2-Hexanone	- -	- -	- -	mg/kg	<0.0060	<0.0070 J	R	<0.0070	<0.0060
4-Chlorotoluene	290 {sat}	290 {sat}	- -	mg/kg	<0.0010	<0.0010 J	R	<0.0010	<0.0010
4-Methyl-2-pentanone	530 {nc}	5,200 {sat}	- -	mg/kg	<0.0060	<0.0070 J	R	<0.0070	<0.0060
Acetone	6,100 {nc}	61,000 {nc}	- -	mg/kg	<0.0060 J	<0.0070 J	R	<0.0070 J	<0.0060 J
Acrolein	0.016 {nc}	0.068 {nc}	- -	mg/kg	<0.0060	<0.0070 J	R	<0.0070	<0.0060
Acrylonitrile	0.24 {ca*}	1.2 {ca*}	- -	mg/kg	<0.0060	<0.0070 J	R	<0.0070	<0.0060
Benzene	1.1 {ca*}	5.6 {ca*}	- -	mg/kg	<0.0010	<0.0010 J	R	<0.0010	<0.0010
Bromobenzene	- -	- -	- -	mg/kg	<0.0010	<0.0010 J	R	<0.0010	<0.0010
Bromochloromethane	- -	- -	- -	mg/kg	<0.0020	<0.0020 J	R	<0.0020	<0.0020
Bromodichloromethane	10 {ca}	46 {ca}	- -	mg/kg	<0.0010	<0.0010 J	R	<0.0010	<0.0010
Bromoform	61 {ca*}	220 {ca*}	- -	mg/kg	<0.00060	<0.00070 J	R	<0.00070	<0.00060
Bromomethane	0.79 {nc}	3.5 {nc}	- -	mg/kg	<0.0050	<0.0050 J	R	<0.0050	<0.0040
Carbon Disulfide	67 {nc}	300 {nc}	- -	mg/kg	<0.0060	<0.0070 J	R	<0.0070	<0.0060
Carbon Tetrachloride	0.25 {ca}	1.3 {ca}	- -	mg/kg	<0.0050	<0.0050 J	R	<0.0060	<0.0050
Chlorobenzene	31 {nc}	860 {sat}	- -	mg/kg	<0.0010	<0.0010 J	R	<0.0020	<0.0010
Chloroethane	2,200 {sat}	2,200 {sat}	- -	mg/kg	<0.0060	<0.0070 J	R	<0.0070	<0.0060
Chloroform	0.3 {ca}	1.5 {ca}	- -	mg/kg	<0.0020	<0.0020 J	R	<0.0020	<0.0010
Chloromethane	1.7 {ca*}	8.4 {ca*}	- -	mg/kg	<0.0040	<0.0040 J	R	<0.0050	<0.0040
cis-1,2-Dichloroethene	78 {nc}	1,300 {sat}	- -	mg/kg	<0.0020	<0.0020 J	R	<0.0020	<0.0020
cis-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.0010	<0.0010 J	R	<0.0010	<0.0010
Dibromochloromethane	5.8 {ca}	21 {ca}	- -	mg/kg	<0.00090	<0.00090 J	R	<0.0010	<0.00080
Dibromomethane	78 {nc}	3,000 {sat}	- -	mg/kg	<0.0020	<0.0020 J	R	<0.0020	<0.0020
Dichlorodifluoromethane	19 {nc}	78 {nc}	- -	mg/kg	<0.0020	<0.0020 J	R	<0.0020	<0.0020
Ethylbenzene	5.7 {ca}	29 {ca}	- -	mg/kg	<0.0010	<0.0010 J	R	<0.0020	<0.0010
Hexachlorobutadiene	6.2 {ca**}	22 {ca*}	- -	mg/kg	<0.0010	<0.0010 J	R	<0.0010	<0.0010
Isopropylbenzene	310 {sat}	310 {sat}	- -	mg/kg	<0.0020	<0.0020 J	R	<0.0020	<0.0020
m,p-Xylene	60 {nc}	260 {nc}	- -	mg/kg	0.0030	<0.0030 J	R	<0.0030	<0.0030
Methylene Chloride	11 {ca}	54 {ca}	- -	mg/kg	<0.0010	<0.0010 J	R	<0.0010	<0.0010
n-Butylbenzene	- -	- -	- -	mg/kg	<0.0020	<0.0020 J	R	<0.0020	<0.0020
n-Propylbenzene	- -	- -	- -	mg/kg	<0.0020	<0.0020 J	R	<0.0020	<0.0020
o-Xylene	300 {sat}	300 {sat}	- -	mg/kg	<0.0020	<0.0020 J	R	<0.0020	<0.0010
p-Isopropyltoluene	- -	- -	- -	mg/kg	<0.0010	<0.0010 J	R	<0.0010	<0.0010
sec-Butylbenzene	- -	- -	- -	mg/kg	<0.0020	<0.0020 J	R	<0.0020	<0.0010
Styrene	1,000 {sat}	1,000 {sat}	- -	mg/kg	<0.00030	<0.00030 J	R	<0.00030	<0.00020
tert-Butylbenzene	- -	- -	- -	mg/kg	<0.0020	<0.0020 J	R	<0.0020	<0.0010
Tetrachloroethene	0.57 {ca}	2.7 {ca}	- -	mg/kg	<0.0010	<0.0010 J	R	<0.0020	<0.0010
Toluene	500 {nc}	4600 {nc}	- -	mg/kg	<0.0020	<0.0020 J	R	<0.0020	<0.0020
trans-1,2-Dichloroethene	11 {nc}	50 {nc}	- -	mg/kg	<0.0050	<0.0060 J	R	<0.0060	<0.0050
trans-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.0010	<0.0010 J	R	<0.0010	<0.0010
Trichloroethene	2.8 {ca}	14 {ca}	- -	mg/kg	<0.0030	<0.0030 J	R	<0.0040	<0.0030
Trichlorofluoromethane	80 {nc}	1,300 {sat}	- -	mg/kg	<0.0020	<0.0020 J	R	<0.0020	<0.0010
Vinyl Acetate	99 {nc}	2,800 {sat}	- -	mg/kg	<0.0060	<0.0070 J	R	<0.0070	<0.0060
Vinyl Chloride	0.06 {ca}	1.7 {ca}	- -	mg/kg	<0.0020	<0.0020 J	R	<0.0030	<0.0020
Xylenes (total)	60 {nc}	260 {nc}	- -	mg/kg	0.0030	<0.0030	R	<0.0030	<0.0030

Location ID: Sample Depth(Feet): Date Collected:	DTSB3 2.5 - 3 08/12/98	DTSB4 2.5 - 3 08/12/98	DTSB5 0.5 - 1 08/12/98	DTSB6 1 - 1.5 08/12/98	DTSB7 2 - 2.5 08/12/98	DTSB8 1 - 1.5 08/12/98	DTSB9 3 - 3.5 08/12/98	DTSB10 3.5 - 4 08/12/98	DTSB11 3.5 - 4 08/12/98	DTSB12 3.5 - 4 08/12/98	DTSB13 0.5 - 1 08/12/98	DTSB14 3.5 - 4 08/12/98	DTSB15 2 - 2.5 08/13/98	DTSB16 2 - 2.5 08/18/98
Explosives														
1,3,5-Trinitrobenzene	<0.2 [<0.2]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.3
1,3-Dinitrobenzene	<0.2 [<0.2]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.3
2,4,6-Trinitrotoluene	<0.2 [<0.2]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.3
2,4-Dinitrotoluene	<0.2 [<0.2]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.3
2,6-Dinitrotoluene	<0.2 [<0.2]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.3
2-Amino-4,6-Dinitrotoluene	<0.2 [<0.2]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.3
4-Amino-2,6-Dinitrotoluene	<0.2 [<0.2]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.3
Dinitrotoluene Mix	<0.2 [<0.2]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.3
HMX	<2.4 [<2.4]	<2.2	<2.4	<2.4	<2.2	<2.3	<2.4	<2.1	<2.3	<2.2	<2.4	<2.4	<2.1	<3
m-Nitrotoluene	<0.2 [<0.2]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.3
Nitrobenzene	<0.2 [<0.2]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.3
Nitroglycerine	<1.2 [<1.2]	<1.1	<1.2	<1.2	<1.1	<1.1	<1.2	<1.1	<1.1	<1.1	<1.2	<1.2	<1.1	<1.3
o-Nitrotoluene	<0.2 [<0.2]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.3
Pentaerythritol Tetranitrate	<1.2 [<1.2]	<1.1	<1.2	<1.2	<1.1	<1.1	<1.2	<1.1	<1.1	<1.1	<1.2	<1.2	<1.1	<1.3
p-Nitrotoluene	<0.2 [<0.2]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.3
RDX	<0.2 [<0.2]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.3
Tetryl	<0.2 [<0.2]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.3
PAHs														
Acenaphthene	<0.020 [<0.020]	<0.020	<0.020	<0.020	<0.020	<0.42	<0.43	<0.41	<0.43	<0.020	<0.41	<0.020	<0.020	4.0 J
Acenaphthylene	<0.040 [<0.040]	<0.040	<0.040	<0.040	<0.040	<0.84	<0.85	<0.82	<0.86	<0.040	<0.82	<0.040	<0.040	<17
Anthracene	<0.0021 [0.0018 J]	<0.0020	<0.0020	<0.0020	<0.0020	0.33	0.54	0.25	0.020 J	0.00080 J	0.090	0.020	0.0056	11
Benzo(a)anthracene	<0.0021 [0.0028]	<0.0020	<0.0020	<0.0020	<0.0020	0.80	0.88	0.34	0.020 J	0.0011 J	0.27	0.040	0.0077	20
Benzo(a)pyrene	<0.0021 [0.0039]	0.0030	<0.0020	<0.0020	0.0020	0.83	0.85	0.41	0.020 J	0.0021	0.23	0.050	0.0071	22
Benzo(b)fluoranthene	<0.0041 [0.0043]	<0.0040	<0.0040	<0.0040	0.00070 J	0.94	1.2	0.44	0.040 J	0.0043	0.36	0.060	0.0089	27
Benzo(g,h,i)perylene	<0.0041 [<0.0040]	<0.0040	<0.0040	<0.0040	<0.0040	0.29 J	0.56 J	0.14 J	<0.080	0.0017 J	0.090 J	0.030 J	0.0025 J	10 J
Benzo(k)fluoranthene	<0.0021 [0.0022]	<0.0020	<0.0020	<0.0020	0.0012 J	0.67	0.43	0.16	0.020 J	0.0018 J	0.15	0.020	0.0080	10
Chrysene	<0.0021 [<0.0020]	<0.0020	<0.0020	<0.0020	0.00050 J	0.87	1.0	0.42	0.040	0.0030	0.34	0.060	0.010	26
Dibenzo(a,h)anthracene	<0.0041 J [<0.0040 J]	<0.0040 J	<0.0040 J	<0.0040 J	<0.0040 J	0.080 J	<0.080 J	<0.080 J	<0.080 J	<0.0041 J	<0.080 J	0.0035 J	<0.0041 J	1.3 J
Fluoranthene	<0.0041 [0.0097]	0.0018 J	<0.0040	<0.0040	0.0016 J	2.6	3.2	1.2	0.12	0.0056	0.86	0.16	0.020	76
Fluorene	<0.0041 [<0.0040]	<0.0040	<0.0040	<0.0040	<0.0040	0.11	0.19	0.050 J	<0.080	<0.0041	<0.080	0.010	0.0026 J	6.2
Indeno(1,2,3-cd)pyrene	<0.0021 [0.0030]	<0.0020	<0.0020	<0.0020	0.00080 J	0.43	0.57	0.24	0.020 J	0.0021	0.20	0.030	0.0055	12
Naphthalene	<0.020 [<0.020]	<0.020	<0.020	<0.020	<0.020	<0.42	<0.43	<0.41	<0.43	<0.020	<0.41	<0.020	<0.020	<8.5
Phenanthrene	<0.0021 [0.0068]	<0.0020	<0.0020	<0.0020	<0.0020	1.8	2.5	1.1	0.13	0.0028	0.37	0.13	0.020	67
Pyrene	0.0050 [0.010]	<0.0020	<0.0020	<0.0020	0.0016 J	1.9	2.4	0.94	0.12	0.0053	0.69	0.12	0.020	56
Volatile Organics														
1,1,1,2-Tetrachloroethane	<0.0010 [<0.0010 J]	<0.0010	<0.0020	<0.0020	R	R	R	<0.0020 J	R	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	R
1,1,1-Trichloroethane	<0.0010 [<0.0010 J]	<0.0010	<0.0010	<0.0010	R	R	R	<0.0010 J	R	<0.0010 J	<0.0010 J	<0.0010 J	<0.0010	R
1,1,2,2-Tetrachloroethane	R [<0.0020 J]	<0.0020	<0.0020	<0.0020	R	R	R	<0.0020 J	R	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	R
1,1,2-Trichloroethane	<0.0020 [<0.0020 J]	<0.0020	<0.0020	<0.0020	R	R	R	<0.0020 J	R	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	R
1,1-Dichloroethane	<0.0020 [<0.0020 J]	<0.0020	<0.0020	<0.0020	R	R	R	<0.0020 J	R	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	R
1,1-Dichloroethene	<0.0020 [<0.0020 J]	<0.0020	<0.0020	<0.0020	R	R	R	<0.0020 J	R	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	R
1,1-Dichloropropene	<0.0010 [<0.0010 J]	<0.0010	<0.0010	<0.0010	R	R	R	<0.0010 J	R	<0.0010 J	<0.0020 J	<0.0010 J	<0.0010	R
1,2,3-Trichlorobenzene	R [<0.0020 J]	<0.0020	<0.0020	<0.0020	R	R	R	<0.0020 J	R	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	R
1,2,3-Trichloropropane	R [<0.0030 J]	<0.0030	<0.0030	<0.0030	R	R	R	<0.0030 J	R	<0.0030 J	<0.0030 J	<0.0030 J	<0.0030	R
1,2,4-Trichlorobenzene	NA	<0.0010	<0.0020	<0.0020	NA	NA	NA	<0.0020 J	NA	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	NA
1,2,4-Trimethylbenzene	R [<0.0020 J]	<0.0020	<0.0020	<0.0020	R	R	R	<0.0020 J	R	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	R
1,2-Dibromo-3-chloropropane	R [<0.0060 J]	<0.0060	<0.0060	<0.0060	R	R	R	<0.0060 J	R	<0.0060 J	<0.0060 J	<0.0060 J	<0.0060	R
1,2-Dibromoethane	<0.0020 [<0.0020 J]	<0.0020	<0.0020	<0.0020	R	R	R	<0.0020 J	R	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	R
1,2-Dichlorobenzene	NA	<0.0010	<0.0010	<0.0010	NA	NA	NA	<0.0010 J	NA	<0.0010 J	<0.0010 J	<0.0010 J	<0.0010	NA
1,2-Dichloroethane	<0.0010 [<0.0010 J]	<0.0010	<0.0010	<0.0010	R	R	R	<0.0010 J	R	<0.0010 J	<0.0010 J	<0.0010 J	<0.0010	R
1,2-Dichloropropane	<0.0040 [<0.0040 J]	<0.0040	<0.0040	<0.0040	R	R	R	<0.0040 J	R	<0.0040 J	<0.0040 J	<0.0040 J	<0.0040	R
1,3,5-Trimethylbenzene	R [<0.0020 J]	<0.0020	<0.0020	<0.0020	R	R	R	<0.0020 J	R	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	R
1,3-Dichlorobenzene	NA	<0.0010	<0.0020	<0.0020	NA	NA	NA	<0.0020 J	NA	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	NA
1,3-Dichloropropane	<0.0010 [<0.0010 J]	<0.0010	<0.0020	<0.0020	R	R	R	<0.0020 J	R	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	R
1,4-Dichlorobenzene	NA	<0.0010	<0.0020	<0.0020	NA	NA	NA	<0.0020 J	NA	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	NA
2,2-Dichloropropane	<0.0010 [<0.0010 J]	<0.0010	<0.0010	<0.0010	R	R	R	<0.0010 J	R	<0.0010 J	<0.0010 J	<0.0010 J	<0.0010	R
2-Butanone	<0.0060 J [<0.0060 J]	<0.0060 J	<0.0060 J	<0.0060 J	R	R	R	<0.0060 J	R	<0.0060 J	<0.0060 J	<0.0060 J	<0.0060 J	R
2-Chloroethyl Vinyl Ether	<0.0060 [<0.0060 J]	<0.0060	<0.0060	<0.0060	R	R	R	<0.0060 J	R	<0.0060 J	<0.0060 J	<0.0060 J	<0.0060	R
2-Chlorotoluene	R [<0.0010 J]	<0.0010	<0.0010	<0.0010	R	R	R	<0.0010 J	R	<0.0010 J	<0.0010 J	<0.0010 J	<0.0010	R
2-Hexanone	<0.0060 [<0.0060 J]	<0.0060	<0.0060	<0.0060	R	R	R	<0.0060 J	R	<0.0060 J	<0.0060 J	<0.0060 J	<0.0060	R
4-Chlorotoluene	R [<0.0010 J]	<0.0010	<0.0010	<0.0010	R	R	R	<0.0010 J	R	<0.0010 J	<0.0010 J	<0.0010 J	<0.0010	R
4-Methyl-2-pentanone	<0.0060 [<0.0060 J]	<0.0060	<0.0060	<0.0060	R	R	R	<0.0060 J	R	<0.0060 J	<0.0060 J	<0.0060 J	<0.0060	R
Acetone	<0.0060 J [<0.0060 J]	<0.0060 J	<0.0060	<0.0060 J	R	R	R	<0.0060 J	R	<0.0060 J	<0.0060 J	<0.0060 J	<0.0060 J	R
Acrolein	<0.0060 [<0.0060 J]	<0.0060	<0.0060	<0.0060	R	R	R	<0.0060 J	R	<0.0060 J	<0.0060 J	<0.0060 J	<0.0060	R
Acrylonitrile	<0.0060 [<0.0060 J]	<0.0060	<0.0060	<0.0060	R	R	R	<0.0060 J	R	<0.0060 J	<0.0060 J	<0.0060 J	<0.0060	R
Benzene	<0.0010 [<0.0010 J]	<0.0010	<0.0010	<0.0010	R	R	R	<0.0010 J	R	<0.0010 J	<0.0010 J	<0.0010 J	<0.0010	R
Bromobenzene	R [<0.0010 J]	<0.0010	<0.0010	<0.0010	R	R	R	<0.0010 J	R	<0.0010 J	<0.0010 J	<0.0010 J	<0.0010	R
Bromochloromethane	<0.0020 [<0.0020 J]	<0.0020	<0.0020	<0.0020	R	R	R	<0.0020 J	R	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	R
Bromodichloromethane	<0.0010 [<0.0010 J]	<0.0010	<0.0010	<0.0010	R	R	R	<0.0010 J	R	<0.0010 J	<0.0010 J	<0.0010 J	<0.0010	R
Bromoform	<0.00060 [<0.00060 J]	<0.00060	<0.00060	<0.00060	R	R	R	<0.00060 J	R	<0.00060 J	<0.00060 J	<0.00060 J	<0.0010	R
Bromomethane	<0.0040 [<0.0040 J]	<0.0040	<0.0050	<0.0050	R	R	R	<0.0050 J	R	<0.0050 J	<0.0050 J	<0.0050 J	<0.0050	R
Carbon Disulfide	<0.0060 [<0.0060 J]	<0.0060	<0.0060	<0.0060	R	R	R	<0.0060 J	R	<0.0060 J	<0.0060 J	<0.0060 J	<0.0060	R
Carbon Tetrachloride	<0.0050 [<0.0050 J]	<0.0050	<0.0050	<0.0050	R	R	R	<0.0050 J	R	<0.0050 J	<0.0050 J	<0.0050 J	<0.0050	R
Chlorobenzene	<0.0010 [<0.0010 J]	<0.0010	<0.0010	<0.0010	R	R	R	<0.0010 J	R	<0.0010 J	<0.0010 J	<0.0010 J	<0.0010	R
Chloroethane	<0.0060 [<0.0060 J]	<0.0060	<0.0060	<0.0060	R	R	R	<0.0060 J	R	<0.0060 J	<0.0060 J	<0.0060 J	<0.0060	R
Chloroform	<0.0010 [<0.0010 J]	<0.0010	<0.0020	<0.0020	R	R	R	<0.0020 J	R	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	R
Chloromethane	<0.0040 [<0.0040 J]	<0.0040	<0.0040	<0.0040	R	R	R	<0.0040 J	R	<0.0040 J	<0.0040 J	<0.0040 J	<0.0040	R
cis-1,2-Dichloroethene	<0.0020 [<0.0020 J]	<0.0020	<0.0020	<0.0020	R	R	R	<0.0020 J	R	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	R
cis-1,3-Dichloropropene	<0.0010 [<0.0010 J]	<0.0010	<0.0010	<0.0010	R	R	R	<0.0010 J	R	<0.0010 J	<0.0010 J	<0.0010 J	<0.0010	R
Dibromochloromethane	<0.00080 [<0.00080 J]	<0.00080	<0.00090	<0.00090	R	R	R	<0.00090 J	R	<0.00090 J	<0.00090 J	<0.00090 J	<0.0010	R
Dibromomethane	<0.0020 [<0.0020 J]	<0.0020	<0.0020	<0.0020	R	R	R	<0.0020 J	R	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	R
Dichlorodifluoromethane	<0.0020 [<0.0020 J]	<0.0020	<0.0020	<0.0020	R	R	R	<0.0020 J	R	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	R
Ethylbenzene	<0.0010 [<0.0010 J]	<0.0010	<0.0010	<0.0010	R	R	R	<0.0010 J	R	<0.0010 J	<0.0010 J	<0.0010 J	<0.0010	R
Hexachlorobutadiene	R [<0.0010 J]	<0.0010	<0.0010	<0.0010	R	R	R	<0.0010 J	R	<0.0010 J	<0.0010 J	<0.0010 J	<0.0010	R
Isopropylbenzene	R [<0.0020 J]	<0.0020	<0.0020	<0.0020	R	R	R	<0.0020 J	R	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	R
m,p-Xylene	<0.0030 [<0.0030 J]	<0.0030	<0.0030	<0.0030	R	R	R	<0.0030 J	R	<0.0030 J	<0.0030 J	<0.0030 J	<0.0030	R
Methylene Chloride	<0.0010 [<0.0010 J]	<0.0010	0.0040	0.0030	R	R	R	<0.0010 J	R	0.0030 J	0.0050 J	<0.0010 J	0.15	R
n-Butylbenzene	R [<0.0020 J]	<0.0020	<0.0020	<0.0020	R	R	R	<0.0020 J	R	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	R
n-Propylbenzene	R [<0.0020 J]	<0.0020	<0.0020	<0.0020	R	R	R	<0.0020 J	R	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	R
o-Xylene	<0.0010 [<0.0010 J]	<0.0010	<0.0020	<0.0020	R	R	R	<0.0020 J	R	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	R
p-Isopropyltoluene	R [<0.0010 J]	<0.0010	<0.0010	<0.0010	R	R	R	<0.0010 J	R	<0.0010 J	<0.0010 J	<0.0010 J	<0.0010	R
sec-Butylbenzene	R [<0.0010 J]	<0.0010	<0.0020	<0.0020	R	R	R	<0.0020 J	R	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	R
Styrene	<0.00020 [<0.00020 J]	<0.00020	<0.00030	<0.00020	R	R	R	<0.00030 J	R	<0.00030 J	<0.00030 J	<0.00030 J	<0.00030	R
tert-Butylbenzene	R [<0.0010 J]	<0.0010	<0.0020	<0.0020	R	R	R	<0.0020 J	R	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	R
Tetrachloroethene	<0.0010 [<0.0010 J]	<0.0010	<0.0010	<0.0010	R	R	R	<0.0010 J	R	<0.0010 J	<0.0010 J	<0.0010 J	<0.0010	R
Toluene	<0.0010 [<0.0010 J]	<0.0020	<0.0020	<0.0020	R	R	R	<0.0020 J	R	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	R
trans-1,2-Dichloroethene	<0.0050 [<0.0050 J]	<0.0050	<0.0050	<0.0050	R	R	R	<0.0050 J	R	<0.0050 J	<0.0050 J	<0.0050 J	<0.0050	R
trans-1,3-Dichloropropene	<0.0010 [<0.0010 J]	<0.0010	<0.0010	<0.0010	R	R	R	<0.0010 J	R	<0.0010 J	<0.0010 J	<0.0010 J	<0.0010	R
Trichloroethene	<0.0030 [<0.0030 J]	<0.0030	<0.0030	<0.0030	R	R	R	<0.0030 J	R	<0.0030 J	<0.0030 J	<0.0030 J	<0.0030	R
Trichlorofluoromethane	<0.0010 [<0.0010 J]	<0.0010	<0.0010	<0.0010	R	R	R	<0.0020 J	R	<0.0020 J	<0.0020 J	<0.0010 J	<0.0020	R
Vinyl Acetate	<0.0060 [<0.0060 J]	<0.0060	<0.0060	<0.0060	R	R	R	<0.0060 J	R	<0.0060 J	<0.0060 J	<0.0060 J	<0.0060	R
Vinyl Chloride	<0.0020 [<0.0020 J]	<0.0020	<0.0020	<0.0020	R	R	R	<0.0020 J	R	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	R
Xylenes (total)	<0.0030 [<0.0030]	<0.0030	<0.0030	<0.0030	R	R	R	<0.0030	R	<0.0030	<0.0030	<0.0030	<0.0030	R

Location ID: Sample Depth(Feet): Date Collected:	DTSB17 3 - 3.5 08/18/98	DTSB18 2 - 2.5 08/18/98	DTSB19 2 - 2.5 08/18/98	DTSB20 2 - 2.5 08/18/98	DTSB21 2 - 2.5 08/18/98	DTSB22 2 - 2.5 08/18/98	DTSB23 2 - 2.5 08/18/98	DTSB35 0.5 - 1 08/18/98	DTSB36 0.5 - 1 08/18/98	DTSB37 0.5 - 1 08/18/98	DTSB38 0.5 - 1 08/18/98	DTSB39 0.5 - 1 08/18/98	DTSB40 0.5 - 1 08/18/98	DTSB41 0.5 - 1 08/18/98
Explosives														
1,3,5-Trinitrobenzene	<0.2 [<0.2]	<0.2	<0.3	<0.2	<0.3	<0.2	<0.3	<0.3	<0.3	<0.2	<0.3	<0.2	<0.2	<0.2
1,3-Dinitrobenzene	<0.2 [<0.2]	<0.2	<0.3	<0.2	<0.3	<0.2	<0.3	<0.3	<0.3	<0.2	<0.3	<0.2	<0.2	<0.2
2,4,6-Trinitrotoluene	<0.2 [<0.2]	<0.2	<0.3	<0.2	<0.3	<0.2	<0.3	<0.3	<0.3	<0.2	<0.3	<0.2	<0.2	<0.2
2,4-Dinitrotoluene	<0.2 [<0.2]	<0.2	<0.3	<0.2	<0.3	<0.2	<0.3	<0.3	<0.3	<0.2	<0.3	<0.2	<0.2	<0.2
2,6-Dinitrotoluene	<0.2 [<0.2]	<0.2	<0.3	<0.2	<0.3	<0.2	<0.3	<0.3	<0.3	<0.2	<0.3	<0.2	<0.2	<0.2
2-Amino-4,6-Dinitrotoluene	<0.2 [<0.2]	<0.2	<0.3	<0.2	<0.3	<0.2	<0.3	<0.3	<0.3	<0.2	<0.3	<0.2	<0.2	<0.2
4-Amino-2,6-Dinitrotoluene	<0.2 [<0.2]	<0.2	<0.3	<0.2	<0.3	<0.2	<0.3	<0.3	<0.3	<0.2	<0.3	<0.2	<0.2	<0.2
Dinitrotoluene Mix	<0.2 [<0.2]	<0.2	<0.3	<0.2	<0.3	<0.2	<0.3	<0.3	<0.3	<0.2	<0.3	<0.2	<0.2	<0.2
HMX	<2 [<2]	<2	<3	<2	<3	<2	<3	<0.3	<0.3	<0.2	<0.3	<0.2	<0.2	<0.2
m-Nitrotoluene	<0.2 [<0.2]	<0.2	<0.3	<0.2	<0.3	<0.2	<0.3	<0.3	<0.3	<0.2	<0.3	<0.2	<0.2	<0.2
Nitrobenzene	<0.2 [<0.2]	<0.2	<0.3	<0.2	<0.3	<0.2	<0.3	<0.3	<0.3	<0.2	<0.3	<0.2	<0.2	<0.2
Nitroglycerine	<1.2 [<1.2]	<1.1	<1.3	<1.2	<1.3	<1.2	<1.3	<1.3	<1.3	<1.2	<1.3	<1.1	<1.1	<1.2
o-Nitrotoluene	<0.2 [<0.2]	<0.2	<0.3	<0.2	<0.3	<0.2	<0.3	<0.3	<0.3	<0.2	<0.3	<0.2	<0.2	<0.2
Pentaerythritol Tetranitrate	<1.2 [<1.2]	<1.1	<1.3	<1.2	<1.3	<1.2	<1.3	<1.3	<1.3	<1.2	<1.3	<1.1	<1.1	<1.2
p-Nitrotoluene	<0.2 [<0.2]	<0.2	<0.3	<0.2	<0.3	<0.2	<0.3	<0.3	<0.3	<0.2	<0.3	<0.2	<0.2	<0.2
RDX	<0.2 [<0.2]	<0.2	<0.3	<0.2	<0.3	<0.2	<0.3	<0.3	<0.3	<0.2	<0.3	<0.2	<0.2	<0.2
Tetryl	<0.2 [<0.2]	<0.2	<0.3	<0.2	<0.3	<0.2	<0.3	<0.3	<0.3	<0.2	<0.3	<0.2	<0.2	<0.2
PAHs														
Acenaphthene	1.6 J [5.3 J]	<0.21	<0.020	<0.11	<0.60	0.46 J	<0.020	0.40 J	<0.020	<0.020	<0.020	<0.020	<0.11	<0.020
Acenaphthylene	<8.8 [<42]	<0.41	<0.040	<0.21	<1.2	<1.6	<0.040	<0.85	<0.040	<0.040	<0.040	<0.040	<0.21	<0.040
Anthracene	4.9 [23]	0.060	0.0046	0.080	0.92	1.3	<0.0021	0.71	<0.0020	0.00080 J	<0.0022	<0.0021	<0.010	0.0044
Benzo(a)anthracene	6.6 [28]	0.11	0.0024	0.18	1.5	2.0	0.00070 J	1.7	<0.0020	0.00060 J	0.00090 J	0.0011 J	0.13	0.0060
Benzo(a)pyrene	7.4 [28]	1.6	0.0032	0.21	1.7	2.1	<0.0021	1.8 J	<0.0020	0.0018 J	0.0021 J	0.0024 J	0.15 J	0.010 J
Benzo(b)fluoranthene	8.4 [35]	0.18	0.0049	0.26	2.1	2.8	<0.0042	2.3	<0.0040	0.0021 J	0.0031 J	0.0039 J	0.37	0.010
Benzo(g,h,i)perylene	3.2 J [11 J]	<0.040	0.0024 J	0.11 J	0.88 J	1.1 J	<0.0042	0.80 J	<0.0040	0.00060 J	0.0010 J	<0.0041	0.17 J	0.0049 J
Benzo(k)fluoranthene	3.5 [14]	1.5	0.0024	0.12	0.81	1.1	<0.0021	0.93	<0.0020	0.0011 J	0.0019 J	0.0034	0.14	0.010
Chrysene	7.1 [33]	0.13	0.0040	0.24	1.7	2.3	0.0019 J	2.0	<0.0020	0.0015 J	0.0025	0.0032	0.22	0.010
Dibenzo(a,h)anthracene	0.43 J [1.6 J]	<0.040	<0.0041	0.010 J	0.11 J	0.15 J	<0.0042	0.12	<0.0040	<0.0042	<0.0043	<0.0041	0.090	<0.0042
Fluoranthene	23 [110]	0.40	0.010	0.57	5.3	7.2	0.0050	5.8 J	<0.0040 J	0.0046 J	0.0052 J	0.0073 J	0.21 J	0.020 J
Fluorene	2.3 [10]	<0.040	0.0042	0.040	0.51	0.75	<0.0042	<0.080	<0.0040	<0.0042	<0.0043	<0.0041	<0.020	<0.0042
Indeno(1,2,3-cd)pyrene	4.1 [15]	0.15	0.0035	0.12	0.97	1.2	0.0028	1.0	<0.0020	0.0010 J	0.0020 J	0.0021	<0.010	0.0076
Naphthalene	7.8 [<21]	<0.21	0.0060 J	<0.11	<0.60	<0.80	<0.020	<0.43	<0.020	<0.020	<0.020	<0.020	<0.11	<0.020
Phenanthrene	21 [110]	0.28	0.020	0.41	4.3	6.0	0.0033	4.0	<0.0020	0.0036	0.0043	0.0038	0.090	0.020
Pyrene	18 [80]	0.33	0.010	0.45	4.0	5.3	0.0047	4.2	<0.0020	0.0040	0.0055	0.0062	0.21	0.020
Volatile Organics														
1,1,1,2-Tetrachloroethane	<0.0020 [<0.0020 J]	<0.0020 J	<0.0020	<0.0020 J	<0.0020 J	R	<0.0020	<0.0020	<0.0020	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	<0.0020 J
1,1,1-Trichloroethane	<0.0010 [<0.0010 J]	<0.0010 J	<0.0010	<0.0010 J	<0.0010	R	<0.0010	<0.0010	<0.0010	<0.0010 J	<0.0010 J	<0.0010 J	<0.0010	<0.0010 J
1,1,2,2-Tetrachloroethane	<0.0020 [<0.0020 J]	<0.0020 J	<0.0020	<0.0020 J	<0.0020 J	R	<0.0020	<0.0020 J	<0.0020	<0.0020 J	<0.0020 J	<0.0020 J	R	<0.0020 J
1,1,2-Trichloroethane	<0.0020 [<0.0020 J]	<0.0020 J	<0.0020	<0.0020 J	<0.0020	R	<0.0020	<0.0020	<0.0020	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	<0.0020 J
1,1-Dichloroethane	<0.0020 [<0.0020 J]	<0.0020 J	<0.0020	<0.0020 J	<0.0020	R	<0.0020	<0.0020	<0.0020	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	<0.0020 J
1,1-Dichloroethene	<0.0020 [<0.0020 J]	<0.0020 J	<0.0020	<0.0020 J	<0.0020	R	<0.0020	<0.0020	<0.0020	<0.0020 J	<0.0020 J	<0.0030 J	<0.0020	<0.0020 J
1,1-Dichloropropene	<0.0020 [<0.0020 J]	<0.0010 J	<0.0010	<0.0010 J	<0.0020	R	<0.0010	<0.0020	<0.0010	<0.0010 J	<0.0020 J	<0.0020 J	<0.0010	<0.0010 J
1,2,3-Trichlorobenzene	<0.0020 [<0.0020 J]	<0.0020 J	<0.0020	<0.0020 J	<0.0020 J	R	<0.0020	<0.0020 J	<0.0020	<0.0020 J	<0.0020 J	<0.0020 J	R	<0.0020 J
1,2,3-Trichloropropane	<0.0030 [<0.0030 J]	<0.0030 J	<0.0030	<0.0030 J	<0.0030 J	R	<0.0030	<0.0030 J	<0.0030	<0.0030 J	<0.0030 J	0.080 J	R	<0.0030 J
1,2,4-Trichlorobenzene	<0.0020 [<0.0020 J]	<0.0020 J	<0.0020	<0.0020 J	<0.0020 J	NA	<0.0020	<0.0020 J	<0.0020	<0.0020 J	<0.0020 J	<0.0020 J	NA	<0.0020 J
1,2,4-Trimethylbenzene	<0.0020 [<0.0020 J]	<0.0020 J	<0.0020	<0.0020 J	<0.0020 J	R	<0.0020	<0.0020 J	<0.0020	<0.0020 J	<0.0020 J	<0.0020 J	R	<0.0020 J
1,2-Dibromo-3-chloropropane	<0.0060 [<0.0060 J]	<0.0060 J	<0.0060	<0.0060 J	<0.0060 J	R	<0.0060	<0.0070 J	<0.0060	<0.0060 J	<0.0060 J	<0.0070 J	R	<0.0060 J
1,2-Dibromoethane	<0.0020 [<0.0020 J]	<0.0020 J	<0.0020	<0.0020 J	<0.0020 J	R	<0.0020	<0.0020	<0.0020	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	<0.0020 J
1,2-Dichlorobenzene	<0.0010 [<0.0010 J]	<0.0010 J	<0.0010	<0.0010 J	<0.0010 J	NA	<0.0010	<0.0010 J	<0.0010	<0.0010 J	<0.0010 J	<0.0010 J	NA	<0.0010 J
1,2-Dichloroethane	<0.0010 [<0.0010 J]	<0.0010 J	<0.0010	<0.0010 J	<0.0010	R	<0.0010	<0.0010	<0.0010	<0.0010 J	<0.0010 J	<0.0010 J	<0.0010	<0.0010 J
1,2-Dichloropropane	<0.0040 [<0.0040 J]	<0.0040 J	<0.0040	<0.0040 J	<0.0040	R	<0.0040	<0.0040	<0.0040	<0.0040 J	<0.0040 J	<0.0050 J	<0.0040	<0.0040 J
1,3,5-Trimethylbenzene	<0.0020 [<0.0020 J]	<0.0020 J	<0.0020	<0.0020 J	<0.0020 J	R	<0.0020	<0.0020 J	<0.0020	<0.0020 J	<0.0020 J	<0.0020 J	R	<0.0020 J
1,3-Dichlorobenzene	<0.0020	<0.0020 J	<0.0020	<0.0020 J	<0.0020 J	NA	<0.0020	<0.0020 J	<0.0020	<0.0020 J	<0.0020 J	<0.0020 J	NA	<0.0020 J
1,3-Dichloropropane	<0.0020 [<0.0020 J]	<0.0020 J	<0.0020	<0.0020 J	<0.0020 J	R	<0.0020	<0.0020	<0.0020	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	<0.0020 J
1,4-Dichlorobenzene	<0.0020 [<0.0020 J]	<0.0020 J	<0.0020	<0.0020 J	<0.0020 J	NA	<0.0020	<0.0020 J	<0.0020	<0.0020 J	<0.0020 J	<0.0020 J	NA	<0.0020 J
2,2-Dichloropropane	<0.0010 [<0.0010 J]	<0.0010 J	<0.0010	<0.0010 J	<0.0010	R	<0.0010	<0.0010	<0.0010	<0.0010 J	<0.0010 J	<0.0010 J	<0.0010	<0.0010 J
2-Butanone	<0.0060 J [<0.0060 J]	<0.0060 J	<0.0060	<0.0060 J	<0.0060	R	<0.0060	<0.0070	<0.0060	<0.0060 J	<0.0060 J	<0.0070 J	<0.0060	<0.0060 J
2-Chloroethyl Vinyl Ether	<0.0060 [<0.0060 J]	<0.0060 J	<0.0060	<0.0060 J	<0.0060	R	<0.0060	<0.0070	<0.0060	<0.0060 J	<0.0060 J	<0.0070 J	<0.0060	<0.0060 J
2-Chlorotoluene	<0.0010 [<0.0010 J]	<0.0010 J	<0.0010	<0.0010 J	<0.0010 J	R	<0.0010	<0.0010 J	<0.0010	<0.0010 J	<0.0010 J	<0.0020 J	R	<0.0010 J
2-Hexanone	<0.0060 [<0.0060 J]	<0.0060 J	<0.0060	<0.0060 J	<0.0060 J	R	<0.0060	<0.0070	<0.0060	<0.0060 J	<0.0060 J	<0.0070 J	<0.0060	<0.0060 J
4-Chlorotoluene	<0.0010 [<0.0010 J]	<0.0010 J	<0.0010	<0.0010 J	<0.0010 J	R	<0.0010	<0.0010 J	<0.0010	<0.0010 J	<0.0010 J	<0.0010 J	R	<0.0010 J
4-Methyl-2-pentanone	<0.0060 [<0.0060 J]	<0.0060 J	<0.0060	<0.0060 J	<0.0060 J	R	<0.0060	<0.0070	<0.0060	<0.0060 J	<0.0060 J	<0.0070 J	<0.0060	<0.0060 J
Acetone	<0.0060 J [<0.0060 J]	<0.0060 J	<0.0060 J	<0.0060 J	<0.0060 J	R	<0.0060 J	<0.0070	<0.0060	<0.0060 J	<0.0060 J	<0.0070 J	<0.0060	<0.0060 J
Acrolein	<0.0060 [<0.0060 J]	<0.0060 J	<0.0060	<0.0060 J	<0.0060	R	<0.0060	<0.0070	<0.0060	<0.0060 J	<0.0060 J	<0.0070 J	<0.0060	<0.0060 J
Acrylonitrile	<0.0060 [<0.0060 J]	<0.0060 J	<0.0060	<0.0060 J	<0.0060	R	<0.0060	<0.0070	<0.0060	<0.0060 J	<0.0060 J	<0.0070 J	<0.0060	<0.0060 J
Benzene	<0.0010 [<0.0010 J]	<0.0010 J	<0.0010	<0.0010 J	<0.0010	R	<0.0010	<0.0010	<0.0010	<0.0010 J	<0.0010 J	<0.0010 J	<0.0010	<0.0010 J
Bromobenzene	<0.0010 [<0.0010 J]	<0.0010 J	<0.0010	<0.0010 J	<0.0010 J	R	<0.0010	<0.0010 J	<0.0010	<0.0010 J	<0.0010 J	<0.0010 J	R	<0.0010 J
Bromochloromethane	<0.0020 [<0.0020 J]	<0.0020 J	<0.0020	<0.0020 J	<0.0020	R	<0.0020	<0.0020	<0.0020	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	<0.0020 J
Bromodichloromethane	<0.0010 [<0.0010 J]	<0.0010 J	<0.0010	<0.0010 J	<0.0010	R	<0.0010	<0.0010	<0.0010	<0.0010 J	<0.0010 J	<0.0010 J	<0.0010	<0.0010 J
Bromoform	<0.0010 [<0.0010 J]	<0.0010 J	<0.0010	<0.0010 J	<0.0010 J	R	<0.0010	<0.00070	<0.00060	<0.00060 J	<0.00060 J	<0.00070 J	<0.00060	<0.00060 J
Bromomethane	<0.0050 [<0.0050 J]	<0.0050 J	<0.0050	<0.0050 J	<0.0050	R	<0.0050	<0.0050	<0.0050	<0.0050 J	<0.0050 J	<0.0050 J	<0.0050	<0.0050 J
Carbon Disulfide	<0.0060 [<0.0060 J]	<0.0060 J	<0.0060	<0.0060 J	<0.0060	R	<0.0060	<0.0070	<0.0060	<0.0060 J	<0.0060 J	<0.0070 J	<0.0060	<0.0060 J
Carbon Tetrachloride	<0.0050 [<0.0050 J]	<0.0050 J	<0.0050	<0.0050 J	<0.0050	R	<0.0050	<0.0050	<0.0050	<0.0050 J	<0.0050 J	<0.0060 J	<0.0050	<0.0050 J
Chlorobenzene	<0.0010 [<0.0010 J]	<0.0010 J	<0.0010	<0.0010 J	<0.0010 J	R	<0.0010	<0.0010	<0.0010	<0.0010 J	<0.0010 J	<0.0020 J	<0.0010	<0.0010 J
Chloroethane	<0.0060 [<0.0060 J]	<0.0060 J	<0.0060	<0.0060 J	<0.0060	R	<0.0060	<0.0070	<0.0060	<0.0060 J	<0.0060 J	<0.0070 J	<0.0060	<0.0060 J
Chloroform	<0.0020 [<0.0020 J]	<0.0020 J	<0.0020	<0.0020 J	<0.0020	R	<0.0020	<0.0020	<0.0020	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	<0.0020 J
Chloromethane	<0.0040 [<0.0040 J]	<0.0040 J	<0.0040	<0.0040 J	<0.0040	R	<0.0040	<0.0040	<0.0040	<0.0040 J	<0.0040 J	<0.0050 J	<0.0040	<0.0040 J
cis-1,2-Dichloroethene	<0.0020 [<0.0020 J]	<0.0020 J	<0.0020	<0.0020 J	<0.0020	R	<0.0020	<0.0020	<0.0020	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	<0.0020 J
cis-1,3-Dichloropropene	<0.0010 [<0.0010 J]	<0.0010 J	<0.0010	<0.0010 J	<0.0010	R	<0.0010	<0.0010	<0.0010	<0.0010 J	<0.0010 J	<0.0010 J	<0.0010	<0.0010 J
Dibromochloromethane	<0.0010 [<0.0010 J]	<0.0010 J	<0.0010	<0.0010 J	<0.0010 J	R	<0.0010	<0.00090	<0.00090	<0.00090 J	<0.00090 J	<0.0010 J	<0.00090	<0.00090 J
Dibromomethane	<0.0020 [<0.0020 J]	<0.0020 J	<0.0020	<0.0020 J	<0.0020	R	<0.0020	<0.0020	<0.0020	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	<0.0020 J
Dichlorodifluoromethane	<0.0020 [<0.0020 J]	<0.0020 J	<0.0020	<0.0020 J	<0.0020	R	<0.0020	<0.0020	<0.0020	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	<0.0020 J
Ethylbenzene	<0.0010 [<0.0010 J]	<0.0010 J	<0.0010	<0.0010 J	<0.0010 J	R	<0.0010	<0.0010	<0.0010	<0.0010 J	<0.0010 J	<0.0020 J	<0.0010	<0.0010 J
Hexachlorobutadiene	<0.0010 [<0.0010 J]	<0.0010 J	<0.0010	<0.0010 J	<0.0010 J	R	<0.0010	<0.0010 J	<0.0010	<0.0010 J	<0.0010 J	<0.0010 J	R	<0.0010 J
Isopropylbenzene	<0.0020 [<0.0020 J]	<0.0020 J	<0.0020	<0.0020 J	<0.0020 J	R	<0.0020	<0.0020 J	<0.0020	<0.0020 J	<0.0020 J	<0.0020 J	R	<0.0020 J
m,p-Xylene	<0.0030 [<0.0030 J]	<0.0030 J	<0.0030	<0.0030 J	<0.0030 J	R	<0.0030	<0.0030	<0.0030	<0.0030 J	<0.0030 J	<0.0030 J	<0.0030	<0.0030 J
Methylene Chloride	<0.0010 [0.0060 J]	0.0040 J	<0.0010	<0.0010 J	<0.0010	0.0040 J	<0.0010	<0.0010	<0.0010	<0.0010 J	<0.0010 J	<0.0010 J	<0.0010	<0.0010 J
n-Butylbenzene	<0.0020 [<0.0020 J]	<0.0020 J	<0.0020	<0.0020 J	<0.0020 J	R	<0.0020	<0.0020 J	<0.0020	<0.0020 J	<0.0020 J	<0.0020 J	R	<0.0020 J
n-Propylbenzene	<0.0020 [<0.0020 J]	<0.0020 J	<0.0020	<0.0020 J	<0.0020 J	R	<0.0020	<0.0020 J	<0.0020	<0.0020 J	<0.0020 J	<0.0020 J	R	<0.0020 J
o-Xylene	<0.0020 [<0.0020 J]	<0.0020 J	<0.0020	<0.0020 J	<0.0020 J	R	<0.0020	<0.0020	<0.0020	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	<0.0020 J
p-Isopropyltoluene	<0.0010 [<0.0010 J]	<0.0010 J	<0.0010	<0.0010 J	<0.0010 J	R	<0.0010	<0.0010 J	<0.0010	<0.0010 J	<0.0010 J	<0.0010 J	R	<0.0010 J
sec-Butylbenzene	<0.0020 [<0.0020 J]	<0.0020 J	<0.0020	<0.0020 J	<0.0020 J	R	<0.0020	<0.0020 J	<0.0020	<0.0020 J	<0.0020 J	<0.0020 J	R	<0.0020 J
Styrene	<0.00030 [<0.00030 J]	<0.00030 J	<0.00030	<0.00030 J	<0.00030 J	R	<0.00030	<0.00030	<0.00020	<0.00030 J	<0.00030 J	<0.00030 J	<0.00030	<0.00030 J
tert-Butylbenzene	<0.0020 [<0.0020 J]	<0.0020 J	<0.0020	<0.0020 J	<0.0020 J	R	<0.0020	<0.0020 J	<0.0020	<0.0020 J	<0.0020 J	<0.0020 J	R	<0.0020 J
Tetrachloroethene	<0.0010 [<0.0010 J]	<0.0010 J	<0.0010	<0.0010 J	<0.0010 J	R	<0.0010	<0.0010	<0.0010	<0.0010 J	<0.0010 J	<0.0020 J	<0.0010	<0.0010 J
Toluene	<0.0020 [<0.0020 J]	<0.0020 J	<0.0020	<0.0020 J	<0.0020	R	<0.0020	<0.0020	<0.0020	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020	<0.0020 J
trans-1,2-Dichloroethene	<0.0050 [<0.0050 J]	<0.0050 J	<0.0050	<0.0050 J	<0.0060	R	<0.0050	<0.0060	<0.0050	<0.0050 J	<0.0050 J	<0.0060 J	<0.0050	<0.0050 J
trans-1,3-Dichloropropene	<0.0010 [<0.0010 J]	<0.0010 J	<0.0010	<0.0010 J	<0.0010	R	<0.0010	<0.0010	<0.0010	<0.0010 J	<0.0010 J	<0.0010 J	<0.0010	<0.0010 J
Trichloroethene	<0.0030 [<0.0030 J]	<0.0030 J	<0.0030	<0.0030 J	<0.0030	R	<0.0030	<0.0030	<0.0030	<0.0030 J	<0.0030 J	<0.0040 J	<0.0030	<0.0030 J
Trichlorofluoromethane	<0.0020 [<0.0020 J]	<0.0010 J	<0.0010	<0.0010 J	<0.0020	R	<0.0020	<0.0020	<0.0010	<0.0010 J	<0.0020 J	<0.0020 J	<0.0020	<0.0010 J
Vinyl Acetate	<0.0060 [<0.0060 J]	<0.0060 J	<0.0060	<0.0060 J	<0.0060	R	<0.0060	<0.0070	<0.0060	<0.0060 J	<0.0060 J	<0.0070 J	<0.0060	<0.0060 J
Vinyl Chloride	<0.0020 [<0.0020 J]	<0.0020 J	<0.0020	<0.0020 J	<0.0020	R	<0.0020	<0.0020	<0.0020	<0.0020 J	<0.0020 J	<0.0030 J	<0.0020	<0.0020 J
Xylenes (total)	<0.0030 [<0.0030]	<0.0030	<0.0030	<0.0030	<0.0030	R	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes found at end of table.

Table 5-4. Soil Analytical Results, Building Debris Disposal Trench, 1998 ICF KE Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	DTSS1 0 - 0.5 08/11/98	DTSS2 0 - 0.5 08/11/98	DTSS3 0 - 0.5 08/11/98	DTSB1 0.5 - 1 08/12/98	DTSB2 2.5 - 3 08/12/98	DTSB3 2.5 - 3 08/12/98	DTSB4 2.5 - 3 08/12/98	DTSB5 0.5 - 1 08/12/98	DTSB6 1 - 1.5 08/12/98	DTSB7 2 - 2.5 08/12/98	DTSB8 1 - 1.5 08/12/98	DTSB9 3 - 3.5 08/12/98	DTSB10 3.5 - 4 08/12/98	DTSB11 3.5 - 4 08/12/98	DTSB12 3.5 - 4 08/12/98	DTSB13 0.5 - 1 08/12/98	DTSB14 3.5 - 4 08/12/98	DTSB15 2 - 2.5 08/13/98	DTSB16 2 - 2.5 08/18/98	DTSB17 3 - 3.5 08/18/98	DTSB18 2 - 2.5 08/18/98	DTSB19 2 - 2.5 08/18/98	DTSB20 2 - 2.5 08/18/98	DTSB21 2 - 2.5 08/18/98	DTSB22 2 - 2.5 08/18/98	DTSB23 2 - 2.5 08/18/98	DTSB35 0.5 - 1 08/18/98	DTSB36 0.5 - 1 08/18/98	DTSB37 0.5 - 1 08/18/98	DTSB38 0.5 - 1 08/18/98	DTSB39 0.5 - 1 08/18/98	DTSB40 0.5 - 1 08/18/98	DTSB41 0.5 - 1 08/18/98
Semivolatile Organics																																					
1,2,4-Trichlorobenzene	8.7 {ca**}	40 {ca**}	- -	mg/kg	NA	NA	<0.40	NA	<0.39	<0.38	NA	NA	NA	<0.41	<0.43	<0.43	NA	<0.43	NA	NA	NA	NA	<0.47	NA	NA	NA	NA	NA	<0.41	NA	NA	NA	NA	NA	NA	<0.42	NA
1,2-Dichlorobenzene	220 {sat}	220 {sat}	- -	mg/kg	NA	NA	<0.40	NA	NA	<0.38	NA	NA	NA	<0.41	<0.43	<0.43	NA	<0.43	NA	NA	NA	NA	<0.47	NA	NA	NA	NA	NA	<0.41	NA	NA	NA	NA	NA	NA	<0.42	NA
1,2-Diphenylhydrazine	0.61 {ca**}	2.2 {ca**}	- -	mg/kg	<0.42	<0.43	<0.40	<0.46	<0.39	<0.38 [<0.38]	<0.39	<0.41	<0.41	<0.41	<0.43	<0.43	<0.42	<0.43	<0.42	<0.43	<0.42	<0.42	<0.47	<0.42 [<0.42]	<0.41	<0.41	<0.41	<0.43	<0.41	<0.42	<0.43	<0.41	<0.41	<0.42	<0.45	<0.42	<0.41
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	NA	NA	<0.40	NA	NA	<0.38	NA	NA	NA	<0.41	<0.43	<0.43	NA	<0.43	NA	NA	NA	NA	<0.47	NA	NA	NA	NA	NA	<0.41	NA	NA	NA	NA	NA	NA	<0.42	NA
1,4-Dichlorobenzene	2.6 {ca}	13 {ca}	- -	mg/kg	NA	NA	<0.40	NA	NA	<0.38	NA	NA	NA	<0.41	<0.43	<0.43	NA	<0.43	NA	NA	NA	NA	<0.47	NA	NA	NA	NA	NA	<0.41	NA	NA	NA	NA	NA	NA	<0.42	NA
2,4,5-Trichlorophenol	610 {nc}	6,200 {nc}	- -	mg/kg	<1.0	<1.1	<0.98	<1.1	<0.94	<0.93 [<0.93]	<0.95	<1.0	<0.99	<0.99	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.1	<1.0 [<1.0]	<1.0	<1.0	<0.99	<1.0	<0.99	<1.0	<1.1	<0.99	<1.0	<1.0	<1.1	<1.0	<1.0
2,4,6-Trichlorophenol	44 {ca**}	160 {ca**}	- -	mg/kg	<0.42	<0.43	<0.40	<0.46	<0.39	<0.38 [<0.38]	<0.39	<0.41	<0.41	<0.41	<0.43	<0.43	<0.42	<0.43	<0.42	<0.43	<0.42	<0.42	<0.47	<0.42 [<0.42]	<0.41	<0.41	<0.41	<0.43	<0.41	<0.42	<0.43	<0.41	<0.41	<0.42	<0.45	<0.42	<0.41
2,4-Dichlorophenol	18 {nc}	180 {nc}	- -	mg/kg	<0.42	<0.43	<0.40	<0.46	<0.39	<0.38 [<0.38]	<0.39	<0.41	<0.41	<0.41	<0.43	<0.43	<0.42	<0.43	<0.42	<0.43	<0.42	<0.42	<0.47	<0.42 [<0.42]	<0.41	<0.41	<0.41	<0.43	<0.41	<0.42	<0.43	<0.41	<0.41	<0.42	<0.45	<0.42	<0.41
2,4-Dimethylphenol	120 {nc}	1,200 {nc}	- -	mg/kg	<0.42	<0.43	<0.40	<0.46	<0.39	<0.38 [<0.38]	<0.39	<0.41	<0.41	<0.41	<0.43	<0.43	<0.42	<0.43	<0.42	<0.43	<0.42	<0.42	<0.47	<0.42 [<0.42]	<0.41	<0.41	<0.41	<0.43	<0.41	<0.42	<0.43	<0.41	<0.41	<0.42	<0.45	<0.42	<0.41
2,4-Dinitrophenol	12 {nc}	120 {nc}	- -	mg/kg	<2.1	<2.2	<2.0	<2.3	<1.9	<1.9 [<1.9]	<2.0	<2.1	<2.0	<2.1	<2.2	<2.2	<2.1	<2.2	<2.1	<2.2	<2.1	<2.1	<2.4	<2.1 [<2.1]	<2.1	<2.1	<2.0	<2.1	<2.0	<2.1	<2.2	<2.0	<2.1	<2.1	<2.3	<2.1	<2.1
2-Chloronaphthalene	210 {sat}	210 {sat}	- -	mg/kg	<0.42	<0.43	<0.40	<0.46	<0.39	<0.38 [<0.38]	<0.39	<0.41	<0.41	<0.41	<0.43	<0.43	<0.42	<0.43	<0.42	<0.43	<0.42	<0.42	<0.47	<0.42 [<0.42]	<0.41	<0.41	<0.41	<0.43	<0.41	<0.42	<0.43	<0.41	<0.41	<0.42	<0.45	<0.42	<0.41
2-Chlorophenol	39 {nc}	510 {nc}	- -	mg/kg	<0.42	<0.43	<0.40	<0.46	<0.39	<0.38 [<0.38]	<0.39	<0.41	<0.41	<0.41	<0.43	<0.43	<0.42	<0.43	<0.42	<0.43	<0.42	<0.42	<0.47	<0.42 [<0.42]	<0.41	<0.41	<0.41	<86	<0.41	<0.42	<0.43	<0.41	<0.41	<0.42	<0.45	<0.42	<0.41
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	<0.42	<0.43	<0.40	<0.46	<0.39	<0.38 [<0.38]	<0.39	<0.41	<0.41	<0.41	0.060 J	0.090 J	<0.42	<0.43	<0.42	<0.43	<0.42	<0.42	0.070 J	0.29 J [<0.42]	0.090 J	<0.41	<0.41	1.2	<0.41	<0.42	0.090 J	<0.41	<0.41	<0.42	<0.45	<0.42	<0.41
2-Methylphenol	310 {nc}	3,100 {nc}	- -	mg/kg	<0.42	<0.43	<0.40	<0.46	<0.39	<0.38 [<0.38]	<0.39	<0.41	<0.41	<0.41	<0.43	<0.43	<0.42	<0.43	<0.42	<0.43	<0.42	<0.42	<0.47	<0.42 [<0.42]	<0.41	<0.41	<0.41	<0.43	<0.41	<0.42	<0.43	<0.41	<0.41	<0.42	<0.45	<0.42	<0.41
2-Nitroaniline	- -	- -	- -	mg/kg	<2.1	<2.2	<2.0	<2.3	<1.9	<1.9 [<1.9]	<2.0	<2.1	<2.0	<2.1	<2.2	<2.2	<2.1	<2.2	<2.1	<2.2	<2.1	<2.1	<2.4	<2.1 [<2.1]	<2.1	<2.1	<2.0	<2.1	<2.0	<2.1	<2.2	<2.0	<2.1	<2.1	<2.3	<2.1	<2.1
2-Nitrophenol	- -	- -	- -	mg/kg	<0.42	<0.43	<0.40	<0.46	<0.39	<0.38 [<0.38]	<0.39	<0.41	<0.41	<0.41	<0.43	<0.43	<0.42	<0.43	<0.42	<0.43	<0.42	<0.42	<0.47	<0.42 [<0.42]	<0.41	<0.41	<0.41	<0.43	<0.41	<0.42	<0.43	<0.41	<0.41	<0.42	<0.45	<0.42	<0.41
3,3'-Dichlorobenzidine	1.1 {ca**}	3.8 {ca**}	- -	mg/kg	<0.82	<0.86	<0.79	<0.90	<0.76	<0.76 [<0.76]	<0.77	<0.81	<0.80	<0.80	<0.83	0.12 J	<0.82	<0.83	<0.82	<0.83	<0.81	<0.82	<0.93	<0.83 J [<0.83]	<0.81	<0.81	<0.80	<170	<0.80	<0.82	<0.86 J	<0.80	<0.81	<0.83	<0.89	<0.82	<0.81
3-Nitroaniline	- -	- -	- -	mg/kg	<2.1	<2.2	<2.0	<2.3	<1.9	<1.9 [<1.9]	<2.0	<2.1	<2.0	<2.1	<2.2	<2.2	<2.1	<2.2	<2.1	<2.2	<2.1	<2.1	<2.4	<2.1 [<2.1]	<2.1	<2.1	<2.0	<2.1	<2.0	<2.1	<2.2	<2.0	<2.1	<2.1	<2.3	<2.1	<2.1
4,6-Dinitro-2-methylphenol	- -	- -	- -	mg/kg	<2.1	<2.2	<2.0	<2.3	<1.9	<1.9 [<1.9]	<2.0	<2.1	<2.0	<2.1	<2.2	<2.2	<2.1	<2.2	<2.1	<2.2	<2.1	<2.1	<2.4	<2.1 [<2.1]	<2.1	<2.1	<2.0	<430	<2.0	<2.1	<2.2	<2.0	<0.41	<2.1	<2.3	<2.1	<2.1
4-Bromophenyl-phenylether	- -	- -	- -	mg/kg	<0.42	<0.43	<0.40	<0.46	<0.39	<0.38 [<0.38]	<0.39	<0.41	<0.41	<0.41	<0.43	<0.43	<0.42	<0.43	<0.42	<0.43	<0.42	<0.42	<0.47	<0.42 [<0.42]	<0.41	<0.41	<0.41	<86	<0.41	<0.42	<0.43	<0.41	<0.41	<0.42	<0.45	<0.42	<0.41
4-Chloro-3-Methylphenol	- -	- -	- -	mg/kg	<0.82	<0.86	<0.79	<0.90	<0.76	<0.76 [<0.76]	<0.77	<0.81	<0.80	<0.80	<0.83	<0.84	<0.82	<0.83	<0.82	<0.83	<0.81	<0.82	<0.93	<0.83 [<0.83]	<0.81	<0.81	<0.80	<170	<0.80	<0.82	<0.86	<0.80	<0.81	<0.83	<0.89	<0.82	<0.81
4-Chloroaniline	24 {nc}	250 {nc}	- -	mg/kg	<0.82	<0.86	<0.79	<0.90	<0.76	<0.76 [<0.76]	<0.77	<0.81	<0.80	<0.80	<0.83	<0.84	<0.82	<0.83	<0.82	<0.83	<0.81	<0.82	<0.93	<0.83 [<0.83]	<0.81	<0.81	<0.80	<0.84	<0.80	<0.82	<0.86	<0.80	<0.81	<0.83	<0.89	<0.82	<0.81
4-Chlorophenyl-phenylether	- -	- -	- -	mg/kg	<0.42	<0.43	<0.40	<0.46	<0.39	<0.38 [<0.38]	<0.39	<0.41	<0.41	<0.41	<0.43	<0.43	<0.42	<0.43	<0.42	<0.43	<0.42	<0.42	<0.47	<0.42 [<0.42]	<0.41	<0.41	<0.41	<0.43	<0.41	<0.42	<0.43	<0.41	<0.41	<0.42	<0.45	<0.42	<0.41
4-Methylphenol	31 {nc}	310 {nc}	- -	mg/kg	<0.42	<0.43	<0.40	<0.46	<0.39	<0.38 [<0.38]	<0.39	<0.41	<0.41	<0.41	<0.43	<0.43	<0.42	<0.43	<0.42	<0.43	<0.42	<0.42	<0.47	<0.42 [<0.42]	<0.41	<0.41	<0.41	0.10 J	<0.41	<0.42	<0.43	<0.41	<0.41	<0.42	<0.45	<0.42	<0.41
4-Nitroaniline	- -	- -	- -	mg/kg	<2.1	<2.2	<2.0	<2.3	<1.9	<1.9 [<1.9]	<2.0	<2.1	<2.0	<2.1	<2.2	<2.2	<2.1	<2.2	<2.1	<2.2	<2.1	<2.1	<2.4	<2.1 [<2.1]	<2.1	<2.1	<2.0	<2.1	<2.0	<2.1	<2.2	<2.0	<2.1	<2.1	<2.3	<2.1	<2.1
4-Nitrophenol	- -	- -	- -	mg/kg	<2.1	<2.2	<2.0	<2.3	<1.9	<1.9 [<1.9]	<2.0	<2.1	<2.0	<2.1	<2.2	<2.2	<2.1	<2.2	<2.1	<2.2	<2.1	<2.1	<2.4	<2.1 [<2.1]	<2.1	<2.1	<2.0	<430	<2.0	<2.1	<2.2	<2.0	<2.1	<2.1	<2.3	<2.1	<2.1
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	0.56	0.61	0.060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.42	<0.43	<0.40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.61	0.86	0.14 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	2.9	1.8	0.27 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	2.1	2.0	0.31 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	6.2 J	3.0 J	0.51 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	0.84 J	0.75 J	0.14 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	2.7	1.2	0.39 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzoic Acid	240,000 {max}	2,500,000 {max}	- -	mg/kg	<2.1	<2.2	<2.0	<2.3	<1.9	<1.9 [<1.9]	<2.0	<2.1	<2.0	<2.1	<2.2	<2.2	<2.1	<2.2	<2.1	<2.2	<2.1	<2.1	<2.4	<2.1 [<2.1]	<2.1	<2.1	<2.0	<2.1	<2.0	<2.1	<2.2	<2.0	<2.1	<2.1	<2.3	<2.1	<2.1
Benzyl Alcohol	3,100 {nc}	310,000 {max}	- -	mg/kg	<0.82	<0.86	<0.79	<0.90	<0.76	<0.76 [<0.76]	<0.77	<0.81	<0.80	<0.80	<0.83	<0.84	<0.82	<0.83	<0.82	<0.83	<0.81	<0.82	<0.93	<0.83 [<0.83]	<0.81	<0.81	<0.80	<0.84	<0.80	<0.82	<0.86	<0.80	<0.81	<0.83	<0.89	<0.82	<0.81
bis(2-Chloroethoxy)methane	18 {nc}	180 {nc}	- -	mg/kg	<0.42	<0.43	<0.40	<0.46	<0.39	<0.38 [<0.38]	<0.39	<0.41	<0.41	<0.41	<0.43	<0.43	<0.42	<0.43	<0.42	<0.43	<0.42	<0.42	<0.47	<0.42 [<0.42]	<0.41	<0.41	<0.41	<0.43	<0.41	<0.42	<0.43	<0.41	<0.41	<0.42	<0.45	<0.42	<0.41
bis(2-Chloroethyl)ether	0.19 {ca**}	0.9 {ca**}	- -	mg/kg	<0.42	<0.43	<0.40	<0.46	<0.39	<0.38 [<0.38]	<0.39	<0.41	<0.41	<0.41	<0.43	<0.43	<0.42	<0.43	<0.42	<0.43	<0.42	<0.42	<0.47	<0.42 [<0.42]	<0.41	<0.41	<0.41	<0.43	<0.41	<0.42	<0.43	<0.41	<0.41	<0.42	<0.45	<0.42	<0.41
bis(2-Chloroisopropyl)ether	- -	- -	- -	mg/kg	<0.42	<0.43	<0.40	<0.46	<0.39	<0.38 [<0.38]	<0.39	<0.41	<0.41	<0.41	<0.43	<0.43	<0.42	<0.43	<0.42	<0.43	<0.42	<0.42	<0.47	<0.42 [<0.42]	<0.41	<0.41	<0.41	<0.43	<0.41	<0.42	<0.43	<0.41	<0.41	<0.42	<0.45	<0.42	<0.41
bis(2-Ethylhexyl)phthalate	35 {ca*}	120 {ca*}	- -	mg/kg	<0.42	<0.43	<0.40	<0.46	<0.39	<0.38 [<0.38]	<0.39	<0.41	<0.41	<0.41	<0.43	<0.43	<0.42	<0.43	<0.42	<0.43	<0.42	<0.42	<0.47	<0.42 J [<0.42]	<0.41	<0.41	<0.41	<86	<0.41	<0.42	<0.43 J	<0.41	<0.41	<0.42	<0.45	<0.42	<0.41
Butylbenzylphthalate	260 {ca*}	910 {ca*}	- -	mg/kg	<0.42	<0.43	<0.40	<0.46	<0.39	<0.38 [<0.38]	<0.39	<0.41	<0.41	<0.41	<0.43	<0.43	<0.42	<0.43	<0.42	<0.43	<0.42	<0.42	<0.47	<0.42 J [<0.42]	<0.41	<0.41	<0.41	<86	<0.41	<0.42	<0.43 J	<0.41	<0.41	<0.42	<0.45	<0.42	<0.41
Carbazole	24 {ca**}	86 {ca**}	- -	mg/kg	1.9 J	1.4 J	0.17 J	<0.46	<0.39	<0.38 [<0.38]	<0.39	<0.41	<0.41	<0.41	0.57 J	0.45 J	<0.42	0.11 J	<0.42	<0.43	<0.42	0.070 J	1.4 J	1.7 J [0.17 J]	1.3 J	<0.41	0.50 J	<86	0.29 J	<0.42	3.5 J	<0.41	<0.41	<0.42	0.080 J	<0.42	0.35 J
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	3.9	2.1	0.43	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	0.40 J	0.38 J	0.040 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran	- -	- -	- -	mg/kg	0.28 J	0.29 J	<0.40	<0.46	<0.39	<0.38 [<0.38]	<0.39	<0.41	<0.41	<0.41	0.23 J	1.1	<0.42	<0.43	<0.42	<0.43	<0.42	<0.42	0.44 J	0.74 [<0.42]	0.43	<0.41	0.15 J	2.0	0.060 J	<0.42	0.80	<0.41	<0.41	<0.42	<0.45	<0.42	0.090 J
Diethylphthalate	4,900 {nc}	490,000 {max}	- -	mg/kg	<0.42	<0.43	<0.40	<0.46	<0.39	<0.38 [<0.38]	<0.39	<0.41	<0.41	0.070 J	0.050 J	0.17 J	0.090 J	0.12 J	0.060 J	0.21 J	0.11 J	<0.42	<0.47	<0.42 [<0.42]	<0.41	<0.41	<0.41	<0.43	<0.41	<0.42	<0.43	<0.41	<0.41	<0.42	<0.45	<0.42	<0.41
Dimethylphthalate	- -	- -	- -	mg/kg	<0.42	<0.43	<0.40	<0.46	<0.39	<0.38 [<0.38]	<0.39	<0.41	<0.41	<0.41	<0.43	<0.43	<0.42	<0.43	<0.42	<0.43	<0.42	<0.42	<0.47	<0.42 [<0.42]	<0.41	<0.41	<0.41	<0.43	<0.41	<0.42	<0.43	<0.41	<0.41	<0.42	<0.45	<0.42	<0.41
Di-n-Butylphthalate	610 {nc}	6,200 {nc}	- -	mg/kg	<0.42	<0.43	<0.40	0.12 B	<0.39	<0.38 [<0.38]	<0.39	<0.41	<0.41	<0.41	<0.43	<0.43	<0.42	<0.43	<0.42	<0.43	<0.42	<0.42	<0.47	<0.42 [<0.42]	<0.41	<0.41	<0.41	<86	<0.41	<0.42	<0.43	<0.41	<0.41	<0.42	<0.45	<0.42	0.10 B
Di-n-Octylphthalate	- -	- -	- -	mg/kg	<0.42	<0.43	<0.40	<0.46	<0.39	<0.38 [<0.38]	<0.39	<0.41	<0.41	<0.41	<0.43	<0.43	<0.42	<0.43	<0.42	<0.43	<0.42	<0.42	<0.47	<0.42 J [<0.42]	<0.41	<0.41	<0.41	<86	<0.41	<0.42	<2.2 J	<0.41	<0.41	<0.42	<0.45	<0.42	<0.41
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	6.8	4.8	0.87	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	32 J	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	0.54	0.56	0.050 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	0.3 {ca}	1.1 {ca}	- -	mg/kg	<0.42	<0.43	<0.40	<0.46	<0.39	<0.38 [<0.38]	<0.39	<0.41	<0.41	<0.41	<0.43	<0.43	<0.42	<0.43	<0.42	<0.43	<0.42	<0.42	<0.47	<0.42 [<0.42]	<0.41	<0.41	<0.41	<86	<0.41	<0.42	<0.43	<0.41	<0.41	<0.42	<0.45	<0.42	<0.41
Hexachlorocyclopentadiene	37 {nc}	370 {nc}	- -	mg/kg	<0.42	<0.43	<0.40	<0.46	<0.39	<0.38 [<0.38]	<0.39	<0.41	<0.41	<0.41	<0.43	<0.43	<0.42	<0.43	<0.42	<0.43	<0.42	<0.42	<0.47	<0.42 [<0.42]	<0.41	<0.41	<0.41	<0.43	<0.41	<0.42	<0.43	<0.41	<0.41	<0.42	<0.45	<0.42	<0.41
Hexachloroethane	35 {ca**}	120 {ca**}	- -	mg/kg	<0.42	<0.43	<0.40	<0.46	<0.39	<0.38 [<0.38]	<0.39	<0.41	<0.41	<0.41	<0.43	<0.43	<0.42	<0.43	<0.42	<0.43	<0.42	<0.42	<0.47	<0.42 [<0.42]	<0.41	<0.41	<0.41	<0.43	<0.41	<0.42	<0.43	<0.41	<0.41	<0.42	<0.45	<0.42	<0.41
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.82 J	0.77 J	0.14 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Isophorone	510 {ca*}	1,800 {ca*}	- -	mg/kg	<0.42	<0.43	<0.40	<0.46	<0.39	<0.38 [<0.38]	<0.39	<0.41	<0.41	<0.41	<0.43	<0.43	<0.42	<0.43	<0.42	<0.43	<0.42	<0.42	<0.47	<0.42 [<0.42]	<0.41	<0.41	<0.41	<0.43	<0.41	<0.42	<0.43	<0.41	<0.41	<0.42	<0.45	<0.42	<0.41
Naphthalene	15 {nc}	67 {nc}	- -	mg/kg	0.12 J	0.12 J	<0.40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	0.069 {ca**}	0.25 {ca**}	- -	mg/kg	<0.42	<0.43	<0.40	<0.46	<0.39	<0.38 [<0.38]	<0.39	<0.41	<0.41	<0.41	<0.43	<0.43	<0.42	<0.43	<0.42	<0.43	<0.42	<0.42	<0.47	<0.42 [<0.42]	<0.41	<0.41	<0.41	<86	<0.41	<0.42	<0.43	<0.41	<0.41	<0.42	<0.45	<0.42	<0.41
N-Nitrosodiphenylamine	99 {ca**}	350 {ca**}	- -	mg/kg	<0.42	<0.43	<0.40	<0.46	<0.39	<0.38 [<0.38]	<0.39	<0.41	<0.41	<0.41	<0.43	<0.43	<0.42	<0.43	<0.42	<0.43	<0.42	<0.42	<0.47	<0.42 [<0.42]	<0.41	<0.41	<0.41	<86	<0.41	<0.42	<0.43	<0.41	<0.41	<0.42	<0.45	<0.42	<0.41
Pentachlorophenol	3 {ca}	9 {ca}	- -	mg/kg	<2.1	<2.2	<2.0	<2.3	<1.9	<1.9 [<1.9]	<2.0	<2.1	<2.0	<2.1	<2.2	<2.2	<2.1	<2.2	<2.1	<2.2	<2.1	<2.1	<2.4	<2.1 [<2.1]	<2.1	<2.1	<2.0	0.47 J	<2.0	<2.1	<2.2	<2.0	<2.1	<2.1	<2.3	<2.1	<2.1
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	6.3	4.7	0.68	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenol	1,800 {nc}	180,000 {max}	- -	mg/kg	<0.42	<0.43	<0.40	<0.46	<0.39	<0.38 [<0.38]	<0.39	<0.41	<0.41	<0.41	<0.43	<0.43	<0.42	<0.43	<0.42	<0.43	<0.42	<0.42	<0.47	<0.42 [<0.42]	<0.41	<0.41	<0.41	<86	<0.41	<0.42	<0.43	<0.41	<0.41	<0.42	<0.45	<0.42	<0.41
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	5.8	4.7	0.63	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Inorganics																																					
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	15,000	15,800	20,100	11,600	11,800	11,200 [10,900]	12,900	11,000	16,000	10,700	9,990	11,100	10,100	7,770	11,800	10,100	12,600	10,600	14,700	15,400 [13,000]	15,100	17,000	16,300	8,560	13,600	12,500	14,600	15,000	15,900	14,000	19,900	15,600	10,700
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	<0.610	<0.660	<0.590	<0.670	<0.570	4.80 K [<0.560]	<0.580	<0.620	<0.610	1.50 B	1.80 B	1.70 B	1.90 B	2.10 B	2.00 B	2.00 B	2.10 B	4.80 J	<0.610	<0.620 [<0.640]	<0.600	<0.630	<0.610	<0.630	<0.600	<0.640	<0.660	<0.620	<0.620	<0.640	<0.680	<0.630	<0.630
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	4.30	7.90	11.6	4.80	4.50	7.00 [3.90]	6.10	6.10	6.10	7.30	6.30	7.30	6.50	6.40	7.20	7.10	7.00	4.40	5.80	9.60 [5.50]	5.70	5.70	7.10	2.60	5.40	3.40	4.60	7.00	6.70	5.20	6.10	5.20	3.30
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	72.0 K	63.0 K	73.5 K	53.3 K	54.9 K	48.9 K [39.2 K]	47.3 K	32.4 K	41.7 K	46.2 B	65.7 K	44.6 B	43.2 K	41.3 B	42.4 B	48.7 B	61.9 B	47.9 L	48.0 L	72.0 L [52.7 L]	45.2 L	48.5 L	49.3 L	62.8 L	48.4 L	63.6 L	73.8 K	47.2 K	58.4 K	60.8 K	71.4 K	70.6 K	39.1 K
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	**1.10**	0.760	**1.50**	0.900	0.720	0.570 B [0.460 B]	0.660	0.610 B	0.590 B	0.590 B	**1.10 B**	0.670 B	0.560 B	0.720 B	0.670 B	0.970 B	**1.10 B**	0.710 B	0.910 B	**1.30 B [0.930 B]**	0.790 B	0.960 B	1.00 B	0.780 B	0.890 B	0.920 B	**1.10 B**	1.00 B	**1.30 B**	0.990 B	**1.40 B**	**1.10 B**	0.860 B
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	<0.120	<0.130	<0.120	<0.130	<0.110	<0.110 [<0.110]	<0.120	<0.120	<0.120	<0.240	<0.250	<0.260	<0.250	<0.260	<0.240	<0.260	<0.240	<0.120	<0.120	<0.120 [<0.130]	<0.120	<0.130	<0.120	<0.120	<0.120	<0.130	<0.130	<0.120	<0.120	<0.130	<0.140	<0.130	<0.130
Calcium	- -	- -	- -	mg/kg	1,440 B	1,890 B	2,560 B	4,600 B	773 B	734 B [630 B]	729 B	662 B	908 B	786 B	874 B	966 B	901 B	769 B	961 B	1,060 B	638 B	934 B	1,370 B	1,680 B [1,430 B]	1,350 B	1,550 B	1,300 B	1,330 B	1,250 B	1,160 B	1,650 B	1,280 B	1,510 B	1,580 B	1,460 B	1,290 B	1,210 B
Chromium	280 {ca}	1,460 {ca}	65.3	mg/kg	37.0	33.4	60.8	30.1	37.6	27.2 [22.3]	31.4	33.9	32.3	28.3	40.5	33.8	25.1	35.0	37.5	27.8	29.4	40.0	38.1	53.5 [36.8]	32.8	32.5	38.0	38.4	40.7	29.3	47.2	51.9	58.0	43.6	38.3	41.2	19.8
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	29.8	**446**	40.8 L	14.5	19.0	11.3 [9.20]	18.1	15.6	17.6	15.3	26.3	17.2	13.7	13.8	8.40 J	15.4	19.1	12.9 L	15.9 L	20.3 L [20.5 L]	15.3 L	15.2 L	15.4 L	12.3 L	12.0 L	16.4 L	16.9	17.0	28.7	20.6	15.6	19.4	10.7
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	33.9 L	**138 L**	40.8	17.2 B	31.1 L	**68.0 L [20.0 L]**	21.3 L	10.4 B	35.3 L	40.5 L	20.0 B	**113 L**	11.6 B	37.4 L	21.6 B	**108 L**	6.20 B	25.9 K	**99.4 K**	**233 K [31.0 K]**	25.1 K	12.9 B	33.3 K	**110 K**	23.8 K	10.0 B	**136**	12.7 B	14.9 B	47.1	21.9	20.2	14.0 B
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	37,200	32,700	**58,100**	29,100	32,000	29,000 [21,400]	30,500	30,800	32,100	28,600	32,100	29,700	23,500	29,400	32,500	28,600	36,900	29,100	30,800	47,800 [34,700]	31,400	30,000	38,900	23,900	34,800	26,200	29,600	41,300	41,600	29,500	37,400	31,900	23,200
Lead	400 {++}	800 {++}	26.8	mg/kg	**157**	**336**	**82.5**	22.6	15.1	12.5 [9.00]	13.2	13.5	13.2	14.0	19.9	12.1	12.4	19.5	11.1	18.4	20.0	16.1	**32.9**	**47.1 [14.5]**	13.5	11.4	18.9	**62.7**	13.0	11.8	**66.9**	13.6	17.9	**72.8**	12.8	16.4	10.3
Magnesium	- -	- -	- -	mg/kg	12,800	6,700	13,500	6,850	4,930	2,700 [2,450 B]	3,290	3,950	3,120	3,000 B	3,610	4,040 B	2,550	2,930 B	4,330 B	2,830 B	4,430 B	3,360	5,700	5,810 [5,080]	5,270	6,630	5,790	3,310	7,890	5,870	5,090	6,670	8,930	6,080	11,400	7,610	2,950
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	1,580	**3,430**	2,030	408	812	515 [405]	790	543	587	815	1,660	536	847	612	303	620	1,040	712	553	1,110 [733]	462	470	564	541	437	918	746	815	1,490	1,070	703	1,060	390
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	<0.130	<0.130	<0.120	<0.140	<0.120	<0.120 [<0.120]	<0.120	<0.130	<0.120	<0.120	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130 [<0.130]	<0.120	<0.130	<0.120	<0.130	<0.120	<0.130	<0.130	<0.120	<0.120	<0.130	<0.140	<0.130	<0.130
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	19.4 K	41.3 K	20.1 K	38.4 K	10.3 K	8.40 K [7.30 K]	9.40 K	9.50 K	11.3 K	7.90 K	9.80 K	11.2 K	7.70 K	7.40 K	10.0 K	11.6 K	10.5 K	9.00 K	15.1 K	14.8 K [13.4 K]	13.8 K	16.2 K	13.5 K	9.00 K	14.8 K	13.8 K	15.4	14.4	17.1	14.1	25.5	17.1	11.8
Potassium	- -	- -	- -	mg/kg	2,280 J	1,670 J	3,980 J	1,070 J	843 J	917 J [832 J]	1,180 J	1,210 J	1,440 J	721 B	593 B	711 B	654 J	611 B	974 B	766 B	859 B	917 K	1,550 K	1,890 K [1,260 K]	1,540 K	1,850 K	1,720 K	839 K	1,880 K	1,380 K	1,430 K	1,710 K	1,870 K	1,770	2,880 K	2,190 K	974 K
Selenium	39 {nc}	510 {nc}	- -	mg/kg	<0.610 J	<0.660 J	<0.590 J	<0.670 J	<0.570 J	<0.560 J [<0.560 J]	<0.580 J	<0.620 J	<0.610 J	<1.20 J	<1.20 J	<1.30 J	<1.30 J	<1.30 J	<1.20 J	<1.30 J	<1.20 J	<0.620 L	<0.610 L	<0.620 L [<0.640 L]	<0.600 L	<0.630 L	<0.610 L	<0.630 L	<0.600 L	<0.640 L	<0.660 L	<0.620 L	<0.620 L	<0.640 L	<0.680 L	<0.630 L	<0.630 L
Silver	39 {nc}	510 {nc}	- -	mg/kg	<0.240	<0.260	<0.240	<0.270	<0.230	<0.220 [<0.230]	<0.230	<0.250	<0.240	<0.480	<0.500	<0.520	<0.500	<0.510	<0.490	<0.510	<0.490	<0.250 L	<0.240 L	<0.250 L [<0.260 L]	<0.240 L	<0.250 L	<0.240 L	<0.250 L	<0.240 L	<0.250 L	<0.260 L	<0.250 L	<0.250 L	<0.260 L	<0.270 L	<0.250 L	<0.250 L
Sodium	- -	- -	- -	mg/kg	126 B	119 B	119 B	120 B	106 B	95.2 B [162 B]	96.2 B	107 B	103 B	47.2 B	57.7 B	68.3 B	42.7 B	45.6 B	42.3 B	27.4 B	25.4 B	86.2 B	105 B	108 B [104 B]	103 B	104 B	99.8 B	86.9 B	107 B	91.0 B	173 B	193 B	165 B	168 B	166 B	141 B	94.3 B
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	<0.240 L	<0.260 L	<0.240 L	<0.270 J	<0.230 L	<0.220 L [<0.230 L]	<0.230 L	<0.250 L	<0.240 L	2.00 B	0.990 B	<0.520 L	0.890 B	<0.510 L	0.630 B	0.810 B	<0.490 L	<0.250 L	0.360 B	1.00 B [0.380 B]	0.470 B	<0.250 L	<0.240 L	0.310 B	0.530 B	0.990 B	0.510 B	<0.250 L	<0.250 L	<0.260 L	<0.270 L	<0.250 L	<0.250 L
Vanadium	55 {nc}	720 {nc}	108	mg/kg	60.9 J	64.1 J	108 J	45.3 J	52.3 J	44.6 J [36.0 J]	55.8 J	50.7 J	56.3 J	47.2 J	52.4 J	50.1 J	38.3 J	48.7 J	52.8 J	47.6 J	53.2 J	52.4 K	53.6 K	85.0 K [59.6 K]	54.8 K	53.7 K	70.2 K	40.6 K	59.4 K	47.9 K	52.6 K	69.7 J	71.6 J	53.4 J	63.4 J	59.5 J	38.1 J
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	178	137 B	109 B	**271 L**	34.9 B	35.0 B [25.1 B]	22.8 B	20.5 B	31.7 B	28.0 B	38.7 B	26.3 B	31.4 B	34.0 B	22.3 B	50.7 B	22.6 B	36.1 B	81.7 B	101 B [39.3 B]	40.1 B	32.0 B	40.4 B	60.3 B	34.9 B	29.5 B	157 B	78.8 B	35.2 B	119 B	46.6 B	67.8 B	36.0 B

Notes found at end of table.

Table 5-4. Soil Analytical Results, Building Debris Disposal Trench, 1998 ICF KE Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	DTSB42 0.5 - 1 08/18/98	DTSB43 0.5 - 1 08/18/98	DTSB44 0.5 - 1 08/18/98	DTSB45 0.5 - 1 08/18/98
Explosives								
1,3,5-Trinitrobenzene	220 {nc}	2,700 {nc}	- -	mg/kg	<0.2	<0.2	<0.2 [<0.3]	<0.2
1,3-Dinitrobenzene	0.61 {nc}	6.2 {nc}	- -	mg/kg	<0.2	<0.2	<0.2 [<0.3]	<0.2
2,4,6-Trinitrotoluene	3.6 {ca**}	42 {ca**}	- -	mg/kg	<0.2	<0.2	<0.2 [<0.3]	<0.2
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.2	<0.2	<0.2 [<0.3]	<0.2
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	<0.2	<0.2	<0.2 [<0.3]	<0.2
2-Amino-4,6-Dinitrotoluene	15 {nc}	190 {nc}	- -	mg/kg	<0.2	<0.2	<0.2 [<0.3]	<0.2
4-Amino-2,6-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.2	<0.2	<0.2 [<0.3]	<0.2
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	<0.2	<0.2	<0.2 [<0.3]	<0.2
HMX	310 {nc}	3,100 {nc}	- -	mg/kg	<0.2	<0.2	<0.2 [<0.3]	<0.2
m-Nitrotoluene	- -	- -	- -	mg/kg	<0.2	<0.2	<0.2 [<0.3]	<0.2
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	<0.2	<0.2	<0.2 [<0.3]	<0.2
Nitroglycerine	0.61 {nc}	6.2 {nc}	- -	mg/kg	<1.1	<1.2	<1.2 [<1.3]	<1.1
o-Nitrotoluene	78 {nc}	1,300 {sat}	- -	mg/kg	<0.2	<0.2	<0.2 [<0.3]	<0.2
Pentaerythritol Tetranitrate	- -	- -	- -	mg/kg	<1.1	<1.2	<1.2 [<1.3]	<1.1
p-Nitrotoluene	30 {ca**}	110 {ca*}	- -	mg/kg	<0.2	<0.2	<0.2 [<0.3]	<0.2
RDX	4.4 {ca*}	16 {ca}	- -	mg/kg	<0.2	<0.2	<0.2 [<0.3]	<0.2
Tetryl	24 {nc}	250 {nc}	- -	mg/kg	<0.2	<0.2	<0.2 [<0.3]	<0.2
PAHs								
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	0.26 J	0.38 J	2.4 J [<2.2]	<0.43
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.83	<1.2	<8.3 [<4.3]	<0.85
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.64	1.3	6.4 [1.3]	0.49
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	1.4	1.9	9.6 [2.0]	1.2
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	1.7 J	1.9 J	10 J [2.1 J]	1.3 J
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	2.3	2.5	13 [3.0]	1.9
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	0.81 J	0.77 J	3.9 J [0.93 J]	0.72 J
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	1.0	1.2	6.0 [1.6]	0.82
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	1.8	2.2	11 [2.4]	1.6
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	0.090	0.090 J	0.70 J [0.11 J]	0.090
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	4.9 J	6.5 J	34 J [7.5 J]	4.1 J
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	0.29	0.69	4.8 [0.52]	<0.080
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.90	0.93	4.9 [1.0]	0.76
Naphthalene	3.9 {nc}	20 {nc}	- -	mg/kg	<0.42	<0.60	<4.2 [<2.2]	<0.43
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	3.7	5.6	33 [6.9]	2.6
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	3.8	5.0	26 [5.7]	3.2
Volatile Organics								
1,1,1,2-Tetrachloroethane	2 {ca}	9.8 {ca}	- -	mg/kg	<0.0020	<0.0020	<0.0020 [<0.0020]	<0.0020 J
1,1,1-Trichloroethane	680 {sat}	680 {sat}	- -	mg/kg	<0.0010	<0.0010	<0.0010 [<0.0010]	<0.0010 J
1,1,2,2-Tetrachloroethane	0.59 {ca**}	2.9 {ca**}	- -	mg/kg	<0.0020 J	<0.0020 J	<0.0020 [<0.0020]	<0.0020 J
1,1,2-Trichloroethane	1.1 {ca}	5.5 {ca}	- -	mg/kg	<0.0020	<0.0020	<0.0020 [<0.0020]	<0.0020 J
1,1-Dichloroethane	3.4 {ca}	17 {ca}	- -	mg/kg	<0.0020	<0.0020	<0.0020 [<0.0020]	<0.0020 J
1,1-Dichloroethene	25 {nc}	110 {nc}	- -	mg/kg	<0.0020	<0.0020	<0.0030 [<0.0030]	<0.0020 J
1,1-Dichloropropene	- -	- -	- -	mg/kg	<0.0020	<0.0020	<0.0020 [<0.0020]	<0.0020 J
1,2,3-Trichlorobenzene	- -	- -	- -	mg/kg	<0.0020 J	<0.0020 J	<0.0020 [<0.0020]	<0.0020 J
1,2,3-Trichloropropane	0.091 {ca}	0.41 {ca}	- -	mg/kg	<0.0030 J	<0.0030 J	<0.0030 [<0.0030]	<0.0030 J
1,2,4-Trichlorobenzene	180 {ca**}	220 {sat}	- -	mg/kg	<0.0020 J	<0.0020 J	<0.0020 [<0.0020]	<0.0020 J
1,2,4-Trimethylbenzene	6.7 {nc}	28 {nc}	- -	mg/kg	<0.0020 J	<0.0020 J	<0.0020 [<0.0020]	<0.0020 J
1,2-Dibromo-3-chloropropane	0.0056 {ca}	0.073 {ca}	- -	mg/kg	<0.0060 J	<0.0060 J	<0.0070 [<0.0070]	<0.0060 J
1,2-Dibromoethane	0.034 {ca}	0.17 {ca}	- -	mg/kg	<0.0020	<0.0020	<0.0020 [<0.0020]	<0.0020 J
1,2-Dichlorobenzene	220 {sat}	220 {sat}	- -	mg/kg	<0.0010 J	<0.0010 J	<0.0010 [<0.0010]	<0.0010 J
1,2-Dichloroethane	0.45 {ca}	2.2 {ca}	- -	mg/kg	<0.0010	<0.0010	<0.0010 [<0.0010]	<0.0010 J
1,2-Dichloropropane	0.93 {ca*}	4.7 {ca*}	- -	mg/kg	<0.0040	<0.0040	<0.0050 [<0.0050]	<0.0040 J
1,3,5-Trimethylbenzene	- -	- -	- -	mg/kg	<0.0020 J	<0.0020 J	<0.0020 [<0.0020]	<0.0020 J
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	<0.0020 J	<0.0020 J	<0.0020 [<0.0020]	<0.0020 J
1,3-Dichloropropane	160 {nc}	1,600 {sat}	- -	mg/kg	<0.0020	<0.0020	<0.0020 [<0.0020]	<0.0020 J
1,4-Dichlorobenzene	2.6 {ca}	13 {ca}	- -	mg/kg	<0.0020 J	NA	<0.0020 [<0.0020]	<0.0020 J
2,2-Dichloropropane	- -	- -	- -	mg/kg	<0.0010	<0.0010	<0.0010 [<0.0010]	<0.0010 J
2-Butanone	2,800 {nc}	19,000 {nc}	- -	mg/kg	<0.0060	<0.0060	<0.0070 [<0.0070]	<0.0060 J
2-Chloroethyl Vinyl Ether	- -	- -	- -	mg/kg	<0.0060	<0.0060	<0.0070 [<0.0070]	<0.0060 J
2-Chlorotoluene	1,000 {sat}	1,000 {sat}	- -	mg/kg	<0.0010 J	<0.0010 J	<0.0020 [<0.0020]	<0.0010 J
2-Hexanone	- -	- -	- -	mg/kg	<0.0060	<0.0060	<0.0070 [<0.0070]	<0.0060 J
4-Chlorotoluene	290 {sat}	290 {sat}	- -	mg/kg	<0.0010 J	<0.0010 J	<0.0010 [<0.0010]	<0.0010 J
4-Methyl-2-pentanone	530 {nc}	5,200 {sat}	- -	mg/kg	<0.0060	<0.0060	<0.0070 [<0.0070]	<0.0060 J
Acetone	6,100 {nc}	61,000 {nc}	- -	mg/kg	<0.0060	<0.0060	<0.0070 [<0.0070]	<0.0060 J
Acrolein	0.016 {nc}	0.068 {nc}	- -	mg/kg	<0.0060	<0.0060	<0.0070 [<0.0070]	<0.0060 J
Acrylonitrile	0.24 {ca*}	1.2 {ca*}	- -	mg/kg	<0.0060	<0.0060	<0.0070 [<0.0070]	<0.0060 J
Benzene	1.1 {ca*}	5.6 {ca*}	- -	mg/kg	<0.0010	<0.0010	<0.0010 [<0.0010]	<0.0010 J
Bromobenzene	- -	- -	- -	mg/kg	<0.0010 J	<0.0010 J	<0.0010 [<0.0010]	<0.0010 J
Bromochloromethane	- -	- -	- -	mg/kg	<0.0020	<0.0020	<0.0020 [<0.0020]	<0.0020 J
Bromodichloromethane	10 {ca}	46 {ca}	- -	mg/kg	<0.0010	<0.0010	<0.0010 [<0.0010]	<0.0010 J
Bromoform	61 {ca*}	220 {ca*}	- -	mg/kg	<0.00060	<0.00060	<0.00070 [<0.00070]	<0.00060 J
Bromomethane	0.79 {nc}	3.5 {nc}	- -	mg/kg	<0.0050	<0.0050	<0.0050 [<0.0050]	<0.0050 J
Carbon Disulfide	67 {nc}	300 {nc}	- -	mg/kg	<0.0060	<0.0060	<0.0070 [<0.0070]	<0.0060 J
Carbon Tetrachloride	0.25 {ca}	1.3 {ca}	- -	mg/kg	<0.0050	<0.0050	<0.0050 [<0.0050]	<0.0050 J
Chlorobenzene	31 {nc}	860 {sat}	- -	mg/kg	<0.0010	<0.0010	<0.0020 [<0.0020]	<0.0010 J
Chloroethane	2,200 {sat}	2,200 {sat}	- -	mg/kg	<0.0060	<0.0060	<0.0070 [<0.0070]	<0.0060 J
Chloroform	0.3 {ca}	1.5 {ca}	- -	mg/kg	<0.0020	<0.0020	<0.0020 [<0.0020]	<0.0020 J
Chloromethane	1.7 {ca*}	8.4 {ca*}	- -	mg/kg	<0.0040	<0.0040	<0.0040 [<0.0040]	<0.0040 J
cis-1,2-Dichloroethene	78 {nc}	1,300 {sat}	- -	mg/kg	<0.0020	<0.0020	<0.0020 [<0.0020]	<0.0020 J
cis-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.0010	<0.0010	<0.0010 [<0.0010]	<0.0010 J
Dibromochloromethane	5.8 {ca}	21 {ca}	- -	mg/kg	<0.00090	<0.00090	<0.00090 [<0.00090]	<0.00090 J
Dibromomethane	78 {nc}	3,000 {sat}	- -	mg/kg	<0.0020	<0.0020	<0.0020 [<0.0020]	<0.0020 J
Dichlorodifluoromethane	19 {nc}	78 {nc}	- -	mg/kg	<0.0020	<0.0020	<0.0020 [<0.0020]	<0.0020 J
Ethylbenzene	5.7 {ca}	29 {ca}	- -	mg/kg	<0.0010	<0.0010	<0.0020 [<0.0020]	<0.0010 J
Hexachlorobutadiene	6.2 {ca**}	22 {ca*}	- -	mg/kg	<0.0010 J	<0.0010 J	<0.0010 [<0.0010]	<0.0010 J
Isopropylbenzene	310 {sat}	310 {sat}	- -	mg/kg	<0.0020 J	<0.0020 J	<0.0020 [<0.0020]	<0.0020 J
m,p-Xylene	60 {nc}	260 {nc}	- -	mg/kg	<0.0030	<0.0030	<0.0030 [<0.0030]	<0.0030 J
Methylene Chloride	11 {ca}	54 {ca}	- -	mg/kg	<0.0010	0.0050 K	<0.0010 [0.0050 K]	0.0050 J
n-Butylbenzene	- -	- -	- -	mg/kg	<0.0020 J	<0.0020 J	<0.0020 [<0.0020]	<0.0020 J
n-Propylbenzene	- -	- -	- -	mg/kg	<0.0020 J	<0.0020 J	<0.0020 [<0.0020]	<0.0020 J
o-Xylene	300 {sat}	300 {sat}	- -	mg/kg	<0.0020	<0.0020	<0.0020 [<0.0020]	<0.0020 J
p-Isopropyltoluene	- -	- -	- -	mg/kg	<0.0010 J	<0.0010 J	<0.0010 [<0.0010]	<0.0010 J
sec-Butylbenzene	- -	- -	- -	mg/kg	<0.0020 J	<0.0020 J	<0.0020 [<0.0020]	<0.0020 J
Styrene	1,000 {sat}	1,000 {sat}	- -	mg/kg	<0.00030	<0.00030	<0.00030 [<0.00030]	<0.00030 J
tert-Butylbenzene	- -	- -	- -	mg/kg	<0.0020 J	<0.0020 J	<0.0020 [<0.0020]	<0.0020 J
Tetrachloroethene	0.57 {ca}	2.7 {ca}	- -	mg/kg	<0.0010	<0.0010	<0.0020 [<0.0020]	<0.0010 J
Toluene	500 {nc}	4600 {nc}	- -	mg/kg	<0.0020	<0.0020	<0.0020 [<0.0020]	<0.0020 J
trans-1,2-Dichloroethene	11 {nc}	50 {nc}	- -	mg/kg	<0.0060	<0.0050	<0.0060 [<0.0060]	<0.0060 J
trans-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.0010	<0.0010	<0.0010 [<0.0010]	<0.0010 J
Trichloroethene	2.8 {ca}	14 {ca}	- -	mg/kg	<0.0030	<0.0030	<0.0040 [<0.0040]	<0.0030 J
Trichlorofluoromethane	80 {nc}	1,300 {sat}	- -	mg/kg	<0.0020	<0.0020	<0.0020 [<0.0020]	<0.0020 J
Vinyl Acetate	99 {nc}	2,800 {sat}	- -	mg/kg	<0.0060	<0.0060	<0.0070 [<0.0070]	<0.0060 J
Vinyl Chloride	0.06 {ca}	1.7 {ca}	- -	mg/kg	<0.0020	<0.0020	<0.0020 [<0.0020]	<0.0020 J
Xylenes (total)	60 {nc}	260 {nc}	- -	mg/kg	<0.0030	<0.0030	<0.0030 [<0.0030]	<0.0030

Notes found at end of table.

Table 5-4. Soil Analytical Results, Building Debris Disposal Trench, 1998 ICF KE Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	DTSB42 0.5 - 1 08/18/98	DTSB43 0.5 - 1 08/18/98	DTSB44 0.5 - 1 08/18/98	DTSB45 0.5 - 1 08/18/98
Semivolatile Organics								
1,2,4-Trichlorobenzene	8.7 {ca**}	40 {ca**}	- -	mg/kg	NA	NA	NA	NA
1,2-Dichlorobenzene	220 {sat}	220 {sat}	- -	mg/kg	NA	NA	NA	NA
1,2-Diphenylhydrazine	0.61 {ca**}	2.2 {ca**}	- -	mg/kg	<0.43	<0.42	<0.45 [<0.45]	<0.43
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	NA	NA	NA	NA
1,4-Dichlorobenzene	2.6 {ca}	13 {ca}	- -	mg/kg	NA	NA	NA	NA
2,4,5-Trichlorophenol	610 {nc}	6,200 {nc}	- -	mg/kg	<1.0	<1.0	<1.1 [<1.1]	<1.0
2,4,6-Trichlorophenol	44 {ca**}	160 {ca**}	- -	mg/kg	<0.43	<0.42	<0.45 [<0.45]	<0.43
2,4-Dichlorophenol	18 {nc}	180 {nc}	- -	mg/kg	<0.43	<0.42	<0.45 [<0.45]	<0.43
2,4-Dimethylphenol	120 {nc}	1,200 {nc}	- -	mg/kg	<0.43	<0.42	<0.45 [<0.45]	<0.43
2,4-Dinitrophenol	12 {nc}	120 {nc}	- -	mg/kg	<2.1	<2.1	<2.2 [<2.2]	<2.1
2-Chloronaphthalene	210 {sat}	210 {sat}	- -	mg/kg	<0.43	<0.42	<0.45 [<0.45]	<0.43
2-Chlorophenol	39 {nc}	510 {nc}	- -	mg/kg	<0.43	<0.42	<0.45 [<0.45]	<0.43
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	<0.43	<0.42	0.19 K [0.090 J]	<0.43
2-Methylphenol	310 {nc}	3,100 {nc}	- -	mg/kg	<0.43	<0.42	<0.45 [<0.45]	<0.43
2-Nitroaniline	- -	- -	- -	mg/kg	<2.1	<2.1	<2.2 [<2.2]	<2.1
2-Nitrophenol	- -	- -	- -	mg/kg	<0.43	<0.42	<0.45 [<0.45]	<0.43
3,3'-Dichlorobenzidine	1.1 {ca**}	3.8 {ca**}	- -	mg/kg	<0.84	<0.83	<8.8 [<0.88 J]	<0.84
3-Nitroaniline	- -	- -	- -	mg/kg	<2.1	<2.1	<2.2 [<2.2]	<2.1
4,6-Dinitro-2-methylphenol	- -	- -	- -	mg/kg	<2.1	<2.1	<2.2 J [<2.2]	<0.43
4-Bromophenyl-phenylether	- -	- -	- -	mg/kg	<0.43	<0.42	<0.45 J [<0.45]	<0.43
4-Chloro-3-Methylphenol	- -	- -	- -	mg/kg	<0.84	<0.83	<0.88 [<0.88]	<0.84
4-Chloroaniline	24 {nc}	250 {nc}	- -	mg/kg	<0.84	<0.83	<0.88 [<0.88]	<0.84
4-Chlorophenyl-phenylether	- -	- -	- -	mg/kg	<0.43	<0.42	<0.45 [<0.45]	<0.43
4-Methylphenol	31 {nc}	310 {nc}	- -	mg/kg	<0.43	<0.42	<0.45 [<0.45]	<0.43
4-Nitroaniline	- -	- -	- -	mg/kg	<2.1	<2.1	<2.2 [<2.2]	<2.1
4-Nitrophenol	- -	- -	- -	mg/kg	<2.1	<2.1	<2.2 [<2.2]	<2.1
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	NA	NA	NA	NA
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	NA	NA	NA	NA
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	NA	NA	NA	NA
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	NA	NA	NA	NA
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	NA	NA	NA	NA
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	NA	NA	NA	NA
Benzoic Acid	240,000 {max}	2,500,000 {max}	- -	mg/kg	<2.1	<2.1	<2.2 [<2.2]	<2.1
Benzyl Alcohol	3,100 {nc}	310,000 {max}	- -	mg/kg	<0.84	<0.83	<0.88 [<0.88]	<0.84
bis(2-Chloroethoxy)methane	18 {nc}	180 {nc}	- -	mg/kg	<0.43	<0.42	<0.45 [<0.45]	<0.43
bis(2-Chloroethyl)ether	0.19 {ca**}	0.9 {ca**}	- -	mg/kg	<0.43	<0.42	<0.45 [<0.45]	<0.43
bis(2-Chloroisopropyl)ether	- -	- -	- -	mg/kg	<0.43	<0.42	<0.45 [<0.45]	<0.43
bis(2-Ethylhexyl)phthalate	35 {ca*}	120 {ca*}	- -	mg/kg	<0.43	<0.42	<4.5 [<0.45 J]	<0.43
Butylbenzylphthalate	260 {ca*}	910 {ca*}	- -	mg/kg	<0.43	<0.42	<4.5 [<0.45 J]	<0.43
Carbazole	24 {ca**}	86 {ca**}	- -	mg/kg	0.070 J	<0.42	6.3 J [1.4 J]	<0.43
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	NA	NA	NA	NA
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	NA	NA	NA	NA
Dibenzofuran	- -	- -	- -	mg/kg	<0.43	<0.42	1.4 K [0.44 J]	<0.43
Diethylphthalate	4,900 {nc}	490,000 {max}	- -	mg/kg	<0.43	<0.42	<0.45 [<0.45]	<0.43
Dimethylphthalate	- -	- -	- -	mg/kg	<0.43	<0.42	<0.45 [<0.45]	<0.43
Di-n-Butylphthalate	610 {nc}	6,200 {nc}	- -	mg/kg	0.070 B	<0.42	<0.45 J [<0.45]	0.12 B
Di-n-Octylphthalate	- -	- -	- -	mg/kg	<0.43	<0.42	<4.5 J [<0.45 J]	<0.43
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	NA	NA	NA	NA
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	NA	NA	NA	NA
Hexachlorobenzene	0.3 {ca}	1.1 {ca}	- -	mg/kg	<0.43	<0.42	<0.45 J [<0.45]	<0.43
Hexachlorocyclopentadiene	37 {nc}	370 {nc}	- -	mg/kg	<0.43	<0.42	<0.45 [<0.45]	<0.43
Hexachloroethane	35 {ca**}	120 {ca**}	- -	mg/kg	<0.43	<0.42	<0.45 [<0.45]	<0.43
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA
Isophorone	510 {ca*}	1,800 {ca*}	- -	mg/kg	<0.43	<0.42	<0.45 [<0.45]	<0.43
Naphthalene	15 {nc}	67 {nc}	- -	mg/kg	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	0.069 {ca**}	0.25 {ca**}	- -	mg/kg	<0.43	<0.42	<0.45 [<0.45]	<0.43
N-Nitrosodiphenylamine	99 {ca**}	350 {ca**}	- -	mg/kg	<0.43	<0.42	<0.45 J [<0.45]	<0.43
Pentachlorophenol	3 {ca}	9 {ca}	- -	mg/kg	<2.1	<2.1	<2.2 J [<2.2]	<2.1
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	NA	NA	NA	NA
Phenol	1,800 {nc}	180,000 {max}	- -	mg/kg	<0.43	<0.42	<0.45 [<0.45]	<0.43
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	NA	NA	NA	NA
Inorganics								
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	13,200	16,000	28,500 [13,000]	8,890
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	<0.650	<0.640	<0.670 [<0.670]	<0.650
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	7.60	7.40	5.70 [7.60 K]	3.60
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	64.8 K	60.3 K	63.6 K [56.2 B]	45.5 K
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	**1.20 B**	**1.10 B**	**1.60 K [1.20]**	0.740 B
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	<0.130	<0.130	<0.130 [<0.140]	<0.130
Calcium	- -	- -	- -	mg/kg	1,680 B	1,280 B	1,530 B [1,160 B]	920 B
Chromium	280 {ca}	1,460 {ca}	65.3	mg/kg	63.4	50.2	36.0 [58.5]	27.3
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	21.1	22.1	13.3 [21.8]	13.3
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	30.9	26.3	24.3 [27.9]	19.4
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	43,500	42,600	47,500 [43,600]	20,000
Lead	400 {++}	800 {++}	26.8	mg/kg	**34.4**	**39.2**	**7.90 [55.6]**	22.7
Magnesium	- -	- -	- -	mg/kg	5,390	9,120	19,100 [6,680]	4,000
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	1,170	1,190	571 [1,250]	746
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	<0.130	<0.130	<0.130	<0.130
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	14.0	16.1	24.2 [12.1]	9.60
Potassium	- -	- -	- -	mg/kg	1,590 K	2,370 K	3,890 K [1,390 K]	886 K
Selenium	39 {nc}	510 {nc}	- -	mg/kg	<0.650 L	<0.640 L	<0.670 L [<0.670 L]	<0.650 L
Silver	39 {nc}	510 {nc}	- -	mg/kg	<0.260 L	<0.260 L	<0.270 L [<0.270 L]	<0.260 L
Sodium	- -	- -	- -	mg/kg	123 B	114 B	138 B [108 B]	97.6 B
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	<0.260 L	<0.260 L	0.300 B [<0.270 L]	1.00 B
Vanadium	55 {nc}	720 {nc}	108	mg/kg	77.0 J	75.7 J	72.5 J [76.7 J]	36.6 J
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	102 B	137 B	58.6 B [87.5 B]	54.4 B

mg/kg	Milligrams per kilogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Inorganics)	Constituent concentration
B (Organics)	Constituent was detected in
J	Constituent concentration
K	Estimated concentration
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 5-5. Sediment Analytical Results, Building Debris Disposal Trench, 1998 ICF KE Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	DTSD01 0 - 0.5 07/17/98	DTSD01 0 - 0.5 08/17/98	DTSD02 0 - 0.5 07/17/98	DTSD02 0 - 0.5 08/17/98	DTSD03 0 - 0.5 07/17/98	DTSD03 0 - 0.5 08/17/98	DTSD04 0 - 0.5 08/17/98
Explosives											
1,3,5-Trinitrobenzene	220 {nc}	2,700 {nc}	- -	mg/kg	<0.25	<0.2	<0.25	<0.2	<0.25	<0.2	<0.3
1,3-Dinitrobenzene	0.61 {nc}	6.2 {nc}	- -	mg/kg	<0.25	<0.2	<0.25	<0.2	<0.25	<0.2	<0.3
2,4,6-Trinitrotoluene	3.6 {ca**}	42 {ca**}	- -	mg/kg	<0.25	<0.2	<0.25	<0.2	<0.25	<0.2	<0.3
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.25	<0.2	<0.25	<0.2	<0.25	<0.2	<0.3
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	<0.25	<0.2	<0.25	<0.2	<0.25	<0.2	<0.3
2-Amino-4,6-Dinitrotoluene	15 {nc}	190 {nc}	- -	mg/kg	<0.25	<0.2	<0.25	<0.2	<0.25	<0.2	<0.3
4-Amino-2,6-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.25	<0.2	<0.25	<0.2	<0.25	<0.2	<0.3
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	<0.25	<0.2	<0.25	<0.2	<0.25	<0.2	<0.3
HMX	310 {nc}	3,100 {nc}	- -	mg/kg	<0.25	<0.2	<0.25	<0.2	<0.25	<2	<0.3
m-Nitrotoluene	- -	- -	- -	mg/kg	<0.25	<0.2	<0.25	<0.2	<0.25	<0.2	<0.3
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	<0.25	<0.2	<0.25	<0.2	<0.25	<0.2	<0.3
Nitroglycerine	0.61 {nc}	6.2 {nc}	- -	mg/kg	<1.3	<1.1	<1.2	<1.2	<1.2	<1.1	<1.3
o-Nitrotoluene	78 {nc}	1,300 {sat}	- -	mg/kg	<0.25	<0.2	<0.25	<0.2	<0.25	<0.2	<0.3
Pentaerythritol Tetranitrate	- -	- -	- -	mg/kg	<1.3	<1.1	<1.2	<1.2	<1.2	<1.1	<1.3
p-Nitrotoluene	30 {ca**}	110 {ca*}	- -	mg/kg	<0.25	<0.2	<0.25	<0.2	<0.25	<0.2	<0.3
RDX	4.4 {ca*}	16 {ca}	- -	mg/kg	<0.25	<0.2	<0.25	<0.2	<0.25	<0.2	<0.3
Tetryl	24 {nc}	250 {nc}	- -	mg/kg	<0.25	<0.2	<0.25	<0.2	<0.25	<0.2	<0.3
PAHs											
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.030	<0.60	<0.020	<0.49	<0.020	<0.47 J	<0.50
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.060	<1.2	<0.050	<0.97	<0.050	<0.94 J	<1.0
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	<0.0031	<0.060	<0.0026	<0.040	<0.0028	<0.040 J	0.030 J
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.0031	0.010 J	<0.0026	<0.040	<0.0028	<0.040 J	0.030 J
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.0031	0.030 J	<0.0026	<0.040	<0.0028	<0.040 J	0.020 J
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.0061	<0.12	<0.0052	<0.090	<0.0056	<0.090 J	<0.10
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	<0.0061	<0.12	<0.0052	<0.090	<0.0056	<0.090 J	0.040 J
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	<0.0031	<0.060	<0.0026	<0.040	<0.0028	<0.040 J	0.010 J
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	<0.0031	0.020 J	0.0044	<0.040	<0.0028	<0.040 J	0.090
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.0061	<0.12	<0.0052	<0.090	<0.0056	<0.090 J	<0.10
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	0.010	0.030 J	0.010	<0.090	0.010	0.010 J	0.20
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.0061	<0.12	<0.0052	<0.090	<0.0056	<0.090 J	<0.10
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.0031	<0.060	<0.0026	<0.040	<0.0028	<0.040 J	0.040 J
Naphthalene	3.9 {nc}	20 {nc}	- -	mg/kg	<0.030	<0.60	<0.020	<0.49	<0.020	<0.47 J	<0.50
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.0049	0.040 J	0.0042	<0.040	0.0048	0.020 J	0.21
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	0.010	0.020 J	0.010	<0.040	0.010	<0.040 J	0.10
Volatile Organics											
1,1,1,2-Tetrachloroethane	2 {ca}	9.8 {ca}	- -	mg/kg	<0.0020 J	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
1,1,1-Trichloroethane	680 {sat}	680 {sat}	- -	mg/kg	<0.0010 J	<0.0020	<0.0020	<0.0010 J	<0.0020	<0.0010	<0.0010
1,1,2,2-Tetrachloroethane	0.59 {ca**}	2.9 {ca**}	- -	mg/kg	<0.0020	<0.0030 J	<0.0030	<0.0020 J	<0.0030	<0.0020	<0.0020
1,1,2-Trichloroethane	1.1 {ca}	5.5 {ca}	- -	mg/kg	<0.0020 J	<0.0020	<0.0020	<0.0020 J	<0.0020 J	<0.0020	<0.0020
1,1-Dichloroethane	3.4 {ca}	17 {ca}	- -	mg/kg	<0.0020 J	<0.0020	<0.0020	<0.0020 J	<0.0020	<0.0020	<0.0020
1,1-Dichloroethene	25 {nc}	110 {nc}	- -	mg/kg	<0.0030 J	<0.0030	<0.0030	<0.0030 J	<0.0030	<0.0030	<0.0030
1,1-Dichloropropene	- -	- -	- -	mg/kg	<0.0020 J	<0.0020	<0.0020	<0.0020 J	<0.0020	<0.0020	<0.0020
1,2,3-Trichlorobenzene	- -	- -	- -	mg/kg	<0.0020 J	<0.0020 J	<0.0020	<0.0020 J	<0.0020	<0.0020	<0.0020
1,2,3-Trichloropropane	0.091 {ca}	0.41 {ca}	- -	mg/kg	<0.0040 J	<0.0040 J	<0.0040	<0.0040 J	<0.0040	<0.0040	<0.0040
1,2,4-Trichlorobenzene	180 {ca**}	220 {sat}	- -	mg/kg	<0.0020 J	<0.0020 J	<0.0020	<0.0020 J	<0.0020	<0.0020	<0.0020
1,2,4-Trimethylbenzene	6.7 {nc}	28 {nc}	- -	mg/kg	<0.0020 J	<0.0030 J	<0.0030	<0.0020 J	<0.0030	<0.0020	<0.0020
1,2-Dibromo-3-chloropropane	0.0056 {ca}	0.073 {ca}	- -	mg/kg	<0.0080 J	<0.0090 J	<0.0090	<0.0070 J	<0.0090	<0.0070	<0.0080
1,2-Dibromoethane	0.034 {ca}	0.17 {ca}	- -	mg/kg	<0.0020	<0.0030	<0.0030	<0.0020	<0.0030	<0.0020	<0.0020
1,2-Dichlorobenzene	220 {sat}	220 {sat}	- -	mg/kg	<0.0020 J	<0.0020 J	<0.0020	<0.0010 J	<0.0020	<0.0010	<0.0020
1,2-Dichloroethane	0.45 {ca}	2.2 {ca}	- -	mg/kg	<0.0020 J	<0.0020	<0.0020	<0.0010 J	<0.0020	<0.0010	<0.0020
1,2-Dichloropropane	0.93 {ca*}	4.7 {ca*}	- -	mg/kg	<0.0050 J	<0.0060	<0.0060	<0.0050 J	<0.0060	<0.0050	<0.0050
1,3,5-Trimethylbenzene	- -	- -	- -	mg/kg	<0.0020 J	<0.0030 J	<0.0030	<0.0020 J	<0.0030	<0.0020	<0.0020
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	<0.0020 J	<0.0020 J	<0.0020	<0.0020 J	<0.0020	<0.0020	<0.0020
1,3-Dichloropropane	160 {nc}	1,600 {sat}	- -	mg/kg	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
1,4-Dichlorobenzene	2.6 {ca}	13 {ca}	- -	mg/kg	<0.0020 J	<0.0020 J	<0.0020	<0.0020 J	<0.0020	<0.0020	<0.0020
2,2-Dichloropropane	- -	- -	- -	mg/kg	<0.0020 J	<0.0020	<0.0020	<0.0010 J	<0.0020	<0.0010	<0.0020
2-Butanone	2,800 {nc}	19,000 {nc}	- -	mg/kg	<0.0080 J	<0.0090	<0.0090	<0.0070 J	<0.0090	<0.0070	<0.0080
2-Chloroethyl Vinyl Ether	- -	- -	- -	mg/kg	<0.0080 J	<0.0090	<0.0090	<0.0070 J	<0.0090	<0.0070	<0.0080
2-Chlorotoluene	1,000 {sat}	1,000 {sat}	- -	mg/kg	<0.0020 J	<0.0020 J	<0.0020	<0.0020 J	<0.0020	<0.0020	<0.0020
2-Hexanone	- -	- -	- -	mg/kg	<0.0080	<0.0090	<0.0090	<0.0070	<0.0090	<0.0070	<0.0080
4-Chlorotoluene	290 {sat}	290 {sat}	- -	mg/kg	<0.0020 J	<0.0020 J	<0.0020	<0.0010 J	<0.0020	<0.0010	<0.0020
4-Methyl-2-pentanone	530 {nc}	5,200 {sat}	- -	mg/kg	<0.0080	<0.0090	<0.0090	<0.0070	<0.0090	<0.0070	<0.0080
Acetone	6,100 {nc}	61,000 {nc}	- -	mg/kg	<0.0080 J	<0.0090 J	<0.0090	<0.0070 J	<0.0090	<0.0070 J	<0.0080 J
Acrolein	0.016 {nc}	0.068 {nc}	- -	mg/kg	<0.0080 J	<0.0090	<0.0090	<0.0070 J	<0.0090	<0.0070	<0.0080
Acrylonitrile	0.24 {ca*}	1.2 {ca*}	- -	mg/kg	<0.0080 J	<0.0090	<0.0090	<0.0070 J	<0.0090	<0.0070	<0.0080

Notes found at end of table.

Table 5-5. Sediment Analytical Results, Building Debris Disposal Trench, 1998 ICF KE Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	DTSD01 0 - 0.5 07/17/98	DTSD01 0 - 0.5 08/17/98	DTSD02 0 - 0.5 07/17/98	DTSD02 0 - 0.5 08/17/98	DTSD03 0 - 0.5 07/17/98	DTSD03 0 - 0.5 08/17/98	DTSD04 0 - 0.5 08/17/98
Volatile Organics (cont'd)											
Benzene	1.1 {ca*}	5.6 {ca*}	- -	mg/kg	<0.0020 J	<0.0020	<0.0020	<0.0010 J	<0.0020	<0.0010	<0.0020
Bromobenzene	- -	- -	- -	mg/kg	<0.0020 J	<0.0020 J	<0.0020	<0.0010 J	<0.0020	<0.0010	<0.0020
Bromochloromethane	- -	- -	- -	mg/kg	<0.0030 J	<0.0030	<0.0030	<0.0020 J	<0.0030	<0.0020	<0.0030
Bromodichloromethane	10 {ca}	46 {ca}	- -	mg/kg	<0.0020 J	<0.0020	<0.0020	<0.0010 J	<0.0020	<0.0010	<0.0020
Bromoform	61 {ca*}	220 {ca*}	- -	mg/kg	<0.0010	<0.00090	<0.00090	<0.00070	<0.00090	<0.0010	<0.00080
Bromomethane	0.79 {nc}	3.5 {nc}	- -	mg/kg	<0.0060 J	<0.0060	<0.0070	<0.0050 J	<0.0070	<0.0050	<0.0060
Carbon Disulfide	67 {nc}	300 {nc}	- -	mg/kg	<0.0080 J	<0.0090	<0.0090	<0.0070 J	<0.0090	<0.0070	<0.0080
Carbon Tetrachloride	0.25 {ca}	1.3 {ca}	- -	mg/kg	<0.0060 J	<0.0070	<0.0070	<0.0060 J	<0.0070	<0.0060	<0.0060
Chlorobenzene	31 {nc}	860 {sat}	- -	mg/kg	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Chloroethane	2,200 {sat}	2,200 {sat}	- -	mg/kg	<0.0080 J	<0.0090	<0.0090	<0.0070 J	<0.0090	<0.0070	<0.0080
Chloroform	0.3 {ca}	1.5 {ca}	- -	mg/kg	<0.0020 J	<0.0020	<0.0020	<0.0020 J	<0.0020	<0.0020	<0.0020
Chloromethane	1.7 {ca*}	8.4 {ca*}	- -	mg/kg	<0.0050 J	<0.0060	<0.0060	<0.0050 J	<0.0060	<0.0050	<0.0050
cis-1,2-Dichloroethene	78 {nc}	1,300 {sat}	- -	mg/kg	<0.0030 J	<0.0030	<0.0030	<0.0020 J	<0.0030	<0.0020	<0.0030
cis-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.0020 J	<0.0020	<0.0020	<0.0010 J	<0.0020	<0.0010	<0.0020
Dibromochloromethane	5.8 {ca}	21 {ca}	- -	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Dibromomethane	78 {nc}	3,000 {sat}	- -	mg/kg	<0.0020 J	<0.0020	<0.0020	<0.0020 J	<0.0030	<0.0020	<0.0020
Dichlorodifluoromethane	19 {nc}	78 {nc}	- -	mg/kg	<0.0020 J	<0.0030	<0.0030	<0.0020 J	<0.0030	<0.0020	<0.0030
Ethylbenzene	5.7 {ca}	29 {ca}	- -	mg/kg	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Hexachlorobutadiene	6.2 {ca**}	22 {ca*}	- -	mg/kg	<0.0020 J	<0.0020 J	<0.0020	<0.0010 J	<0.0020	<0.0010	<0.0020
Isopropylbenzene	310 {sat}	310 {sat}	- -	mg/kg	<0.0020 J	<0.0020 J	<0.0020	<0.0020 J	<0.0020	<0.0020	<0.0020
m,p-Xylene	60 {nc}	260 {nc}	- -	mg/kg	<0.0040	<0.0040	<0.0040	<0.0030	<0.0040	<0.0030	<0.0040
Methylene Chloride	11 {ca}	54 {ca}	- -	mg/kg	<0.0020 J	<0.0020	<0.0020	<0.0010 J	<0.0020	0.0050	<0.0020
n-Butylbenzene	- -	- -	- -	mg/kg	<0.0030 J	<0.0030 J	<0.0030	<0.0020 J	<0.0030	<0.0020	<0.0030
n-Propylbenzene	- -	- -	- -	mg/kg	<0.0020 J	<0.0020 J	<0.0020	<0.0020 J	<0.0020	<0.0020	<0.0020
o-Xylene	300 {sat}	300 {sat}	- -	mg/kg	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
p-Isopropyltoluene	- -	- -	- -	mg/kg	<0.0010 J	0.0040 J	<0.0020	<0.0010 J	<0.0020	<0.0010	<0.0010
sec-Butylbenzene	- -	- -	- -	mg/kg	<0.0020 J	<0.0020 J	<0.0020	<0.0020 J	<0.0020	<0.0020	<0.0020
Styrene	1,000 {sat}	1,000 {sat}	- -	mg/kg	<0.00040	<0.00030	<0.00040	<0.00030	<0.00040	<0.00030	<0.00030
tert-Butylbenzene	- -	- -	- -	mg/kg	<0.0020 J	<0.0020 J	<0.0020	<0.0020 J	<0.0020	<0.0020	<0.0020
Tetrachloroethene	0.57 {ca}	2.7 {ca}	- -	mg/kg	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Toluene	500 {nc}	4600 {nc}	- -	mg/kg	<0.0020 J	<0.0020	<0.0020	<0.0020 J	<0.0020	<0.0020	<0.0020
trans-1,2-Dichloroethene	11 {nc}	50 {nc}	- -	mg/kg	<0.0060 J	<0.0070	<0.0070	<0.0060 J	<0.0080	<0.0060	<0.0070
trans-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.0020 J	<0.0020	<0.0020	<0.0010 J	<0.0020	<0.0010	<0.0020
Trichloroethene	2.8 {ca}	14 {ca}	- -	mg/kg	<0.0040 J	<0.0040	<0.0040	0.0030 J	<0.0050	<0.0040	<0.0040
Trichlorofluoromethane	80 {nc}	1,300 {sat}	- -	mg/kg	<0.0020 J	<0.0020	<0.0020	<0.0020 J	<0.0020	<0.0020	<0.0020
Vinyl Acetate	99 {nc}	2,800 {sat}	- -	mg/kg	<0.0080 J	<0.0090	<0.0090	<0.0070 J	<0.0090	<0.0070	<0.0080
Vinyl Chloride	0.06 {ca}	1.7 {ca}	- -	mg/kg	<0.0030 J	<0.0030	<0.0030	<0.0030 J	<0.0030	<0.0030	<0.0030
Xylenes (total)	60 {nc}	260 {nc}	- -	mg/kg	<0.0040	<0.0040	<0.0040	<0.0030	<0.0040	<0.0030	<0.0040
Semivolatile Organics											
1,2-Diphenylhydrazine	0.61 {ca**}	2.2 {ca**}	- -	mg/kg	<0.50	<0.57	<0.58	<0.46	<0.59	<0.47	<0.52
2,4,5-Trichlorophenol	610 {nc}	6,200 {nc}	- -	mg/kg	<1.2	<1.4	<1.4	<1.1	<1.4	<1.1	<1.3
2,4,6-Trichlorophenol	44 {ca**}	160 {ca**}	- -	mg/kg	<0.50	<0.57	<0.58	<0.46	<0.59	<0.47	<0.52
2,4-Dichlorophenol	18 {nc}	180 {nc}	- -	mg/kg	<0.50	<0.57	<0.58	<0.46	<0.59	<0.47	<0.52
2,4-Dimethylphenol	120 {nc}	1,200 {nc}	- -	mg/kg	<0.50	<0.57	<0.58	<0.46	<0.59	<0.47	<0.52
2,4-Dinitrophenol	12 {nc}	120 {nc}	- -	mg/kg	<2.5	<2.8	<2.9	<2.3	<2.9	<2.4	<2.6
2-Chloronaphthalene	210 {sat}	210 {sat}	- -	mg/kg	<0.50	<0.57	<0.58	<0.46	<0.59	<0.47	<0.52
2-Chlorophenol	39 {nc}	510 {nc}	- -	mg/kg	<0.50	<0.57	<0.58	<0.46	<0.59	<0.47	<0.52
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	<0.50	<0.57	<0.58	<0.46	<0.59	<0.47	<0.52
2-Methylphenol	310 {nc}	3,100 {nc}	- -	mg/kg	<0.50	<0.57	<0.58	<0.46	<0.59	<0.47	<0.52
2-Nitroaniline	- -	- -	- -	mg/kg	<2.5	<2.8	<2.9	<2.3	<2.9	<2.4	<2.6
2-Nitrophenol	- -	- -	- -	mg/kg	<0.50	<0.57	<0.58	<0.46	<0.59	<0.47	<0.52
3,3'-Dichlorobenzidine	1.1 {ca**}	3.8 {ca**}	- -	mg/kg	<0.98	<1.1	<1.1	<0.90	<1.2	<0.93	<1.0
3-Nitroaniline	- -	- -	- -	mg/kg	<2.5	<2.8	<2.9	<2.3	<2.9	<2.4	<2.6
4,6-Dinitro-2-methylphenol	- -	- -	- -	mg/kg	<2.5	<2.8	<2.9	<2.3	<2.9	<2.4	<2.6
4-Bromophenyl-phenylether	- -	- -	- -	mg/kg	<0.50	<0.57	<0.58	<0.46	<0.59	<0.47	<0.52
4-Chloro-3-Methylphenol	- -	- -	- -	mg/kg	<0.98	<1.1	<1.1	<0.90	<1.2	<0.93	<1.0
4-Chloroaniline	24 {nc}	250 {nc}	- -	mg/kg	<0.98	<1.1	<1.1	<0.90	<1.2	<0.93	<1.0
4-Chlorophenyl-phenylether	- -	- -	- -	mg/kg	<0.50	<0.57	<0.58	<0.46	<0.59	<0.47	<0.52
4-Methylphenol	31 {nc}	310 {nc}	- -	mg/kg	<0.50	<0.57	<0.58	<0.46	0.060 J	<0.47	<0.52
4-Nitroaniline	- -	- -	- -	mg/kg	<2.5	<2.8	<2.9	<2.3	<2.9	<2.4	<2.6
4-Nitrophenol	- -	- -	- -	mg/kg	<2.5	<2.8	<2.9	<2.3	<2.9	<2.4	<2.6
Benzoic Acid	240,000 {max}	2,500,000 {max}	- -	mg/kg	<2.5	<2.8	<2.9	<2.3	<2.9	<2.4	<2.6
Benzyl Alcohol	3,100 {nc}	310,000 {max}	- -	mg/kg	<0.98	<1.1	<1.1	<0.90	<1.2	<0.93	<1.0
bis(2-Chloroethoxy)methane	18 {nc}	180 {nc}	- -	mg/kg	<0.50	<0.57	<0.58	<0.46	<0.59	<0.47	<0.52
bis(2-Chloroethyl)ether	0.19 {ca**}	0.9 {ca**}	- -	mg/kg	<0.50	<0.57	<0.58	<0.46	<0.59	<0.47	<0.52
bis(2-Chloroisopropyl)ether	- -	- -	- -	mg/kg	<0.50	<0.57	<0.58	<0.46	<0.59	<0.47	<0.52
bis(2-Ethylhexyl)phthalate	35 {ca*}	120 {ca*}	- -	mg/kg	<0.50	<0.57	<0.58	<0.46	<0.59	<0.47	<0.52
Butylbenzylphthalate	1,200 {nc}	120,000 {max}	- -	mg/kg	<0.50	<0.57	<0.58	<0.46	<0.59	<0.47	<0.52

Notes found at end of table.

Table 5-5. Sediment Analytical Results, Building Debris Disposal Trench, 1998 ICF KE Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	DTSD01 0 - 0.5 07/17/98	DTSD01 0 - 0.5 08/17/98	DTSD02 0 - 0.5 07/17/98	DTSD02 0 - 0.5 08/17/98	DTSD03 0 - 0.5 07/17/98	DTSD03 0 - 0.5 08/17/98	DTSD04 0 - 0.5 08/17/98
Semivolatile Organics (cont'd)											
Carbazole	24 {ca**}	86 {ca**}	- -	mg/kg	<0.50	<0.57	<0.58	<0.46	<0.59	<0.47	<0.52
Dibenzofuran	- -	- -	- -	mg/kg	<0.50	<0.57	<0.58	<0.46	<0.59	<0.47	<0.52
Diethylphthalate	4,900 {nc}	490,000 {max}	- -	mg/kg	<0.50	<0.57	<0.58	<0.46	<0.59	<0.47	<0.52
Dimethylphthalate	- -	- -	- -	mg/kg	<0.50	<0.57	<0.58	<0.46	<0.59	<0.47	<0.52
Di-n-Butylphthalate	610 {nc}	6,200 {nc}	- -	mg/kg	<0.50	0.080 B	<0.58	<0.46	<0.59	<0.47	0.090 B
Di-n-Octylphthalate	- -	- -	- -	mg/kg	<0.50	<0.57	<0.58	<0.46	<0.59	<0.47	<0.52
Hexachlorobenzene	0.3 {ca}	1.1 {ca}	- -	mg/kg	<0.50	<0.57	<0.58	<0.46	<0.59	<0.47	<0.52
Hexachlorocyclopentadiene	37 {nc}	370 {nc}	- -	mg/kg	<0.50	<0.57	<0.58	<0.46	<0.59	<0.47	<0.52
Hexachloroethane	35 {ca**}	120 {ca**}	- -	mg/kg	<0.50	<0.57	<0.58	<0.46	<0.59	<0.47	<0.52
Isophorone	510 {ca*}	1,800 {ca*}	- -	mg/kg	<0.50	<0.57	<0.58	<0.46	<0.59	<0.47	<0.52
N-Nitroso-di-n-propylamine	0.069 {ca**}	0.25 {ca**}	- -	mg/kg	<0.50	<0.57	<0.58	<0.46	<0.59	<0.47	<0.52
N-Nitrosodiphenylamine	99 {ca**}	350 {ca**}	- -	mg/kg	<0.50	<0.57	<0.58	<0.46	<0.59	<0.47	<0.52
Pentachlorophenol	3 {ca}	9 {ca}	- -	mg/kg	<2.5	<2.8	<2.9	<2.3	<2.9	<2.4	<2.6
Phenol	1,800 {nc}	180,000 {max}	- -	mg/kg	<0.50	<0.57	<0.58	<0.46	<0.59	<0.47	<0.52
Inorganics											
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	17,200	8,690	15,200	8,980	10,800	9,250	8,970
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	<0.740	<0.860	<0.870	<0.690	<0.880	<0.690	<0.780
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	6.50	5.00 J	8.00	11.6 J	4.20	13.2	5.40 J
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	93.5 K	75.0 K	92.0 K	104 K	72.5 K	**358 L**	80.7 K
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	0.960 B	0.750 J	**1.20 B**	**1.10**	0.700 B	**1.30 B**	0.740 J
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	<0.150	<0.170	<0.170	<0.140	<0.180	<0.140	<0.160
Calcium	- -	- -	- -	mg/kg	59,900	60,400 J	50,800	88,100 J	64,100	62,600	98,600 J
Chromium	280 {ca}	1,460 {ca}	65.3	mg/kg	43.8	22.3	52.5	56.2	24.9	**73.0**	33.6
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	15.4 K	8.80 L	15.0 K	27.6 L	8.80 K	26.2 L	10.9 L
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	15.0 B	10.1 B	14.8 B	4.40 B	11.7 B	13.3 B	10.3 B
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	29,900	20,400	32,300	44,900	17,300	**56,200**	20,200
Lead	400 {++}	800 {++}	26.8	mg/kg	18.1	17.8	21.2	23.5	14.2	**28.6**	15.3
Magnesium	- -	- -	- -	mg/kg	6,620	3,070 B	6,790	7,720	3,750	4,560	6,130
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	468	904 J	614	1,640 J	387	**3,340**	539 J
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	<0.150	<0.170	<0.180	<0.140	<0.170	<0.140	<0.160
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	16.3 K	7.90 J	16.4 K	8.00 J	10.6 K	20.8 K	8.70 J
Potassium	- -	- -	- -	mg/kg	2,140 J	776 K	1,930 J	1,760 K	1,180 J	1,250 K	1,670 K
Selenium	39 {nc}	510 {nc}	- -	mg/kg	<0.740 L	<0.860	<0.870 L	<0.690	<0.880 L	<0.690 L	<0.780
Silver	39 {nc}	510 {nc}	- -	mg/kg	0.860 B	<0.350	<0.350	<0.280	<0.350	<0.280 L	<0.310
Sodium	- -	- -	- -	mg/kg	510 B	225 B	275 B	187 B	344 B	260 B	257 B
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	<0.300 L	1.10 B	0.380 B	<0.280 L	<0.350 L	0.760 B	<0.310 L
Vanadium	55{nc}	720 {nc}	108	mg/kg	56.0 K	33.5 L	55.5 K	69.5 L	31.6 K	75.7 K	34.7 L
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	46.9 B	41.7 B	51.9 B	32.6 B	44.3 B	46.8 B	35.7 B

mg/kg	Milligrams per kilogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Inorganics)	Constituent concentration
B (Organics)	Constituent was detected
J	Constituent concentration
K	Estimated concentration
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 5-6. Surface Water Analytical Results, Building Debris Disposal Trench, 1998 ICF KE Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Date Collected:	Tapwater Screening Values	Units	DTSW1 07/17/98	DTSW1 08/17/98	DTSW2 07/17/98	DTSW2 08/17/98	DTSW3 07/17/98	DTSW3 08/17/98	DTSW4 08/17/98
Explosives									
1,3,5-Trinitrobenzene	1,100 {nc}	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	NA	<0.5
1,3-Dinitrobenzene	3.7 {nc}	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	NA	<0.5
2,4,6-Trinitrotoluene	1.8 {ca**}	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	NA	NA
2,4-Dinitrotoluene	73 {nc}	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	NA	<0.5
2,6-Dinitrotoluene	37 {nc}	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	NA	<0.5
2-Amino-4,6-Dinitrotoluene	73 {nc}	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	NA	<0.5
4-Amino-2,6-Dinitrotoluene	73 {nc}	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	NA	<0.5
Dinitrotoluene Mix	0.099 {ca}	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	NA	<0.5
HMX	1,800 {nc}	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	NA	<0.5
m-Nitrotoluene	730 {nc}	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	NA	<0.5
Nitrobenzene	3.4 {nc}	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	NA	<0.5
Nitroglycerine	3.7 {nc}	µg/L	<2.5	<2.5	<2.5	<2.5	<2.5	NA	<2.5
o-Nitrotoluene	370 {nc}	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	NA	<0.5
Pentaerythritol Tetranitrate	- -	µg/L	<2.5	<2.5	<2.5	<2.5	<2.5	NA	<2.5
p-Nitrotoluene	4.2 {ca*}	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	NA	<0.5
RDX	0.61 {ca}	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	NA	<0.5
Tetryl	150 {nc}	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	NA	<0.5
PAHs									
Acenaphthene	2,200 {nc}	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10	NA	<0.10
Acenaphthylene	2,200 {nc}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	NA	<1.0
Anthracene	11,000 {nc}	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050	NA	<0.050
Benzo(a)anthracene	0.029 {ca**}	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050	NA	<0.050
Benzo(a)pyrene	0.0029 {ca**}	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050	NA	<0.050
Benzo(b)fluoranthene	0.029 {ca**}	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10	NA	<0.10
Benzo(g,h,i)perylene	1,100 {nc}	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10	NA	<0.10
Benzo(k)fluoranthene	0.29 {ca**}	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050	NA	<0.050
Chrysene	2.9 {ca**}	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050	NA	<0.050
Dibenzo(a,h)anthracene	0.0029 {ca**}	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10	NA	<0.10
Fluoranthene	1,500 {nc}	µg/L	<0.10 J	<0.10	<0.10 J	<0.10	<0.10 J	NA	<0.10
Fluorene	1,500 {nc}	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10	NA	<0.10
Indeno(1,2,3-cd)pyrene	0.029 {ca**}	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050	NA	<0.050
Naphthalene	0.14 {ca}	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10	NA	<0.10
Phenanthrene	11,000 {nc}	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050	NA	<0.050
Pyrene	1,100 {nc}	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050	NA	<0.050
Volatile Organics									
1,1,1,2-Tetrachloroethane	0.52 {ca}	µg/L	<1.0	<0.90	<1.0	<0.90	<1.0	<0.90	<0.90
1,1,1-Trichloroethane	9,100 {nc}	µg/L	<1.0	<0.90	<1.0	<0.90	<1.0	<0.90	<0.90
1,1,2,2-Tetrachloroethane	0.067 {ca**}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2-Trichloroethane	0.24 {ca}	µg/L	<1.0	<0.90	<1.0	<0.90	<1.0	<0.90	<0.90
1,1-Dichloroethane	2.4 {ca}	µg/L	<1.0	<0.40	<1.0	<0.40	<1.0	<0.40	<0.40
1,1-Dichloroethene	340 {nc}	µg/L	<1.0	<0.60	<1.0	<0.60	<1.0	<0.60	<0.60
1,1-Dichloropropene	- -	µg/L	<1.0	<0.70	<1.0	<0.70	<1.0	<0.70	<0.70
1,2,3-Trichlorobenzene	- -	µg/L	<1.0	<0.70	<1.0	<0.70	<1.0	<0.70	<0.70
1,2,3-Trichloropropane	0.0096 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2,4-Trichlorobenzene	8.2 {nc}	µg/L	<1.0	<0.80	<1.0	<0.80	<1.0	<0.80	<0.80
1,2,4-Trimethylbenzene	15 {nc}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dibromo-3-chloropropane	0.00032 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dibromoethane	0.0065 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichlorobenzene	370 {nc}	µg/L	NA	NA	NA	NA	<1.0	<0.80	<0.80
1,2-Dichloroethane	0.15 {ca}	µg/L	<1.0	<0.90	<1.0	<0.90	<1.0	<0.90	<0.90
1,2-Dichloropropane	0.39 {ca*}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,3,5-Trimethylbenzene	- -	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,3-Dichlorobenzene	370 {nc}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,3-Dichloropropane	730 {nc}	µg/L	<1.0	<0.90	<1.0	<0.90	<1.0	<0.90	<0.90
1,4-Dichlorobenzene	0.43 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2,2-Dichloropropane	- -	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-Butanone	7,100 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2-Chloroethyl Vinyl Ether	- -	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2-Chlorotoluene	730 {nc}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-Hexanone	- -	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4-Chlorotoluene	2,600 {nc}	µg/L	<1.0	<0.90	<1.0	<0.90	<1.0	<0.90	<0.90
4-Methyl-2-pentanone	2,000 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Acetone	22,000 {nc}	µg/L	<5.0	<5.0 J	<5.0	<5.0 J	<5.0	<5.0 J	<5.0 J
Acrolein	0.042 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Acrylonitrile	0.045 {ca*}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Benzene	0.41 {ca}	µg/L	<1.0	<0.90	<1.0	<0.90	<1.0	<0.90	<0.90
Bromobenzene	- -	µg/L	<1.0	<0.70	<1.0	<0.70	<1.0	<0.70	<0.70
Bromochloromethane	- -	µg/L	<1.0	<0.90	<1.0	<0.90	<1.0	<0.90	<0.90
Bromodichloromethane	1.1 {ca}	µg/L	<1.0	<0.60	<1.0	<0.60	<1.0	23	<0.60
Bromoform	8.5 {ca*}	µg/L	<1.0	<0.50	<1.0	<0.50	<1.0	<0.50	<0.50
Bromomethane	8.7 {nc}	µg/L	<2.0	<2.0 J	<2.0	<2.0 J	<2.0	<2.0 J	<2.0 J
Carbon Disulfide	1,000 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Carbon Tetrachloride	0.2 {ca}	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Chlorobenzene	91 {nc}	µg/L	<1.0	<0.90	<1.0	<0.90	<1.0	<0.90	<0.90
Chloroethane	21,000 {nc}	µg/L	<2.0	<2.0	<2.0	<2.0 J	<2.0	<2.0 J	<2.0 J
Chloroform	0.19 {ca}	µg/L	<1.0	<0.80	<1.0	<0.80	<1.0	4.0	<0.80
Chloromethane	1.8 {ca}	µg/L	<2.0	<2.0 J	<2.0	<2.0	<2.0	<2.0	<2.0
cis-1,2-Dichloroethene	370 {nc}	µg/L	<1.0	<0.80	<1.0	<0.80	<1.0	<0.80	<0.80
cis-1,3-Dichloropropene	- -	µg/L	<1.0	<0.10	<1.0	<0.10	<1.0	<0.10	<0.10
Dibromochloromethane	0.8 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dibromomethane	370 {nc}	µg/L	<1.0	<0.90	<1.0	<0.90	<1.0	<0.90	<0.90
Dichlorodifluoromethane	390 {nc}	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Ethylbenzene	1.5 {ca}	µg/L	<1.0	<0.90	<1.0	<0.90	<1.0	<0.90	<0.90
Hexachlorobutadiene	0.86 {ca*}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Isopropylbenzene	680 {nc}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
m,p-Xylene	200 {nc}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Methylene Chloride	4.8 {ca}	µg/L	<1.0	<0.70	<1.0	<0.70	<1.0	<0.70	<0.70
n-Butylbenzene	- -	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
n-Propylbenzene	- -	µg/L	<1.0	<0.90	<1.0	<0.90	<1.0	<0.90	<0.90
o-Xylene	1,400 {nc}	µg/L	<1.0	<0.90	<1.0	<0.90	<1.0	<0.90	<0.90
p-Isopropyltoluene	680 {nc}	µg/L	<1.0	<0.50	<1.0	<0.50	<1.0	<0.50	<0.50
sec-Butylbenzene	- -	µg/L	<1.0	<0.60	<1.0	<0.60	<1.0	<0.60	<0.60
Styrene	1,600 {nc}	µg/L	<1.0	<0.50	<1.0	<0.50	<1.0	<0.50	<0.50
tert-Butylbenzene	- -	µg/L	<1.0	<0.70	<1.0	<0.70	<1.0	<0.70	<0.70
Tetrachloroethene	0.11 {ca}	µg/L	<1.0	<0.90	<1.0	<0.90	<1.0	<0.90	<0.90
Toluene	2,300 {nc}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,2-Dichloroethene	110 {nc}	µg/L	<1.0	<0.70	<1.0	<0.70	<1.0	<0.70	<0.70
trans-1,3-Dichloropropene	- -	µg/L	<1.0	<0.20	<1.0	<0.20	<1.0	<0.20	<0.20
Trichloroethene	1.7 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Trichlorofluoromethane	1,300 {nc}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Vinyl Acetate	410 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Vinyl Chloride	0.016 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Xylenes (total)	200 {nc}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Notes found at end of table.

Table 5-6. Surface Water Analytical Results, Building Debris Disposal Trench, 1998 ICF KE Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Date Collected:	Tapwater Screening Values	Units	DTSW1 07/17/98	DTSW1 08/17/98	DTSW2 07/17/98	DTSW2 08/17/98	DTSW3 07/17/98	DTSW3 08/17/98	DTSW4 08/17/98
Semivolatile Organics									
1,2-Dichlorobenzene	370 {nc}	µg/L	<10	<10	<10	<10	NA	NA	NA
1,2-Diphenylhydrazine	0.084 {ca**}	µg/L	<10	<10	<10	<10	<10	<10	<10
1-Methylnaphthalene	2.3 {ca}	µg/L	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	3,700 {nc}	µg/L	<50	<50	<50	<50	<50	<50	<50
2,4,6-Trichlorophenol	6.1 {ca**}	µg/L	<10	<10	<10	<10	<10	<10	<10
2,4-Dichlorophenol	110 {nc}	µg/L	<10	<10	<10	<10	<10	<10	<10
2,4-Dimethylphenol	730 {nc}	µg/L	<10	<10	<10	<10	<10	<10	<10
2,4-Dinitrophenol	73 {nc}	µg/L	<50	<50	<50	<50	<50	<50	<50
2-Chloronaphthalene	2,900 {nc}	µg/L	<10	<10	<10	<10	<10	<10	<10
2-Chlorophenol	180 {nc}	µg/L	<10	<10	<10	<10	<10	<10	<10
2-Methylnaphthalene	150 {nc}	µg/L	<10	<10	<10	<10	<10	<10	<10
2-Methylphenol	1,800 {nc}	µg/L	<10	<10	<10	<10	<10	<10	<10
2-Nitroaniline	- -	µg/L	<50	<50	<50	<50	<50	<50	<50
2-Nitrophenol	- -	µg/L	<10	<10	<10	<10	<10	<10	<10
3,3'-Dichlorobenzidine	0.15 {ca**}	µg/L	<20	<20	<20	<20	<20	<20	<20
3-Nitroaniline	- -	µg/L	<50	<50	<50	<50	<50	<50	<50
4,6-Dinitro-2-methylphenol	- -	µg/L	<50	<50	<50	<50	<50	<50	<50
4-Bromophenyl-phenylether	- -	µg/L	<10	<10	<10	<10	<10	<10	<10
4-Chloro-3-Methylphenol	- -	µg/L	<20	<20	<20	<20	<20	<20	<20
4-Chloroaniline	150 {nc}	µg/L	<20	<20	<20	<20	<20	<20	<20
4-Chlorophenyl-phenylether	- -	µg/L	<10	<10	<10	<10	<10	<10	<10
4-Methylphenol	180 {nc}	µg/L	<10	<10	<10	<10	<10	<10	<10
4-Nitroaniline	- -	µg/L	<50	<50	<50	<50	<50	<50	<50
4-Nitrophenol	- -	µg/L	<50	<50	<50	<50	<50	<50	<50
Acenaphthene	2,200 {nc}	µg/L	NA	NA	NA	NA	NA	<10	NA
Acenaphthylene	- -	µg/L	NA	NA	NA	NA	NA	<10	NA
Anthracene	11,000 {nc}	µg/L	NA	NA	NA	NA	NA	<10	NA
Benzo(a)anthracene	0.029 {ca**}	µg/L	NA	NA	NA	NA	NA	<10	NA
Benzo(a)pyrene	0.0029 {ca**}	µg/L	NA	NA	NA	NA	NA	<10	NA
Benzo(b)fluoranthene	0.029 {ca**}	µg/L	NA	NA	NA	NA	NA	<10	NA
Benzo(g,h,i)perylene	- -	µg/L	NA	NA	NA	NA	NA	<10	NA
Benzo(k)fluoranthene	0.29 {ca**}	µg/L	NA	NA	NA	NA	NA	<10	NA
Benzoic Acid	150,000 {max}	µg/L	<50	<50	<50	<50	<50	<50	<50
Benzyl Alcohol	18,000 {nc}	µg/L	<20	<20	<20	<20	<20	<20	<20
bis(2-Chloroethoxy)methane	110 {nc}	µg/L	<10	<10	<10	<10	<10	<10	<10
bis(2-Chloroethyl)ether	0.012 {ca**}	µg/L	<10	<10	<10	<10	<10	<10	<10
bis(2-Chloroisopropyl)ether	- -	µg/L	<10	<10	<10	<10	<10	<10	<10
bis(2-Ethylhexyl)phthalate	4.8 {ca}	µg/L	<10	<10	<10	<10	<10	<10	<10
Butylbenzylphthalate	35 {ca}	µg/L	<10	<10	<10	<10	<10	<10	<10
Carbazole	3.4 {ca**}	µg/L	<10	<10	<10	<10	<10	<10	<10
Chrysene	2.9 {ca**}	µg/L	NA	NA	NA	NA	NA	<10	NA
Dibenzo(a,h)anthracene	0.0029 {ca**}	µg/L	NA	NA	NA	NA	NA	<10	NA
Dibenzofuran	37 {nc}	µg/L	<10	<10	<10	<10	<10	<10	<10
Diethylphthalate	29,000 {nc}	µg/L	<10	<10	<10	<10	<10	<10	<10
Dimethylphthalate	- -	µg/L	<10	<10	<10	<10	<10	<10	<10
Di-n-Butylphthalate	3,700 {nc}	µg/L	2.0 B	<10	3.0 B	<10	<10	<10	<10
Di-n-Octylphthalate	3,700 {nc}	µg/L	<10	<10	<10	<10	<10	<10	<10
Fluoranthene	1,500 {nc}	µg/L	NA	NA	NA	NA	NA	<10	NA
Fluorene	1,500 {nc}	µg/L	NA	NA	NA	NA	NA	<10	NA
Hexachlorobenzene	0.042 {ca}	µg/L	<10	<10	<10	<10	<10	<10	<10
Hexachlorocyclopentadiene	220 {nc}	µg/L	<10	<10	<10	<10	<10	<10	<10
Hexachloroethane	4.8 {ca**}	µg/L	<10	<10	<10	<10	<10	<10	<10
Indeno(1,2,3-cd)pyrene	0.029 {ca**}	µg/L	NA	NA	NA	NA	NA	<10	NA
Isophorone	71 {ca}	µg/L	<10	<10	<10	<10	<10	<10	<10
Naphthalene	6.2 {nc}	µg/L	NA	NA	NA	NA	NA	<10	NA
N-Nitroso-di-n-propylamine	0.0096 {ca**}	µg/L	<10	<10	<10	<10	<10	<10	<10
N-Nitrosodiphenylamine	14 {ca**}	µg/L	<10	<10	<10	<10	<10	<10	<10
Pentachlorophenol	0.56 {ca}	µg/L	<50	<50	<50	<50	<50	<50	<50
Phenanthrene	- -	µg/L	NA	NA	NA	NA	NA	<10	NA
Phenol	11,000 {nc}	µg/L	<10	<10	<10	<10	<10	<10	<10
Pyrene	1,100 {nc}	µg/L	<10	NA	NA	NA	NA	<10	NA
Inorganics									
Aluminum	37,000 {nc}	µg/L	68.5 B	82.3 J	67.9 B	78.5 J	76.7 B	49.8 J	67.4 J
Antimony	15 {nc}	µg/L	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
Arsenic	0.045 {ca}	µg/L	<7.00	<7.00 J	<7.00	<7.00 J	<7.00	<7.00	<7.00 J
Barium	7,300 {nc}	µg/L	60.6 B	64.5 K	60.1 B	66.5 K	66.2 B	60.0 L	61.0 K
Beryllium	73 {nc}	µg/L	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Cadmium	18 {nc}	µg/L	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Calcium	- -	µg/L	50,600 B	63,100 J	50,100 B	65,000 J	55,100 B	56,000	59,900 J
Chromium	55,000 {nc}	µg/L	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Cobalt	11 {nc}	µg/L	<2.00 L	<2.00 L	<2.00 L	<2.00 L	<2.00 L	<2.00 L	<2.00 L
Copper	1,500 {nc}	µg/L	18.1 B	34.8 J	19.8 B	27.4 J	30.7 B	12.0 K	16.7 J
Iron	26,000 {nc}	µg/L	114 B	105	127 B	106	115 B	76.3 J	87.6 J
Lead	15 {nc}	µg/L	<2.00	4.60 K	<2.00	2.30 K	<2.00	<2.00	<2.00
Magnesium	- -	µg/L	13,700 B	14,100	13,600 B	14,600	15,000 B	12,700	13,200
Manganese	880 {nc}	µg/L	5.60 B	3.40 J	5.30 B	3.60 J	5.40 B	4.00 J	3.40 J
Mercury	0.63 {nc}	µg/L	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200
Nickel	730 {nc}	µg/L	2.80 K	5.50 J	2.80 K	5.00 J	2.70 K	3.40 K	3.20 J
Potassium	- -	µg/L	1,930 B	2,490 K	1,980 B	2,510 K	2,110 B	2,340 K	2,260 K
Selenium	180 {nc}	µg/L	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00 L	<5.00
Silver	180 {nc}	µg/L	2.10 B	<2.00	<2.00 J	<2.00	<2.00 J	<2.00 L	<2.00
Sodium	- -	µg/L	26,900	26,500 K	26,900	25,300 K	29,300	22,400 K	25,600 K
Thallium	2.4 {nc}	µg/L	<2.00 L	<2.00 L	5.70 B	6.10 L	2.30 B	<2.00 L	7.20 L
Vanadium	260 {nc}	µg/L	<2.00	<2.00 L	<2.00	<2.00 L	<2.00	<2.00	<2.00 L
Zinc	11,000 {nc}	µg/L	20.2 B	46.2 J	21.9 B	34.2 J	20.4 B	38.7 K	21.6 J

µg/L	Micrograms per liter.
[a]	USEPA Regional Screening Levels (USEPA 2008a). Adjusted tap-water screening levels used to assess surface water at the NRU.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{max}	Concentration may exceed ceiling limit.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
24,400	Highlighted value indicates constituent concentration is above adjusted tap water RSL.

Table 5-7. Soil Analytical Results, Building Debris Disposal Trench, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	DTSB46 0 - 0.5 06/12/02	DTSB46 1 - 3 06/12/02	DTSB47 0 - 0.5 06/12/02	DTSB47 1 - 3 06/12/02
Herbicides								
2,4,5-T	61 {nc}	620 {nc}	- -	mg/kg	<0.0125	NA	NA	NA
2,4,5-TP	49 {nc}	490 {nc}	- -	mg/kg	<0.0125	NA	NA	NA
2,4-D	69 {nc}	770 {nc}	- -	mg/kg	0.171	NA	NA	NA
2,4-DB	49 {nc}	490 {nc}	- -	mg/kg	<0.125	NA	NA	NA
Dalapon	180 {nc}	1,800 {nc}	- -	mg/kg	0.099 J	NA	NA	NA
Dicamba	180 {nc}	1,800 {nc}	- -	mg/kg	0.00849 K	NA	NA	NA
Dichlorprop	- -	- -	- -	mg/kg	<0.025	NA	NA	NA
Dinoseb	6.1 {nc}	62 {nc}	- -	mg/kg	<0.025	NA	NA	NA
MCPA	3.1 {nc}	31 {nc}	- -	mg/kg	<12.5	NA	NA	NA
MCPP	6.1 {nc}	62 {nc}	- -	mg/kg	13.5	NA	NA	NA
Organochlorine Pesticides								
4,4'-DDD	2 {ca**}	7.2 {ca**}	- -	mg/kg	0.0034 J	NA	NA	NA
4,4'-DDE	1.4 {ca**}	5.1 {ca**}	- -	mg/kg	<0.00834	NA	NA	NA
4,4'-DDT	1.7 {ca*}	7 {ca*}	- -	mg/kg	<0.00834	NA	NA	NA
Aldrin	0.029 {ca*}	0.1 {ca}	- -	mg/kg	<0.00834	NA	NA	NA
Alpha-BHC	0.077 {ca**}	0.27 {ca**}	- -	mg/kg	<0.00834	NA	NA	NA
Alpha-Chlordane	1.6 {ca**}	6.5 {ca**}	- -	mg/kg	<0.00834	NA	NA	NA
Beta-BHC	0.27 {ca**}	0.96 {ca**}	- -	mg/kg	<0.00834	NA	NA	NA
Delta-BHC	0.52 {ca**}	2.1 {ca**}	- -	mg/kg	<0.00834	NA	NA	NA
Dieldrin	0.03 {ca}	0.11 {ca}	- -	mg/kg	<0.00834 L	NA	NA	NA
Endosulfan I	- -	- -	- -	mg/kg	<0.00834	NA	NA	NA
Endosulfan II	37 {nc}	370 {nc}	- -	mg/kg	<0.00834	NA	NA	NA
Endosulfan Sulfate	- -	- -	- -	mg/kg	<0.00834 J	NA	NA	NA
Endrin	1.8 {nc}	18 {nc}	- -	mg/kg	<0.00834	NA	NA	NA
Endrin Aldehyde	1.8 {nc}	18 {nc}	- -	mg/kg	<0.00834 L	NA	NA	NA
Endrin Ketone	- -	- -	- -	mg/kg	<0.00834	NA	NA	NA
Gamma-BHC (Lindane)	0.52 {ca*}	2.1 {ca}	- -	mg/kg	<0.00834	NA	NA	NA
Gamma-Chlordane	1.6 {ca**}	6.5 {ca**}	- -	mg/kg	<0.00834	NA	NA	NA
Heptachlor	0.11 {ca}	0.38 {ca}	- -	mg/kg	<0.00834	NA	NA	NA
Heptachlor Epoxide	0.053 {ca*}	0.19 {ca*}	- -	mg/kg	<0.00834	NA	NA	NA
Methoxychlor	31 {nc}	310 {nc}	- -	mg/kg	0.0291 J	NA	NA	NA
Toxaphene	0.44 {ca**}	1.6 {ca**}	- -	mg/kg	<0.416	NA	NA	NA
PAHs								
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	5.1	0.0012 B	0.054 B [<0.0025]	0.00095 B
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	27	0.0066 B	1.5 [0.021]	0.0020 B
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	0.24 J	0.0021 J	<0.0026 [0.0020 J]	0.00087 J
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	37	0.0091	2.7 [0.034]	0.0036
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	66	0.030	7.6 [0.12]	0.016
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	57	0.021	6.5 [0.10]	0.013
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	81	0.046	10 [0.19]	0.022
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	38	0.020	4.2 [0.079]	0.012
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	26	0.011	3.1 [0.050]	0.0062
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	61	0.033	7.6 [0.13]	0.015
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	9.9	0.0050	1.1 [0.018]	0.0027
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	180	0.097	20 [0.29]	0.040
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	28	0.0073	1.6 [0.018]	0.0020 J
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	47	0.025	5.2 [0.090]	0.013
Naphthalene	3.9 {nc}	20 {nc}	- -	mg/kg	29	0.0023 B	0.14 B [0.0025 B]	0.0011 B
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	160	0.077	16 [0.22]	0.023
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	130	0.078 J	16 [0.26 J]	0.033 J
PCBs								
Aroclor-1016	0.39 {nc}	21 {ca**}	- -	mg/kg	<0.040	<0.040	<0.040 [<0.040]	<0.040
Aroclor-1221	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.080	<0.080	<0.080 [<0.080]	<0.080
Aroclor-1232	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.040	<0.040	<0.040 [<0.040]	<0.040
Aroclor-1242	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.040	<0.040	<0.040 [<0.040]	<0.040
Aroclor-1248	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.040	<0.040	<0.040 [<0.040]	<0.040
Aroclor-1254	0.22 {ca**}	0.74 {ca*}	- -	mg/kg	<0.040	<0.040	<0.040 [<0.040]	<0.040
Aroclor-1260	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.040	<0.040	<0.040 [<0.040]	<0.040
Volatile Organics								
1,1,1-Trichloroethane	680 {sat}	680 {sat}	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056
1,1,2,2-Tetrachloroethane	0.59 {ca**}	2.9 {ca**}	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056
1,1,2-Trichloroethane	1.1 {ca}	5.5 {ca}	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056
1,1-Dichloroethane	3.4 {ca}	17 {ca}	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056
1,1-Dichloroethene	25 {nc}	110 {nc}	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056
1,2-Dichloroethane	0.45 {ca}	2.2 {ca}	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056
1,2-Dichloropropane	0.93 {ca*}	4.7 {ca*}	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056
2-Butanone	2,800 {nc}	19,000 {nc}	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056
2-Hexanone	- -	- -	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056
4-Methyl-2-pentanone	530 {nc}	5,200 {sat}	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056
Acetone	6,100 {nc}	61,000 {nc}	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056
Benzene	1.1 {ca*}	5.6 {ca*}	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056
Bromodichloromethane	10 {ca}	46 {ca}	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056
Bromoform	61 {ca*}	220 {ca*}	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056
Bromomethane	0.79 {nc}	3.5 {nc}	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056
Carbon Disulfide	67 {nc}	300 {nc}	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056
Carbon Tetrachloride	0.25 {ca}	1.3 {ca}	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056
Chlorobenzene	31 {nc}	860 {sat}	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056
Chloroethane	2,200 {sat}	2,200 {sat}	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056
Chloroform	0.3 {ca}	1.5 {ca}	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056
Chloromethane	1.7 {ca*}	8.4 {ca*}	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056
cis-1,2-Dichloroethene	78 {nc}	1,300 {sat}	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056
cis-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056
Dibromochloromethane	5.8 {ca}	21 {ca}	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056
Ethylbenzene	5.7 {ca}	29 {ca}	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056
m,p-Xylene	60 {nc}	260 {nc}	- -	mg/kg	<0.014	<0.011	<0.013 [<0.013]	<0.011
Methylene Chloride	11 {ca}	54 {ca}	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056
o-Xylene	300 {sat}	300 {sat}	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056
Styrene	1,000 {sat}	1,000 {sat}	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056

Notes found at end of table.

Table 5-7. Soil Analytical Results, Building Debris Disposal Trench, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: / Sample Depth(Feet): / Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	DTSB46 0 - 0.5 06/12/02	DTSB46 1 - 3 06/12/02	DTSB47 0 - 0.5 06/12/02	DTSB47 1 - 3 06/12/02
Volatile Organics								
Tetrachloroethene	0.57 {ca}	2.7 {ca}	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056
Toluene	500 {nc}	4600 {nc}	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056
trans-1,2-Dichloroethene	11 {nc}	50 {nc}	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056
trans-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056
Trichloroethene	2.8 {ca}	14 {ca}	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056
Vinyl Chloride	0.06 {ca}	1.7 {ca}	- -	mg/kg	<0.0069	<0.0056	<0.0067 [<0.0067]	<0.0056
Xylenes (total)	60 {nc}	260 {nc}	- -	mg/kg	<0.014	<0.011	<0.013 [<0.013]	<0.011
Inorganics								
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	15,400	15,700	15,500 [16,200]	16,500
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	0.220 B	<0.610 L	0.330 B [0.240 B]	<0.620 L
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	4.00	2.11	3.65 [4.05]	4.51
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	58.2	61.5	78.7 [62.5]	56.0
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	**1.11 K**	**1.11 K**	**1.20 K [1.24 K]**	**1.38 K**
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	0.100 J	<0.120	<0.120 [0.0500 B]	<0.120
Calcium	- -	- -	- -	mg/kg	1,340 J	1,120 J	850 J [896 J]	988 J
Chromium	280 {ca}	1,460 {ca}	65.3	mg/kg	27.4 J	23.2 J	39.3 J [41.4 J]	42.7 J
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	19.2 J	10.7 J	24.3 J [20.2 J]	26.1 J
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	**83.4 L**	19.8 L	25.9 L [27.1 L]	19.3 L
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	23,300 J	21,100 J	40,000 J [32,000 J]	35,600 J
Lead	400 {++}	800 {++}	26.8	mg/kg	**37.7 K**	14.1 K	18.2 K [21.4 K]	18.4 K
Magnesium	- -	- -	- -	mg/kg	4,040	4,300	5,000 [5,750]	5,680
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	946 J	484 J	1,490 J [1,060 J]	981 J
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	0.0300 J	0.0300 J	0.0300 J [0.0300 J]	0.0200 J
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	15.1	17.0	17.2 [17.4]	17.8
Potassium	- -	- -	- -	mg/kg	1,530	1,370	1,630 [1,840]	1,630
Selenium	39 {nc}	510 {nc}	- -	mg/kg	0.430 L	<1.23 L	<1.22 L [<1.21 L]	<1.24 L
Silver	39 {nc}	510 {nc}	- -	mg/kg	<1.25 L	<1.23 L	<1.22 L [<1.21 L]	<1.24 L
Sodium	- -	- -	- -	mg/kg	22.0 B	18.0 B	18.0 B [23.0 B]	18.0 B
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	0.350 J	0.210 J	0.230 J [0.280 J]	0.200 J
Vanadium	55{nc}	720 {nc}	108	mg/kg	44.6 J	38.4 J	65.3 J [61.3 J]	66.2 J
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	91.7 J	42.6 J	41.2 J [47.4 J]	39.5 J
Miscellaneous								
pH	- -	- -	- -	pH Units	6.68 J	6.3 J	NA	NA
Total Organic Carbon	- -	- -	- -	mg/kg	17,300 K	12,500 K	NA	NA

mg/kg	Milligrams per kilogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 5-8. Sediment Analytical Results, Building Debris Disposal Trench, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	DTSW/SD05 0 - 0.5 06/20/02	DTSW/SD06 0 - 0.5 06/20/02	DTSW/SD07 0 - 0.5 06/20/02	DTSW/SD08 0 - 0.5 06/20/02	DTSW/SD09 0 - 0.5 06/20/02	DTSW/SD10 0 - 0.5 06/20/02
Herbicides										
2,4,5-T	61 {nc}	620 {nc}	- -	mg/kg	<0.02 J	NA	<0.0198 J [<0.021 J]	NA	NA	NA
2,4,5-TP	49 {nc}	490 {nc}	- -	mg/kg	<0.02	NA	<0.0198 [<0.021]	NA	NA	NA
2,4-D	69 {nc}	770 {nc}	- -	mg/kg	<0.0401	NA	<0.0395 [<0.0419]	NA	NA	NA
2,4-DB	49 {nc}	490 {nc}	- -	mg/kg	<0.2 J	NA	<0.198 J [<0.21 J]	NA	NA	NA
Dalapon	180 {nc}	1,800 {nc}	- -	mg/kg	<0.2	NA	<0.198 [<0.21]	NA	NA	NA
Dicamba	180 {nc}	1,800 {nc}	- -	mg/kg	<0.0401 L	NA	<0.0395 L [<0.0419 L]	NA	NA	NA
Dichlorprop	- -	- -	- -	mg/kg	<0.0401	NA	<0.0395 [<0.0419]	NA	NA	NA
Dinoseb	6.1 {nc}	62 {nc}	- -	mg/kg	<0.0401 J	NA	<0.0395 J [<0.0419 J]	NA	NA	NA
MCPA	3.1 {nc}	31 {nc}	- -	mg/kg	<20	NA	<19.8 [<21]	NA	NA	NA
MCPP	6.1 {nc}	62 {nc}	- -	mg/kg	<20	NA	<19.8 [<21]	NA	NA	NA
Organochlorine Pesticides										
4,4'-DDD	2 {ca**}	7.2 {ca**}	- -	mg/kg	0.00115 J	NA	0.0011 J [0.0011 J]	NA	NA	NA
4,4'-DDE	1.4 {ca**}	5.1 {ca**}	- -	mg/kg	0.00212 B	NA	0.00169 B [0.00141 B]	NA	NA	NA
4,4'-DDT	1.7 {ca*}	7 {ca*}	- -	mg/kg	0.00123 B	NA	0.00069 B [0.00067 B]	NA	NA	NA
Aldrin	0.029 {ca*}	0.1 {ca}	- -	mg/kg	<0.00134	NA	<0.00132 [<0.0014]	NA	NA	NA
Alpha-BHC	0.077 {ca**}	0.27 {ca**}	- -	mg/kg	<0.00134	NA	<0.00132 [<0.0014]	NA	NA	NA
Alpha-Chlordane	1.6 {ca**}	6.5 {ca**}	- -	mg/kg	0.00037 J	NA	0.00039 J [0.00033 J]	NA	NA	NA
Beta-BHC	0.27 {ca**}	0.96 {ca**}	- -	mg/kg	<0.00134	NA	<0.00132 [<0.0014]	NA	NA	NA
Delta-BHC	0.52 {ca**}	2.1 {ca**}	- -	mg/kg	<0.00134	NA	0.00354 [0.0065]	NA	NA	NA
Dieldrin	0.03 {ca}	0.11 {ca}	- -	mg/kg	0.00159	NA	0.0014 [0.00121 J]	NA	NA	NA
Endosulfan I	- -	- -	- -	mg/kg	<0.00134	NA	<0.00132 [<0.0014]	NA	NA	NA
Endosulfan II	37 {nc}	370 {nc}	- -	mg/kg	<0.00134	NA	<0.00132 [<0.0014]	NA	NA	NA
Endosulfan Sulfate	- -	- -	- -	mg/kg	<0.00134	NA	<0.00132 [<0.0014]	NA	NA	NA
Endrin	1.8 {nc}	18 {nc}	- -	mg/kg	<0.00134	NA	<0.00132 [<0.0014]	NA	NA	NA
Endrin Aldehyde	1.8 {nc}	18 {nc}	- -	mg/kg	<0.00134	NA	<0.00132 [<0.0014]	NA	NA	NA
Endrin Ketone	- -	- -	- -	mg/kg	<0.00134	NA	<0.00132 [<0.0014]	NA	NA	NA
Gamma-BHC (Lindane)	0.52 {ca*}	2.1 {ca}	- -	mg/kg	<0.00134	NA	<0.00132 [<0.0014]	NA	NA	NA
Gamma-Chlordane	1.6 {ca**}	6.5 {ca**}	- -	mg/kg	<0.00134	NA	<0.00132 [<0.0014]	NA	NA	NA
Heptachlor	0.11 {ca}	0.38 {ca}	- -	mg/kg	<0.00134	NA	<0.00132 [<0.0014]	NA	NA	NA
Heptachlor Epoxide	0.053 {ca*}	0.19 {ca*}	- -	mg/kg	<0.00134	NA	<0.00132 [<0.0014]	NA	NA	NA
Methoxychlor	31 {nc}	310 {nc}	- -	mg/kg	<0.00134	NA	<0.00132 [<0.0014]	NA	NA	NA
Toxaphene	0.44 {ca**}	1.6 {ca**}	- -	mg/kg	<0.0667	NA	<0.0658 [<0.0698]	NA	NA	NA
PAHs										
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	0.030	0.025	0.015 [0.019]	0.0042 B	0.0060 B	0.074
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	0.13	0.0025 B	0.0036 B [<0.0036]	0.0018 B	0.0023 B	0.24
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.0068	0.0017 J	<0.0034 [<0.0036]	<0.0032	<0.0041	<0.0061
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.19	0.0044	0.0053 [0.0027 J]	0.0023 J	0.0029 J	0.41
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.41	0.020	0.015 [0.011]	0.013	0.015	0.88
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	0.35	0.017	0.013 [0.012]	0.013	0.014	0.71
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.62	0.034	0.023 [0.024]	0.026	0.025	1.2
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	0.17 J	0.011 J	0.0069 J [0.0064 J]	0.0082 J	0.0088 J	0.28 J
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	0.17	0.013	0.0080 [0.0051]	0.0076	0.0090	0.37
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	0.40	0.022	0.014 [0.014]	0.015	0.015	0.80
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	0.041	0.0029 J	<0.0034 [<0.0036]	<0.0032	<0.0041	0.076
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	1.0	0.034	0.024 [0.019]	0.024	0.024	2.0
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	0.13	0.0030 J	0.0038 [0.0026 J]	0.0024 J	0.0028 J	0.24
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.20	0.012	0.0080 [0.0075]	0.0099	0.011	0.36
Naphthalene	3.9 {nc}	20 {nc}	- -	mg/kg	0.053 B	0.024 B	0.019 B [0.024 B]	0.014 B	0.014 B	0.091
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	1.0	0.034	0.022 [0.016]	0.012	0.013	1.9
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	0.94 J	0.035 J	0.027 J [0.022 J]	0.025 J	0.025 J	1.7 J
PCBs										
Aroclor-1016	0.39 {nc}	21 {ca**}	- -	mg/kg	<0.060	<0.050	<0.060 [<0.060]	<0.060	<0.070	<0.050
Aroclor-1221	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.13	<0.12	<0.13 [<0.14]	<0.12	<0.15	<0.11
Aroclor-1232	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.060	<0.050	<0.060 [<0.060]	<0.060	<0.070	<0.050
Aroclor-1242	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.060	<0.050	<0.060 [<0.060]	<0.060	<0.070	<0.050
Aroclor-1248	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.060	<0.050	<0.060 [<0.060]	<0.060	<0.070	<0.050
Aroclor-1254	0.22 {ca**}	0.74 {ca*}	- -	mg/kg	<0.060	<0.050	<0.060 [<0.060]	<0.060	<0.070	<0.050
Aroclor-1260	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.060	<0.050	<0.060 [<0.060]	<0.060	<0.070	<0.050
Volatile Organics										
1,1,1-Trichloroethane	680 {sat}	680 {sat}	- -	mg/kg	<0.010	<0.0090	<0.0099 [<0.010]	<0.0094	<0.012	<0.0089
1,1,2,2-Tetrachloroethane	0.59 {ca**}	2.9 {ca**}	- -	mg/kg	<0.010 L	<0.0090 L	<0.0099 L [<0.010 L]	<0.0094 L	<0.012 L	<0.0089 L
1,1,2-Trichloroethane	1.1 {ca}	5.5 {ca}	- -	mg/kg	<0.010	<0.0090	<0.0099 [<0.010]	<0.0094	<0.012	<0.0089
1,1-Dichloroethane	3.4 {ca}	17 {ca}	- -	mg/kg	<0.010	<0.0090	<0.0099 [<0.010]	<0.0094	<0.012	<0.0089
1,1-Dichloroethene	25 {nc}	110 {nc}	- -	mg/kg	<0.010	<0.0090	<0.0099 [<0.010]	<0.0094	<0.012	<0.0089
1,2-Dichloroethane	0.45 {ca}	2.2 {ca}	- -	mg/kg	<0.010	<0.0090	<0.0099 [<0.010]	<0.0094	<0.012	<0.0089
1,2-Dichloropropane	0.93 {ca*}	4.7 {ca*}	- -	mg/kg	<0.010	<0.0090	<0.0099 [<0.010]	<0.0094	<0.012	<0.0089
2-Butanone	2,800 {nc}	19,000 {nc}	- -	mg/kg	<0.010	<0.0090	<0.0099 [<0.010]	<0.0094	<0.012	<0.0089
2-Hexanone	- -	- -	- -	mg/kg	<0.010 L	<0.0090 L	<0.0099 L [<0.010 L]	<0.0094 L	<0.012 L	<0.0089 L
4-Methyl-2-pentanone	530 {nc}	5,200 {sat}	- -	mg/kg	<0.010	<0.0090	<0.0099 [<0.010]	<0.0094	<0.012	<0.0089
Acetone	6,100 {nc}	61,000 {nc}	- -	mg/kg	0.030 B	0.022 B	0.032 B [0.037 B]	0.028 B	<0.012	0.025 B
Benzene	1.1 {ca*}	5.6 {ca*}	- -	mg/kg	<0.010	<0.0090	<0.0099 [<0.010]	<0.0094	<0.012	<0.0089
Bromodichloromethane	10 {ca}	46 {ca}	- -	mg/kg	<0.010	<0.0090	<0.0099 [<0.010]	<0.0094	<0.012	<0.0089
Bromoform	61 {ca*}	220 {ca*}	- -	mg/kg	<0.010 L	<0.0090 L	<0.0099 L [<0.010 L]	<0.0094 L	<0.012 L	<0.0089 L
Bromomethane	0.79 {nc}	3.5 {nc}	- -	mg/kg	<0.010 L	<0.0090 L	<0.0099 L [<0.010 L]	<0.0094 L	<0.012 L	<0.0089 L
Carbon Disulfide	67 {nc}	300 {nc}	- -	mg/kg	0.00099 B	0.0010 B	0.0012 B [0.0015 B]	0.0014 B	0.0014 B	0.0013 B
Carbon Tetrachloride	0.25 {ca}	1.3 {ca}	- -	mg/kg	<0.010	<0.0090	<0.0099 [<0.010]	<0.0094	<0.012	<0.0089
Chlorobenzene	31 {nc}	860 {sat}	- -	mg/kg	<0.010 L	<0.0090 L	<0.0099 L [<0.010 L]	<0.0094 L	<0.012 L	<0.0089 L
Chloroethane	2,200 {sat}	2,200 {sat}	- -	mg/kg	<0.010	<0.0090	<0.0099 [<0.010]	<0.0094	<0.012	<0.0089
Chloroform	0.3 {ca}	1.5 {ca}	- -	mg/kg	<0.010	<0.0090	<0.0099 [<0.010]	<0.0094	<0.012	<0.0089
Chloromethane	1.7 {ca*}	8.4 {ca*}	- -	mg/kg	<0.010 L	<0.0090 L	<0.0099 L [<0.010 L]	<0.0094 L	<0.012 L	<0.0089 L
cis-1,2-Dichloroethene	78 {nc}	1,300 {sat}	- -	mg/kg	<0.010	<0.0090	<0.0099 [<0.010]	<0.0094	<0.012	<0.0089
cis-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.010	<0.0090	<0.0099 [<0.010]	<0.0094	<0.012	<0.0089
Dibromochloromethane	5.8 {ca}	21 {ca}	- -	mg/kg	<0.010	<0.0090	<0.0099 [<0.010]	<0.0094	<0.012	<0.0089
Dibromomethane	78 {nc}	3,000 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA
Dichlorodifluoromethane	19 {nc}	78 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA
Ethylbenzene	5.7 {ca}	29 {ca}	- -	mg/kg	<0.010 L	<0.0090 L	<0.0099 L [<0.010 L]	<0.0094 L	<0.012 L	<0.0089 L
m,p-Xylene	60 {nc}	260 {nc}	- -	mg/kg	<0.020 L	<0.018 L	<0.020 L [<0.021 L]	<0.019 L	<0.024 L	<0.018 L
Methylene Chloride	11 {ca}	54 {ca}	- -	mg/kg	<0.010	<0.0090	<0.0099 [<0.010]	<0.0094	<0.012	<0.0089
o-Xylene	300 {sat}	300 {sat}	- -	mg/kg	<0.010 L	<0.0090 L	<0.0099 L [<0.010 L]	<0.0094 L	<0.012 L	<0.0089 L
Styrene	1,000 {sat}	1,000 {sat}	- -	mg/kg	<0.010 L	<0.0090 L	<0.0099 L [<0.010 L]	<0.0094 L	<0.012 L	<0.0089 L
Tetrachloroethene	0.57 {ca}	2.7 {ca}	- -	mg/kg	<0.010 L	<0.0090 L	<0.0099 L [<0.010 L]	<0.0094 L	<0.012 L	<0.0089 L
Toluene	500 {nc}	4600 {nc}	- -	mg/kg	0.00094 B	<0.0090 L	0.0011 B [0.0011 B]	<0.0094 L	<0.012 L	0.0027 B
trans-1,2-Dichloroethene	11 {nc}	50 {nc}	- -	mg/kg	<0.010	<0.0090	<0.0099 [<0.010]	<0.0094	<0.012	<0.0089
trans-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.010	<0.0090	<0.0099 [<0.010]	<0.0094	<0.012	<0.0089
Trichloroethene	2.8 {ca}	14 {ca}	- -	mg/kg	<0.010	<0.0090	<0.0099 [<0.010]	<0.0094	<0.012	<0.0089
Vinyl Chloride	0.06 {ca}	1.7 {ca}	- -	mg/kg	<0.010	<0.0090	<0.0099 [<0.010]	<0.0094	<0.012	<0.0089
Xylenes (total)	60 {nc}	260 {nc}	- -	mg/kg	<0.020	<0.018	<0.020 [<0.021]	<0.019	<0.024	<0.018

Notes found at end of table.

Table 5-8. Sediment Analytical Results, Building Debris Disposal Trench, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	DTSW/SD05 0 - 0.5 06/20/02	DTSW/SD06 0 - 0.5 06/20/02	DTSW/SD07 0 - 0.5 06/20/02	DTSW/SD08 0 - 0.5 06/20/02	DTSW/SD09 0 - 0.5 06/20/02	DTSW/SD10 0 - 0.5 06/20/02
Inorganics										
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	17,100	14,900	15,500 [15,700]	18,600	20,200	12,500
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	0.890 L	0.470 B	<0.980 L [<1.05 L]	<0.930 L	<1.19 L	0.370 B
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	2.59 J	1.96 J	<0.980 [2.25 J]	3.59 J	3.08 J	4.37 J
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	95.3	76.9	85.3 [88.0]	98.8	99.1	90.7
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	**1.03 J**	0.940 J	0.880 J [0.840 J]	**1.12 J**	0.970 J	**1.09 J**
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	<0.200	<0.180	<0.190 [<0.210]	<0.180	<0.230	<0.170
Calcium	- -	- -	- -	mg/kg	78,000	46,100	52,600 [59,400]	72,100	76,200	89,500
Chromium	280 {ca}	1,460 {ca}	65.3	mg/kg	29.6 J	29.0 J	24.0 J [22.8 J]	32.2 J	31.1 J	48.7 J
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	10.6 L	11.4 L	10.7 L [9.40 L]	12.7 L	11.0 L	13.5 L
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	12.9 J	11.1 J	11.1 J [11.5 J]	11.2 J	12.1 J	12.7 J
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	19,800	24,500	18,500 [16,400]	22,900	19,500	22,700
Lead	400 {++}	800 {++}	26.8	mg/kg	19.0 J	14.9 J	10.7 J [17.2 J]	17.7 J	21.4 J	18.2 J
Magnesium	- -	- -	- -	mg/kg	5,010	3,950	5,140 [4,030]	5,320	4,810	7,010
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	641	510	589 [562]	829	627	555
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	0.0400 L	0.0300 L	<0.0900 L [<0.100 L]	<0.0900 L	<0.110 L	<0.0800 L
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	13.2	12.1	14.0 [14.1]	14.6	14.0	13.1
Potassium	- -	- -	- -	mg/kg	1,510	1,280	1,440 [1,320]	1,810	1,840	2,200
Selenium	39 {nc}	510 {nc}	- -	mg/kg	<2.00	<1.80	<1.98 [<2.10]	<1.88	<2.39	<1.78
Silver	39 {nc}	510 {nc}	- -	mg/kg	<2.00	<1.80	<1.98 [<2.10]	<1.88	<2.39	<1.78
Sodium	- -	- -	- -	mg/kg	105 J	87.4 J	103 J [107 J]	95.2 J	130 J	134 J
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	0.190 J	0.140 J	0.0900 J [0.160 J]	0.150 J	0.150 J	0.330 J
Vanadium	55 {nc}	720 {nc}	108	mg/kg	38.7 L	43.1 L	37.0 L [33.7 L]	45.4 L	38.4 L	37.2 L
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	44.7 J	37.7 J	38.4 J [38.6 J]	38.4 J	47.2 J	37.6 J

mg/kg	Milligrams per kilogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 5-9. Surface Water Analytical Results, Building Debris Disposal Trench, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Date Collected:	Tapwater Screening Values	Units	DTSW/SD05 06/20/02	DTSW/SD06 06/20/02	DTSW/SD07 06/20/02	DTSW/SD08 06/20/02	DTSW/SD09 06/20/02	DTSW/SD10 06/20/02
Herbicides								
2,4,5-T	370 {nc}	µg/L	<0.1	NA	<0.1	NA	NA	NA
2,4,5-TP	290 {nc}	µg/L	<0.1	NA	<0.1	NA	NA	NA
2,4-D	370 {nc}	µg/L	<0.5	NA	<0.5	NA	NA	NA
2,4-DB	290 {nc}	µg/L	<2	NA	<2	NA	NA	NA
Dalapon	1,100 {nc}	µg/L	<2	NA	<2	NA	NA	NA
Dicamba	1,100 {nc}	µg/L	<0.5 L	NA	<0.5 L	NA	NA	NA
Dichlorprop	- -	µg/L	<0.5	NA	<0.5	NA	NA	NA
Dinoseb	37 {nc}	µg/L	<0.5	NA	<0.5	NA	NA	NA
MCPA	18 {nc}	µg/L	<125	NA	<125	NA	NA	NA
MCPP	37 {nc}	µg/L	<125	NA	<125	NA	NA	NA
Organochlorine Pesticides								
4,4'-DDD	0.28 {ca**}	µg/L	<0.02	NA	<0.02	NA	NA	NA
4,4'-DDE	0.2 {ca**}	µg/L	<0.02	NA	<0.02	NA	NA	NA
4,4'-DDT	0.2 {ca*}	µg/L	0.00516 J	NA	<0.02	NA	NA	NA
Aldrin	0.004 {ca}	µg/L	<0.02	NA	<0.02	NA	NA	NA
Alpha-BHC	0.011 {ca**}	µg/L	<0.02	NA	<0.02	NA	NA	NA
Alpha-Chlordane	- -	µg/L	<0.02	NA	<0.02	NA	NA	NA
Beta-BHC	0.037 {ca**}	µg/L	<0.02	NA	<0.02	NA	NA	NA
Delta-BHC	0.061 {ca}	µg/L	<0.02	NA	<0.02	NA	NA	NA
Dieldrin	0.0042 {ca}	µg/L	0.00548 J	NA	0.00591 J	NA	NA	NA
Endosulfan I	220 {nc}	µg/L	<0.02	NA	<0.02	NA	NA	NA
Endosulfan II	220 {nc}	µg/L	<0.02	NA	<0.02	NA	NA	NA
Endosulfan Sulfate	220 {nc}	µg/L	<0.02	NA	<0.02	NA	NA	NA
Endrin	11 {nc}	µg/L	<0.02	NA	<0.02	NA	NA	NA
Endrin Aldehyde	11 {nc}	µg/L	<0.02	NA	<0.02	NA	NA	NA
Endrin Ketone	11 {nc}	µg/L	0.00437 J	NA	0.00599 J	NA	NA	NA
Gamma-BHC (Lindane)	0.061 {ca}	µg/L	<0.02	NA	<0.02	NA	NA	NA
Gamma-Chlordane	0.19 {ca}	µg/L	<0.02	NA	<0.02	NA	NA	NA
Heptachlor	0.015 {ca}	µg/L	<0.02	NA	<0.02	NA	NA	NA
Heptachlor Epoxide	0.0074 {ca*}	µg/L	<0.02	NA	<0.02	NA	NA	NA
Methoxychlor	180 {nc}	µg/L	<0.02	NA	<0.02	NA	NA	NA
Toxaphene	0.061 {ca**}	µg/L	<1	NA	<1	NA	NA	NA
PAHs								
2-Methylnaphthalene	150 {nc}	µg/L	0.030 B	0.030 B	<0.050	<0.050	0.030 B	0.13 B
Acenaphthene	2,200 {nc}	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.050
Acenaphthylene	2,200 {nc}	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.040 J
Anthracene	11,000 {nc}	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(a)anthracene	0.029 {ca**}	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(a)pyrene	0.0029 {ca**}	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(b)fluoranthene	0.029 {ca**}	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(g,h,i)perylene	1,100 {nc}	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(k)fluoranthene	0.29 {ca**}	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chrysene	2.9 {ca**}	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Dibenzo(a,h)anthracene	0.0029 {ca**}	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Fluoranthene	1,500 {nc}	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Fluorene	1,500 {nc}	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.030 J
Indeno(1,2,3-cd)pyrene	0.029 {ca**}	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Naphthalene	0.14 {ca}	µg/L	0.040 B	0.040 B	0.030 B	0.030 B	0.040 B	0.13 B
Phenanthrene	11,000 {nc}	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Pyrene	1,100 {nc}	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
PCBs								
Aroclor-1016	0.96 {ca**}	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Aroclor-1221	0.0068 {ca**}	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Aroclor-1232	0.0068 {ca**}	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Aroclor-1242	0.034 {ca**}	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Aroclor-1248	0.034 {ca**}	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Aroclor-1254	0.034 {ca*}	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Aroclor-1260	0.034 {ca**}	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Volatile Organics								
1,1,1-Trichloroethane	9,100 {nc}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2,2-Tetrachloroethane	0.067 {ca**}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2-Trichloroethane	0.24 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane	2.4 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethene	340 {nc}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichloroethane	0.15 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichloropropane	0.39 {ca*}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-Butanone	7,100 {nc}	µg/L	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
2-Hexanone	- -	µg/L	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
4-Methyl-2-pentanone	2,000 {nc}	µg/L	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
Acetone	22,000 {nc}	µg/L	<4.0 J	<4.0 J	<4.0 J	<4.0 J	<4.0 J	<4.0 J
Benzene	0.41 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromodichloromethane	1.1 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromoform	8.5 {ca*}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromomethane	8.7 {nc}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Carbon Disulfide	1,000 {nc}	µg/L	0.30 B	<1.0	0.22 B	0.34 B	0.31 B	0.29 B

Notes found at end of table.

Table 5-9. Surface Water Analytical Results, Building Debris Disposal Trench, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Date Collected:	Tapwater Screening Values	Units	DTSW/SD05 06/20/02	DTSW/SD06 06/20/02	DTSW/SD07 06/20/02	DTSW/SD08 06/20/02	DTSW/SD09 06/20/02	DTSW/SD10 06/20/02
Volatile Organics								
Carbon Tetrachloride	0.2 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chlorobenzene	91 {nc}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chloroethane	21,000 {nc}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chloroform	0.19 {ca}	µg/L	0.11 J	0.11 J	0.070 J	0.080 J	<1.0	0.090 J
Chloromethane	1.8 {ca}	µg/L	<1.0 L	<1.0 L	<1.0 L	<1.0 L	<1.0 L	<1.0 L
cis-1,2-Dichloroethene	370 {nc}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
cis-1,3-Dichloropropene	- -	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dibromochloromethane	0.8 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Ethylbenzene	1.5 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
m,p-Xylene	200 {nc}	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Methylene Chloride	4.8 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
o-Xylene	1,400 {nc}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Styrene	1,600 {nc}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Tetrachloroethene	0.11 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Toluene	2,300 {nc}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,2-Dichloroethene	110 {nc}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,3-Dichloropropene	- -	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Trichloroethene	1.7 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Vinyl Chloride	0.016 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Xylenes (total)	200 {nc}	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Inorganics								
Aluminum	37,000 {nc}	µg/L	340	245	120 J	343	603	300
Antimony	15 {nc}	µg/L	<5.00	0.740 B	0.380 B	<5.00	<5.00	<5.00
Arsenic	0.045 {ca}	µg/L	<3.00	<3.00	<3.00	<3.00	<3.00	<3.00
Barium	7,300 {nc}	µg/L	77.1	75.7	72.6	82.5	77.4	77.6
Beryllium	73 {nc}	µg/L	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00
Cadmium	18 {nc}	µg/L	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00
Calcium	- -	µg/L	54,100	52,300	47,000	52,500	48,300	54,900
Chromium	55,000 {nc}	µg/L	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
Cobalt	11 {nc}	µg/L	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0
Copper	1,500 {nc}	µg/L	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0
Iron	26,000 {nc}	µg/L	238 J	314 J	203 J	328 J	507 J	294 J
Lead	15 {nc}	µg/L	1.10 B	0.340 B	0.300 B	0.210 B	0.480 B	0.150 B
Magnesium	- -	µg/L	16,200	15,900	15,400	17,400	15,900	16,100
Manganese	880 {nc}	µg/L	10.8	11.5	12.2	17.2	19.8	10.8
Mercury	0.63 {nc}	µg/L	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Nickel	730 {nc}	µg/L	<40.0	<40.0	<40.0	<40.0	<40.0	<40.0
Potassium	- -	µg/L	3,250	3,050	3,210	3,670	3,360	3,160
Selenium	180 {nc}	µg/L	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
Silver	180 {nc}	µg/L	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
Sodium	- -	µg/L	31,500	31,100	31,200	35,300	32,200	31,200
Thallium	2.4 {nc}	µg/L	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00
Vanadium	260 {nc}	µg/L	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0
Zinc	11,000 {nc}	µg/L	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0
Perchlorate								
Perchlorate	26 {nc}	µg/L	<1	<1	<1	<1	<1	<1
Miscellaneous								
Hardness	- -	µg/L	202,000	196,000	181,000	NA	NA	204,000

µg/L	Micrograms per liter.
[a]	USEPA Regional Screening Levels (USEPA 2008a). Adjusted tap-water screening levels used to assess surface water at the NRU.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{max}	Concentration may exceed ceiling limit.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted tap water RSL.

Table 5-10. Soil Analytical Results, Building Debris Disposal Trench, 2004 Shaw Additional Characterization Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values	Units	DTSB48 0 - 0.5 07/13/04	DTSB50 0 - 0.5 07/13/04	DTSB51 0 - 0.5 07/13/04	DTSB52 0 - 0.5 07/13/04	DTSB54 0 - 0.5 07/13/04	DTSB55 0 - 0.5 07/13/04	DTSB56 0 - 0.5 07/13/04	DTSB57 0 - 0.5 07/13/04
PCBs												
Aroclor-1016	0.39 {nc}	21 {ca**}	- -	mg/kg	<0.12 [<0.12]	<0.13	<0.12	<0.13	<0.14	<0.13	<0.14	<0.13
Aroclor-1221	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.12 [<0.12]	<0.13	<0.12	<0.13	<0.14	<0.13	<0.14	<0.13
Aroclor-1232	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.12 [<0.12]	<0.13	<0.12	<0.13	<0.14	<0.13	<0.14	<0.13
Aroclor-1242	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.12 [<0.12]	<0.13	<0.12	<0.13	<0.14	<0.13	<0.14	<0.13
Aroclor-1248	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.12 [<0.12]	<0.13	<0.12	<0.13	<0.14	<0.13	<0.14	<0.13
Aroclor-1254	0.22 {ca**}	0.74 {ca*}	- -	mg/kg	<0.12 [<0.12]	<0.13	<0.12	<0.13	<0.14	<0.13	<0.14	<0.13
Aroclor-1260	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.12 [<0.12]	<0.13	<0.12	<0.13	<0.14	<0.13	<0.14	<0.13
Semivolatile Organics												
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	0.092 [0.061]	<0.0087	0.051	<0.043	<0.0091	0.51 J	0.011	<0.0088
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	0.73 [0.75]	0.026	0.82	0.64	<0.0091	13	0.30	<0.0088
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	0.15 J [0.12 J]	0.016	0.083 J	<0.043	<0.0091	0.31 J	0.072 J	<0.0088
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	1.6 [1.7]	0.094	1.9	1.1	<0.0091	23	0.65	<0.0088
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	3.7 [3.2]	0.21	3.5	2.2	<0.0091	43	1.3	<0.0088
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	2.8 [2.6]	0.18	2.7	2.0	<0.0091	32	0.97	<0.0088
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	4.7 [4.3]	0.33	4.4	3.0	0.012	54	2.3	<0.0088
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	1.5 J [1.3 J]	0.13	1.3 J	1.0	<0.0091	15 J	0.54 J	<0.0088
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	1.6 [1.6]	0.084	1.6	0.94	<0.0091	16	2.3	<0.0088
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	3.4 [3.3]	0.23	3.4	2.1	<0.0091	43	1.3	<0.0088
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	0.55 J [0.43 J]	0.037	<0.33	0.31	<0.0091	<3.4	0.21 J	<0.0088
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	9.9 [9.0]	0.54	9.8	6.7	0.013	130	3.4	<0.0088
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	0.69 [0.69]	0.024	0.84	0.59	<0.0091	13	0.27	<0.0088
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	1.4 J [1.2 J]	0.12	1.2 J	1.0	<0.0091	15 J	0.55 J	<0.0088
Naphthalene	15 {nc}	67 {nc}	- -	mg/kg	0.40 J [0.21 J]	<0.0087	0.15 J	0.086	<0.0091	1.3 J	0.024 J	<0.0088
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	7.4 J [7.2 J]	0.30	8.3 J	5.5	<0.0091	110 J	2.5 J	<0.0088
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	7.6 [7.2]	0.37	7.9	4.3	0.012	99	2.7	<0.0088
Miscellaneous												
Percent Solids	- -	- -	- -	%	83 [83]	77	81	77	74	78	74	75

Notes found at end of table.

Table 5-10. Soil Analytical Results, Building Debris Disposal Trench, 2004 Shaw Additional Characterization Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values	Units	DTSB58 0 - 0.5 07/13/04	DTSB59 0 - 0.5 07/13/04	DTSB60 0 - 0.5 07/13/04	DTSB62 0 - 0.5 07/13/04	DTSB63 0 - 0.5 07/13/04	DTSB64 0 - 0.5 07/13/04	DTSB65 0 - 0.5 07/13/04	DTSB66 0 - 0.5 07/13/04	DTSB67 0 - 0.5 07/13/04	DTSB68 0 - 0.5 07/13/04	DTSB69 0 - 0.5 07/13/04	DTSB70 0 - 0.5 07/13/04
PCBs																
Aroclor-1016	0.39 {nc}	21 {ca**}	- -	mg/kg	<0.16	<0.13 L [<0.13]	<0.17	<0.14	<0.13	<0.050 J	<0.15	<0.13	<0.13	<0.14	<0.13	<0.046
Aroclor-1221	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.16	<0.13 L [<0.13]	<0.17	<0.14	<0.13	<0.050 J	<0.15	<0.13	<0.13	<0.14	<0.13	<0.046
Aroclor-1232	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.16	<0.13 L [<0.13]	<0.17	<0.14	<0.13	<0.050 J	<0.15	<0.13	<0.13	<0.14	<0.13	<0.046
Aroclor-1242	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.16	<0.13 L [<0.13]	<0.17	<0.14	<0.13	<0.050 J	<0.15	<0.13	<0.13	<0.14	<0.13	<0.046
Aroclor-1248	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.16	<0.13 L [<0.13]	<0.17	<0.14	<0.13	<0.050 J	<0.15	<0.13	<0.13	<0.14	<0.13	<0.046
Aroclor-1254	0.22 {ca**}	0.74 {ca*}	- -	mg/kg	<0.16	<0.13 L [<0.13]	<0.17	<0.14	<0.13	<0.050 J	<0.15	<0.13	<0.13	<0.14	<0.13	<0.046
Aroclor-1260	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.16	<0.13 L [<0.13]	<0.17	<0.14	<0.13	<0.050 J	<0.15	<0.13	<0.13	<0.14	<0.13	<0.046
Semivolatile Organics																
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	<0.010 L	0.054 J [0.058 J]	<0.011	<0.0091	<0.0087	<0.030	<0.010	<0.0084	2.0	<0.0092	<0.0085	<0.0092
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	0.062 L	0.69 J [1.2 J]	<0.011	<0.0091	0.049 J	0.16	<0.010	<0.0084	10	0.11	0.022	0.013
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	0.011 J	0.099 J [0.13 J]	<0.011	<0.0091	0.013 J	<0.030	<0.010	<0.0084	0.21 J	0.043 J	<0.0085	<0.0092
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.15 L	1.5 [2.4]	<0.011	<0.0091	0.13 J	0.34	0.021	<0.0084	17	0.29	0.043	0.037
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.35 L	2.9 [3.9]	<0.011	<0.0091	0.34 J	0.96	0.058	<0.0084	27	0.69	0.16	0.10
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	0.27 L	2.2 [3.2]	<0.011	<0.0091	0.28 J	0.88	0.058	<0.0084	22	0.60	0.15	0.11 L
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.43 L	3.7 [5.6]	<0.011	<0.0091	0.46 J	1.5	0.11	<0.0084	36	1.1	0.25	0.13
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	0.18 L	1.1 J [1.5 J]	<0.011	<0.0091	0.19 J	0.49	0.041	<0.0084	11 J	0.35 J	0.085	0.076
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	0.15 L	1.0 [1.3]	<0.011	<0.0091	0.14	0.33	0.031	<0.0084	9.3	0.26	0.066	0.087 L
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	0.38 L	2.7 [4.1]	<0.011	<0.0091	0.38 J	0.97	0.066	<0.0084	25	0.77	0.16	0.13 L
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.010 L	0.37 J [0.41 J]	<0.011	<0.0091	<0.0087	<0.030	0.012	<0.0084	3.6 J	0.12 J	0.023	<0.0092
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	0.94	8.3 [12]	0.012	0.0091	0.84 J	2.6	0.15	<0.0084	78	1.7	0.42	0.35 L
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	0.069 L	0.67 [1.1]	<0.011	<0.0091	0.045 J	0.14	<0.010	<0.0084	10	0.096	0.018	0.012
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.17 J	1.1 J [1.6 J]	<0.011	<0.0091	0.17 J	0.49	0.035	<0.0084	10 J	0.34 J	0.078	0.076
Naphthalene	15 {nc}	67 {nc}	- -	mg/kg	<0.010 L	0.15 J [0.14 J]	<0.011	<0.0091	<0.0087	0.042	<0.010	<0.0084	11 J	0.015 J	<0.0085	<0.0092
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.73 J	6.7 J [11 J]	<0.011	<0.0091	0.43 J	1.5	0.067	<0.0084	74 J	1.1 J	0.24	0.16
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	0.70	6.2 [10]	<0.011	<0.0091	0.69 J	1.5	0.10	<0.0084	60	1.4	0.27	0.22
Miscellaneous																
Percent Solids	- -	- -	- -	%	64	77 [78]	58	73	77	66	66	79	76	73	79	72

Notes found at end of table.

Table 5-10. Soil Analytical Results, Building Debris Disposal Trench, 2004 Shaw Additional Characterization Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values	Units	DTSB71 0 - 0.5 07/13/04	DTSB72 0 - 0.5 07/13/04	DTSB73 0 - 0.5 07/13/04	DTSB74 0 - 0.5 07/13/04	DTSB75 0 - 0.5 07/13/04	DTSB76 0 - 0.5 07/13/04	DTSB77 0 - 0.5 07/13/04	DTSB78 0 - 0.5 07/13/04	DTSB48 1 - 3 07/20/04	DTSB55 1 - 3 07/20/04	DTSB59 1 - 3 07/20/04	DTSB67 1 - 3 07/20/04
PCBs																
Aroclor-1016	0.39 {nc}	21 {ca**}	- -	mg/kg	<0.047 [<0.048]	<0.044	<0.044 L	<0.040	.045 [<0.045	<0.040	<0.045	<0.046	<0.041	<0.042	<0.041	<0.041
Aroclor-1221	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.047 [<0.048]	<0.044	<0.044 L	<0.040	.045 [<0.045	<0.040	<0.045	<0.046	<0.041	<0.042	<0.041	<0.041
Aroclor-1232	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.047 [<0.048]	<0.044	<0.044 L	<0.040	.045 [<0.045	<0.040	<0.045	<0.046	<0.041	<0.042	<0.041	<0.041
Aroclor-1242	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.047 [<0.048]	<0.044	<0.044 L	<0.040	.045 [<0.045	<0.040	<0.045	<0.046	<0.041	<0.042	<0.041	<0.041
Aroclor-1248	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.047 [<0.048]	<0.044	<0.044 L	<0.040	.045 [<0.045	<0.040	<0.045	<0.046	<0.041	<0.042	<0.041	<0.041
Aroclor-1254	0.22 {ca**}	0.74 {ca*}	- -	mg/kg	<0.047 [<0.048]	<0.044	<0.044 L	<0.040	.045 [<0.045	<0.040	<0.045	<0.046	<0.041	<0.042	<0.041	<0.041
Aroclor-1260	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.047 [<0.048]	<0.044	<0.044 L	<0.040	.045 [<0.045	<0.040	<0.045	<0.046	<0.041	<0.042	<0.041	<0.041
Semivolatile Organics																
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	<0.0095 [<0.0097]	<0.0087	<0.0089	<0.0081	0090 [<0.00	<0.0081	<0.18	<0.0092	0.089	0.024	<0.0083	<0.0081
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	0.028 [0.038]	0.011	<0.0089	<0.0081	.063 J [0.26	0.11 J	2.5	<0.0092	1.8	0.078	<0.0083	<0.0081
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.0095 [<0.0097]	<0.0087	<0.0089	<0.0081	0.011 [0.016	0.0089	<0.18	<0.0092	<0.081	<0.0083	<0.0083	<0.0081
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.068 [0.071]	0.030	0.018	<0.0081	.20 J [0.63 J	0.22 J	4.8	0.018	3.1	0.073	<0.0083	<0.0081
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.20 [0.22]	0.069	0.040	0.0093	0.45 J [1.2 J]	0.46 J	6.5	0.074	5.9	0.15	<0.0083	<0.0081
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	0.19 [0.20]	0.067	0.034	0.0089	0.42 J [1.1 J]	0.39 J	6.3	0.079	5.0	0.12	<0.0083	<0.0081
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.21 [0.26]	0.097	0.039	0.014	0.45 J [1.2 J]	0.59 J	6.8	0.12	7.7	0.18	<0.0083	<0.0081
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	0.12 [0.14]	0.052	0.024	<0.0081	.28 J [0.80 J	0.21 J	4.3	0.050	3.0	0.061	<0.0083	<0.0081
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	0.16 [0.15]	0.048	0.035	<0.0081	.32 J [0.82 J	0.18 J	4.8	0.034	2.4	0.056	<0.0083	<0.0081
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	0.24 [0.26]	0.084	0.048	0.0089	0.55 J [1.3 J]	0.43 J	7.1	0.072	5.2	0.14	<0.0083	<0.0081
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	0.056 J [0.064 J]	0.024 J	<0.0089	<0.0081	13 J [<0.009	0.060 J	<0.18	0.015	<0.081	0.020	<0.0083	<0.0081
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	0.65 [0.66]	0.19	0.11	0.015	1.4 J [3.7 J]	1.2 J	27	0.16	17	0.47	<0.0083	<0.0081
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	0.026 [0.035]	0.011	<0.0089	<0.0081	.070 J [0.27	0.11 J	2.8	<0.0092	1.8	0.072	<0.0083	<0.0081
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.12 [0.14]	0.052	0.024	<0.0081	.28 J [0.75 J	0.21 J	4.2	0.043	2.9	0.068	<0.0083	<0.0081
Naphthalene	15 {nc}	67 {nc}	- -	mg/kg	<0.0095 [0.011]	<0.0087	<0.0089	<0.0081	013 J [0.015	<0.0081	0.25	<0.0092	0.32	0.16	<0.0083	<0.0081
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.33 [0.41]	0.13	0.072	<0.0081	0.83 J [2.9 J]	0.95 J	22	0.077	14	0.43	<0.0083	<0.0081
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	0.40 [0.44]	0.14	0.076	0.013	0.82 J [2.1 J]	0.81 J	7.7 J	0.12	9.8	0.28 J	<0.0083	<0.0081
Miscellaneous																
Percent Solids	- -	- -	- -	%	71 [69]	76	75	83	74 [74]	83	74	72	82	80	81	82

Notes found at end of table.

Table 5-10. Soil Analytical Results, Building Debris Disposal Trench, 2004 Shaw Additional Characterization Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values- Residential [a]	Adjusted Soil Screening Values- Industrial [a]	Facility-Wide Background Values	Units	DTSB77 1 - 3 07/20/04	DTSB80 0 - 0.5 07/20/04	DTSB81 0 - 0.5 07/20/04	DTSB82 0 - 0.5 07/20/04	DTSB83 0 - 0.5 07/20/04	DTSB84 0 - 0.5 07/20/04	DTSB85 0 - 0.5 07/20/04	DTSB86 0 - 0.5 07/20/04	DTSB87 0 - 0.5 07/20/04	DTSB88 0 - 0.5 07/20/04	DTSB89 0 - 0.5 07/23/04
PCBs															
Aroclor-1016	0.39 {nc}	21 {ca**}	- -	mg/kg	<0.040	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.037
Aroclor-1221	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.040	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.037
Aroclor-1232	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.040	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.037
Aroclor-1242	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.040	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.037
Aroclor-1248	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.040	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.037
Aroclor-1254	0.22 {ca**}	0.74 {ca*}	- -	mg/kg	<0.040	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.037
Aroclor-1260	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.040	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.037
Semivolatile Organics															
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	<0.0080	<0.0081	<0.0091	<0.0085	<0.0085	<0.0086	<0.0088	<0.0082	<0.0081	<0.0083	<0.0074
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.0080	<0.0081	<0.0091	<0.0085	<0.0085	<0.0086	<0.0088	<0.0082	<0.0081	<0.0083	0.013
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.0080	<0.0081	0.020	<0.0085	<0.0085	<0.0086	<0.0088	<0.0082	<0.0081	<0.0083	0.0081
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	<0.0080	<0.0081	0.056	<0.0085	<0.0085	<0.0086	<0.0088	<0.0082	<0.0081	0.015	0.038
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.0080	0.024 K	0.11	<0.0085	0.014	<0.0086	<0.0088	0.023	0.0097	0.061	0.076
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.0080	0.024 K	0.093	<0.0085	0.011	<0.0086	<0.0088	0.025	0.010	0.052	0.068
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.0080	0.041 K	0.22	<0.0085	0.017	<0.0086	<0.0088	0.045	0.018	0.084	0.12
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	<0.0080	0.018	0.071	<0.0085	<0.0085	<0.0086	<0.0088	0.020	0.0085	0.038	0.055
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	<0.0080	0.0085 K	0.069	<0.0085	<0.0085	<0.0086	<0.0088	0.014	<0.0081	0.024	0.037
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	<0.0080	0.024 K	0.13	<0.0085	0.014	<0.0086	<0.0088	0.027	0.011	0.051	0.076
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.0080	<0.0081	<0.0091	<0.0085	<0.0085	<0.0086	<0.0088	<0.0082	<0.0081	<0.0083	0.016
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.0080	0.050 K	0.21	<0.0085	0.037	<0.0086	<0.0088	0.061	0.023	0.15	0.21
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.0080	<0.0081	<0.0091	<0.0085	<0.0085	<0.0086	<0.0088	<0.0082	<0.0081	<0.0083	0.010
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.0080	0.017 K	0.069	<0.0085	<0.0085	<0.0086	<0.0088	0.019	<0.0081	0.036	0.050
Naphthalene	15 {nc}	67 {nc}	- -	mg/kg	<0.0080	<0.0081	<0.0091	<0.0085	<0.0085	<0.0086	<0.0088	<0.0082	<0.0081	<0.0083	<0.0074
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	<0.0080	0.022 K	0.073	<0.0085	0.026	<0.0086	<0.0088	0.021	0.0085	0.076	0.11
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	<0.0080	0.035 K	0.16	<0.0085	0.022	<0.0086	<0.0088	0.040	0.015	0.094	0.13
Miscellaneous															
Percent Solids	- -	- -	- -	%	84	82	73	79	79	78	76	81	83	80	91

mg/kg	Milligrams per
[a]	USEPA Regional Screening Levels (USEPA 2008a).
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).

Table 5-11. Soil Analytical Results, Building Debris Disposal Trench, 2008 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values	Units	BDDT-SS001 0 - 1 07/28/08	BDDT-SB001 2 - 3 07/28/08	BDDT-SB001 3 - 4 07/28/08	BDDT-SS002 0 - 1 07/28/08	BDDT-SB002 2 - 3 07/28/08	BDDT-SB002 3 - 4 07/28/08	BDDT-SS003 0 - 1 07/28/08	BDDT-SS004 0 - 1 07/28/08
Semivolatile Organics												
1-Methylnaphthalene	22 {ca*}	99 {ca*}	- -	mg/kg	0.0036 J	<0.0042	<0.0042	0.0026 J	<0.0041	<0.0041	<0.0045	0.0020 J
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	0.0045	<0.0042	<0.0042	0.0035 J	<0.0041	<0.0041	<0.0045	<0.0042
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	0.072	0.023	<0.0042	0.059	0.0085	0.013	<0.0045	<0.0042
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	0.018	<0.0042	<0.0042	0.0063	<0.0041	<0.0041	<0.0045	<0.0042
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.19	0.039	<0.0042	0.12	0.0076	0.020	<0.0045	<0.0042
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.41	0.087	<0.0042	0.31	0.026	0.074	<0.0045	<0.0042
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	0.34	0.070	<0.0042	0.26	0.025	0.051	<0.0045	<0.0042
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.59	0.11	<0.0042	0.38	0.032	0.079	0.0042 J	0.0050
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	0.27	0.046	<0.0042	0.19	0.016	0.032	<0.0045	0.0063
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	0.29	0.048	<0.0042	0.21	0.016	0.032	0.0029 J	0.0072
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	0.53	0.10	<0.0042	0.36	0.033	0.081	<0.0045	<0.0042
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	0.074	0.013	<0.0042	0.053	<0.0041	0.0093	<0.0045	<0.0042
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	1.2	0.28	<0.0042	0.86	0.10	0.20	0.0072	0.012
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	0.063	0.021	<0.0042	0.051	0.0064	0.0095	<0.0045	<0.0042
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.31 J	0.050 J	<0.0042 J	0.21 J	0.018 J	0.041 J	<0.0045 J	<0.0042 J
Naphthalene	15 {nc}	67 {nc}	- -	mg/kg	0.0076	<0.0042	<0.0042	<0.0041	<0.0041	<0.0041	<0.0045	<0.0042
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.72	0.20	<0.0042	0.57	0.068	0.11	0.0071	0.0068
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	1.1	0.22	<0.0042	0.85	0.067	0.19	0.0073	0.011

mg/kg	Milligrams per kilogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
J	Constituent concentration quanitified as estimated.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).

Table 5-11. Soil Analytical Results, Building Debris Disposal Trench, 2008 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values	Units	BDDT-SS005 0 - 1 07/28/08	BDDT-SS006 0 - 1 07/28/08	BDDT-SS007 0 - 1 07/28/08	BDDT-SS008 0 - 1 07/28/08
Semivolatile Organics								
1-Methylnaphthalene	22 {ca*}	99 {ca*}	- -	mg/kg	<0.0040 [<0.0040]	<0.0039	<0.0044	<0.0041
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	0.0025 J [<0.0040]	<0.0039	<0.0044	<0.0041
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.0040 [<0.0040]	<0.0039	<0.0044	<0.0041
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.0040 [<0.0040]	<0.0039	<0.0044	<0.0041
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	<0.0040 [<0.0040]	<0.0039	<0.0044	<0.0041
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.0040 [<0.0040]	<0.0039	<0.0044	<0.0041
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.0040 [<0.0040]	<0.0039	<0.0044	<0.0041
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.0079 [0.0038 J]	0.0051	<0.0044	<0.0041
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	<0.0040 [<0.0040]	<0.0039	<0.0044	<0.0041
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	0.0026 J [0.0017 J]	0.0021 J	<0.0044	<0.0041
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	<0.0040 [<0.0040]	<0.0039	<0.0044	<0.0041
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.0040 [<0.0040]	<0.0039	<0.0044	<0.0041
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	0.014 J [<0.0040 J]	0.0074	0.0052	<0.0041
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.0040 [<0.0040]	<0.0039	<0.0044	<0.0041
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.0040 J [<0.0040 J]	<0.0039 J	<0.0044 J	<0.0041 J
Naphthalene	15 {nc}	67 {nc}	- -	mg/kg	<0.0040 [<0.0040]	<0.0039	<0.0044	<0.0041
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.012 [0.0070]	0.0078	0.0047	<0.0041
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	0.012 J [<0.0040 J]	0.0066	0.0054	<0.0041

mg/kg	Milligrams per kilogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
J	Constituent concentration quanitified as estimated.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).

Table 5-12. Sediment Analytical Results, Building Debris Disposal Trench, 2008 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: / Sample Depth(Feet): / Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values	Units	BDDT-SE001 0 - 0.5 07/28/08	BDDT-SE002 0 - 0.5 07/28/08	BDDT-SE003 0 - 0.5 07/28/08	BDDT-SE004 0 - 0.5 07/28/08
Semivolatile Organics								
1-Methylnaphthalene	22 {ca*}	99 {ca*}	- -	mg/kg	<0.0044 J	<0.0045	<0.0048	0.0048 J
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	<0.0044 J	<0.0045	<0.0048	0.0075
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.0044 J	<0.0045	<0.0048	0.055
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.0044 J	<0.0045	<0.0048	<0.0062
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	<0.0044 J	<0.0045	<0.0048	0.083
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.0044 J	<0.0045	0.0026 J	0.17
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.0044 J	<0.0045	<0.0048	0.13
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.0044 J	<0.0045	0.0041 J	0.17
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	<0.0044 J	<0.0045	<0.0048	0.086
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	<0.0044 J	<0.0045	0.0017 J	0.085
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	<0.0044 J	<0.0045	0.0040 J	0.19
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.0044 J	<0.0045	<0.0048	0.026 J
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.0044 J	<0.0045	0.0082	0.57
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.0044 J	<0.0045	<0.0048	0.063
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.0044 J	<0.0045 J	<0.0048 J	0.093 J
Naphthalene	15 {nc}	67 {nc}	- -	mg/kg	<0.0044 J	<0.0045	<0.0048	0.021
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	<0.0044 J	<0.0045	0.0056	0.47
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	<0.0044 J	<0.0045	0.0060	0.32

mg/kg	Milligrams per kilogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
J	Constituent concentration quanitified as estimated.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).

Table 5-13. Surface Water Analytical Results, Building Debris Disposal Trench, 2008 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Date Collected:	Tapwater Screening Values	Units	BDDT-SW001 07/28/08	BDDT-SW002 07/28/08	BDDT-SW003 07/28/08	BDDT-SW004 07/28/08
Semivolatile Organics						
1-Methylnaphthalene	2.3 {ca}	µg/L	<0.050	<0.056	<0.046	<0.053 J
2-Methylnaphthalene	150 {nc}	µg/L	<0.050	<0.056	<0.046	<0.053 J
Acenaphthene	2,200 {nc}	µg/L	<0.050	<0.056	<0.046	<0.053 J
Acenaphthylene	- -	µg/L	<0.050	<0.056	<0.046	<0.053 J
Anthracene	11,000 {nc}	µg/L	<0.050	<0.056	<0.046	<0.053 J
Benzo(a)anthracene	0.029 {ca**}	µg/L	<0.050	<0.056	<0.046	<0.053 J
Benzo(a)pyrene	0.0029 {ca**}	µg/L	<0.050	<0.056	<0.046	<0.053 J
Benzo(b)fluoranthene	0.029 {ca**}	µg/L	<0.050	<0.056	<0.046	<0.053 J
Benzo(g,h,i)perylene	- -	µg/L	<0.050	<0.056	<0.046	<0.053 J
Benzo(k)fluoranthene	0.29 {ca**}	µg/L	<0.050	<0.056	<0.046	<0.053 J
Chrysene	2.9 {ca**}	µg/L	<0.050	<0.056	<0.046	<0.053 J
Dibenzo(a,h)anthracene	0.0029 {ca**}	µg/L	<0.050	<0.056	<0.046	<0.053 J
Fluoranthene	1,500 {nc}	µg/L	<0.050	<0.056	<0.046	<0.053 J
Fluorene	1,500 {nc}	µg/L	<0.050	<0.056	<0.046	<0.053 J
Indeno(1,2,3-cd)pyrene	0.029 {ca**}	µg/L	<0.050 J	<0.056 J	<0.046 J	<0.053 J
Naphthalene	6.2 {nc}	µg/L	<0.050	<0.056	<0.046	<0.053 J
Phenanthrene	- -	µg/L	<0.050	<0.056	<0.046	<0.053 J
Pyrene	1,100 {nc}	µg/L	<0.050	<0.056	<0.046	<0.053 J

µg/L	Micrograms per liter.
[a]	USEPA Regional Screening Levels (USEPA 2008a). Adjusted tap-water screening levels used to assess surface water at the NRU.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
J	Constituent concentration quanitified as estimated.
24,400	Highlighted value indicates constituent concentration is above adjusted tap water RSL.

Table 5-14
Soil Risk Assessment Dataset
Surface Soil (0-1 foot Depth Interval)
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects /		number of samples	FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location	
Volatile Organic Compounds													
1,2,4-Trimethylbenzene	95-63-6	2	-	4	50	0.003	-	0.004	0.002	-	0.002	DTSS1	*
m,p-Xylene	136777612	1	-	5	20	0.003	-	0.003	0.003	-	0.014	DTSS1	*
Xylenes (total)	1330-20-7	1	-	5	20	0.003	-	0.003	0.003	-	0.014	DTSS1	*
Semi-Volatile Organic Compounds													
Carbazole	86-74-8	4	-	4	100	0.17	-	3.5	–	-	–	DTSB35	*r
Dibenzofuran	132-64-9	3	-	4	75	0.28	-	0.8	0.4	-	0.4	DTSB35	*r
Herbicides													
2,4-D	94-75-7	1	-	1	100	0.171	-	0.171	–	-	–	DTSB46	*
Dalapon	75-99-0	1	-	1	100	0.099	-	0.099	–	-	–	DTSB46	*
Dicamba	1918-00-9	1	-	1	100	0.00849	-	0.00849	–	-	–	DTSB46	*
MCPP	93-65-2	1	-	1	100	13.5	-	13.5	–	-	–	DTSB46	*
Pesticides													
4,4'-DDD	72-54-8	1	-	1	100	0.0034	-	0.0034	–	-	–	DTSB46	*
Methoxychlor	72-43-5	1	-	1	100	0.0291	-	0.0291	–	-	–	DTSB46	*
Polycyclic Aromatic Hydrocarbons													
1-Methylnaphthalene	90-12-0	3	-	8	38	0.002	-	0.0036	0.0039	-	0.0045	BDDT-SS001	*
2-Methylnaphthalene	91-57-6	12	-	52	23	0.0025	-	5.1	0.0039	-	0.43	DTSB46	*
Acenaphthene	83-32-9	28	-	52	54	0.011	-	27	0.0039	-	0.011	DTSB46	*
Acenaphthylene	208-96-8	18	-	52	35	0.002	-	0.31	0.0039	-	0.85	DTSB55	*
Anthracene	120-12-7	33	-	52	63	0.015	-	37	0.0039	-	0.011	DTSB46	*
Benzo(a)anthracene	56-55-3	38	-	52	73	0.0093	-	66	0.0039	-	0.011	DTSB46	*
Benzo(a)pyrene	50-32-8	38	-	52	73	0.0089	-	57	0.0039	-	0.011	DTSB46	*
Benzo(b)fluoranthene	205-99-2	43	-	52	83	0.0038	-	81	0.0041	-	0.011	DTSB46	*
Benzo(g,h,i)perylene	191-24-2	37	-	52	71	0.0063	-	38	0.0039	-	0.011	DTSB46	*
Benzo(k)fluoranthene	207-08-9	39	-	52	75	0.0017	-	26	0.0041	-	0.011	DTSB46	*
Chrysene	218-01-9	38	-	52	73	0.0089	-	61	0.0039	-	0.011	DTSB46	*
Dibenzo(a,h)anthracene	53-70-3	23	-	52	44	0.012	-	9.9	0.0039	-	3.4	DTSB46	*
Fluoranthene	206-44-0	46	-	52	88	0.0052	-	180	0.0041	-	0.0088	DTSB46	*
Fluorene	86-73-7	27	-	52	52	0.01	-	28	0.0039	-	0.08	DTSB46	*
Indeno(1,2,3-cd)pyrene	193-39-5	35	-	52	67	0.017	-	47	0.0039	-	0.011	DTSB46	*
Naphthalene	91-20-3	17	-	52	33	0.0025	-	29	0.0039	-	0.43	DTSB46	*
Phenanthrene	85-01-8	42	-	52	81	0.0047	-	160	0.0041	-	0.011	DTSB46	*
Pyrene	129-00-0	44	-	52	85	0.0054	-	130	0.0041	-	0.011	DTSB46	*
Inorganics													
Aluminum	7429-90-5	6	-	6	100	14600	-	20100	–	-	–	DTSS3	*
Antimony	7440-36-0	2	-	6	33	0.22	-	0.33	0.59	-	0.66	DTSB47	*
Arsenic	7440-38-2	6	-	6	100	3.65	-	11.6	–	-	–	DTSS3	*
Barium	7440-39-3	6	-	6	100	58.2	-	78.7	–	-	–	DTSB47	*
Beryllium	7440-41-7	6	-	6	100	0.76	-	1.5	–	-	–	DTSS3	*
Cadmium	7440-43-9	2	-	6	33	0.05	-	0.1	0.12	-	0.13	DTSB46	*

Table 5-14
Soil Risk Assessment Dataset
Surface Soil (0-1 foot Depth Interval)
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b]				Detects			Detection Limits			Maximum Location	
		number of detects / number of samples			FOD %	Min (mg/kg)	-	Max (mg/kg)	Min (mg/kg)	-	Max (mg/kg)		
Calcium	7440-70-2	6	-	6	100	850	-	2560	–	-	–	DTSS3	*
Chromium	7440-47-3	6	-	6	100	27.4	-	60.8	–	-	–	DTSS3	*
Cobalt	7440-48-4	6	-	6	100	16.9	-	446	–	-	–	DTSS2	*
Copper	7440-50-8	6	-	6	100	25.9	-	138	–	-	–	DTSS2	*
Iron	7439-89-6	6	-	6	100	23300	-	58100	–	-	–	DTSS3	*
Lead	7439-92-1	6	-	6	100	18.2	-	336	–	-	–	DTSS2	*
Magnesium	7439-95-4	6	-	6	100	4040	-	13500	–	-	–	DTSS3	*
Manganese	7439-96-5	6	-	6	100	746	-	3430	–	-	–	DTSS2	*
Mercury	7439-97-6	2	-	6	33	0.03	-	0.03	0.12	-	0.13	DTSB46,DTSB47	*
Nickel	7440-02-0	6	-	6	100	15.1	-	41.3	–	-	–	DTSS2	*
Potassium	7440-09-7	6	-	6	100	1430	-	3980	–	-	–	DTSS3	*
Selenium	7782-49-2	1	-	6	17	0.43	-	0.43	0.59	-	1.21	DTSB46	*
Sodium	7440-23-5	6	-	6	100	18	-	173	–	-	–	DTSB35	*r
Thallium	7440-28-0	3	-	6	50	0.23	-	0.51	0.24	-	0.26	DTSB35	*r
Vanadium	7440-62-2	6	-	6	100	44.6	-	108	–	-	–	DTSS3	*
Zinc	7440-66-6	6	-	6	100	41.2	-	178	–	-	–	DTSS1	*

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilograms.

PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

* = Surface soil
r = Rip-rap area

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table 5-15
Soil Risk Assessment Dataset
Surface Soil (0-2 foot Depth Interval)
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location	
Volatile Organic Compounds													
1,2,4-Trimethylbenzene	95-63-6	2	-	4	50	0.003	-	0.004	0.002	-	0.002	DTSS1	*
m,p-Xylene	136777612	1	-	7	14	0.003	-	0.003	0.003	-	0.014	DTSS1	*
Xylenes (total)	1330-20-7	1	-	7	14	0.003	-	0.003	0.003	-	0.014	DTSS1	*
Semi-Volatile Organic Compounds													
Carbazole	86-74-8	4	-	4	100	0.17	-	3.5	–	-	–	DTSB35	*r
Dibenzofuran	132-64-9	3	-	4	75	0.28	-	0.8	0.4	-	0.4	DTSB35	*r
Herbicides													
2,4-D	94-75-7	1	-	1	100	0.171	-	0.171	–	-	–	DTSB46	*
Dalapon	75-99-0	1	-	1	100	0.099	-	0.099	–	-	–	DTSB46	*
Dicamba	1918-00-9	1	-	1	100	0.00849	-	0.00849	–	-	–	DTSB46	*
MCPP	93-65-2	1	-	1	100	13.5	-	13.5	–	-	–	DTSB46	*
Pesticides													
4,4'-DDD	72-54-8	1	-	1	100	0.0034	-	0.0034	–	-	–	DTSB46	*
Methoxychlor	72-43-5	1	-	1	100	0.0291	-	0.0291	–	-	–	DTSB46	*
Polycyclic Aromatic Hydrocarbons													
1-Methylnaphthalene	90-12-0	3	-	8	38	0.002	-	0.0036	0.0039	-	0.0045	BDDT-SS001	*
2-Methylnaphthalene	91-57-6	16	-	59	27	0.00095	-	5.1	0.0039	-	0.43	DTSB46	*
Acenaphthene	83-32-9	32	-	59	54	0.002	-	27	0.0039	-	0.011	DTSB46	*
Acenaphthylene	208-96-8	20	-	59	34	0.00087	-	0.31	0.0039	-	0.85	DTSB55	*
Anthracene	120-12-7	37	-	59	63	0.0036	-	37	0.0039	-	0.011	DTSB46	*
Benzo(a)anthracene	56-55-3	42	-	59	71	0.0093	-	66	0.0039	-	0.011	DTSB46	*
Benzo(a)pyrene	50-32-8	42	-	59	71	0.0089	-	57	0.0039	-	0.011	DTSB46	*
Benzo(b)fluoranthene	205-99-2	47	-	59	80	0.0038	-	81	0.0041	-	0.011	DTSB46	*
Benzo(g,h,i)perylene	191-24-2	41	-	59	69	0.0063	-	38	0.0039	-	0.011	DTSB46	*
Benzo(k)fluoranthene	207-08-9	43	-	59	73	0.0017	-	26	0.0041	-	0.011	DTSB46	*
Chrysene	218-01-9	42	-	59	71	0.0089	-	61	0.0039	-	0.011	DTSB46	*
Dibenzo(a,h)anthracene	53-70-3	26	-	59	44	0.0027	-	9.9	0.0039	-	3.4	DTSB46	*
Fluoranthene	206-44-0	50	-	59	85	0.0052	-	180	0.0041	-	0.0088	DTSB46	*
Fluorene	86-73-7	31	-	59	53	0.002	-	28	0.0039	-	0.08	DTSB46	*
Indeno(1,2,3-cd)pyrene	193-39-5	39	-	59	66	0.013	-	47	0.0039	-	0.011	DTSB46	*
Naphthalene	91-20-3	21	-	59	36	0.0011	-	29	0.0039	-	0.43	DTSB46	*
Phenanthrene	85-01-8	46	-	59	78	0.0047	-	160	0.0041	-	0.011	DTSB46	*
Pyrene	129-00-0	48	-	59	81	0.0054	-	130	0.0041	-	0.011	DTSB46	*
Inorganics													
Aluminum	7429-90-5	8	-	8	100	14600	-	20100	–	-	–	DTSS3	*
Antimony	7440-36-0	2	-	8	25	0.22	-	0.33	0.59	-	0.66	DTSB47	*
Arsenic	7440-38-2	8	-	8	100	2.11	-	11.6	–	-	–	DTSS3	*
Barium	7440-39-3	8	-	8	100	56	-	78.7	–	-	–	DTSB47	*
Beryllium	7440-41-7	8	-	8	100	0.76	-	1.5	–	-	–	DTSS3	*

Table 5-15
Soil Risk Assessment Dataset
Surface Soil (0-2 foot Depth Interval)
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b]				Detects			Detection Limits			Maximum Location	
		number of detects / number of samples			FOD %	Min - Max			Min - Max				
						(mg/kg)		(mg/kg)	(mg/kg)		(mg/kg)		
Cadmium	7440-43-9	2	-	8	25	0.05	-	0.1	0.12	-	0.13	DTSB46	*
Calcium	7440-70-2	8	-	8	100	850	-	2560	–	-	–	DTSS3	*
Chromium	7440-47-3	8	-	8	100	23.2	-	60.8	–	-	–	DTSS3	*
Cobalt	7440-48-4	8	-	8	100	10.7	-	446	–	-	–	DTSS2	*
Copper	7440-50-8	8	-	8	100	19.3	-	138	–	-	–	DTSS2	*
Iron	7439-89-6	8	-	8	100	21100	-	58100	–	-	–	DTSS3	*
Lead	7439-92-1	8	-	8	100	14.1	-	336	–	-	–	DTSS2	*
Magnesium	7439-95-4	8	-	8	100	4040	-	13500	–	-	–	DTSS3	*
Manganese	7439-96-5	8	-	8	100	484	-	3430	–	-	–	DTSS2	*
Mercury	7439-97-6	4	-	8	50	0.02	-	0.03	0.12	-	0.13	DTSB46,DTSB46,DTSB47	*
Nickel	7440-02-0	8	-	8	100	15.1	-	41.3	–	-	–	DTSS2	*
Potassium	7440-09-7	8	-	8	100	1370	-	3980	–	-	–	DTSS3	*
Selenium	7782-49-2	1	-	8	12	0.43	-	0.43	0.59	-	1.24	DTSB46	*
Sodium	7440-23-5	8	-	8	100	18	-	173	–	-	–	DTSB35	*r
Thallium	7440-28-0	5	-	8	62	0.2	-	0.51	0.24	-	0.26	DTSB35	*r
Vanadium	7440-62-2	8	-	8	100	38.4	-	108	–	-	–	DTSS3	*
Zinc	7440-66-6	8	-	8	100	39.5	-	178	–	-	–	DTSS1	*

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilograms.

PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

* = Surface soil
r = Rip-rap area

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table 5-16
Soil Risk Assessment Dataset
Combined Surface and Subsurface Soil
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location	
Volatile Organic Compounds													
1,2,4-Trimethylbenzene	95-63-6	2	-	4	50	0.003	-	0.004	0.002	-	0.002	DTSS1	*
m,p-Xylene	136777612	1	-	7	14	0.003	-	0.003	0.003	-	0.014	DTSS1	*
Xylenes (total)	1330-20-7	1	-	7	14	0.003	-	0.003	0.003	-	0.014	DTSS1	*
Semi-Volatile Organic Compounds													
Carbazole	86-74-8	4	-	4	100	0.17	-	3.5	–	-	–	DTSB35	*r
Dibenzofuran	132-64-9	3	-	4	75	0.28	-	0.8	0.4	-	0.4	DTSB35	*r
Herbicides													
2,4-D	94-75-7	1	-	1	100	0.171	-	0.171	–	-	–	DTSB46	*
Dalapon	75-99-0	1	-	1	100	0.099	-	0.099	–	-	–	DTSB46	*
Dicamba	1918-00-9	1	-	1	100	0.00849	-	0.00849	–	-	–	DTSB46	*
MCPP	93-65-2	1	-	1	100	13.5	-	13.5	–	-	–	DTSB46	*
Pesticides													
4,4'-DDD	72-54-8	1	-	1	100	0.0034	-	0.0034	–	-	–	DTSB46	*
Methoxychlor	72-43-5	1	-	1	100	0.0291	-	0.0291	–	-	–	DTSB46	*
Polycyclic Aromatic Hydrocarbons													
1-Methylnaphthalene	90-12-0	3	-	12	25	0.002	-	0.0036	0.0039	-	0.0045	BDDT-SS001	*
2-Methylnaphthalene	91-57-6	16	-	63	25	0.00095	-	5.1	0.0039	-	0.43	DTSB46	*
Acenaphthene	83-32-9	35	-	63	56	0.002	-	27	0.0039	-	0.011	DTSB46	*
Acenaphthylene	208-96-8	20	-	63	32	0.00087	-	0.31	0.0039	-	0.85	DTSB55	*
Anthracene	120-12-7	40	-	63	63	0.0036	-	37	0.0039	-	0.011	DTSB46	*
Benzo(a)anthracene	56-55-3	45	-	63	71	0.0093	-	66	0.0039	-	0.011	DTSB46	*
Benzo(a)pyrene	50-32-8	45	-	63	71	0.0089	-	57	0.0039	-	0.011	DTSB46	*
Benzo(b)fluoranthene	205-99-2	50	-	63	79	0.0038	-	81	0.0041	-	0.011	DTSB46	*
Benzo(g,h,i)perylene	191-24-2	44	-	63	70	0.0063	-	38	0.0039	-	0.011	DTSB46	*
Benzo(k)fluoranthene	207-08-9	46	-	63	73	0.0017	-	26	0.0041	-	0.011	DTSB46	*
Chrysene	218-01-9	45	-	63	71	0.0089	-	61	0.0039	-	0.011	DTSB46	*
Dibenzo(a,h)anthracene	53-70-3	28	-	63	44	0.0027	-	9.9	0.0039	-	3.4	DTSB46	*
Fluoranthene	206-44-0	53	-	63	84	0.0052	-	180	0.0041	-	0.0088	DTSB46	*
Fluorene	86-73-7	34	-	63	54	0.002	-	28	0.0039	-	0.08	DTSB46	*
Indeno(1,2,3-cd)pyrene	193-39-5	42	-	63	67	0.013	-	47	0.0039	-	0.011	DTSB46	*
Naphthalene	91-20-3	21	-	63	33	0.0011	-	29	0.0039	-	0.43	DTSB46	*
Phenanthrene	85-01-8	49	-	63	78	0.0047	-	160	0.0041	-	0.011	DTSB46	*
Pyrene	129-00-0	51	-	63	81	0.0054	-	130	0.0041	-	0.011	DTSB46	*
Inorganics													
Aluminum	7429-90-5	8	-	8	100	14600	-	20100	–	-	–	DTSS3	*
Antimony	7440-36-0	2	-	8	25	0.22	-	0.33	0.59	-	0.66	DTSB47	*
Arsenic	7440-38-2	8	-	8	100	2.11	-	11.6	–	-	–	DTSS3	*
Barium	7440-39-3	8	-	8	100	56	-	78.7	–	-	–	DTSB47	*
Beryllium	7440-41-7	8	-	8	100	0.76	-	1.5	–	-	–	DTSS3	*

Table 5-16
Soil Risk Assessment Dataset
Combined Surface and Subsurface Soil
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location	
Cadmium	7440-43-9	2	-	8	25	0.05	-	0.1	0.12	-	0.13	DTSB46	*
Calcium	7440-70-2	8	-	8	100	850	-	2560	–	-	–	DTSS3	*
Chromium	7440-47-3	8	-	8	100	23.2	-	60.8	–	-	–	DTSS3	*
Cobalt	7440-48-4	8	-	8	100	10.7	-	446	–	-	–	DTSS2	*
Copper	7440-50-8	8	-	8	100	19.3	-	138	–	-	–	DTSS2	*
Iron	7439-89-6	8	-	8	100	21100	-	58100	–	-	–	DTSS3	*
Lead	7439-92-1	8	-	8	100	14.1	-	336	–	-	–	DTSS2	*
Magnesium	7439-95-4	8	-	8	100	4040	-	13500	–	-	–	DTSS3	*
Manganese	7439-96-5	8	-	8	100	484	-	3430	–	-	–	DTSS2	*
Mercury	7439-97-6	4	-	8	50	0.02	-	0.03	0.12	-	0.13	B46,DTSB46,DTS	*
Nickel	7440-02-0	8	-	8	100	15.1	-	41.3	–	-	–	DTSS2	*
Potassium	7440-09-7	8	-	8	100	1370	-	3980	–	-	–	DTSS3	*
Selenium	7782-49-2	1	-	8	12	0.43	-	0.43	0.59	-	1.24	DTSB46	*
Sodium	7440-23-5	8	-	8	100	18	-	173	–	-	–	DTSB35	*r
Thallium	7440-28-0	5	-	8	62	0.2	-	0.51	0.24	-	0.26	DTSB35	*r
Vanadium	7440-62-2	8	-	8	100	38.4	-	108	–	-	–	DTSS3	*
Zinc	7440-66-6	8	-	8	100	39.5	-	178	–	-	–	DTSS1	*

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilograms.

PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

* = Surface soil
r = Rip-rap area

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table 5-17
Sediment Risk Assessment Dataset
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects /		number of samples	FOD %	Detects Min (mg/kg)	-	Max (mg/kg)	Detection Limits Min (mg/kg)	-	Max (mg/kg)	Maximum Location
Volatile Organic Compounds												
Acetone	67-64-1	5	-	13	38	0.022	-	0.037	0.007	-	0.012	DTSW/SD07
Carbon Disulfide	75-15-0	6	-	13	46	0.00099	-	0.0015	0.007	-	0.009	DTSW/SD07
Methylene Chloride	75-09-2	1	-	13	8	0.005	-	0.005	0.001	-	0.012	DTSD03
p-Isopropyltoluene	99-87-6	1	-	7	14	0.004	-	0.004	0.001	-	0.002	DTSD01
Toluene	108-88-3	3	-	13	23	0.00094	-	0.0027	0.002	-	0.012	DTSW/SD10
Trichloroethene	79-01-6	1	-	13	8	0.003	-	0.003	0.004	-	0.012	DTSD02
Semi-Volatile Organic Compounds										-		
4-Methylphenol	106-44-5	1	-	7	14	0.06	-	0.06	0.46	-	0.58	DTSD03
Di-n-Butylphthalate	84-74-2	2	-	7	29	0.08	-	0.09	0.46	-	0.59	DTSD04
Pesticides										-		
4,4'-DDD	72-54-8	2	-	2	100	0.0011	-	0.00115	–	-	–	DTSW/SD05
4,4'-DDE	72-55-9	2	-	2	100	0.00141	-	0.00212	–	-	–	DTSW/SD05
4,4'-DDT	50-29-3	2	-	2	100	0.00067	-	0.00123	–	-	–	DTSW/SD05
Delta-BHC	319-86-8	1	-	2	50	0.00354	-	0.0065	0.00134	-	0.00134	DTSW/SD07
Alpha-Chlordane	5103-71-9	2	-	2	100	0.00033	-	0.00039	–	-	–	DTSW/SD07
Dieldrin	60-57-1	2	-	2	100	0.00121	-	0.00159	–	-	–	DTSW/SD05
Polycyclic Aromatic Hydrocarbons										-		
1-Methylnaphthalene	90-12-0	1	-	4	25	0.0048	-	0.0048	0.0044	-	0.0048	BDDT-SE004
2-Methylnaphthalene	91-57-6	7	-	17	41	0.0042	-	0.074	0.0044	-	0.59	DTSW/SD10
Acenaphthene	83-32-9	7	-	17	41	0.0018	-	0.24	0.0044	-	0.6	DTSW/SD10
Acenaphthylene	208-96-8	1	-	17	6	0.0017	-	0.0017	0.0032	-	1.2	DTSW/SD06
Anthracene	120-12-7	8	-	17	47	0.0023	-	0.41	0.0026	-	0.06	DTSW/SD10
Benzo(a)anthracene	56-55-3	10	-	17	59	0.0026	-	0.88	0.0026	-	0.04	DTSW/SD10
Benzo(a)pyrene	50-32-8	9	-	17	53	0.012	-	0.71	0.0026	-	0.04	DTSW/SD10
Benzo(b)fluoranthene	205-99-2	8	-	17	47	0.0041	-	1.2	0.0044	-	0.12	DTSW/SD10
Benzo(g,h,i)perylene	191-24-2	8	-	17	47	0.0064	-	0.28	0.0044	-	0.12	DTSW/SD10
Benzo(k)fluoranthene	207-08-9	9	-	17	53	0.0017	-	0.37	0.0026	-	0.06	DTSW/SD10
Chrysene	218-01-9	11	-	17	65	0.004	-	0.8	0.0028	-	0.04	DTSW/SD10
Dibenzo(a,h)anthracene	53-70-3	4	-	17	24	0.0029	-	0.076	0.0032	-	0.12	DTSW/SD10
Fluoranthene	206-44-0	14	-	17	82	0.0082	-	2	0.0044	-	0.09	DTSW/SD10
Fluorene	86-73-7	7	-	17	41	0.0024	-	0.24	0.0044	-	0.12	DTSW/SD10
Indeno(1,2,3-cd)pyrene	193-39-5	8	-	17	47	0.0075	-	0.36	0.0026	-	0.06	DTSW/SD10
Naphthalene	91-20-3	7	-	17	41	0.014	-	0.091	0.0044	-	0.6	DTSW/SD10
Phenanthrene	85-01-8	14	-	17	82	0.0042	-	1.9	0.0044	-	0.04	DTSW/SD10
Pyrene	129-00-0	13	-	17	76	0.006	-	1.7	0.0044	-	0.04	DTSW/SD10
Inorganics										-		

Table 5-17
Sediment Risk Assessment Dataset
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Aluminum	7429-90-5	13	-	13	100	8690	-	20200	–	-	–	DTSW/SD09
Antimony	7440-36-0	3	-	13	23	0.37	-	0.89	0.69	-	1.19	DTSW/SD05
Arsenic	7440-38-2	13	-	13	100	1.96	-	13.2	–	-	–	DTSD03
Barium	7440-39-3	13	-	13	100	72.5	-	358	–	-	–	DTSD03
Beryllium	7440-41-7	13	-	13	100	0.7	-	1.3	–	-	–	DTSD03
Calcium	7440-70-2	13	-	13	100	46100	-	98600	–	-	–	DTSD04
Chromium	7440-47-3	13	-	13	100	22.3	-	73	–	-	–	DTSD03
Cobalt	7440-48-4	13	-	13	100	8.8	-	27.6	–	-	–	DTSD02
Copper	7440-50-8	13	-	13	100	4.4	-	15	–	-	–	DTSD01
Iron	7439-89-6	13	-	13	100	16400	-	56200	–	-	–	DTSD03
Lead	7439-92-1	13	-	13	100	10.7	-	28.6	–	-	–	DTSD03
Magnesium	7439-95-4	13	-	13	100	3070	-	7720	–	-	–	DTSD02
Manganese	7439-96-5	13	-	13	100	387	-	3340	–	-	–	DTSD03
Mercury	7439-97-6	2	-	13	15	0.03	-	0.04	0.08	-	0.18	DTSW/SD05
Nickel	7440-02-0	13	-	13	100	7.9	-	20.8	–	-	–	DTSD03
Potassium	7440-09-7	13	-	13	100	776	-	2200	–	-	–	DTSW/SD10
Silver	7440-22-4	1	-	13	8	0.86	-	0.86	0.28	-	2.39	DTSD01
Sodium	7440-23-5	13	-	13	100	87.4	-	510	–	-	–	DTSD01
Thallium	7440-28-0	9	-	13	69	0.09	-	1.1	0.28	-	0.35	DTSD01
Vanadium	7440-62-2	13	-	13	100	31.6	-	75.7	–	-	–	DTSD03
Zinc	7440-66-6	13	-	13	100	32.6	-	51.9	–	-	–	DTSD02

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilograms.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table 5-18
Surface Water Risk Assessment Dataset
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)		Detects Max (mg/kg)	Detection Limits Min (mg/kg)		Detection Limits Max (mg/kg)	Maximum Location
Volatile Organic Compounds												
Bromodichloromethane	75-27-4	1	-	13	8	0.023	-	0.023	0.0006	-	0.001	DTSW3
Carbon Disulfide	75-15-0	5	-	13	38	0.00022	-	0.00034	0.001	-	0.005	DTSW/SD08
Chloroform	67-66-3	6	-	13	46	0.00007	-	0.004	0.0008	-	0.001	DTSW3
Semi-Volatile Organic Compounds												
Di-n-Butylphthalate	84-74-2	2	-	7	29	0.002	-	0.003	0.01	-	0.01	DTSW2
Pesticides												
4,4'-DDT	50-29-3	1	-	2	50	5.16E-06	-	5.16E-06	0.00002	-	0.00002	DTSW/SD05
Dieldrin	60-57-1	2	-	2	100	5.48E-06	-	5.91E-06	–	-	–	DTSW/SD07
Endrin Ketone	53494-70-5	2	-	2	100	4.37E-06	-	5.99E-06	–	-	–	DTSW/SD07
Polycyclic Aromatic Hydrocarbons												
2-Methylnaphthalene	91-57-6	4	-	17	24	0.00003	-	0.00013	0.000046	-	0.01	DTSW/SD10
Acenaphthene	83-32-9	1	-	17	6	0.00005	-	0.00005	0.000046	-	0.01	DTSW/SD10
Acenaphthylene	208-96-8	1	-	17	6	0.00004	-	0.00004	0.000046	-	0.01	DTSW/SD10
Fluorene	86-73-7	1	-	17	6	0.00003	-	0.00003	0.000046	-	0.01	DTSW/SD10
Naphthalene	91-20-3	6	-	17	35	0.00003	-	0.00013	0.000046	-	0.01	DTSW/SD10
Inorganics												
Aluminum	7429-90-5	13	-	13	100	0.0498	-	0.603	–	-	–	DTSW/SD09
Antimony	7440-36-0	2	-	13	15	0.00038	-	0.00074	0.005	-	0.005	DTSW/SD06
Barium	7440-39-3	13	-	13	100	0.06	-	0.0825	–	-	–	DTSW/SD08
Calcium	7440-70-2	13	-	13	100	47	-	65	–	-	–	DTSW2
Copper	7440-50-8	7	-	13	54	0.012	-	0.0348	0.02	-	0.02	DTSW1
Iron	7439-89-6	13	-	13	100	0.0763	-	0.507	–	-	–	DTSW/SD09
Lead	7439-92-1	8	-	13	62	0.00015	-	0.0046	0.002	-	0.002	DTSW1
Magnesium	7439-95-4	13	-	13	100	12.7	-	17.4	–	-	–	DTSW/SD08
Manganese	7439-96-5	13	-	13	100	0.0034	-	0.0198	–	-	–	DTSW/SD09
Nickel	7440-02-0	7	-	13	54	0.0027	-	0.0055	0.04	-	0.04	DTSW1
Potassium	7440-09-7	13	-	13	100	1.93	-	3.67	–	-	–	DTSW/SD08
Silver	7440-22-4	1	-	13	8	0.0021	-	0.0021	0.002	-	0.01	DTSW1
Sodium	7440-23-5	13	-	13	100	22.4	-	35.3	–	-	–	DTSW/SD08
Thallium	7440-28-0	4	-	13	31	0.0023	-	0.0072	0.002	-	0.002	DTSW4
Zinc	7440-66-6	7	-	13	54	0.0202	-	0.0462	0.02	-	0.02	DTSW1

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/L = Milligrams per liter.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table 5-19
Selection of Constituents of Potential Concern for Surface Soil (0-2 foot Depth Interval)
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b]					Background Level [c]	Does Maximum Exceed RSL?		Is Constituent a Surface Soil COPC? [d]
			Industrial Scenario		Residential Scenario		Surrogate		Industrial	Residential	
		(mg/kg)	(mg/kg)		(mg/kg)			(mg/kg)	(YES, no)	(YES, no)	(YES, no)
Volatile Organic Compounds											
1,2,4-Trimethylbenzene	95-63-6	4.00E-03	2.80E+01	ns	6.70E+00	n		–	no	no	no
m,p-Xylene	136777612	3.00E-03	2.60E+02	ns	6.00E+01	ns	p-Xylene	–	no	no	no
Xylenes (total)	1330-20-7	3.00E-03	2.60E+02	ns	6.00E+01	ns		–	no	no	no
Semi-Volatile Organic Compounds											
Carbazole	86-74-8	3.50E+00	NA		NA			–	NA	NA	**YES**
Dibenzofuran	132-64-9	8.00E-01	1.00E+02	n	7.80E+00	n	Furan	–	no	no	no
Herbicides											
2,4-D	94-75-7	1.71E-01	7.70E+02	n	6.90E+01	n		–	no	no	no
Dalapon	75-99-0	9.90E-02	1.80E+03	n	1.80E+02	n		–	no	no	no
Dicamba	1918-00-9	8.49E-03	1.80E+03	n	1.80E+02	n		–	no	no	no
MCPP	93-65-2	1.35E+01	6.20E+01	n	6.10E+00	n		–	no	**YES**	**YES**
Pesticides											
4,4'-DDD	72-54-8	3.40E-03	7.20E+00	c	2.00E+00	c		–	no	no	no
Methoxychlor	72-43-5	2.91E-02	3.10E+02	n	3.10E+01	n		–	no	no	no
Polycyclic Aromatic Hydrocarbons											
1-Methylnaphthalene	90-12-0	3.60E-03	9.90E+01	c	2.20E+01	c		–	no	no	no
2-Methylnaphthalene	91-57-6	5.10E+00	4.10E+02	ns	3.10E+01	n		–	no	no	no
Acenaphthene	83-32-9	2.70E+01	3.30E+03	n	3.40E+02	n		–	no	no	no
Acenaphthylene	208-96-8	3.10E-01	3.30E+03	n	3.40E+02	n	Acenaphthene	–	no	no	no
Anthracene	120-12-7	3.70E+01	1.70E+04	nm	1.70E+03	n		–	no	no	no
Benzo(a)anthracene	56-55-3	6.60E+01	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Benzo(a)pyrene	50-32-8	5.70E+01	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Benzo(b)fluoranthene	205-99-2	8.10E+01	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Benzo(g,h,i)perylene	191-24-2	3.80E+01	1.70E+03	n	1.70E+02	n	Pyrene	–	no	no	no
Benzo(k)fluoranthene	207-08-9	2.60E+01	2.10E+01	c	1.50E+00	c		–	**YES**	**YES**	**YES**
Chrysene	218-01-9	6.10E+01	2.10E+02	c	1.50E+01	c		–	no	**YES**	**YES**
Dibenzo(a,h)anthracene	53-70-3	9.90E+00	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Fluoranthene	206-44-0	1.80E+02	2.20E+03	n	2.30E+02	n		–	no	no	no
Fluorene	86-73-7	2.80E+01	2.20E+03	n	2.30E+02	n		–	no	no	no
Indeno(1,2,3-cd)pyrene	193-39-5	4.70E+01	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Naphthalene	91-20-3	2.90E+01	2.00E+01	c*	3.90E+00	c*		–	**YES**	**YES**	**YES**
Phenanthrene	85-01-8	1.60E+02	1.70E+04	nm	1.70E+03	n	Anthracene	–	no	no	no
Pyrene	129-00-0	1.30E+02	1.70E+03	n	1.70E+02	n		–	no	no	no
Inorganics											
Aluminum	7429-90-5	2.01E+04	9.90E+04	nm	7.70E+03	n		4.00E+04	no	**YES**	no
Antimony	7440-36-0	3.30E-01	4.10E+01	n	3.10E+00	n		–	no	no	no
Arsenic	7440-38-2	1.16E+01	1.60E+00	c	3.90E-01	c*		1.58E+01	**YES**	**YES**	no
Barium	7440-39-3	7.87E+01	1.90E+04	nm	1.50E+03	n		2.09E+02	no	no	no
Beryllium	7440-41-7	1.50E+00	2.00E+02	n	1.60E+01	n		1.02E+00	no	no	no
Cadmium	7440-43-9	1.00E-01	8.10E+01	n	7.00E+00	n		6.90E-01	no	no	no
Calcium	7440-70-2	2.56E+03	NA		NA			–	NA	NA	no
Chromium	7440-47-3	6.08E+01	1.40E+03	c	2.80E+02	c		6.53E+01	no	no	no
Cobalt	7440-48-4	4.46E+02	3.00E+01	n	2.30E+00	n		7.23E+01	**YES**	**YES**	**YES**
Copper	7440-50-8	1.38E+02	4.10E+03	n	3.10E+02	n		5.35E+01	no	no	no

Table 5-19
Selection of Constituents of Potential Concern for Surface Soil (0-2 foot Depth Interval)
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b]					Background Level [c]	Does Maximum Exceed RSL?		Is Constituent a Surface Soil COPC? [d]
			Industrial Scenario		Residential Scenario		Surrogate		Industrial	Residential	
		(mg/kg)	(mg/kg)		(mg/kg)			(mg/kg)	(YES, no)	(YES, no)	(YES, no)
Iron	7439-89-6	5.81E+04	7.20E+04	nm	5.50E+03	n		5.10E+04	no	**YES**	**YES**
Lead	7439-92-1	3.36E+02	8.00E+02	«	4.00E+02	«		2.68E+01	no	no	no
Magnesium	7439-95-4	1.35E+04	NA		NA			–	NA	NA	no
Manganese	7439-96-5	3.43E+03	2.30E+03	n	1.80E+02	n		2.54E+03	**YES**	**YES**	**YES**
Mercury	7439-97-6	3.00E-02	3.10E+01	n	2.30E+00	n		1.30E-01	no	no	no
Nickel	7440-02-0	4.13E+01	2.00E+03	n	1.60E+02	n		6.28E+01	no	no	no
Potassium	7440-09-7	3.98E+03	NA		NA			–	NA	NA	no
Selenium	7782-49-2	4.30E-01	5.10E+02	n	3.90E+01	n		–	no	no	no
Sodium	7440-23-5	1.73E+02	NA		NA			–	NA	NA	no
Thallium	7440-28-0	5.10E-01	6.60E+00	n	5.10E-01	n		2.11E+00	no	no	no
Vanadium	7440-62-2	1.08E+02	7.20E+02	n	5.50E+01	n		1.08E+02	no	**YES**	no
Zinc	7440-66-6	1.78E+02	3.10E+04	nm	2.30E+03	n		2.02E+02	no	no	no

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
mg/kg = Milligrams per kilogram.
NA = Not available or not applicable.
RSL = Regional Screening Level.
USEPA = United States Environmental Protection Agency.

[a] Maximum concentration in surface soil (0-2 foot depth interval).
[b] The screening levels used were from USEPA (2008a). Screening levels based on non-cancer effects were adjusted downward by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = concentration may exceed ceiling limit; s = Concentration may exceed saturation concentration (Csat).
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.
[c] Background levels for metals are facility-wide soil background point estimates taken from Facility-Wide Background Study Report (IT Corporation, 2001).
[d] Constituents detected with maximum concentrations greater than adjusted residential screening levels were considered COPCs unless they were metals detected at concentrations lower than background, or are essential nutrients (i.e., calcium, magnesium, potassium, sodium), or they were known laboratory contaminants (i.e. acetone).

Table 5-20
Selection of Constituents of Potential Concern for Combined Surface and Subsurface Soil
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b]					Background Level [c]	Does Maximum Exceed RSL?		Is Constituent a Surface/ Subsurface Soil COPC? [d]
			Industrial Scenario		Residential Scenario		Surrogate		Industrial	Residential	
		(mg/kg)	(mg/kg)		(mg/kg)			(mg/kg)	(YES, no)	(YES, no)	(YES, no)
Volatile Organic Compounds											
1,2,4-Trimethylbenzene	95-63-6	4.00E-03	2.80E+01	ns	6.70E+00	n		–	no	no	no
m,p-Xylene	136777612	3.00E-03	2.60E+02	ns	6.00E+01	ns	p-Xylene	–	no	no	no
Xylenes (total)	1330-20-7	3.00E-03	2.60E+02	ns	6.00E+01	ns		–	no	no	no
Semi-Volatile Organic Compounds											
Carbazole	86-74-8	3.50E+00	NA		NA			–	NA	NA	**YES**
Dibenzofuran	132-64-9	8.00E-01	1.00E+02	n	7.80E+00	n	Furan	–	no	no	no
Herbicides											
2,4-D	94-75-7	1.71E-01	7.70E+02	n	6.90E+01	n		–	no	no	no
Dalapon	75-99-0	9.90E-02	1.80E+03	n	1.80E+02	n		–	no	no	no
Dicamba	1918-00-9	8.49E-03	1.80E+03	n	1.80E+02	n		–	no	no	no
MCPP	93-65-2	1.35E+01	6.20E+01	n	6.10E+00	n		–	no	**YES**	**YES**
Pesticides											
4,4'-DDD	72-54-8	3.40E-03	7.20E+00	c	2.00E+00	c		–	no	no	no
Methoxychlor	72-43-5	2.91E-02	3.10E+02	n	3.10E+01	n		–	no	no	no
Polycyclic Aromatic Hydrocarbons											
1-Methylnaphthalene	90-12-0	3.60E-03	9.90E+01	c	2.20E+01	c		–	no	no	no
2-Methylnaphthalene	91-57-6	5.10E+00	4.10E+02	ns	3.10E+01	n		–	no	no	no
Acenaphthene	83-32-9	2.70E+01	3.30E+03	n	3.40E+02	n		–	no	no	no
Acenaphthylene	208-96-8	3.10E-01	3.30E+03	n	3.40E+02	n	Acenaphthene	–	no	no	no
Anthracene	120-12-7	3.70E+01	1.70E+04	nm	1.70E+03	n		–	no	no	no
Benzo(a)anthracene	56-55-3	6.60E+01	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Benzo(a)pyrene	50-32-8	5.70E+01	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Benzo(b)fluoranthene	205-99-2	8.10E+01	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Benzo(g,h,i)perylene	191-24-2	3.80E+01	1.70E+03	n	1.70E+02	n	Pyrene	–	no	no	no
Benzo(k)fluoranthene	207-08-9	2.60E+01	2.10E+01	c	1.50E+00	c		–	**YES**	**YES**	**YES**
Chrysene	218-01-9	6.10E+01	2.10E+02	c	1.50E+01	c		–	no	**YES**	**YES**
Dibenzo(a,h)anthracene	53-70-3	9.90E+00	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Fluoranthene	206-44-0	1.80E+02	2.20E+03	n	2.30E+02	n		–	no	no	no
Fluorene	86-73-7	2.80E+01	2.20E+03	n	2.30E+02	n		–	no	no	no
Indeno(1,2,3-cd)pyrene	193-39-5	4.70E+01	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Naphthalene	91-20-3	2.90E+01	2.00E+01	c*	3.90E+00	c*		–	**YES**	**YES**	**YES**
Phenanthrene	85-01-8	1.60E+02	1.70E+04	nm	1.70E+03	n	Anthracene	–	no	no	no
Pyrene	129-00-0	1.30E+02	1.70E+03	n	1.70E+02	n		–	no	no	no
Inorganics											
Aluminum	7429-90-5	2.01E+04	9.90E+04	nm	7.70E+03	n		4.00E+04	no	**YES**	no
Antimony	7440-36-0	3.30E-01	4.10E+01	n	3.10E+00	n		–	no	no	no
Arsenic	7440-38-2	1.16E+01	1.60E+00	c	3.90E-01	c*		1.58E+01	**YES**	**YES**	no
Barium	7440-39-3	7.87E+01	1.90E+04	nm	1.50E+03	n		2.09E+02	no	no	no
Beryllium	7440-41-7	1.50E+00	2.00E+02	n	1.60E+01	n		1.02E+00	no	no	no
Cadmium	7440-43-9	1.00E-01	8.10E+01	n	7.00E+00	n		6.90E-01	no	no	no
Calcium	7440-70-2	2.56E+03	NA		NA			–	NA	NA	no

Table 5-20
Selection of Constituents of Potential Concern for Combined Surface and Subsurface Soil
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b]					Background Level [c]	Does Maximum Exceed RSL?		Is Constituent a Surface/ Subsurface Soil COPC? [d]
			Industrial Scenario		Residential Scenario		Surrogate		Industrial	Residential	
		(mg/kg)	(mg/kg)		(mg/kg)			(mg/kg)	(YES, no)	(YES, no)	(YES, no)
Chromium	7440-47-3	6.08E+01	1.40E+03	c	2.80E+02	c		6.53E+01	no	no	no
Cobalt	7440-48-4	4.46E+02	3.00E+01	n	2.30E+00	n		7.23E+01	**YES**	**YES**	**YES**
Copper	7440-50-8	1.38E+02	4.10E+03	n	3.10E+02	n		5.35E+01	no	no	no
Iron	7439-89-6	5.81E+04	7.20E+04	nm	5.50E+03	n		5.10E+04	no	**YES**	**YES**
Lead	7439-92-1	3.36E+02	8.00E+02	«	4.00E+02	«		2.68E+01	no	no	no
Magnesium	7439-95-4	1.35E+04	NA		NA			–	NA	NA	no
Manganese	7439-96-5	3.43E+03	2.30E+03	n	1.80E+02	n		2.54E+03	**YES**	**YES**	**YES**
Mercury	7439-97-6	3.00E-02	3.10E+01	n	2.30E+00	n		1.30E-01	no	no	no
Nickel	7440-02-0	4.13E+01	2.00E+03	n	1.60E+02	n		6.28E+01	no	no	no
Potassium	7440-09-7	3.98E+03	NA		NA			–	NA	NA	no
Selenium	7782-49-2	4.30E-01	5.10E+02	n	3.90E+01	n		–	no	no	no
Sodium	7440-23-5	1.73E+02	NA		NA			–	NA	NA	no
Thallium	7440-28-0	5.10E-01	6.60E+00	n	5.10E-01	n		2.11E+00	no	no	no
Vanadium	7440-62-2	1.08E+02	7.20E+02	n	5.50E+01	n		1.08E+02	no	**YES**	no
Zinc	7440-66-6	1.78E+02	3.10E+04	nm	2.30E+03	n		2.02E+02	no	no	no

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
mg/kg = Milligrams per kilogram.
NA = Not available or not applicable.
RSL = Regional Screening Level.
USEPA = United States Environmental Protection Agency.

[a] Maximum concentration in combined surface and subsurface soil.
[b] The screening levels used were from USEPA (2008a). Screening levels based on non-cancer effects were adjusted downward by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = Concentration may exceed ceiling limit; s = Concentration may exceed saturation concentration (Csat).
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.
[c] Background levels for metals are facility-wide soil background point estimates taken from Facility-Wide Background Study Report (IT Corporation, 2001).
[d] Constituents detected with maximum concentrations greater than adjusted residential screening levels were considered COPCs unless they were metals detected at concentrations lower than background, or are essential nutrients (i.e., calcium, magnesium, potassium, sodium), or they were known laboratory contaminants (i.e. acetone).

Table 5-21
Selection of Constituents of Potential Concern for Sediment
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a] (mg/kg)	Adjusted Soil Regional Screening Level (RSL) [b] Residential Scenario (mg/kg)		Surrogate	Is Constituent a Sediment COPC? [c] (YES, no)
Volatile Organic Compounds						
Acetone	67-64-1	3.70E-02	6.10E+03	n		no
Carbon Disulfide	75-15-0	1.50E-03	6.70E+01	ns		no
Methylene Chloride	75-09-2	5.00E-03	1.10E+01	c		no
p-Isopropyltoluene	99-87-6	4.00E-03	2.20E+02	ns	Isopropylbenzene	no
Toluene	108-88-3	2.70E-03	5.00E+02	ns		no
Trichloroethene	79-01-6	3.00E-03	2.80E+00	c		no
Semi-Volatile Organic Compounds						
4-Methylphenol	106-44-5	6.00E-02	3.10E+01	n		no
Di-n-Butylphthalate	84-74-2	9.00E-02	6.10E+02	n		no
Pesticides						
4,4'-DDD	72-54-8	1.15E-03	2.00E+00	c		no
4,4'-DDE	72-55-9	2.12E-03	1.40E+00	c		no
4,4'-DDT	50-29-3	1.23E-03	1.70E+00	c*		no
Delta-BHC	319-86-8	6.50E-03	5.20E-01	c*	gamma-BHC	no
Alpha-Chlordane	5103-71-9	3.90E-04	1.60E+00	c*	Chlordane	no
Dieldrin	60-57-1	1.59E-03	3.00E-02	c		no
Polycyclic Aromatic Hydrocarbons						
1-Methylnaphthalene	90-12-0	4.80E-03	2.20E+01	c		no
2-Methylnaphthalene	91-57-6	7.40E-02	3.10E+01	n		no
Acenaphthene	83-32-9	2.40E-01	3.40E+02	n		no
Acenaphthylene	208-96-8	1.70E-03	3.40E+02	n	Acenaphthene	no
Anthracene	120-12-7	4.10E-01	1.70E+03	n		no
Benzo(a)anthracene	56-55-3	8.80E-01	1.50E-01	c		**YES**
Benzo(a)pyrene	50-32-8	7.10E-01	1.50E-02	c		**YES**
Benzo(b)fluoranthene	205-99-2	1.20E+00	1.50E-01	c		**YES**
Benzo(g,h,i)perylene	191-24-2	2.80E-01	1.70E+02	n	Pyrene	no
Benzo(k)fluoranthene	207-08-9	3.70E-01	1.50E+00	c		no
Chrysene	218-01-9	8.00E-01	1.50E+01	c		no
Dibenzo(a,h)anthracene	53-70-3	7.60E-02	1.50E-02	c		**YES**
Fluoranthene	206-44-0	2.00E+00	2.30E+02	n		no
Fluorene	86-73-7	2.40E-01	2.30E+02	n		no
Indeno(1,2,3-cd)pyrene	193-39-5	3.60E-01	1.50E-01	c		**YES**
Naphthalene	91-20-3	9.10E-02	3.90E+00	c*		no
Phenanthrene	85-01-8	1.90E+00	1.70E+03	n	Anthracene	no
Pyrene	129-00-0	1.70E+00	1.70E+02	n		no
Inorganics						
Aluminum	7429-90-5	2.02E+04	7.70E+03	n		**YES**
Antimony	7440-36-0	8.90E-01	3.10E+00	n		no

Table 5-21
Selection of Constituents of Potential Concern for Sediment
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a] (mg/kg)	Adjusted Soil Regional Screening Level (RSL) [b] Residential Scenario (mg/kg)		Surrogate	Is Constituent a Sediment COPC? [c] (YES, no)
Arsenic	7440-38-2	1.32E+01	3.90E-01	c*		**YES**
Barium	7440-39-3	3.58E+02	1.50E+03	n		no
Beryllium	7440-41-7	1.30E+00	1.60E+01	n		no
Calcium	7440-70-2	9.86E+04	NA			no
Chromium	7440-47-3	7.30E+01	2.80E+02	c		no
Cobalt	7440-48-4	2.76E+01	2.30E+00	n		**YES**
Copper	7440-50-8	1.50E+01	3.10E+02	n		no
Iron	7439-89-6	5.62E+04	5.50E+03	n		**YES**
Lead	7439-92-1	2.86E+01	4.00E+02	«		no
Magnesium	7439-95-4	7.72E+03	NA			no
Manganese	7439-96-5	3.34E+03	1.80E+02	n		**YES**
Mercury	7439-97-6	4.00E-02	2.30E+00	n		no
Nickel	7440-02-0	2.08E+01	1.60E+02	n		no
Potassium	7440-09-7	2.20E+03	NA			no
Silver	7440-22-4	8.60E-01	3.90E+01	n		no
Sodium	7440-23-5	5.10E+02	NA			no
Thallium	7440-28-0	1.10E+00	5.10E-01	n		**YES**
Vanadium	7440-62-2	7.57E+01	5.50E+01	n		**YES**
Zinc	7440-66-6	5.19E+01	2.30E+03	n		no

Notes:

CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
mg/kg = Milligrams per kilogram.
NA = Not available or not applicable.
RSL = Regional Screening Level.
USEPA = United States Environmental Protection Agency.

[a] Maximum concentration in sediment.

[b] The screening levels used were risk screening levels for the residential scenario from USEPA (2008a). Screening levels based on non-cancer effects were adjusted downward by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = Concentration may exceed ceiling limit; s = Concentration may exceed saturation concentration (Csat).
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.

[c] Constituents detected with maximum concentrations greater than adjusted residential screening levels were considered COPCs unless they were metals detected at concentrations lower than background, or are essential nutrients (i.e., calcium, magnesium, potassium, sodium), or they were known laboratory contaminants (i.e. acetone).

Table 5-22
Selection Constituents of Potential Concern for Surface Water
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Tap Water Regional Screening Level (RSL) [b]			Is Constituent a Surface Water COPC? [c]
		(mg/L)	(mg/L)		Surrogate	(YES, no)
Volatile Organic Compounds						
Bromodichloromethane	75-27-4	2.30E-02	1.10E-03	c		**YES**
Carbon Disulfide	75-15-0	3.40E-04	1.00E-01	n		no
Chloroform	67-66-3	4.00E-03	1.90E-04	c		**YES**
Semi-Volatile Organic Compounds						
Di-n-Butylphthalate	84-74-2	3.00E-03	3.70E-01	n		no
Pesticides						
4,4'-DDT	50-29-3	5.16E-06	2.00E-04	c*		no
Dieldrin	60-57-1	5.91E-06	4.20E-06	c		**YES**
Endrin Ketone	53494-70-5	5.99E-06	1.10E-03	n	Endrin	no
Polycyclic Aromatic Hydrocarbons						
2-Methylnaphthalene	91-57-6	1.30E-04	1.50E-02	n		no
Acenaphthene	83-32-9	5.00E-05	2.20E-01	n		no
Acenaphthylene	208-96-8	4.00E-05	2.20E-01	n	Acenaphthene	no
Fluorene	86-73-7	3.00E-05	1.50E-01	n		no
Naphthalene	91-20-3	1.30E-04	1.40E-04	c*		no
Inorganics						
Aluminum	7429-90-5	6.03E-01	3.70E+00	n		no
Antimony	7440-36-0	7.40E-04	1.50E-03	n		no
Barium	7440-39-3	8.25E-02	7.30E-01	n		no
Calcium	7440-70-2	6.50E+01	NA			no
Copper	7440-50-8	3.48E-02	1.50E-01	n		no
Iron	7439-89-6	5.07E-01	2.60E+00	n		no
Lead	7439-92-1	4.60E-03	1.50E-02	**		no
Magnesium	7439-95-4	1.74E+01	NA			no
Manganese	7439-96-5	1.98E-02	8.80E-02	n		no
Nickel	7440-02-0	5.50E-03	7.30E-02	n		no
Potassium	7440-09-7	3.67E+00	NA			no
Silver	7440-22-4	2.10E-03	1.80E-02	n		no
Sodium	7440-23-5	3.53E+01	NA			no
Thallium	7440-28-0	7.20E-03	2.40E-04	n		**YES**
Zinc	7440-66-6	4.62E-02	1.10E+00	n		no

Table 5-22
Selection Constituents of Potential Concern for Surface Water
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:

CASN =	Chemical abstracts registry number.	NA =	Not available or not applicable.
COPC =	Constituent of Potential Concern.	RSL =	Regional Screening Level.
mg/L =	Milligrams per liter.	USEPA =	United States Environmental Protection Agency.

[a] Maximum concentration in surface water.

[b] The screening levels used were risk screening levels for tap water from USEPA (2008a). Screening levels based on non-cancer effects were adjusted downward by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = Concentration may exceed ceiling limit;
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.

[c] Constituents detected with maximum concentrations greater than screening levels were considered COPCs unless they were essential nutrients (i.e., calcium, magnesium, potassium, sodium), or were known laboratory contaminants (i.e. acetone).

Table 5-23
Exposure Point Concentrations
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a]				Exposure Point Concentrations [b]					
		Surface Soil	Combined Surface and Subsurface Soil	Sediment	Surface Water	Surface Soil (mg/kg)	Surface Soil - Rip Rap (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Combined Surface and Subsurface Soil - Rip Rap (mg/kg)	Sediment (mg/kg)	Surface Water (mg/L)
Volatile Organic Compounds											
1,2,3-Trichloropropane	96-18-4	no	no	no	no	–	–	–	–	–	–
1,2,4-Trimethylbenzene	95-63-6	no	no	no	no	–	–	–	–	–	–
2-Butanone	78-93-3	no	no	no	no	–	–	–	–	–	–
3-Octanone	106-68-3	no	no	no	no	–	–	–	–	–	–
4-Methyl-2-pentanone	108-10-1	no	no	no	no	–	–	–	–	–	–
Acetone	67-64-1	no	no	no	no	–	–	–	–	–	–
Bromodichloromethane	75-27-4	no	no	no	**YES**	–	–	–	–	–	2.30E-02 m
Carbon Disulfide	75-15-0	no	no	no	no	–	–	–	–	–	–
Chloroform	67-66-3	no	no	no	**YES**	–	–	–	–	–	2.37E-03
cis-1,2-Dichloroethene	156-59-2	no	no	no	no	–	–	–	–	–	–
d-Limonene	5989-27-5	no	no	no	no	–	–	–	–	–	–
Ethanol	64-17-5	no	no	no	no	–	–	–	–	–	–
m,p-Xylene	136777612	no	no	no	no	–	–	–	–	–	–
Methylene Chloride	75-09-2	no	no	no	no	–	–	–	–	–	–
p-Isopropyltoluene	99-87-6	no	no	no	no	–	–	–	–	–	–
Tetrachloroethene	127-18-4	no	no	no	no	–	–	–	–	–	–
Toluene	108-88-3	no	no	no	no	–	–	–	–	–	–
Trichloroethene	79-01-6	no	no	no	no	–	–	–	–	–	–
Xylenes (total)	1330-20-7	no	no	no	no	–	–	–	–	–	–
Semi-Volatile Organic Compounds											
1,2,4-Trichlorobenzene	120-82-1	no	no	no	no	–	–	–	–	–	–
1,2-Dichlorobenzene	95-50-1	no	no	no	no	–	–	–	–	–	–
1,3-Dichlorobenzene	541-73-1	no	no	no	no	–	–	–	–	–	–
1,4-Dichlorobenzene	106-46-7	no	no	no	no	–	–	–	–	–	–
2,4-Dinitrotoluene	121-14-2	no	no	no	no	–	–	–	–	–	–
2,6-Dinitrotoluene	606-20-2	no	no	no	no	–	–	–	–	–	–
3,3'-Dichlorobenzidine	91-94-1	no	no	no	no	–	–	–	–	–	–
4-Methylphenol	106-44-5	no	no	no	no	–	–	–	–	–	–
Benzoic Acid	65-85-0	no	no	no	no	–	–	–	–	–	–
bis(2-Ethylhexyl)phthalate	117-81-7	no	no	no	no	–	–	–	–	–	–
Butylbenzylphthalate	85-68-7	no	no	no	no	–	–	–	–	–	–
Carbazole	86-74-8	**YES**	**YES**	no	no	1.20E+00	1.20E+00	8.20E-01	7.70E-01	–	–
Dibenzofuran	132-64-9	no	no	no	no	–	–	–	–	–	–
Diethylphthalate	84-66-2	no	no	no	no	–	–	–	–	–	–
Di-n-Butylphthalate	84-74-2	no	no	no	no	–	–	–	–	–	–
Di-n-Octylphthalate	117-84-0	no	no	no	no	–	–	–	–	–	–
N-Nitrosodiphenylamine	86-30-6	no	no	no	no	–	–	–	–	–	–
Pentachlorophenol	87-86-5	no	no	no	no	–	–	–	–	–	–
Phenol	108-95-2	no	no	no	no	–	–	–	–	–	–
Dioxin/Furan Compounds											
1,2,3,4,6,7,8-HpCDD	35822-46-9	no	no	no	no	–	–	–	–	–	–
1,2,3,4,6,7,8-HpCDF	67562-39-4	no	no	no	no	–	–	–	–	–	–
1,2,3,4,7,8,9-HpCDF	55673-89-7	no	no	no	no	–	–	–	–	–	–
1,2,3,4,7,8-HxCDD	39227-28-6	no	no	no	no	–	–	–	–	–	–
1,2,3,4,7,8-HxCDF	70648-26-9	no	no	no	no	–	–	–	–	–	–
1,2,3,6,7,8-HxCDD	57653-85-7	no	no	no	no	–	–	–	–	–	–
1,2,3,6,7,8-HxCDF	57117-44-9	no	no	no	no	–	–	–	–	–	–
1,2,3,7,8,9-HxCDD	19408-74-3	no	no	no	no	–	–	–	–	–	–
1,2,3,7,8,9-HxCDF	72918-21-9	no	no	no	no	–	–	–	–	–	–
1,2,3,7,8-PeCDD	40321-76-4	no	no	no	no	–	–	–	–	–	–
1,2,3,7,8-PeCDF	57117-41-6	no	no	no	no	–	–	–	–	–	–
2,3,4,6,7,8-HxCDF	60851-34-5	no	no	no	no	–	–	–	–	–	–
2,3,4,7,8-PeCDF	57117-31-4	no	no	no	no	–	–	–	–	–	–
2,3,7,8-TCDD	1746-01-6	no	no	no	no	–	–	–	–	–	–
2,3,7,8-TCDF	51207-31-9	no	no	no	no	–	–	–	–	–	–
OCDD	3268-87-9	no	no	no	no	–	–	–	–	–	–
OCDF	39001-02-0	no	no	no	no	–	–	–	–	–	–

Table 5-23
Exposure Point Concentrations
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a]				Exposure Point Concentrations [b]					
		Surface Soil	Combined Surface and Subsurface Soil	Sediment	Surface Water	Surface Soil (mg/kg)	Surface Soil - Rip Rap (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Combined Surface and Subsurface Soil - Rip Rap (mg/kg)	Sediment (mg/kg)	Surface Water (mg/L)
Explosives											
1,3,5-Trinitrobenzene	99-35-4	no	no	no	no	–	–	–	–	–	–
1,3-Dinitrobenzene	99-65-0	no	no	no	no	–	–	–	–	–	–
2,4,6-Trinitrotoluene	118-96-7	no	no	no	no	–	–	–	–	–	–
4-Amino-2,6-Dinitrotoluene	19406-51-0	no	no	no	no	–	–	–	–	–	–
m-Nitrotoluene	99-08-1	no	no	no	no	–	–	–	–	–	–
Nitrobenzene	98-95-3	no	no	no	no	–	–	–	–	–	–
Nitroglycerine	55-63-0	no	no	no	no	–	–	–	–	–	–
Pentaerythritol Tetranitrate	78-11-5	no	no	no	no	–	–	–	–	–	–
Perchlorate	14797-73-0	no	no	no	no	–	–	–	–	–	–
Herbicides											
2,4,5-T	93-76-5	no	no	no	no	–	–	–	–	–	–
2,4,5-TP	93-72-1	no	no	no	no	–	–	–	–	–	–
2,4-D	94-75-7	no	no	no	no	–	–	–	–	–	–
2,4-DB	94-82-6	no	no	no	no	–	–	–	–	–	–
Dalapon	75-99-0	no	no	no	no	–	–	–	–	–	–
Dicamba	1918-00-9	no	no	no	no	–	–	–	–	–	–
Dichlorprop	120-36-5	no	no	no	no	–	–	–	–	–	–
MCPA	94-74-6	no	no	no	no	–	–	–	–	–	–
MCPP	93-65-2	**YES**	**YES**	no	no	*	NA	*	NA	–	–
Pesticides											
4,4'-DDD	72-54-8	no	no	no	no	–	–	–	–	–	–
4,4'-DDE	72-55-9	no	no	no	no	–	–	–	–	–	–
4,4'-DDT	50-29-3	no	no	no	no	–	–	–	–	–	–
Alpha-BHC	319-84-6	no	no	no	no	–	–	–	–	–	–
Beta-BHC	319-85-7	no	no	no	no	–	–	–	–	–	–
Delta-BHC	319-86-8	no	no	no	no	–	–	–	–	–	–
Gamma-BHC (Lindane)	58-89-9	no	no	no	no	–	–	–	–	–	–
Alpha-Chlordane	5103-71-9	no	no	no	no	–	–	–	–	–	–
Gamma-Chlordane	5566-34-7	no	no	no	no	–	–	–	–	–	–
Dieldrin	60-57-1	no	no	no	**YES**	–	–	–	–	–	5.91E-06 m
Endosulfan I	115-29-7	no	no	no	no	–	–	–	–	–	–
Endosulfan II	33213-65-9	no	no	no	no	–	–	–	–	–	–
Endosulfan Sulfate	1031-07-8	no	no	no	no	–	–	–	–	–	–
Endrin	72-20-8	no	no	no	no	–	–	–	–	–	–
Endrin Aldehyde	7421-93-4	no	no	no	no	–	–	–	–	–	–
Endrin Ketone	53494-70-5	no	no	no	no	–	–	–	–	–	–
Heptachlor	76-44-8	no	no	no	no	–	–	–	–	–	–
Heptachlor Epoxide	1024-57-3	no	no	no	no	–	–	–	–	–	–
Methoxychlor	72-43-5	no	no	no	no	–	–	–	–	–	–

Table 5-23
Exposure Point Concentrations
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a] Surface Soil	COPC? [a] Combined Surface and Subsurface Soil	COPC? [a] Sediment	COPC? [a] Surface Water	Exposure Point Concentrations [b] Surface Soil (mg/kg)	Surface Soil - Rip Rap (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Combined Surface and Subsurface Soil - Rip Rap (mg/kg)	Sediment (mg/kg)	Surface Water (mg/L)
Polycyclic Aromatic Hydrocarbons											
1-Methylnaphthalene	90-12-0	no	no	no	no	–	–	–	–	–	–
2-Methylnaphthalene	91-57-6	no	no	no	no	–	–	–	–	–	–
Acenaphthene	83-32-9	no	no	no	no	–	–	–	–	–	–
Acenaphthylene	208-96-8	no	no	no	no	–	–	–	–	–	–
Anthracene	120-12-7	no	no	no	no	–	–	–	–	–	–
Benzo(a)anthracene	56-55-3	**YES**	**YES**	**YES**	no	9.50E+00	2.50E+00	8.00E+00	4.99E+00	6.54E-01	–
Benzo(a)pyrene	50-32-8	**YES**	**YES**	**YES**	no	7.90E+00	2.59E+00	6.92E+00	5.35E+00	5.35E-01	–
Benzo(b)fluoranthene	205-99-2	**YES**	**YES**	**YES**	no	1.20E+01	3.43E+00	1.01E+01	6.59E+00	2.66E-01	–
Benzo(g,h,i)perylene	191-24-2	no	no	no	no	–	–	–	–	–	–
Benzo(k)fluoranthene	207-08-9	**YES**	**YES**	no	no	3.80E+00	1.61E+00	3.34E+00	2.64E+00	–	–
Chrysene	218-01-9	**YES**	**YES**	no	no	9.10E+00	2.89E+00	7.94E+00	6.15E+00	–	–
Dibenzo(a,h)anthracene	53-70-3	**YES**	**YES**	**YES**	no	8.70E-01	3.25E-01	7.01E-01	1.89E-01	7.60E-02 m	–
Fluoranthene	206-44-0	no	no	no	no	–	–	–	–	–	–
Fluorene	86-73-7	no	no	no	no	–	–	–	–	–	–
Indeno(1,2,3-cd)pyrene	193-39-5	**YES**	**YES**	**YES**	no	5.60E+00	1.30E+00	4.68E+00	2.88E+00	8.91E-02	–
Naphthalene	91-20-3	**YES**	**YES**	no	no	3.20E+00	ND	2.64E+00	7.80E+00 m	–	–
Phenanthrene	85-01-8	no	no	no	no	–	–	–	–	–	–
Pyrene	129-00-0	no	no	no	no	–	–	–	–	–	–
Polychlorinated Biphenyls											
Aroclor 1254	11097-69-1	no	no	no	no	–	–	–	–	–	–
Aroclor 1260	11096-82-5	no	no	no	no	–	–	–	–	–	–
Inorganics											
Aluminum	7429-90-5	no	no	**YES**	no	–	–	–	–	1.57E+04	–
Antimony	7440-36-0	no	no	no	no	–	–	–	–	–	–
Arsenic	7440-38-2	no	no	**YES**	no	–	–	–	–	7.58E+00	–
Barium	7440-39-3	no	no	no	no	–	–	–	–	–	–
Beryllium	7440-41-7	no	no	no	no	–	–	–	–	–	–
Cadmium	7440-43-9	no	no	no	no	–	–	–	–	–	–
Calcium	7440-70-2	no	no	no	no	–	–	–	–	–	–
Chromium	7440-47-3	no	no	no	no	–	–	–	–	–	–
Cobalt	7440-48-4	**YES**	**YES**	**YES**	no	1.20E+02	2.03E+01	7.40E+01	1.78E+01	1.71E+01	–
Copper	7440-50-8	no	no	no	no	–	–	–	–	–	–
Iron	7439-89-6	**YES**	**YES**	**YES**	no	3.72E+04	3.70E+04	3.46E+04	3.40E+04	3.29E+04	–
Lead	7439-92-1	no	no	no	no	–	–	–	–	–	–
Magnesium	7439-95-4	no	no	no	no	–	–	–	–	–	–
Manganese	7439-96-5	**YES**	**YES**	**YES**	no	1.32E+03	1.04E+03	1.03E+03	8.57E+02	1.86E+03	–
Mercury	7439-97-6	no	no	no	no	–	–	–	–	–	–
Nickel	7440-02-0	no	no	no	no	–	–	–	–	–	–
Potassium	7440-09-7	no	no	no	no	–	–	–	–	–	–
Selenium	7782-49-2	no	no	no	no	–	–	–	–	–	–
Silver	7440-22-4	no	no	no	no	–	–	–	–	–	–
Sodium	7440-23-5	no	no	no	no	–	–	–	–	–	–
Thallium	7440-28-0	no	no	**YES**	**YES**	–	–	–	–	4.50E-01	7.20E-03 m
Vanadium	7440-62-2	no	no	**YES**	no	–	–	–	–	5.33E+01	–
Zinc	7440-66-6	no	no	no	no	–	–	–	–	–	–

Notes:
– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilogram.
mg/L = Milligrams per liter.

[a] Constituent of Potential Concern.
[b] The exposure point concentration (EPC) was the upper confidence level on the mean (UCL) or the maximum concentration where the UCL was incalculable.
EPCs marked with "m" are based on the maximum detected concentration.
Exposure to lead is evaluated by predicting resultant blood lead levels using the arithmetic average (avg).
The UCLs were calculated using ProUCL 4.0. The UCL used is the one recommended by ProUCL 4.0.

Table 5-24
Summary of Calculated Human Health Risks and Hazards
BUILDING DEBRIS DISPOSAL TRENCH
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

RECEPTOR / Exposure Medium - Scenario	Total Excess Lifetime Cancer Risk	Total Non-Cancer Hazard
Site Worker		
Surface Soil - Direct Contact	5E-05	0.5
Combined Surface and Subsurface Soil - Vapor Migration to Indoor Air	NA	0.04
Sediment - Wading	1E-05	0.02
Surface Water - Wading	4E-07	0.04
TOTAL SITE RISKS (Site Worker):	7E-05	0.6
Hypothetical Future Construction Worker		
Combined Surface and Subsurface Soil - Direct Contact	2E-06	1
TOTAL SITE RISKS (Construction Worker):	2E-06	1
Hypothetical Future Adult Resident		
Combined Surface and Subsurface Soil - Direct Contact	8E-05	0.5
Combined Surface and Subsurface Soil - Vapor Migration to Indoor Air	NA	0.06
Sediment - Wading	3E-05	0.04
Surface Water - Wading	1E-07	0.01
TOTAL SITE RISKS (Adult Resident):	1E-04	0.6
Hypothetical Future Child Resident		
Combined Surface and Subsurface Soil - Direct Contact	3E-04	4
Combined Surface and Subsurface Soil - Vapor Migration to Indoor Air	NA	0.06
Sediment - Wading	2E-05	0.3
Surface Water - Wading	1E-07	0.04
TOTAL SITE RISKS (Child Resident):	3E-04	5
Hypothetical Future Aggregate Resident (Adult + Child)		
Combined Surface and Subsurface Soil - Direct Contact	4E-04	--
Combined Surface and Subsurface Soil - Vapor Migration to Indoor Air	NA	--
Sediment - Wading	5E-05	--
Surface Water - Wading	2E-07	--
TOTAL SITE RISKS (Aggregate Resident):	4E-04	--

Table 5-24a
Summary of Calculated Human Health Risks and Hazards
BUILDING DEBRIS DISPOSAL TRENCH - RIP RAP AREA
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

RECEPTOR Exposure Medium - Scenario	Total Excess Lifetime Cancer Risk	Total Non-Cancer Hazard
Site Worker		
Surface Soil - Direct Contact	2E-05	0.1
Combined Surface and Subsurface Soil - Vapor Migration to Indoor Air	NA	0.1
Sediment - Wading	NA	NA
Surface Water - Wading	NA	NA
TOTAL SITE RISKS (Site Worker):	2E-05	0.3
Hypothetical Future Construction Worker		
Combined Surface and Subsurface Soil - Direct Contact	2E-06	0.4
TOTAL SITE RISKS (Construction Worker):	2E-06	0.4
Hypothetical Future Adult Resident		
Combined Surface and Subsurface Soil - Direct Contact	5E-05	0.2
Combined Surface and Subsurface Soil - Vapor Migration to Indoor Air	NA	0.2
Sediment - Wading	NA	NA
Surface Water - Wading	NA	NA
TOTAL SITE RISKS (Adult Resident):	5E-05	0.4
Hypothetical Future Child Resident		
Combined Surface and Subsurface Soil - Direct Contact	2E-04	2
Combined Surface and Subsurface Soil - Vapor Migration to Indoor Air	NA	0.2
Sediment - Wading	NA	NA
Surface Water - Wading	NA	NA
TOTAL SITE RISKS (Child Resident):	2E-04	2
Hypothetical Future Aggregate Resident (Adult + Child)		
Combined Surface and Subsurface Soil - Direct Contact	3E-04	--
Combined Surface and Subsurface Soil - Vapor Migration to Indoor Air	NA	--
Sediment - Wading	NA	--
Surface Water - Wading	NA	--
TOTAL SITE RISKS (Aggregate Resident):	3E-04	--

Table 5-25
Screening Level -Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Background Concentration [a] (mg/kg)	Ecological Screening Level (ESLs) [b] (mg/kg)		Maximum HQ [c] (unitless)	Bioaccumulative Chemical?[d] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [e]	
			Value	*Source*			(YES/no)	Rationale
Volatile Organic Compounds								
1,2,4-Trimethylbenzene	0.004	–	0.25462	*R5s*	0.02	no	no	HQ • 1
m,p-Xylene	0.003	–	10	*R5s*	0.0003	no	no	HQ • 1
Xylene	0.003	–	10	*R5*	0.0003	no	no	HQ • 1
Semi-Volatile Organic Compounds								
Carbazole	3.5	–	NA		NA	no	**YES**	**NSL**
Dibenzofuran	0.8	–	NA		NA	no	**YES**	**NSL**
Herbicides								
2,4-D	0.171	–	0.272	*R5*	0.6	no	no	HQ • 1
Dalapon	0.099	–	NA		NA	no	**YES**	**NSL**
Dicamba	0.00849	–	NA		NA	no	**YES**	**NSL**
MCPP	13.5	–	NA		NA	no	**YES**	**NSL**
Pesticides								
4,4'-DDD	0.0034	–	0.021	*EcoSSL*	0.2	YES	**YES**	**Bioaccumulative**
Methoxychlor	0.0291	–	0.0199	*R5*	1	YES	**YES**	**Bioaccumulative**
Polycyclic Aromatic Hydrocarbons								
1-Methylnaphthalene	0.0036	–	3.24	*R5s*	0.001	no	no	HQ • 1
2-Methylnaphthalene	5.1	–	3.24	*R5*	2	no	**YES**	**HQ > 1**
Acenaphthene	27	–	682	*R5*	0.04	YES	**YES**	**Bioaccumulative**
Acenaphthylene	0.31	–	682	*R5*	0.0005	YES	**YES**	**Bioaccumulative**
Anthracene	37	–	1,480	*R5*	0.03	YES	**YES**	**Bioaccumulative**
Benzo(a)anthracene	66	–	5.21	*R5*	10	YES	**YES**	**HQ > 1**
Benzo(a)pyrene	57	–	1.52	*R5*	40	YES	**YES**	**HQ > 1**
Benzo(b)fluoranthene	81	–	59.8	*R5*	1	YES	**YES**	**Bioaccumulative**
Benzo(g,h,i)perylene	38	–	119	*R5*	0.3	YES	**YES**	**Bioaccumulative**
Benzo(k)fluoranthene	26	–	148	*R5*	0.2	YES	**YES**	**Bioaccumulative**
Chrysene	61	–	4.73	*R5*	10	YES	**YES**	**HQ > 1**
Dibenzo(a,h)anthracene	9.9	–	18.4	*R5*	0.5	YES	**YES**	**Bioaccumulative**
Fluoranthene	180	–	122	*R5*	1	YES	**YES**	**Bioaccumulative**
Fluorene	28	–	122	*R5*	0.2	YES	**YES**	**Bioaccumulative**
Indeno(1,2,3-cd)pyrene	47	–	109	*R5*	0.4	YES	**YES**	**Bioaccumulative**
Naphthalene	29	–	0.0994	*R5*	300	no	**YES**	**HQ > 1**
Phenanthrene	160	–	45.7	*R5*	4	YES	**YES**	**HQ > 1**
Pyrene	130	–	78.5	*R5*	2	YES	**YES**	**HQ > 1**
Inorganics								
Aluminum	20,100	40,041	50	*ORNL*	400	no	no	max • BKGD
Antimony	0.33	NA	0.27	*EcoSSL*	1	no	no	HQ • 1
Arsenic	11.6	15.8	18	*EcoSSL*	0.6	YES	no	max • BKGD
Barium	78.7	209	330	*EcoSSL*	0.2	no	no	max • BKGD
Beryllium	1.5	1.02	21	*EcoSSL*	0.07	no	no	HQ • 1
Cadmium	0.1	0.69	0.36	*EcoSSL*	0.3	YES	no	max • BKGD
Calcium	2,560	NA	NA		NA	no	no	NT
Chromium	60.8	65.3	26	*EcoSSL*	2	YES	no	max • BKGD
Cobalt	446	72.3	13	*EcoSSL*	30	no	**YES**	**HQ > 1**
Copper	138	53.5	28	*EcoSSL*	5	YES	**YES**	**HQ > 1**

Table 5-25
Screening Level -Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Background Concentration [a] (mg/kg)	Ecological Screening Level (ESLs) [b] (mg/kg)		Maximum HQ [c] (unitless)	Bioaccumulative Chemical?[d] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [e]	
			Value	*Source*			(YES/no)	Rationale
Iron	58,100	50,962	NA		NA	no	**YES**	**NSL**
Lead	336	26.8	11	*EcoSSL*	30	YES	**YES**	**HQ > 1**
Magnesium	13,500	NA	NA		NA	no	no	NT
Manganese	3,430	2,543	220	*EcoSSL*	20	no	**YES**	**HQ > 1**
Mercury	0.03	0.13	0.1	*R5*	0.3	no	no	max • BKGD
Nickel	41.3	62.8	38	*EcoSSL*	1	YES	no	max • BKGD
Potassium	3,980	NA	NA		NA	no	no	NT
Selenium	0.43	NA	0.52	*EcoSSL*	0.8	YES	**YES**	**Bioaccumulative**
Sodium	173	NA	NA		NA	no	no	NT
Thallium	0.51	2.11	0.05692	*R5*	9	no	no	max • BKGD
Vanadium	108	108	7.8	*EcoSSL*	10	no	no	max • BKGD
Zinc	178	202	46	*EcoSSL*	4	YES	no	max • BKGD

Notes:

– = Not available or applicable.

mg/kg = Milligrams per kilogram.

NA = Not available or applicable.

[a] Background levels for inorganics are facility-wide soil background point estimates taken from Facility-Wide Background Study Report (IT Corporation 2001).

[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.

[c] The maximum hazard quotient (HQ) is the ratio of the maximum constituent concentration to the surface soil screening level. HQs are rounded to one significant figure.

[d] Constituent was considered at bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment quality Assessment, Status and Needs, February 2000.

[e] Constituents with a hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for screening level assessment unless they were essential nutrients and thus considered non-toxic (NT), or were metals present at concentrations below background (max • BKGD).

Table 5-26
Screening Level - Constituents of Potential Ecological Concern in Sediment
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Ecological Screening Level (ESLs) [a] (mg/kg)		Maximum HQ [b] (unitless)	Bioaccumulative Chemical?[c] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [d]	
		Value	*Source*			(YES/no)	Rationale
Volatile Organic Compounds							
Acetone	0.037	0.0099	*R5*	4	no	**YES**	**HQ > 1**
Carbon Disulfide	0.0015	0.000851	*R3*	2	no	**YES**	**HQ > 1**
Methylene Chloride	0.005	0.159	*R5*	0.03	no	no	HQ • 1
p-Isopropyltoluene	0.004	0.086	*R3s*	0.05	no	no	HQ • 1
Toluene	0.0027	1.22	*R5*	0.002	no	no	HQ • 1
Trichloroethene	0.003	0.0969	*R3*	0.03	no	no	HQ • 1
Semi-Volatile Organic Compounds							
4-Methylphenol	0.06	0.67	*R3*	0.09	no	no	HQ • 1
Di-n-Butylphthalate	0.09	6.47	*R3*	0.01	no	no	HQ • 1
Pesticides							
4,4'-DDD	0.00115	0.00488	*R3*	0.2	YES	**YES**	**Bioaccumulative**
4,4'-DDE	0.00212	0.00316	*R3*	0.7	YES	**YES**	**Bioaccumulative**
4,4'-DDT	0.00123	7	*ORNL*	0.0002	YES	**YES**	**Bioaccumulative**
BHC, delta-	0.0065	6.4	*R3*	0.001	YES	**YES**	**Bioaccumulative**
Chlordane, alpha-	0.00039	0.00324	*R3s*	0.1	YES	**YES**	**Bioaccumulative**
Dieldrin	0.00159	0.0019	*R3*	0.8	YES	**YES**	**Bioaccumulative**
Polycyclic Aromatic Hydrocarbons							
1-Methylnaphthalene	0.0048	0.0202	*R3s*	0.2	no	no	HQ • 1
2-Methylnaphthalene	0.074	0.0202	*R3*	4	no	**YES**	**HQ > 1**
Acenaphthene	0.24	0.0067	*R3*	40	YES	**YES**	**HQ > 1**
Acenaphthylene	0.0017	0.0059	*R3*	0.3	YES	**YES**	**Bioaccumulative**
Anthracene	0.41	0.0572	*R3*	7	YES	**YES**	**HQ > 1**
Benzo(a)anthracene	0.88	0.108	*R3*	8	YES	**YES**	**HQ > 1**
Benzo(a)pyrene	0.71	0.15	*R3*	5	YES	**YES**	**HQ > 1**
Benzo(b)fluoranthene	1.2	10.4	*R5*	0.1	YES	**YES**	**Bioaccumulative**
Benzo(g,h,i)perylene	0.28	0.17	*R3*	2	YES	**YES**	**HQ > 1**
Benzo(k)fluoranthene	0.37	0.24	*R3*	2	YES	**YES**	**HQ > 1**
Chrysene	0.8	0.166	*R3*	5	YES	**YES**	**HQ > 1**
Dibenzo(a,h)anthracene	0.076	0.033	*R3*	2	YES	**YES**	**HQ > 1**
Fluoranthene	2	0.423	*R3*	5	YES	**YES**	**HQ > 1**
Fluorene	0.24	0.0774	*R3*	3	YES	**YES**	**HQ > 1**
Indeno(1,2,3-cd)pyrene	0.36	0.017	*R3*	20	YES	**YES**	**HQ > 1**
Naphthalene	0.091	0.176	*R3*	0.5	no	no	HQ • 1
Phenanthrene	1.9	0.204	*R3*	9	YES	**YES**	**HQ > 1**
Pyrene	1.7	0.195	*R3*	9	YES	**YES**	**HQ > 1**
Inorganics							
Aluminum	20,200	58,000	*ARCS_PEC*	0.3	no	no	HQ • 1
Antimony	0.89	2	*R3*	0.4	no	no	HQ • 1
Arsenic	13.2	9.8	*R3*	1	YES	**YES**	**Bioaccumulative**
Barium	358	NA		NA	no	**YES**	**NSL**
Beryllium	1.3	NA		NA	no	**YES**	**NSL**
Calcium	98,600	NA		NA	no	no	NT
Chromium	73	43.4	*R3*	2	YES	**YES**	**HQ > 1**
Cobalt	27.6	50	*R3*	0.6	no	no	HQ • 1
Copper	15	31.6	*R3*	0.5	YES	**YES**	**Bioaccumulative**
Iron	56,200	20,000	*R3*	3	no	**YES**	**HQ > 1**

Table 5-26
Screening Level - Constituents of Potential Ecological Concern in Sediment
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Ecological Screening Level (ESLs) [a] (mg/kg) Value	*Source*	Maximum HQ [b] (unitless)	Bioaccumulative Chemical?[c] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rationale
Lead	28.6	35.8	*R3*	0.8	YES	**YES**	**Bioaccumulative**
Magnesium	7,720	NA		NA	no	no	NT
Manganese	3,340	460	*R3*	7	no	**YES**	**HQ > 1**
Mercury	0.04	0.18	*R3*	0.2	no	no	HQ • 1
Nickel	20.8	22.7	*R3*	0.9	YES	**YES**	**Bioaccumulative**
Potassium	2,200	NA		NA	no	no	NT
Silver	0.86	1	*R3*	0.9	YES	**YES**	**Bioaccumulative**
Sodium	510	NA		NA	no	no	NT
Thallium	1.1	NA		NA	no	**YES**	**NSL**
Vanadium	75.7	NA		NA	no	**YES**	**NSL**
Zinc	51.9	121	*R3*	0.4	YES	**YES**	**Bioaccumulative**

Notes:

– = Not available or applicable.
mg/kg = Milligrams per kilogram.
NA = Not available or applicable.

[a] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.

[b] The maximum hazard quotient (HQ) is the ratio of the maximum constituent concentration to the sediment screening level. HQs are rounded to one significant figure.

[c] Constituent was considered at bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment quality Assessment, Statu and Needs, February 2000.

[d] Constituents with a hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) f screening level assessment unless they were essential nutrients and thus considered non-toxic (NT), or were metals present at concentrations below background (max • BKGD).

Table 5-27
Screening Level - Constituents of Potential Ecological Concern in Surface Water
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/L)	Ecological Screening Level (ESLs) [a] (mg/L)		Maximum HQ [b] (unitless)	Bioaccumulative Chemical?[c] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [d]	
		Value	*Source*			(YES/no)	Rationale
Volatile Organic Compounds							
Bromodichloromethane	0.023	NA		NA	no	**YES**	**NSL**
Carbon Disulfide	0.00034	0.00092	*R3*	0.4	no	no	HQ • 1
Chloroform	0.004	0.0018	*R3*	2	no	**YES**	**HQ > 1**
Semi-Volatile Organic Compounds							
Di-n-Butylphthalate	0.003	0.019	*R3*	0.2	no	no	HQ • 1
Pesticides							
4,4'-DDT	0.00000516	0.0000005	*R3*	10	YES	**YES**	**HQ > 1**
Dieldrin	0.00000591	0.000056	*R3*	0.1	YES	**YES**	**Bioaccumulative**
Endrin Ketone	0.00000599	0.000036	*R3s*	0.2	no	no	HQ • 1
Polycyclic Aromatic Hydrocarbons							
2-Methylnaphthalene	0.00013	0.0047	*R3*	0.03	no	no	HQ • 1
Acenaphthene	0.00005	0.0058	*R3*	0.009	YES	**YES**	**Bioaccumulative**
Acenaphthylene	0.00004	4.84	*R5*	0.000008	YES	**YES**	**Bioaccumulative**
Fluorene	0.00003	0.003	*R3*	0.01	YES	**YES**	**Bioaccumulative**
Naphthalene	0.00013	0.0011	*R3*	0.1	no	no	HQ • 1
Inorganics							
Aluminum	0.603	0.087	*R3*	7	no	**YES**	**HQ > 1**
Antimony	0.00074	0.03	*R3*	0.02	no	no	HQ • 1
Barium	0.0825	0.004	*R3*	20	no	**YES**	**HQ > 1**
Calcium	65	116	*R3*	NA	no	no	NT
Copper	0.0348	0.009	*R3*	4	YES	**YES**	**HQ > 1**
Iron	0.507	0.3	*R3*	2	no	**YES**	**HQ > 1**
Lead	0.0046	0.0025	*R3*	2	YES	**YES**	**HQ > 1**
Magnesium	17.4	82	*R3*	NA	no	no	NT
Manganese	0.0198	0.12	*R3*	0.2	no	no	HQ • 1
Nickel	0.0055	0.052	*R3*	0.1	YES	**YES**	**Bioaccumulative**
Potassium	3.67	NA		NA	no	no	NT
Silver	0.0021	0.0032	*R3*	0.7	YES	**YES**	**Bioaccumulative**
Sodium	35.3	680	*R3*	NA	no	no	NT
Thallium	0.0072	0.0008	*R3*	9	no	**YES**	**HQ > 1**
Zinc	0.0462	0.12	*R3*	0.4	YES	**YES**	**Bioaccumulative**

Notes:

– = Not available or applicable.
mg/L = Milligrams per liter.
NA = Not available or applicable.

[a] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.

[b] The maximum hazard quotient (HQ) is the ratio of the maximum constituent concentration to the surface water screening level. HQs are rounded to one significant figure.

[c] Constituent was considered at bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.

[d] Constituents with a hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for screening level assessment unless they were essential nutrients and thus considered non-toxic (NT), or were metals present at concentrations below background (max • BKGD).

Table 5-28
Baseline Level - Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	**Exposure Point Concentration [a] (mg/kg)**		**Ecological Screening Level (ESLs) [b] (mg/kg)**		**Refined HQ [c] (unitless)**	**Baseline Level Constituent of Potential Ecological Concern? [d]**		**Bioaccumulative ? [e] (YES/no)**
			Value	***Source***		**(YES/no)**	**Rationale**	
Semi-Volatile Organic Compounds								
Carbazole	3.5	m	NA		NA	**YES**	**NSL**	no
Dibenzofuran	0.8	m	NA		NA	**YES**	**NSL**	no
Herbicides								
Dalapon	0.099	m	NA		NA	**YES**	**NSL**	no
Dicamba	0.00849	m	NA		NA	**YES**	**NSL**	no
MCPP	13.5	m	NA		NA	**YES**	**NSL**	no
Pesticides								
4,4'-DDD	0.0034	m	0.021	*EcoSSL*	0.2	**YES**	**Bioaccumulative**	**YES**
Methoxychlor	0.0291	m	0.0199	*R5*	1	**YES**	**Bioaccumulative**	**YES**
Polycyclic Aromatic Hydrocarbons								
2-Methylnaphthalene	1.233		3.24	*R5*	0.4	no	HQ • 1	no
Acenaphthene	7.14		682	*R5*	0.01	**YES**	**Bioaccumulative**	**YES**
Acenaphthylene	0.0469		682	*R5*	0.00007	**YES**	**Bioaccumulative**	**YES**
Anthracene	10.67		1,480	*R5*	0.007	**YES**	**Bioaccumulative**	**YES**
Benzo(a)anthracene	19.04		5.21	*R5*	4	**YES**	**HQ > 1**	**YES**
Benzo(a)pyrene	15.79		1.52	*R5*	10	**YES**	**HQ > 1**	**YES**
Benzo(b)fluoranthene	23.81		59.8	*R5*	0.4	**YES**	**Bioaccumulative**	**YES**
Benzo(g,h,i)perylene	9.622		119	*R5*	0.08	**YES**	**Bioaccumulative**	**YES**
Benzo(k)fluoranthene	7.473		148	*R5*	0.05	**YES**	**Bioaccumulative**	**YES**
Chrysene	18.1		4.73	*R5*	4	**YES**	**HQ > 1**	**YES**
Dibenzo(a,h)anthracene	1.235		18.4	*R5*	0.07	**YES**	**Bioaccumulative**	**YES**
Fluoranthene	53.96		122	*R5*	0.4	**YES**	**Bioaccumulative**	**YES**
Fluorene	7.328		122	*R5*	0.06	**YES**	**Bioaccumulative**	**YES**
Indeno(1,2,3-cd)pyrene	7.795		109	*R5*	0.07	**YES**	**Bioaccumulative**	**YES**
Naphthalene	6.839		0.0994	*R5*	70	**YES**	**HQ > 1**	no
Phenanthrene	47.5		45.7	*R5*	1	**YES**	**Bioaccumulative**	**YES**
Pyrene	39.71		78.5	*R5*	0.5	**YES**	**Bioaccumulative**	**YES**
Inorganics								
Cobalt	446	m	13	*EcoSSL*	30	**YES**	**HQ > 1**	no
Copper	138	m	28	*EcoSSL*	5	**YES**	**HQ > 1**	**YES**
Iron	58,100	m	NA		NA	**YES**	**NSL**	no
Lead	336	m	11	*EcoSSL*	30	**YES**	**HQ > 1**	**YES**
Manganese	3,430	m	220	*EcoSSL*	20	**YES**	**HQ > 1**	no
Selenium	0.43	m	0.52	*EcoSSL*	0.8	**YES**	**Bioaccumulative**	**YES**

Table 5-28
Baseline Level - Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:
– = Not available or applicable.
mg/kg = Milligrams per kilogram.
NA = Not available or applicable.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[c] The refined hazard quotient (HQ) is the ratio of the EPC to the surface soil screening level. HQs are rounded to one significant figure.
[d] Constituents with a refined hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for baseline risk assessment.
[e] Constituent was considered at bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment quality Assessment, Status and Needs, February 2000.

Table 5-29
Baseline Level - Constituents of Potential Ecological Concern in Sediment
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)		Ecological Screening Level (ESLs) [b] (mg/kg) Value	*Source*	Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rationale	Bioaccumulative ? [e] (YES/no)
Volatile Organic Compounds								
Acetone	0.037	m	0.0099	*R5*	4	**YES**	**HQ > 1**	no
Carbon Disulfide	0.00142		0.000851	*R3*	2	**YES**	**HQ > 1**	no
Pesticides								
4,4'-DDD	0.00115	m	0.00488	*R3*	0.2	**YES**	**Bioaccumulative**	**YES**
4,4'-DDE	0.00212	m	0.00316	*R3*	0.7	**YES**	**Bioaccumulative**	**YES**
4,4'-DDT	0.00123	m	7	*ORNL*	0.0002	**YES**	**Bioaccumulative**	**YES**
BHC, delta-	0.0065	m	6.4	*R3*	0.001	**YES**	**Bioaccumulative**	**YES**
Chlordane, alpha-	0.00039	m	0.00324	*R3s*	0.1	**YES**	**Bioaccumulative**	**YES**
Dieldrin	0.00159	m	0.0019	*R3*	0.8	**YES**	**Bioaccumulative**	**YES**
Polycyclic Aromatic Hydrocarbons								
2-Methylnaphthalene	0.0303		0.0202	*R3*	2	**YES**	**HQ > 1**	no
Acenaphthene	0.0708		0.0067	*R3*	10	**YES**	**HQ > 1**	**YES**
Acenaphthylene	0.0017	m	0.0059	*R3*	0.3	**YES**	**Bioaccumulative**	**YES**
Anthracene	0.0911		0.0572	*R3*	2	**YES**	**HQ > 1**	**YES**
Benzo(a)anthracene	0.654		0.108	*R3*	6	**YES**	**HQ > 1**	**YES**
Benzo(a)pyrene	0.535		0.15	*R3*	4	**YES**	**HQ > 1**	**YES**
Benzo(b)fluoranthene	0.266		10.4	*R5*	0.03	**YES**	**Bioaccumulative**	**YES**
Benzo(g,h,i)perylene	0.0747		0.17	*R3*	0.4	**YES**	**Bioaccumulative**	**YES**
Benzo(k)fluoranthene	0.277		0.24	*R3*	1	**YES**	**Bioaccumulative**	**YES**
Chrysene	0.606		0.166	*R3*	4	**YES**	**HQ > 1**	**YES**
Dibenzo(a,h)anthracene	0.076	m	0.033	*R3*	2	**YES**	**HQ > 1**	**YES**
Fluoranthene	1.514		0.423	*R3*	4	**YES**	**HQ > 1**	**YES**
Fluorene	0.058		0.0774	*R3*	0.7	**YES**	**Bioaccumulative**	**YES**
Indeno(1,2,3-cd)pyrene	0.0891		0.017	*R3*	5	**YES**	**HQ > 1**	**YES**
Phenanthrene	1.443		0.204	*R3*	7	**YES**	**HQ > 1**	**YES**
Pyrene	1.293		0.195	*R3*	7	**YES**	**HQ > 1**	**YES**
Inorganics								
Arsenic	7.577		9.8	*R3*	0.8	**YES**	**Bioaccumulative**	**YES**
Barium	150.2		NA		NA	**YES**	**NSL**	no
Beryllium	1.073		NA		NA	**YES**	**NSL**	no
Chromium	46.05		43.4	*R3*	1	no	HQ • 1	no
Copper	12.93		31.6	*R3*	0.4	**YES**	**Bioaccumulative**	**YES**
Iron	32,855		20,000	*R3*	2	**YES**	**HQ > 1**	no
Lead	19	avg	35.8	*R3*	0.5	**YES**	**Bioaccumulative**	**YES**
Manganese	1,863		460	*R3*	4	**YES**	**HQ > 1**	no
Nickel	14.89		22.7	*R3*	0.7	**YES**	**Bioaccumulative**	**YES**
Silver	0.86	m	1	*R3*	0.9	**YES**	**Bioaccumulative**	**YES**
Thallium	0.45		NA		NA	**YES**	**NSL**	no
Vanadium	53.28		NA		NA	**YES**	**NSL**	no
Zinc	44.62		121	*R3*	0.4	**YES**	**Bioaccumulative**	**YES**

Table 5-29
Baseline Level - Constituents of Potential Ecological Concern in Sediment
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:

– = Not available or applicable.

mg/kg = Milligrams per kilogram.

NA = Not available or applicable.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.

[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.

[c] The refined hazard quotient (HQ) is the ratio of the EPC to the sediment screening level. HQs are rounded to one significant figure.

[d] Constituents with a refined hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for baseline risk assessment.

[e] Constituent was considered at bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment quality Assessment, Status and Needs, February 2000.

Table 5-30
Baseline Level - Constituents of Potential Ecological Concern in Surface Water
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/L)		Ecological Screening Level (ESLs) [b] (mg/L) Value	*Source*	Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rationale	Bioaccumulative ? [e] (YES/no)
Volatile Organic Compounds								
Bromodichloromethane	0.023	m	NA		NA	**YES**	**NSL**	no
Chloroform	0.00237		0.0018	*R3*	1	no	HQ • 1	no
Pesticides								
4,4'-DDT	0.00000516	m	0.0000005	*R3*	10	**YES**	**HQ > 1**	**YES**
Dieldrin	0.00000591	m	0.000056	*R3*	0.1	**YES**	**Bioaccumulative**	**YES**
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	0.00005	m	0.0058	*R3*	0.009	**YES**	**Bioaccumulative**	**YES**
Acenaphthylene	0.00004	m	4.84	*R5*	0.000008	**YES**	**Bioaccumulative**	**YES**
Fluorene	0.00003	m	0.003	*R3*	0.01	**YES**	**Bioaccumulative**	**YES**
Inorganics								
Aluminum	0.391		0.087	*R3*	4	**YES**	**HQ > 1**	no
Barium	0.0733		0.004	*R3*	20	**YES**	**HQ > 1**	no
Copper	0.0239		0.009	*R3*	3	**YES**	**HQ > 1**	**YES**
Iron	0.278		0.3	*R3*	0.9	no	HQ • 1	no
Lead	0.00119	avg	0.0025	*R3*	0.5	**YES**	**Bioaccumulative**	**YES**
Nickel	0.0044		0.052	*R3*	0.08	**YES**	**Bioaccumulative**	**YES**
Silver	0.0021	m	0.0032	*R3*	0.7	**YES**	**Bioaccumulative**	**YES**
Thallium	0.0072	m	0.0008	*R3*	9	**YES**	**HQ > 1**	no
Zinc	0.0295		0.12	*R3*	0.2	**YES**	**Bioaccumulative**	**YES**

Notes:
– = Not available or applicable.
mg/L = Milligrams per liter.
NA = Not available or applicable.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[c] The refined hazard quotient (HQ) is the ratio of the EPC to the surface water screening level. HQs are rounded to one significant figure.
[d] Constituents with a refined hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for baseline risk assessment.
[e] Constituent was considered at bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment quality Assessment, Status and Needs, February 2000.

Table 5-31

Summary of Ecological Risk Characterization Results - Terrestrial Habitat

BUILDING DEBRIS DISPOSAL TRENCH

New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Soil Frequency of Detection # detects / n samples	Soil Frequency of Detection %	EPC (mg/kg)		Baseline Level Assessment: Hazard Quotient [a]	Baseline Level Assessment: Ecological Screening Level [b] Source	Baseline Level Assessment: Ecological Screening Level [b] Basis	Bioaccum-ulative ? (YES/no)	Results of Refined Food Chain Models [c]: Short-tailed Shrew LOAEL HQ	Short-tailed Shrew NOAEL HQ	American Robin LOAEL HQ	American Robin NOAEL HQ
Semi-Volatile Organic Compounds												
Carbazole	4 - 4	100%	3.5	m	NA			no	–	–	–	–
Dibenzofuran	3 - 4	75%	0.8	m	NA			no	–	–	–	–
Herbicides												
Dalapon	1 - 1	100%	0.099	m	NA			no	–	–	–	–
Dicamba	1 - 1	100%	0.0085	m	NA			no	–	–	–	–
MCPP	1 - 1	100%	13.5	m	NA			no	–	–	–	–
Pesticides												
4,4'-DDD	1 - 1	100%	0.0034	m	0.2	EcoSSL	mam	YES	0.00009	0.0004	0.01	0.1
Methoxychlor	1 - 1	100%	0.0291	m	1	R5		YES	0.001	0.003	–	–
Polycyclic Aromatic Hydrocarbons												
Acenaphthene	35 - 63	56%	7.14		0.01	R5		YES	0.02	0.2	0.003	0.03
Acenaphthylene	20 - 63	32%	0.0469		0.00007	R5		YES	0.00003	0.000003	0.00002	0.0002
Anthracene	40 - 63	63%	10.67		0.007	R5		YES	0.00002	0.0002	0.002	0.02
Benzo(a)anthracene	45 - 63	71%	19.04		**4**	R5		YES	0.06	0.6	0.003	0.03
Benzo(a)pyrene	45 - 63	71%	15.79		**10**	R5		YES	0.03	0.3	0.002	0.02
Benzo(b)fluoranthene	50 - 63	79%	23.81		0.4	R5		YES	0.01	0.3	0.004	0.04
Benzo(g,h,i)perylene	44 - 63	70%	9.622		0.08	R5		YES	0.3	**3**	0.001	0.01
Benzo(k)fluoranthene	46 - 63	73%	7.473		0.05	R5		YES	0.004	0.1	0.001	0.01
Chrysene	45 - 63	71%	18.1		**4**	R5		YES	0.001	0.01	0.003	0.03
Dibenzo(a,h)anthracene	28 - 63	44%	1.235		0.07	R5		YES	**2**	**20**	0.0002	0.002
Fluoranthene	53 - 63	84%	53.96		0.4	R5		YES	0.04	0.4	0.02	0.2
Fluorene	34 - 63	54%	7.328		0.06	R5		YES	0.002	0.005	0.003	0.03
Indeno(1,2,3-cd)pyrene	42 - 63	67%	7.795		0.07	R5		YES	0.7	**7**	0.001	0.01
Naphthalene	21 - 63	33%	6.839		**70**	R5		no	–	–	–	–
Phenanthrene	49 - 63	78%	47.5		1	R5		YES	0.02	0.2	0.007	0.07
Pyrene	51 - 63	81%	39.71		0.5	R5		YES	0.03	0.3	0.006	0.06
Inorganics												
Cobalt	8 - 8	100%	446	m	**30**	EcoSSL	veg	no	–	–	–	–
Copper	8 - 8	100%	138	m	**5**	EcoSSL	avi	YES	0.06	0.08	0.05	0.07
Iron	8 - 8	100%	58,100	m	NA			no	–	–	–	–
Lead	8 - 8	100%	336	m	**30**	EcoSSL	avi	YES	0.03	0.3	0.1	1
Manganese	8 - 8	100%	3,430	m	**20**	EcoSSL	veg	no	–	–	–	–
Selenium	1 - 8	13%	0.43	m	0.8	EcoSSL	veg	YES	0.04	0.06	0.01	0.02

Table 5-31
Summary of Ecological Risk Characterization Results - Terrestrial Habitat
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:

– =	Not applicable.
COPEC =	Constituent of Potential Ecological Concern.
EPC =	Exposure point concentrations - the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration.
	EPCs marked with "m" are the maximum concentration.
LOAEL HQ =	Lowest observed adverse effect level hazard quotient.
mg/kg =	Milligrams per kilogram.
NA =	Not available.
NOAEL HQ =	No observed adverse effect level hazard quotient.
[a]	Hazard quotients (HQs) greater than one are presented in bold font. HQs are rounded to one significant figure (unitless).
[b]	See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
	R5: Region 5 Ecological Screening Levels (USEPA 2003e; R5).
	EcoSSL: USEPA Ecological Soil Screening Levels (USEPA 2005b; EcoSSL).
	Where readily available (i.e., EcoSSLs), the basis of the ESL is presented.
[c]	Foodchain modeling was conducted for bioaccumulative COPECs.

Table 5-32
Summary of Ecological Risk Characterization Results - Aquatic Habitat
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

	Sediment			Surface Water			Baseline Level Assessment			Results of Refined Food Chain Models [b]			
	Frequency of Detection		EPC	Frequency of Detection		EPC	Sediment Hazard Quotient	Surface Water Hazard Quotient	Bioaccum-ulative ?	Mink		Great Blue Heron	
Constituent	**# detects / n samples**	**%**	**(mg/kg)**	**# detects / n samples**	**%**	**(mg/L)**	**[a]**	**[a]**	**(YES/no)**	**LOAEL HQ**	**NOAEL HQ**	**LOAEL HQ**	**NOAEL HQ**
Volatile Organic Compounds													
Acetone	5 - 13	38%	3.7E-02 m	0 - 13	0%	–	**4**	NA	no	–	–	–	–
Bromodichloromethane	0 - 13	0%	–	1 - 13	8%	2.3E-02 m	NA	NA	no	–	–	–	–
Carbon Disulfide	6 - 13	46%	1.4E-03	5 - 13	38%	–	**2**	NA	no	–	–	–	–
Pesticides													
4,4'-DDD	2 - 2	100%	1.2E-03 m	0 - 2	0%	–	0.2	NA	YES	0.00003	0.0002	0.003	0.03
4,4'-DDE	2 - 2	100%	2.1E-03 m	0 - 2	0%	–	0.7	NA	YES	0.0006	0.003	0.07	0.7
4,4'-DDT	2 - 2	100%	1.2E-03 m	1 - 2	50%	5.2E-06 m	0.0002	**10**	YES	0.00003	0.0001	0.003	0.03
BHC, delta-	1 - 2	50%	6.5E-03 m	0 - 2	0%	–	0.001	NA	YES	–	–	–	–
Chlordane, alpha-	2 - 2	100%	3.9E-04 m	0 - 2	0%	–	0.1	NA	YES	0.000002	0.00002	0.000001	0.00001
Dieldrin	2 - 2	100%	1.6E-03 m	2 - 2	100%	5.9E-06 m	0.8	0.1	YES	0.003	0.03	0.0004	0.004
Polycyclic Aromatic Hydrocarbons													
2-Methylnaphthalene	7 - 17	41%	3.0E-02	4 - 17	24%	–	**2**	NA	no	–	–	–	–
Acenaphthene	7 - 17	41%	7.1E-02	1 - 17	6%	5.0E-05 m	**10**	0.009	YES	0.000003	0.00003	0.0000001	0.000001
Acenaphthylene	1 - 17	6%	1.7E-03 m	1 - 17	6%	4.0E-05 m	0.3	0.000008	YES	0.0000001	1E-08	0.00000001	1E-07
Anthracene	8 - 17	47%	9.1E-02	0 - 17	0%	–	**2**	NA	YES	0.000000008	8E-08	0.0000002	0.000002
Benzo(a)anthracene	10 - 17	59%	6.5E-01	0 - 17	0%	–	**6**	NA	YES	0.0002	0.002	0.000003	0.00003
Benzo(a)pyrene	9 - 17	53%	5.4E-01	0 - 17	0%	–	**4**	NA	YES	0.00005	0.0005	0.000002	0.00002
Benzo(b)fluoranthene	8 - 17	47%	2.7E-01	0 - 17	0%	–	0.03	NA	YES	0.000007	0.0002	0.000001	0.00001
Benzo(g,h,i)perylene	8 - 17	47%	7.5E-02	0 - 17	0%	–	0.4	NA	YES	0.00007	0.0007	0.0000003	0.000003
Benzo(k)fluoranthene	9 - 17	53%	2.8E-01	0 - 17	0%	–	1	NA	YES	0.000007	0.0002	0.000001	0.00001
Chrysene	11 - 17	65%	6.1E-01	0 - 17	0%	–	**4**	NA	YES	0.000004	0.00004	0.000003	0.00003
Dibenzo(a,h)anthracene	4 - 17	24%	7.6E-02 m	0 - 17	0%	–	**2**	NA	YES	0.006	0.06	0.0000003	0.000003
Fluoranthene	14 - 17	82%	1.5E+00	0 - 17	0%	–	**4**	NA	YES	0.00002	0.0002	0.000007	0.00007
Fluorene	7 - 17	41%	5.8E-02	1 - 17	6%	3.0E-05 m	0.7	0.01	YES	0.00000008	0.0000003	0.0000001	0.000001
Indeno(1,2,3-cd)pyrene	8 - 17	47%	8.9E-02	0 - 17	0%	–	**5**	NA	YES	0.00009	0.0009	0.0000004	0.000004
Phenanthrene	14 - 17	82%	1.4E+00	0 - 17	0%	–	**7**	NA	YES	0.00003	0.0003	0.000002	0.00002
Pyrene	13 - 17	76%	1.3E+00	0 - 17	0%	–	**7**	NA	YES	0.00009	0.0009	0.000005	0.00005
Inorganics													
Aluminum	13 - 13	100%	–	13 - 13	100%	3.9E-01	NA	**4**	no	–	–	–	–
Arsenic	13 - 13	100%	7.6E+00	0 - 13	0%	–	0.8	NA	YES	0.09	0.9	0.03	0.08
Barium	13 - 13	100%	1.5E+02	13 - 13	100%	7.3E-02	NA	**20**	no	–	–	–	–
Beryllium	13 - 13	100%	1.1E+00	0 - 13	0%	–	NA	NA	no	–	–	–	–
Copper	13 - 13	100%	1.3E+01	7 - 13	54%	2.4E-02	0.4	**3**	YES	0.04	0.05	0.01	0.01
Iron	13 - 13	100%	3.3E+04	13 - 13	100%	–	**2**	NA	no	–	–	–	–
Lead	13 - 13	100%	1.9E+01 avg	8 - 13	62%	1.2E-03 avg	0.5	0.5	YES	0.02	0.2	0.03	0.3
Manganese	13 - 13	100%	1.9E+03	13 - 13	100%	–	**4**	NA	no	–	–	–	–
Nickel	13 - 13	100%	1.5E+01	7 - 13	54%	4.4E-03	0.7	0.08	YES	0.01	0.03	0.007	0.01
Silver	1 - 13	8%	8.6E-01 m	1 - 13	8%	2.1E-03 m	0.9	0.7	YES	0.0004	0.004	0.05	0.1
Thallium	9 - 13	69%	4.5E-01	4 - 13	31%	7.2E-03 m	NA	**9**	no	–	–	–	–
Vanadium	13 - 13	100%	5.3E+01	0 - 13	0%	–	NA	NA	no	–	–	–	–
Zinc	13 - 13	100%	4.5E+01	7 - 13	54%	3.0E-02	0.4	0.2	YES	0.1	1	0.02	0.1

Table 5-32
Summary of Ecological Risk Characterization Results - Aquatic Habitat
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:

– =	Not applicable.
EPC =	Exposure point concentrations - the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration.
	EPCs marked with "m" are the maximum concentration.
LOAEL HQ =	Lowest observed adverse effect level hazard quotient.
mg/kg =	Milligrams per kilogram.
mg/L =	Milligrams per liter.
NOAEL HQ =	No observed adverse effect level hazard quotient.
[a]	Hazard quotients (HQs) greater than one are presented in bold font. HQs are rounded to one significant figure (unitless).
[b]	Foodchain modeling was conducted for bioaccumulative COPECs.

Table 6-1. Soil Analytical Results, Bag Loading Area, 1997 Dames and Moore Soil Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: / Sample Depth(Feet): / Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	407712 0-1 12/09/97	407712 1-2 12/09/97	407712 2-3 12/09/97	407736 0-1 12/09/97	407736 1-2 12/09/97	407760 0-1 12/09/97	407760 1-2 12/09/97
Inorganics											
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	36,000	32,600	**40,700**	29,200	32,700	33,600	39,100
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	**0.33 J**	ND	**0.29 J**	ND	ND	ND	ND
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	4.6	5.3	5.4	4.4	3.5	4.9	4.4
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	86.3	71.3	81.6	78.6	54.8	50.4	49.2
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	**1.6**	**1.6**	**2.0**	**1.4**	**1.5**	**1.5**	**1.6**
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	NA	NA	NA	NA	NA	NA	NA
Calcium	- -	- -	- -	mg/kg	483 J	3840	661 J	761 J	787 J	1080 J	1360
Chromium	280 {ca}	1,460 {ca}	65.3	mg/kg	42.1	42.4	57.9	39	38.7	43.3	47.2
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	14.8	16.9	**119**	11.4	14.8	16.6	13.9
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	**57.8**	40.9	**71.1**	**78.1**	40.7	41.2	34.5
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	38,700	41,300	47,600	41,400	36,800	39,000	43,500
Lead	400 {++}	800 {++}	26.8	mg/kg	15.1	20.5	**35.9**	**105**	13.8	16.1	**43.3**
Magnesium	- -	- -	- -	mg/kg	6,220	8,150	7,810	4,850	5,820	5,660	6,630
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	218	286	736	183	216	289	180
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	NA	NA	NA	NA	NA	NA	NA
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	27.6	25.4	33.9	23.2	25.3	25.6	28.2
Potassium	- -	- -	- -	mg/kg	4,870	4,760	5,740	4,080	4,850	4,880	5,610
Selenium	39 {nc}	510 {nc}	- -	mg/kg	1.4	0.8 J	1.1	1.2	0.63 J	0.96 J	0.85 J
Silver	39 {nc}	510 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA
Sodium	- -	- -	- -	mg/kg	54.4 J	54.3 J	58 J	35.6 J	44.8 J	48.1 J	49.9 J
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	0.78 J	0.47 J	ND	ND	ND	ND	ND
Vanadium	55{nc}	720 {nc}	108	mg/kg	77.4	79.9	93.1	78.3	71.6	76.5	86.6
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	39.8	42.6	57.8	91.4	33.8	38.4	41.2

mg/kg	Milligrams per killogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
J	Constituent concentration quanitified as estimated.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 6-2. Soil Analytical Results, Bag Loading Area, 1997 and 1998 Gannett Fleming Independent Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	SS-09 0 - 0.5 06/04/97	SS-14 0 - 0.16 03/31/98	TR-03E 0.04 - 0.16 04/02/98
Explosives							
1,3,5-Trinitrobenzene	220 {nc}	2,700 {nc}	- -	mg/kg	ND	NA	NA
1,3-Dinitrobenzene	0.61 {nc}	6.2 {nc}	- -	mg/kg	ND	NA	NA
2,4,6-Trinitrotoluene	3.6 {ca**}	42 {ca**}	- -	mg/kg	ND	NA	NA
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	ND	NA	NA
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	1.9 C,J	NA	NA
2-Amino-4,6-Dinitrotoluene	15 {nc}	190 {nc}	- -	mg/kg	ND	NA	NA
4-Amino-2,6-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	ND	NA	NA
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	1.9 J	NA	NA
HMX	310 {nc}	3,100 {nc}	- -	mg/kg	ND	NA	NA
m-Nitrotoluene	- -	- -	- -	mg/kg	ND	NA	NA
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	ND	NA	NA
Nitroglycerine	0.61 {nc}	6.2 {nc}	- -	mg/kg	ND	NA	NA
o-Nitrotoluene	78 {nc}	1,300 {sat}	- -	mg/kg	ND	NA	NA
Pentaerythritol Tetranitrate	- -	- -	- -	mg/kg	ND	NA	NA
p-Nitrotoluene	30 {ca**}	110 {ca*}	- -	mg/kg	ND	NA	NA
RDX	4.4 {ca*}	16 {ca}	- -	mg/kg	ND	NA	NA
Tetryl	24 {nc}	250 {nc}	- -	mg/kg	ND	NA	NA
Organochlorine Pesticides							
4,4'-DDD	2 {ca**}	7.2 {ca**}	- -	mg/kg	0.043 I	NA	NA
4,4'-DDE	1.4 {ca**}	5.1 {ca**}	- -	mg/kg	ND	NA	NA
4,4'-DDT	1.7 {ca*}	7 {ca*}	- -	mg/kg	R	NA	NA
Aldrin	0.029 {ca*}	0.1 {ca}	- -	mg/kg	I,R,J	NA	NA
Alpha-BHC	0.077 {ca**}	0.27 {ca**}	- -	mg/kg	ND	NA	NA
Alpha-Chlordane	1.6 {ca**}	6.5 {ca**}	- -	mg/kg	0.089 I	NA	NA
Beta-BHC	0.27 {ca**}	0.96 {ca**}	- -	mg/kg	ND	NA	NA
Delta-BHC	0.52 {ca**}	2.1 {ca**}	- -	mg/kg	ND	NA	NA
Dieldrin	0.03 {ca}	0.11 {ca}	- -	mg/kg	I,R	NA	NA
Endosulfan I	- -	- -	- -	mg/kg	0.022 I	NA	NA
Endosulfan II	37 {nc}	370 {nc}	- -	mg/kg	I,R	NA	NA
Endosulfan Sulfate	- -	- -	- -	mg/kg	ND	NA	NA
Endrin	1.8 {nc}	18 {nc}	- -	mg/kg	I,R	NA	NA
Endrin Aldehyde	1.8 {nc}	18 {nc}	- -	mg/kg	I,R	NA	NA
Endrin Ketone	- -	- -	- -	mg/kg	ND	NA	NA
Gamma-BHC (Lindane)	0.52 {ca*}	2.1 {ca}	- -	mg/kg	ND	NA	NA
Gamma-Chlordane	1.6 {ca**}	6.5 {ca**}	- -	mg/kg	0.01 I	NA	NA
Heptachlor	0.11 {ca}	0.38 {ca}	- -	mg/kg	ND	NA	NA
Heptachlor Epoxide	0.053 {ca*}	0.19 {ca*}	- -	mg/kg	0.015 I	NA	NA
Methoxychlor	31 {nc}	310 {nc}	- -	mg/kg	ND	NA	NA
Toxaphene	0.44 {ca**}	1.6 {ca**}	- -	mg/kg	ND	NA	NA
PCBs							
Aroclor-1016	0.39 {nc}	21 {ca**}	- -	mg/kg	ND	ND	ND
Aroclor-1221	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	ND	ND	ND
Aroclor-1232	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	ND	ND	ND
Aroclor-1242	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	ND	ND	ND
Aroclor-1248	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	ND	ND	ND
Aroclor-1254	0.22 {ca**}	0.74 {ca*}	- -	mg/kg	8.3	ND	0.11
Aroclor-1260	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	ND	ND	ND
Volatile Organics							
1,1,1-Trichloroethane	680	680	- -	mg/kg	ND	ND	NA
1,1,2,2-Tetrachloroethane	0.59	2.9	- -	mg/kg	ND	ND	NA
1,1,2-trichloro-1,2,2-trifluoroethane	940	940	- -	mg/kg	ND	ND	NA
1,1,2-Trichloroethane	1.1	5.5	- -	mg/kg	ND	ND	NA
1,1-Dichloroethane	3.4	17	- -	mg/kg	ND	ND	NA
1,1-Dichloroethene	25	110	- -	mg/kg	ND	ND	NA
1,2,3-Trichlorobenzene	- -	- -	- -	mg/kg	ND	ND	NA
1,2,4-Trichlorobenzene	180	220	- -	mg/kg	ND	ND	NA
1,2-Dibromo-3-chloropropane	0.0056	0.073	- -	mg/kg	ND	ND	NA
1,2-Dibromoethane	0.034	0.17	- -	mg/kg	ND	ND	NA
1,2-Dichlorobenzene	220	220	- -	mg/kg	ND	ND	NA
1,2-Dichloroethane	0.45	2.2	- -	mg/kg	ND	ND	NA
1,2-Dichloropropane	0.93	4.7	- -	mg/kg	ND	ND	NA
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	ND	ND	NA
1,4-Dichlorobenzene	2.6	13	- -	mg/kg	ND	ND	NA
1,4-Dioxane	44	160	- -	mg/kg	ND	ND	NA
2-Butanone	28,000	28,000	- -	mg/kg	ND	ND	NA
2-Hexanone	- -	- -	- -	mg/kg	ND	ND	NA
3-Octanone	- -	- -	- -	mg/kg	ND	ND	NA
4-Methyl-2-pentanone	3,200	3,200	- -	mg/kg	ND	ND	NA
Acetone	6,100	110,000	- -	mg/kg	ND	ND	NA
Benzene	1.1	5.6	- -	mg/kg	ND	ND	NA
Bromochloromethane	- -	- -	- -	mg/kg	ND	ND	NA
Bromodichloromethane	10	46	- -	mg/kg	ND	ND	NA
Bromoform	61	220	- -	mg/kg	ND	ND	NA
Bromomethane	0.79	3.5	- -	mg/kg	ND	ND	NA
Carbon Disulfide	260	260	- -	mg/kg	ND	ND	NA
Carbon Tetrachloride	0.25	1.3	- -	mg/kg	ND	ND	NA
Chlorobenzene	31	860	- -	mg/kg	ND	ND	NA
Chloroethane	2,200	2,200	- -	mg/kg	ND	ND	NA
Chloroform	0.3	1.5	- -	mg/kg	ND	ND	NA
Chloromethane	1.7	8.4	- -	mg/kg	ND	ND	NA
cis-1,2-Dichloroethene	78	1,400	- -	mg/kg	ND	ND	NA
cis-1,3-Dichloropropene	- -	- -	- -	mg/kg	ND	ND	NA
Cyclohexane	120	120	- -	mg/kg	ND	ND	NA
Dibromochloromethane	5.8	21	- -	mg/kg	ND	ND	NA
Dichlorodifluoromethane	19	78	- -	mg/kg	ND	ND	NA

Notes found at end of table.

Table 6-2. Soil Analytical Results, Bag Loading Area, 1997 and 1998 Gannett Fleming Independent Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	SS-09 0 - 0.5 06/04/97	SS-14 0 - 0.16 03/31/98	TR-03E 0.04 - 0.16 04/02/98
Volatile Organics							
d-Limonene	- -	- -	- -	mg/kg	ND	ND	NA
Ethylbenzene	5.7	29	- -	mg/kg	ND	ND	NA
Isopropylbenzene	310	310	- -	mg/kg	ND	ND	NA
m,p-Xylene	- -	- -	- -	mg/kg	ND	ND	NA
Methyl acetate	29,000	29,000	- -	mg/kg	ND	ND	NA
Methyl tert-butyl ether	39	190	- -	mg/kg	ND	ND	NA
Methylcylohexane	71	71	- -	mg/kg	ND	ND	NA
Methylene Chloride	11	54	- -	mg/kg	0.0010 B	0.0020 B	NA
o-Xylene	300	300	- -	mg/kg	ND	ND	NA
Styrene	1,000	1,000	- -	mg/kg	ND	ND	NA
Tetrachloroethene	0.57	2.7	- -	mg/kg	ND	ND	NA
Toluene	930	930	- -	mg/kg	ND	ND	NA
trans-1,2-Dichloroethene	11	50	- -	mg/kg	ND	ND	NA
trans-1,3-Dichloropropene	- -	- -	- -	mg/kg	ND	ND	NA
Trichloroethene	2.8	14	- -	mg/kg	ND	ND	NA
Trichlorofluoromethane	80	1,300	- -	mg/kg	ND	ND	NA
Vinyl Chloride	0.06	1.7	- -	mg/kg	ND	ND	NA
Xylenes (total)	300	300	- -	mg/kg	ND	ND	NA
Semivolatile Organics							
1,2,4-Trichlorobenzene	180	220	- -	mg/kg	ND	ND	ND
1,2-Dichlorobenzene	220	220	- -	mg/kg	ND	ND	ND
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	ND	ND	ND
1,4-Dichlorobenzene	2.6	13	- -	mg/kg	ND	ND	ND
1-Methylnaphthalene	22	99	- -	mg/kg	ND	ND	ND
2,4,5-Trichlorophenol	610	6,200	- -	mg/kg	ND	ND	ND
2,4,6-Trichlorophenol	44	160	- -	mg/kg	ND	ND	ND
2,4-Dichlorophenol	18	180	- -	mg/kg	ND	ND	ND
2,4-Dimethylphenol	120	1,200	- -	mg/kg	ND	ND	ND
2,4-Dinitrophenol	12	120	- -	mg/kg	ND	ND	ND
2,4-Dinitrotoluene	12	120	- -	mg/kg	0.78	ND	ND
2,6-Dinitrotoluene	6.1	62	- -	mg/kg	ND	ND	ND
2-Chloronaphthalene	210	210	- -	mg/kg	ND	ND	ND
2-Chlorophenol	39	510	- -	mg/kg	ND	ND	ND
2-Methylnaphthalene	31	440	- -	mg/kg	0.030 J	ND	ND
2-Methylphenol	310	3,100	- -	mg/kg	ND	ND	ND
2-Nitroaniline	- -	- -	- -	mg/kg	ND	ND	ND
2-Nitrophenol	- -	- -	- -	mg/kg	ND	ND	ND
3,3'-Dichlorobenzidine	1.1	3.8	- -	mg/kg	ND	ND	ND
3-Nitroaniline	- -	- -	- -	mg/kg	ND	ND	ND
4,6-Dinitro-2-methylphenol	- -	- -	- -	mg/kg	ND	ND	ND
4-Bromophenyl-phenylether	- -	- -	- -	mg/kg	ND	ND	ND
4-Chloro-3-Methylphenol	- -	- -	- -	mg/kg	ND	ND	ND
4-Chloroaniline	24	250	- -	mg/kg	ND	ND	ND
4-Chlorophenyl-phenylether	- -	- -	- -	mg/kg	ND	ND	ND
4-Methylphenol	31	310	- -	mg/kg	ND	ND	ND
4-Nitroaniline	- -	- -	- -	mg/kg	ND	ND	ND
4-Nitrophenol	- -	- -	- -	mg/kg	ND	ND	ND
Acenaphthene	340	3,300	- -	mg/kg	0.10 J	ND	ND
Acenaphthylene	340	3,300	- -	mg/kg	0.060 J	ND	ND
Anthracene	1,700	170,000	- -	mg/kg	0.20 J	ND	ND
Benzo(a)anthracene	0.15	2.1	- -	mg/kg	1.1	ND	0.11
Benzo(a)pyrene	0.015	0.21	- -	mg/kg	1.3 K	ND	0.070 J
Benzo(b)fluoranthene	0.15	2.1	- -	mg/kg	1.9 K	ND	0.12 J
Benzo(g,h,i)perylene	170	1,700	- -	mg/kg	0.51 K	ND	ND
Benzo(k)fluoranthene	1.5	21	- -	mg/kg	2.0 K	ND	0.080 J
Benzoic Acid	240,000	2,500,000	- -	mg/kg	ND	ND	0.30 J
Benzyl Alcohol	3,100	310,000	- -	mg/kg	ND	ND	ND
bis(2-Chloroethoxy)methane	18	180	- -	mg/kg	ND	ND	ND
bis(2-Chloroethyl)ether	0.19	0.9	- -	mg/kg	ND	ND	ND
bis(2-Chloroisopropyl)ether	- -	- -	- -	mg/kg	ND	ND	ND
bis(2-Ethylhexyl)phthalate	35	120	- -	mg/kg	0.57	0.050 J	0.10 J
Butylbenzylphthalate	1,200	120,000	- -	mg/kg	ND	ND	ND
Carbazole	24	86	- -	mg/kg	0.40	ND	ND
Chrysene	15	210	- -	mg/kg	1.7	ND	0.11 J
Dibenzo(a,h)anthracene	0.015	0.21	- -	mg/kg	0.20 J,K	ND	ND
Dibenzofuran	- -	- -	- -	mg/kg	0.10	ND	ND
Diethylphthalate	4,900	490,000	- -	mg/kg	ND	ND	ND
Dimethylphthalate	- -	- -	- -	mg/kg	ND	ND	ND
Di-n-Butylphthalate	610	6,200	- -	mg/kg	3.6	ND	ND
Dinitrotoluene Mix	0.71	2.5	- -	mg/kg	0.78	ND	ND
Di-n-Octylphthalate	- -	- -	- -	mg/kg	ND	ND	ND
Fluoranthene	230	2,200	- -	mg/kg	2.9	ND	0.10 J
Fluorene	230	2,200	- -	mg/kg	0.20 J	ND	ND
Hexachlorobenzene	0.3	1.1	- -	mg/kg	ND	ND	ND
Hexachlorobutadiene	6.2	22	- -	mg/kg	ND	ND	ND
Hexachlorocyclopentadiene	37	370	- -	mg/kg	ND	ND	ND
Hexachloroethane	35	120	- -	mg/kg	ND	ND	ND
Indeno(1,2,3-cd)pyrene	0.15	2.1	- -	mg/kg	0.52 K	ND	ND
Isophorone	510	1,800	- -	mg/kg	ND	ND	ND
Naphthalene	3.9 {ca}	20 {ca}	- -	mg/kg	0.10 J	ND	ND
Nitrobenzene	3.1	28	- -	mg/kg	ND	ND	ND
N-Nitroso-di-n-propylamine	0.069	0.25	- -	mg/kg	ND	ND	ND
N-Nitrosodiphenylamine	99	350	- -	mg/kg	0.10 J	ND	ND
Pentachlorophenol	3	9	- -	mg/kg	ND	ND	ND
Phenanthrene	1,700	170,000	- -	mg/kg	2.0	ND	0.10 J
Phenol	1,800	180,000	- -	mg/kg	ND	0.080 J	ND
Pyrene	170	1,700	- -	mg/kg	2.5 C	ND	0.10 J
Pyridine	7.8	100	- -	mg/kg	ND	ND	ND

Notes found at end of table.

Table 6-2. Soil Analytical Results, Bag Loading Area, 1997 and 1998 Gannett Fleming Independent Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	SS-09 0 - 0.5 06/04/97	SS-14 0 - 0.16 03/31/98	TR-03E 0.04 - 0.16 04/02/98
Inorganics							
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	12,400	35,600	NA
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	ND	NA	NA
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	7.60	4.70	NA
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	**10,200 J**	65.8	NA
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	0.700	**1.60**	NA
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	ND	NA	NA
Calcium	- -	- -	- -	mg/kg	77,200	1,460	NA
Chromium	280 {ca}	1,460 {ca}	65.3	mg/kg	56.6	44.0	NA
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	17.2	22.5	NA
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	**13,600**	27.1	NA
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	31,300	40,000	NA
Lead	400 {++}	800 {++}	26.8	mg/kg	**1,970**	14.7	NA
Magnesium	- -	- -	- -	mg/kg	52,600	6,270	NA
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	327	573	NA
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	ND	NA	NA
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	57.1	23.8	NA
Potassium	- -	- -	- -	mg/kg	2,700	4,200	NA
Selenium	39 {nc}	510 {nc}	- -	mg/kg	0.600	NA	NA
Silver	39 {nc}	510 {nc}	- -	mg/kg	ND	NA	NA
Sodium	- -	- -	- -	mg/kg	ND	NA	NA
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	ND	NA	NA
Vanadium	55{nc}	720 {nc}	108	mg/kg	39.6	78.3	NA
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	**5,940**	41.4	NA
Miscellaneous							
pH	- -	- -	- -	pH Units	ND	NA	NA
Total Organic Carbon	- -	- -	- -	mg/kg	ND	NA	NA

mg/kg	Milligrams per killogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 6-3. Conductive Flooring Analytical Results, Bag Loading Area, 1997 and 1998 Gannett Fleming Independent Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Date Collected:	Adjusted Soil Screening Values- Residential [a]	Adjusted Soil Screening Values- Industrial [a]	Facility-Wide Background Values [b]	Units	WS-01 5-JUN-97	WS-04 3-MAR-98	WS-05 3-MAR-98
Organochlorine Pesticides							
4,4'-DDE	1.4 {ca**}	5.1 {ca**}	- -	mg/kg	**0.51**	NA	NA
Alpha-Chlordane	1.6 {ca**}	6.5 {ca**}	- -	mg/kg	**0.45**	NA	NA
Endosulfan I	- -	- -	- -	mg/kg	**0.37**	NA	NA
Endrin	1.8 {nc}	18 {nc}	- -	mg/kg	**0.25**	NA	NA
Endrin Aldehyde	1.8 {nc}	18 {nc}	- -	mg/kg	**0.54**	NA	NA
Endrin Ketone	- -	- -	- -	mg/kg	**0.59**	NA	NA
Heptachlor Epoxide	0.053 {ca*}	0.19 {ca*}	- -	mg/kg	**0.52**	NA	NA
Methoxychlor	31 {nc}	310 {nc}	- -	mg/kg	**4.4**	NA	NA
PCBs							
Aroclor-1254	0.22 {ca**}	0.74 {ca*}	- -	mg/kg	2.80	NA	NA
Volatile Organics							
Acetone	6,100 {nc}	61,000 {nc}	- -	mg/kg	0.02 B	NA	NA
Methylene Chloride	11 {ca}	54 {ca}	- -	mg/kg	0.003 B	NA	NA
Semivolatile Organics							
2-Methylnaphthalene	31	440	- -	mg/kg	0.4 J	NA	NA
Acenaphthylene	340	3,300	- -	mg/kg	4.72	NA	NA
Anthracene	1,700	170,000	- -	mg/kg	16.1	NA	NA
Benzo(a)anthracene	0.15	2.1	- -	mg/kg	20.8	NA	NA
Benzo(a)pyrene	0.015	0.21	- -	mg/kg	22.2	NA	NA
Benzo(b)fluoranthene	0.15	2.1	- -	mg/kg	27.3	NA	NA
Benzo(g,h,i)perylene	170	1,700	- -	mg/kg	17 J	NA	NA
Benzo(k)fluoranthene	1.5	21	- -	mg/kg	18.2	NA	NA
Chrysene	15	210	- -	mg/kg	18	NA	NA
Dibenzo(a,h)anthracene	0.015	0.21	- -	mg/kg	1 J	NA	NA
Dibenzofuran	- -	- -	- -	mg/kg	3 J	NA	NA
Fluoranthene	230	2,200	- -	mg/kg	13.45	NA	NA
Fluorene	230	2,200	- -	mg/kg	4.33	NA	NA
Indeno(1,2,3-cd)pyrene	0.15	2.1	- -	mg/kg	16 J	NA	NA
Naphthalene	3.9 {ca}	20 {ca}	- -	mg/kg	1 J	NA	NA
Phenanthrene	1,700	170,000	- -	mg/kg	24.6	NA	NA
Pyrene	170	1,700	- -	mg/kg	26	NA	NA
Inorganics							
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	3,270	1,190	683
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	9.5	7.8	4.1
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	**4,250 J**	172	54.1
Calcium	- -	- -	- -	mg/kg	90,600	110,000	70,700
Chromium	280 {ca}	1,460 {ca}	65.3	mg/kg	**72.5**	**92.3**	**67.9**
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	13.9	12	10.2
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	**59,600**	**86,000**	**65,500**
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	40,200	32,000	24,600
Lead	400 {++}	800 {++}	26.8	mg/kg	**492**	**214**	**255**
Magnesium	- -	- -	- -	mg/kg	71,600	120,000	140,000
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	231	139	111
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	**130**	**213**	**147**
Potassium	- -	- -	- -	mg/kg	482	633	312
Vanadium	55{nc}	720 {nc}	108	mg/kg	18.8	NA	NA
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	**3,730**	**441**	**187**
Asbestos							
Chrysotile	- -	- -	- -	%	NA	1.6	1.6

mg/kg	Milligrams per killogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
NA	Not Analyzed.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics indicates concentration is above facility-wide background value.

Table 6-4. Conductive Flooring Analytical Results, Bag Loading Area, 2002 US Army Corp of Engineers Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values- Residential [a]	Adjusted Soil Screening Values- Industrial [a]	Facility-Wide Background Values [b]	Units	RFAAP-405 Flooring	RFAAP-407 Flooring	RFAAP-413 Flooring
Explosives							
1,3,5-Trinitrobenzene	220 {nc}	2,700 {nc}	- -	mg/kg	< 0.0032	<0.0028	<0.0028
1,3-Dinitrobenzene	0.61 {nc}	6.2 {nc}	- -	mg/kg	< 0.0032	<0.0028	<0.0028
2,4,6-Trinitrotoluene	3.6 {ca**}	42 {ca**}	- -	mg/kg	< 0.0032	<0.0028	<0.0028
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	< 0.0032	<0.0028	<0.0028
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	< 0.0032	<0.0028	<0.0028
2-Amino-4,6-Dinitrotoluene	15 {nc}	190 {nc}	- -	mg/kg	< 0.0032	<0.0028	<0.0028
4-Amino-2,6-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	< 0.0032	<0.0028	<0.0028
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	< 0.0032	<0.0028	<0.0028
HMX	310 {nc}	3,100 {nc}	- -	mg/kg	< 0.013	< 0.011	< 0.011
m-Nitrotoluene	- -	- -	- -	mg/kg	< 0.0016	< 0.0014	< 0.0014
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	< 0.0016	< 0.0014	< 0.0014
Nitroglycerine	0.61 {nc}	6.2 {nc}	- -	mg/kg	< 0.0032	<0.0028	<0.0028
o-Nitrotoluene	78 {nc}	1,300 {sat}	- -	mg/kg	< 0.0016	< 0.0014	< 0.0014
Pentaerythritol Tetranitrate	- -	- -	- -	mg/kg	< 0.0032	<0.0028	<0.0028
p-Nitrotoluene	30 {ca**}	110 {ca*}	- -	mg/kg	< 0.0016	< 0.0014	< 0.0014
RDX	4.4 {ca*}	16 {ca}	- -	mg/kg	< 0.0064	< 0.0057	< 0.0057
Tetryl	24 {nc}	250 {nc}	- -	mg/kg	< 0.013	< 0.011	< 0.011
Pesticides							
4,4'-DDD	2 {ca**}	7.2 {ca**}	- -	mg/kg	< 0.00029	< 0.00026	< 0.00025
4,4'-DDE	1.4 {ca**}	5.1 {ca**}	- -	mg/kg	**0.00490**	< 0.00023	< 0.0014
4,4'-DDT	1.7 {ca*}	7 {ca*}	- -	mg/kg	**0.01700**	**0.00410**	**0.00340**
Aldrin	0.029 {ca*}	0.1 {ca}	- -	mg/kg	< 0.00037	< 0.00033	< 0.00032
Alpha-BHC	0.077 {ca**}	0.27 {ca**}	- -	mg/kg	< 0.00029	< 0.00026	< 0.00025
Alpha-Chlordane	1.6 {ca**}	6.5 {ca**}	- -	mg/kg	< 0.0017	< 0.0015	< 0.0015
Beta-BHC	0.27 {ca**}	0.96 {ca**}	- -	mg/kg	< 0.00026	< 0.00023	< 0.00022
Delta-BHC	0.52 {ca**}	2.1 {ca**}	- -	mg/kg	< 0.0017	< 0.0015	< 0.0015
Chlordane	- -	- -		mg/kg	< 0.00022	< 0.0002	< 0.00019
Dieldrin	0.03 {ca}	0.11 {ca}	- -	mg/kg	**0.00690**	**0.00098**	**0.00120**
Endosulfan I	- -	- -	- -	mg/kg	< 0.00036	< 0.00032	< 0.00031
Endosulfan II	37 {nc}	370 {nc}	- -	mg/kg	< 0.00026	< 0.00023	< 0.00022
Endosulfan Sulfate	- -	- -	- -	mg/kg	< 0.00022	< 0.0002	< 0.00019
Endrin	1.8 {nc}	18 {nc}	- -	mg/kg	**0.00230**	< 0.00021	< 0.00021
Endrin Aldehyde	1.8 {nc}	18 {nc}	- -	mg/kg	< 0.00031	< 0.00027	< 0.00027
Endrin Ketone	- -	- -	- -	mg/kg	< 0.00019	< 0.00017	< 0.00017
Gamma-BHC (Lindane)	0.52 {ca*}	2.1 {ca}	- -	mg/kg	< 0.00055	< 0.00049	< 0.00048
Gamma-Chlordane	1.6 {ca**}	6.5 {ca**}	- -	mg/kg	< 0.00036	< 0.00032	< 0.00031
Heptachlor	0.11 {ca}	0.38 {ca}	- -	mg/kg	< 0.00041	< 0.00036	< 0.00035
Heptachlor Epoxide	0.053 {ca*}	0.19 {ca*}	- -	mg/kg	< 0.0012	< 0.001	< 0.001
Methoxychlor	31 {nc}	310 {nc}	- -	mg/kg	< 0.00037	< 0.00033	< 0.00032
Toxaphene	0.44 {ca**}	1.6 {ca**}	- -	mg/kg	< 0.021	< 0.018	< 0.018
PCBs							
Aroclor-1016	0.39 {nc}	21 {ca**}	- -	mg/kg	< 0.0042	< 0.0037	< 0.0036
Aroclor-1221	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	< 0.015	< 0.013	< 0.013
Aroclor-1232	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	< 0.024	< 0.021	< 0.021
Aroclor-1242	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	< 0.031	< 0.027	< 0.026
Aroclor-1248	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	< 0.011	< 0.0098	< 0.0096
Aroclor-1254	0.22 {ca**}	0.74 {ca*}	- -	mg/kg	**0.190**	**0.030**	**0.034**
Aroclor-1260	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	< 0.0061	< 0.0054	< 0.0053
Volatile Organics							
1,1,1-Trichloroethane	680	680	- -	mg/kg	< 0.0029	< 0.0026	< 0.0025
1,1,2,2-Tetrachloroethane	0.59	2.9	- -	mg/kg	< 0.0032	< 0.0028	< 0.0028
1,1,2-Trichloroethane	1.1	5.5	- -	mg/kg	< 0.0031	< 0.0027	< 0.0026
1,1-Dichloroethane	3.4	17	- -	mg/kg	< 0.0029	< 0.0026	< 0.0025
1,1-Dichloroethene	25	110	- -	mg/kg	< 0.0023	< 0.002	< 0.0019
1,2-Dichloroethane	0.45	2.2	- -	mg/kg	< 0.0026	< 0.0023	< 0.0022
1,2-Dichloropropane	0.93	4.7	- -	mg/kg	< 0.0029	< 0.0026	< 0.0025
2-Butanone	28,000	28,000	- -	mg/kg	< 0.0061	< 0.0054	< 0.0053
2-Hexanone	- -	- -	- -	mg/kg	< 0.0039	< 0.0034	< 0.0033
4-Methyl-2-pentanone	3,200	3,200	- -	mg/kg	< 0.0039	< 0.0034	< 0.0033
Acetone	6,100	110,000	- -	mg/kg	< 0.0027	< 0.0024	< 0.0024
Benzene	1.1	5.6	- -	mg/kg	< 0.0029	< 0.0026	< 0.0025
Bromochloromethane	- -	- -	- -	mg/kg	< 0.0027	< 0.0024	< 0.0024
Bromoform	61	220	- -	mg/kg	< 0.0023	< 0.002	< 0.0019
Bromomethane	0.79	3.5	- -	mg/kg	< 0.0029	< 0.0026	< 0.0025
Carbon Disulfide	260	260	- -	mg/kg	< 0.0023	< 0.002	< 0.0019
Carbon Tetrachloride	0.25	1.3	- -	mg/kg	< 0.0031	< 0.0027	< 0.0026

Notes found at end of table.

Table 6-4. Conductive Flooring Analytical Results, Bag Loading Area, 2002 US Army Corp of Engineers Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values- Residential [a]	Adjusted Soil Screening Values- Industrial [a]	Facility-Wide Background Values [b]	Units	RFAAP-405 Flooring	RFAAP-407 Flooring	RFAAP-413 Flooring
Volatile Organics							
Chlorobenzene	31	860	- -	mg/kg	< 0.0029	< 0.0026	< 0.0025
Chloroethane	2,200	2,200	- -	mg/kg	< 0.0032	< 0.0028	< 0.0028
Chloroform	0.3	1.5	- -	mg/kg	< 0.0031	< 0.0027	< 0.0026
Chloromethane	1.7	8.4	- -	mg/kg	< 0.0031	< 0.0027	< 0.0026
cis-1,2-Dichloroethene	78	1,400	- -	mg/kg	< 0.0029	< 0.0026	< 0.0025
cis-1,3-Dichloropropene	- -	- -	- -	mg/kg	< 0.0019	< 0.0017	< 0.0017
Dichlorodifluoromethane	19	78	- -	mg/kg	< 0.0024	< 0.0021	< 0.0021
Ethylbenzene	5.7	29	- -	mg/kg	< 0.0031	< 0.0027	< 0.0026
m,p-Xylene	- -	- -	- -	mg/kg	< 0.0056	< 0.005	< 0.0048
Methylene Chloride	11	54	- -	mg/kg	**0.013**	**0.011**	**0.012**
o-Xylene	300	300	- -	mg/kg	< 0.0026	< 0.0023	< 0.0022
Styrene	1,000	1,000	- -	mg/kg	< 0.0027	< 0.0024	< 0.0024
Tetrachloroethene	0.57	2.7	- -	mg/kg	< 0.0029	< 0.0026	< 0.0025
Toluene	930	930	- -	mg/kg	< 0.0026	< 0.0023	< 0.0022
trans-1,2-Dichloroethene	11	50	- -	mg/kg	< 0.0023	< 0.002	< 0.0019
trans-1,3-Dichloropropene	- -	- -	- -	mg/kg	< 0.0019	< 0.0017	< 0.0017
Trichloroethene	2.8	14	- -	mg/kg	< 0.0018	< 0.0016	< 0.0016
Vinyl Chloride	0.06	1.7	- -	mg/kg	< 0.0032	< 0.0028	< 0.0028
Xylenes (total)	300	300	- -	mg/kg	ND	ND	ND
Semivolatile Organics							
1,2,4-Trichlorobenzene	180 {ca**}	220 {sat}	- -	mg/kg	< 0.053	< 0.047	< 0.046
1,2-Dichlorobenzene	220 {sat}	220 {sat}	- -	mg/kg	< 0.056	< 0.05	< 0.048
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	< 0.051	< 0.045	< 0.044
1,4-Dichlorobenzene	2.6 {ca}	13 {ca}	- -	mg/kg	< 0.048	< 0.043	< 0.042
2,2-Oxybis(1-Chloropropane)	- -	- -	- -	mg/kg	< 0.055	< 0.048	< 0.047
2,4,5-Trichlorophenol	610 {nc}	6,200 {nc}	- -	mg/kg	< 0.10	< 0.092	< 0.09
2,4,6-Trichlorophenol	44 {ca**}	160 {ca**}	- -	mg/kg	< 0.10	< 0.091	< 0.089
2,4-Dichlorophenol	18 {nc}	180 {nc}	- -	mg/kg	< 0.071	< 0.062	< 0.061
2,4-Dimethylphenol	120 {nc}	1,200 {nc}	- -	mg/kg	< 0.22	< 0.2	< 0.19
2,4-Dinitrophenol	12 {nc}	120 {nc}	- -	mg/kg	< 0.14	< 0.12	< 0.12
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	< 0.071	< 0.062	< 0.061
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	< 0.059	< 0.053	< 0.051
2-Chloronaphthalene	210 {sat}	210 {sat}	- -	mg/kg	< 0.056	< 0.05	< 0.048
2-Chlorophenol	39 {nc}	510 {nc}	- -	mg/kg	< 0.077	< 0.068	< 0.066
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	< 0.051	< 0.045	< 0.044
2-Methylphenol	310 {nc}	3,100 {nc}	- -	mg/kg	< 0.092	< 0.081	< 0.079
2-Nitroaniline	- -	- -	- -	mg/kg	< 0.063	< 0.055	< 0.054
2-Nitrophenol	- -	- -	- -	mg/kg	< 0.11	< 0.097	< 0.094
3,3'-Dichlorobenzidine	1.1 {ca**}	3.8 {ca**}	- -	mg/kg	< 0.071	< 0.062	< 0.061
3-Nitroaniline	- -	- -	- -	mg/kg	< 0.063	< 0.055	< 0.054
4,6-Dinitro-2-methylphenol	- -	- -	- -	mg/kg	< 0.22	< 0.2	< 0.19
4-Bromophenyl-phenylether	- -	- -	- -	mg/kg	< 0.039	< 0.034	< 0.033
4-Chloro-3-Methylphenol	- -	- -	- -	mg/kg	< 0.066	< 0.058	< 0.057
4-Chloroaniline	24 {nc}	250 {nc}	- -	mg/kg	< 0.016	< 0.014	< 0.013
4-Chlorophenyl-phenylether	- -	- -	- -	mg/kg	< 0.039	< 0.034	< 0.033
4-Methylphenol	31 {nc}	310 {nc}	- -	mg/kg	< 0.11	< 0.098	< 0.096
4-Nitroaniline	- -	- -	- -	mg/kg	< 0.10	< 0.088	< 0.086
4-Nitrophenol	- -	- -	- -	mg/kg	< 0.18	< 0.16	< 0.15
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	< 0.066	< 0.058	< 0.057
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	< 0.18	< 0.16	< 0.15
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	< 0.079	< 0.07	< 0.068
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	< 0.051	< 0.045	< 0.044
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	< 0.045	< 0.04	< 0.039
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	< 0.11	< 0.099	< 0.097
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	< 0.11	< 0.099	< 0.097
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	< 0.087	< 0.077	< 0.075
Benzyl Butyl Phthalate			- -	mg/kg	< 0.055	< 0.048	< 0.047
bis(2-Chloroethoxy)methane	18 {nc}	180 {nc}	- -	mg/kg	< 0.047	< 0.041	< 0.04
bis(2-Chloroethyl)ether	0.19 {ca**}	0.9 {ca**}	- -	mg/kg	< 0.051	< 0.045	< 0.044
bis(2-Ethylhexyl)phthalate	35 {ca*}	120 {ca*}	- -	mg/kg	**0.08**	**0.097**	**0.052**
Carbazole	24 {ca**}	86 {ca**}	- -	mg/kg	< 0.061	< 0.054	< 0.053
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	< 0.069	< 0.061	< 0.06
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	< 0.09	< 0.08	< 0.078
Dibenzofuran	- -	- -	- -	mg/kg	< 0.059	< 0.053	< 0.051
Diethylphthalate	4,900 {nc}	490,000 {max}	- -	mg/kg	< 0.19	< 0.17	< 0.17
Dimethylphthalate	- -	- -	- -	mg/kg	< 0.18	< 0.16	< 0.15
Di-n-Butylphthalate	610 {nc}	6,200 {nc}	- -	mg/kg	**0.100 J**	**0.074 J**	**0.120 J**
Di-n-Octylphthalate	- -	- -	- -	mg/kg	< 0.071	< 0.062	< 0.061
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	< 0.12	< 0.1	< 0.1
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	< 0.082	< 0.072	< 0.071
Hexachlorobenzene	0.3 {ca}	1.1 {ca}	- -	mg/kg	< 0.048	< 0.043	< 0.042
Hexachlorobutadiene	6.2 {ca**}	22 {ca*}	- -	mg/kg	< 0.51	< 0.45	< 0.44

Notes found at end of table.

Table 6-4. Conductive Flooring Analytical Results, Bag Loading Area, 2002 US Army Corp of Engineers Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	RFAAP-405 Flooring	RFAAP-407 Flooring	RFAAP-413 Flooring
Semivolatile Organics							
Hexachlorocyclopentadiene	37 {nc}	370 {nc}	- -	mg/kg	< 0.15	< 0.13	< 0.13
Hexachloroethane	35 {ca**}	120 {ca**}	- -	mg/kg	< 0.061	< 0.054	< 0.053
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	< 0.084	< 0.074	< 0.072
Isophorone	510 {ca*}	1,800 {ca*}	- -	mg/kg	< 0.058	< 0.051	< 0.05
Naphthalene	3.9 {ca}	20 {ca}	- -	mg/kg	< 0.071	< 0.062	< 0.061
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	< 0.061	< 0.054	< 0.053
N-Nitroso-di-n-propylamine	0.069 {ca**}	0.25 {ca**}	- -	mg/kg	< 0.051	< 0.045	< 0.044
N-Nitrosodiphenylamine	99 {ca**}	350 {ca**}	- -	mg/kg	< 0.032	< 0.028	< 0.028
Pentachlorophenol	3 {ca}	9 {ca}	- -	mg/kg	< 0.17	< 0.15	< 0.14
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	< 0.066	< 0.058	< 0.057
Phenol	1,800 {nc}	180,000 {max}	- -	mg/kg	< 0.043	< 0.038	< 0.037
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	< 0.11	< 0.097	< 0.094
Inorganics							
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	1,270	1,230	8,330
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	< 5.1	< 5.1	<5.4
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	5.3	5.5	10.2
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	149	36	80
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	0.58	0.31	0.97
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	**6.8**	**3.5**	**9.3**
Calcium	- -	- -	- -	mg/kg	**97,600**	**88,300**	**76,400**
Chromium	280 {ca}	1,460 {ca}	65.3	mg/kg	**95.4**	**102.0**	**91.7**
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	12.2	12.1	14.6
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	**120,000**	**112,000**	**80,600**
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	32,500	33,600	41,900
Lead	400 {++}	800 {++}	26.8	mg/kg	**268**	**273**	**289**
Magnesium	- -	- -	- -	mg/kg	**126,000**	**111,000**	**125,000**
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	166	150	290
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	< 0.02	< 0.02	< 0.02
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	**188**	**212**	**143**
Potassium	- -	- -	- -	mg/kg	**428**	**281**	**1,250**
Selenium	39 {nc}	510 {nc}	- -	mg/kg	< 1.3	< 1.3	<1.4
Silver	39 {nc}	510 {nc}	- -	mg/kg	**4.3**	**2.6**	**3.5**
Sodium	- -	- -	- -	mg/kg	**365**	**320**	ND
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	< 3.5	< 3.5	<3.7
Vanadium	55{nc}	720 {nc}	108	mg/kg	3.2	3.4	30.5
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	**460**	**430**	**306**
Asbestos							
Chrysotile	- -	- -	- -	%	2	2	2

mg/kg	Milligrams per kilogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics indicates concentration is above facility-wide background value.

Table 6-5. Soil Analytical Results, Bag Loading Area, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	BLASB01 0 - 0.5 06/11/02	BLASB01 2 - 4 06/20/02	BLASB02 0 - 0.5 06/11/02	BLASB02 2 - 4 06/20/02	BLASB03 0 - 0.5 06/11/02	BLASB03 2 - 4 06/20/02	BLASS01 0 - 0.5 06/11/02	BLASS02 0 - 0.5 06/11/02	BLASS03 0 - 0.5 06/11/02	BLASS04 0 - 0.5 06/11/02	BLASS02 0 - 0.5 06/11/02	BLASS05 0 - 0.5 06/11/02	BLASS06 0 - 0.5 06/11/02	BLASS07 0 - 0.5 06/11/02	BLASS08 0 - 0.5 06/11/02	BLASS09 0 - 0.5 06/11/02	BLASS10 0 - 0.5 06/11/02	BLASS11 0 - 0.5 06/11/02	BLATR01 0 - 0.5 06/20/02	BLATR02 0 - 0.5 06/20/02	BLATR03 0 - 0.5 06/20/02
Explosives																									
1,3,5-Trinitrobenzene	220 {nc}	2,700 {nc}	- -	mg/kg	<0.1	<0.1 [<0.1]	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.07 J	<0.1	<0.1	<0.1	<0.1 [<0.1]	<0.1	NA	NA	NA
1,3-Dinitrobenzene	0.61 {nc}	6.2 {nc}	- -	mg/kg	<0.1	<0.1 [<0.1]	<0.1	<0.1	<0.2	<0.1	<0.1	0.05 J	<0.1	<0.1	0.05 J	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 [<0.1]	<0.1	NA	NA	NA
2,4,6-Trinitrotoluene	3.6 {ca**}	42 {ca**}	- -	mg/kg	<0.2	<0.2 [<0.2]	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	0.06 J	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2 [<0.2]	<0.2	NA	NA	NA
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.2	<0.2 [<0.2]	0.05 J	<0.2	0.43 K	<0.2	<0.2	0.26	2.99	0.08 J	0.26	0.08 J	<0.2	<0.2	0.25	0.04 K	<0.2 [<0.2]	<0.2	NA	NA	NA
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	<0.2	<0.2 [<0.2]	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	0.32	<0.2	<0.2	<0.2	0.07 J	<0.2	<0.2	<0.2	<0.2 [<0.2]	<0.2	NA	NA	NA
2-Amino-4,6-Dinitrotoluene	15 {nc}	190 {nc}	- -	mg/kg	<0.2	<0.2 [<0.2]	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2 [<0.2]	<0.2	NA	NA	NA
4-Amino-2,6-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.2	<0.2 [<0.2]	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	0.07 K	<0.2	<0.2	<0.2	<0.2	0.06 K	0.04 K	<0.2	<0.2 [<0.2]	<0.2	NA	NA	NA
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	<0.2	<0.2 [<0.2]	0.05 J	<0.2	0.43	<0.2	<0.2	0.26	3.31	0.08 J	0.26	0.08 J	0.07 J	<0.2	0.25	0.04	<0.2 [<0.2]	<0.2	NA	NA	NA
HMX	310 {nc}	3,100 {nc}	- -	mg/kg	<0.2	<0.2 [<0.2]	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2 [<0.2]	<0.2	NA	NA	NA
m-Nitrotoluene	- -	- -	- -	mg/kg	<0.4	<0.4 [<0.4]	<0.4	<0.4	<0.8	<0.4	<0.4	<0.4	<0.4	2.86	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4 [<0.4]	<0.4	NA	NA	NA
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	<0.2	<0.2 [<0.2]	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2 [<0.2]	<0.2	NA	NA	NA
Nitroglycerine	0.61 {nc}	6.2 {nc}	- -	mg/kg	<0.34	<0.41 [<0.38]	<0.35	<0.47	<0.68	<0.39	<0.34	<0.31	<0.72	<0.39	<0.31	<0.31	<0.72	<0.69	<0.7	<0.37	<0.36 [<0.37]	0.21 J	NA	NA	NA
o-Nitrotoluene	78 {nc}	1,300 {sat}	- -	mg/kg	<0.4	<0.4 [<0.4]	<0.4	<0.4	<0.8	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4 [<0.4]	<0.4	NA	NA	NA
Pentaerythritol Tetranitrate	- -	- -	- -	mg/kg	<0.34	<0.41 [<0.38]	<0.35	<0.47	<0.68	<0.39	<0.34	<0.31	<0.72	<0.39	<0.31	<0.31	<0.72	<0.69	<0.7	<0.37	<0.36 [<0.37]	<0.36	NA	NA	NA
p-Nitrotoluene	30 {ca**}	110 {ca*}	- -	mg/kg	<0.4	<0.4 [<0.4]	<0.4	<0.4	<0.8	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4 [<0.4]	<0.4	NA	NA	NA
RDX	4.4 {ca*}	16 {ca}	- -	mg/kg	<0.2	<0.2 [<0.2]	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2 [<0.2]	<0.2	NA	NA	NA
Tetryl	24 {nc}	250 {nc}	- -	mg/kg	<0.2	<0.2 [<0.2]	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2 [<0.2]	<0.2	NA	NA	NA
Herbicides																									
2,4,5-T	61	620	- -	mg/kg	NA	NA	<0.12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.121 [<0.124]	NA	NA	NA	NA
2,4,5-TP	49	490	- -	mg/kg	NA	NA	<0.12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.121 [<0.124]	NA	NA	NA	NA
2,4-D	69	770	- -	mg/kg	NA	NA	<0.239	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.243 [<0.249]	NA	NA	NA	NA
2,4-DB	49	490	- -	mg/kg	NA	NA	<1.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<1.21 [<1.24]	NA	NA	NA	NA
Dalapon	180	1,800	- -	mg/kg	NA	NA	<1.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<1.21 [<1.24]	NA	NA	NA	NA
Dicamba	180	1,800	- -	mg/kg	NA	NA	<0.239	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.243 [<0.249]	NA	NA	NA	NA
Dichlorprop	- -	- -	- -	mg/kg	NA	NA	<0.239	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.243 [<0.249]	NA	NA	NA	NA
Dinoseb	6.1	62	- -	mg/kg	NA	NA	<0.239	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.243 [<0.249]	NA	NA	NA	NA
MCPA	3.1	31	- -	mg/kg	NA	NA	<120	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<121 [<124]	NA	NA	NA	NA
MCPP	6.1	62	- -	mg/kg	NA	NA	<120	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<121 [<124]	NA	NA	NA	NA
Organochlorine Pesticides																									
4,4'-DDD	2 {ca**}	7.2 {ca**}	- -	mg/kg	NA	NA	<0.00798	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00574 J [0.00627 J]	NA	NA	NA	NA
4,4'-DDE	1.4 {ca**}	5.1 {ca**}	- -	mg/kg	NA	NA	<0.00798	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00809 [<0.0083]	NA	NA	NA	NA
4,4'-DDT	1.7 {ca*}	7 {ca*}	- -	mg/kg	NA	NA	<0.00798	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00809 [<0.0083]	NA	NA	NA	NA
Aldrin	0.029 {ca*}	0.1 {ca}	- -	mg/kg	NA	NA	<0.00798	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00809 [<0.0083]	NA	NA	NA	NA
Alpha-BHC	0.077 {ca**}	0.27 {ca**}	- -	mg/kg	NA	NA	<0.00798	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00809 [<0.0083]	NA	NA	NA	NA
Alpha-Chlordane	1.6 {ca**}	6.5 {ca**}	- -	mg/kg	NA	NA	<0.00798	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00809 [<0.0083]	NA	NA	NA	NA
Beta-BHC	0.27 {ca**}	0.96 {ca**}	- -	mg/kg	NA	NA	<0.00798	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00809 [<0.0083]	NA	NA	NA	NA
Delta-BHC	0.52 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	<0.00798	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00809 [<0.0083]	NA	NA	NA	NA
Dieldrin	0.03 {ca}	0.11 {ca}	- -	mg/kg	NA	NA	<0.00798 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00809 J [<0.0083 J]	NA	NA	NA	NA
Endosulfan I	- -	- -	- -	mg/kg	NA	NA	<0.00798	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00809 [<0.0083]	NA	NA	NA	NA
Endosulfan II	37 {nc}	370 {nc}	- -	mg/kg	NA	NA	<0.00798	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00809 [<0.0083]	NA	NA	NA	NA
Endosulfan Sulfate	- -	- -	- -	mg/kg	NA	NA	<0.00798	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00809 [<0.0083]	NA	NA	NA	NA
Endrin	1.8 {nc}	18 {nc}	- -	mg/kg	NA	NA	<0.00798	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00809 [<0.0083]	NA	NA	NA	NA
Endrin Aldehyde	1.8 {nc}	18 {nc}	- -	mg/kg	NA	NA	<0.00798 L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00809 L [<0.0083 L]	NA	NA	NA	NA
Endrin Ketone	- -	- -	- -	mg/kg	NA	NA	<0.00798	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00809 [<0.0083]	NA	NA	NA	NA
Gamma-BHC (Lindane)	0.52 {ca*}	2.1 {ca}	- -	mg/kg	NA	NA	<0.00798 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00809 J [<0.0083 J]	NA	NA	NA	NA
Gamma-Chlordane	1.6 {ca**}	6.5 {ca**}	- -	mg/kg	NA	NA	<0.00798	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00809 [<0.0083]	NA	NA	NA	NA
Heptachlor	0.11 {ca}	0.38 {ca}	- -	mg/kg	NA	NA	<0.00798	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00809 [<0.0083]	NA	NA	NA	NA
Heptachlor Epoxide	0.053 {ca*}	0.19 {ca*}	- -	mg/kg	NA	NA	<0.00798	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00809 [<0.0083]	NA	NA	NA	NA
Methoxychlor	31 {nc}	310 {nc}	- -	mg/kg	NA	NA	0.0674 K	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00809 [<0.0083]	NA	NA	NA	NA
Toxaphene	0.44 {ca**}	1.6 {ca**}	- -	mg/kg	NA	NA	<0.398	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.404 [<0.414]	NA	NA	NA	NA
PAHs																									
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	0.0035 B	<0.0023 [0.0013 B]	NA	NA	NA	NA	0.013	0.0022 B	NA	NA	0.0022 B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	0.0015 B	<0.0023 [<0.0022]	NA	NA	NA	NA	0.0017 B	<0.0018	NA	NA	<0.0018	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	0.019	<0.0023 [<0.0022]	NA	NA	NA	NA	0.0022	0.00076 J	NA	NA	0.00076 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.0053	<0.0023 [<0.0022]	NA	NA	NA	NA	0.0035	0.0013 J	NA	NA	0.0013 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.072	<0.0023 [<0.0022]	NA	NA	NA	NA	0.029	0.016	NA	NA	0.016	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	0.074	<0.0023 [<0.0022]	NA	NA	NA	NA	0.030	0.017	NA	NA	0.017	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.11	<0.0023 [<0.0022]	NA	NA	NA	NA	0.059	0.033	NA	NA	0.033	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	0.062	<0.0023 [<0.0022]	NA	NA	NA	NA	0.024	0.018	NA	NA	0.018	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	0.040	<0.0023 [<0.0022]	NA	NA	NA	NA	0.016	0.0086	NA	NA	0.0086	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	0.068	<0.0023 [<0.0022]	NA	NA	NA	NA	0.038	0.021	NA	NA	0.021	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	0.015	<0.0023 [<0.0022]	NA	NA	NA	NA	0.0063	0.0039	NA	NA	0.0039	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	0.13	<0.0023 [<0.0022]	NA	NA	NA	NA	0.062	0.047	NA	NA	0.047	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	0.0025	<0.0023 [0.00085 J]	NA	NA	NA	NA	0.0019 J	0.0011 J	NA	NA	0.0011 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.072	<0.0023 [<0.0022]	NA	NA	NA	NA	0.026	0.020	NA	NA	0.020	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	3.9 {nc}	20 {nc}	- -	mg/kg	0.0034 B	0.0040 B [0.0043 B]	NA	NA	NA	NA	0.012	0.0019 B	NA	NA	0.0019 B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.034	<0.0023 [<0.0022]	NA	NA	NA	NA	0.033	0.019	NA	NA	0.019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	0.11	<0.0023 [<0.0022]	NA	NA	NA	NA	0.045	0.027	NA	NA	0.027	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCBs																									
Aroclor-1016	0.39 {nc}	21 {ca**}	- -	mg/kg	<0.030	<0.040 [<0.040]	<0.030	NA	NA	NA	<0.030	<0.030	NA	NA	<0.030	NA	NA	NA	NA	NA	<0.040 [<0.040]	NA	<0.030	<0.040	<0.030
Aroclor-1221	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.070	<0.090 [<0.080]	<0.070	NA	NA	NA	<0.070	<0.060	NA	NA	<0.060	NA	NA	NA	NA	NA	<0.080 [<0.080]	NA	<0.070	<0.080	<0.070
Aroclor-1232	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.030	<0.040 [<0.040]	<0.030	NA	NA	NA	<0.030	<0.030	NA	NA	<0.030	NA	NA	NA	NA	NA	<0.040 [<0.040]	NA	<0.030	<0.040	<0.030
Aroclor-1242	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.030	<0.040 [<0.040]	<0.030	NA	NA	NA	<0.030	<0.030	NA	NA	<0.030	NA	NA	NA	NA	NA	<0.040 [<0.040]	NA	<0.030	<0.040	<0.030
Aroclor-1248	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.030	<0.040 [<0.040]	<0.030	NA	NA	NA	<0.030	<0.030	NA	NA	<0.030	NA	NA	NA	NA	NA	<0.040 [<0.040]	NA	<0.030	<0.040	<0.030
Aroclor-1254	0.22 {ca**}	0.74 {ca*}	- -	mg/kg	<0.030	<0.040 [<0.040]	<0.030	NA	NA	NA	3.2	0.060	NA	NA	0.060	NA	NA	NA	NA	NA	<0.040 [<0.040]	NA	0.040	5.7	<0.030
Aroclor-1260	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.030	<0.040 [<0.040]	<0.030	NA	NA	NA	<0.030	<0.030	NA	NA	<0.030	NA	NA	NA	NA	NA	<0.040 [<0.040]	NA	<0.030	<0.040	<0.030
Volatile Organics																									
1,1,1-Trichloroethane	680	680	- -	mg/kg	<0.0057	<0.0069 [<0.0064]	<0.0066	<0.0079	<0.0074	<0.0059	<0.0058	<0.0067	<0.0066	NA	<0.0067	<0.0088	<0.0066	<0.0070	NA	<0.0055	<0.0061 [<0.0056]	<0.0068	NA	NA	NA
1,1,2,2-Tetrachloroethane	0.59	2.9	- -	mg/kg	<0.0057	<0.0069 [<0.0064]	<0.0066	<0.0079	<0.0074	<0.0059	<0.0058	<0.0067	<0.0066	NA	<0.0067	<0.0088	<0.0066	<0.0070	NA	<0.0055	<0.0061 [<0.0056]	<0.0068	NA	NA	NA
1,1,2-trichloro-1,2,2-trifluoroethan	940	940	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	1.1	5.5	- -	mg/kg	<0.0057	<0.0069 [<0.0064]	<0.0066	<0.0079	<0.0074	<0.0059	<0.0058	<0.0067	<0.0066	NA	<0.0067	<0.0088	<0.0066	<0.0070	NA	<0.0055	<0.0061 [<0.0056]	<0.0068	NA	NA	NA
1,1-Dichloroethane	3.4	17	- -	mg/kg	<0.0057	<0.0069 [<0.0064]	<0.0066	<0.0079	<0.0074	<0.0059	<0.0058	<0.0067	<0.0066	NA	<0.0067	<0.0088	<0.0066	<0.0070	NA	<0.0055	<0.0061 [<0.0056]	<0.0068	NA	NA	NA
1,1-Dichloroethene	25	110	- -	mg/kg	<0.0057	<0.0069 [<0.0064]	<0.0066	<0.0079	<0.0074	<0.0059	<0.0058	<0.0067	<0.0066	NA	<0.0067	<0.0088	<0.0066	<0.0070	NA	<0.0055	<0.0061 [<0.0056]	<0.0068	NA	NA	NA

Notes found at end of table.

Table 6-5. Soil Analytical Results, Bag Loading Area, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values- Residential [a]	Adjusted Soil Screening Values- Industrial [a]	Facility-Wide Background Values [b]	Units	BLASB01 0 - 0.5 06/11/02	BLASB01 2 - 4 06/20/02	BLASB02 0 - 0.5 06/11/02	BLASB02 2 - 4 06/20/02	BLASB03 0 - 0.5 06/11/02	BLASB03 2 - 4 06/20/02	BLASS01 0 - 0.5 06/11/02	BLASS02 0 - 0.5 06/11/02	BLASS03 0 - 0.5 06/11/02	BLASS04 0 - 0.5 06/11/02	BLASS02 0 - 0.5 06/11/02	BLASS05 0 - 0.5 06/11/02	BLASS06 0 - 0.5 06/11/02	BLASS07 0 - 0.5 06/11/02	BLASS08 0 - 0.5 06/11/02	BLASS09 0 - 0.5 06/11/02	BLASS10 0 - 0.5 06/11/02	BLASS11 0 - 0.5 06/11/02	BLATR01 0 - 0.5 06/20/02	BLATR02 0 - 0.5 06/20/02	BLATR03 0 - 0.5 06/20/02
Volatile Organics																									
1,2,3-Trichlorobenzene	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	180	220	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dibromo-3-chloropropane	0.0056	0.073	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dibromoethane	0.034	0.17	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	220	220	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	0.45	2.2	- -	mg/kg	<0.0057	<0.0069 [<0.0064]	<0.0066	<0.0079	<0.0074	<0.0059	<0.0058	<0.0067	<0.0066	NA	<0.0067	<0.0088	<0.0066	<0.0070	NA	<0.0055	<0.0061 [<0.0056]	<0.0068	NA	NA	NA
1,2-Dichloropropane	0.93	4.7	- -	mg/kg	<0.0057	<0.0069 [<0.0064]	<0.0066	<0.0079	<0.0074	<0.0059	<0.0058	<0.0067	<0.0066	NA	<0.0067	<0.0088	<0.0066	<0.0070	NA	<0.0055	<0.0061 [<0.0056]	<0.0068	NA	NA	NA
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	2.6	13	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Dioxane	44	160	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone	28,000	28,000	- -	mg/kg	<0.0057 J	<0.0069 [<0.0064]	<0.0066 J	<0.0079	<0.0074 J	<0.0059	<0.0058 J	<0.0067 J	<0.0066 J	NA	<0.0067 J	<0.0088 J	<0.0066 J	<0.0070 J	NA	<0.0055 J	<0.0061 J [<0.0056 J]	<0.0068 J	NA	NA	NA
2-Hexanone	- -	- -	- -	mg/kg	<0.0057 J	<0.0069 [<0.0064]	<0.0066 J	<0.0079	<0.0074 J	<0.0059	<0.0058 J	<0.0067 J	<0.0066 J	NA	<0.0067 J	<0.0088 J	<0.0066 J	<0.0070 J	NA	<0.0055 J	<0.0061 J [<0.0056 J]	<0.0068 J	NA	NA	NA
3-Octanone	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.011 J	NA	NA	NA	NA	NA	NA	NA
4-Methyl-2-pentanone	3,200	3,200	- -	mg/kg	<0.0057	<0.0069 [<0.0064]	<0.0066	<0.0079	<0.0074	<0.0059	<0.0058	<0.0067	<0.0066	NA	<0.0067	<0.0088	<0.0066	<0.0070	NA	<0.0055	<0.0061 [<0.0056]	<0.0068	NA	NA	NA
Acetone	6,100	110,000	- -	mg/kg	<0.0057 J	<0.0069 [<0.0064]	<0.0066 J	<0.0079	<0.0074 J	<0.0059	<0.0058 J	<0.0067 J	<0.0066 J	NA	<0.0067 J	<0.0088 J	<0.0066 J	0.023 B	NA	<0.0055 J	<0.0061 J [<0.0056 J]	<0.0068 J	NA	NA	NA
Benzene	1.1	5.6	- -	mg/kg	<0.0057	<0.0069 [<0.0064]	<0.0066	<0.0079	<0.0074	<0.0059	<0.0058	<0.0067	<0.0066	NA	<0.0067	<0.0088	<0.0066	<0.0070	NA	<0.0055	<0.0061 [<0.0056]	<0.0068	NA	NA	NA
Bromochloromethane	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromodichloromethane	10	46	- -	mg/kg	<0.0057	<0.0069 [<0.0064]	<0.0066	<0.0079	<0.0074	<0.0059	<0.0058	<0.0067	<0.0066	NA	<0.0067	<0.0088	<0.0066	<0.0070	NA	<0.0055	<0.0061 [<0.0056]	<0.0068	NA	NA	NA
Bromoform	61	220	- -	mg/kg	<0.0057	<0.0069 L [<0.0064 L]	<0.0066	<0.0079 L	<0.0074	<0.0059 L	<0.0058	<0.0067	<0.0066	NA	<0.0067	<0.0088	<0.0066	<0.0070	NA	<0.0055	<0.0061 [<0.0056]	<0.0068	NA	NA	NA
Bromomethane	0.79	3.5	- -	mg/kg	<0.0057	<0.0069 [<0.0064]	<0.0066	<0.0079	<0.0074	<0.0059	<0.0058	<0.0067	<0.0066	NA	<0.0067	<0.0088	<0.0066	<0.0070	NA	<0.0055	<0.0061 [<0.0056]	<0.0068	NA	NA	NA
Carbon Disulfide	260	260	- -	mg/kg	<0.0057	0.0016 B [<0.0064]	<0.0066	<0.0079	<0.0074	0.00043 B	<0.0058	<0.0067	<0.0066	NA	<0.0067	<0.0088	<0.0066	<0.0070	NA	<0.0055	<0.0061 [<0.0056]	<0.0068	NA	NA	NA
Carbon Tetrachloride	0.25	1.3	- -	mg/kg	<0.0057	<0.0069 [<0.0064]	<0.0066	<0.0079	<0.0074	<0.0059	<0.0058	<0.0067	<0.0066	NA	<0.0067	<0.0088	<0.0066	<0.0070	NA	<0.0055	<0.0061 [<0.0056]	<0.0068	NA	NA	NA
Chlorobenzene	31	860	- -	mg/kg	<0.0057	<0.0069 [<0.0064]	<0.0066	<0.0079	<0.0074	<0.0059	<0.0058	<0.0067	<0.0066	NA	<0.0067	<0.0088	<0.0066	<0.0070	NA	<0.0055	<0.0061 [<0.0056]	<0.0068	NA	NA	NA
Chloroethane	2,200	2,200	- -	mg/kg	<0.0057	<0.0069 [<0.0064]	<0.0066	<0.0079	<0.0074	<0.0059	<0.0058	<0.0067	<0.0066	NA	<0.0067	<0.0088	<0.0066	<0.0070	NA	<0.0055	<0.0061 [<0.0056]	<0.0068	NA	NA	NA
Chloroform	0.3	1.5	- -	mg/kg	<0.0057	<0.0069 [<0.0064]	<0.0066	<0.0079	<0.0074	<0.0059	<0.0058	<0.0067	<0.0066	NA	<0.0067	<0.0088	<0.0066	<0.0070	NA	<0.0055	<0.0061 [<0.0056]	<0.0068	NA	NA	NA
Chloromethane	1.7	8.4	- -	mg/kg	<0.0057	<0.0069 [<0.0064]	<0.0066	<0.0079	<0.0074	<0.0059	<0.0058	<0.0067	<0.0066	NA	<0.0067	<0.0088	<0.0066	<0.0070	NA	<0.0055	<0.0061 [<0.0056]	<0.0068	NA	NA	NA
cis-1,2-Dichloroethene	78	1,400	- -	mg/kg	<0.0057	<0.0069 [<0.0064]	<0.0066	<0.0079	<0.0074	<0.0059	<0.0058	<0.0067	<0.0066	NA	<0.0067	<0.0088	<0.0066	<0.0070	NA	<0.0055	<0.0061 [<0.0056]	<0.0068	NA	NA	NA
cis-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.0057	<0.0069 [<0.0064]	<0.0066	<0.0079	<0.0074	<0.0059	<0.0058	<0.0067	<0.0066	NA	<0.0067	<0.0088	<0.0066	<0.0070	NA	<0.0055	<0.0061 [<0.0056]	<0.0068	NA	NA	NA
Cyclohexane	120	120	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibromochloromethane	5.8	21	- -	mg/kg	<0.0057	<0.0069 [<0.0064]	<0.0066	<0.0079	<0.0074	<0.0059	<0.0058	<0.0067	<0.0066	NA	<0.0067	<0.0088	<0.0066	<0.0070	NA	<0.0055	<0.0061 [<0.0056]	<0.0068	NA	NA	NA
Dichlorodifluoromethane	19	78	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
d-Limonene	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.057 J	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	5.7	29	- -	mg/kg	<0.0057	<0.0069 [<0.0064]	<0.0066	<0.0079	<0.0074	<0.0059	<0.0058	<0.0067	<0.0066	NA	<0.0067	<0.0088	<0.0066	<0.0070	NA	<0.0055	<0.0061 [<0.0056]	<0.0068	NA	NA	NA
Isopropylbenzene	310	310	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
m,p-Xylene	- -	- -	- -	mg/kg	<0.011	<0.014 [<0.013]	<0.013	<0.016	<0.015	<0.012	<0.012	<0.013	<0.013	NA	<0.013	<0.018	<0.013	<0.014	NA	<0.011	<0.012 [<0.011]	<0.014	NA	NA	NA
Methyl acetate	29,000	29,000	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl tert-butyl ether	39	190	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylcylohexane	71	71	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	11	54	- -	mg/kg	<0.0057	<0.0069 [<0.0064]	<0.0066	<0.0079	<0.0074	<0.0059	<0.0058	<0.0067	<0.0066	NA	<0.0067	<0.0088	<0.0066	<0.0070	NA	<0.0055	<0.0061 [<0.0056]	<0.0068	NA	NA	NA
o-Xylene	300	300	- -	mg/kg	<0.0057	<0.0069 [<0.0064]	<0.0066	<0.0079	<0.0074	<0.0059	<0.0058	<0.0067	<0.0066	NA	<0.0067	<0.0088	<0.0066	<0.0070	NA	<0.0055	<0.0061 [<0.0056]	<0.0068	NA	NA	NA
Styrene	1,000	1,000	- -	mg/kg	<0.0057	<0.0069 [<0.0064]	<0.0066	<0.0079	<0.0074	<0.0059	<0.0058	<0.0067	<0.0066	NA	<0.0067	<0.0088	<0.0066	<0.0070	NA	<0.0055	<0.0061 [<0.0056]	<0.0068	NA	NA	NA
Tetrachloroethene	0.57	2.7	- -	mg/kg	<0.0057	<0.0069 [<0.0064]	<0.0066	<0.0079	<0.0074	<0.0059	<0.0058	<0.0067	<0.0066	NA	<0.0067	<0.0088	0.00090 J	0.00092 J	NA	<0.0055	<0.0061 [<0.0056]	<0.0068	NA	NA	NA
Toluene	930	930	- -	mg/kg	0.0017 J	<0.0069 [<0.0064]	0.00071 B	<0.0079	<0.0074	<0.0059	<0.0058	<0.0067	<0.0066	NA	<0.0067	0.0041 J	0.0059 J	0.0070	NA	<0.0055	<0.0061 [<0.0056]	<0.0068	NA	NA	NA
trans-1,2-Dichloroethene	11	50	- -	mg/kg	<0.0057	<0.0069 [<0.0064]	<0.0066	<0.0079	<0.0074	<0.0059	<0.0058	<0.0067	<0.0066	NA	<0.0067	<0.0088	<0.0066	<0.0070	NA	<0.0055	<0.0061 [<0.0056]	<0.0068	NA	NA	NA
trans-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.0057	<0.0069 [<0.0064]	<0.0066	<0.0079	<0.0074	<0.0059	<0.0058	<0.0067	<0.0066	NA	<0.0067	<0.0088	<0.0066	<0.0070	NA	<0.0055	<0.0061 [<0.0056]	<0.0068	NA	NA	NA
Trichloroethene	2.8	14	- -	mg/kg	<0.0057	<0.0069 [<0.0064]	<0.0066	<0.0079	<0.0074	<0.0059	<0.0058	<0.0067	<0.0066	NA	<0.0067	<0.0088	<0.0066	<0.0070	NA	<0.0055	<0.0061 [<0.0056]	<0.0068	NA	NA	NA
Trichlorofluoromethane	80	1,300	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	0.06	1.7	- -	mg/kg	<0.0057	<0.0069 [<0.0064]	<0.0066	<0.0079	<0.0074	<0.0059	<0.0058	<0.0067	<0.0066	NA	<0.0067	<0.0088	<0.0066	<0.0070	NA	<0.0055	<0.0061 [<0.0056]	<0.0068	NA	NA	NA
Xylenes (total)	300	300	- -	mg/kg	<0.011	<0.014 [<0.013]	<0.013	<0.016	<0.015	<0.012	<0.012	<0.013	<0.013	NA	<0.013	<0.018	<0.013	<0.014	NA	<0.011	<0.012 [<0.011]	<0.014	NA	NA	NA
Semivolatile Organics																									
1,2,4-Trichlorobenzene	180	220	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	R	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
1,2-Dichlorobenzene	220	220	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	R	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	R	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
1,4-Dichlorobenzene	2.6	13	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	R	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
1-Methylnaphthalene	22	99	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	610	6,200	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	R	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
2,4,6-Trichlorophenol	44	160	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	R	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
2,4-Dichlorophenol	18	180	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	R	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
2,4-Dimethylphenol	120	1,200	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	<0.18	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
2,4-Dinitrophenol	12	120	- -	mg/kg	NA	NA	<0.99	<1.3	<3.8	<1.1	NA	NA	<1.0	NA	NA	<0.86	<1.0 J	<1.9	NA	<1.0	<1.0 [<1.0]	<1.0	NA	NA	NA
2,4-Dinitrotoluene	12	120	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	120	NA	NA	R	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
2,6-Dinitrotoluene	6.1	62	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	6.3 J	NA	NA	R	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
2-Chloronaphthalene	210	210	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	R	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
2-Chlorophenol	39	510	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	R	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
2-Methylnaphthalene	31	440	- -	mg/kg	NA	NA	0.16 J	<0.26	0.061 J	<0.22	NA	NA	<0.21	NA	NA	0.048 J	<0.20 J	<0.39	NA	<0.21	0.015 J [<0.21]	<0.21	NA	NA	NA
2-Methylphenol	310	3,100	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	R	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
2-Nitroaniline	- -	- -	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	<0.18	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
2-Nitrophenol	- -	- -	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	<0.18	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
3,3'-Dichlorobenzidine	1.1	3.8	- -	mg/kg	NA	NA	<0.20 J	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	<0.18	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
3-Nitroaniline	- -	- -	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	<0.18	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
4,6-Dinitro-2-methylphenol	- -	- -	- -	mg/kg	NA	NA	<0.99	<1.3	<3.8	<1.1	NA	NA	<1.0	NA	NA	<0.86	<1.0 J	<1.9	NA	<1.0	<1.0 [<1.0]	<1.0	NA	NA	NA
4-Bromophenyl-phenylether	- -	- -	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	R	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
4-Chloro-3-Methylphenol	- -	- -	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	<0.18	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
4-Chloroaniline	24	250	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	<0.18	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
4-Chlorophenyl-phenylether	- -	- -	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	R	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
4-Methylphenol	31	310	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	R	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
4-Nitroaniline	- -	- -	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	<0.18	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
4-Nitrophenol	- -	- -	- -	mg/kg	NA	NA	<0.99	<1.3	<3.8	<1.1	NA	NA	<1.0	NA	NA	<0.86	<1.0 J	<1.9	NA	<1.0	<1.0 [<1.0]	<1.0	NA	NA	NA
Acenaphthene	340	3,300	- -	mg/kg	NA	NA	5.7 J	<0.26	0.25 J	<0.22	NA	NA	<0.21	NA	NA	0.067 J	0.015 J	0.22 J	NA	0.040 J	0.086 J [0.079 J]	0.067 J	NA	NA	NA
Acenaphthylene	340	3,300	- -	mg/kg	NA	NA	0.044 J	<0.26	0.058 J	<0.22	NA	NA	<0.21	NA	NA	0.065 J	<0.20 J	<0.39	NA	<0.21	0.042 J [<0.21]	<0.21	NA	NA	NA
Anthracene	1,700	170,000	- -	mg/kg	NA	NA	13	<0.26	0.35 J	<0.22	NA	NA	0.022 J	NA	NA	0.099 J	0.039 J	0.41	NA	0.11 J	0.21 J [0.20 J]	0.14 J	NA	NA	NA
Benzo(a)anthracene	0.15	2.1	- -	mg/kg	NA	NA	39	0.010 J	2.8	0.022 J	NA	NA	0.15 J	NA	NA	0.72	0.28 J	1.8	NA	0.73	1.1 [1.1]	0.74	NA	NA	NA
Benzo(a)pyrene	0.015	0.21	- -	mg/kg	NA	NA	36	<0.26	3.4	<0.22	NA	NA	0.17 J	NA	NA	0.84	0.30 J	1.4	NA	0.69	1.0 [0.95]	0.70	NA	NA	NA
Benzo(b)fluoranthene	0.15	2.1	- -	mg/kg	NA	NA	68	<0.26	6.8	0.024 J	NA	NA	0.36 J	NA	NA	1.6	0.51 J	2.6	NA	1.2	1.6 [1.6]	1.2	NA	NA	NA
Benzo(g,h,i)perylene	170	1,700	- -	mg/kg	NA	NA	20	<0.26	2.0	<0.22	NA	NA	0.12 J	NA	NA	0.55	0.18 J	0.97	NA	0.61	0.79 [0.71]	0.55	NA	NA	NA
Benzo(k)fluoranthene	1.5	21	- -	mg/kg	NA	NA	14	<0.26	2.1	0.0080 J	NA	NA	0.10 J	NA	NA	0.47	0.13 J	0.60	NA	0.33	0.53 [0.53]	0.25	NA	NA	NA
Benzoic Acid	240,000	2,500,000	- -	mg/kg	NA	NA	<0.99	0.18 B	<3.8	0.16 B	NA	NA	<1.0	NA	NA	<0.86	<1.0 J	<1.9	NA	<1.0	<1.0 [<1.0]	<1.0	NA	NA	NA
Benzyl Alcohol	3,100	310,000	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	<0.18 J	<0.20 J	<0.39	NA	<0.21 J	<0.21 J [<0.21 J]	<0.21 J	NA	NA	NA
bis(2-Chloroethoxy)methane	18	180	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	R	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
bis(2-Chloroethyl)ether	0.19	0.9	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	R	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA

Notes found at end of table.

Table 6-5. Soil Analytical Results, Bag Loading Area, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	BLASB01 0 - 0.5 06/11/02	BLASB01 2 - 4 06/20/02	BLASB02 0 - 0.5 06/11/02	BLASB02 2 - 4 06/20/02	BLASB03 0 - 0.5 06/11/02	BLASB03 2 - 4 06/20/02	BLASS01 0 - 0.5 06/11/02	BLASS02 0 - 0.5 06/11/02	BLASS03 0 - 0.5 06/11/02	BLASS04 0 - 0.5 06/11/02	BLASS02 0 - 0.5 06/11/02	BLASS05 0 - 0.5 06/11/02	BLASS06 0 - 0.5 06/11/02	BLASS07 0 - 0.5 06/11/02	BLASS08 0 - 0.5 06/11/02	BLASS09 0 - 0.5 06/11/02	BLASS10 0 - 0.5 06/11/02	BLASS11 0 - 0.5 06/11/02	BLATR01 0 - 0.5 06/20/02	BLATR02 0 - 0.5 06/20/02	BLATR03 0 - 0.5 06/20/02
Semivolatile Organics																									
bis(2-Chloroisopropyl)ether	- -	- -	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	R	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
bis(2-Ethylhexyl)phthalate	35	120	- -	mg/kg	NA	NA	<0.20 J	0.030 B	0.18 B	0.037 B	NA	NA	<0.21	NA	NA	0.21 B	0.17 B	0.30 B	NA	<0.21	0.083 B [<0.21]	0.10 B	NA	NA	NA
Butylbenzylphthalate	1,200	120,000	- -	mg/kg	NA	NA	<0.20 J	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	R	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
Carbazole	24	86	- -	mg/kg	NA	NA	13	<0.26	0.71 J	<0.22	NA	NA	0.045 J	NA	NA	0.13 J	0.057 J	0.35 J	NA	0.14 J	0.25 [0.25]	0.18 J	NA	NA	NA
Chrysene	15	210	- -	mg/kg	NA	NA	48	<0.26	4.4	0.015 J	NA	NA	0.21	NA	NA	0.89	0.31 J	1.4	NA	0.88	1.2 [1.1]	0.89	NA	NA	NA
Dibenzo(a,h)anthracene	0.015	0.21	- -	mg/kg	NA	NA	5.9 J	<0.26	0.53 J	<0.22	NA	NA	<0.21 J	NA	NA	0.18	0.044 J	0.19 J	NA	0.14 J	0.18 J [0.19 J]	0.13 J	NA	NA	NA
Dibenzofuran	- -	- -	- -	mg/kg	NA	NA	2.8	<0.26	0.24 J	<0.22	NA	NA	<0.21	NA	NA	0.074 J	0.016 J	0.084 J	NA	0.019 J	0.055 J [0.036 J]	0.025 J	NA	NA	NA
Diethylphthalate	4,900	490,000	- -	mg/kg	NA	NA	<0.20 L	<0.26	<0.78 L	<0.22	NA	NA	<0.21 L	NA	NA	R	<0.20 J	<0.39 L	NA	<0.21 L	<0.21 L [<0.21 L]	<0.21 L	NA	NA	NA
Dimethylphthalate	- -	- -	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	R	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
Di-n-Butylphthalate	610	6,200	- -	mg/kg	NA	NA	<0.20	<0.26	2.5 B	<0.22	NA	NA	120 B	NA	NA	0.58 B	<0.20 J	<0.39	NA	0.36 B	0.061 B [<0.21]	<0.21	NA	NA	NA
Dinitrotoluene Mix	0.71	2.5	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	130 J	NA	NA	R	<0.20	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
Di-n-Octylphthalate	- -	- -	- -	mg/kg	NA	NA	<0.20 J	<0.26	<0.78	<0.22	NA	NA	<0.21 J	NA	NA	R	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
Fluoranthene	230	2,200	- -	mg/kg	NA	NA	110	<0.26	9.4	0.033 J	NA	NA	0.37	NA	NA	1.5	0.69 J	3.9	NA	1.7	2.9 [2.5]	2.0	NA	NA	NA
Fluorene	230	2,200	- -	mg/kg	NA	NA	5.2 J	<0.26	0.32 J	<0.22	NA	NA	<0.21	NA	NA	0.075 J	0.020 J	0.21 J	NA	0.032 J	0.11 J [0.083 J]	0.069 J	NA	NA	NA
Hexachlorobenzene	0.3	1.1	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	R	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
Hexachlorobutadiene	6.2	22	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	R	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
Hexachlorocyclopentadiene	37	370	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	<0.18	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
Hexachloroethane	35	120	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	R	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.15	2.1	- -	mg/kg	NA	NA	23	<0.26	2.3	<0.22	NA	NA	0.13 J	NA	NA	0.60	0.22 J	1.1	NA	0.68	0.91 [0.85]	0.63	NA	NA	NA
Isophorone	510	1,800	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	R	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
Naphthalene	3.9 {ca}	20 {ca}	- -	mg/kg	NA	NA	0.37	<0.26	0.23 J	<0.22	NA	NA	<0.21	NA	NA	0.072 J	0.013 J	0.019 J	NA	<0.21	0.036 J [<0.21]	<0.21	NA	NA	NA
Nitrobenzene	3.1	28	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	R	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
N-Nitroso-di-n-propylamine	0.069	0.25	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	<0.18	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
N-Nitrosodiphenylamine	99	350	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	8.3	NA	NA	R	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
Pentachlorophenol	3	9	- -	mg/kg	NA	NA	<0.99	<1.3	<3.8	<1.1	NA	NA	<1.0	NA	NA	<0.86	<1.0 J	<1.9	NA	<1.0	<1.0 [<1.0]	<1.0	NA	NA	NA
Phenanthrene	1,700	170,000	- -	mg/kg	NA	NA	78	<0.26	5.4	0.017 J	NA	NA	0.19 J	NA	NA	0.62	0.30 J	2.6	NA	0.73	1.7 [1.4]	1.2	NA	NA	NA
Phenol	1,800	180,000	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	R	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
Pyrene	170	1,700	- -	mg/kg	NA	NA	85 J	<0.26	7.9 J	0.026 J	NA	NA	0.42	NA	NA	1.6	0.53 J	3.1 J	NA	1.2	2.1 [1.9]	1.5	NA	NA	NA
Pyridine	7.8	100	- -	mg/kg	NA	NA	<0.20	<0.26	<0.78	<0.22	NA	NA	<0.21	NA	NA	<0.18	<0.20 J	<0.39	NA	<0.21	<0.21 [<0.21]	<0.21	NA	NA	NA
Inorganics																									
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	17,400	**43,700 J [32,300 J]**	26,500	**40,900 J**	14,000	30,500 J	18,000	5,530	13,500	NA	5,530	26,600	22,200	20,300	21,700	29,700	28,600 [25,400]	24,100	NA	NA	NA
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	0.200 B	0.280 B [0.280 B]	<0.590 L	0.320 B	0.440 L	<0.650 L	0.230 B	0.200 B	0.970 L	NA	0.200 B	0.220 B	0.250 B	0.370 B	1.62 L	0.230 B	0.230 B [0.230 B]	0.230 B	NA	NA	NA
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	6.40 J	5.26 J [3.99 J]	1.29 J	3.67 J	7.16 J	5.66 J	7.48 J	<0.510	7.05 J	NA	<0.510	14.8 J	7.94 J	12.5 J	4.94 J	7.97 J	5.50 J [4.91 J]	5.15 J	NA	NA	NA
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	84.9	37.2 [39.9]	49.9	108	**3,980**	89.9	155	49.2	**3,120**	NA	49.2	57.9	48.3	45.4	**267**	**331**	69.6 [89.3]	98.6	NA	NA	NA
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	0.860	**1.64 [1.44]**	**1.32**	**2.97**	0.520 B	**1.36**	0.950	0.360 B	0.500 B	NA	0.360 B	**1.24**	**1.18**	**1.37**	1.00	0.370 B	**1.41 [1.27]**	**1.49**	NA	NA	NA
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	0.250	<0.130 [<0.120]	<0.120	<0.150	**11.8**	<0.130	0.350	**1.29**	**12.2**	NA	**1.29**	0.530	0.100 J	0.170	**12.1**	**1.12**	0.350 [0.300]	**1.50**	NA	NA	NA
Calcium	- -	- -	- -	mg/kg	17,100	1,040 J [1,210 J]	1,130	3,360 J	23,500	1,360 J	10,700	64,700	71,400	NA	64,700	6,240	1,800	642	43,600	15,800	1,370 [1,620]	1,890	NA	NA	NA
Chromium	280 {ca}	1,460 {ca}	65.3	mg/kg	33.6 L	48.0 J [45.6 J]	39.9 L	54.9 J	**73.9 L**	31.1 J	33.5 L	11.2 L	40.2 L	NA	11.2 L	62.6 L	43.4 L	37.3 L	30.2 L	51.4 L	29.3 L [29.0 L]	58.9 L	NA	NA	NA
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	37.8 J	8.52 J [7.67 J]	14.2 J	12.0 J	13.6 J	17.8 J	20.5 J	4.43 J	8.54 J	NA	4.43 J	16.6 J	18.4 J	15.8 J	27.1 J	4.15 J	24.7 J [22.6 J]	**149 J**	NA	NA	NA
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	29.7	22.4 J [21.0 J]	29.3	31.9 J	**1,860**	34.0 J	26.0	**244**	**2,270**	NA	**244**	**490**	**503**	**691**	**1,450**	**962**	51.6 [50.6]	53.4	NA	NA	NA
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	45,300	**51,500 [49,900]**	41,500	46,700	37,400	35,000	32,300	8,500	19,500	NA	8,500	42,000	37,500	30,500	23,900	33,500	35,800 [34,800]	44,700	NA	NA	NA
Lead	400 {++}	800 {++}	26.8	mg/kg	**51.5**	10.0 [9.82]	16.0	11.6	**1,720**	19.0	**61.1**	**79.9**	**3,850**	NA	**79.9**	**81.5**	**28.8**	**34.1**	**8,790**	**255**	**95.6 [97.9]**	**143**	NA	NA	NA
Magnesium	- -	- -	- -	mg/kg	12,100	4,150 J [3,470 J]	8,490	30,800 J	13,000	3,840 J	8,610	40,000	48,100	NA	40,000	8,500	6,140	6,000	20,300	11,000	5,710 [5,540]	5,230	NA	NA	NA
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	1,360	71.0 J [79.5 J]	255	429 J	290	435 J	628	140	153	NA	140	332	399	292	508	88.0	350 [347]	**3,080**	NA	NA	NA
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	0.0400 J	0.0800 L [0.0500 L]	0.0500 J	0.0400 L	**0.260**	0.0500 L	0.0600	<0.0500	**5.24**	NA	<0.0500	0.0300 J	0.0400 J	0.0200 J	0.0400 J	**2.16**	**0.190 [0.170]**	**0.140**	NA	NA	NA
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	12.4	24.9 [21.0]	25.9	46.5	26.6	20.1	12.9	5.99	25.1	NA	5.99	25.5	23.2	22.7	20.3	15.2	25.3 [23.7]	27.0	NA	NA	NA
Potassium	- -	- -	- -	mg/kg	1,710	3,240 [2,570]	4,520	9,590	1,330	2,870	1,910	1,490	1,380	NA	1,490	3,290	3,940	3,100	3,580	752	4,100 [3,910]	2,680	NA	NA	NA
Selenium	39 {nc}	510 {nc}	- -	mg/kg	<1.14	<1.37 [<1.27]	<1.20	<1.57	<1.15	<1.31	0.410 J	<1.03	<1.21	NA	<1.03	<1.03	<1.20	0.390 J	<1.17	<1.23	<1.21 [<1.24]	<1.23	NA	NA	NA
Silver	39 {nc}	510 {nc}	- -	mg/kg	<1.14	<1.37 [<1.27]	<1.20	<1.57	0.680 J	<1.31	<1.16	<1.03	0.770 J	NA	<1.03	<1.03	<1.20	<1.16	<1.17	0.620 J	<1.21 [<1.24]	<1.23	NA	NA	NA
Sodium	- -	- -	- -	mg/kg	37.4 J	28.9 B [28.0 B]	31.2 J	51.4	40.4 J	26.0 B	38.8 J	74.4 J	118 J	NA	74.4 J	31.9 J	23.8 B	33.2 J	70.5 J	38.5 J	28.4 B [26.2 B]	25.7 B	NA	NA	NA
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	0.170 J	0.380 J [0.280 J]	0.280 J	0.310 J	0.170 J	0.260 J	0.190 J	0.0400 J	0.110 J	NA	0.0400 J	0.270 J	0.250 J	0.260 J	0.190 J	0.180 J	0.350 J [0.360 J]	0.280 J	NA	NA	NA
Vanadium	55{nc}	720 {nc}	108	mg/kg	71.5	92.7 J [76.7 J]	72.6	78.0 J	35.4	59.1 J	58.3	14.4	29.6	NA	14.4	65.1	66.4	52.1	41.7	58.4	62.2 [60.4]	77.4	NA	NA	NA
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	79.1 J	32.1 J [30.4 J]	64.0 J	62.3 J	**2,050 J**	49.2 J	139 J	**976 J**	**2,140 J**	NA	**976 J**	**1,090 J**	53.2 J	75.6 J	**2,450 J**	185 J	94.1 J [126 J]	164 J	NA	NA	NA

mg/kg	Milligrams per killogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quantified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics indicates concentration is above facility-wide background value.

Table 6-6. Sediment Analytical Results, Bag Loading Area, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	BLASD01 0 - 0.5 06/18/02	BLASD02 0 - 0.5 06/18/02	BLASD04 0 - 0.5 06/24/02	BLASD05 0 - 0.5 06/24/02
Explosives								
1,3,5-Trinitrobenzene	220 {nc}	2,700 {nc}	- -	mg/kg	<0.1	<0.1	<0.1	<0.1
1,3-Dinitrobenzene	0.61 {nc}	6.2 {nc}	- -	mg/kg	<0.1	<0.1	<0.1	<0.1
2,4,6-Trinitrotoluene	3.6 {ca**}	42 {ca**}	- -	mg/kg	<0.2	<0.2	<0.2	<0.2
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.2	<0.2	<0.2	<0.2
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	<0.2	<0.2	<0.2	<0.2
2-Amino-4,6-Dinitrotoluene	15 {nc}	190 {nc}	- -	mg/kg	<0.2	<0.2	<0.2	<0.2
4-Amino-2,6-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.2	<0.2	<0.2	<0.2
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	<0.2	<0.2	<0.2	<0.2
HMX	310 {nc}	3,100 {nc}	- -	mg/kg	<0.2	<0.2	<0.2	<0.2
m-Nitrotoluene	- -	- -	- -	mg/kg	<0.4	<0.4	<0.4	<0.4
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	<0.2	<0.2	<0.2	<0.2
Nitroglycerine	0.61 {nc}	6.2 {nc}	- -	mg/kg	<0.35	<0.37	<0.47	<0.44
o-Nitrotoluene	78 {nc}	1,300 {sat}	- -	mg/kg	<0.4	<0.4	<0.4	<0.4
Pentaerythritol Tetranitrate	- -	- -	- -	mg/kg	0.16 J	<0.37	<0.47	<0.44
p-Nitrotoluene	30 {ca**}	110 {ca*}	- -	mg/kg	<0.4	<0.4	<0.4	<0.4
RDX	4.4 {ca*}	16 {ca}	- -	mg/kg	<0.2	<0.2	<0.2	<0.2
Tetryl	24 {nc}	250 {nc}	- -	mg/kg	<0.2	<0.2	<0.2	<0.2
Herbicides								
2,4,5-T	61	620	- -	mg/kg	<0.119	<0.0124	<0.159	<0.15
2,4,5-TP	49	490	- -	mg/kg	<0.119	<0.0124	<0.159	<0.15
2,4-D	69	770	- -	mg/kg	<0.239	<0.0248	<0.318	<0.299
2,4-DB	49	490	- -	mg/kg	<1.19	<0.124	<1.59	<1.5
Dalapon	180	1,800	- -	mg/kg	<1.19	<0.124	<1.59	<1.5
Dicamba	180	1,800	- -	mg/kg	<0.239	<0.0248	<0.318 L	<0.299 L
Dichlorprop	- -	- -	- -	mg/kg	<0.239	<0.0248	<0.318	<0.299
Dinoseb	6.1	62	- -	mg/kg	<0.239	<0.0248	<0.318	<0.299
MCPA	3.1	31	- -	mg/kg	<119	<12.4	<159	<150
MCPP	6.1	62	- -	mg/kg	<119	<12.4	<159	<150
Organochlorine Pesticides								
4,4'-DDD	2 {ca**}	7.2 {ca**}	- -	mg/kg	0.00092	0.00064 J	0.00073 J	0.00059 J
4,4'-DDE	1.4 {ca**}	5.1 {ca**}	- -	mg/kg	0.00086 B	0.00058 B	0.00182 B	0.00102 B
4,4'-DDT	1.7 {ca*}	7 {ca*}	- -	mg/kg	<0.00079	<0.00082	0.00077 B	0.00062 B
Aldrin	0.029 {ca*}	0.1 {ca}	- -	mg/kg	<0.00079	<0.00082	<0.00106	<0.00099
Alpha-BHC	0.077 {ca**}	0.27 {ca**}	- -	mg/kg	<0.00079	<0.00082	<0.00106	<0.00099
Alpha-Chlordane	1.6 {ca**}	6.5 {ca**}	- -	mg/kg	<0.00079	<0.00082	0.00038 J	0.00025 J
Beta-BHC	0.27 {ca**}	0.96 {ca**}	- -	mg/kg	0.00028 J	<0.00082	0.00029 J	<0.00099
Delta-BHC	0.52 {ca**}	2.1 {ca**}	- -	mg/kg	<0.00079	<0.00082	<0.00106	<0.00099
Dieldrin	0.03 {ca}	0.11 {ca}	- -	mg/kg	<0.00079	<0.00082	0.00094 K	<0.00099
Endosulfan I	- -	- -	- -	mg/kg	<0.00079	<0.00082	<0.00106	<0.00099
Endosulfan II	37 {nc}	370 {nc}	- -	mg/kg	<0.00079	<0.00082	<0.00106	<0.00099
Endosulfan Sulfate	- -	- -	- -	mg/kg	<0.00079	<0.00082	<0.00106	<0.00099
Endrin	1.8 {nc}	18 {nc}	- -	mg/kg	<0.00079	0.00035 J	<0.00106	<0.00099
Endrin Aldehyde	1.8 {nc}	18 {nc}	- -	mg/kg	<0.00079	<0.00082	<0.00106	<0.00099
Endrin Ketone	- -	- -	- -	mg/kg	<0.00079	<0.00082	<0.00106	<0.00099
Gamma-BHC (Lindane)	0.52 {ca*}	2.1 {ca}	- -	mg/kg	<0.00079	<0.00082	<0.00106	<0.00099
Gamma-Chlordane	1.6 {ca**}	6.5 {ca**}	- -	mg/kg	<0.00079	<0.00082	0.00041 J	<0.00099
Heptachlor	0.11 {ca}	0.38 {ca}	- -	mg/kg	<0.00079	<0.00082	<0.00106	<0.00099
Heptachlor Epoxide	0.053 {ca*}	0.19 {ca*}	- -	mg/kg	0.00094	<0.00082	<0.00106	<0.00099
Methoxychlor	31 {nc}	310 {nc}	- -	mg/kg	0.00442	<0.00082	<0.00106	<0.00099
Toxaphene	0.44 {ca**}	1.6 {ca**}	- -	mg/kg	<0.0397	<0.0413	<0.053	<0.0499
PAHs								
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	0.0044	0.0064	0.0018 B	0.0013 B
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.0024	<0.0026	<0.0027	<0.0025
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	0.00099 J	<0.0026	<0.0027	<0.0025
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	<0.0024	0.00099 J	0.0017 J	<0.0025
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.0054	0.0074	0.013	0.0059
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	0.0049	0.0098	0.012	0.0050
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.0098	0.017	0.019	0.013
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	0.0068	0.0083	0.0071	0.0031
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	0.0028	0.0051	0.0071	0.0033
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	0.0065	0.011	0.013	0.0073
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	0.0019 J	0.0028	0.0021 J	0.0013 J
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	0.0089	0.015	0.019	0.0078
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	0.0015 J	0.00095 J	0.0012 J	<0.0025
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.0052	0.0098	0.0081	0.0039
Naphthalene	3.9 {nc}	20 {nc}	- -	mg/kg	0.0037 B	0.0040 B	0.0021 B	0.0020 B
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.0058	0.010	0.0090	0.0037
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	0.0071	0.012	0.019	0.0091
PCBs								
Aroclor-1016	0.39 {nc}	21 {ca**}	- -	mg/kg	<0.030	<0.040	<0.050 J	<0.040 J
Aroclor-1221	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.070	<0.080	<0.10 J	<0.090 J
Aroclor-1232	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.030	<0.040	<0.050 J	<0.040 J
Aroclor-1242	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.030	<0.040	<0.050 J	<0.040 J
Aroclor-1248	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.030	<0.040	<0.050 J	<0.040 J
Aroclor-1254	0.22 {ca**}	0.74 {ca*}	- -	mg/kg	<0.030	<0.040	<0.050 J	<0.040 J
Aroclor-1260	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.030	<0.040	<0.050 J	<0.040 J

Notes found at end of table.

Table 6-6. Sediment Analytical Results, Bag Loading Area, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	BLASD01 0 - 0.5 06/18/02	BLASD02 0 - 0.5 06/18/02	BLASD04 0 - 0.5 06/24/02	BLASD05 0 - 0.5 06/24/02
Volatile Organics								
1,1,1-Trichloroethane	680	680	- -	mg/kg	<0.0060	<0.0062	<0.0080	<0.0075
1,1,2,2-Tetrachloroethane	0.59	2.9	- -	mg/kg	<0.0060	<0.0062	<0.0080	<0.0075
1,1,2-trichloro-1,2,2-trifluoroethane	940	940	- -	mg/kg	NA	NA	NA	NA
1,1,2-Trichloroethane	1.1	5.5	- -	mg/kg	<0.0060	<0.0062	<0.0080	<0.0075
1,1-Dichloroethane	3.4	17	- -	mg/kg	<0.0060	<0.0062	<0.0080	<0.0075
1,1-Dichloroethene	25	110	- -	mg/kg	<0.0060	<0.0062	<0.0080	<0.0075
1,2,3-Trichlorobenzene	- -	- -	- -	mg/kg	NA	NA	NA	NA
1,2,4-Trichlorobenzene	180	220	- -	mg/kg	NA	NA	NA	NA
1,2-Dibromo-3-chloropropane	0.0056	0.073	- -	mg/kg	NA	NA	NA	NA
1,2-Dibromoethane	0.034	0.17	- -	mg/kg	NA	NA	NA	NA
1,2-Dichlorobenzene	220	220	- -	mg/kg	NA	NA	NA	NA
1,2-Dichloroethane	0.45	2.2	- -	mg/kg	<0.0060	<0.0062	<0.0080	<0.0075
1,2-Dichloropropane	0.93	4.7	- -	mg/kg	<0.0060	<0.0062	<0.0080	<0.0075
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	NA	NA	NA	NA
1,4-Dichlorobenzene	2.6	13	- -	mg/kg	NA	NA	NA	NA
1,4-Dioxane	44	160	- -	mg/kg	NA	NA	NA	NA
2-Butanone	28,000	28,000	- -	mg/kg	<0.0060	<0.0062	<0.0080	<0.0075
2-Hexanone	- -	- -	- -	mg/kg	<0.0060	<0.0062	<0.0080	<0.0075
3-Octanone	- -	- -	- -	mg/kg	NA	NA	NA	NA
4-Methyl-2-pentanone	3,200	3,200	- -	mg/kg	<0.0060	<0.0062	<0.0080	<0.0075
Acetone	6,100	110,000	- -	mg/kg	<0.0060	<0.0062	<0.0080 J	0.028 B
Benzene	1.1	5.6	- -	mg/kg	<0.0060	<0.0062	<0.0080	<0.0075
Bromochloromethane	- -	- -	- -	mg/kg	NA	NA	NA	NA
Bromodichloromethane	10	46	- -	mg/kg	<0.0060	<0.0062	<0.0080	<0.0075
Bromoform	61	220	- -	mg/kg	<0.0060	<0.0062	<0.0080	<0.0075
Bromomethane	0.79	3.5	- -	mg/kg	<0.0060	<0.0062	<0.0080	<0.0075
Carbon Disulfide	260	260	- -	mg/kg	<0.0060	<0.0062	<0.0080	<0.0075
Carbon Tetrachloride	0.25	1.3	- -	mg/kg	<0.0060	<0.0062	<0.0080	<0.0075
Chlorobenzene	31	860	- -	mg/kg	<0.0060	<0.0062	<0.0080	<0.0075
Chloroethane	2,200	2,200	- -	mg/kg	<0.0060	<0.0062	<0.0080	<0.0075
Chloroform	0.3	1.5	- -	mg/kg	<0.0060	<0.0062	<0.0080	<0.0075
Chloromethane	1.7	8.4	- -	mg/kg	<0.0060	<0.0062	<0.0080 L	<0.0075 L
cis-1,2-Dichloroethene	78	1,400	- -	mg/kg	<0.0060	<0.0062	<0.0080	<0.0075
cis-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.0060	<0.0062	<0.0080	<0.0075
Cyclohexane	120	120	- -	mg/kg	NA	NA	NA	NA
Dibromochloromethane	5.8	21	- -	mg/kg	<0.0060	<0.0062	<0.0080	<0.0075
Dichlorodifluoromethane	19	78	- -	mg/kg	NA	NA	NA	NA
d-Limonene	- -	- -	- -	mg/kg	NA	NA	NA	NA
Ethylbenzene	5.7	29	- -	mg/kg	<0.0060	<0.0062	<0.0080	<0.0075
Isopropylbenzene	310	310	- -	mg/kg	NA	NA	NA	NA
m,p-Xylene	- -	- -	- -	mg/kg	<0.012	<0.012	<0.016	<0.015
Methyl acetate	29,000	29,000	- -	mg/kg	NA	NA	NA	NA
Methyl tert-butyl ether	39	190	- -	mg/kg	NA	NA	NA	NA
Methylcylohexane	71	71	- -	mg/kg	NA	NA	NA	NA
Methylene Chloride	11	54	- -	mg/kg	<0.0060	<0.0062	<0.0080	<0.0075
o-Xylene	300	300	- -	mg/kg	<0.0060	<0.0062	<0.0080	<0.0075
Styrene	1,000	1,000	- -	mg/kg	<0.0060	<0.0062	<0.0080	<0.0075
Tetrachloroethene	0.57	2.7	- -	mg/kg	<0.0060	<0.0062	<0.0080	<0.0075
Toluene	930	930	- -	mg/kg	<0.0060	<0.0062	<0.0080	0.00096 B
trans-1,2-Dichloroethene	11	50	- -	mg/kg	<0.0060	<0.0062	<0.0080	<0.0075
trans-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.0060	<0.0062	<0.0080	<0.0075
Trichloroethene	2.8	14	- -	mg/kg	<0.0060	<0.0062	<0.0080	<0.0075
Trichlorofluoromethane	80	1,300	- -	mg/kg	NA	NA	NA	NA
Vinyl Chloride	0.06	1.7	- -	mg/kg	<0.0060	<0.0062	<0.0080	<0.0075
Xylenes (total)	300	300	- -	mg/kg	<0.012	<0.012	<0.016	<0.015
Semivolatile Organics								
1,2,4-Trichlorobenzene	180	220	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
1,2-Dichlorobenzene	220	220	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
1,4-Dichlorobenzene	2.6	13	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
1-Methylnaphthalene	22	99	- -	mg/kg	NA	NA	<0.27	<0.25
2,4,5-Trichlorophenol	610	6,200	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
2,4,6-Trichlorophenol	44	160	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
2,4-Dichlorophenol	18	180	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
2,4-Dimethylphenol	120	1,200	- -	mg/kg	<0.20 L	<0.21 L	<0.27 L	<0.25 L
2,4-Dinitrophenol	12	120	- -	mg/kg	<0.99	<1.0	<1.3	<1.2
2,4-Dinitrotoluene	12	120	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
2,6-Dinitrotoluene	6.1	62	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
2-Chloronaphthalene	210	210	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
2-Chlorophenol	39	510	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
2-Methylnaphthalene	31	440	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
2-Methylphenol	310	3,100	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
2-Nitroaniline	- -	- -	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
2-Nitrophenol	- -	- -	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
3,3'-Dichlorobenzidine	1.1	3.8	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
3-Nitroaniline	- -	- -	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
4,6-Dinitro-2-methylphenol	- -	- -	- -	mg/kg	<0.99	<1.0	<1.3	<1.2
4-Bromophenyl-phenylether	- -	- -	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
4-Chloro-3-Methylphenol	- -	- -	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
4-Chloroaniline	24	250	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
4-Chlorophenyl-phenylether	- -	- -	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
4-Methylphenol	31	310	- -	mg/kg	<0.20 L	<0.21 L	<0.27	<0.25
4-Nitroaniline	- -	- -	- -	mg/kg	<0.20	<0.21	<0.27 J	<0.25 J
4-Nitrophenol	- -	- -	- -	mg/kg	<0.99	<1.0	<1.3	<1.2

Notes found at end of table.

Table 6-6. Sediment Analytical Results, Bag Loading Area, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	BLASD01 0 - 0.5 06/18/02	BLASD02 0 - 0.5 06/18/02	BLASD04 0 - 0.5 06/24/02	BLASD05 0 - 0.5 06/24/02
Semivolatile Organics								
Acenaphthene	340	3,300	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
Acenaphthylene	340	3,300	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
Anthracene	1,700	170,000	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
Benzo(a)anthracene	0.15	2.1	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
Benzo(a)pyrene	0.015	0.21	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
Benzo(b)fluoranthene	0.15	2.1	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
Benzo(g,h,i)perylene	170	1,700	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
Benzo(k)fluoranthene	1.5	21	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
Benzoic Acid	240,000	2,500,000	- -	mg/kg	0.14 B	<1.0	<1.3	<1.2
Benzyl Alcohol	3,100	310,000	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
bis(2-Chloroethoxy)methane	18	180	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
bis(2-Chloroethyl)ether	0.19	0.9	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
bis(2-Chloroisopropyl)ether	- -	- -	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
bis(2-Ethylhexyl)phthalate	35	120	- -	mg/kg	0.20 B	0.20 B	0.058 B	<0.25
Butylbenzylphthalate	1,200	120,000	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
Carbazole	24	86	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
Chrysene	15	210	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
Dibenzo(a,h)anthracene	0.015	0.21	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
Dibenzofuran	- -	- -	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
Diethylphthalate	4,900	490,000	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
Dimethylphthalate	- -	- -	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
Di-n-Butylphthalate	610	6,200	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
Dinitrotoluene Mix	0.71	2.5	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
Di-n-Octylphthalate	- -	- -	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
Fluoranthene	230	2,200	- -	mg/kg	0.0095 J	0.015 J	0.029 J	0.013 J
Fluorene	230	2,200	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
Hexachlorobenzene	0.3	1.1	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
Hexachlorobutadiene	6.2	22	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
Hexachlorocyclopentadiene	37	370	- -	mg/kg	<0.20	<0.21	<0.27 J	<0.25 J
Hexachloroethane	35	120	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
Indeno(1,2,3-cd)pyrene	0.15	2.1	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
Isophorone	510	1,800	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
Naphthalene	3.9 {ca}	20 {ca}	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
Nitrobenzene	3.1	28	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
N-Nitroso-di-n-propylamine	0.069	0.25	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
N-Nitrosodiphenylamine	99	350	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
Pentachlorophenol	3	9	- -	mg/kg	<0.99	<1.0	<1.3	<1.2
Phenanthrene	1,700	170,000	- -	mg/kg	<0.20	<0.21	0.018 J	0.012 J
Phenol	1,800	180,000	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
Pyrene	170	1,700	- -	mg/kg	0.022 J	0.014 J	0.022 J	0.010 J
Pyridine	7.8	100	- -	mg/kg	<0.20	<0.21	<0.27	<0.25
Inorganics								
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	24,400	31,500	13,300	7,900
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	0.460 L	0.320 B	0.280 B	0.370 B
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	10.6 J	4.92 J	2.10 L	4.60 L
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	151	54.5	77.2	74.8
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	**1.36**	**2.20**	0.890	0.920
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	0.0900 J	<0.120	<0.150	<0.150
Calcium	- -	- -	- -	mg/kg	5,640 J	1,490 J	61,200 J	102,000 J
Chromium	280 {ca}	1,460 {ca}	65.3	mg/kg	54.5 J	33.7 J	26.8	28.5
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	28.8	19.6	7.30 J	10.5 J
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	23.5 L	23.8 L	8.89	6.06
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	41,100 J	32,000 J	17,600 J	23,300 J
Lead	400 {++}	800 {++}	26.8	mg/kg	24.6	23.6	14.6	19.3
Magnesium	- -	- -	- -	mg/kg	7,550 J	6,370 J	3,200 J	9,810 J
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	1,030 J	180 J	681 J	649 J
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	0.0500 J	0.0500 J	<0.0700	<0.0700
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	23.4	31.0	11.5 J	10.9 J
Potassium	- -	- -	- -	mg/kg	3,030	4,730	1,240	1,310
Selenium	39 {nc}	510 {nc}	- -	mg/kg	0.470 L	<1.24 L	<1.59 L	<1.50 L
Silver	39 {nc}	510 {nc}	- -	mg/kg	<1.19	<1.24	<1.59	<1.50
Sodium	- -	- -	- -	mg/kg	28.7 B	34.9	81.9 J	83.6 J
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	0.240 J	0.310 J	0.180 J	0.290 J
Vanadium	55{nc}	720 {nc}	108	mg/kg	71.5 J	59.5 J	31.7 J	37.8 J
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	50.3 J	45.8 J	36.0 J	25.8 J

mg/kg	Milligrams per killogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics indicates concentration is above facility-wide background value.

Table 6-7. Surface Water Analytical Results, Bag Loading Area, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Date Collected:	Tapwater Screening Values [a]	Units	BLASW04 06/24/02	BLASW05 06/24/02
Explosives				
1,3,5-Trinitrobenzene	1.1	mg/L	<0.00013	<0.00013
1,3-Dinitrobenzene	0.0037	mg/L	<0.00013	<0.00013
2,4,6-Trinitrotoluene	0.0022	mg/L	<0.00026	<0.00026
2,4-Dinitrotoluene	0.073	mg/L	<0.00013	<0.00013
2,6-Dinitrotoluene	0.037	mg/L	<0.00026	<0.00026
2-Amino-4,6-Dinitrotoluene	0.073	mg/L	<0.00026	<0.00026
4-Amino-2,6-Dinitrotoluene	0.073	mg/L	<0.00026	<0.00026
Dinitrotoluene Mix	0.000099	mg/L	<0.00026	<0.00026
HMX	1.8	mg/L	<0.00026	<0.00026
m-Nitrotoluene	- -	mg/L	0.00043 J	0.00042 J
Nitrobenzene	0.0034	mg/L	<0.00026	<0.00026
Nitroglycerine	0.0037	mg/L	<0.00097 L	<0.00097 L
o-Nitrotoluene	0.37	mg/L	<0.00052	<0.00052
Pentaerythritol Tetranitrate	- -	mg/L	<0.00097 L	<0.00097 L
p-Nitrotoluene	0.0042	mg/L	<0.00052	<0.00052
RDX	0.00061	mg/L	<0.00026	<0.00026
Tetryl	0.15	mg/L	<0.00026	<0.00026
Herbicides				
2,4,5-T	0.37	mg/L	<0.0001	<0.0001
2,4,5-TP	0.29	mg/L	<0.0001	<0.0001
2,4-D	0.37	mg/L	0.00326	<0.0005
2,4-DB	0.29	mg/L	<0.002	<0.002
Dalapon	1.1	mg/L	<0.002	<0.002
Dicamba	1.1	mg/L	<0.0005	<0.0005
Dichlorprop	- -	mg/L	<0.0005	<0.0005
Dinoseb	0.037	mg/L	<0.0005	<0.0005
MCPA	0.018	mg/L	<0.125	<0.125
MCPP	0.037	mg/L	<0.125	<0.125
Organochlorine Pesticides				
4,4'-DDD	0.00028	mg/L	<0.00002	<0.00002
4,4'-DDE	0.0002	mg/L	<0.00002	<0.00002
4,4'-DDT	0.0002	mg/L	<0.00002	<0.00002
Aldrin	0.000004	mg/L	<0.00002	<0.00002
Alpha-BHC	0.000011	mg/L	<0.00002	<0.00002
Alpha-Chlordane	- -	mg/L	<0.00002	<0.00002
Beta-BHC	0.000037	mg/L	<0.00002	<0.00002
Delta-BHC	- -	mg/L	<0.00002	<0.00002
Dieldrin	0.0000042	mg/L	0.0000041 J	0.00000582 J
Endosulfan I	- -	mg/L	<0.00002	<0.00002
Endosulfan II	- -	mg/L	<0.00002	<0.00002
Endosulfan Sulfate	- -	mg/L	<0.00002	<0.00002
Endrin	0.011	mg/L	<0.00002	<0.00002
Endrin Aldehyde	- -	mg/L	<0.00002	<0.00002
Endrin Ketone	- -	mg/L	<0.00002	<0.00002
Gamma-BHC (Lindane)	0.000061	mg/L	<0.00002	<0.00002
Gamma-Chlordane	- -	mg/L	<0.00002	<0.00002
Heptachlor	0.000015	mg/L	<0.00002	<0.00002
Heptachlor Epoxide	0.0000074	mg/L	<0.00002	<0.00002
Methoxychlor	0.18	mg/L	<0.00002	<0.00002
Toxaphene	0.000061	mg/L	<0.001	<0.001
PAHs				
2-Methylnaphthalene	0.15	mg/L	<0.000050	<0.000050
Acenaphthene	2.2	mg/L	<0.000050	<0.000050
Acenaphthylene	- -	mg/L	<0.000050	<0.000050
Anthracene	11	mg/L	<0.000050	<0.000050
Benzo(a)anthracene	0.000029	mg/L	<0.000050	<0.000050
Benzo(a)pyrene	0.0000029	mg/L	<0.000050	<0.000050
Benzo(b)fluoranthene	0.000029	mg/L	<0.000050	<0.000050
Benzo(g,h,i)perylene	- -	mg/L	<0.000050 J	<0.000050 J
Benzo(k)fluoranthene	0.00029	mg/L	<0.000050	<0.000050
Chrysene	0.0029	mg/L	<0.000050	<0.000050
Dibenzo(a,h)anthracene	0.0000029	mg/L	<0.000050 J	<0.000050 J
Fluoranthene	1.5	mg/L	<0.000050	<0.000050
Fluorene	1.5	mg/L	<0.000050	<0.000050
Indeno(1,2,3-cd)pyrene	0.000029	mg/L	<0.000050 J	<0.000050 J
Naphthalene	0.0062	mg/L	<0.000050	<0.000050
Phenanthrene	- -	mg/L	<0.000050	<0.000050
Pyrene	1.1	mg/L	<0.000050	<0.000050
PCBs				
Aroclor-1016	0.00096	mg/L	<0.00010	<0.00010
Aroclor-1221	0.0000068	mg/L	<0.00020	<0.00020
Aroclor-1232	0.0000068	mg/L	<0.00010	<0.00010
Aroclor-1242	0.000034	mg/L	<0.00010	<0.00010
Aroclor-1248	0.000034	mg/L	<0.00010	<0.00010
Aroclor-1254	0.000034	mg/L	<0.00010	<0.00010
Aroclor-1260	0.000034	mg/L	<0.00010	<0.00010

Notes found at end of table.

Table 6-7. Surface Water Analytical Results, Bag Loading Area, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Date Collected:	Tapwater Screening Values [a]	Units	BLASW04 06/24/02	BLASW05 06/24/02
Volatile Organics				
1,1,1-Trichloroethane	9.1	mg/L	<0.0010	<0.0010
1,1,2,2-Tetrachloroethane	0.000067	mg/L	<0.0010	<0.0010
1,1,2-trichloro-1,2,2-trifluoroethane	59	mg/L	NA	NA
1,1,2-Trichloroethane	0.00024	mg/L	<0.0010	<0.0010
1,1-Dichloroethane	0.0024	mg/L	<0.0010	<0.0010
1,1-Dichloroethene	0.34	mg/L	<0.0010	<0.0010
1,2,3-Trichlorobenzene	- -	mg/L	NA	NA
1,2,4-Trichlorobenzene	0.019	mg/L	NA	NA
1,2-Dibromo-3-chloropropane	0.00000032	mg/L	NA	NA
1,2-Dibromoethane	0.0000065	mg/L	NA	NA
1,2-Dichlorobenzene	0.37	mg/L	NA	NA
1,2-Dichloroethane	0.00015	mg/L	<0.0010	<0.0010
1,2-Dichloropropane	0.00039	mg/L	<0.0010	<0.0010
1,3-Dichlorobenzene	- -	mg/L	NA	NA
1,4-Dichlorobenzene	0.00043	mg/L	NA	NA
1,4-Dioxane	0.0061	mg/L	NA	NA
2-Butanone	7.1	mg/L	<0.0040	<0.0040
2-Hexanone	- -	mg/L	<0.0040	<0.0040
4-Methyl-2-pentanone	2	mg/L	<0.0040	<0.0040
Acetone	22	mg/L	<0.0040 J	<0.0040 J
Benzene	0.00041	mg/L	<0.0010	<0.0010
Bromochloromethane	- -	mg/L	NA	NA
Bromodichloromethane	0.0011	mg/L	<0.0010	<0.0010
Bromoform	0.0085	mg/L	<0.0010	<0.0010
Bromomethane	0.0087	mg/L	<0.0010 L	<0.0010 L
Carbon Disulfide	1	mg/L	0.00012 B	0.000070 B
Carbon Tetrachloride	0.0002	mg/L	<0.0010	<0.0010
Chlorobenzene	0.091	mg/L	<0.0010	<0.0010
Chloroethane	21	mg/L	<0.0010	<0.0010
Chloroform	0.00019	mg/L	0.00018 J	0.00013 J
Chloromethane	0.0018	mg/L	<0.0010 L	<0.0010 L
cis-1,2-Dichloroethene	0.37	mg/L	<0.0010	<0.0010
cis-1,3-Dichloropropene	- -	mg/L	<0.0010	<0.0010
Cyclohexane	13	mg/L	NA	NA
Dibromochloromethane	0.0008	mg/L	<0.0010	<0.0010
Dichlorodifluoromethane	0.39	mg/L	NA	NA
Ethylbenzene	0.0015	mg/L	<0.0010	<0.0010
Isopropylbenzene	0.68	mg/L	NA	NA
m,p-Xylene	- -	mg/L	<0.0020	<0.0020
Methyl acetate	37	mg/L	NA	NA
Methyl tert-butyl ether	0.012	mg/L	NA	NA
Methylcylohexane	6.3	mg/L	NA	NA
Methylene Chloride	0.0048	mg/L	<0.0010	<0.0010
o-Xylene	1.4	mg/L	<0.0010	<0.0010
Styrene	1.6	mg/L	<0.0010	<0.0010
Tetrachloroethene	0.00011	mg/L	<0.0010	<0.0010
Toluene	2.3	mg/L	<0.0010	<0.0010
trans-1,2-Dichloroethene	0.11	mg/L	<0.0010	<0.0010
trans-1,3-Dichloropropene	- -	mg/L	<0.0010	<0.0010
Trichloroethene	0.0017	mg/L	<0.0010	<0.0010
Trichlorofluoromethane	1.3	mg/L	NA	NA
Vinyl Chloride	0.000016	mg/L	<0.0010	<0.0010
Xylenes (total)	0.2	mg/L	<0.0020	<0.0020
Semivolatile Organics				
1,2,4-Trichlorobenzene	0.019	mg/L	<0.0050	<0.0050
1,2-Dichlorobenzene	0.37	mg/L	<0.0050	<0.0050
1,3-Dichlorobenzene	- -	mg/L	<0.0050	<0.0050
1,4-Dichlorobenzene	0.00043	mg/L	<0.0050	<0.0050
1-Methylnaphthalene	0.0023	mg/L	NA	NA
2,4,5-Trichlorophenol	3.7	mg/L	<0.0050	<0.0050
2,4,6-Trichlorophenol	0.0061	mg/L	<0.0050	<0.0050
2,4-Dichlorophenol	0.11	mg/L	<0.0050	<0.0050
2,4-Dimethylphenol	0.73	mg/L	<0.0050	<0.0050
2,4-Dinitrophenol	0.073	mg/L	<0.025	<0.025
2,4-Dinitrotoluene	0.073	mg/L	<0.0050	<0.0050
2,6-Dinitrotoluene	0.037	mg/L	<0.0050	<0.0050
2-Chloronaphthalene	2.9	mg/L	<0.0050	<0.0050
2-Chlorophenol	0.18	mg/L	<0.0050	<0.0050
2-Methylnaphthalene	0.15	mg/L	<0.0050	<0.0050
2-Methylphenol	1.8	mg/L	<0.0050	<0.0050
2-Nitroaniline	- -	mg/L	<0.0050	<0.0050
2-Nitrophenol	- -	mg/L	<0.0050	<0.0050
3,3'-Dichlorobenzidine	0.00015	mg/L	<0.0050	<0.0050
3-Nitroaniline	- -	mg/L	<0.0050	<0.0050
4,6-Dinitro-2-methylphenol	- -	mg/L	<0.025	<0.025
4-Bromophenyl-phenylether	- -	mg/L	<0.0050	<0.0050
4-Chloro-3-Methylphenol	- -	mg/L	<0.0050	<0.0050
4-Chloroaniline	0.15	mg/L	<0.0050	<0.0050
4-Chlorophenyl-phenylether	- -	mg/L	<0.0050	<0.0050

Notes found at end of table.

Table 6-7. Surface Water Analytical Results, Bag Loading Area, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Date Collected:	Tapwater Screening Values [a]	Units	BLASW04 06/24/02	BLASW05 06/24/02
Semivolatile Organics				
4-Methylphenol	0.18	mg/L	<0.0050	<0.0050
4-Nitroaniline	- -	mg/L	<0.0050 J	<0.0050 J
4-Nitrophenol	- -	mg/L	<0.025	<0.025
Acenaphthene	2.2	mg/L	<0.0050	<0.0050
Acenaphthylene	- -	mg/L	<0.0050	<0.0050
Anthracene	11	mg/L	<0.0050	<0.0050
Benzo(a)anthracene	0.000029	mg/L	<0.0050	<0.0050
Benzo(a)pyrene	0.0000029	mg/L	<0.0050	<0.0050
Benzo(b)fluoranthene	0.000029	mg/L	<0.0050	<0.0050
Benzo(g,h,i)perylene	- -	mg/L	<0.0050	<0.0050
Benzo(k)fluoranthene	0.00029	mg/L	<0.0050	<0.0050
Benzoic Acid	150	mg/L	<0.025	<0.025
Benzyl Alcohol	18	mg/L	<0.0050	<0.0050
bis(2-Chloroethoxy)methane	0.11	mg/L	<0.0050	<0.0050
bis(2-Chloroethyl)ether	0.000012	mg/L	<0.0050	<0.0050
bis(2-Chloroisopropyl)ether	- -	mg/L	<0.0050	<0.0050
bis(2-Ethylhexyl)phthalate	0.0048	mg/L	<0.0050	<0.0050
Butylbenzylphthalate	7.3	mg/L	0.00044 B	<0.0050
Carbazole	0.0034	mg/L	<0.0050	<0.0050
Chrysene	0.0029	mg/L	<0.0050	<0.0050
Dibenzo(a,h)anthracene	0.0000029	mg/L	<0.0050	<0.0050
Dibenzofuran	- -	mg/L	<0.0050	<0.0050
Diethylphthalate	29	mg/L	<0.0050	<0.0050
Dimethylphthalate	- -	mg/L	<0.0050	<0.0050
Di-n-Butylphthalate	3.7	mg/L	0.00090 B	<0.0050
Dinitrotoluene Mix	0.000099	mg/L	<0.0050	<0.0050
Di-n-Octylphthalate	- -	mg/L	<0.0050	<0.0050
Fluoranthene	1.5	mg/L	<0.0050	<0.0050
Fluorene	1.5	mg/L	<0.0050	<0.0050
Hexachlorobenzene	0.000042	mg/L	<0.0050	<0.0050
Hexachlorobutadiene	0.00086	mg/L	<0.0050	<0.0050
Hexachlorocyclopentadiene	0.22	mg/L	<0.0050 J	<0.0050 J
Hexachloroethane	0.0048	mg/L	<0.0050	<0.0050
Indeno(1,2,3-cd)pyrene	0.000029	mg/L	<0.0050	<0.0050
Isophorone	0.071	mg/L	<0.0050	<0.0050
Naphthalene	0.0062	mg/L	<0.0050	<0.0050
Nitrobenzene	0.0034	mg/L	<0.0050	<0.0050
N-Nitroso-di-n-propylamine	0.0000096	mg/L	<0.0050	<0.0050
N-Nitrosodiphenylamine	0.014	mg/L	<0.0050	<0.0050
Pentachlorophenol	0.00056	mg/L	<0.025	<0.025
Phenanthrene	- -	mg/L	<0.0050	<0.0050
Phenol	11	mg/L	<0.0050	<0.0050
Pyrene	1.1	mg/L	<0.0050	<0.0050
Pyridine	0.037	mg/L	<0.0050	<0.0050
Inorganics				
Aluminum	37	mg/L	0.140 J	0.384
Antimony	0.015	mg/L	<0.00500	0.000770 B
Arsenic	0.000045	mg/L	<0.00300	<0.00300
Barium	7.3	mg/L	0.0851	0.0847
Beryllium	0.073	mg/L	<0.00200	<0.00200
Cadmium	0.018	mg/L	<0.00200	<0.00200
Calcium	- -	mg/L	57.2	54.6
Chromium	- -	mg/L	<0.0100	<0.0100
Cobalt	- -	mg/L	<0.0500	<0.0500
Copper	1.5	mg/L	<0.0200	<0.0200
Iron	26	mg/L	0.274	0.297
Lead	- -	mg/L	0.000500 B	0.000340 B
Magnesium	- -	mg/L	16.4	16.4
Manganese	0.88	mg/L	0.0304	0.0184
Mercury	0.00063	mg/L	<0.000100	<0.000100
Nickel	0.73	mg/L	<0.0400	<0.0400
Potassium	- -	mg/L	3.30	3.31
Selenium	0.18	mg/L	0.000510 B	<0.00500
Silver	0.18	mg/L	<0.0100	<0.0100
Sodium	- -	mg/L	34.2	34.7
Thallium	0.0024	mg/L	<0.00200	<0.00200
Vanadium	0.18	mg/L	<0.0500	<0.0500
Zinc	11	mg/L	<0.0200	<0.0200
Perchlorate				
Perchlorate	0.026	mg/L	<0.001	<0.001
Miscellaneous				
Hardness	- -	mg/L	210	204

mg/L	Milligrams per liter.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
	Adjusted tap-water screening levels used to assess surface water at the NRU.
J	Constituent concentration quanitified as estimated.
24,400	Highlighted value indicates constituent concentration is above tapwater screening value.

Table 6-8. Soil, Conductive Flooring, and Building Material Analytical Results, Bag Loading Area, 2005 Shaw Soil Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Sample Name:	Adjusted Soil Screening Values- Residential [a]	Adjusted Soil Screening Values- Industrial [a]	Facility-Wide Background Values [b]		BLASS12	BLASS13	BLASS14	BLASS15	BLASS16	BLASS17	BLADF01	BLADF02	BLAIF01	BLAIF02	BLAW01	BLAW02	WB01	BLAPC01
Sample Matrix:					Soil	Soil	Soil	Soil	Soil	Soil	Flooring	Flooring	Flooring	Flooring	Wipe	Wipe	Wipe	Paint
Sample Type/Paint Color:					-	-	-	-	-	-	Deteriorated	Deteriorated	Intact	Intact	-	-	-	White
Sample Depth (ft):					0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	-	-	-	-	-	-	-	-
Distance from Building (in):					6	6	30	6	6	30	-	-	-	-	-	-	-	-
Date Collected:				Units	01/26/05	01/26/05	01/26/05	01/26/05	01/26/05	01/26/05	01/26/05	01/26/05	01/26/05	01/26/05	01/26/05	01/26/05	01/26/05	01/26/05
Sample Components																		
Acid Soluble	--	--	--	%	18.1	17.3	22.3	20.7	7.3	20.5	29.2	29.5	27.4	17.9	NA	NA	NA	NA
Organics	--	--	--	%	8.2	7.2	13.8	22.5	13.1	21.7	14.5	17.8	17.8	22.5	NA	NA	NA	NA
Other	--	--	--	%	66.3	68.0	60.7	42.6	67.6	46.2	45.0	42.2	38.4	38.7	NA	NA	NA	NA
Asbestos																		
Actinolite	--	--	--	%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	NA	NA
Amosite	--	--	--	%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	NA	NA
Anthophyllite	--	--	--	%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	NA	NA
Chrysotile	--	--	--	%	7.4	7.6	3.2	14.2	11.9	11.6	11.3	10.5	16.5	20.8	NA	NA	NA	NA
Crocidolite	--	--	--	%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	NA	NA
Tremolite	--	--	--	%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	NA	NA
Total Asbestos	--	--	--	%	7.4	7.6	3.2	14.2	11.9	11.6	11.3	10.5	16.5	20.8	NA	NA	NA	NA
Total Asbestos	--	--	--	s/cm^2	NA	NA	NA	NA	NA	NA	0.0	0.0	0.0	0.0	225,000,000	122,000,000	2,820	NA
Inorganics																		
Lead	400 {++}	800 {++}	26.8	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	306

[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
ft	Feet.
in	Inches.
%	Percent.
s/cm^2	Structures per square centimeter.
mg/kg	Milligrams per kilogram.
NA	Not Analyzed.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).

Table 6-9. XRF Screening Results for Soil, Bag Loading Area, 2008 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID	Sample Depth (ft)	Date Collected	Distance From Building (ft)	Lead (mg/kg)
			Adjusted Soil Screening Values-Residential [a]:	400 {++}
			Adjusted Soil Screening Values-Industrial [a]:	800 {++}
			Facility-Wide Background Values [b]:	26.8
			Units:	mg/kg
		Building 412		
BLA-R1A	0 - 0.5	08/04/08	1	**84**
BLA-R1B	0 - 0.5	08/04/08	5	**75**
BLA-R1C	0 - 0.5	08/04/08	10	**73**
BLA-R2A	0 - 0.5	08/04/08	1	**120**
BLA-R2B	0 - 0.5	08/04/08	5	**74**
BLA-R2C	0 - 0.5	08/04/08	10	**136**
BLA-R3A	0 - 0.5	08/04/08	1	**35**
BLA-R3B	0 - 0.5	08/04/08	5	19
BLA-R3C	0 - 0.5	08/04/08	10	23
BLA-R4A	0 - 0.5	08/04/08	1	20
BLA-R4B	0 - 0.5	08/04/08	5	18
BLA-R4C	0 - 0.5	08/04/08	10	19
BLA-R5A	0 - 0.5	08/04/08	1	23
BLA-R5B	0 - 0.5	08/04/08	5	18
BLA-R5C	0 - 0.5	08/04/08	10	20
BLA-R6A	0 - 0.5	08/04/08	1	22
BLA-R6B	0 - 0.5	08/04/08	5	21
BLA-R6C	0 - 0.5	08/04/08	10	12
BLA-R7A	0 - 0.5	08/04/08	1	19
BLA-R7B	0 - 0.5	08/04/08	5	15
BLA-R7C	0 - 0.5	08/04/08	10	13
		Building 411		
BLA-R8A	0 - 0.5	08/04/08	1	**150**
BLA-R8B	0 - 0.5	08/04/08	5	**236**
BLA-R8C	0 - 0.5	08/04/08	10	**34**
BLA-R9A	0 - 0.5	08/04/08	1	25
BLA-R9B	0 - 0.5	08/04/08	5	16
BLA-R9C	0 - 0.5	08/04/08	10	18
BLA-R10A	0 - 0.5	08/04/08	1	24
BLA-R10B	0 - 0.5	08/04/08	5	13
BLA-R10C	0 - 0.5	08/04/08	10	14
BLA-R11A	0 - 0.5	08/04/08	1	16
BLA-R11B	0 - 0.5	08/04/08	5	18
BLA-R12A	0 - 0.5	08/04/08	1	22
BLA-R12B	0 - 0.5	08/04/08	5	11
BLA-R12C	0 - 0.5	08/04/08	10	22
BLA-R13A	0 - 0.5	08/04/08	1	16
BLA-R13B	0 - 0.5	08/04/08	5	18
BLA-R13C	0 - 0.5	08/04/08	10	19
		Building 413		
BLA-R14A	0 - 0.5	08/04/08	1	**49**
BLA-R14B	0 - 0.5	08/04/08	5	**38**
BLA-R14C	0 - 0.5	08/04/08	10	**30**
BLA-R15A	0 - 0.5	08/04/08	1	**43**
BLA-R15B	0 - 0.5	08/04/08	5	**41**
BLA-R15C	0 - 0.5	08/04/08	10	**64**
BLA-R16A	0 - 0.5	08/04/08	1	25
BLA-R16B	0 - 0.5	08/04/08	5	25
BLA-R16C	0 - 0.5	08/04/08	10	18
BLA-R17A	0 - 0.5	08/04/08	1	18
BLA-R17B	0 - 0.5	08/04/08	5	14
BLA-R17C	0 - 0.5	08/04/08	10	22
BLA-R18A	0 - 0.5	08/04/08	1	25
BLA-R18B	0 - 0.5	08/04/08	5	20
BLA-R18C	0 - 0.5	08/04/08	10	14
BLA-R19A	0 - 0.5	08/04/08	1	22
BLA-R19B	0 - 0.5	08/04/08	5	**31**
BLA-R19C	0 - 0.5	08/04/08	10	<13

Notes found at end of table.

Table 6-9. XRF Screening Results for Soil, Bag Loading Area, 2008 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID	Sample Depth (ft)	Date Collected	Distance From Building (ft)	Lead (mg/kg)
			Adjusted Soil Screening Values-Residential [a]:	400 {++}
			Adjusted Soil Screening Values-Industrial [a]:	800 {++}
			Facility-Wide Background Values [b]:	26.8
			Units:	mg/kg
Building 407				
BLA-R20A	0 - 0.5	08/05/08	1	**12,843**
BLA-R20B	0 - 0.5	08/05/08	5	**2,055**
BLA-R20C	0 - 0.5	08/05/08	10	**2,278**
BLA-R20D	0 - 0.5	08/05/08	15	**273**
BLA-R21A	0 - 0.5	08/05/08	1	**4,590**
BLA-R21B	0 - 0.5	08/05/08	5	**5,288**
BLA-R21C	0 - 0.5	08/05/08	10	**216**
Building 405				
BLA-R22A	0 - 0.5	08/05/08	1	**1,294**
BLA-R22B	0 - 0.5	08/05/08	5	**808**
BLA-R22C	0 - 0.5	08/05/08	10	**902**
BLA-R22D	0 - 0.5	08/05/08	15	**152**
BLA-R23A	0 - 0.5	08/05/08	1	**98**
BLA-R23B	0 - 0.5	08/05/08	5	**332**
BLA-R23C	0 - 0.5	08/05/08	10	**37**
BLA-R24A	0 - 0.5	08/05/08	1	**590**
BLA-R24B	0 - 0.5	08/05/08	5	**297**
BLA-R24C	0 - 0.5	08/05/08	10	**120**
BLA-R25A	0 - 0.5	08/05/08	1	**41**
BLA-R25B	0 - 0.5	08/05/08	5	**179**
BLA-R25C	0 - 0.5	08/05/08	10	**44**
BLA-R26A	0 - 0.5	08/05/08	1	**1,036**
BLA-R26B	0 - 0.5	08/05/08	5	**405**
BLA-R26C	0 - 0.5	08/05/08	10	**126**
BLA-R27A	0 - 0.5	08/05/08	1	**1,203**
BLA-R27B	0 - 0.5	08/05/08	5	**224**
BLA-R27C	0 - 0.5	08/05/08	10	**310**
BLA-R28A	0 - 0.5	08/05/08	1	**176**
BLA-R28B	0 - 0.5	08/05/08	5	**82**
BLA-R28C	0 - 0.5	08/05/08	10	**43**
BLA-R29A	0 - 0.5	08/05/08	1	**665**
BLA-R29B	0 - 0.5	08/05/08	5	**277**
BLA-R29C	0 - 0.5	08/05/08	10	**128**
BLA-R30A	0 - 0.5	08/05/08	1	**860**
BLA-R30B	0 - 0.5	08/05/08	5	**483**
BLA-R30C	0 - 0.5	08/05/08	10	**34**
BLA-R31A	0 - 0.5	08/05/08	1	**1263**
BLA-R31B	0 - 0.5	08/05/08	5	**83**
BLA-R31C	0 - 0.5	08/05/08	10	18
BLA-R32A	0 - 0.5	08/05/08	1	**607**
BLA-R32B	0 - 0.5	08/05/08	5	**70**
BLA-R32C	0 - 0.5	08/05/08	10	**72**
BLA-R33A	0 - 0.5	08/05/08	1	**55**
BLA-R33B	0 - 0.5	08/05/08	5	**49**
BLA-R33C	0 - 0.5	08/05/08	10	**132**
BLA-R34A	0 - 0.5	08/05/08	1	**164**
BLA-R34B	0 - 0.5	08/05/08	5	**190**
BLA-R34C	0 - 0.5	08/05/08	10	**76**
BLA-R35A	0 - 0.5	08/05/08	1	**302**
BLA-R35B	0 - 0.5	08/05/08	5	**165**
BLA-R35C	0 - 0.5	08/05/08	10	**148**
BLA-R36A	0 - 0.5	08/05/08	1	**456**
BLA-R36B	0 - 0.5	08/05/08	5	**417**
BLA-R36C	0 - 0.5	08/05/08	10	**36**
BLA-R37A	0 - 0.5	08/05/08	1	**206**
BLA-R37B	0 - 0.5	08/05/08	5	**386**
BLA-R37C	0 - 0.5	08/05/08	10	**164**
BLA-R38A	0 - 0.5	08/05/08	1	**299**
BLA-R38B	0 - 0.5	08/05/08	5	**204**
BLA-R38C	0 - 0.5	08/05/08	10	**146**
BLA-R39A	0 - 0.5	08/05/08	1	**240**
BLA-R39B	0 - 0.5	08/05/08	5	**170**
BLA-R39C	0 - 0.5	08/05/08	10	**36**
BLA-R40A	0 - 0.5	08/05/08	1	**316**
BLA-R40B	0 - 0.5	08/05/08	5	**80**
BLA-R40C	0 - 0.5	08/05/08	10	17
Building 406				
BLA-R41A	0 - 0.5	08/05/08	1	**12,799**
BLA-R41B	0 - 0.5	08/05/08	5	**3,284**
BLA-R41C	0 - 0.5	08/05/08	10	**3,104**
BLA-R42A	0 - 0.5	08/05/08	1	**6,031**
BLA-R42B	0 - 0.5	08/05/08	5	**1,940**
BLA-R42C	0 - 0.5	08/05/08	10	**588**

Notes found at end of table.

Table 6-9. XRF Screening Results for Soil, Bag Loading Area, 2008 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID	Sample Depth (ft)	Date Collected	Distance From Building (ft)	Lead (mg/kg)
Adjusted Soil Screening Values-Residential [a]:				400 {++}
Adjusted Soil Screening Values-Industrial [a]:				800 {++}
Facility-Wide Background Values [b]:				26.8
Units:				mg/kg
Building 404				
BLA-R43A	0 - 0.5	08/05/08	1	**2,387**
BLA-R43B	0 - 0.5	08/05/08	5	**1,546**
BLA-R43C	0 - 0.5	08/05/08	10	**886**
BLA-R43D	0 - 0.5	08/05/08	15	**402**
BLA-R44A	0 - 0.5	08/05/08	1	**1,360**
BLA-R44B	0 - 0.5	08/05/08	5	**820**
BLA-R44C	0 - 0.5	08/05/08	10	**147**
BLA-R45A	0 - 0.5	08/05/08	1	**1,100**
BLA-R45B	0 - 0.5	08/05/08	5	**816**
BLA-R45C	0 - 0.5	08/05/08	10	**483**
BLA-R45D	0 - 0.5	08/05/08	15	**124**
BLA-R46A	0 - 0.5	08/05/08	1	**1,691**
BLA-R46B	0 - 0.5	08/05/08	5	**686**
BLA-R46C	0 - 0.5	08/05/08	10	**82**
BLA-R47A	0 - 0.5	08/05/08	1	**86**
BLA-R47B	0 - 0.5	08/05/08	5	**313**
BLA-R47C	0 - 0.5	08/05/08	10	**339**
BLA-R48A	0 - 0.5	08/05/08	1	**257**
BLA-R48B	0 - 0.5	08/05/08	5	**358**
BLA-R48C	0 - 0.5	08/05/08	10	**74**
BLA-R49A	0 - 0.5	08/05/08	1	**906**
BLA-R49B	0 - 0.5	08/05/08	5	**438**
BLA-R49C	0 - 0.5	08/05/08	10	**75**
BLA-R50A	0 - 0.5	08/05/08	1	**1,866**
BLA-R50B	0 - 0.5	08/05/08	5	**515**
BLA-R50C	0 - 0.5	08/05/08	10	**90**
BLA-R51A	0 - 0.5	08/05/08	1	**773**
BLA-R51B	0 - 0.5	08/05/08	5	**242**
BLA-R51C	0 - 0.5	08/05/08	10	**45**
BLA-R52A	0 - 0.5	08/05/08	1	**1,289**
BLA-R52B	0 - 0.5	08/05/08	5	**240**
BLA-R52C	0 - 0.5	08/05/08	10	**62**
BLA-R53A	0 - 0.5	08/05/08	1	**602**
BLA-R53B	0 - 0.5	08/05/08	5	**79**
BLA-R53C	0 - 0.5	08/05/08	10	**77**
BLA-R54A	0 - 0.5	08/05/08	1	**179**
BLA-R54B	0 - 0.5	08/05/08	5	**115**
BLA-R54C	0 - 0.5	08/05/08	10	**63**
BLA-R55A	0 - 0.5	08/05/08	1	**4,640**
BLA-R55B	0 - 0.5	08/05/08	5	**259**
BLA-R55C	0 - 0.5	08/05/08	10	**107**
BLA-R56A	0 - 0.5	08/05/08	1	**243**
BLA-R56B	0 - 0.5	08/05/08	5	**117**
BLA-R56C	0 - 0.5	08/05/08	10	**90**
BLA-R57A	0 - 0.5	08/05/08	1	**209**
BLA-R57B	0 - 0.5	08/05/08	5	**639**
BLA-R57C	0 - 0.5	08/05/08	10	**507**
BLA-R58A	0 - 0.5	08/05/08	1	**333**
BLA-R58B	0 - 0.5	08/05/08	5	**46**
BLA-R58C	0 - 0.5	08/05/08	10	**131**
BLA-R59A	0 - 0.5	08/05/08	1	**664**
BLA-R59B	0 - 0.5	08/05/08	5	**536**
BLA-R59C	0 - 0.5	08/05/08	10	**308**
BLA-R60A	0 - 0.5	08/05/08	1	**341**
BLA-R60B	0 - 0.5	08/05/08	5	**164**
BLA-R60C	0 - 0.5	08/05/08	10	**104**
BLA-R61A	0 - 0.5	08/05/08	1	**1,061**
BLA-R61B	0 - 0.5	08/05/08	5	**89**
BLA-R61C	0 - 0.5	08/05/08	10	**118**
BLA-R62A	0 - 0.5	08/05/08	1	**529**
BLA-R62B	0 - 0.5	08/05/08	5	**315**
BLA-R62C	0 - 0.5	08/05/08	10	**199**
BLA-R63A	0 - 0.5	08/05/08	1	**640**
BLA-R63B	0 - 0.5	08/05/08	5	**156**
BLA-R63C	0 - 0.5	08/05/08	10	**27**

[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
ft	Feet.
mg/kg	Milligrams per kilogram.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 6-10. Soil Analytical Results, Bag Loading Area, 2008 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID:					BLA-SB001	BLA-SB001	BLA-SS001	BLA-SS002	BLA-SS003	BLA-SS004	BLA-SS005	BLA-SS006	BLA-SS007	BLA-SS008	BLA-SS001	BLA-SS002	BLA-SS003	BLA-SS004	BLA-SS005	BLA-SS006	BLA-SS007	BLA-SS008	BLA-SS009	BLA-SS010	BLA-SS011	BLA-SS012	BLA-SS013
Sample Depth(Feet):					1 - 2	2 - 3	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5
Date Collected:	Adjusted Soil	Adjusted Soil			07/29/08	07/29/08	07/29/08	07/29/08	07/29/08	07/29/08	07/29/08	07/29/08	07/29/08	07/29/08	08/05/08	08/05/08	08/05/08	08/05/08	08/05/08	08/05/08	08/05/08	08/05/08	08/05/08	08/05/08	08/05/08	08/05/08	08/05/08
Corresponding XRF Screening Location:	Screening	Screening	Facility-Wide		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	BLA-R1A	BLA-R4C	BLA-R8B	BLA-R11A	BLA-R16B	BLA-R21A	BLA-R22C	BLA-R27A	BLA-R31A	BLA-R33B	BLA-R36A	BLA-R39B	BLA-R42A
Building:	Values-	Values-	Background		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	412	412	411	411	413	407	405	405	405	405	405	405	406
Distance from Building (ft):	Residential [a]	Industrial [a]	Values [b]	Units	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1	5	5	1	5	1	10	1	1	5	1	5	1
XRF Metals																											
Lead	400 {++}	800 {++}	26.8		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	84	19	236	16	25	**4590**	**902**	**1203**	**1263**	49	456	170	6031
Inorganics																											
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	27,200	26,400	8,050	34,200	29,200	27,600	13,300	15,000	13,900 [15,200]	22,900	23,600	13,600	5,750
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<4.40 J	<4.20 J	<3.80 J	<4.60 J	<4.40 J	<4.70 J	<5.60 J	<4.70 J	<3.90 J [<4.20]	<4.20 J	<4.10 J	<4.10 J	4.10 J
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.30	12.2	6.20	13.6	14.5	8.90	10.3	12.2	8.40 [14.8]	10.0	10.9	11.0	**17.9**
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	52.0 J	58.4 J	120 J	78.8 J	55.6 J	**781 J**	**1,730 J**	**11,100 J**	**1,550 J [1,610]**	115 J	**7,770 J**	**6,500 J**	**654 J**
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**1.70**	**1.90**	0.700 J	**2.00**	**2.20**	**2.10**	**1.10 J**	1.00 J	0.950 J [0.980 J]	**1.50**	0.880 J	0.620 J	0.790 J
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**1.80**	<1.40	**0.950 J**	<1.50	<1.50	**2.70**	**9.40**	**34.7**	**3.60 [5.60]**	**1.00 J**	**12.7**	**9.30**	**44.8**
Calcium	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4,090 J	1,350 J	189,000 J	601 J	1,770 J	2,580 J	191,000 J	126,000 J	35,000 J [113,000 J	64,400 J	60,100 J	53,400 J	79,600 J
Chromium	280 {ca}	1,460 {ca}	65.3	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	48.7	53.9	40.6	46.9	52.5	42.2	35.3	58.9	**64.0 [96.4]**	39.7	59.3	52.0	**95.6**
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	16.5	23.9	8.40	39.8	29.4	17.0	13.1	<47.0	12.7 J [20.2]	15.7	<40.6	<41.4	19.3
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**13,000**	43.8	**127**	30.2	**192**	**2,620**	**1,210**	**13,100**	**1,460 J [3,890 J]**	**227**	**3,660**	**3,590**	**72,000**
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	46,000	**57,100**	13,600	50,200	46,700	43,000	25,200	31,800	33,700 [28,300]	36,900	35,200	**61,500**	35,500
Lead	400 {++}	800 {++}	26.8	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**105**	23.9	**163**	**28.7**	25.9	**1,340**	**927**	**1,030**	**1,830 [1,080]**	**128**	**1,420**	**2,230**	**58,000**
Magnesium	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12,700	4,500	105,000	4,880	6,890	8,390	100,000	75,800	48,300 [58,000]	34,500	37,400	28,100	64,700
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	340 J	897 J	228 J	1,270 J	633 J	331 J	491 J	277 J	395 J [491]	438 J	281 J	530 J	470 J
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0470	0.0360 J	0.0550	0.0450 J	0.0270 J	0.0390 J	**0.210**	**1.90**	**0.570 J [16.8 J]**	**0.410**	**0.530**	**0.630**	0.0580 J
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	48.7	26.0	14.8	26.2	31.2	35.9	21.3	46.2	22.9 [34.1]	22.2	30.0	39.9	**148**
Potassium	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3,320 J	3,230 J	1,520 J	3,640 J	5,000 J	3,810 J	3,820 J	3,240 J	2,840 J [2,030]	3,210 J	2,220 J	1,140 J	1,040 J
Selenium	39 {nc}	510 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<1.50	<1.40	<1.30	<1.50	<1.50	<1.60	<1.90	<1.60	<1.30 [<1.40]	<1.40	<1.40	<1.40	1.90 J
Silver	39 {nc}	510 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.440 J	<2.80	<2.50	<3.00	<2.90	<3.10	<3.70	0.650 J	<2.60 [0.570 J]	<2.80	0.500 J	1.10 J	2.30 J
Sodium	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<1,460	<1,410	<1,270	<1,520	<1,470	<1,550	<1,850	<1,570	<1,310 [<1,410]	<1,390	<1,350	<1,380	<2,330
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<2.90	<2.80	<2.50	<3.00	<2.90	<3.10	<3.70	<3.10	<2.60 [<2.80]	<2.80	<2.70	<2.80	<4.70
Vanadium	55{nc}	720 {nc}	108	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	71.7	102	24.1	82.6	82.0	70.2	36.8	35.9	30.5 [40.2]	58.4	57.1	37.6	22.2 J
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	148	37.2	**723**	43.0	49.9	**988**	**2,050**	**7,860**	**1,250 J [2,600 J]**	**300**	**3,340**	**4,410**	**12,500**
PAHs																											
1,2,4-Trichlorobenzene	180 {ca**}	220 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	220 {sat}	220 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	2.6 {ca}	13 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1-Methylnaphthalene	22	99	- -	mg/kg	NA	NA	NA	NA	NA	NA	0.013	0.011	0.025	0.0056 J	0.047	<0.0093	<0.0085	<0.010	0.40	<0.0054	0.028 J	0.0092 J	0.33 J [<0.024 J]	0.048	<0.0094	<0.024	0.0087 J
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	0.016	0.014	0.027	0.0061 J	0.054	<0.0093	<0.0085	<0.010	0.58	<0.0054	0.028 J	0.012	0.48 J [<0.024 J]	0.051	<0.0094	0.016 J	<0.015
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	0.27	0.36	0.83	0.21	0.092	<0.0093	0.0058 J	0.014	12	<0.0054	0.24	0.0084 J	9.0 J [0.13 J]	0.24	0.017	0.098	0.057
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	0.20	0.11	0.31	<0.0082	0.044	<0.0093	0.012	0.0090 J	0.14	<0.0054	0.078	<0.011	0.051 J [<0.024 J]	0.032	0.030	0.032	<0.015
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	0.76	1.0	2.1	0.66	0.20	<0.0093	0.040	0.040	22	0.0074	0.48	<0.011	16 J [0.31 J]	0.51	0.034	0.15	0.084
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	4.6	4.5	10	4.0	1.1	0.025	0.14	0.32	46	0.044	2.3	0.080	26 J [1.0 J]	1.7	0.19	0.81	0.35
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	4.2 J	4.0 J	9.4	3.6	1.1	0.027	<0.0085	0.32	39	0.038	2.6	0.11	19 J [0.85 J]	1.4	0.26	0.86	0.44
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	6.4 J	6.4 J	15	5.4	1.5	0.039	0.21	0.42	56	0.048	3.6	0.13	28 J [1.1 J]	2.2	0.40	1.1	0.66
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	4.0 J	2.8 J	8.3	1.9	0.90	0.016	0.11	0.17	21	0.026	1.5	0.071	11 J [0.52 J]	0.95	0.17	0.60	0.33
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	1.8	3.2	6.1	1.7	1.0	0.021	0.18	0.30	31	0.038	2.6	0.13	14 J [0.88 J]	0.73	0.27	0.68	0.38
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	5.8	5.5	13	4.8	1.6	0.037	0.24	0.41	54	0.054	3.5	0.16	28 J [1.2 J]	1.8	0.31	1.3	0.57
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	1.0 J	1.2 J	2.0 J	0.76 J	0.24	<0.0093	<0.0085	0.056	6.9	<0.0054	0.50	<0.011	4.7 J [0.19 J]	0.34	<0.0094	0.19	<0.015
Dinitrotoluene Mix	0.71	2.5	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	13	12 J	32	12	3.8	0.074	0.52	0.96	160	0.12	9.1	0.36	100 J [2.6 J]	4.9	0.80	3.2	1.3
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	0.26	0.33	0.74	0.20	0.14	<0.0093	<0.0085	0.018	12	<0.0054	0.34	<0.011	8.8 J [0.11 J]	0.26	<0.0094	0.084	<0.015
Hexachlorobutadiene	6.2	22	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	4.3 J	3.7 J	8.9 J	2.4 J	1.1	0.020	<0.0085	0.22	25	0.030	1.9	0.088	13 J [0.71 J]	1.2	0.22	0.75	0.40
Naphthalene	3.9 {ca}	20 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	0.027	0.022	0.043	<0.0082	0.17	<0.0093	<0.0085	<0.010	1.4	<0.0054	0.050	<0.011	1.1 J [<0.024 J]	0.12	<0.0094	0.042	<0.015
Nitrobenzene	3.9 {nc}	20 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	5.5	5.4	12	4.6	2.3	0.022	0.15	0.28	100	0.042	4.8	0.18	74 J [1.4 J]	3.0	0.31	1.7	0.65
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	7.6	7.4 J	18	6.7	3.3	0.061	0.33	0.69	88	0.090	6.2	0.28	53 J [2.4 J]	3.4	0.51	2.2	0.71
Asbestos																											
Asbestos (Y/N)	--	--	- -	-	-	-	-	-	-	-	-	-	-	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PCBs																											
Aroclor-1016	0.39 {nc}	21 {ca**}	- -	mg/kg	<0.022	<0.022	<0.020	<0.020	<0.020	<0.020	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1221	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.022	<0.022	<0.020	<0.020	<0.020	<0.020	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1232	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.022	<0.022	<0.020	<0.020	<0.020	<0.020	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1242	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.022	<0.022	<0.020	<0.020	<0.020	<0.020	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1248	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.022	<0.022	<0.020	<0.020	<0.020	<0.020	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1254	0.22 {ca**}	0.74 {ca*}	- -	mg/kg	<0.022	<0.022	0.0069 J	0.0066 J	<0.020	0.015 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1260	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.022	<0.022	<0.020	<0.020	<0.020	<0.020	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Inorganics-TCLP	**TCLP Standard**																										
Arsenic	5,000	- -	- -	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<100	NA	NA	NA	NA	<100	NA	<100	NA	NA	NA
Barium	10,000	- -	- -	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	875	NA	NA	NA	NA	1,830	NA	1,040	NA	NA	NA
Cadmium	1,000	- -	- -	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	27.1 J	NA	NA	NA	NA	119	NA	<50	NA	NA	NA
Chromium	5,000	- -	- -	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	83.2 J	NA	NA	NA	NA	<100	NA	<100	NA	NA	NA
Lead	5,000	- -	- -	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	644	NA	NA	NA	NA	1,350	NA	22 J	NA	NA	NA
Mercury	200	- -	- -	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<2	NA	NA	NA	NA	<2	NA	<2	NA	NA	NA
Selenium	1,000	- -	- -	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<50	NA	NA	NA	NA	<50	NA	<50	NA	NA	NA
Silver	5,000	- -	- -	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<100	NA	NA	NA	NA	<100	NA	<100	NA	NA	NA

Notes found at end of table.

Table 6-10. Soil Analytical Results, Bag Loading Area, 2008 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: / Sample Depth(Feet): / Date Collected: / Corresponding XRF Screening Location: / Building: / Distance from Building (ft):	Adjusted Soil Screening Values- Residential [a]	Adjusted Soil Screening Values- Industrial [a]	Facility-Wide Background Values [b]	Units	BLA-SS014 / 0 - 0.5 / 08/05/08 / BLA-R45A / 404 / 1	BLA-SS015 / 0 - 0.5 / 08/05/08 / BLA-R49B / 404 / 5	BLA-SS016 / 0 - 0.5 / 08/05/08 / BLA-R52A / 404 / 1	BLA-SS017 / 0 - 0.5 / 08/05/08 / BLA-R55B / 404 / 5	BLA-SS018 / 0 - 0.5 / 08/05/08 / BLA-R58B / 404 / 5	BLA-SS019 / 0 - 0.5 / 08/05/08 / BLA-R61A / 404 / 1
XRF Metals										
Lead	400 {++}	800 {++}	26.8		1100	**438**	**1289**	259	46	**1061**
Inorganics										
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	10,900 [11,100]	11,800	11,900	18,000	25,500	19,800
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	<3.60 J [8.10]	<3.60	<3.70	<4.40	<4.40	<4.70
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	**47.2 [58.4]**	4.30	14.5	9.70	6.90	10.8
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	**9,320 J [10,600]**	**829**	**1,450**	**316**	**273**	**1,650**
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	**1.10 J [0.930 J]**	0.710 J	0.840 J	0.630 J	0.660 J	0.570 J
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	**28.6 [34.2]**	**4.00**	**11.2**	**2.90**	**1.50 J**	**4.70**
Calcium	- -	- -	- -	mg/kg	119,000 J [97,100]	142,000 J	151,000 J	32,900	72,800	56,000
Chromium	280 {ca}	1,460 {ca}	65.3	mg/kg	**73.7 [76.6]**	52.8	**106**	43.9	32.9	37.6
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	20.5 J [21.1 J]	8.30	16.0	8.10	3.90 J	6.50 J
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	**15,100 [17,600]**	**2,890**	**3,680**	**5,200**	**150**	**551**
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	37,000 [36,500]	28,600	35,400	29,200	32,100	28,800
Lead	400 {++}	800 {++}	26.8	mg/kg	**4,310 [7,250]**	**439**	**1,210**	**405**	**109**	**881**
Magnesium	- -	- -	- -	mg/kg	73,700 [62,400]	87,100	65,500	19,200	44,600	20,800
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	336 J [331]	319	353	254	201	318
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	**0.600 [0.540]**	**1.00**	**12.6**	**2.30**	**0.320**	**0.730**
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	**81.2 [86.6]**	21.0	38.2	20.5	14.1	17.5
Potassium	- -	- -	- -	mg/kg	3,300 J [2,680]	4,160	2,200	978 J	1,880	2,330
Selenium	39 {nc}	510 {nc}	- -	mg/kg	<1.20 [<1.20]	<1.20	<1.20	<1.50	<1.50	<1.60
Silver	39 {nc}	510 {nc}	- -	mg/kg	1.70 J [2.00 J]	<2.40	1.00 J	0.390 J	<2.90	<3.10
Sodium	- -	- -	- -	mg/kg	<1,190 [<6,020]	<1,190	<1,250	<1,460	<1,470	<1,560
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	<2.40 [<2.40]	<2.40	<2.50	<2.90	<2.90	<3.10
Vanadium	55{nc}	720 {nc}	108	mg/kg	34.7 [30.7]	29.6	28.2	49.1	61.9	47.5
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	**5,810 [7,140]**	**495**	**1,120**	**609**	170	**1,040**
PAHs										
1,2,4-Trichlorobenzene	180 {ca**}	220 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	220 {sat}	220 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	2.6 {ca}	13 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA
1-Methylnaphthalene	22	99	- -	mg/kg	<0.021 [0.017 J]	<0.0084	<0.023	0.034	<0.027	0.0056 J
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	<0.021 [0.018 J]	<0.0084	<0.023	0.038	<0.027	0.0079 J
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	0.022 [0.058]	<0.0084	0.028	0.41	0.055	0.013
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	0.021 [0.036]	<0.0084	0.073	0.23	0.058	0.047
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.067 J [0.14 J]	0.019	0.10	1.9	0.31	0.033
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.49 [0.88]	0.019	0.53	11	1.4	0.22
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	0.54 [0.93]	0.020	0.53	10	1.3	0.27
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.87 [1.3]	0.032	0.84	17	2.0	0.42
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	0.43 [0.65]	0.016	0.46	7.8	0.75	0.18
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	0.57 [1.1]	0.018	0.56	7.5	0.68	0.23
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	0.82 [1.5]	0.027	0.72	13	1.6	0.32
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	0.12 [0.21]	<0.0084	0.15	2.4	0.25	<0.011
Dinitrotoluene Mix	0.71	2.5	- -	mg/kg	NA	NA	NA	NA	NA	NA
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	1.5 [2.7]	0.050	1.2	32	3.6	0.80
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.021 [0.062]	<0.0084	0.031	0.51	0.074	<0.011
Hexachlorobutadiene	6.2	22	- -	mg/kg	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.51 [0.81]	0.018	0.55	7.8	0.97	0.22
Naphthalene	3.9 {ca}	20 {ca}	- -	mg/kg	<0.021 [0.040]	<0.0084	<0.023	0.062	<0.027	<0.011
Nitrobenzene	3.9 {nc}	20 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.55 J [1.4 J]	0.018	0.56	10	1.6	0.24
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	1.2 J [2.6 J]	0.044	1.1	18	2.9	0.40
Asbestos										
Asbestso (Y/N)	--	--	- -	-	Yes	Yes	Yes	Yes	Yes	Yes
PCBs										
Aroclor-1016	0.39 {nc}	21 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA
Aroclor-1221	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA
Aroclor-1232	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA
Aroclor-1242	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA
Aroclor-1248	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA
Aroclor-1254	0.22 {ca**}	0.74 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA
Aroclor-1260	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA
Inorganics-TCLP	**TCLP Standard**									
Arsenic	5,000	- -	- -	µg/L	NA	NA	NA	<100	NA	<100
Barium	10,000	- -	- -	µg/L	NA	NA	NA	2,050	NA	1,230
Cadmium	1,000	- -	- -	µg/L	NA	NA	NA	21.6 J	NA	<50
Chromium	5,000	- -	- -	µg/L	NA	NA	NA	<100	NA	<100
Lead	5,000	- -	- -	µg/L	NA	NA	NA	342	NA	172
Mercury	200	- -	- -	µg/L	NA	NA	NA	<2	NA	<2
Selenium	1,000	- -	- -	µg/L	NA	NA	NA	<50	NA	<50
Silver	5,000	- -	- -	µg/L	NA	NA	NA	<100	NA	<100

mg/kg	Milligrams per killogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics indicates concentration is above facility-wide background value.

Table 6-11. Surface Water Analytical Results, Bag Loading Area, 2008 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Date Collected:	Tapwater Screening Values [a]	Units	BLA-SPSW01 08/01/08	BLA-VLTW01 08/01/08
Volatile Organics				
1,1,1-Trichloroethane	9.1	mg/L	NA	<0.0010
1,1,2,2-Tetrachloroethane	0.000067	mg/L	NA	<0.0010
1,1,2-trichloro-1,2,2-trifluoroethane	59	mg/L	NA	<0.0010
1,1,2-Trichloroethane	0.00024	mg/L	NA	<0.0010
1,1-Dichloroethane	0.0024	mg/L	NA	<0.0010
1,1-Dichloroethene	0.34	mg/L	NA	<0.0010
1,2,3-Trichlorobenzene	- -	mg/L	NA	<0.0010
1,2,4-Trichlorobenzene	0.019	mg/L	NA	<0.0010
1,2-Dibromo-3-chloropropane	0.00000032	mg/L	NA	<0.0010
1,2-Dibromoethane	0.0000065	mg/L	NA	<0.0010
1,2-Dichlorobenzene	0.37	mg/L	NA	<0.0010
1,2-Dichloroethane	0.00015	mg/L	NA	<0.0010
1,2-Dichloropropane	0.00039	mg/L	NA	<0.0010
1,3-Dichlorobenzene	- -	mg/L	NA	<0.0010
1,4-Dichlorobenzene	0.00043	mg/L	NA	<0.0010
1,4-Dioxane	0.0061	mg/L	NA	<0.0050
2-Butanone	7.1	mg/L	NA	<0.010
2-Hexanone	- -	mg/L	NA	<0.0050
4-Methyl-2-pentanone	2	mg/L	NA	<0.0050
Acetone	22	mg/L	NA	<0.010
Benzene	0.00041	mg/L	NA	<0.0010
Bromochloromethane	- -	mg/L	NA	<0.0010
Bromodichloromethane	0.0011	mg/L	NA	<0.0010
Bromoform	0.0085	mg/L	NA	<0.0010
Bromomethane	0.0087	mg/L	NA	<0.0010
Carbon Disulfide	1	mg/L	NA	<0.0010
Carbon Tetrachloride	0.0002	mg/L	NA	<0.0010
Chlorobenzene	0.091	mg/L	NA	<0.0010
Chloroethane	21	mg/L	NA	<0.0010
Chloroform	0.00019	mg/L	NA	<0.0010
Chloromethane	0.0018	mg/L	NA	<0.0010
cis-1,2-Dichloroethene	0.37	mg/L	NA	<0.0010
cis-1,3-Dichloropropene	- -	mg/L	NA	<0.0010
Cyclohexane	13	mg/L	NA	<0.0010
Dibromochloromethane	0.0008	mg/L	NA	<0.0010
Dichlorodifluoromethane	0.39	mg/L	NA	<0.0010
Ethylbenzene	0.0015	mg/L	NA	<0.0010
Isopropylbenzene	0.68	mg/L	NA	<0.0010
m,p-Xylene	- -	mg/L	NA	NA
Methyl acetate	37	mg/L	NA	<0.0010
Methyl tert-butyl ether	0.012	mg/L	NA	<0.0010
Methylcylohexane	6.3	mg/L	NA	<0.0010
Methylene Chloride	0.0048	mg/L	NA	<0.0010
o-Xylene	1.4	mg/L	NA	NA
Styrene	1.6	mg/L	NA	<0.0010
Tetrachloroethene	0.00011	mg/L	NA	<0.0010
Toluene	2.3	mg/L	NA	<0.0010
trans-1,2-Dichloroethene	0.11	mg/L	NA	<0.0010
trans-1,3-Dichloropropene	- -	mg/L	NA	<0.0010
Trichloroethene	0.0017	mg/L	NA	<0.0010
Trichlorofluoromethane	1.3	mg/L	NA	<0.0010
Vinyl Chloride	0.000016	mg/L	NA	<0.0010
Xylenes (total)	0.2	mg/L	NA	<0.0010
Semivolatile Organics				
1,2,4-Trichlorobenzene	0.019	mg/L	NA	NA
1,2-Dichlorobenzene	0.37	mg/L	NA	NA
1,3-Dichlorobenzene	- -	mg/L	NA	NA
1,4-Dichlorobenzene	0.00043	mg/L	NA	NA
1-Methylnaphthalene	0.0023	mg/L	<0.000047	<0.000046
2,4,5-Trichlorophenol	3.7	mg/L	NA	NA
2,4,6-Trichlorophenol	0.0061	mg/L	NA	NA
2,4-Dichlorophenol	0.11	mg/L	NA	NA
2,4-Dimethylphenol	0.73	mg/L	NA	NA

Notes found at end of table.

Table 6-11. Surface Water Analytical Results, Bag Loading Area, 2008 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Date Collected:	Tapwater Screening Values [a]	Units	BLA-SPSW01 08/01/08	BLA-VLTW01 08/01/08
Semivolatile Organics				
2,4-Dinitrophenol	0.073	mg/L	NA	NA
2,4-Dinitrotoluene	0.073	mg/L	NA	NA
2,6-Dinitrotoluene	0.037	mg/L	NA	NA
2-Chloronaphthalene	2.9	mg/L	NA	NA
2-Chlorophenol	0.18	mg/L	NA	NA
2-Methylnaphthalene	0.15	mg/L	<0.000047	<0.000046
2-Methylphenol	1.8	mg/L	NA	NA
2-Nitroaniline	- -	mg/L	NA	NA
2-Nitrophenol	- -	mg/L	NA	NA
3,3'-Dichlorobenzidine	0.00015	mg/L	NA	NA
3-Nitroaniline	- -	mg/L	NA	NA
4,6-Dinitro-2-methylphenol	- -	mg/L	NA	NA
4-Bromophenyl-phenylether	- -	mg/L	NA	NA
4-Chloro-3-Methylphenol	- -	mg/L	NA	NA
4-Chloroaniline	0.15	mg/L	NA	NA
4-Chlorophenyl-phenylether	- -	mg/L	NA	NA
4-Methylphenol	0.18	mg/L	NA	NA
4-Nitroaniline	- -	mg/L	NA	NA
4-Nitrophenol	- -	mg/L	NA	NA
Acenaphthene	2.2	mg/L	<0.000047	<0.000046
Acenaphthylene	- -	mg/L	<0.000047	<0.000046
Anthracene	11	mg/L	<0.000047	<0.000046
Benzo(a)anthracene	0.000029	mg/L	<0.00047	0.000024 J
Benzo(a)pyrene	0.0000029	mg/L	<0.00047	<0.000046
Benzo(b)fluoranthene	0.000029	mg/L	<0.00047	0.000025 J
Benzo(g,h,i)perylene	- -	mg/L	<0.00047	<0.000046
Benzo(k)fluoranthene	0.00029	mg/L	<0.00047	<0.000046
Benzoic Acid	150	mg/L	NA	NA
Benzyl Alcohol	18	mg/L	NA	NA
bis(2-Chloroethoxy)methane	0.11	mg/L	NA	NA
bis(2-Chloroethyl)ether	0.000012	mg/L	NA	NA
bis(2-Chloroisopropyl)ether	- -	mg/L	NA	NA
bis(2-Ethylhexyl)phthalate	0.0048	mg/L	NA	NA
Butylbenzylphthalate	7.3	mg/L	NA	NA
Carbazole	0.0034	mg/L	NA	NA
Chrysene	0.0029	mg/L	<0.00047	0.000030 J
Dibenzo(a,h)anthracene	0.0000029	mg/L	<0.00047	<0.000046
Dibenzofuran	- -	mg/L	NA	NA
Diethylphthalate	29	mg/L	NA	NA
Dimethylphthalate	- -	mg/L	NA	NA
Di-n-Butylphthalate	3.7	mg/L	NA	NA
Dinitrotoluene Mix	0.000099	mg/L	NA	NA
Di-n-Octylphthalate	- -	mg/L	NA	NA
Fluoranthene	1.5	mg/L	<0.000047	0.000066
Fluorene	1.5	mg/L	<0.000047	<0.000046
Hexachlorobenzene	0.000042	mg/L	NA	NA
Hexachlorobutadiene	0.00086	mg/L	NA	NA
Hexachlorocyclopentadiene	0.22	mg/L	NA	NA
Hexachloroethane	0.0048	mg/L	NA	NA
Indeno(1,2,3-cd)pyrene	0.000029	mg/L	<0.00047 J	<0.000046 J
Isophorone	0.071	mg/L	NA	NA
Naphthalene	0.0062	mg/L	<0.000047	<0.000046
Nitrobenzene	0.0034	mg/L	NA	NA
N-Nitroso-di-n-propylamine	0.0000096	mg/L	NA	NA
N-Nitrosodiphenylamine	0.014	mg/L	NA	NA
Pentachlorophenol	0.00056	mg/L	NA	NA
Phenanthrene	- -	mg/L	<0.000047	0.000036 J
Phenol	11	mg/L	NA	NA
Pyrene	1.1	mg/L	<0.00047	0.000041 J
Pyridine	0.037	mg/L	NA	NA

Notes found at end of table.

Table 6-11. Surface Water Analytical Results, Bag Loading Area, 2008 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Date Collected:	Tapwater Screening Values [a]	Units	BLA-SPSW01 08/01/08	BLA-VLTW01 08/01/08
Inorganics				
Aluminum	37	mg/L	0.549	0.273
Antimony	0.015	mg/L	<0.0150	<0.0150
Arsenic	0.000045	mg/L	0.0100	0.00340 J
Barium	7.3	mg/L	0.0588	0.0981
Beryllium	0.073	mg/L	<0.00500	<0.00500
Cadmium	0.018	mg/L	<0.00500	<0.00500
Calcium	- -	mg/L	86.5	25.6
Chromium	- -	mg/L	<0.0100	0.00270 J
Cobalt	- -	mg/L	<0.0150	<0.0150
Copper	1.5	mg/L	0.828	0.646
Iron	26	mg/L	0.554	0.742
Lead	- -	mg/L	0.00220 J	0.247
Magnesium	- -	mg/L	496	23.3
Manganese	0.88	mg/L	0.377	0.0443
Mercury	0.00063	mg/L	<0.000200 J	0.000200 J
Nickel	0.73	mg/L	<0.0100	<0.0100
Potassium	- -	mg/L	146	43.6
Selenium	0.18	mg/L	<0.00500	<0.00500
Silver	0.18	mg/L	<0.0100	<0.0100
Sodium	- -	mg/L	107	22.1
Thallium	0.0024	mg/L	<0.0100	<0.0100
Vanadium	0.18	mg/L	<0.0500	<0.0500
Zinc	11	mg/L	0.0263	0.116

mg/L	milligram per liter
[a]	USEPA Regional Screening Levels (USEPA 2008a).
	Adjusted tap-water screening levels used to assess surface water at the NRU.
J	Constituent concentration quanitified as estimated.
24,400	Highlighted value indicates constituent concentration is above tapwater screening value.

Table 6-12. Sediment Analytical Results, Bag Loading Area, 2008 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: / Sample Depth(Feet): / Date Collected:	Adjusted Soil Screening Values- Residential [a]	Adjusted Soil Screening Values- Industrial [a]	Facility-Wide Background Values [b]	Units	BLA-SPSD01 / 0 - 0.5 / 08/01/08
Inorganics					
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	31,200
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	<4.10 J
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	9.40
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	**1,090**
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	**1.80**
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	**2.60**
Calcium	- -	- -	- -	mg/kg	22,000
Chromium	280 {ca}	1,460 {ca}	65.3	mg/kg	40.6
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	18.4
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	**1,280**
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	47,600
Lead	400 {++}	800 {++}	26.8	mg/kg	**71.0 J**
Magnesium	- -	- -	- -	mg/kg	18,400
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	284
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	0.0630 J
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	29.8
Potassium	- -	- -	- -	mg/kg	4,510
Selenium	39 {nc}	510 {nc}	- -	mg/kg	<1.40
Silver	39 {nc}	510 {nc}	- -	mg/kg	<2.80
Sodium	- -	- -	- -	mg/kg	<1,380
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	<2.80
Vanadium	55{nc}	720 {nc}	108	mg/kg	69.7
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	**721**
PAHs					
1,2,4-Trichlorobenzene	8.7 {ca**}	40 {ca**}	- -	mg/kg	<0.0094
1,2-Dichlorobenzene	220 {sat}	220 {sat}	- -	mg/kg	<0.0094
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	<0.0094
1,4-Dichlorobenzene	2.6 {ca}	13 {ca}	- -	mg/kg	<0.0094
1-Methylnaphthalene	22 {ca*}	99 {ca*}	- -	mg/kg	0.021 J
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	NA
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	NA
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	0.029 J
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	0.36
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.050
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.46
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	1.8
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	1.6
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	2.5
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	1.1
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	1.3
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	2.8
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	0.31
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	NA
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	7.4
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	0.39
Hexachlorobutadiene	6.2 {ca**}	22 {ca*}	- -	mg/kg	NA
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	1.4 J
Naphthalene	3.9 {nc}	20 {nc}	- -	mg/kg	0.11
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	NA
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	5.4
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	5.3

mg/kg	Milligrams per killogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
J	Constituent concentration quanitified as estimated.
NA	Not Analyzed.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics indicates concentration is above facility-wide background value.

Table 6-13. Surface Soil Analytical Results, 2009 ARCADIS Supplemental Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth (ft): Date Collected:	Units	BLA404-SS001A 0-0.25 07/22/09	BLA404-SS001B 0-0.25 07/22/09	BLA404-SS001C 0-0.25 07/22/09	BLA404-SS001D 0-0.25 07/22/09	BLA404-SS001E 0-0.25 07/22/09	BLA411-SS001A 0-0.25 07/22/09	BLA411-SS001B 0-0.25 07/22/09	BLA411-SS001C 0-0.25 07/22/09	BLA411-SS001D 0-0.25 07/22/09	BLA411-SS001E 0-0.25 07/22/09	BLA-SS020A 0-0.5 07/14/09	BLA-SS020B 0-0.5 07/14/09
Asbestos													
Asbestos weight percent	%	0.2	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.6	0.1 U	0.1 U	0.1	0.2
Chrysotile	struc.	26	24	NA	NA	NA	NA	NA	1	NA	NA	63	95
Crocidolite	struc.	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Percent Moisture													
Percent Moisture	%	15	100	23	24	26	16	7.0	2.1	2.3	2.4	NA	NA
Soil Particle Size													
3/4"	%	0	4.2	0	0	1.8	0	0	0	0	0	NA	NA
3/8"	%	14	3.0	16	12	3.3	2.9	15	2.2	0	4.6	NA	NA
d < 75 µm	%	8.0	1.7	30	4.3	6.5	6.3	5.8	9.7	3.8	3.0	NA	NA
No. 10	%	17	14	8.4	23	24	19	13	10	7.9	8.1	NA	NA
No. 200	%	18	31	12	10	18	19	16	30	51	40	NA	NA
No. 4	%	21	15	20	20	5.7	12	18	12	5.8	17	NA	NA
No. 40	%	21	31	14	30	41	42	32	36	31	27	NA	NA

U The compound was analyzed for but not detected. The associated value is the compound quantitation limit.
NA Not Analyzed
ND Not Detected

Table 6-13. Surface Soil Analytical Results, 2009 ARCADIS Supplemental Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth (ft): Date Collected:	Units	BLA-SS021A 0-0.5 07/14/09	BLA-SS021B 0-0.5 07/14/09	BLA-SS022A 0-0.5 07/15/09	BLA-SS022B 0-0.5 07/15/09	BLA-SS023C 0-0.5 07/15/09	BLA-SS024A 0-0.5 07/14/09	BLA-SS024B 0-0.5 07/14/09	BLA-SS025A 0-0.5 07/14/09	BLA-SS025B 0-0.5 07/14/09	BLA-SS026A 0-0.5 07/15/09	BLA-SS026B 0-0.5 07/15/09	BLA-SS027B 0-0.5 07/15/09	BLA-SS027C 0-0.5 07/15/09	BLA-SS028B 0-0.5 07/15/09	BLA-SS028C 0-0.5 07/15/09	BLA-SS029B 0-0.5 07/15/09	BLA-SS029C 0-0.5 07/15/09
Asbestos																		
Asbestos weight percent	%	0.1 U	0.1 U	0.1	0.1 U	0.1	0.1 U	0.1 U	0.1	0.1 U	9.4	0.1 U	0.1	0.1 U	0.1	0.1 U	0.1 U	0.1 U
Chrysotile	struc.	1	1	52	53	52	9	2	39	11	56	6	52	22	50	52	50	4
Crocidolite	struc.	ND	ND	ND	ND	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Percent Moisture																		
Percent Moisture	%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Soil Particle Size																		
3/4"	%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3/8"	%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
d < 75 µm	%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
No. 10	%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
No. 200	%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
No. 4	%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
No. 40	%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

U The compound was analyzed for but not detected. The associated value is the compound quantitation limit.
NA Not Analyzed
ND Not Detected

Table 6-14. Activity Based Air Sampling Results, 2009 ARCADIS Supplemental Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Date Collected:	Method	Units	BLA404-AA1 07/25/09	BLA404-AP1 07/26/09	BLA404-AA2 07/22/09	BLA404-AP2 07/23/09	BLA404-BK2 07/24/09	BLA411-AA1 07/29/09	BLA411-AP1 07/30/09	BLA411-BK1 07/31/09	BLA411-AA2 07/27/09	BLA411-AP2 07/28/09
Asbestos												
Air Concentration	AHERA	s/cc	0.017	0.069	0	0	0	0.078	0.034	0	NA	0
Loading on Filter	AHERA	s/mm2	53.25	214.3	0	0	0	16.92	1.54	0	NA	0
Number of structures	AHERA	struc.	18	39	0	0	0	11	1	0	0	0
Air Concentration	BCPS	s/cc	0	0.0018	0	0	0	0.0213	0	0	NA	0
Loading on Filter	BCPS	s/mm2	0	5.49	0	0	0	4.62	0	0	NA	0
Number of structures	BCPS	struc.	0	1	0	0	0	3	0	0	0	0
Air Concentration	PCME	s/cc	0.0019	0.0018	0	0	0	0.014	0.034	0	NA	0
Loading on Filter	PCME	s/mm2	5.92	5.49	0	0	0	3.08	1.54	0	NA	0
Number of structures	PCME	struc.	2	1	0	0	0	2	1	0	0	0
Air Concentration	TEM	s/cc	0.0218	0.090	0	0	0	0.0783	0.0345	0	NA	0
Loading on Filter	TEM	s/mm2	68.0	280	0	0	0	16.92	1.54	0	NA	0
Number of structures	TEM	struc.	23	51	0	0	0	11	1	0	0	0

s/cc: structures per cubic centimeter
S/mm2: structures per square millimeter
struc: structures
AHERA - Asbestos hazard emergency response act
BCPS - Berman-Crump Protocol Structures
PCE - Phase contrast microscopy
TEM - Transmission electron microscopy

Table 6-15
Surface Soil Risk Assessment Dataset
Surface Soil (0-1 foot Depth Interval)
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects /		number of samples	FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Volatile Organic Compounds												
2-Butanone	78-93-3	1	-	15	7	0.011	-	0.011	0.0055	-	0.0088	BLA-SPSD01
3-Octanone	106-68-3	1	-	1	100	0.011	-	0.011	–	-	–	BLASS07
4-Methyl-2-pentanone	108-10-1	1	-	15	7	0.0016	-	0.0016	0.0055	-	0.0088	BLA-SPSD01
Acetone	67-64-1	2	-	15	13	0.023	-	0.043	0.0055	-	0.0088	BLA-SPSD01
Carbon Disulfide	75-15-0	1	-	15	7	0.0031	-	0.0031	0.0055	-	0.0088	BLA-SPSD01
d-Limonene	5989-27-5	1	-	1	100	0.057	-	0.057	–	-	–	BLASS07
Methylene Chloride	75-09-2	3	-	17	18	0.001	-	0.0028	0.0055	-	0.0088	BLA-SPSD01
Tetrachloroethene	127-18-4	2	-	15	13	0.0009	-	0.00092	0.0055	-	0.0094	BLASS07
Toluene	108-88-3	5	-	15	33	0.00071	-	0.007	0.0055	-	0.0094	BLASS07
Semi-Volatile Organic Compounds												
2,4-Dinitrotoluene	121-14-2	9	-	17	53	0.04	-	3	0.2	-	0.2	BLASS03
2,6-Dinitrotoluene	606-20-2	3	-	17	18	0.07	-	1.9	0.2	-	0.4	SS-09
Benzoic Acid	65-85-0	2	-	13	15	0.14	-	0.3	0.86	-	3.8	TR-03E
bis(2-Ethylhexyl)phthalate	117-81-7	11	-	14	79	0.05	-	0.57	0.2	-	0.21	SS-09
Carbazole	86-74-8	10	-	12	83	0.045	-	13	0.2	-	0.21	BLASB02
Dibenzofuran	132-64-9	9	-	12	75	0.016	-	2.8	0.2	-	0.21	BLASB02
Di-n-Butylphthalate	84-74-2	6	-	12	50	0.061	-	120	0.2	-	0.39	BLASS03
N-Nitrosodiphenylamine	86-30-6	2	-	11	18	0.1	-	8.3	0.2	-	0.78	BLASS03
Phenol	108-95-2	1	-	12	8	0.08	-	0.08	0.2	-	0.78	SS-14
Explosives												
1,3,5-Trinitrobenzene	99-35-4	1	-	16	6	0.07	-	0.07	0.1	-	0.2	BLASS06
1,3-Dinitrobenzene	99-65-0	1	-	16	6	0.05	-	0.05	0.1	-	0.2	BLASS02
2,4,6-Trinitrotoluene	118-96-7	1	-	16	6	0.06	-	0.06	0.2	-	0.4	BLASS03
4-Amino-2,6-Dinitrotoluene	19406-51-0	3	-	16	19	0.04	-	0.07	0.2	-	0.4	BLASS03
m-Nitrotoluene	99-08-1	1	-	16	6	2.86	-	2.86	0.4	-	0.8	BLASS04
Nitroglycerine	55-63-0	1	-	16	6	0.21	-	0.21	0.31	-	0.72	BLASS11
Pentaerythritol Tetranitrate	78-11-5	1	-	16	6	0.16	-	0.16	0.31	-	0.72	BLASD01
Pesticides												
4,4'-DDD	72-54-8	4	-	5	80	0.00064	-	0.043	0.00798	-	0.00798	SS-09
4,4'-DDE	72-55-9	2	-	4	50	0.00058	-	0.00086	0.00798	-	0.00809	BLASD01
Beta-BHC	319-85-7	1	-	4	25	0.00028	-	0.00028	0.00082	-	0.00809	BLASD01
Alpha-Chlordane	5103-71-9	1	-	5	20	0.089	-	0.089	0.00079	-	0.00809	SS-09
Gamma-Chlordane	5566-34-7	1	-	5	20	0.01	-	0.01	0.00079	-	0.00809	SS-09
Endosulfan I	115-29-7	1	-	5	20	0.022	-	0.022	0.00079	-	0.00809	SS-09
Endrin	72-20-8	1	-	4	25	0.00035	-	0.00035	0.00079	-	0.00809	BLASD02
Heptachlor Epoxide	1024-57-3	2	-	5	40	0.00094	-	0.015	0.00082	-	0.00809	SS-09
Methoxychlor	72-43-5	2	-	4	50	0.00442	-	0.0674	0.00082	-	0.00809	BLASB02

Table 6-15
Surface Soil Risk Assessment Dataset
Surface Soil (0-1 foot Depth Interval)
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Polycyclic Aromatic Hydrocarbons												
1-Methylnaphthalene	90-12-0	15	-	24	62	0.0056	-	0.4	0.0054	-	0.027	BLA-SS005
2-Methylnaphthalene	91-57-6	25	-	39	64	0.0022	-	0.58	0.0054	-	0.39	BLA-SS005
Acenaphthene	83-32-9	32	-	39	82	0.0015	-	12	0.0018	-	0.21	BLA-SS005
Acenaphthylene	208-96-8	26	-	39	67	0.00076	-	0.31	0.0026	-	0.39	BLA-SS007
Anthracene	120-12-7	36	-	39	92	0.00099	-	22	0.0024	-	0.011	BLA-SS005
Benzo(a)anthracene	56-55-3	40	-	41	98	0.0054	-	46	–	-	–	BLA-SS005
Benzo(a)pyrene	50-32-8	39	-	41	95	0.0049	-	39	0.0085	-	0.0085	BLA-SS005
Benzo(b)fluoranthene	205-99-2	40	-	41	98	0.0098	-	68	–	-	–	BLASB02
Benzo(g,h,i)perylene	191-24-2	39	-	39	100	0.0068	-	21	–	-	–	BLA-SS005
Benzo(k)fluoranthene	207-08-9	40	-	41	98	0.0028	-	31	–	-	–	BLA-SS005
Chrysene	218-01-9	40	-	41	98	0.0065	-	54	–	-	–	BLA-SS005
Dibenzo(a,h)anthracene	53-70-3	30	-	39	77	0.0019	-	6.9	0.0054	-	0.21	BLA-SS005
Fluoranthene	206-44-0	40	-	41	98	0.0089	-	160	–	-	–	BLA-SS005
Fluorene	86-73-7	30	-	39	77	0.00095	-	12	0.0054	-	0.21	BLA-SS005
Indeno(1,2,3-cd)pyrene	193-39-5	38	-	39	97	0.0052	-	25	0.0085	-	0.0085	BLA-SS005
Naphthalene	91-20-3	24	-	39	62	0.0019	-	1.4	0.0054	-	0.21	BLA-SS005
Phenanthrene	85-01-8	40	-	41	98	0.0058	-	100	–	-	–	BLA-SS005
Pyrene	129-00-0	40	-	41	98	0.0071	-	88	–	-	–	BLA-SS005
Polychlorinated Biphenyls												
Aroclor 1254	11097-69-1	9	-	17	53	0.0066	-	8.3	0.02	-	0.04	SS-09
Inorganics												
Aluminum	7429-90-5	40	-	40	100	5530	-	36000	–	-	–	407712
Antimony	7440-36-0	17	-	38	45	0.2	-	8.1	0.59	-	5.6	BLA-SS014
Arsenic	7440-38-2	39	-	40	98	1.29	-	58.4	0.51	-	0.51	BLA-SS014
Barium	7440-39-3	40	-	40	100	45.4	-	11100	–	-	–	BLA-SS008
Beryllium	7440-41-7	40	-	40	100	0.36	-	2.2	–	-	–	BLASD02,BLA-SS005
Cadmium	7440-43-9	30	-	35	86	0.09	-	44.8	0.12	-	1.5	BLA-SS013
Calcium	7440-70-2	40	-	40	100	483	-	191000	–	-	–	BLA-SS007
Chromium	7440-47-3	40	-	40	100	11.2	-	106	–	-	–	BLA-SS016
Cobalt	7440-48-4	37	-	40	92	3.9	-	149	40.6	-	47	BLASS11
Copper	7440-50-8	40	-	40	100	23.5	-	72000	–	-	–	BLA-SS013
Iron	7439-89-6	40	-	40	100	8500	-	61500	–	-	–	BLA-SS012
Lead	7439-92-1	40	-	40	100	14.7	-	58000	–	-	–	BLA-SS013
Magnesium	7439-95-4	40	-	40	100	4500	-	105000	–	-	–	BLA-SS003
Manganese	7439-96-5	40	-	40	100	88	-	3080	–	-	–	BLASS11
Mercury	7439-97-6	33	-	35	94	0.02	-	16.8	0.047	-	0.05	BLA-SS009
Nickel	7440-02-0	40	-	40	100	5.99	-	148	–	-	–	BLA-SS013
Potassium	7440-09-7	40	-	40	100	752	-	5000	–	-	–	BLA-SS005
Selenium	7782-49-2	8	-	39	21	0.39	-	1.9	1.03	-	1.9	BLA-SS013

Table 6-15
Surface Soil Risk Assessment Dataset
Surface Soil (0-1 foot Depth Interval)
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Silver	7440-22-4	12	-	35	34	0.39	-	2.3	1.03	-	3.7	BLA-SS013
Sodium	7440-23-5	18	-	38	47	23.8	-	118	1190	-	2330	BLASS03
Thallium	7440-28-0	16	-	38	42	0.04	-	0.78	2.4	-	4.7	407712
Vanadium	7440-62-2	40	-	40	100	14.4	-	102	–	-	–	BLA-SS002
Zinc	7440-66-6	40	-	40	100	37.2	-	12500	–	-	–	BLA-SS013

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilograms.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table 6-16
Surface Soil Risk Assessment Dataset
Surface Soil (0-2 foot Depth Interval)
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Volatile Organic Compounds												
2-Butanone	78-93-3	1	-	15	7	0.011	-	0.011	0.0055	-	0.0088	BLA-SPSD01
3-Octanone	106-68-3	1	-	1	100	0.011	-	0.011	–	-	–	BLASS07
4-Methyl-2-pentanone	108-10-1	1	-	15	7	0.0016	-	0.0016	0.0055	-	0.0088	BLA-SPSD01
Acetone	67-64-1	2	-	15	13	0.023	-	0.043	0.0055	-	0.0088	BLA-SPSD01
Carbon Disulfide	75-15-0	1	-	15	7	0.0031	-	0.0031	0.0055	-	0.0088	BLA-SPSD01
d-Limonene	5989-27-5	1	-	1	100	0.057	-	0.057	–	-	–	BLASS07
Methylene Chloride	75-09-2	3	-	17	18	0.001	-	0.0028	0.0055	-	0.0088	BLA-SPSD01
Tetrachloroethene	127-18-4	2	-	15	13	0.0009	-	0.00092	0.0055	-	0.0094	BLASS07
Toluene	108-88-3	5	-	15	33	0.00071	-	0.007	0.0055	-	0.0094	BLASS07
Semi-Volatile Organic Compounds												
2,4-Dinitrotoluene	121-14-2	9	-	17	53	0.04	-	3	0.2	-	0.2	BLASS03
2,6-Dinitrotoluene	606-20-2	3	-	17	18	0.07	-	1.9	0.2	-	0.4	SS-09
Benzoic Acid	65-85-0	2	-	13	15	0.14	-	0.3	0.86	-	3.8	TR-03E
bis(2-Ethylhexyl)phthalate	117-81-7	11	-	14	79	0.05	-	0.57	0.2	-	0.21	SS-09
Carbazole	86-74-8	10	-	12	83	0.045	-	13	0.2	-	0.21	BLASB02
Dibenzofuran	132-64-9	9	-	12	75	0.016	-	2.8	0.2	-	0.21	BLASB02
Di-n-Butylphthalate	84-74-2	6	-	12	50	0.061	-	120	0.2	-	0.39	BLASS03
N-Nitrosodiphenylamine	86-30-6	2	-	11	18	0.1	-	8.3	0.2	-	0.78	BLASS03
Phenol	108-95-2	1	-	12	8	0.08	-	0.08	0.2	-	0.78	SS-14
Explosives												
1,3,5-Trinitrobenzene	99-35-4	1	-	16	6	0.07	-	0.07	0.1	-	0.2	BLASS06
1,3-Dinitrobenzene	99-65-0	1	-	16	6	0.05	-	0.05	0.1	-	0.2	BLASS02
2,4,6-Trinitrotoluene	118-96-7	1	-	16	6	0.06	-	0.06	0.2	-	0.4	BLASS03
4-Amino-2,6-Dinitrotoluene	19406-51-0	3	-	16	19	0.04	-	0.07	0.2	-	0.4	BLASS03
m-Nitrotoluene	99-08-1	1	-	16	6	2.86	-	2.86	0.4	-	0.8	BLASS04
Nitroglycerine	55-63-0	1	-	16	6	0.21	-	0.21	0.31	-	0.72	BLASS11
Pentaerythritol Tetranitrate	78-11-5	1	-	16	6	0.16	-	0.16	0.31	-	0.72	BLASD01
Pesticides												
4,4'-DDD	72-54-8	4	-	5	80	0.00064	-	0.043	0.00798	-	0.00798	SS-09
4,4'-DDE	72-55-9	2	-	4	50	0.00058	-	0.00086	0.00798	-	0.00809	BLASD01
Beta-BHC	319-85-7	1	-	4	25	0.00028	-	0.00028	0.00082	-	0.00809	BLASD01
Alpha-Chlordane	5103-71-9	1	-	5	20	0.089	-	0.089	0.00079	-	0.00809	SS-09
Gamma-Chlordane	5566-34-7	1	-	5	20	0.01	-	0.01	0.00079	-	0.00809	SS-09
Endosulfan I	115-29-7	1	-	5	20	0.022	-	0.022	0.00079	-	0.00809	SS-09
Endrin	72-20-8	1	-	4	25	0.00035	-	0.00035	0.00079	-	0.00809	BLASD02
Heptachlor Epoxide	1024-57-3	2	-	5	40	0.00094	-	0.015	0.00082	-	0.00809	SS-09
Methoxychlor	72-43-5	2	-	4	50	0.00442	-	0.0674	0.00082	-	0.00809	BLASB02
Polycyclic Aromatic Hydrocarbons												

Table 6-16
Surface Soil Risk Assessment Dataset
Surface Soil (0-2 foot Depth Interval)
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b]				Detects			Detection Limits			Maximum Location
		number of detects / number of samples			FOD %	Min (mg/kg)	-	Max (mg/kg)	Min (mg/kg)	-	Max (mg/kg)	
1-Methylnaphthalene	90-12-0	15	-	24	62	0.0056	-	0.4	0.0054	-	0.027	BLA-SS005
2-Methylnaphthalene	91-57-6	25	-	39	64	0.0022	-	0.58	0.0054	-	0.39	BLA-SS005
Acenaphthene	83-32-9	32	-	39	82	0.0015	-	12	0.0018	-	0.21	BLA-SS005
Acenaphthylene	208-96-8	26	-	39	67	0.00076	-	0.31	0.0026	-	0.39	BLA-SS007
Anthracene	120-12-7	36	-	39	92	0.00099	-	22	0.0024	-	0.011	BLA-SS005
Benzo(a)anthracene	56-55-3	40	-	41	98	0.0054	-	46	–	-	–	BLA-SS005
Benzo(a)pyrene	50-32-8	39	-	41	95	0.0049	-	39	0.0085	-	0.0085	BLA-SS005
Benzo(b)fluoranthene	205-99-2	40	-	41	98	0.0098	-	68	–	-	–	BLASB02
Benzo(g,h,i)perylene	191-24-2	39	-	39	100	0.0068	-	21	–	-	–	BLA-SS005
Benzo(k)fluoranthene	207-08-9	40	-	41	98	0.0028	-	31	–	-	–	BLA-SS005
Chrysene	218-01-9	40	-	41	98	0.0065	-	54	–	-	–	BLA-SS005
Dibenzo(a,h)anthracene	53-70-3	30	-	39	77	0.0019	-	6.9	0.0054	-	0.21	BLA-SS005
Fluoranthene	206-44-0	40	-	41	98	0.0089	-	160	–	-	–	BLA-SS005
Fluorene	86-73-7	30	-	39	77	0.00095	-	12	0.0054	-	0.21	BLA-SS005
Indeno(1,2,3-cd)pyrene	193-39-5	38	-	39	97	0.0052	-	25	0.0085	-	0.0085	BLA-SS005
Naphthalene	91-20-3	24	-	39	62	0.0019	-	1.4	0.0054	-	0.21	BLA-SS005
Phenanthrene	85-01-8	40	-	41	98	0.0058	-	100	–	-	–	BLA-SS005
Pyrene	129-00-0	40	-	41	98	0.0071	-	88	–	-	–	BLA-SS005
Polychlorinated Biphenyls												
Aroclor 1254	11097-69-1	9	-	18	50	0.0066	-	8.3	0.02	-	0.04	SS-09
Inorganics												
Aluminum	7429-90-5	43	-	43	100	5530	-	39100	–	-	–	407760
Antimony	7440-36-0	17	-	41	41	0.2	-	8.1	0.59	-	5.6	BLA-SS014
Arsenic	7440-38-2	42	-	43	98	1.29	-	58.4	0.51	-	0.51	BLA-SS014
Barium	7440-39-3	43	-	43	100	45.4	-	11100	–	-	–	BLA-SS008
Beryllium	7440-41-7	43	-	43	100	0.36	-	2.2	–	-	–	BLASD02,BLA-SS005
Cadmium	7440-43-9	30	-	35	86	0.09	-	44.8	0.12	-	1.5	BLA-SS013
Calcium	7440-70-2	43	-	43	100	483	-	191000	–	-	–	BLA-SS007
Chromium	7440-47-3	43	-	43	100	11.2	-	106	–	-	–	BLA-SS016
Cobalt	7440-48-4	40	-	43	93	3.9	-	149	40.6	-	47	BLASS11
Copper	7440-50-8	43	-	43	100	23.5	-	72000	–	-	–	BLA-SS013
Iron	7439-89-6	43	-	43	100	8500	-	61500	–	-	–	BLA-SS012
Lead	7439-92-1	43	-	43	100	13.8	-	58000	–	-	–	BLA-SS013
Magnesium	7439-95-4	43	-	43	100	4500	-	105000	–	-	–	BLA-SS003
Manganese	7439-96-5	43	-	43	100	88	-	3080	–	-	–	BLASS11
Mercury	7439-97-6	33	-	35	94	0.02	-	16.8	0.047	-	0.05	BLA-SS009
Nickel	7440-02-0	43	-	43	100	5.99	-	148	–	-	–	BLA-SS013
Potassium	7440-09-7	43	-	43	100	752	-	5610	–	-	–	407760
Selenium	7782-49-2	11	-	42	26	0.39	-	1.9	1.03	-	1.9	BLA-SS013
Silver	7440-22-4	12	-	35	34	0.39	-	2.3	1.03	-	3.7	BLA-SS013

Table 6-16
Surface Soil Risk Assessment Dataset
Surface Soil (0-2 foot Depth Interval)
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Sodium	7440-23-5	21	-	41	51	23.8	-	118	1190	-	2330	BLASS03
Thallium	7440-28-0	17	-	41	41	0.04	-	0.78	2.4	-	4.7	407712
Vanadium	7440-62-2	43	-	43	100	14.4	-	102	–	-	–	BLA-SS002
Zinc	7440-66-6	43	-	43	100	33.8	-	12500	–	-	–	BLA-SS013

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilograms.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table 6-17
Soil Risk Assessment Dataset
Combined Surface and Subsurface Soil
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Volatile Organic Compounds												
2-Butanone	78-93-3	1	-	18	6	0.011	-	0.011	0.0055	-	0.0088	BLA-SPSD01
3-Octanone	106-68-3	1	-	1	100	0.011	-	0.011	–	-	–	BLASS07
4-Methyl-2-pentanone	108-10-1	1	-	18	6	0.0016	-	0.0016	0.0055	-	0.0088	BLA-SPSD01
Acetone	67-64-1	2	-	18	11	0.023	-	0.043	0.0055	-	0.0088	BLA-SPSD01
Carbon Disulfide	75-15-0	3	-	18	17	0.00043	-	0.0031	0.0055	-	0.0088	BLA-SPSD01
d-Limonene	5989-27-5	1	-	1	100	0.057	-	0.057	–	-	–	BLASS07
Methylene Chloride	75-09-2	3	-	20	15	0.001	-	0.0028	0.0055	-	0.0088	BLA-SPSD01
Tetrachloroethene	127-18-4	2	-	18	11	0.0009	-	0.00092	0.0055	-	0.0094	BLASS07
Toluene	108-88-3	5	-	18	28	0.00071	-	0.007	0.0055	-	0.0094	BLASS07
Semi-Volatile Organic Compounds												
2,4-Dinitrotoluene	121-14-2	9	-	20	45	0.04	-	3	0.2	-	0.2	BLASS03
2,6-Dinitrotoluene	606-20-2	3	-	20	15	0.07	-	1.9	0.2	-	0.4	SS-09
Benzoic Acid	65-85-0	4	-	15	27	0.14	-	0.3	0.86	-	3.8	TR-03E
bis(2-Ethylhexyl)phthalate	117-81-7	13	-	16	81	0.03	-	0.57	0.2	-	0.21	SS-09
Carbazole	86-74-8	10	-	14	71	0.045	-	13	0.2	-	0.26	BLASB02
Dibenzofuran	132-64-9	9	-	14	64	0.016	-	2.8	0.2	-	0.26	BLASB02
Di-n-Butylphthalate	84-74-2	6	-	14	43	0.061	-	120	0.2	-	0.39	BLASS03
N-Nitrosodiphenylamine	86-30-6	2	-	13	15	0.1	-	8.3	0.2	-	0.78	BLASS03
Phenol	108-95-2	1	-	14	7	0.08	-	0.08	0.2	-	0.78	SS-14
Explosives												
1,3,5-Trinitrobenzene	99-35-4	1	-	19	5	0.07	-	0.07	0.1	-	0.2	BLASS06
1,3-Dinitrobenzene	99-65-0	1	-	19	5	0.05	-	0.05	0.1	-	0.2	BLASS02
2,4,6-Trinitrotoluene	118-96-7	1	-	19	5	0.06	-	0.06	0.2	-	0.4	BLASS03
4-Amino-2,6-Dinitrotoluene	19406-51-0	3	-	19	16	0.04	-	0.07	0.2	-	0.4	BLASS03
m-Nitrotoluene	99-08-1	1	-	19	5	2.86	-	2.86	0.4	-	0.8	BLASS04
Nitroglycerine	55-63-0	1	-	19	5	0.21	-	0.21	0.31	-	0.72	BLASS11
Pentaerythritol Tetranitrate	78-11-5	1	-	19	5	0.16	-	0.16	0.31	-	0.72	BLASD01
Pesticides												
4,4'-DDD	72-54-8	4	-	5	80	0.00064	-	0.043	0.00798	-	0.00798	SS-09
4,4'-DDE	72-55-9	2	-	4	50	0.00058	-	0.00086	0.00798	-	0.00809	BLASD01
Beta-BHC	319-85-7	1	-	4	25	0.00028	-	0.00028	0.00082	-	0.00809	BLASD01
Alpha-Chlordane	5103-71-9	1	-	5	20	0.089	-	0.089	0.00079	-	0.00809	SS-09
Gamma-Chlordane	5566-34-7	1	-	5	20	0.01	-	0.01	0.00079	-	0.00809	SS-09
Endosulfan I	115-29-7	1	-	5	20	0.022	-	0.022	0.00079	-	0.00809	SS-09
Endrin	72-20-8	1	-	4	25	0.00035	-	0.00035	0.00079	-	0.00809	BLASD02
Heptachlor Epoxide	1024-57-3	2	-	5	40	0.00094	-	0.015	0.00082	-	0.00809	SS-09
Methoxychlor	72-43-5	2	-	4	50	0.00442	-	0.0674	0.00082	-	0.00809	BLASB02

Table 6-17
Soil Risk Assessment Dataset
Combined Surface and Subsurface Soil
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Polycyclic Aromatic Hydrocarbons												
1-Methylnaphthalene	90-12-0	15	-	24	62	0.0056	-	0.4	0.0054	-	0.027	BLA-SS005
2-Methylnaphthalene	91-57-6	26	-	42	62	0.0013	-	0.58	0.0054	-	0.39	BLA-SS005
Acenaphthene	83-32-9	32	-	42	76	0.0015	-	12	0.0018	-	0.26	BLA-SS005
Acenaphthylene	208-96-8	26	-	42	62	0.00076	-	0.31	0.0022	-	0.39	BLA-SS007
Anthracene	120-12-7	36	-	42	86	0.00099	-	22	0.0022	-	0.26	BLA-SS005
Benzo(a)anthracene	56-55-3	42	-	44	95	0.0054	-	46	0.0022	-	0.0022	BLA-SS005
Benzo(a)pyrene	50-32-8	39	-	44	89	0.0049	-	39	0.0022	-	0.26	BLA-SS005
Benzo(b)fluoranthene	205-99-2	41	-	44	93	0.0098	-	68	0.0022	-	0.26	BLASB02
Benzo(g,h,i)perylene	191-24-2	39	-	42	93	0.0068	-	21	0.0022	-	0.26	BLA-SS005
Benzo(k)fluoranthene	207-08-9	41	-	44	93	0.0028	-	31	0.0022	-	0.26	BLA-SS005
Chrysene	218-01-9	41	-	44	93	0.0065	-	54	0.0022	-	0.26	BLA-SS005
Dibenzo(a,h)anthracene	53-70-3	30	-	42	71	0.0019	-	6.9	0.0022	-	0.26	BLA-SS005
Fluoranthene	206-44-0	41	-	44	93	0.0089	-	160	0.0022	-	0.26	BLA-SS005
Fluorene	86-73-7	31	-	42	74	0.00085	-	12	0.0054	-	0.26	BLA-SS005
Indeno(1,2,3-cd)pyrene	193-39-5	38	-	42	90	0.0052	-	25	0.0022	-	0.26	BLA-SS005
Naphthalene	91-20-3	25	-	42	60	0.0019	-	1.4	0.0054	-	0.26	BLA-SS005
Phenanthrene	85-01-8	41	-	44	93	0.0058	-	100	0.0022	-	0.26	BLA-SS005
Pyrene	129-00-0	41	-	44	93	0.0071	-	88	0.0022	-	0.26	BLA-SS005
Polychlorinated Biphenyls												
Aroclor 1254	11097-69-1	9	-	20	45	0.0066	-	8.3	0.02	-	0.04	SS-09
Inorganics												
Aluminum	7429-90-5	47	-	47	100	5530	-	43700	–	-	–	BLASB01
Antimony	7440-36-0	20	-	45	44	0.2	-	8.1	0.59	-	5.6	BLA-SS014
Arsenic	7440-38-2	46	-	47	98	1.29	-	58.4	0.51	-	0.51	BLA-SS014
Barium	7440-39-3	47	-	47	100	37.2	-	11100	–	-	–	BLA-SS008
Beryllium	7440-41-7	47	-	47	100	0.36	-	2.97	–	-	–	BLASB02
Cadmium	7440-43-9	30	-	38	79	0.09	-	44.8	0.12	-	1.5	BLA-SS013
Calcium	7440-70-2	47	-	47	100	483	-	191000	–	-	–	BLA-SS007
Chromium	7440-47-3	47	-	47	100	11.2	-	106	–	-	–	BLA-SS016
Cobalt	7440-48-4	44	-	47	94	3.9	-	149	40.6	-	47	BLASS11
Copper	7440-50-8	47	-	47	100	21	-	72000	–	-	–	BLA-SS013
Iron	7439-89-6	47	-	47	100	8500	-	61500	–	-	–	BLA-SS012
Lead	7439-92-1	47	-	47	100	9.82	-	58000	–	-	–	BLA-SS013
Magnesium	7439-95-4	47	-	47	100	3470	-	105000	–	-	–	BLA-SS003
Manganese	7439-96-5	47	-	47	100	71	-	3080	–	-	–	BLASS11
Mercury	7439-97-6	36	-	38	95	0.02	-	16.8	0.047	-	0.05	BLA-SS009
Nickel	7440-02-0	47	-	47	100	5.99	-	148	–	-	–	BLA-SS013
Potassium	7440-09-7	47	-	47	100	752	-	9590	–	-	–	BLASB02

Table 6-17
Soil Risk Assessment Dataset
Combined Surface and Subsurface Soil
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Selenium	7782-49-2	12	-	46	26	0.39	-	1.9	1.03	-	1.9	BLA-SS013
Silver	7440-22-4	12	-	38	32	0.39	-	2.3	1.03	-	3.7	BLA-SS013
Sodium	7440-23-5	25	-	45	56	23.8	-	118	1190	-	2330	BLASS03
Thallium	7440-28-0	20	-	45	44	0.04	-	0.78	2.4	-	4.7	407712
Vanadium	7440-62-2	47	-	47	100	14.4	-	102	–	-	–	BLA-SS002
Zinc	7440-66-6	47	-	47	100	30.4	-	12500	–	-	–	BLA-SS013

Notes:
– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilograms.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table 6-18
Sediment Risk Assessment Dataset
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Volatile Organic Compounds												
Acetone	67-64-1	1	-	2	50	0.028	-	0.028	0.008	-	0.008	BLASD05
Toluene	108-88-3	1	-	2	50	0.00096	-	0.00096	0.008	-	0.008	BLASD05
Semi-Volatile Organic Compounds										-		
bis(2-Ethylhexyl)phthalate	117-81-7	1	-	2	50	0.058	-	0.058	0.25	-	0.25	BLASD04
Pesticides										-		
4,4'-DDD	72-54-8	2	-	2	100	0.00059	-	0.00073	–	-	–	BLASD04
4,4'-DDE	72-55-9	2	-	2	100	0.00102	-	0.00182	–	-	–	BLASD04
4,4'-DDT	50-29-3	2	-	2	100	0.00062	-	0.00077	–	-	–	BLASD04
Beta-BHC	319-85-7	1	-	2	50	0.00029	-	0.00029	0.00099	-	0.00099	BLASD04
Alpha-Chlordane	5103-71-9	2	-	2	100	0.00025	-	0.00038	–	-	–	BLASD04
Gamma-Chlordane	5566-34-7	1	-	2	50	0.00041	-	0.00041	0.00099	-	0.00099	BLASD04
Dieldrin	60-57-1	1	-	2	50	0.00094	-	0.00094	0.00099	-	0.00099	BLASD04
Polycyclic Aromatic Hydrocarbons										-		
2-Methylnaphthalene	91-57-6	2	-	2	100	0.0013	-	0.0018	–	-	–	BLASD04
Anthracene	120-12-7	1	-	2	50	0.0017	-	0.0017	0.0025	-	0.0025	BLASD04
Benzo(a)anthracene	56-55-3	2	-	2	100	0.0059	-	0.013	–	-	–	BLASD04
Benzo(a)pyrene	50-32-8	2	-	2	100	0.005	-	0.012	–	-	–	BLASD04
Benzo(b)fluoranthene	205-99-2	2	-	2	100	0.013	-	0.019	–	-	–	BLASD04
Benzo(g,h,i)perylene	191-24-2	2	-	2	100	0.0031	-	0.0071	–	-	–	BLASD04
Benzo(k)fluoranthene	207-08-9	2	-	2	100	0.0033	-	0.0071	–	-	–	BLASD04
Chrysene	218-01-9	2	-	2	100	0.0073	-	0.013	–	-	–	BLASD04
Dibenzo(a,h)anthracene	53-70-3	2	-	2	100	0.0013	-	0.0021	–	-	–	BLASD04
Fluoranthene	206-44-0	2	-	2	100	0.0078	-	0.019	–	-	–	BLASD04
Fluorene	86-73-7	1	-	2	50	0.0012	-	0.0012	0.0025	-	0.0025	BLASD04
Indeno(1,2,3-cd)pyrene	193-39-5	2	-	2	100	0.0039	-	0.0081	–	-	–	BLASD04
Naphthalene	91-20-3	2	-	2	100	0.002	-	0.0021	–	-	–	BLASD04
Phenanthrene	85-01-8	2	-	2	100	0.0037	-	0.009	–	-	–	BLASD04
Pyrene	129-00-0	2	-	2	100	0.0091	-	0.019	–	-	–	BLASD04
Inorganics										-		
Aluminum	7429-90-5	2	-	2	100	7900	-	13300	–	-	–	BLASD04
Antimony	7440-36-0	2	-	2	100	0.28	-	0.37	–	-	–	BLASD05
Arsenic	7440-38-2	2	-	2	100	2.1	-	4.6	–	-	–	BLASD05
Barium	7440-39-3	2	-	2	100	74.8	-	77.2	–	-	–	BLASD04
Beryllium	7440-41-7	2	-	2	100	0.89	-	0.92	–	-	–	BLASD05
Calcium	7440-70-2	2	-	2	100	61200	-	102000	–	-	–	BLASD05
Chromium	7440-47-3	2	-	2	100	26.8	-	28.5	–	-	–	BLASD05

Table 6-18
Sediment Risk Assessment Dataset
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Cobalt	7440-48-4	2	-	2	100	7.3	-	10.5	–	-	–	BLASD05
Copper	7440-50-8	2	-	2	100	6.06	-	8.89	–	-	–	BLASD04
Iron	7439-89-6	2	-	2	100	17600	-	23300	–	-	–	BLASD05
Lead	7439-92-1	2	-	2	100	14.6	-	19.3	–	-	–	BLASD05
Magnesium	7439-95-4	2	-	2	100	3200	-	9810	–	-	–	BLASD05
Manganese	7439-96-5	2	-	2	100	649	-	681	–	-	–	BLASD04
Nickel	7440-02-0	2	-	2	100	10.9	-	11.5	–	-	–	BLASD04
Potassium	7440-09-7	2	-	2	100	1240	-	1310	–	-	–	BLASD05
Sodium	7440-23-5	2	-	2	100	81.9	-	83.6	–	-	–	BLASD05
Thallium	7440-28-0	2	-	2	100	0.18	-	0.29	–	-	–	BLASD05
Vanadium	7440-62-2	2	-	2	100	31.7	-	37.8	–	-	–	BLASD05
Zinc	7440-66-6	2	-	2	100	25.8	-	36	–	-	–	BLASD04

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilograms.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table 6-19
Surface Water Risk Assessment Dataset
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/L)		Detects Max (mg/L)	Detection Limits Min (mg/L)		Detection Limits Max (mg/L)	Maximum Location
Volatile Organic Compounds												
Carbon Disulfide	75-15-0	2	-	3	67	0.00007	-	0.00012	0.001	-	0.001	BLASW/SD04
Chloroform	67-66-3	2	-	3	67	0.00013	-	0.00018	0.001	-	0.001	BLASW/SD04
Semi-Volatile Organic Compounds												
Butylbenzylphthalate	85-68-7	1	-	2	50	0.00044	-	0.00044	0.005	-	0.005	BLASW/SD04
Di-n-Butylphthalate	84-74-2	1	-	2	50	0.0009	-	0.0009	0.005	-	0.005	BLASW/SD04
Explosives												
m-Nitrotoluene	99-08-1	2	-	2	100	0.00042	-	0.00043	–	-	–	BLASW/SD04
Herbicides												
2,4-D	94-75-7	1	-	2	50	0.00326	-	0.00326	0.0005	-	0.0005	BLASW/SD04
Pesticides												
Dieldrin	60-57-1	2	-	2	100	0.0000041	-	5.82E-06	–	-	–	BLASW/SD05
Polycyclic Aromatic Hydrocarbons												
Benzo(a)anthracene	56-55-3	1	-	4	25	0.000024	-	0.000024	0.00005	-	0.00047	BLA-VLTW01
Benzo(b)fluoranthene	205-99-2	1	-	4	25	0.000025	-	0.000025	0.00005	-	0.00047	BLA-VLTW01
Chrysene	218-01-9	1	-	4	25	0.00003	-	0.00003	0.00005	-	0.00047	BLA-VLTW01
Fluoranthene	206-44-0	1	-	4	25	0.000066	-	0.000066	0.000047	-	0.00005	BLA-VLTW01
Phenanthrene	85-01-8	1	-	4	25	0.000036	-	0.000036	0.000047	-	0.00005	BLA-VLTW01
Pyrene	129-00-0	1	-	4	25	0.000041	-	0.000041	0.00005	-	0.00047	BLA-VLTW01
Inorganics												
Aluminum	7429-90-5	4	-	4	100	0.14	-	0.549	–	-	–	BLA-SPSW01
Antimony	7440-36-0	1	-	4	25	0.00077	-	0.00077	0.005	-	0.015	BLASW/SD05
Arsenic	7440-38-2	2	-	4	50	0.0034	-	0.01	0.003	-	0.003	BLA-SPSW01
Barium	7440-39-3	4	-	4	100	0.0588	-	0.0981	–	-	–	BLA-VLTW01
Calcium	7440-70-2	4	-	4	100	25.6	-	86.5	–	-	–	BLA-SPSW01
Chromium	7440-47-3	1	-	4	25	0.0027	-	0.0027	0.01	-	0.01	BLA-VLTW01
Copper	7440-50-8	2	-	4	50	0.646	-	0.828	0.02	-	0.02	BLA-SPSW01
Iron	7439-89-6	4	-	4	100	0.274	-	0.742	–	-	–	BLA-VLTW01
Lead	7439-92-1	4	-	4	100	0.00034	-	0.247	–	-	–	BLA-VLTW01
Magnesium	7439-95-4	4	-	4	100	16.4	-	496	–	-	–	BLA-SPSW01
Manganese	7439-96-5	4	-	4	100	0.0184	-	0.377	–	-	–	BLA-SPSW01
Mercury	7439-97-6	1	-	4	25	0.0002	-	0.0002	0.0001	-	0.0002	BLA-VLTW01
Potassium	7440-09-7	4	-	4	100	3.3	-	146	–	-	–	BLA-SPSW01
Selenium	7782-49-2	1	-	4	25	0.00051	-	0.00051	0.005	-	0.005	BLASW/SD04
Sodium	7440-23-5	4	-	4	100	22.1	-	107	–	-	–	BLA-SPSW01
Zinc	7440-66-6	2	-	4	50	0.0263	-	0.116	0.02	-	0.02	BLA-VLTW01

Notes:

– =	Not detected/ not analyzed/ not applicable.
CASN =	Chemical abstracts registry number.
mg/L =	Milligrams per liter.
PAH =	Polycyclic Aromatic Hydrocarbon.
USEPA =	United States Environmental Protection Agency.
VOC =	Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.

[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table 6-20
Selection of Constituents of Potential Concern for Surface Soil
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a] (mg/kg)	Adjusted Soil Regional Screening Level (RSL) [b] Industrial Scenario (mg/kg)		Residential Scenario (mg/kg)		Surrogate	Background Level [c] (mg/kg)	Does Maximum Exceed RSL? Industrial (YES, no)	Residential (YES, no)	Is Constituent a Surface Soil COPC? [d] (YES, no)
Volatile Organic Compounds											
2-Butanone	78-93-3	1.10E-02	1.90E+04	nms	1.90E+04	ns		–	no	no	no
3-Octanone	106-68-3	1.10E-02	NA		NA			–	NA	NA	**YES**
4-Methyl-2-pentanone	108-10-1	1.60E-03	5.20E+03	ns	5.20E+03	ns		–	no	no	no
Acetone	67-64-1	4.30E-02	6.10E+04	nms	6.10E+04	n		–	no	no	no
Carbon Disulfide	75-15-0	3.10E-03	3.00E+02	ns	3.00E+02	ns		–	no	no	no
d-Limonene	5989-27-5	5.70E-02	NA		NA			–	NA	NA	**YES**
Methylene Chloride	75-09-2	2.80E-03	5.40E+01	c	1.10E+01	c		–	no	no	no
Tetrachloroethene	127-18-4	9.20E-04	2.70E+00	c	5.70E-01	c		–	no	no	no
Toluene	108-88-3	7.00E-03	6.10E+04	ns	4.60E+03	ns		–	no	no	no
Semi-Volatile Organic Compounds											
2,4-Dinitrotoluene	121-14-2	3.00E+00	1.20E+02	n	1.20E+02	n		–	no	no	no
2,6-Dinitrotoluene	606-20-2	1.90E+00	6.20E+01	n	6.20E+01	n		–	no	no	no
Benzoic Acid	65-85-0	3.00E-01	2.50E+05	nm	2.50E+05	nm		–	no	no	no
bis(2-Ethylhexyl)phthalate	117-81-7	5.70E-01	1.20E+02	c*	3.50E+01	c*		–	no	no	no
Carbazole	86-74-8	1.30E+01	NA		NA			–	NA	NA	**YES**
Dibenzofuran	132-64-9	2.80E+00	3.70E+02	n	1.00E+02	n	Furan	–	no	no	no
Di-n-Butylphthalate	84-74-2	1.20E+02	6.20E+03	n	6.20E+03	n		–	no	no	no
N-Nitrosodiphenylamine	86-30-6	8.30E+00	3.50E+02	c	9.90E+01	c		–	no	no	no
Phenol	108-95-2	8.00E-02	1.80E+04	nm	1.80E+04	n		–	no	no	no
Explosives											
1,3,5-Trinitrobenzene	99-35-4	7.00E-02	2.00E+01	n	2.70E+03	n		–	no	no	no
1,3-Dinitrobenzene	99-65-0	5.00E-02	6.20E+00	n	6.20E+00	n		–	no	no	no
2,4,6-Trinitrotoluene	118-96-7	6.00E-02	2.70E+03	c**	4.20E+01	c**		–	no	no	no
4-Amino-2,6-Dinitrotoluene	19406-51-0	7.00E-02	1.90E+02	n	1.90E+02	n		–	no	no	no
m-Nitrotoluene	99-08-1	2.86E+00	1.20E+03	n	1.20E+03	n		–	no	no	no
Nitroglycerine	55-63-0	2.10E-01	6.20E+00	n	6.20E+00	n		–	no	no	no
Pentaerythritol Tetranitrate	78-11-5	1.60E-01	NA		NA			–	NA	NA	**YES**
Pesticides											
4,4'-DDD	72-54-8	4.30E-02	7.20E+00	c	2.00E+00	c		–	no	no	no
4,4'-DDE	72-55-9	8.60E-04	5.10E+00	c	1.40E+00	c		–	no	no	no
Beta-BHC	319-85-7	2.80E-04	9.60E-01	c	2.70E-01	c		–	no	no	no
Alpha-Chlordane	5103-71-9	8.90E-02	6.50E+00	c*	1.60E+00	c*	Chlordane	–	no	no	no
Gamma-Chlordane	5566-34-7	1.00E-02	6.50E+00	c*	1.60E+00	c*	Chlordane	–	no	no	no
Endosulfan I	115-29-7	2.20E-02	3.70E+02	n	3.70E+02	n		–	no	no	no
Endrin	72-20-8	3.50E-04	1.80E+01	n	1.80E+01	n		–	no	no	no
Heptachlor Epoxide	1024-57-3	1.50E-02	1.90E-01	c*	5.30E-02	c*		–	no	no	no
Methoxychlor	72-43-5	6.74E-02	3.10E+02	n	3.10E+02	n		–	no	no	no
Polycyclic Aromatic Hydrocarbons											
1-Methylnaphthalene	90-12-0	4.00E-01	9.90E+01	c	2.20E+01	c		–	no	no	no

Table 6-20
Selection of Constituents of Potential Concern for Surface Soil
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b]					Background Level [c]	Does Maximum Exceed RSL?		Is Constituent a Surface Soil COPC? [d]
			Industrial Scenario		Residential Scenario		Surrogate		Industrial	Residential	
		(mg/kg)	(mg/kg)		(mg/kg)			(mg/kg)	(YES, no)	(YES, no)	(YES, no)
2-Methylnaphthalene	91-57-6	5.80E-01	#VALUE!		4.10E+02	n		–	NA	no	no
Acenaphthene	83-32-9	1.20E+01	#VALUE!		3.30E+03	n		–	NA	no	no
Acenaphthylene	208-96-8	3.10E-01	1.70E+03	n	3.30E+03	n	Acenaphthene	–	no	no	no
Anthracene	120-12-7	2.20E+01	3.30E+03	nm	1.70E+04	n		–	no	no	no
Benzo(a)anthracene	56-55-3	4.60E+01	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Benzo(a)pyrene	50-32-8	3.90E+01	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Benzo(b)fluoranthene	205-99-2	6.80E+01	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Benzo(g,h,i)perylene	191-24-2	2.10E+01	3.30E+01	n	1.70E+03	n	Pyrene	–	no	no	no
Benzo(k)fluoranthene	207-08-9	3.10E+01	2.10E+01	c	1.50E+00	c		–	**YES**	**YES**	**YES**
Chrysene	218-01-9	5.40E+01	2.10E+02	c	1.50E+01	c		–	no	**YES**	**YES**
Dibenzo(a,h)anthracene	53-70-3	6.90E+00	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Fluoranthene	206-44-0	1.60E+02	#VALUE!		2.20E+03	n		–	NA	no	no
Fluorene	86-73-7	1.20E+01	2.20E+03	n	2.20E+03	n		–	no	no	no
Indeno(1,2,3-cd)pyrene	193-39-5	2.50E+01	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Naphthalene	91-20-3	1.40E+00	2.00E+01	c*	3.90E+00	c*		–	no	no	no
Phenanthrene	85-01-8	1.00E+02	#VALUE!		1.70E+04	n	Anthracene	–	NA	no	no
Pyrene	129-00-0	8.80E+01	6.70E+01	n	1.70E+03	n		–	**YES**	no	no
Polychlorinated Biphenyls											
Aroclor 1254	11097-69-1	8.30E+00	7.40E-01	c*	1.10E+00	n		–	**YES**	**YES**	**YES**
Inorganics											
Aluminum	7429-90-5	3.91E+04	9.90E+04	nm	9.90E+04	n		4.00E+04	no	no	no
Antimony	7440-36-0	8.10E+00	4.10E+01	n	4.10E+01	n		–	no	no	no
Arsenic	7440-38-2	5.84E+01	1.60E+00	c	3.90E-01	c*		1.58E+01	**YES**	**YES**	**YES**
Barium	7440-39-3	1.11E+04	1.90E+04	nm	1.90E+04	n		2.09E+02	no	no	no
Beryllium	7440-41-7	2.20E+00	2.00E+02	n	2.00E+02	n		1.02E+00	no	no	no
Cadmium	7440-43-9	4.48E+01	8.10E+01	n	8.10E+01	n		6.90E-01	no	no	no
Calcium	7440-70-2	1.91E+05	NA		NA			–	NA	NA	no
Chromium	7440-47-3	1.06E+02	1.40E+03	c	2.80E+02	c		6.53E+01	no	no	no
Cobalt	7440-48-4	1.49E+02	3.00E+01	n	3.00E+01	n		7.23E+01	**YES**	**YES**	**YES**
Copper	7440-50-8	7.20E+04	4.10E+03	n	4.10E+03	n		5.35E+01	**YES**	**YES**	**YES**
Iron	7439-89-6	6.15E+04	7.20E+04	nm	7.20E+04	n		5.10E+04	no	no	no
Lead	7439-92-1	5.80E+04	8.00E+02	«	4.00E+02	«		2.68E+01	**YES**	**YES**	**YES**
Magnesium	7439-95-4	1.05E+05	NA		NA			–	NA	NA	no
Manganese	7439-96-5	3.08E+03	2.30E+03	n	2.30E+03	n		2.54E+03	**YES**	**YES**	**YES**
Mercury	7439-97-6	1.68E+01	2.80E+00	ns	2.80E+00	ns		1.30E-01	**YES**	**YES**	**YES**
Nickel	7440-02-0	1.48E+02	2.00E+03	n	2.00E+03	n		6.28E+01	no	no	no
Potassium	7440-09-7	5.61E+03	NA		NA			–	NA	NA	no
Selenium	7782-49-2	1.90E+00	5.10E+02	n	5.10E+02	n		–	no	no	no
Silver	7440-22-4	2.30E+00	5.50E+03	n	5.10E+02	n		–	no	no	no
Sodium	7440-23-5	1.18E+02	NA		NA			–	NA	NA	no

Table 6-20
Selection of Constituents of Potential Concern for Surface Soil
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b]					Background Level [c]	Does Maximum Exceed RSL?		Is Constituent a Surface Soil COPC? [d]
			Industrial Scenario		Residential Scenario		Surrogate		Industrial	Residential	
		(mg/kg)	(mg/kg)		(mg/kg)			(mg/kg)	(YES, no)	(YES, no)	(YES, no)
Thallium	7440-28-0	7.80E-01	9.20E+00	n	6.60E+00	n		2.11E+00	no	no	no
Vanadium	7440-62-2	1.02E+02	5.20E+02	n	7.20E+02	n		1.08E+02	no	no	no
Zinc	7440-66-6	1.25E+04	2.30E+03	nm	3.10E+04	n		2.02E+02	**YES**	no	no

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
mg/kg = Milligrams per kilogram.
NA = Not available or not applicable.
RSL = Regional Screening Level.
USEPA = United States Environmental Protection Agency.

[a] Maximum concentration in surface soil.
[b] The screening levels used were from USEPA (2008a). Screening levels based on non-cancer effects were adjusted by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = concentration may exceed ceiling limit; s = Concentration may exceed saturation concentration (Csat).
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.
[c] Background levels for metals are facility-wide soil background point estimates taken from Facility-Wide Background Study Report (IT Corporation, 2001).
[d] Constituents detected with maximum concentrations greater than adjusted residential screening levels were considered COPCs unless they were metals detected at concentrations lower than background, or are essential nutrients (i.e., calcium, magnesium, potassium, sodium), or they were known laboratory contaminants (i.e. acetone).

Table 6-21
Selection of Constituents of Potential Concern for Combined Surface and Subsurface Soil
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a] (mg/kg)	Adjusted Soil Regional Screening Level (RSL) [b] Industrial Scenario (mg/kg)		Residential Scenario (mg/kg)		Surrogate	Background Level [c] (mg/kg)	Does Maximum Exceed RSL? Industrial (YES, no)	Residential (YES, no)	Is Constituent a Surface/ Subsurface Soil COPC? [d] (YES, no)
Volatile Organic Compounds											
2-Butanone	78-93-3	1.10E-02	1.90E+04	nms	1.90E+04	ns		–	no	no	no
3-Octanone	106-68-3	1.10E-02	NA		NA			–	NA	NA	**YES**
4-Methyl-2-pentanone	108-10-1	1.60E-03	5.20E+03	ns	5.20E+03	ns		–	no	no	no
Acetone	67-64-1	4.30E-02	6.10E+04	nms	6.10E+04	n		–	no	no	no
Carbon Disulfide	75-15-0	3.10E-03	3.00E+02	ns	3.00E+02	ns		–	no	no	no
d-Limonene	5989-27-5	5.70E-02	NA		NA			–	NA	NA	**YES**
Methylene Chloride	75-09-2	2.80E-03	5.40E+01	c	1.10E+01	c		–	no	no	no
Tetrachloroethene	127-18-4	9.20E-04	2.70E+00	c	5.70E-01	c		–	no	no	no
Toluene	108-88-3	7.00E-03	6.10E+04	ns	4.60E+03	ns		–	no	no	no
Semi-Volatile Organic Compounds											
2,4-Dinitrotoluene	121-14-2	3.00E+00	1.20E+02	n	1.20E+02	n		–	no	no	no
2,6-Dinitrotoluene	606-20-2	1.90E+00	6.20E+01	n	6.20E+01	n		–	no	no	no
Benzoic Acid	65-85-0	3.00E-01	2.50E+05	nm	2.50E+05	nm		–	no	no	no
bis(2-Ethylhexyl)phthalate	117-81-7	5.70E-01	1.20E+02	c*	3.50E+01	c*		–	no	no	no
Carbazole	86-74-8	1.30E+01	NA		NA			–	NA	NA	**YES**
Dibenzofuran	132-64-9	2.80E+00	3.70E+02	n	1.00E+02	n	Furan	–	no	no	no
Di-n-Butylphthalate	84-74-2	1.20E+02	6.20E+03	n	6.20E+03	n		–	no	no	no
N-Nitrosodiphenylamine	86-30-6	8.30E+00	3.50E+02	c	9.90E+01	c		–	no	no	no
Phenol	108-95-2	8.00E-02	1.80E+04	nm	1.80E+04	n		–	no	no	no
Explosives											
1,3,5-Trinitrobenzene	99-35-4	7.00E-02	2.00E+01	n	2.70E+03	n		–	no	no	no
1,3-Dinitrobenzene	99-65-0	5.00E-02	6.20E+00	n	6.20E+00	n		–	no	no	no
2,4,6-Trinitrotoluene	118-96-7	6.00E-02	2.70E+03	c**	4.20E+01	c**		–	no	no	no
4-Amino-2,6-Dinitrotoluene	19406-51-0	7.00E-02	1.90E+02	n	1.90E+02	n		–	no	no	no
m-Nitrotoluene	99-08-1	2.86E+00	1.20E+03	n	1.20E+03	n		–	no	no	no
Nitroglycerine	55-63-0	2.10E-01	6.20E+00	n	6.20E+00	n		–	no	no	no
Pentaerythritol Tetranitrate	78-11-5	1.60E-01	NA		NA			–	NA	NA	**YES**
Pesticides											
4,4'-DDD	72-54-8	4.30E-02	7.20E+00	c	2.00E+00	c		–	no	no	no
4,4'-DDE	72-55-9	8.60E-04	5.10E+00	c	1.40E+00	c		–	no	no	no
Beta-BHC	319-85-7	2.80E-04	9.60E-01	c	2.70E-01	c		–	no	no	no
Alpha-Chlordane	5103-71-9	8.90E-02	6.50E+00	c*	1.60E+00	c*	Chlordane	–	no	no	no
Gamma-Chlordane	5566-34-7	1.00E-02	6.50E+00	c*	1.60E+00	c*	Chlordane	–	no	no	no
Endosulfan I	115-29-7	2.20E-02	3.70E+02	n	3.70E+02	n		–	no	no	no
Endrin	72-20-8	3.50E-04	1.80E+01	n	1.80E+01	n		–	no	no	no
Heptachlor Epoxide	1024-57-3	1.50E-02	1.90E-01	c*	5.30E-02	c*		–	no	no	no
Methoxychlor	72-43-5	6.74E-02	3.10E+02	n	3.10E+02	n		–	no	no	no
Polycyclic Aromatic Hydrocarbons											
1-Methylnaphthalene	90-12-0	4.00E-01	9.90E+01	c	2.20E+01	c		–	no	no	no
2-Methylnaphthalene	91-57-6	5.80E-01	#VALUE!		4.10E+02	n		–	NA	no	no
Acenaphthene	83-32-9	1.20E+01	#VALUE!		3.30E+03	n		–	NA	no	no

Table 6-21
Selection of Constituents of Potential Concern for Combined Surface and Subsurface Soil
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b] Industrial Scenario		Residential Scenario		Surrogate	Background Level [c]	Does Maximum Exceed RSL? Industrial	Residential	Is Constituent a Surface/ Subsurface Soil COPC? [d]
		(mg/kg)	(mg/kg)		(mg/kg)			(mg/kg)	(YES, no)	(YES, no)	(YES, no)
Acenaphthylene	208-96-8	3.10E-01	1.70E+03	n	3.30E+03	n	Acenaphthene	–	no	no	no
Anthracene	120-12-7	2.20E+01	3.30E+03	nm	1.70E+04	n		–	no	no	no
Benzo(a)anthracene	56-55-3	4.60E+01	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Benzo(a)pyrene	50-32-8	3.90E+01	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Benzo(b)fluoranthene	205-99-2	6.80E+01	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Benzo(g,h,i)perylene	191-24-2	2.10E+01	3.30E+01	n	1.70E+03	n	Pyrene	–	no	no	no
Benzo(k)fluoranthene	207-08-9	3.10E+01	2.10E+01	c	1.50E+00	c		–	**YES**	**YES**	**YES**
Chrysene	218-01-9	5.40E+01	2.10E+02	c	1.50E+01	c		–	no	**YES**	**YES**
Dibenzo(a,h)anthracene	53-70-3	6.90E+00	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Fluoranthene	206-44-0	1.60E+02	#VALUE!		2.20E+03	n		–	NA	no	no
Fluorene	86-73-7	1.20E+01	2.20E+03	n	2.20E+03	n		–	no	no	no
Indeno(1,2,3-cd)pyrene	193-39-5	2.50E+01	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Naphthalene	91-20-3	1.40E+00	2.00E+01	c*	3.90E+00	c*		–	no	no	no
Phenanthrene	85-01-8	1.00E+02	#VALUE!		1.70E+04	n	Anthracene	–	NA	no	no
Pyrene	129-00-0	8.80E+01	6.70E+01	n	1.70E+03	n		–	**YES**	no	no
Polychlorinated Biphenyls											
Aroclor 1254	11097-69-1	8.30E+00	7.40E-01	c*	1.10E+00	n		–	**YES**	**YES**	**YES**
Inorganics											
Aluminum	7429-90-5	4.37E+04	9.90E+04	nm	9.90E+04	n		4.00E+04	no	no	no
Antimony	7440-36-0	8.10E+00	4.10E+01	n	4.10E+01	n		–	no	no	no
Arsenic	7440-38-2	5.84E+01	1.60E+00	c	3.90E-01	c*		1.58E+01	**YES**	**YES**	**YES**
Barium	7440-39-3	1.11E+04	1.90E+04	nm	1.90E+04	n		2.09E+02	no	no	no
Beryllium	7440-41-7	2.97E+00	2.00E+02	n	2.00E+02	n		1.02E+00	no	no	no
Cadmium	7440-43-9	4.48E+01	8.10E+01	n	8.10E+01	n		6.90E-01	no	no	no
Calcium	7440-70-2	1.91E+05	NA		NA			–	NA	NA	no
Chromium	7440-47-3	1.06E+02	1.40E+03	c	2.80E+02	c		6.53E+01	no	no	no
Cobalt	7440-48-4	1.49E+02	3.00E+01	n	3.00E+01	n		7.23E+01	**YES**	**YES**	**YES**
Copper	7440-50-8	7.20E+04	4.10E+03	n	4.10E+03	n		5.35E+01	**YES**	**YES**	**YES**
Iron	7439-89-6	6.15E+04	7.20E+04	nm	7.20E+04	n		5.10E+04	no	no	no
Lead	7439-92-1	5.80E+04	8.00E+02	«	4.00E+02	«		2.68E+01	**YES**	**YES**	**YES**
Magnesium	7439-95-4	1.05E+05	NA		NA			–	NA	NA	no
Manganese	7439-96-5	3.08E+03	2.30E+03	n	2.30E+03	n		2.54E+03	**YES**	**YES**	**YES**
Mercury	7439-97-6	1.68E+01	2.80E+00	ns	2.80E+00	ns		1.30E-01	**YES**	**YES**	**YES**
Nickel	7440-02-0	1.48E+02	2.00E+03	n	2.00E+03	n		6.28E+01	no	no	no
Potassium	7440-09-7	9.59E+03	NA		NA			–	NA	NA	no
Selenium	7782-49-2	1.90E+00	5.10E+02	n	5.10E+02	n		–	no	no	no
Silver	7440-22-4	2.30E+00	5.50E+03	n	5.10E+02	n		–	no	no	no
Sodium	7440-23-5	1.18E+02	NA		NA			–	NA	NA	no
Thallium	7440-28-0	7.80E-01	9.20E+00	n	6.60E+00	n		2.11E+00	no	no	no
Vanadium	7440-62-2	1.02E+02	5.20E+02	n	7.20E+02	n		1.08E+02	no	no	no
Zinc	7440-66-6	1.25E+04	2.30E+03	nm	3.10E+04	n		2.02E+02	**YES**	no	no

Table 6-21
Selection of Constituents of Potential Concern for Combined Surface and Subsurface Soil
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b]			Background Level [c]	Does Maximum Exceed RSL?		Is Constituent a Surface/ Subsurface Soil COPC? [d]
			Industrial Scenario	Residential Scenario	Surrogate		Industrial	Residential	
		(mg/kg)	(mg/kg)	(mg/kg)		(mg/kg)	(YES, no)	(YES, no)	(YES, no)

Notes:

– =	Not detected/ not analyzed/ not applicable.	NA =	Not available or not applicable.
CASN =	Chemical abstracts registry number.	RSL =	Regional Screening Level.
COPC =	Constituent of Potential Concern.	USEPA =	United States Environmental Protection Agency.
mg/kg =	Milligrams per kilogram.		

[a] Maximum concentration in combined surface and subsurface soil.

[b] The screening levels used were from USEPA (2008a). Screening levels based on non-cancer effects were adjusted by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = Concentration may exceed ceiling limit; s = Concentration may exceed saturation concentration (Csat).
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.

[c] Background levels for metals are facility-wide soil background point estimates taken from Facility-Wide Background Study Report (IT Corporation, 2001).

[d] Constituents detected with maximum concentrations greater than adjusted residential screening levels were considered COPCs unless they were metals detected at concentrations lower than background, or are essential nutrients (i.e., calcium, magnesium, potassium, sodium), or they were known laboratory contaminants (i.e. acetone).

Table 6-22
Selection of Constituents of Potential Concern for Sediment
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a] (mg/kg)	Adjusted Soil Regional Screening Level (RSL) [b] Residential Scenario (mg/kg)		Adjusted Soil Regional Screening Level (RSL) [b] Surrogate	Is Constituent a Sediment COPC? [c] (YES, no)
Volatile Organic Compounds						
Acetone	67-64-1	2.80E-02	6.10E+04	n		no
Toluene	108-88-3	9.60E-04	4.60E+03	ns		no
Semi-Volatile Organic Compounds						
bis(2-Ethylhexyl)phthalate	117-81-7	5.80E-02	3.50E+01	c*		no
Pesticides						
4,4'-DDD	72-54-8	7.30E-04	2.00E+00	c		no
4,4'-DDE	72-55-9	1.82E-03	1.40E+00	c		no
4,4'-DDT	50-29-3	7.70E-04	1.70E+00	c*		no
Beta-BHC	319-85-7	2.90E-04	2.70E-01	c		no
Alpha-Chlordane	5103-71-9	3.80E-04	1.60E+00	c*	Chlordane	no
Gamma-Chlordane	5566-34-7	4.10E-04	1.60E+00	c*	Chlordane	no
Dieldrin	60-57-1	9.40E-04	3.00E-02	c		no
Polycyclic Aromatic Hydrocarbons						
2-Methylnaphthalene	91-57-6	1.80E-03	4.10E+02	n		no
Anthracene	120-12-7	1.70E-03	1.70E+04	n		no
Benzo(a)anthracene	56-55-3	1.30E-02	1.50E-01	c		no
Benzo(a)pyrene	50-32-8	1.20E-02	1.50E-02	c		no
Benzo(b)fluoranthene	205-99-2	1.90E-02	1.50E-01	c		no
Benzo(g,h,i)perylene	191-24-2	7.10E-03	1.70E+03	n	Pyrene	no
Benzo(k)fluoranthene	207-08-9	7.10E-03	1.50E+00	c		no
Chrysene	218-01-9	1.30E-02	1.50E+01	c		no
Dibenzo(a,h)anthracene	53-70-3	2.10E-03	1.50E-02	c		no
Fluoranthene	206-44-0	1.90E-02	2.20E+03	n		no
Fluorene	86-73-7	1.20E-03	2.20E+03	n		no
Indeno(1,2,3-cd)pyrene	193-39-5	8.10E-03	1.50E-01	c		no
Naphthalene	91-20-3	2.10E-03	3.90E+00	c*		no
Phenanthrene	85-01-8	9.00E-03	1.70E+04	n	Anthracene	no
Pyrene	129-00-0	1.90E-02	1.70E+03	n		no
Inorganics						
Aluminum	7429-90-5	1.33E+04	9.90E+04	n		no
Antimony	7440-36-0	3.70E-01	4.10E+01	n		no
Arsenic	7440-38-2	4.60E+00	3.90E-01	c*		**YES**
Barium	7440-39-3	7.72E+01	1.90E+04	n		no
Beryllium	7440-41-7	9.20E-01	2.00E+02	n		no
Calcium	7440-70-2	1.02E+05	NA			no
Chromium	7440-47-3	2.85E+01	2.80E+02	c		no
Cobalt	7440-48-4	1.05E+01	3.00E+01	n		no
Copper	7440-50-8	8.89E+00	4.10E+03	n		no

Table 6-22
Selection of Constituents of Potential Concern for Sediment
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b]			Is Constituent a Sediment COPC? [c]
			Residential Scenario		Surrogate	
		(mg/kg)	(mg/kg)			(YES, no)
Iron	7439-89-6	2.33E+04	7.20E+04	n		no
Lead	7439-92-1	1.93E+01	4.00E+02	«		no
Magnesium	7439-95-4	9.81E+03	NA			no
Manganese	7439-96-5	6.81E+02	2.30E+03	n		no
Nickel	7440-02-0	1.15E+01	2.00E+03	n		no
Potassium	7440-09-7	1.31E+03	NA			no
Sodium	7440-23-5	8.36E+01	NA			no
Thallium	7440-28-0	2.90E-01	6.60E+00	n		no
Vanadium	7440-62-2	3.78E+01	7.20E+02	n		no
Zinc	7440-66-6	3.60E+01	3.10E+04	n		no

Notes:
CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
mg/kg = Milligrams per kilogram.
NA = Not available or not applicable.
RSL = Regional Screening Level.
USEPA = United States Environmental Protection Agency.

[a] Maximum concentration in sediment.

[b] The screening levels used were risk screening levels for the residential scenario from USEPA (2008a). Screening levels based on non-cancer effects were adjusted by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = Concentration may exceed ceiling limit; s = Concentration may exceed saturation concentration (Csat).
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.

[c] Constituents detected with maximum concentrations greater than adjusted residential screening levels were considered COPCs unless they were metals detected at concentrations lower than background, or are essential nutrients (i.e., calcium, magnesium, potassium, sodium), or they were known laboratory contaminants (i.e. acetone).

Table 6-23
Selection Constituents of Potential Concern for Surface Water
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Tap Water Regional Screening Level (RSL) [b]			Is Constituent a Surface Water COPC? [c]
		(mg/L)	(mg/L)		Surrogate	(YES, no)
Volatile Organic Compounds						
Carbon Disulfide	75-15-0	1.20E-04	1.00E-01	n		no
Chloroform	67-66-3	1.80E-04	1.90E-04	c		no
Semi-Volatile Organic Compounds						
Butylbenzylphthalate	85-68-7	4.40E-04	3.50E-02	c		no
Di-n-Butylphthalate	84-74-2	9.00E-04	3.70E-01	n		no
Explosives						
m-Nitrotoluene	99-08-1	4.30E-04	7.30E-02	n		no
Herbicides						
2,4-D	94-75-7	3.26E-03	3.70E-02	n		no
Pesticides						
Dieldrin	60-57-1	5.82E-06	4.20E-06	c		**YES**
Polycyclic Aromatic Hydrocarbons						
Benzo(a)anthracene	56-55-3	2.40E-05	2.90E-05	c		no
Benzo(b)fluoranthene	205-99-2	2.50E-05	2.90E-05	c		no
Chrysene	218-01-9	3.00E-05	2.90E-03	c		no
Fluoranthene	206-44-0	6.60E-05	1.50E-01	n		no
Phenanthrene	85-01-8	3.60E-05	1.10E+00	n	Anthracene	no
Pyrene	129-00-0	4.10E-05	1.10E-01	n		no
Inorganics						
Aluminum	7429-90-5	5.49E-01	3.70E+00	n		no
Antimony	7440-36-0	7.70E-04	1.50E-03	n		no
Arsenic	7440-38-2	1.00E-02	4.50E-05	c		**YES**
Barium	7440-39-3	9.81E-02	7.30E-01	n		no
Calcium	7440-70-2	8.65E+01	NA			no
Chromium	7440-47-3	2.70E-03	5.50E+00	n		no
Copper	7440-50-8	8.28E-01	1.50E-01	n		**YES**
Iron	7439-89-6	7.42E-01	2.60E+00	n		no
Lead	7439-92-1	2.47E-01	1.50E-02	**		**YES**
Magnesium	7439-95-4	4.96E+02	NA			no
Manganese	7439-96-5	3.77E-01	8.80E-02	n		**YES**
Mercury	7439-97-6	2.00E-04	6.30E-05	n		**YES**
Potassium	7440-09-7	1.46E+02	NA			no
Selenium	7782-49-2	5.10E-04	1.80E-02	n		no
Sodium	7440-23-5	1.07E+02	NA			no
Zinc	7440-66-6	1.16E-01	1.10E+00	n		no

Table 6-23
Selection Constituents of Potential Concern for Surface Water
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:

CASN =	Chemical abstracts registry number.	NA =	Not available or not applicable.
COPC =	Constituent of Potential Concern.	RSL =	Regional Screening Level.
mg/L =	Milligrams per liter.	USEPA =	United States Environmental Protection Agency.

[a] Maximum concentration in surface water.

[b] The screening levels used were risk screening levels for tap water from USEPA (2008a). Screening levels based on non-cancer effects were adjusted by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.

c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = Concentration may exceed ceiling limit;

« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.

Some RSL values were based on surrogates as identified next to each value.

[c] Constituents detected with maximum concentrations greater than screening levels were considered COPCs unless they were essential nutrients (i.e., calcium, magnesium, potassium, sodium), or were known laboratory contaminants (i.e. acetone).

Table 6-24
Exposure Point Concentrations
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a]				Exposure Point Concentrations [b]			
		Surface Soil	Combined Surface and Subsurface Soil	Sediment	Surface Water	Surface Soil (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Sediment (mg/kg)	Surface Water (mg/L)
Volatile Organic Compounds									
1,2,3-Trichloropropane	96-18-4	no	no	no	no	–	–	–	–
1,2,4-Trimethylbenzene	95-63-6	no	no	no	no	–	–	–	–
2-Butanone	78-93-3	no	no	no	no	–	–	–	–
3-Octanone	106-68-3	**YES**	**YES**	no	no	1.10E-02 m	1.10E-02 m	–	–
4-Methyl-2-pentanone	108-10-1	no	no	no	no	–	–	–	–
Acetone	67-64-1	no	no	no	no	–	–	–	–
Bromodichloromethane	75-27-4	no	no	no	no	–	–	–	–
Carbon Disulfide	75-15-0	no	no	no	no	–	–	–	–
Chloroform	67-66-3	no	no	no	no	–	–	–	–
cis-1,2-Dichloroethene	156-59-2	no	no	no	no	–	–	–	–
d-Limonene	5989-27-5	**YES**	**YES**	no	no	5.70E-02 m	5.70E-02 m	–	–
Ethanol	64-17-5	no	no	no	no	–	–	–	–
m,p-Xylene	136777612	no	no	no	no	–	–	–	–
Methylene Chloride	75-09-2	no	no	no	no	–	–	–	–
p-Isopropyltoluene	99-87-6	no	no	no	no	–	–	–	–
Tetrachloroethene	127-18-4	no	no	no	no	–	–	–	–
Toluene	108-88-3	no	no	no	no	–	–	–	–
Trichloroethene	79-01-6	no	no	no	no	–	–	–	–
Xylenes (total)	1330-20-7	no	no	no	no	–	–	–	–
Semi-Volatile Organic Compounds									
1,2,4-Trichlorobenzene	120-82-1	no	no	no	no	–	–	–	–
1,2-Dichlorobenzene	95-50-1	no	no	no	no	–	–	–	–
1,3-Dichlorobenzene	541-73-1	no	no	no	no	–	–	–	–
1,4-Dichlorobenzene	106-46-7	no	no	no	no	–	–	–	–
2,4-Dinitrotoluene	121-14-2	no	no	no	no	–	–	–	–
2,6-Dinitrotoluene	606-20-2	no	no	no	no	–	–	–	–
3,3'-Dichlorobenzidine	91-94-1	no	no	no	no	–	–	–	–
4-Methylphenol	106-44-5	no	no	no	no	–	–	–	–
Benzoic Acid	65-85-0	no	no	no	no	–	–	–	–
bis(2-Ethylhexyl)phthalate	117-81-7	no	no	no	no	–	–	–	–
Butylbenzylphthalate	85-68-7	no	no	no	no	–	–	–	–
Carbazole	86-74-8	**YES**	**YES**	no	no	1.20E+01	1.04E+01	–	–
Dibenzofuran	132-64-9	no	no	no	no	–	–	–	–
Diethylphthalate	84-66-2	no	no	no	no	–	–	–	–
Di-n-Butylphthalate	84-74-2	no	no	no	no	–	–	–	–
Di-n-Octylphthalate	117-84-0	no	no	no	no	–	–	–	–
N-Nitrosodiphenylamine	86-30-6	no	no	no	no	–	–	–	–
Pentachlorophenol	87-86-5	no	no	no	no	–	–	–	–
Phenol	108-95-2	no	no	no	no	–	–	–	–
Dioxin/Furan Compounds									
1,2,3,4,6,7,8-HpCDD	35822-46-9	no	no	no	no	–	–	–	–

Table 6-24
Exposure Point Concentrations
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a]				Exposure Point Concentrations [b]			
		Surface Soil	Combined Surface and Subsurface Soil	Sediment	Surface Water	Surface Soil (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Sediment (mg/kg)	Surface Water (mg/L)
1,2,3,4,6,7,8-HpCDF	67562-39-4	no	no	no	no	–	–	–	–
1,2,3,4,7,8,9-HpCDF	55673-89-7	no	no	no	no	–	–	–	–
1,2,3,4,7,8-HxCDD	39227-28-6	no	no	no	no	–	–	–	–
1,2,3,4,7,8-HxCDF	70648-26-9	no	no	no	no	–	–	–	–
1,2,3,6,7,8-HxCDD	57653-85-7	no	no	no	no	–	–	–	–
1,2,3,6,7,8-HxCDF	57117-44-9	no	no	no	no	–	–	–	–
1,2,3,7,8,9-HxCDD	19408-74-3	no	no	no	no	–	–	–	–
1,2,3,7,8,9-HxCDF	72918-21-9	no	no	no	no	–	–	–	–
1,2,3,7,8-PeCDD	40321-76-4	no	no	no	no	–	–	–	–
1,2,3,7,8-PeCDF	57117-41-6	no	no	no	no	–	–	–	–
2,3,4,6,7,8-HxCDF	60851-34-5	no	no	no	no	–	–	–	–
2,3,4,7,8-PeCDF	57117-31-4	no	no	no	no	–	–	–	–
2,3,7,8-TCDD	1746-01-6	no	no	no	no	–	–	–	–
2,3,7,8-TCDF	51207-31-9	no	no	no	no	–	–	–	–
OCDD	3268-87-9	no	no	no	no	–	–	–	–
OCDF	39001-02-0	no	no	no	no	–	–	–	–
Explosives									
1,3,5-Trinitrobenzene	99-35-4	no	no	no	no	–	–	–	–
1,3-Dinitrobenzene	99-65-0	no	no	no	no	–	–	–	–
2,4,6-Trinitrotoluene	118-96-7	no	no	no	no	–	–	–	–
4-Amino-2,6-Dinitrotoluene	19406-51-0	no	no	no	no	–	–	–	–
m-Nitrotoluene	99-08-1	no	no	no	no	–	–	–	–
Nitrobenzene	98-95-3	no	no	no	no	–	–	–	–
Nitroglycerine	55-63-0	no	no	no	no	–	–	–	–
Pentaerythritol Tetranitrate	78-11-5	**YES**	**YES**	no	no	1.60E-01 m	1.60E-01 m	–	–
Perchlorate	14797-73-0	no	no	no	no	–	–	–	–
Herbicides									
2,4,5-T	93-76-5	no	no	no	no	–	–	–	–
2,4,5-TP	93-72-1	no	no	no	no	–	–	–	–
2,4-D	94-75-7	no	no	no	no	–	–	–	–
2,4-DB	94-82-6	no	no	no	no	–	–	–	–
Dalapon	75-99-0	no	no	no	no	–	–	–	–
Dicamba	1918-00-9	no	no	no	no	–	–	–	–
Dichlorprop	120-36-5	no	no	no	no	–	–	–	–
MCPA	94-74-6	no	no	no	no	–	–	–	–
MCPP	93-65-2	no	no	no	no	–	–	–	–
Pesticides									
4,4'-DDD	72-54-8	no	no	no	no	–	–	–	–
4,4'-DDE	72-55-9	no	no	no	no	–	–	–	–
4,4'-DDT	50-29-3	no	no	no	no	–	–	–	–
Alpha-BHC	319-84-6	no	no	no	no	–	–	–	–
Beta-BHC	319-85-7	no	no	no	no	–	–	–	–

Table 6-24
Exposure Point Concentrations
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a]				Exposure Point Concentrations [b]			
		Surface Soil	Combined Surface and Subsurface Soil	Sediment	Surface Water	Surface Soil (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Sediment (mg/kg)	Surface Water (mg/L)
Delta-BHC	319-86-8	no	no	no	no	–	–	–	–
Gamma-BHC (Lindane)	58-89-9	no	no	no	no	–	–	–	–
Alpha-Chlordane	5103-71-9	no	no	no	no	–	–	–	–
Gamma-Chlordane	5566-34-7	no	no	no	no	–	–	–	–
Dieldrin	60-57-1	no	no	no	**YES**	–	–	–	5.82E-06 m
Endosulfan I	115-29-7	no	no	no	no	–	–	–	–
Endosulfan II	33213-65-9	no	no	no	no	–	–	–	–
Endosulfan Sulfate	1031-07-8	no	no	no	no	–	–	–	–
Endrin	72-20-8	no	no	no	no	–	–	–	–
Endrin Aldehyde	7421-93-4	no	no	no	no	–	–	–	–
Endrin Ketone	53494-70-5	no	no	no	no	–	–	–	–
Heptachlor	76-44-8	no	no	no	no	–	–	–	–
Heptachlor Epoxide	1024-57-3	no	no	no	no	–	–	–	–
Methoxychlor	72-43-5	no	no	no	no	–	–	–	–
Polycyclic Aromatic Hydrocarbons									
1-Methylnaphthalene	90-12-0	no	no	no	no	–	–	–	–
2-Methylnaphthalene	91-57-6	no	no	no	no	–	–	–	–
Acenaphthene	83-32-9	no	no	no	no	–	–	–	–
Acenaphthylene	208-96-8	no	no	no	no	–	–	–	–
Anthracene	120-12-7	no	no	no	no	–	–	–	–
Benzo(a)anthracene	56-55-3	**YES**	**YES**	no	no	2.47E+01	1.87E+01	–	–
Benzo(a)pyrene	50-32-8	**YES**	**YES**	no	no	1.73E+01	1.61E+01	–	–
Benzo(b)fluoranthene	205-99-2	**YES**	**YES**	no	no	3.33E+01	2.64E+01	–	–
Benzo(g,h,i)perylene	191-24-2	no	no	no	no	–	–	–	–
Benzo(k)fluoranthene	207-08-9	**YES**	**YES**	no	no	1.48E+01	1.06E+01	–	–
Chrysene	218-01-9	**YES**	**YES**	no	no	3.00E+01	2.21E+01	–	–
Dibenzo(a,h)anthracene	53-70-3	**YES**	**YES**	no	no	3.30E+00	3.08E+00	–	–
Fluoranthene	206-44-0	no	no	no	no	–	–	–	–
Fluorene	86-73-7	no	no	no	no	–	–	–	–
Indeno(1,2,3-cd)pyrene	193-39-5	**YES**	**YES**	no	no	1.18E+01	1.10E+01	–	–
Naphthalene	91-20-3	no	no	no	no	–	–	–	–
Phenanthrene	85-01-8	no	no	no	no	–	–	–	–
Pyrene	129-00-0	no	no	no	no	–	–	–	–
Polychlorinated Biphenyls									
Aroclor 1254	11097-69-1	**YES**	**YES**	no	no	2.19E+00	1.87E+00	–	–
Aroclor 1260	11096-82-5	no	no	no	no	–	–	–	–

Table 6-24
Exposure Point Concentrations
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a]				Exposure Point Concentrations [b]			
		Surface Soil	Combined Surface and Subsurface Soil	Sediment	Surface Water	Surface Soil (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Sediment (mg/kg)	Surface Water (mg/L)
Inorganics									
Aluminum	7429-90-5	no	no	no	no	–	–	–	–
Antimony	7440-36-0	no	no	no	no	–	–	–	–
Arsenic	7440-38-2	**YES**	**YES**	**YES**	**YES**	1.26E+01	1.16E+01	4.60E+00 m	1.00E-02 m
Barium	7440-39-3	no	no	no	no	–	–	–	–
Beryllium	7440-41-7	no	no	no	no	–	–	–	–
Cadmium	7440-43-9	no	no	no	no	–	–	–	–
Calcium	7440-70-2	no	no	no	no	–	–	–	–
Chromium	7440-47-3	no	no	no	no	–	–	–	–
Cobalt	7440-48-4	**YES**	**YES**	no	no	3.62E+01	3.80E+01	–	–
Copper	7440-50-8	**YES**	**YES**	no	**YES**	7.31E+03	1.95E+04	–	8.28E-01 m
Iron	7439-89-6	no	no	no	no	–	–	–	–
Lead	7439-92-1	**YES**	**YES**	no	**YES**	2.21E+03 avg	2.02E+03 avg	–	6.25E-02 avg
Magnesium	7439-95-4	no	no	no	no	–	–	–	–
Manganese	7439-96-5	**YES**	**YES**	no	**YES**	5.76E+02	5.46E+02	–	3.77E-01 m
Mercury	7439-97-6	**YES**	**YES**	no	**YES**	7.27E+00	6.72E+00	–	2.00E-04 m
Nickel	7440-02-0	no	no	no	no	–	–	–	–
Potassium	7440-09-7	no	no	no	no	–	–	–	–
Selenium	7782-49-2	no	no	no	no	–	–	–	–
Silver	7440-22-4	no	no	no	no	–	–	–	–
Sodium	7440-23-5	no	no	no	no	–	–	–	–
Thallium	7440-28-0	no	no	no	no	–	–	–	–
Vanadium	7440-62-2	no	no	no	no	–	–	–	–
Zinc	7440-66-6	no	no	no	no	–	–	–	–

Notes:
– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilogram.
mg/L = Milligrams per liter.

[a] Constituent of Potential Concern.
[b] The exposure point concentration (EPC) was the upper confidence level on the mean (UCL) or the maximum concentration where the UCL was incalculable.
EPCs marked with "m" are based on the maximum detected concentration.
Exposure to lead is evaluated by predicting resultant blood lead levels using the arithmetic average (avg).
The UCLs were calculated using ProUCL 4.0. The UCL used is the one recommended by ProUCL 4.0.

Table 6-25
Summary of Calculated Human Health Risks and Hazards
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

RECEPTOR Exposure Medium - Scenario	Total Excess Lifetime Cancer Risk	Total Non-Cancer Hazard
Site Worker		
Surface Soil - Direct Contact	1E-04	0.7
Sediment - Wading	4E-07	0.007
Surface Water - Wading	2E-06	0.05
TOTAL SITE RISKS (Site Worker):	1E-04	0.8
Hypothetical Future Construction Worker		
Combined Surface and Subsurface Soil - Direct Contact	7E-06	3
TOTAL SITE RISKS (Construction Worker):	7E-06	3
Hypothetical Future Adult Resident		
Combined Surface and Subsurface Soil - Direct Contact	2E-04	1
Sediment - Wading	6E-07	0.01
Surface Water - Wading	6E-07	0.01
TOTAL SITE RISKS (Adult Resident):	2E-04	1
Hypothetical Future Child Resident		
Combined Surface and Subsurface Soil - Direct Contact	8E-04	12
Sediment - Wading	6E-07	0.09
Surface Water - Wading	6E-07	0.04
TOTAL SITE RISKS (Child Resident):	8E-04	12
Hypothetical Future Aggregate Resident (Adult + Child)		
Combined Surface and Subsurface Soil - Direct Contact	1E-03	--
Sediment - Wading	1E-06	--
Surface Water - Wading	1E-06	--
TOTAL SITE RISKS (Aggregate Resident):	1E-03	--

Table 6-26
Summary of Calculated Blood Lead Level Estimates
BAG LOADING AREA
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Exposure Medium/Receptor	Model Used [a]	Receptor Blood Lead Level[b] Adult 50th Percentile/ Geometric Mean (µg/dL)	Receptor Blood Lead Level[b] Child range in seven years (µg/dL)	Fetus Blood Level [b] 95th Percentile (µg/dL)
BAG LOADING AREA				
Surface Soil (0-1 feet below ground surface)				
Hypothetical Current Commercial/Industrial Worker Receptor	USEPA ALM	4.9	–	17
Surface and Subsurface Soil				
Hypothetical Construction Worker Receptor	USEPA ALM	5.2	–	18
Hypothetical Future Child Resident Receptor	IEUBK	–	10.9 - 18.4	–
Hypothetical Future Adult Resident Receptor	USEPA ALM	6.5	–	23

Notes:
– = Not applicable.
µg/dL = Microgram(s) per deciliter.

[a] USEPA ALM: USEPA Adult Lead Methodology Spreadsheet.
USEPA Technical Review Workgroup for Lead, Adult Lead Committee (USEPA 2003b).
USEPA IEUBK: USEPA Integrated Exposure Uptake Biogenetic Model for Lead in Children (USEPA 2005).
[b] Compare to a target blood lead level of 10 mg/dL.

Table 6-27
Screening Level -Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Background Concentration [a] (mg/kg)	Ecological Screening Level (ESLs) [b] (mg/kg)		Maximum HQ [c] (unitless)	Bioaccumulative Chemical?[d] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [e]	
			Value	*Source*			(YES/no)	Rationale
Volatile Organic Compounds								
2-Butanone	0.011	–	89.6	*R5*	0.0001	no	no	HQ • 1
3-Octanone	0.011	–	NA		NA	no	**YES**	**NSL**
4-Methyl-2-pentanone	0.0016	–	443	*R5*	0.000004	no	no	HQ • 1
Acetone	0.043	–	2.5	*R5*	0.02	no	no	HQ • 1
Carbon Disulfide	0.0031	–	0.09412	*R5*	0.03	no	no	HQ • 1
d-Limonene	0.057	–	NA		NA	no	**YES**	**NSL**
Methylene Chloride	0.0028	–	4.05	*R5*	0.0007	no	no	HQ • 1
Tetrachloroethene	0.00092	–	9.92	*R5*	0.00009	no	no	HQ • 1
Toluene	0.007	–	5.45	*R5*	0.001	no	no	HQ • 1
Semi-Volatile Organic Compounds								
2,4-Dinitrotoluene	3	–	1.28	*R5*	2	no	**YES**	**HQ > 1**
2,6-Dinitrotoluene	1.9	–	0.0328	*R5*	60	no	**YES**	**HQ > 1**
Benzoic Acid	0.3	–	NA		NA	no	**YES**	**NSL**
bis(2-Ethylhexyl)phthalate	0.57	–	0.92594	*R5*	0.6	no	no	HQ • 1
Carbazole	13	–	NA		NA	no	**YES**	**NSL**
Dibenzofuran	2.8	–	NA		NA	no	**YES**	**NSL**
Di-n-Butylphthalate	120	–	0.15	*R5*	800	no	**YES**	**HQ > 1**
N-Nitrosodiphenylamine	8.3	–	0.545	*R5*	20	no	**YES**	**HQ > 1**
Phenol	0.08	–	120	*R5*	0.0007	no	no	HQ • 1
Explosives								
1,3,5-Trinitrobenzene	0.07	–	0.376	*R5*	0.2	no	no	HQ • 1
1,3-Dinitrobenzene	0.05	–	0.655	*R5*	0.08	no	no	HQ • 1
2,4,6-Trinitrotoluene	0.06	–	NA		NA	no	**YES**	**NSL**
4-Amino-2,6-Dinitrotoluene	0.07	–	80	*T*	0.0009	no	no	HQ • 1
m-Nitrotoluene	2.86	–	NA		NA	no	**YES**	**NSL**
Nitroglycerine	0.21	–	NA		NA	no	**YES**	**NSL**
Pentaerythritol Tetranitrate	0.16	–	NA		NA	no	**YES**	**NSL**
Pesticides								
4,4'-DDD	0.043	–	0.021	*EcoSSL*	2	YES	**YES**	**HQ > 1**
4,4'-DDE	0.00086	–	0.021	*EcoSSL*	0.04	YES	**YES**	**Bioaccumulative**
BHC, beta-	0.00028	–	0.00398	*R5*	0.07	YES	**YES**	**Bioaccumulative**

Table 6-27
Screening Level -Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Background Concentration [a] (mg/kg)	Ecological Screening Level (ESLs) [b] (mg/kg)		Maximum HQ [c] (unitless)	Bioaccumulative Chemical?[d] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [e]	
			Value	*Source*			(YES/no)	Rationale
Chlordane, alpha-	0.089	–	0.224	*R5*	0.4	YES	**YES**	**Bioaccumulative**
Chlordane, gamma-	0.01	–	0.224	*R5s*	0.04	no	no	HQ • 1
Endosulfan	0.022	–	NA		NA	no	**YES**	**NSL**
Endrin	0.00035	–	0.0101	*R5*	0.03	YES	**YES**	**Bioaccumulative**
Heptachlor Epoxide	0.015	–	0.152	*R5*	0.1	YES	**YES**	**Bioaccumulative**
Methoxychlor	0.0674	–	0.0199	*R5*	3	YES	**YES**	**HQ > 1**
Polycyclic Aromatic Hydrocarbons								
1-Methylnaphthalene	0.4	–	3.24	*R5s*	0.1	no	no	HQ • 1
2-Methylnaphthalene	0.58	–	3.24	*R5*	0.2	no	no	HQ • 1
Acenaphthene	12	–	682	*R5*	0.02	YES	**YES**	**Bioaccumulative**
Acenaphthylene	0.31	–	682	*R5*	0.0005	YES	**YES**	**Bioaccumulative**
Anthracene	22	–	1,480	*R5*	0.01	YES	**YES**	**Bioaccumulative**
Benzo(a)anthracene	46	–	5.21	*R5*	9	YES	**YES**	**HQ > 1**
Benzo(a)pyrene	39	–	1.52	*R5*	30	YES	**YES**	**HQ > 1**
Benzo(b)fluoranthene	68	–	59.8	*R5*	1	YES	**YES**	**Bioaccumulative**
Benzo(g,h,i)perylene	21	–	119	*R5*	0.2	YES	**YES**	**Bioaccumulative**
Benzo(k)fluoranthene	31	–	148	*R5*	0.2	YES	**YES**	**Bioaccumulative**
Chrysene	54	–	4.73	*R5*	10	YES	**YES**	**HQ > 1**
Dibenzo(a,h)anthracene	6.9	–	18.4	*R5*	0.4	YES	**YES**	**Bioaccumulative**
Fluoranthene	160	–	122	*R5*	1	YES	**YES**	**Bioaccumulative**
Fluorene	12	–	122	*R5*	0.1	YES	**YES**	**Bioaccumulative**
Indeno(1,2,3-cd)pyrene	25	–	109	*R5*	0.2	YES	**YES**	**Bioaccumulative**
Naphthalene	1.4	–	0.0994	*R5*	10	no	**YES**	**HQ > 1**
Phenanthrene	100	–	45.7	*R5*	2	YES	**YES**	**HQ > 1**
Pyrene	88	–	78.5	*R5*	1	YES	**YES**	**Bioaccumulative**
Polychlorinated Biphenyls								
Aroclor 1254	8.3	–	NA		NA	YES	**YES**	**Bioaccumulative**
Inorganics								
Aluminum	36,000	40,041	50	*ORNL*	700	no	no	max • BKGD
Antimony	8.1	NA	0.27	*EcoSSL*	30	no	**YES**	**HQ > 1**
Arsenic	58.4	15.8	18	*EcoSSL*	3	YES	**YES**	**HQ > 1**
Barium	11,100	209	330	*EcoSSL*	30	no	**YES**	**HQ > 1**
Beryllium	2.2	1.02	21	*EcoSSL*	0.1	no	no	HQ • 1
Cadmium	44.8	0.69	0.36	*EcoSSL*	100	YES	**YES**	**HQ > 1**
Calcium	191,000	NA	NA		NA	no	no	NT
Chromium	106	65.3	26	*EcoSSL*	4	YES	**YES**	**HQ > 1**
Cobalt	149	72.3	13	*EcoSSL*	10	no	**YES**	**HQ > 1**
Copper	72,000	53.5	28	*EcoSSL*	3000	YES	**YES**	**HQ > 1**
Iron	61,500	50,962	NA		NA	no	**YES**	**NSL**
Lead	58,000	26.8	11	*EcoSSL*	5000	YES	**YES**	**HQ > 1**
Magnesium	105,000	NA	NA		NA	no	no	NT
Manganese	3,080	2,543	220	*EcoSSL*	10	no	**YES**	**HQ > 1**

Table 6-27
Screening Level -Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

			Ecological Screening Level (ESLs) [b] (mg/kg)				**Screening Level Constituent of Potential Ecological Concern? [e]**	
Constituent	**Maximum Concentration (mg/kg)**	**Background Concentration [a] (mg/kg)**	**Value**	***Source***	**Maximum HQ [c] (unitless)**	**Bioaccumulative Chemical?[d] (YES/no)**	**(YES/no)**	**Rationale**
Mercury	16.8	0.13	0.1	*R5*	200	no	**YES**	**HQ > 1**
Nickel	148	62.8	38	*EcoSSL*	4	YES	**YES**	**HQ > 1**
Potassium	5,000	NA	NA		NA	no	no	NT
Selenium	1.9	NA	0.52	*EcoSSL*	4	YES	**YES**	**HQ > 1**
Silver	2.3	NA	4.2	*EcoSSL*	0.5	YES	**YES**	**Bioaccumulative**
Sodium	118	NA	NA		NA	no	no	NT
Thallium	0.78	2.11	0.05692	*R5*	10	no	no	max • BKGD
Vanadium	102	108	7.8	*EcoSSL*	10	no	no	max • BKGD
Zinc	12,500	202	46	*EcoSSL*	300	YES	**YES**	**HQ > 1**

Notes:

– = Not available or applicable.

mg/kg = Milligrams per kilogram.

NA = Not available or applicable.

[a] Background levels for inorganics are facility-wide soil background point estimates taken from Facility-Wide Background Study Report (IT Corporation 2001).

[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.

[c] The maximum hazard quotient (HQ) is the ratio of the maximum constituent concentration to the surface soil screening level. HQs are rounded to one significant figure.

[d] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment quality Assessment, Status and Needs, February 2000.

[e] (COPECs) for screening level assessment unless they were essential nutrients and thus considered non-toxic (NT), or were inorganics present at concentrations below background (max • BKGD).

Table 6-28
Screening Level - Constituents of Potential Ecological Concern in Sediment
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Ecological Screening Level (ESLs) [a] (mg/kg) Value	*Source*	Maximum HQ [b] (unitless)	Bioaccumulative Chemical?[c] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rationale
Volatile Organic Compounds							
Acetone	0.028	0.0099	*R5*	3	no	**YES**	**HQ > 1**
Toluene	0.00096	1.22	*R5*	0.0008	no	no	HQ • 1
Semi-Volatile Organic Compounds							
bis(2-Ethylhexyl)phthalate	0.058	0.18	*R3*	0.3	no	no	HQ • 1
Pesticides							
4,4'-DDD	0.00073	0.00488	*R3*	0.1	YES	**YES**	**Bioaccumulative**
4,4'-DDE	0.00182	0.00316	*R3*	0.6	YES	**YES**	**Bioaccumulative**
4,4'-DDT	0.00077	7	*ORNL*	0.0001	YES	**YES**	**Bioaccumulative**
BHC, beta-	0.00029	0.005	*R3*	0.06	YES	**YES**	**Bioaccumulative**
Chlordane, alpha-	0.00038	0.00324	*R3s*	0.1	YES	**YES**	**Bioaccumulative**
Chlordane, gamma-	0.00041	0.00324	*R3s*	0.1	no	no	HQ • 1
Dieldrin	0.00094	0.0019	*R3*	0.5	YES	**YES**	**Bioaccumulative**
Polycyclic Aromatic Hydrocarbons							
2-Methylnaphthalene	0.0018	0.0202	*R3*	0.09	no	no	HQ • 1
Anthracene	0.0017	0.0572	*R3*	0.03	YES	**YES**	**Bioaccumulative**
Benzo(a)anthracene	0.013	0.108	*R3*	0.1	YES	**YES**	**Bioaccumulative**
Benzo(a)pyrene	0.012	0.15	*R3*	0.08	YES	**YES**	**Bioaccumulative**
Benzo(b)fluoranthene	0.019	10.4	*R5*	0.002	YES	**YES**	**Bioaccumulative**
Benzo(g,h,i)perylene	0.0071	0.17	*R3*	0.04	YES	**YES**	**Bioaccumulative**
Benzo(k)fluoranthene	0.0071	0.24	*R3*	0.03	YES	**YES**	**Bioaccumulative**
Chrysene	0.013	0.166	*R3*	0.08	YES	**YES**	**Bioaccumulative**
Dibenzo(a,h)anthracene	0.0021	0.033	*R3*	0.06	YES	**YES**	**Bioaccumulative**
Fluoranthene	0.019	0.423	*R3*	0.04	YES	**YES**	**Bioaccumulative**
Fluorene	0.0012	0.0774	*R3*	0.02	YES	**YES**	**Bioaccumulative**
Indeno(1,2,3-cd)pyrene	0.0081	0.017	*R3*	0.5	YES	**YES**	**Bioaccumulative**
Naphthalene	0.0021	0.176	*R3*	0.01	no	no	HQ • 1
Phenanthrene	0.009	0.204	*R3*	0.04	YES	**YES**	**Bioaccumulative**
Pyrene	0.019	0.195	*R3*	0.1	YES	**YES**	**Bioaccumulative**
Inorganics							
Aluminum	13,300	58,000	*ARCS_PEC*	0.2	no	no	HQ • 1
Antimony	0.37	2	*R3*	0.2	no	no	HQ • 1
Arsenic	4.6	9.8	*R3*	0.5	YES	**YES**	**Bioaccumulative**
Barium	77.2	NA		NA	no	**YES**	**NSL**
Beryllium	0.92	NA		NA	no	**YES**	**NSL**
Calcium	102,000	NA		NA	no	no	NT
Chromium	28.5	43.4	*R3*	0.7	YES	**YES**	**Bioaccumulative**
Cobalt	10.5	50	*R3*	0.2	no	no	HQ • 1
Copper	8.89	31.6	*R3*	0.3	YES	**YES**	**Bioaccumulative**
Iron	23,300	20,000	*R3*	1	no	no	HQ • 1
Lead	19.3	35.8	*R3*	0.5	YES	**YES**	**Bioaccumulative**

Table 6-28
Screening Level - Constituents of Potential Ecological Concern in Sediment
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Ecological Screening Level (ESLs) [a] (mg/kg) Value	*Source*	Maximum HQ [b] (unitless)	Bioaccumulative Chemical?[c] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rationale
Magnesium	9,810	NA		NA	no	no	NT
Manganese	681	460	*R3*	1	no	no	HQ • 1
Nickel	11.5	22.7	*R3*	0.5	YES	**YES**	**Bioaccumulative**
Potassium	1,310	NA		NA	no	no	NT
Sodium	83.6	NA		NA	no	no	NT
Thallium	0.29	NA		NA	no	**YES**	**NSL**
Vanadium	37.8	NA		NA	no	**YES**	**NSL**
Zinc	36	121	*R3*	0.3	YES	**YES**	**Bioaccumulative**

Notes:
– = Not available or applicable.
mg/kg = Milligrams per kilogram.
NA = Not available or applicable.

[a] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[b] The maximum hazard quotient (HQ) is the ratio of the maximum constituent concentration to the sediment screening level. HQs are rounded to one significant figure.
[c] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment quality Assessment, Status and Needs, February 2000.
[d] Constituents with a hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for screening level assessment unless they were essential nutrients and thus considered non-toxic (NT), or were inorganics present at concentrations below background (max • BKGD).

Table 6-29
Screening Level - Constituents of Potential Ecological Concern in Surface Water
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/L)	Ecological Screening Level (ESLs) [a] (mg/L) Value	*Source*	Maximum HQ [b] (unitless)	Bioaccumulative Chemical?[c] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rationale
Volatile Organic Compounds							
Carbon Disulfide	0.00012	0.00092	*R3*	0.1	no	no	HQ • 1
Chloroform	0.00018	0.0018	*R3*	0.1	no	no	HQ • 1
Semi-Volatile Organic Compounds							
Butylbenzylphthalate	0.00044	0.019	*R3*	0.02	no	no	HQ • 1
Di-n-Butylphthalate	0.0009	0.019	*R3*	0.05	no	no	HQ • 1
Explosives							
m-Nitrotoluene	0.00043	0.75	*R3*	0.0006	no	no	HQ • 1
Herbicides							
2,4-D	0.00326	0.22	*R5*	0.01	no	no	HQ • 1
Pesticides							
Dieldrin	0.00000582	0.000056	*R3*	0.1	YES	**YES**	**Bioaccumulative**
Polycyclic Aromatic Hydrocarbons							
Benzo(a)anthracene	0.000024	0.000018	*R3*	1	YES	**YES**	**Bioaccumulative**
Benzo(b)fluoranthene	0.000025	0.00907	*R5*	0.003	YES	**YES**	**Bioaccumulative**
Chrysene	0.00003	0.000025	*R3s*	1	YES	**YES**	**Bioaccumulative**
Fluoranthene	0.000066	0.00004	*R3*	2	YES	**YES**	**HQ > 1**
Phenanthrene	0.000036	0.0004	*R3*	0.09	YES	**YES**	**Bioaccumulative**
Pyrene	0.000041	0.000025	*R3*	2	YES	**YES**	**HQ > 1**
Inorganics							
Aluminum	0.549	0.087	*R3*	6	no	**YES**	**HQ > 1**
Antimony	0.00077	0.03	*R3*	0.03	no	no	HQ • 1
Arsenic	0.01	0.005	*R3*	2	YES	**YES**	**HQ > 1**
Barium	0.0981	0.004	*R3*	20	no	**YES**	**HQ > 1**
Calcium	86.5	116	*R3*	NA	no	no	NT
Chromium	0.0027	0.085	*R3*	0.03	YES	**YES**	**Bioaccumulative**
Copper	0.828	0.009	*R3*	90	YES	**YES**	**HQ > 1**
Iron	0.742	0.3	*R3*	2	no	**YES**	**HQ > 1**
Lead	0.247	0.0025	*R3*	100	YES	**YES**	**HQ > 1**
Magnesium	496	82	*R3*	NA	no	no	NT
Manganese	0.377	0.12	*R3*	3	no	**YES**	**HQ > 1**
Mercury	0.0002	0.000026	*R3*	8	no	**YES**	**HQ > 1**
Potassium	146	NA		NA	no	no	NT
Selenium	0.00051	0.001	*R3*	0.5	YES	**YES**	**Bioaccumulative**
Sodium	107	680	*R3*	NA	no	no	NT
Zinc	0.116	0.12	*R3*	1	YES	**YES**	**Bioaccumulative**

Table 6-29
Screening Level - Constituents of Potential Ecological Concern in Surface Water
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:

– =	Not available or applicable.
mg/L =	Milligrams per liter.
NA =	Not available or applicable.
[a]	See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[b]	The maximum hazard quotient (HQ) is the ratio of the maximum constituent concentration to the surface soil screening level. HQs are rounded to one significant figure.
[c]	Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment quality Assessment, Status and Needs, February 2000.
[d]	Constituents with a hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for screening level assessment unless they were essential nutrients and thus considered non-toxic (NT), or were inorganics present at concentrations below background (max • BKGD).

Table 6-30
Baseline Level - Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)		Ecological Screening Level (ESLs) [b] (mg/kg) Value	*Source*	Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rationale	Bioaccumulative ? [e] (YES/no)
Volatile Organic Compounds								
3-Octanone	0.011	m	NA		NA	**YES**	**NSL**	no
d-Limonene	0.057	m	NA		NA	**YES**	**NSL**	no
Semi-Volatile Organic Compounds								
2,4-Dinitrotoluene	0.648		1.28	*R5*	0.5	no	HQ • 1	no
2,6-Dinitrotoluene	1.9	m	0.0328	*R5*	60	**YES**	**HQ > 1**	no
Benzoic Acid	0.3	m	NA		NA	**YES**	**NSL**	no
Carbazole	11.99		NA		NA	**YES**	**NSL**	no
Dibenzofuran	2.604		NA		NA	**YES**	**NSL**	no
Di-n-Butylphthalate	29.36		0.15	*R5*	200	**YES**	**HQ > 1**	no
N-Nitrosodiphenylamine	8.3	m	0.545	*R5*	20	**YES**	**HQ > 1**	no
Explosives								
2,4,6-Trinitrotoluene	0.06	m	NA		NA	**YES**	**NSL**	no
m-Nitrotoluene	2.86	m	NA		NA	**YES**	**NSL**	no
Nitroglycerine	0.21	m	NA		NA	**YES**	**NSL**	no
Pentaerythritol Tetranitrate	0.16	m	NA		NA	**YES**	**NSL**	no
Pesticides								
4,4'-DDD	0.043	m	0.021	*EcoSSL*	2	**YES**	**HQ > 1**	**YES**
4,4'-DDE	0.00086	m	0.021	*EcoSSL*	0.04	**YES**	**Bioaccumulative**	**YES**
BHC, beta-	0.00028	m	0.00398	*R5*	0.07	**YES**	**Bioaccumulative**	**YES**
Chlordane, alpha-	0.089	m	0.224	*R5*	0.4	**YES**	**Bioaccumulative**	**YES**
Endosulfan	0.022	m	NA		NA	**YES**	**NSL**	**YES**
Endrin	0.00035	m	0.0101	*R5*	0.03	**YES**	**Bioaccumulative**	**YES**
Heptachlor Epoxide	0.015	m	0.152	*R5*	0.1	**YES**	**Bioaccumulative**	**YES**
Methoxychlor	0.0674	m	0.0199	*R5*	3	**YES**	**HQ > 1**	**YES**
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	4.763		682	*R5*	0.007	**YES**	**Bioaccumulative**	**YES**
Acenaphthylene	0.0728		682	*R5*	0.0001	**YES**	**Bioaccumulative**	**YES**
Anthracene	9.003		1,480	*R5*	0.006	**YES**	**Bioaccumulative**	**YES**
Benzo(a)anthracene	24.65		5.21	*R5*	5	**YES**	**HQ > 1**	**YES**
Benzo(a)pyrene	17.26		1.52	*R5*	10	**YES**	**HQ > 1**	**YES**
Benzo(b)fluoranthene	33.31		59.8	*R5*	0.6	**YES**	**Bioaccumulative**	**YES**
Benzo(g,h,i)perylene	13.05		119	*R5*	0.1	**YES**	**Bioaccumulative**	**YES**
Benzo(k)fluoranthene	14.82		148	*R5*	0.1	**YES**	**Bioaccumulative**	**YES**
Chrysene	29.95		4.73	*R5*	6	**YES**	**HQ > 1**	**YES**
Dibenzo(a,h)anthracene	3.297		18.4	*R5*	0.2	**YES**	**Bioaccumulative**	**YES**
Fluoranthene	92.29		122	*R5*	0.8	**YES**	**Bioaccumulative**	**YES**
Fluorene	4.686		122	*R5*	0.04	**YES**	**Bioaccumulative**	**YES**
Indeno(1,2,3-cd)pyrene	11.79		109	*R5*	0.1	**YES**	**Bioaccumulative**	**YES**
Naphthalene	0.194		0.0994	*R5*	2	**YES**	**HQ > 1**	no
Phenanthrene	53.49		45.7	*R5*	1	**YES**	**Bioaccumulative**	**YES**

Table 6-30
Baseline Level - Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)	Ecological Screening Level (ESLs) [b] (mg/kg)		Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d]		Bioaccumulative ? [e] (YES/no)
		Value	*Source*		(YES/no)	Rationale	
Pyrene	56.42	78.5	*R5*	0.7	**YES**	**Bioaccumulative**	**YES**
Polychlorinated Biphenyls							
Aroclor 1254	2.155	NA		NA	**YES**	**NSL**	**YES**
Inorganics							
Antimony	1.236	0.27	*EcoSSL*	5	**YES**	**HQ > 1**	no
Arsenic	12.33	18	*EcoSSL*	0.7	**YES**	**Bioaccumulative**	**YES**
Barium	6,101	330	*EcoSSL*	20	**YES**	**HQ > 1**	no
Cadmium	14.42	0.36	*EcoSSL*	40	**YES**	**HQ > 1**	**YES**
Chromium	53.69	26	*EcoSSL*	2	**YES**	**HQ > 1**	no
Cobalt	34.68	13	*EcoSSL*	3	**YES**	**HQ > 1**	no
Copper	21,230	28	*EcoSSL*	800	**YES**	**HQ > 1**	**YES**
Iron	39,125	NA		NA	**YES**	**NSL**	no
Lead	15,706	11	*EcoSSL*	1,000	**YES**	**HQ > 1**	**YES**
Manganese	545.9	220	*EcoSSL*	2	**YES**	**HQ > 1**	no
Mercury	7.271	0.1	*R5*	70	**YES**	**HQ > 1**	no
Nickel	45.55	38	*EcoSSL*	1	**YES**	**Bioaccumulative**	**YES**
Selenium	0.857	0.52	*EcoSSL*	2	**YES**	**HQ > 1**	**YES**
Silver	0.971	4.2	*EcoSSL*	0.2	**YES**	**Bioaccumulative**	**YES**
Zinc	5,351	46	*EcoSSL*	100	**YES**	**HQ > 1**	**YES**

Notes:
– = Not available or applicable.
mg/kg = Milligrams per kilogram.
NA = Not available or applicable.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[c] The refined hazard quotient (HQ) is the ratio of the EPC to the surface soil screening level. HQs are rounded to one significant figure.
[d] Constituents with a refined hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for baseline risk assessment.
[e] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment quality Assessment, Status and Needs, February 2000.

Table 6-31
Baseline Level - Constituents of Potential Ecological Concern in Sediment
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)		Ecological Screening Level (ESLs) [b] (mg/kg) Value	Source	Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rationale	Bioaccumulative ? [e] (YES/no)
Volatile Organic Compounds								
Acetone	0.028	m	0.0099	*R5*	3	**YES**	**HQ > 1**	no
Pesticides								
4,4'-DDD	0.00073	m	0.00488	*R3*	0.1	**YES**	**Bioaccumulative**	**YES**
4,4'-DDE	0.00182	m	0.00316	*R3*	0.6	**YES**	**Bioaccumulative**	**YES**
4,4'-DDT	0.00077	m	7	*ORNL*	0.0001	**YES**	**Bioaccumulative**	**YES**
BHC, beta-	0.00029	m	0.005	*R3*	0.06	**YES**	**Bioaccumulative**	**YES**
Chlordane, alpha-	0.00038	m	0.00324	*R3s*	0.1	**YES**	**Bioaccumulative**	**YES**
Dieldrin	0.00094	m	0.0019	*R3*	0.5	**YES**	**Bioaccumulative**	**YES**
Polycyclic Aromatic Hydrocarbons								
Anthracene	0.0017	m	0.0572	*R3*	0.03	**YES**	**Bioaccumulative**	**YES**
Benzo(a)anthracene	0.013	m	0.108	*R3*	0.1	**YES**	**Bioaccumulative**	**YES**
Benzo(a)pyrene	0.012	m	0.15	*R3*	0.08	**YES**	**Bioaccumulative**	**YES**
Benzo(b)fluoranthene	0.019	m	10.4	*R5*	0.002	**YES**	**Bioaccumulative**	**YES**
Benzo(g,h,i)perylene	0.0071	m	0.17	*R3*	0.04	**YES**	**Bioaccumulative**	**YES**
Benzo(k)fluoranthene	0.0071	m	0.24	*R3*	0.03	**YES**	**Bioaccumulative**	**YES**
Chrysene	0.013	m	0.166	*R3*	0.08	**YES**	**Bioaccumulative**	**YES**
Dibenzo(a,h)anthracene	0.0021	m	0.033	*R3*	0.06	**YES**	**Bioaccumulative**	**YES**
Fluoranthene	0.019	m	0.423	*R3*	0.04	**YES**	**Bioaccumulative**	**YES**
Fluorene	0.0012	m	0.0774	*R3*	0.02	**YES**	**Bioaccumulative**	**YES**
Indeno(1,2,3-cd)pyrene	0.0081	m	0.017	*R3*	0.5	**YES**	**Bioaccumulative**	**YES**
Phenanthrene	0.009	m	0.204	*R3*	0.04	**YES**	**Bioaccumulative**	**YES**
Pyrene	0.019	m	0.195	*R3*	0.1	**YES**	**Bioaccumulative**	**YES**
Inorganics								
Arsenic	4.6	m	9.8	*R3*	0.5	**YES**	**Bioaccumulative**	**YES**
Barium	77.2	m	NA		NA	**YES**	**NSL**	no
Beryllium	0.92	m	NA		NA	**YES**	**NSL**	no
Chromium	28.5	m	43.4	*R3*	0.7	no	HQ • 1	no
Copper	8.89	m	31.6	*R3*	0.3	**YES**	**Bioaccumulative**	**YES**
Lead	17	avg	35.8	*R3*	0.5	**YES**	**Bioaccumulative**	**YES**
Nickel	11.5	m	22.7	*R3*	0.5	**YES**	**Bioaccumulative**	**YES**
Thallium	0.29	m	NA		NA	**YES**	**NSL**	no
Vanadium	37.8	m	NA		NA	**YES**	**NSL**	no
Zinc	36	m	121	*R3*	0.3	**YES**	**Bioaccumulative**	**YES**

Table 6-31
Baseline Level - Constituents of Potential Ecological Concern in Sediment
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:

– =	Not available or applicable.
mg/kg =	Milligrams per kilogram.
NA =	Not available or applicable.
[a]	Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
[b]	See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[c]	The refined hazard quotient (HQ) is the ratio of the EPC to the sediment screening level. HQs are rounded to one significant figure.
[d]	Constituents with a refined hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for baseline risk assessment.
[e]	Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment quality Assessment, Status and Needs, February 2000.

Table 6-32
Baseline Level - Constituents of Potential Ecological Concern in Surface Water
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/L)		Ecological Screening Level (ESLs) [b] (mg/L) Value	*Source*	Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rationale	Bioaccumulative ? [e] (YES/no)
Pesticides								
Dieldrin	0.00000582	m	0.000056	*R3*	0.1	**YES**	**Bioaccumulative**	**YES**
Polycyclic Aromatic Hydrocarbons								
Benzo(a)anthracene	0.000024	m	0.000018	*R3*	1	**YES**	**Bioaccumulative**	**YES**
Benzo(b)fluoranthene	0.000025	m	0.00907	*R5*	0.003	**YES**	**Bioaccumulative**	**YES**
Chrysene	0.00003	m	0.000025	*R3s*	1	**YES**	**Bioaccumulative**	**YES**
Fluoranthene	0.000066	m	0.00004	*R3*	2	**YES**	**HQ > 1**	**YES**
Phenanthrene	0.000036	m	0.0004	*R3*	0.09	**YES**	**Bioaccumulative**	**YES**
Pyrene	0.000041	m	0.000025	*R3*	2	**YES**	**HQ > 1**	**YES**
Inorganics								
Aluminum	0.549	m	0.087	*R3*	6	**YES**	**HQ > 1**	no
Arsenic	0.01	m	0.005	*R3*	2	**YES**	**HQ > 1**	**YES**
Barium	0.0981	m	0.004	*R3*	20	**YES**	**HQ > 1**	no
Chromium	0.0027	m	0.085	*R3*	0.03	no	HQ • 1	no
Copper	0.828	m	0.009	*R3*	90	**YES**	**HQ > 1**	**YES**
Iron	0.742	m	0.3	*R3*	2	**YES**	**HQ > 1**	no
Lead	0.247	m	0.0025	*R3*	100	**YES**	**HQ > 1**	**YES**
Manganese	0.377	m	0.12	*R3*	3	**YES**	**HQ > 1**	no
Mercury	0.0002	m	0.000026	*R3*	8	**YES**	**HQ > 1**	no
Selenium	0.00051	m	0.001	*R3*	0.5	**YES**	**Bioaccumulative**	**YES**
Zinc	0.116	m	0.12	*R3*	1	**YES**	**Bioaccumulative**	**YES**

Notes:
– = Not available or applicable.
mg/L = Milligrams per liter.
NA = Not available or applicable.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[c] The refined hazard quotient (HQ) is the ratio of the EPC to the surface water screening level. HQs are rounded to one significant figure.
[d] Constituents with a refined hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for baseline risk assessment.
[e] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment quality Assessment, Status and Needs, February 2000.

Table 6-33

Summary of Ecological Risk Characterization Results - Terrestrial Habitat

BAG LOADING AREA

New River Unit, Radford Army Ammunition Plant, Radford, Virginia

	Soil			Baseline Level Assessment				Results of Refined Food Chain Models [c]			
	Frequency of Detection		EPC	Hazard Quotient	Ecological Screening Level [b]		Bioaccum-ulative ?	Short-tailed Shrew		American Robin	
Constituent	# detects / n samples	%	(mg/kg)	[a]	Source	Basis	(YES/no)	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ
Volatile Organic Compounds											
3-Octanone	1 - 1	100%	0.011 m	NA			no	–	–	–	–
d-Limonene	1 - 1	100%	0.057 m	NA			no	–	–	–	–
Semi-Volatile Organic Compounds											
2,6-Dinitrotoluene	3 - 20	15%	1.9 m	**60**	R5		no	–	–	–	–
Benzoic Acid	4 - 15	27%	0.3 m	NA			no	–	–	–	–
Carbazole	10 - 14	71%	11.99	NA			no	–	–	–	–
Dibenzofuran	9 - 14	64%	2.604	NA			no	–	–	–	–
Di-n-Butylphthalate	6 - 14	43%	29.36	**200**	R5		no	–	–	–	–
N-Nitrosodiphenylamine	2 - 13	15%	8.3 m	**20**	R5		no	–	–	–	–
Explosives											
2,4,6-Trinitrotoluene	1 - 19	5%	0.06 m	NA			no	–	–	–	–
m-Nitrotoluene	1 - 19	5%	2.86 m	NA			no	–	–	–	–
Nitroglycerine	1 - 19	5%	0.21 m	NA			no	–	–	–	–
Pentaerythritol Tetranitrate	1 - 19	5%	0.16 m	NA			no	–	–	–	–
Pesticides											
4,4'-DDD	4 - 5	80%	0.043 m	**2**	EcoSSL	mam	YES	0.001	0.006	0.1	1
4,4'-DDE	2 - 4	50%	0.0009 m	0.04	EcoSSL	mam	YES	0.00002	0.0001	0.003	0.03
BHC, beta-	1 - 4	25%	0.0003 m	0.07	R5		YES	0.00001	0.00006	0.000009	0.00004
Chlordane, alpha-	1 - 5	20%	0.089 m	0.4	R5		YES	0.0003	0.003	0.0003	0.003
Endosulfan	1 - 5	20%	0.022 m	NA			YES	0.001	0.01	0.00002	0.0002
Endrin	1 - 4	25%	0.0004 m	0.03	R5		YES	0.00006	0.0006	0.000008	0.00008
Heptachlor Epoxide	2 - 5	40%	0.015 m	0.1	R5		YES	0.0009	0.009	–	–
Methoxychlor	2 - 4	50%	0.0674 m	**3**	R5		YES	0.003	0.006	–	–
Polycyclic Aromatic Hydrocarbons											
Acenaphthene	32 - 42	76%	4.763	0.007	R5		YES	0.02	0.2	0.002	0.02
Acenaphthylene	26 - 42	62%	0.0728	0.0001	R5		YES	0.00004	0.000004	0.00003	0.0003
Anthracene	36 - 42	86%	9.003	0.006	R5		YES	0.00001	0.0001	0.001	0.01
Benzo(a)anthracene	42 - 44	95%	24.65	**5**	R5		YES	0.08	0.8	0.004	0.04
Benzo(a)pyrene	39 - 44	89%	17.26	**10**	R5		YES	0.03	0.3	0.003	0.03
Benzo(b)fluoranthene	41 - 44	93%	33.31	0.6	R5		YES	0.02	0.5	0.005	0.05
Benzo(g,h,i)perylene	39 - 42	93%	13.05	0.1	R5		YES	0.4	**4**	0.002	0.02
Benzo(k)fluoranthene	41 - 44	93%	14.82	0.1	R5		YES	0.009	0.2	0.002	0.02
Chrysene	41 - 44	93%	29.95	**6**	R5		YES	0.002	0.02	0.004	0.04
Dibenzo(a,h)anthracene	30 - 42	71%	3.297	0.2	R5		YES	**6**	**60**	0.0005	0.005
Fluoranthene	41 - 44	93%	92.29	0.8	R5		YES	0.07	0.7	0.03	0.3
Fluorene	31 - 42	74%	4.686	0.04	R5		YES	0.0009	0.003	0.002	0.02
Indeno(1,2,3-cd)pyrene	38 - 42	90%	11.79	0.1	R5		YES	1	**10**	0.002	0.02
Naphthalene	25 - 42	60%	0.194	**2**	R5		no	–	–	–	–
Phenanthrene	41 - 44	93%	53.49	1	R5		YES	0.02	0.2	0.008	0.08
Pyrene	41 - 44	93%	56.42	0.7	R5		YES	0.04	0.4	0.008	0.08

Table 6-33
Summary of Ecological Risk Characterization Results - Terrestrial Habitat
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Soil Frequency of Detection # detects / n samples			%	EPC (mg/kg)	Baseline Level Assessment Hazard Quotient [a]	Ecological Screening Level [b] Source	Basis	Bioaccum-ulative ? (YES/no)	Results of Refined Food Chain Models [c] Short-tailed Shrew LOAEL HQ	Short-tailed Shrew NOAEL HQ	American Robin LOAEL HQ	American Robin NOAEL HQ
Polychlorinated Biphenyls													
Aroclor 1254	9	-	20	45%	2.155	NA			YES	0.5	**5**	0.09	0.9
Inorganics													
Antimony	20	-	45	44%	1.236	**5**	EcoSSL	mam	no	–	–	–	–
Arsenic	46	-	47	98%	12.33	0.7	EcoSSL	veg	YES	0.06	0.6	0.03	0.07
Barium	47	-	47	100%	6,101	**20**	EcoSSL	inv	no	–	–	–	–
Cadmium	30	-	38	79%	14.42	**40**	EcoSSL	mam	YES	**2**	**20**	0.1	1
Chromium	47	-	47	100%	53.69	**2**	EcoSSL	avi	no	–	–	–	–
Cobalt	44	-	47	94%	34.68	**3**	EcoSSL	veg	no	–	–	–	–
Copper	47	-	47	100%	21,230	**800**	EcoSSL	avi	YES	**10**	**10**	**8**	**10**
Iron	47	-	47	100%	39,125	NA			no	–	–	–	–
Lead	47	-	47	100%	15,706	**1,000**	EcoSSL	avi	YES	**2**	**20**	**6**	**60**
Manganese	47	-	47	100%	545.9	**2**	EcoSSL	veg	no	–	–	–	–
Mercury	36	-	38	95%	7.271	**70**	R5		no	–	–	–	–
Nickel	47	-	47	100%	45.55	1	EcoSSL	veg	YES	0.004	0.04	0.006	0.009
Selenium	12	-	46	26%	0.857	**2**	EcoSSL	veg	YES	0.07	0.1	0.02	0.05
Silver	12	-	38	32%	0.971	0.2	EcoSSL	avi	YES	0.0001	0.001	0.03	0.07
Zinc	47	-	47	100%	5,351	**100**	EcoSSL	avi	YES	**7**	**70**	**2**	**20**

Notes:
– = Not applicable.
COPEC = Constituent of Potential Ecological Concern.
EPC = Exposure point concentrations - the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration.
EPCs marked with "m" are the maximum concentration.
LOAEL HQ = Lowest observed adverse effect level hazard quotient.
mg/kg = Milligrams per kilogram.
NA = Not available.
NOAEL HQ = No observed adverse effect level hazard quotient.

[a] Hazard quotients (HQs) greater than one are presented in bold font. HQs are rounded to one significant figure (unitless).
[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
R5: Region 5 Ecological Screening Levels (USEPA 2003e; R5).
EcoSSL: USEPA Ecological Soil Screening Levels (USEPA 2005b, EcoSSL).
Where readily available (i.e., EcoSSLs), the basis of the ESL is presented.
[c] Foodchain modeling was conducted for bioaccumulative COPECs.

Table 6-34
Summary of Ecological Risk Characterization Results - Aquatic Habitat
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

	Sediment				Surface Water				Baseline Level Assessment			Results of Refined Food Chain Models [b]			
	Frequency of Detection		EPC		Frequency of Detection		EPC		Sediment Hazard Quotient	Surface Water Hazard Quotient	Bioaccum-ulative ?	Mink		Great Blue Heron	
Constituent	**# detects / n samples**	**%**	**(mg/kg)**		**# detects / n samples**	**%**	**(mg/L)**		**[a]**	**[a]**	**(YES/no)**	**LOAEL HQ**	**NOAEL HQ**	**LOAEL HQ**	**NOAEL HQ**
Volatile Organic Compounds															
Acetone	1 - 2	50%	0.028	m	0 - 3	0%	–		**3**	NA	no	–	–	–	–
Pesticides					-										
4,4'-DDD	2 - 2	100%	0.00073	m	0 - 2	0%	–		0.1	NA	YES	0.00002	0.00009	0.002	0.02
4,4'-DDE	2 - 2	100%	0.00182	m	0 - 2	0%	–		0.6	NA	YES	0.0006	0.003	0.07	0.7
4,4'-DDT	2 - 2	100%	0.00077	m	0 - 2	0%	–		0.0001	NA	YES	0.00002	0.00009	0.002	0.02
BHC, beta-	1 - 2	50%	0.00029	m	0 - 2	0%	–		0.06	NA	YES	–	–	–	–
Chlordane, alpha-	2 - 2	100%	0.00038	m	0 - 2	0%	–		0.1	NA	YES	0.000002	0.00002	0.000001	0.00001
Dieldrin	1 - 2	50%	0.00094	m	2 - 2	100%	0.00000582	m	0.5	0.1	YES	0.001	0.01	0.0003	0.003
Polycyclic Aromatic Hydrocarbons					-										
Anthracene	1 - 2	50%	0.0017	m	0 - 4	0%	–		0.03	NA	YES	1E-10	0.000000001	0.000000003	0.00000003
Benzo(a)anthracene	2 - 2	100%	0.013	m	1 - 4	25%	0.000024	m	0.1	1	YES	0.000006	0.00006	0.00000006	0.0000006
Benzo(a)pyrene	2 - 2	100%	0.012	m	0 - 4	0%	–		0.08	NA	YES	0.000001	0.00001	0.00000005	0.0000005
Benzo(b)fluoranthene	2 - 2	100%	0.019	m	1 - 4	25%	0.000025	m	0.002	0.003	YES	0.0000007	0.00002	0.00000009	0.0000009
Benzo(g,h,i)perylene	2 - 2	100%	0.0071	m	0 - 4	0%	–		0.04	NA	YES	0.000007	0.00007	0.00000003	0.0000003
Benzo(k)fluoranthene	2 - 2	100%	0.0071	m	0 - 4	0%	–		0.03	NA	YES	0.0000002	0.000005	0.00000003	0.0000003
Chrysene	2 - 2	100%	0.013	m	1 - 4	25%	0.00003	m	0.08	1	YES	0.0000001	0.000001	0.00000006	0.0000006
Dibenzo(a,h)anthracene	2 - 2	100%	0.0021	m	0 - 4	0%	–		0.06	NA	YES	0.0002	0.002	0.000000009	0.00000009
Fluoranthene	2 - 2	100%	0.019	m	1 - 4	25%	0.000066	m	0.04	**2**	YES	0.0000006	0.000006	0.0000001	0.000001
Fluorene	1 - 2	50%	0.0012	m	0 - 4	0%	–		0.02	NA	YES	0.000000002	0.000000005	0.000000002	0.00000002
Indeno(1,2,3-cd)pyrene	2 - 2	100%	0.0081	m	0 - 4	0%	–		0.5	NA	YES	0.000009	0.00009	0.00000003	0.0000003
Phenanthrene	2 - 2	100%	0.009	m	1 - 4	25%	0.000036	m	0.04	0.09	YES	0.0000005	0.000005	0.00000002	0.0000002
Pyrene	2 - 2	100%	0.019	m	1 - 4	25%	0.000041	m	0.1	**2**	YES	0.000001	0.00001	0.00000009	0.0000009
Inorganics					-										
Aluminum	2 - 2	100%	–		4 - 4	100%	0.549	m	NA	**6**	no	–	–	–	–
Arsenic	2 - 2	100%	4.6	m	2 - 4	50%	0.01	m	0.5	**2**	YES	0.07	0.7	0.02	0.06
Barium	2 - 2	100%	77.2	m	4 - 4	100%	0.0981	m	NA	**20**	no	–	–	–	–
Beryllium	2 - 2	100%	0.92	m	0 - 4	0%	–		NA	NA	no	–	–	–	–
Copper	2 - 2	100%	8.89	m	2 - 4	50%	0.828	m	0.3	**90**	YES	0.03	0.04	0.008	0.01
Iron	2 - 2	100%	–		4 - 4	100%	0.742	m	NA	**2**	no	–	–	–	–
Lead	2 - 2	100%	17	avg	4 - 4	100%	0.247	m	0.5	**100**	YES	0.02	0.2	0.03	0.3
Manganese	2 - 2	100%	–		4 - 4	100%	0.377	m	NA	**3**	no	–	–	–	–
Mercury	0 - 2	0%	–		1 - 4	25%	0.0002	m	NA	**8**	no	–	–	–	–
Nickel	2 - 2	100%	11.5	m	0 - 4	0%	–		0.5	NA	YES	0.01	0.02	0.007	0.009
Selenium	0 - 2	0%	–		1 - 4	25%	0.00051	m	NA	0.5	YES	–	–	–	–
Thallium	2 - 2	100%	0.29	m	0 - 4	0%	–		NA	NA	no	–	–	–	–
Vanadium	2 - 2	100%	37.8	m	0 - 4	0%	–		NA	NA	no	–	–	–	–
Zinc	2 - 2	100%	36	m	2 - 4	50%	0.116	m	0.3	1	YES	0.08	0.8	0.02	0.1

Notes:

– =	Not applicable.
EPC =	Exposure point concentrations - the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration.
	EPCs marked with "m" are the maximum concentration.
LOAEL HQ =	Lowest observed adverse effect level hazard quotient.
mg/kg =	Milligrams per kilogram.
mg/L =	Milligrams per liter.
NOAEL HQ =	No observed adverse effect level hazard quotient.
[a]	Hazard quotients (HQs) greater than one are presented in bold font. HQs are rounded to one significant figure (unitless).
[b]	Foodchain modeling was conducted for bioaccumulative COPECs.

Table 7-1. Soil Analytical Results, Igniter Assembly Area, 1997 Dames and Moore Soil Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	50240 0 - 1 12/08/97	50240 1 - 2 12/11/97	50240 2 - 3 12/11/97	502436 0 - 1 12/11/97	502436 1 - 2 12/11/97	502460 0 - 1 12/11/97	502460 1 - 2 12/11/97	504312 0 - 1 12/11/97	504312 1 - 2 12/09/97	504312 2 - 3 12/09/97	504336 0 - 1 12/09/97	504336 1 - 2 12/09/97	504360 0 - 1 12/09/97	504360 1 - 2 12/09/97	81022612 0 - 1 12/11/97	81022612 1 - 2 12/11/97	81022612 2 - 3 12/11/97	81022636 0 - 1 12/11/97	81022636 1 - 2 12/11/97	81022660 0 - 1 12/11/97	81022660 1 - 2 12/11/97	81027112 0 - 1 12/08/97	81027112 1 - 2 12/08/97
Organochlorine Pesticides																											
4,4'-DDT	1.7 {ca*}	7 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan II	37 {nc}	370 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endrin	1.8 {nc}	18 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methoxychlor	31	310	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCBs																											
Aroclor-1254	0.22 {ca**}	0.74 {ca*}	- -	mg/kg	0.26	0.031 JP	0.0070 JP	0.14	0.13	0.041 JP	ND	0.89 P	ND	0.046 P	0.32	0.054 P	0.56	10 D*	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organics																											
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	ND	ND	ND	ND	ND	48 J	210 J	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	41 J	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	35 {ca*}	120 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	750	ND	110 J	81 J	ND	110 J	260 J	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	44 J	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diethylphthalate	4,900 {nc}	490,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	ND	ND	ND	ND	ND	250 J	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	<0	<0	<0	<0	<0	48 J	210 J	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	59 J	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	48 J	NA	NA	NA	NA	NA	NA	NA	NA	NA
Inorganics																											
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	39,000	18,100	23,000	12,800	22,200	25,100	20,400	20,200	20,300	23,500	14,200	15,700	10,900	7,430	9,790	17,600	19,200	15,900	27,200	24,300	25,600	29,300	20,800
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	0.530 J	ND	ND	ND	ND	ND	ND	0.800 J	ND	ND	1.30 J	0.410 J	3.20 J	7.20 J	ND	ND	0.260 J	0.210 J	0.470 J	ND	0.290 J	ND	ND
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	10.6	2.4	4.8	1.20 J	3.4	7.9	6	7.5	5.4	7.7	4.9	5.7	5.3	11.9	ND	8.2	6	1.40 J	8.2	5.5	5	10.5	2.10 J
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	80.1	20.0 J	12.8 J	61	16.4 J	54.7	29.4 J	**961**	50.2	40.5	**394**	133	**489**	**906**	20.2 J	8.50 J	22.7 J	12.3 J	14.0 J	14.4 J	12.6 J	29.2 J	29.8 J
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	0.760 J	0.500 J	0.390 J	0.370 J	0.34	0.700 J	0.650 J	0.580 J	0.360 J	0.340 J	0.470 J	0.430 J	0.550 J	0.370 J	ND	ND	ND	ND	ND	0.420 J	0.340 J	**1.2**	0.860 J
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	NA	NA	NA	NA	NA	NA	NA	0.640 J	ND	ND	0.420 J	ND	**2.1**	**2**	ND	ND	ND	ND	ND	ND	**1.8**	NA	NA
Calcium	- -	- -	- -	mg/kg	1,690	1,280	1,560	1,640	1,220	1,460	1,460	10,500	876 J	734 J	23,500	7,930	148,000	82,000	1,340	633 J	1,080	1,300	488 J	866 J	275 J	739 J	1,370
Chromium	280 {ca**}	1,400 {ca**}	65.3	mg/kg	60.3	31.4	48.8	25.5	46.1	40.9	36.6	**511**	42.4	42.8	**468**	**176**	**884**	**1,920**	25.2	44.3	43.9	33.5	51.1	49.8	50.8	37.2	28.8
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	5.90 J	4.10 J	2.80 J	15.9	2.50 J	5.60 J	4.10 J	10.3	4.40 J	2.60 J	8.70 J	10.5	15.3	16.9	0.260 J	1.00 J	0.980 J	0.830 J	1.50 J	1.90 J	1.40 J	27.1	6.10 J
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	29.7	16.8	20.4	16.8	16.6	26.7	23.5	**1,780**	19	30.4	**653**	**123**	**397**	**812**	15.9	14.4	18.1	11.7	17.3	18.8	16.5	42.4	19.6
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	45,500	29,000	37,400	19,100	35,200	40,600	33,900	**56,000**	35,800	33,500	38,600	33,400	41,800	**88,000**	18,600	40,900	41,300	31,500	44,800	40,900	44,800	38,500	37,400
Lead	400 {++}	800 {++}	26.8	mg/kg	25.9	**28**	26.7	**51.9**	**36.1**	**40.3**	**43.2**	**4,090**	15.4	18.5	**3,850**	**1,280**	**7,370**	**16,200**	10.7	11.4	11.5	10.5	13.3	13.9	13.5	**38.3**	25.4
Magnesium	- -	- -	- -	mg/kg	1,520	569 J	511 J	784 J	464 J	745 J	722 J	6,430	1,070	1,010	15,000	4,650	64,600	52,500	447 J	324 J	509 J	479 J	414 J	497 J	323 J	1,500	1,400
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	104	107	83.7	420	88.8	151	100	312	169	51.9	281	274	349	584	8.60	23.4	25.1	25.8	29.1	48.4	35.4	590	69.3
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	**0.400**	ND	ND	0.110	ND	**3.30**	**0.630**	0.100	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	ND	ND
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	21.0	12.8	13.7	11.0	11.7	18.2	16.6	30.0	9.20	8.80	20.3	15.8	30.0	57.3	1.40 J	5.20 J	4.80 J	3.90 J	7.80 J	9.20	7.40 J	34.8	14.7
Potassium	- -	- -	- -	mg/kg	1,100 J	521 J	633 J	394 J	561 J	613 J	484 J	697 J	586 J	640 J	1,410	607 J	4,610	2,100	173 J	239 J	306 J	240 J	477 J	440 J	413 J	921 J	642 J
Selenium	39 {nc}	510 {nc}	- -	mg/kg	1.90	0.710 J	1.30	ND	1.30	0.570 J	1.00	1.20	1.40	1.20	0.850 J	0.870 J	ND	ND	0.570 J	1.40	1.20	0.760 J	1.90	1.20	1.60	1.20	0.750 J
Silver	39 {nc}	510 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	0.180 J	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	- -	- -	- -	mg/kg	52.9 J	38.6 J	38.5 J	29.3 J	38.0 J	26.9 J	30.0 J	44.3 J	39.0 J	30.9 J	60.9 J	43.2 J	138 J	127 J	22.0 J	22.3 J	23.2 J	20.8 J	32.7 J	33.4 J	29.5 J	45.1 J	43.5 J
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	ND	0.580 J	ND	0.460 J	ND	ND	0.410 J	ND	ND	ND	0.370 J	ND	ND	ND	ND	ND	ND	ND	0.630 J	ND	ND	ND	ND
Vanadium	55 {nc}	720 {nc}	108	mg/kg	98.4	64.6	87.3	46.0	82.3	86.5	70.6	66.9	74.8	71.4	39.9	52.6	24.6	23.4	42.5	80.8	84.4	61.5	95.3	76.6	91.8	65.8	ND
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	29.6	16.4	11.5	21.3	9.20	34.0	23.6	**1,550**	17.0	27.0	**1,090**	**323**	**1,490**	**3,170**	6.00	10.7	19.4	7.90	14.1	21.4	13.5	61.6	ND

Notes found at end of table.

Table 7-1. Soil Analytical Results, Igniter Assembly Area, 1997 Dames and Moore Soil Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: / Sample Depth(Feet): / Date Collected:	Adjusted Soil Screening Values- Residential	Adjusted Soil Screening Values- Industrial	Facility-Wide Background Values	Units	81027112 2 - 3 12/08/97	81027136 0 - 1 12/08/97	81027136 1 - 2 12/08/97	81027160 0 - 1 12/08/97	81027160 1 - 2 12/08/97	81027236 0 - 1 12/08/97	81027236 1 - 2 12/08/97	81027260 0 - 1 12/08/97	81027260 1 - 2 12/08/97	8102727 0 - 1 12/08/97	8102727 1 - 2 12/08/97	8102727 2 - 3 12/08/97
Organochlorine Pesticides																
4,4'-DDT	1.7 {ca*}	7 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	ND	ND	ND	0.00042 JP
Endosulfan II	37 {nc}	370 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	ND	ND	ND	0.0003 J
Endrin	1.8 {nc}	18 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	ND	ND	ND	0.00042 JP
Methoxychlor	31	310	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	5 J	ND	ND	ND
PCBs																
Aroclor-1254	0.22 {ca**}	0.74 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	ND	0.0049 JP	ND	ND
Semivolatile Organics																
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	35 {ca*}	120 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	0.22 J	0.085 J	0.082 J	ND
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diethylphthalate	4,900 {nc}	490,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Inorganics																
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	23,800	20,000	35,100	18,500	**46,900**	18,000	31,500	35,400	38,600	16,100	37,600	33,200
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	ND	ND	ND	ND	0.230 J	ND	ND	0.240 J	ND	ND	ND	ND
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	2.8	2.6	8.2	1.40 J	11.4	4	8.1	11.3	14.6	8.7	11.3	11.1
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	46.4 J	39.0 J	54.4	20.3 J	31.9 J	33.9 J	70	27.2 J	54.8	166	51.5	82.6
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	0.810 J	0.680 J	**1.2**	0.460 J	**1.1**	0.890 J	**2.8**	0.630 J	**3.8**	0.670 J	**2.3**	**2.9**
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	- -	- -	- -	mg/kg	1,790	1,490	1,400	1,250	1,360	2,640	2,720	2,590	2,670	1,060	4,380	3,170
Chromium	280 {ca**}	1,400 {ca**}	65.3	mg/kg	31.9	26.5	40	24.8	44.4	26.8	52.5	41.5	56.7	25.2	48.5	47.1
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	5.90 J	4.80 J	21.1	3.00 J	5.90 J	26	17.5	9.30 J	11.9	12	47.6	18.7
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	**207**	**175**	34.5	15.2	34.6	35	29.9	51.5	36.8	**274**	38.3	**61.6**
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	38,600	32,200	41,600	29,300	45,300	28,900	37,300	41,100	47,000	21,100	40,800	30,900
Lead	400 {++}	800 {++}	26.8	mg/kg	24.3	20.4	**49**	12.4	**30**	26.8	24.2	20.8	25.8	**475**	**40**	**30**
Magnesium	- -	- -	- -	mg/kg	1,600	1,340	1,400	921 J	1,530	2,190	14,600	1,240	3,940	1,910	8,420	22,900
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	56.5	47.1	410	34.1	84.1	188	442	99.4	178	221	341	408
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	ND	ND	ND	ND	ND	ND	0.100	ND	**0.150**	ND	ND	ND
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	16.8	14.0	27.4	7.70 J	24.7	15.1	37.9	16.9	38.9	13.9	33.0	32.5
Potassium	- -	- -	- -	mg/kg	734 J	620 J	1,080 J	621 J	1,450	778 J	3,940	855 J	1,830	718 J	2,430	4,620
Selenium	39 {nc}	510 {nc}	- -	mg/kg	0.850 J	0.730 J	0.830 J	0.990 J	1.30	0.600 J	ND	1.60	1.40	0.660 J	0.860 J	0.590 J
Silver	39 {nc}	510 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	- -	- -	- -	mg/kg	47.5 J	30.4 J	29.7 J	41.8 J	27.0 J	33.7 J	42.7 J	35.0 J	35.8 J	26.6 J	39.3 J	48.8 J
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	ND	ND	0.660 J	ND	ND	ND	0.530 J	ND	0.550 J	ND	ND	0.520 J
Vanadium	55 {nc}	720 {nc}	108	mg/kg	ND	59.7	77.9	58.3	84.8	54.6	67.5	79.9	83.1	37.6	76.7	59.2
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	ND	43.3	56.3	22.6	43.3	30.4	35.7	36.3	35.9	**293**	43.8	86.2

mg/kg	Milligrams per kilogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 7-2. Soil Analytical Results (Hits Only), Igniter Assembly Area, 1998 Dames and Moore Soil Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values	Units	81027112012 0-1 2/19/1998	810271121224 1-2 2/19/1998	810271122436 2-3 2/18/1998	81027136012 0-1 2/18/1998	810271361224 1-2 2/18/1998	81027160012 0-1 2/18/1998	810271601224 1-2 2/18/1998
SVOCs (ug/kg)											
bis(2-Ethylhexyl)phthalate	35 {ca*}	120 {ca*}	- -	ug/kg	ND	ND	ND	ND	ND	ND	300 J
Organochlorine Pesticides											
4,4'-DDT	1.7 {ca*}	7 {ca*}	- -	mg/kg	3.2 J	ND	ND	0.66 J	0.49 J	0.62 J	1.3 J
Endosulfan II	37 {nc}	370 {nc}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND
Endrin	1.8 {nc}	18 {nc}	- -	mg/kg	1.8 J	0.24 J	1.3 J	ND	ND	ND	ND
Methoxychlor	31	310	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND
PCBs (mg/kg)											
Aroclor-1254	0.22 {ca**}	0.74 {ca*}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND

mg/kg	Milligrams per kilogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
µg/kg	Micrograms per kilogram.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
J	Constituent concentration quanitified as estimated.
ND	Not Detected.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 7-3. Soil Analytical Results, Igniter Assembly Area, 1997 and 1998 Gannett Fleming Independent Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	SS-03 0 - 0.5 06/03/97	SS-11 0 - 0.5 06/03/97	SS-11a 0 - 0.2 03/30/98	SS-11b 0 - 0.2 03/30/98	SS-12 0 - 0.2 03/30/98	TR-01A 0 - 0.2 04/02/98	TR-01B 0 - 0.2 04/02/98	WS-03 Paint Chip 03/30/98
Organochlorine Pesticides												
4,4'-DDT	1.7 {ca*}	7 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	ND	ND	NA
Endrin	1.8 {nc}	18 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	0.02	ND	NA
Endrin Aldehyde	1.8 {nc}	18 {nc}	- -	mg/kg	ND	NA	NA	NA	NA	ND	ND	NA
Methoxychlor	31 {nc}	310 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	ND	ND	NA
PCBs												
Aroclor-1260	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	0.37	1.0	NA	NA	NA	NA	NA	NA
Volatile Organics												
Acetone	6,100 {nc}	61,000 {nc}	- -	mg/kg	ND	0.0090 B	NA	NA	NA	NA	NA	NA
Methylene Chloride	11 {ca}	54 {ca}	- -	mg/kg	0.0020 B	0.0040 B	NA	NA	NA	NA	NA	NA
Naphthalene	3.9 {nc}	20 {nc}	- -	mg/kg	ND	0.00090 B	NA	NA	NA	NA	NA	NA
Semivolatile Organics												
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	0.30 J	ND	NA
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	1.0	ND	NA
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.11 J	0.070 J	NA	NA	NA	3.5	ND	NA
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	ND	0.15 J	NA	NA	NA	5.2	0.040 J	NA
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	ND	0.20 J	NA	NA	NA	13	0.090 J	NA
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	ND	0.11 J	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	ND	0.15 J	NA	NA	NA	6.5	0.050 J	NA
Benzoic Acid	240,000 {max}	2,500,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	0.30 J	0.10 J	NA
bis(2-Ethylhexyl)phthalate	35 {ca*}	120 {ca*}	- -	mg/kg	1.3 J	5.7	NA	NA	NA	0.40 J	0.20 J	NA
Butylbenzylphthalate	1,200 {nc}	120,000 {max}	- -	mg/kg	ND	0.13 J	NA	NA	NA	NA	NA	NA
Carbazole	24 {ca**}	86 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	0.50 J	ND	NA
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	0.10 J	0.15 J	NA	NA	NA	7.7	0.060 J	NA
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	0.94	ND	NA
Diethylphthalate	4,900 {nc}	490,000 {max}	- -	mg/kg	ND	0.070 J	NA	NA	NA	NA	NA	NA
Di-n-Butylphthalate	610 {nc}	6,200 {nc}	- -	mg/kg	ND	0.070 J	NA	NA	NA	NA	NA	NA
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	0.30 J	0.20 J	NA	NA	NA	4.4	ND	NA
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	6.1	ND	NA
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.10 J	0.13 J	NA	NA	NA	0.30 J	ND	NA
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	0.30 J	0.20 J	NA	NA	NA	4.9	ND	NA

Notes found at end of table.

Table 7-3. Soil Analytical Results, Igniter Assembly Area, 1997 and 1998 Gannett Fleming Independent Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	SS-03 0 - 0.5 06/03/97	SS-11 0 - 0.5 06/03/97	SS-11a 0 - 0.2 03/30/98	SS-11b 0 - 0.2 03/30/98	SS-12 0 - 0.2 03/30/98	TR-01A 0 - 0.2 04/02/98	TR-01B 0 - 0.2 04/02/98	WS-03 Paint Chip 03/30/98
Inorganics												
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	15,300	7,920	8,060	3,900	4,860	NA	NA	2,680
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	ND	0.600	NA	NA	NA	NA	NA	NA
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	**25.2**	**85.8**	**100**	**56.4**	**164**	NA	NA	**204**
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	50.2 J	**9,360 J**	**11,800**	**4,600**	**3,220**	NA	NA	**2,080**
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	0.500	0.600	0.500	ND	ND	NA	NA	NA
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	**2.30**	**7.80**	**5.50**	**3.20**	**6.80**	NA	NA	**2.80**
Calcium	- -	- -	- -	mg/kg	28,000	54,000	62,100	101,000	87,700	NA	NA	126,000
Chromium	280 {ca**}	1,400 {ca**}	65.3	mg/kg	54.4	**86.8**	**79.4**	**79.1**	**99.2**	NA	NA	**69.3**
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	23.8	**76.9**	66.5	42.1	**85.6**	NA	NA	57.8
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	**24,600**	**38,000**	**43,900**	**53,400**	**56,500**	NA	NA	**54,200**
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	35,800	28,700	28,600	27,500	35,100	NA	NA	30,600
Lead	400 {++}	800 {++}	26.8	mg/kg	**207**	**1,040**	**918**	**336**	**563**	NA	NA	**308**
Magnesium	- -	- -	- -	mg/kg	28,800	46,000	52,500	82,200	71,500	NA	NA	100,000
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	225	498	465	300	281	NA	NA	201
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	NA	NA	**0.200**	ND	ND	NA	NA	0.100
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	61.0	**110**	**97.2**	**124**	**173**	NA	NA	**147**
Potassium	- -	- -	- -	mg/kg	673	664	733	837	814	NA	NA	778
Selenium	39 {nc}	510 {nc}	- -	mg/kg	ND	1.20	NA	NA	NA	NA	NA	NA
Silver	39 {nc}	510 {nc}	- -	mg/kg	3.60	9.40	11.0	13.0	22.5	NA	NA	15.9
Sodium	- -	- -	- -	mg/kg	NA	NA	ND	ND	101	NA	NA	128
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	1.00	1.00	0.500	0.300	0.700	NA	NA	0.400
Vanadium	55 {nc}	720 {nc}	108	mg/kg	53.0	60.0	23.8	10.8	16.3	NA	NA	NA
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	**626**	**21,800**	**18,300**	**8,280**	**6,460**	NA	NA	**18,300**
Asbestos												
Chrysotile	- -	- -	- -	% ASB	NA	NA	NA	NA	2.1	NA	NA	NA

mg/kg	Milligrams per kilogram
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
NA	Not Analyzed.
ND	Not Detected above laboratory detection limit.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 7-4. Soil Analytical Results, Igniter Assembly Area, 1998 ICF KE Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	IASB1A 0.5 - 1 08/05/98	IASB1B 5 - 6 08/05/98	IASB2A 0 - 2 08/05/98	IASB2B 4 - 6 08/05/98	IASB2C 26 - 28 08/05/98	IASB3A 0.5 - 1 08/05/98	IASB3B 5 - 6 08/05/98	IASB4A 0.5 - 1.5 08/05/98	IASB4B 5 - 6 08/05/98	IASB5A 0.5 - 1 08/05/98	IASB5B 0.5 - 6 08/05/98	IATP1A 0.5 - 1 08/04/98	IATP1C 0.5 - 4.5 08/04/98	IATP1B 0.5 - 1 08/04/98	IATP1D 0.5 - 4.5 08/04/98	IATP2A 0.5 - 1 08/04/98	IATP2C 0.5 - 4.5 08/04/98	IATP2B 0.5 - 1 08/04/98	IATP2D 0.5 - 4.5 08/04/98
Explosives																							
1,3,5-Trinitrobenzene	220 {nc}	2,700 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.2	<0.2	<0.3	<0.3	<0.2	<0.3	<0.2	<0.3	<0.3
1,3-Dinitrobenzene	0.61 {nc}	6.2 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.2	<0.2	<0.3	<0.3	<0.2	<0.3	<0.2	<0.3	<0.3
2,4,6-Trinitrotoluene	3.6 {ca**}	42 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.2	<0.2	<0.3	<0.3	<0.2	<0.3	<0.2	<0.3	<0.3
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.2	<0.2	<0.3	<0.3	<0.2	<0.3	<0.2	<0.3	<0.3
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.2	<0.2	<0.3	<0.3	<0.2	<0.3	<0.2	<0.3	<0.3
2-Amino-4,6-Dinitrotoluene	15 {nc}	190 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.2	<0.2	<0.3	<0.3	<0.2	<0.3	<0.2	<0.3	<0.3
4-Amino-2,6-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.2	<0.2	<0.3	<0.3	<0.2	<0.3	<0.2	<0.3	<0.3
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.2	<0.2	<0.3	<0.3	<0.2	<0.3	<0.2	<0.3	<0.3
HMX	310 {nc}	3,100 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<2.4	<2	<3	<3	<2.4	<2.5	<2.4	<2.5	<2.5
m-Nitrotoluene	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.2	<0.2	<0.3	<0.3	<0.2	<0.3	<0.2	<0.3	<0.3
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.2	<0.2	<0.3	<0.3	<0.2	<0.3	<0.2	<0.3	<0.3
Nitroglycerine	0.61 {nc}	6.2 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<1.2	<1.2	<1.3	<1.3	<1.2	<1.3	<1.2	<1.3	<1.3
o-Nitrotoluene	78 {nc}	1,300 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.2	<0.2	<0.3	<0.3	<0.2	<0.3	<0.2	<0.3	<0.3
Pentaerythritol Tetranitrate	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<1.2	<1.2	<1.3	<1.3	<1.2	<1.3	<1.2	<1.3	<1.3
p-Nitrotoluene	30 {ca**}	110 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.2	<0.2	<0.3	<0.3	<0.2	<0.3	<0.2	<0.3	<0.3
RDX	4.4 {ca*}	16 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.2	<0.2	<0.3	<0.3	<0.2	<0.3	<0.2	<0.3	<0.3
Tetryl	24 {nc}	250 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.2	<0.2	<0.3	<0.3	<0.2	<0.3	<0.2	<0.3	<0.3
Semivolatile Organics																							
1,2,4-Trichlorobenzene	180 {ca**}	220 {sat}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
1,2-Dichlorobenzene	220 {sat}	220 {sat}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
1,2-Diphenylhydrazine	0.61 {ca**}	2.2 {ca**}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
1,4-Dichlorobenzene	2.6 {ca}	13 {ca}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
2,4,5-Trichlorophenol	610 {nc}	6,200 {nc}	- -	mg/kg	<0.91	<0.98	<0.98	<1.0	<1.0	<1.1	<1.1	<1.1 [<0.91]	<1.2	<1.0	<1.2	<0.93	NA	<0.89	NA	<0.94	NA	<0.91	NA
2,4,6-Trichlorophenol	44 {ca**}	160 {ca**}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
2,4-Dichlorophenol	18 {nc}	180 {nc}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
2,4-Dimethylphenol	120 {nc}	1,200 {nc}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
2,4-Dinitrophenol	12 {nc}	120 {nc}	- -	mg/kg	<1.9	<2.0	<2.0	<2.1	<2.1	<2.3	<2.3	<2.2 [<1.9]	<2.4	<2.1	<2.4	<1.9	NA	<1.8	NA	<1.9	NA	<1.9	NA
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43	<0.49	<0.42	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43	<0.49	<0.42	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	210 {sat}	210 {sat}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
2-Chlorophenol	39 {nc}	510 {nc}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
2-Methylphenol	310 {nc}	3,100 {nc}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
2-Nitroaniline	- -	- -	- -	mg/kg	<1.9	<2.0	<2.0	<2.1	<2.1	<2.3	<2.3	<2.2 [<1.9]	<2.4	<2.1	<2.4	<1.9	NA	<1.8	NA	<1.9	NA	<1.9	NA
2-Nitrophenol	- -	- -	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
3,3'-Dichlorobenzidine	1.1 {ca**}	3.8 {ca**}	- -	mg/kg	<0.74	<0.79	<0.79	<0.83	<0.81	<0.92	<0.92	<0.86 [<0.74]	<0.96	<0.82	<0.96	<0.76 J	NA	<0.72	NA	<0.76	NA	<0.74	NA
3-Nitroaniline	- -	- -	- -	mg/kg	<1.9	<2.0	<2.0	<2.1	<2.1	<2.3	<2.3	<2.2 [<1.9]	<2.4	<2.1	<2.4	<1.9	NA	<1.8	NA	<1.9	NA	<1.9	NA
4,6-Dinitro-2-methylphenol	- -	- -	- -	mg/kg	<1.9	<2.0	<2.0	<2.1	<2.1	<2.3	<2.3	<2.2 [<1.9]	<2.4	<2.1	<2.4	<1.9	NA	<1.8	NA	<1.9	NA	<1.9	NA
4-Bromophenyl-phenylether	- -	- -	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
4-Chloro-3-Methylphenol	- -	- -	- -	mg/kg	<0.74	<0.79	<0.79	<0.83	<0.81	<0.92	<0.92	<0.86 [<0.74]	<0.96	<0.82	<0.96	<0.76	NA	<0.72	NA	<0.76	NA	<0.74	NA
4-Chloroaniline	24 {nc}	250 {nc}	- -	mg/kg	<0.74	<0.79	<0.79	<0.83	<0.81	<0.92	<0.92	<0.86 [<0.74]	<0.96	<0.82	<0.96	<0.76	NA	<0.72	NA	<0.76	NA	<0.74	NA
4-Chlorophenyl-phenylether	- -	- -	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
4-Methylphenol	31 {nc}	310 {nc}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
4-Nitroaniline	- -	- -	- -	mg/kg	<1.9	<2.0	<2.0	<2.1	<2.1	<2.3	<2.3	<2.2 [<1.9]	<2.4	<2.1	<2.4	<1.9	NA	<1.8	NA	<1.9	NA	<1.9	NA
4-Nitrophenol	- -	- -	- -	mg/kg	<1.9	<2.0	<2.0	<2.1	<2.1	<2.3	<2.3	<2.2 [<1.9]	<2.4	<2.1	<2.4	<1.9	NA	<1.8	NA	<1.9	NA	<1.9	NA
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	**0.060 J**	NA	<0.37	NA	<0.39	NA	<0.38	NA
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42 J	<0.49	**0.080 J**	NA	<0.37	NA	<0.39 J	NA	<0.38 J	NA
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42 J	<0.49	**0.12 J**	NA	<0.37	NA	<0.39 J	NA	<0.38 J	NA
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42 J	<0.49	**0.040 J**	NA	<0.37	NA	<0.39 J	NA	<0.38 J	NA
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	<0.38	**0.050 J**	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42 J	<0.49	**0.16 J**	NA	<0.37	NA	<0.39 J	NA	<0.38 J	NA
Benzoic Acid	240,000 {max}	2,500,000 {max}	- -	mg/kg	<1.9	<2.0	<2.0	<2.1	<2.1	<2.3	<2.3	<2.2 [<1.9]	<2.4	<2.1	<2.4	<1.9	NA	<1.8	NA	<1.9	NA	<1.9	NA
Benzyl Alcohol	3,100 {nc}	310,000 {max}	- -	mg/kg	<0.74	<0.79	<0.79	<0.83	<0.81	<0.92	<0.92	<0.86 [<0.74]	<0.96	<0.82	<0.96	<0.76	NA	<0.72	NA	<0.76	NA	<0.74	NA
bis(2-Chloroethoxy)methane	18 {nc}	180 {nc}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
bis(2-Chloroethyl)ether	0.19 {ca**}	0.9 {ca**}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
bis(2-Chloroisopropyl)ether	- -	- -	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
bis(2-Ethylhexyl)phthalate	35 {ca*}	120 {ca*}	- -	mg/kg	**0.030 J**	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	**0.53 J**	NA	0.090 J	NA	**0.60**	NA	**0.23 J**	NA
Butylbenzylphthalate	1,200 {nc}	120,000 {max}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38 J	NA	<0.37	NA	<0.39	NA	<0.38	NA
Carbazole	24 {ca**}	86 {ca**}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	0.11 J	NA	<0.37	NA	<0.39	NA	<0.38	NA
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42 J	<0.49	<0.38	NA	<0.37	NA	<0.39 J	NA	<0.38 J	NA
Dibenzofuran	- -	- -	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
Diethylphthalate	4,900 {nc}	490,000 {max}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	0.070 J [<0.38]	<0.49	<0.42	0.23 J	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
Dimethylphthalate	- -	- -	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA

Notes found at end of table.

Table 7-4. Soil Analytical Results, Igniter Assembly Area, 1998 ICF KE Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values- Residential [a]	Adjusted Soil Screening Values- Industrial [a]	Facility-Wide Background Values [b]	Units	IASB1A 0.5 - 1 08/05/98	IASB1B 5 - 6 08/05/98	IASB2A 0 - 2 08/05/98	IASB2B 4 - 6 08/05/98	IASB2C 26 - 28 08/05/98	IASB3A 0.5 - 1 08/05/98	IASB3B 5 - 6 08/05/98	IASB4A 0.5 - 1.5 08/05/98	IASB4B 5 - 6 08/05/98	IASB5A 0.5 - 1 08/05/98	IASB5B 0.5 - 6 08/05/98	IATP1A 0.5 - 1 08/04/98	IATP1C 0.5 - 4.5 08/04/98	IATP1B 0.5 - 1 08/04/98	IATP1D 0.5 - 4.5 08/04/98	IATP2A 0.5 - 1 08/04/98	IATP2C 0.5 - 4.5 08/04/98	IATP2B 0.5 - 1 08/04/98	IATP2D 0.5 - 4.5 08/04/98
Semivolatile Organics																							
Di-n-Butylphthalate	610 {nc}	6,200 {nc}	- -	mg/kg	<0.38	**0.11 J**	<0.40	**0.090 J**	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43	<0.49	<0.42	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-Octylphthalate	- -	- -	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42 J	<0.49	<0.38	NA	<0.37	NA	**0.040 J**	NA	<0.38 J	NA
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.38	**0.080 J**	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	0.16 J	NA	<0.37	NA	<0.39	NA	<0.38	NA
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
Hexachlorobenzene	0.3 {ca}	1.1 {ca}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
Hexachlorobutadiene	6.2 {ca**}	22 {ca*}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
Hexachlorocyclopentadiene	37 {nc}	370 {nc}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
Hexachloroethane	35 {ca**}	120 {ca**}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42 J	<0.49	<0.38	NA	<0.37	NA	<0.39 J	NA	<0.38 J	NA
Isophorone	510 {ca*}	1,800 {ca*}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
Naphthalene	3.9 {ca}	20 {ca}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43	<0.49	<0.42	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	0.069 {ca**}	0.25 {ca**}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
N-Nitrosodiphenylamine	99 {ca**}	350 {ca**}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
Pentachlorophenol	3 {ca}	9 {ca}	- -	mg/kg	<1.9	<2.0	<2.0	<2.1	<2.1	<2.3	<2.3	<2.2 [<1.9]	<2.4	<2.1	<2.4	<1.9	NA	<1.8	NA	<1.9	NA	<1.9	NA
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	<0.38	**0.060 J**	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	0.070 J	NA	<0.37	NA	<0.39	NA	<0.38	NA
Phenol	1,800 {nc}	180,000 {max}	- -	mg/kg	<0.38	<0.40	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	<0.38	NA	<0.37	NA	<0.39	NA	<0.38	NA
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	<0.38	**0.050 J**	<0.40	<0.42	<0.41	<0.46	<0.46	<0.43 [<0.38]	<0.49	<0.42	<0.49	0.15 J	NA	<0.37	NA	<0.39	NA	<0.38	NA
Inorganics																							
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	11,100	11,500	12,900	11,500	9,930	29,200	17,900	15,600 [14,200]	15,700	10,000	16,900	7,680	9,160	5,670	9,690	13,900	13,500	9,870	16,700
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	<0.550	<0.610	<0.590	<0.640	<0.600	<0.680	<0.700	<0.640 [<0.550]	<0.710	<0.620	<0.710	<0.560	<0.580	<0.550	<0.600	<0.580	<0.650	<0.560	<0.720
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	6.10	4.30	6.40	7.60	3.60	7.80	3.90	6.60 [5.50]	7.80	2.00	11.9	4.30 K	3.30	1.80 K	4.00	**28.8 K**	5.90	8.40 K	10.1
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	32.2 K	48.2 K	29.2 K	39.6 K	9.50 B	35.5 K	18.0 B	75.5 K [55.1]	51.4 K	38.7 K	20.3 B	**527 K**	22.5 B	50.7 K	24.2 B	**1,170 K**	38.5	**270 K**	41.7
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	<0.110	<0.120	<0.120	<0.130	<0.120	0.360 J	0.280 J	**2.30 [0.410 J]**	**4.30**	0.450 J	0.990	<0.110	<0.120	<0.110	<0.120	0.580 J	**2.10**	0.520 J	**1.70**
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	<0.110 L	<0.120 L	<0.120 L	<0.130 L	<0.120 L	<0.140 L	<0.140 L	**2.00 L [<0.110]**	<0.140 L	<0.120 L	<0.140	0.250 J	<0.120	<0.110	<0.120	**1.00**	<0.130	0.140 J	<0.140
Calcium	- -	- -	- -	mg/kg	762 B	89.6 B	702 B	230 B	220 B	943 B	462 B	866 B [715 B]	2,080 B	777 B	1,200	1,680	759 B	1,230	508 B	25,100	2,220 B	4,730 B	4,160 B
Chromium	280 {ca**}	1,400 {ca**}	65.3	mg/kg	54.2	28.6	40.5	40.9	24.0	48.5	35.2	35.5 [22.9]	59.8	22.0	42.1	21.8	15.9	15.6	17.3	36.8	42.2	23.7	36.0
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	1.40 J	0.750 J	1.10 J	1.30 J	2.10 J	4.40 J	3.20 J	39.4 [7.30]	18.3	7.30	59.1	4.20 K	0.950 J	2.10 K	1.10 J	17.6 K	25.6	11.8 K	12.3
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	**72.4**	28.9	19.2	25.4	6.10 B	29.0	12.1 B	**265 [27.2]**	20.3	**83.6**	18.3 B	**1,280 K**	9.10 B	38.9 K	24.5	**7,070**	21.1	**1,440**	23.3
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	40,600	19,600	42,700	36,700	25,600	**52,600**	31,200	31,200 [35,600]	36,300	23,100	44,500	16,700	17,600	12,600	19,300	32,300	33,200	24,300	30,900
Lead	400 {++}	800 {++}	26.8	mg/kg	14.1	10.9	8.50	8.30	11.5	21.8	16.4	**46.5 [28.0]**	23.8	19.2	**30.9**	**41.7 L**	7.00	11.8 L	6.40	**190**	24.4	**75.2**	22.7
Magnesium	- -	- -	- -	mg/kg	523 B	128 B	317 B	153 B	120 B	677 B	261 B	2,370 B [989 B]	1,940 B	1,240 B	813 B	2,370	438 B	739	296 B	18,900	2,660	3,680	9,380
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	44.4	24.1	33.4	27.9	46.4	78.7	60.0	144 [134]	557	49.8	254	57.7 K	38.8	114 K	22.4	308	270	234	269
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	**0.270 K**	<0.120	<0.120	<0.130	<0.120	<0.140	<0.150	<0.130 [<0.110]	<0.150	<0.130	<0.130	**0.500**	<0.120	0.120	<0.120	**0.660 K**	**0.170**	**0.150 K**	**0.200**
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	1.50 K	0.880 K	<0.120	1.20 K	3.20 K	10.3 K	7.50 K	17.5 K [7.80]	48.7 K	8.40 K	14.5	5.70 K	0.470 B	1.10 K	0.830 B	33.5 K	21.7	13.3 K	19.3
Potassium	- -	- -	- -	mg/kg	304 B	176 B	218 B	199 B	184 B	352 B	276 B	694 B [390 B]	840 K	324 B	561 B	243 K	274 B	197 K	180 B	821 K	1,120 J	418 B	5,570 J
Selenium	39 {nc}	510 {nc}	- -	mg/kg	<0.550 J	<0.610 J	<0.590 J	0.660 J	<0.600 J	<0.680 J	0.720 J	<0.640 J [<0.550]	<0.710 J	<0.620 J	<0.710	<0.560	0.580	<0.550	<0.600	<0.580	<0.650	<0.560	<0.720
Silver	39 {nc}	510 {nc}	- -	mg/kg	<0.220	<0.250	<0.240	0.270 B	<0.240	<0.270	<0.280	<0.260 [<0.220]	<0.280	<0.250	<0.290	0.630 L	<0.230	<0.220 L	<0.240	1.90 B	<0.260	0.300 B	<0.290
Sodium	- -	- -	- -	mg/kg	47.6 B	41.8 B	35.8 B	36.2 B	44.3 B	57.6 B	37.8 B	48.1 B [90.0 B]	48.5 B	36.5 B	96.0 B	35.8 B	69.4 B	35.1 B	93.2 B	84.7 B	134 B	48.8 B	1,350 B
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	<0.220	<0.250	<0.240	0.550 B	<0.240	0.560 B	<0.280	0.630 B [0.370 B]	<0.280	<0.250	<0.290	<0.220 L	0.540 B	<0.220 L	0.790 B	0.990 B	<0.260	<0.220 L	<0.290
Vanadium	55 {nc}	720 {nc}	108	mg/kg	69.0 L	63.1	70.0 L	56.0 L	43.0 L	89.8 L	54.5 L	57.1 L [58.1]	58.0 L	40.9 L	64.2	33.1 K	33.1	25.0 K	34.9	43.3 K	49.2	38.7 K	47.2
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	50.5 B	26.8 B	16.7 B	24.7 B	11.3 B	41.1 B	26.6 B	101 B [30.5 B]	34.8 B	82.4 B	33.5 B	**467**	8.20 B	30.8	13.5 B	**1,090**	21.4 B	**312**	33.8 B

mg/kg	Milligrams per kilogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 7-5. Summary of Analytical Results for Conductive Flooring Samples Collected in 1998 and 1999, Igniter Assembly Area, Gannett Fleming Independent Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	WS-03 03/30/98	IACF2 07/20/98	CF-1 06/24/99
Dioxin/Furan							
1,2,3,4,6,7,8-HpCDD	0.00039 {ca**}	0.0016 {ca**}	- -	mg/kg	NA	NA	0.00000593
1,2,3,4,6,7,8-HpCDF	0.00032 {ca**}	0.0011 {ca**}	- -	mg/kg	NA	NA	0.00000019
1,2,3,4,7,8,9-HpCDF	0.00032 {ca**}	0.0011 {ca**}	- -	mg/kg	NA	NA	<0.00000009
1,2,3,4,7,8-HxCDD	0.000039 {ca**}	0.00016 {ca**}	- -	mg/kg	NA	NA	<0.00000012
1,2,3,4,7,8-HxCDF	0.000032 {ca**}	0.00011 {ca**}	- -	mg/kg	NA	NA	<0.0000000492
1,2,3,6,7,8-HxCDD	0.000039 {ca**}	0.00016 {ca**}	- -	mg/kg	NA	NA	<0.00000012
1,2,3,6,7,8-HxCDF	0.000032 {ca**}	0.00011 {ca**}	- -	mg/kg	NA	NA	<0.00000005
1,2,3,7,8,9-HxCDD	0.000039 {ca**}	0.00016 {ca**}	- -	mg/kg	NA	NA	<0.00000011
1,2,3,7,8,9-HxCDF	0.000032 {ca**}	0.00011 {ca**}	- -	mg/kg	NA	NA	<0.00000006
1,2,3,7,8-PeCDD	0.0000039 {ca**}	0.000016 {ca**}	- -	mg/kg	NA	NA	<0.00000007
1,2,3,7,8-PeCDF	0.00011 {ca**}	0.00038 {ca**}	- -	mg/kg	NA	NA	<0.0000000492
2,3,4,6,7,8-HxCDF	0.000032 {ca**}	0.00011 {ca**}	- -	mg/kg	NA	NA	<0.00000005
2,3,4,7,8-PeCDF	0.000011 {ca**}	0.000038 {ca**}	- -	mg/kg	NA	NA	<0.0000000492
2,3,7,8-TCDD	0.0000045 {ca*}	0.000018 {ca*}	- -	mg/kg	NA	NA	0.00000052 K
2,3,7,8-TCDF	0.000032 {ca**}	0.00011 {ca**}	- -	mg/kg	NA	NA	<0.0000000492
OCDD	0.013 {ca**}	0.053 {ca**}	- -	mg/kg	NA	NA	0.000766
OCDF	0.011 {ca**}	0.038 {ca**}	- -	mg/kg	NA	NA	0.00000083
Total HpCDDs	- -	- -	- -	mg/kg	NA	NA	0.0000105
Total HpCDFs	- -	- -	- -	mg/kg	NA	NA	0.0000003
Total HxCDDs	- -	- -	- -	mg/kg	NA	NA	<0.00000011
Total HxCDFs	- -	- -	- -	mg/kg	NA	NA	<0.00000005
Total PeCDDs	- -	- -	- -	mg/kg	NA	NA	<0.00000007
Total PeCDFs	- -	- -	- -	mg/kg	NA	NA	<0.00000005
Total TCDDs	- -	- -	- -	mg/kg	NA	NA	<0.00000005
Total TCDFs	- -	- -	- -	mg/kg	NA	NA	<0.00000005
Semivolatile Organics							
1,2,4-Trichlorobenzene	180 {ca**}	220 {sat}	- -	mg/kg	NA	<0.34	<0.0096
1,2-Dichlorobenzene	220 {sat}	220 {sat}	- -	mg/kg	NA	<0.34	<0.020
1,2-Diphenylhydrazine	0.61 {ca**}	2.2 {ca**}	- -	mg/kg	NA	<0.34	NA
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	NA	<0.34	<0.0056
1,4-Dichlorobenzene	2.6 {ca}	13 {ca}	- -	mg/kg	NA	<0.34	<0.010
2,4,5-Trichlorophenol	610 {nc}	6,200 {nc}	- -	mg/kg	NA	<0.82	<0.090
2,4,6-Trichlorophenol	44 {ca**}	160 {ca**}	- -	mg/kg	NA	<0.34	<0.040
2,4-Dichlorophenol	18 {nc}	180 {nc}	- -	mg/kg	NA	<0.34	<0.090
2,4-Dimethylphenol	120 {nc}	1,200 {nc}	- -	mg/kg	NA	<0.34	<0.030
2,4-Dinitrophenol	12 {nc}	120 {nc}	- -	mg/kg	NA	<1.7	<0.18
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	NA	<0.34	<0.010
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	NA	<0.34	<0.010
2-Chloronaphthalene	210 {sat}	210 {sat}	- -	mg/kg	NA	<0.34	<0.0063
2-Chlorophenol	39 {nc}	510 {nc}	- -	mg/kg	NA	<0.34	<0.040
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	NA	<0.34	<0.060
2-Methylphenol	310 {nc}	3,100 {nc}	- -	mg/kg	NA	<0.34	<0.070
2-Nitroaniline	- -	- -	- -	mg/kg	NA	<1.7	<0.13
2-Nitrophenol	- -	- -	- -	mg/kg	NA	<0.34	<0.12
3,3'-Dichlorobenzidine	1.1 {ca**}	3.8 {ca**}	- -	mg/kg	NA	<0.67	<0.15
3-Nitroaniline	- -	- -	- -	mg/kg	NA	<1.7	<0.14
4,6-Dinitro-2-methylphenol	- -	- -	- -	mg/kg	NA	<1.7	<0.23
4-Bromophenyl-phenylether	- -	- -	- -	mg/kg	NA	<0.34	<0.020
4-Chloro-3-Methylphenol	- -	- -	- -	mg/kg	NA	<0.67	<0.070
4-Chloroaniline	24 {nc}	250 {nc}	- -	mg/kg	NA	<0.67	<0.070
4-Chlorophenyl-phenylether	- -	- -	- -	mg/kg	NA	<0.34	<0.010
4-Methylphenol	31 {nc}	310 {nc}	- -	mg/kg	NA	<0.34	<0.070
4-Nitroaniline	- -	- -	- -	mg/kg	NA	<1.7	<0.20
4-Nitrophenol	- -	- -	- -	mg/kg	NA	<1.7	<0.030
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	NA	<0.34	<0.0067
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	NA	<0.34	<0.0082
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	NA	<0.34	<0.020
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	<0.34	<0.010
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	NA	<0.34	<0.010
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	<0.34	<0.11
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	NA	<0.34	<0.0093 J
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	NA	<0.34	<0.11
Benzoic Acid	240,000 {max}	2,500,000 {max}	- -	mg/kg	NA	<1.7	NA
Benzyl Alcohol	3,100 {nc}	310,000 {max}	- -	mg/kg	NA	<0.67	NA
bis(2-Chloroethoxy)methane	18 {nc}	180 {nc}	- -	mg/kg	NA	<0.34	<0.020
bis(2-Chloroethyl)ether	0.19 {ca**}	0.9 {ca**}	- -	mg/kg	NA	<0.34	<0.010 J
bis(2-Chloroisopropyl)ether	- -	- -	- -	mg/kg	NA	<0.34	<0.010 J
bis(2-Ethylhexyl)phthalate	35 {ca*}	120 {ca*}	- -	mg/kg	NA	<0.34	<0.060
Butylbenzylphthalate	1,200 {nc}	120,000 {max}	- -	mg/kg	NA	<0.34	<0.010
Carbazole	24 {ca**}	86 {ca**}	- -	mg/kg	NA	<0.34	<0.050 J
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	NA	<0.34	<0.020
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	NA	<0.34	<0.050 J
Dibenzofuran	- -	- -	- -	mg/kg	NA	<0.34	<0.050
Diethylphthalate	4,900 {nc}	490,000 {max}	- -	mg/kg	NA	<0.34	<0.0093
Dimethylphthalate	- -	- -	- -	mg/kg	NA	<0.34	<0.010
Di-n-Butylphthalate	610 {nc}	6,200 {nc}	- -	mg/kg	NA	<0.34	<0.020
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	NA	<0.34	<0.010
Di-n-Octylphthalate	- -	- -	- -	mg/kg	NA	<0.34	<0.010
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	NA	<0.34	<0.010
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	NA	<0.34	<0.0070
Hexachlorobenzene	0.3 {ca}	1.1 {ca}	- -	mg/kg	NA	<0.34	<0.010
Hexachlorobutadiene	6.2 {ca**}	22 {ca*}	- -	mg/kg	NA	<0.34	<0.010
Hexachlorocyclopentadiene	37 {nc}	370 {nc}	- -	mg/kg	NA	<0.34	<0.010
Hexachloroethane	35 {ca**}	120 {ca**}	- -	mg/kg	NA	<0.34	<0.010
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	<0.34	<0.020 J

Notes found at end of table.

Table 7-5. Summary of Analytical Results for Conductive Flooring Samples Collected in 1998 and 1999, Igniter Assembly Area, Gannett Fleming Independent Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	WS-03 03/30/98	IACF2 07/20/98	CF-1 06/24/99
Semivolatile Organics							
Isophorone	510 {ca*}	1,800 {ca*}	- -	mg/kg	NA	<0.34	<0.010
Naphthalene	3.9 {ca}	20 {ca}	- -	mg/kg	NA	<0.34	<0.0067
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	NA	<0.34	<0.0070
N-Nitroso-di-n-propylamine	0.069 {ca**}	0.25 {ca**}	- -	mg/kg	NA	<0.34	<0.010 J
N-Nitrosodiphenylamine	99 {ca**}	350 {ca**}	- -	mg/kg	NA	<0.34	<0.010
Pentachlorophenol	3 {ca}	9 {ca}	- -	mg/kg	NA	<1.7	<0.12
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	NA	<0.34	<0.010
Phenol	1,800 {nc}	180,000 {max}	- -	mg/kg	NA	<0.34	<0.010
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	NA	<0.34	<0.010
Inorganics							
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	2,680	NA	12,600
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	NA	NA	<0.560
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	**204**	NA	9.50 K
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	**2,080**	NA	190
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	NA	NA	**1.20 B**
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	**2.80**	NA	<0.110
Calcium	- -	- -	- -	mg/kg	126,000	NA	1,210
Chromium	280 {ca**}	1,400 {ca**}	65.3	mg/kg	**69.3**	NA	21.4
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	57.8	NA	23.4
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	**54,200**	NA	32.5 K
Cyanide	160 {nc}	2,000 {nc}	- -	mg/kg	NA	NA	<0.220
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	30,600	NA	35,200
Lead	400 {++}	800 {++}	26.8	mg/kg	**308**	NA	14.7
Magnesium	- -	- -	- -	mg/kg	100,000	NA	2,570
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	201	NA	913
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	0.100	NA	<0.110
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	**147**	NA	27.0
Potassium	- -	- -	- -	mg/kg	778	NA	1,210 J
Selenium	39 {nc}	510 {nc}	- -	mg/kg	NA	NA	<0.450
Silver	39 {nc}	510 {nc}	- -	mg/kg	15.9	NA	<0.110
Sodium	- -	- -	- -	mg/kg	128	NA	109 B
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	0.400	NA	<0.790
Vanadium	55 {nc}	720 {nc}	108	mg/kg	NA	NA	26.7
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	**18,300**	NA	80.3
Asbestos							
Chrysotile	- -	- -	- -	% ASB	NA	NA	NA
Miscellaneous							
pH	- -	- -	- -	pH Units	NA	NA	5.05
Inorganics-TCLP	**TCLP Standard**						
Arsenic	5,000	- -	- -	µg/L	NA	<7	NA
Barium	10,000	- -	- -	µg/L	NA	302	NA
Cadmium	1,000	- -	- -	µg/L	NA	86.5	NA
Chromium	5,000	- -	- -	µg/L	NA	1.7	NA
Lead	5,000	- -	- -	µg/L	NA	3.5	NA
Mercury	200	- -	- -	µg/L	NA	<0.2	NA
Selenium	1,000	- -	- -	µg/L	NA	5.7	NA
Silver	5,000	- -	- -	µg/L	NA	<2	NA

mg/kg	Milligrams per kilogram.
µg/L	Micrograms per liter.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 7-6. Conductive Flooring Analytical Results, Igniter Assembly Area, 2002 US Army Corp of Engineers Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	RFAAP-502 Flooring	RFAAP-504 Flooring	RFAAP-509 Flooring	RFAAP-522 Flooring	RFAAP-529 Flooring	RFAAP-8102-2 Flooring	RFAAP-8102-7A Flooring	RFAAP-8102-7B Flooring	RFAAP-8102A Flooring	RFAAP-XXXX Flooring	RFAAP-1 Flooring	RFAAP-562 Flooring	RFAAP-565 Flooring	RFAAP-571 Flooring
Inorganics																		
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	2,010	2,840	15,700	1,100	1,360	2,690	1,400	1,290	1,240	2,130	1,950	1,940	1,030	1,170
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	<5.1	<9.1	<4.7	<5.9	<3.8	<19	<5.4	<6.2	<5.8	<3.9	<3.7	<18.9	<4.2	<17.9
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	5	**62.9**	14	7.7	5.6	**135**	**66**	**75.9**	**70.2**	**184**	**141**	**52.7**	6.6	**32.2**
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	2,850	6,380	42.1	1,740	69.2	519	398	218	97.6	202	232	13,400	92.9	11,100
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	0.25	ND	0.54	0.33	0.28	0.22	0.31	0.3	0.29	0.34	0.24	ND	0.73	ND
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	3.7	13.8	3.5	5.8	4.2	2.6	2.6	2.8	2.7	4.6	2.6	11.9	9.9	8.6
Calcium	- -	- -	- -	mg/kg	96,800	79,000	63,000	92,900	84,600	74,200	101,000	101,000	95,700	95,400	79,700	63,800	87,300	45,800
Chromium	23 {nc}	1,460 {ca**}	65.3	mg/kg	**88.3**	**957**	**95.6**	**86.8**	**81.8**	**67.6**	**87.9**	**96.9**	**88**	**105**	**69.9**	26.5	**81.6**	5.5
Cobalt	- -	- -	72.3	mg/kg	9.3	36.1	11.5	9.1	9.1	66	42.7	46.2	39	87.9	72.1	7.1	11.1	15900
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	**70,900**	**53,700**	**67,000**	**73,000**	**97,100**	**40,800**	**79,600**	**87,500**	**102,000**	**96,500**	**55,400**	**87,900**	**66,800**	**103,000**
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	29,000	334,000	39,500	33,700	30,800	27,300	37,700	42,100	37,800	42,000	29,700	21,900	31,300	86.5
Lead	400 {++}	800 {++}	26.8	mg/kg	**1,090**	**7,260**	**205**	**412**	**168**	**246**	**147**	**160**	**145**	**349**	**254**	31.3	ND	ND
Magnesium	- -	- -	- -	mg/kg	113,000	101,000	62,100	144,000	140,000	146,000	125,000	114,000	143,000	141,000	125,000	170,000	133,000	60.3
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	147	1600	247	179	151	174	226	231	217	235	182	94.5	142	513
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	ND	0.02	0.03	ND	ND	1.1	0.11	0.13	0.08	0.26	0.21	ND	ND	ND
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	**156**	**377**	**149**	**181**	**170**	**695**	**191**	**202**	**185**	**182**	**127**	**97.4**	**154**	ND
Potassium	- -	- -	- -	mg/kg	601	654	551	313	520	ND	581	521	585	941	596	ND	248	ND
Selenium	39 {nc}	510 {nc}	- -	mg/kg	ND	ND	ND	ND	ND	15.2	ND	ND	ND	1.4	1	ND	ND	ND
Silver	39 {nc}	510 {nc}	- -	mg/kg	2	ND	1.7	3.2	2.6	353	20.7	22.4	22.2	23.8	20.2	ND	4.8	ND
Sodium	- -	- -	- -	mg/kg	406	ND	299	380	250	ND	389	345	395	330	327	ND	267	ND
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vanadium	39 {nc}	520 {nc}	108	mg/kg	3.7	84.5	38	3.6	3.6	7.7	6.2	6.4	6	8	7	7.1	3.4	4.3
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	**2230**	**5640**	**451**	**1360**	**395**	**1910**	**1070**	**888**	**1050**	**1120**	**654**	**111**	**293**	**141**
Semivolatile Organics																		
1,2,4-Trichlorobenzene	180 {ca**}	220 {sat}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
1,2-Dichlorobenzene	220 {sat}	220 {sat}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
1,4-Dichlorobenzene	2.6 {ca}	13 {ca}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
2,2-Oxybis(1-Chloropropane)			- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
2,4,5-Trichlorophenol	610 {nc}	6,200 {nc}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
2,4,6-Trichlorophenol	44 {ca**}	160 {ca**}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
2,4-Dichlorophenol	18 {nc}	180 {nc}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
2,4-Dimethylphenol	120 {nc}	1,200 {nc}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
2,4-Dinitrophenol	12 {nc}	120 {nc}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
2-Chloronaphthalene	210 {sat}	210 {sat}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
2-Chlorophenol	39 {nc}	510 {nc}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
2-Methylphenol	310 {nc}	3,100 {nc}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
2-Nitroaniline	- -	- -	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
2-Nitrophenol	- -	- -	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
3,3'-Dichlorobenzidine	1.1 {ca**}	3.8 {ca**}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
3-Nitroaniline	- -	- -	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
4,6-Dinitro-2-methylphenol	- -	- -	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
4-Bromophenyl-phenylether	- -	- -	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
4-Chloro-3-Methylphenol	- -	- -	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
4-Chloroaniline	24 {nc}	250 {nc}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
4-Chlorophenyl-phenylether	- -	- -	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
4-Methylphenol	31 {nc}	310 {nc}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
4-Nitroaniline	- -	- -	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
4-Nitrophenol	- -	- -	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	ND	ND	**0.14**	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	ND	ND	**1.3**	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	ND	ND	**1.1**	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	ND	ND	**1.8**	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	ND	ND	**0.70**	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	ND	ND	**0.46**	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
Benzyl Butyl Phthalate			- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
bis(2-Chloroethoxy)methane	18 {nc}	180 {nc}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
bis(2-Chloroethyl)ether	0.19 {ca**}	0.9 {ca**}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	35 {ca*}	120 {ca*}	- -	mg/kg	**0.13**	**0.20**	**0.34**	**0.24**	**0.14**	**0.046**	**0.078**	**0.037**	**0.031**	**0.47**	NA	NA	NA	NA
Carbazole	24 {ca**}	86 {ca**}	- -	mg/kg	ND	ND	**0.11**	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA

Notes found at end of table.

Table 7-6. Conductive Flooring Analytical Results, Igniter Assembly Area, 2002 US Army Corp of Engineers Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	RFAAP-502 Flooring	RFAAP-504 Flooring	RFAAP-509 Flooring	RFAAP-522 Flooring	RFAAP-529 Flooring	RFAAP-8102-2 Flooring	RFAAP-8102-7A Flooring	RFAAP-8102-7B Flooring	RFAAP-8102A Flooring	RFAAP-XXXX Flooring	RFAAP-1 Flooring	RFAAP-562 Flooring	RFAAP-565 Flooring	RFAAP-571 Flooring
Semivolatile Organics																		
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	ND	ND	**1.3**	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
Dibenzofuran	- -	- -	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
Diethylphthalate	4,900 {nc}	490,000 {max}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
Dimethylphthalate	- -	- -	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
Di-n-Butylphthalate	610 {nc}	6,200 {nc}	- -	mg/kg	140	ND	ND	ND	ND	**0.071**	ND	ND	ND	ND	NA	NA	NA	NA
Di-n-Octylphthalate	- -	- -	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.073**	NA	NA	NA	NA
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	ND	ND	**2.8**	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
Hexachlorobenzene	0.3 {ca}	1.1 {ca}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
Hexachlorobutadiene	6.2 {ca**}	22 {ca*}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
Hexachlorocyclopentadiene	37 {nc}	370 {nc}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
Hexachloroethane	35 {ca**}	120 {ca**}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	ND	ND	**0.54**	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
Isophorone	510 {ca*}	1,800 {ca*}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
Naphthalene	3.9 {ca}	20 {ca}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	0.069 {ca**}	0.25 {ca**}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
N-Nitrosodiphenylamine	99 {ca**}	350 {ca**}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
Pentachlorophenol	3 {ca}	9 {ca}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	ND	ND	**0.60**	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
Phenol	1,800 {nc}	180,000 {max}	- -	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	ND	ND	**2.1**	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA
PCBs																		
PCB-1016	3,900 {nc}	21,000 {ca**}	- -	µg/kg	< 7.9	< 7.2	< 8	< 19	< 16	< 3.6	< 3.8	< 4.1	< 4.2	< 3.9	< 3.1	< 3.2	< 3.5	< 3.5
PCB-1221	170 {ca**}	620 {ca**}	- -	µg/kg	< 28	< 25	< 28	< 67	< 58	< 13	< 13	< 14	< 15	< 14	< 11	< 11	< 12	< 12
PCB-1232	170 {ca**}	620 {ca**}	- -	µg/kg	**33**	< 42	< 46	< 110	< 94	< 21	< 22	< 24	< 24	< 22	< 18	< 18	< 20	< 20
PCB-1242	220 {ca**}	740 {ca**}	- -	µg/kg	< 58	< 53	< 58	< 140	< 120	< 26	< 28	< 30	< 31	< 28	< 23	< 23	< 25	< 26
PCB-1248	220 {ca**}	740 {ca**}	- -	µg/kg	< 21	< 19	< 21	< 50	< 43	< 9.5	< 10	< 11	< 11	< 10	< 8.3	< 8.5	< 9.2	< 9.3
PCB-1254	220 {ca**}	740 {ca*}	- -	µg/kg	**630**	**740**	**910**	**1600**	**1300**	< 5.5	< 5.8	< 6.3	< 6.5	**260**	< 4.8	< 4.9	**120**	< 5.4
PCB-1260	220 {ca**}	740 {ca**}	- -	µg/kg	< 12	< 11	< 12	< 28	< 24	< 5.2	< 5.5	< 6	< 6.2	< 5.7	< 4.6	< 4.7	< 5.1	< 5.1
VOCs																		
1,1,1-Trichloroethane	680,000 {sat}	680,000 {sat}	- -	µg/kg	< 2.7	< 2.5	< 2.8	< 2.6	< 2.3	< 2.5	< 2.6	< 2.8	< 2.9	< 2.7	< 2.2	< 2.2	< 2.4	< 2.4
1,1,2,2-Tetrachloroethane	590 {ca**}	2,900 {ca**}	- -	µg/kg	< 3	< 2.8	< 3.1	< 2.9	< 2.5	< 2.8	< 2.9	< 3.1	< 3.2	< 3	< 2.4	< 2.5	< 2.7	< 2.7
1,1,2-Trichloroethane	1,100 {ca}	5,500 {ca}	- -	µg/kg	< 2.9	< 2.6	< 2.9	< 2.8	< 2.4	< 2.6	< 2.8	< 3	< 3.1	< 2.9	< 2.3	< 2.3	< 2.5	< 2.6
1,1-Dichloroethane	3,400 {ca}	1,700 {ca}	- -	µg/kg	< 2.7	< 2.5	< 2.8	< 2.6	< 2.3	< 2.5	< 2.6	< 2.8	< 2.9	< 2.7	< 2.2	< 2.2	< 2.4	< 2.4
1,1-Dichloroethene	25,000 {nc}	110,000 {nc}	- -	µg/kg	< 2.1	< 1.9	< 2.2	< 2	< 1.8	< 1.9	< 2	< 2.2	< 2.3	< 2.1	< 1.7	< 1.7	< 1.9	< 1.9
1,2-Dichloroethane	450 {ca}	220 {ca}	- -	µg/kg	< 2.4	< 2.2	< 2.5	< 2.3	< 2	< 2.2	< 2.3	< 2.5	< 2.6	< 2.4	< 1.9	< 2	< 2.1	< 2.2
1,2-Dichloropropane	930 {ca*}	470 {ca*}	- -	µg/kg	< 2.7	< 2.5	< 2.8	< 2.6	< 2.3	< 2.5	< 2.6	< 2.8	< 2.9	< 2.7	< 2.2	< 2.2	< 2.4	< 2.4
2-Butanone	28,000,000 {sat}	28,000,000 {sat}	- -	µg/kg	< 5.8	< 5.3	< 5.8	< 5.5	< 4.8	< 5.2	< 5.5	< 6	< 6.2	< 5.7	< 4.6	< 4.7	< 5.1	< 5.1
2-Hexanone	- -	- -	- -	µg/kg	< 3.6	< 3.3	< 3.7	< 3.5	< 3	< 3.3	< 3.5	< 3.8	< 3.9	< 3.6	< 2.9	< 3	< 3.2	< 3.3
4-Methyl-2-Pentanone	3,200 {sat}	3,200 {sat}	- -	µg/kg	< 3.6	< 3.3	< 3.7	< 3.5	< 3	< 3.3	< 3.5	< 3.8	< 3.9	< 3.6	< 2.9	< 3	< 3.2	< 3.3
Acetone	6,100 {nc}	110,000 {sat}	- -	µg/kg	**3.2**	< 2.4	< 2.6	< 2.5	**2.2**	< 2.3	< 2.5	< 2.7	**4.9**	**2.9**	< 2.1	**3.9**	**3.9**	**2.9**
Benzene	1,100 {ca*}	5,600 {ca*}	- -	µg/kg	< 2.7	< 2.5	< 2.8	< 2.6	< 2.3	< 2.5	< 2.6	< 2.8	< 2.9	< 2.7	< 2.2	< 2.2	< 2.4	< 2.4
Bromodichloromethane	10,000 {ca}	46,000 {ca}	- -	µg/kg	< 2.6	< 2.4	< 2.6	< 2.5	< 2.1	< 2.3	< 2.5	< 2.7	< 2.8	< 2.6	< 2.1	< 2.1	< 2.3	< 2.3
Bromoform	61,000 {ca*}	220,000 {ca*}	- -	µg/kg	< 2.1	< 1.9	< 2.2	< 2	< 1.8	< 1.9	< 2	< 2.2	< 2.3	< 2.1	< 1.7	< 1.7	< 1.9	< 1.9
Bromomethane	790 {nc}	3,500 {nc}	- -	µg/kg	< 2.7	< 2.5	< 2.8	< 2.6	< 2.3	< 2.5	< 2.6	< 2.8	< 2.9	< 2.7	< 2.2	< 2.2	< 2.4	< 2.4
Carbon Disulfide	260,000 {sat}	260,000 {sat}	- -	µg/kg	< 2.1	< 1.9	< 2.2	< 2	< 1.8	< 1.9	< 2	< 2.2	< 2.3	< 2.1	< 1.7	< 1.7	< 1.9	< 1.9
Carbon Tetrachloride	250 {ca}	1,300{ca}	- -	µg/kg	< 2.9	< 2.6	< 2.9	< 2.8	< 2.4	< 2.6	< 2.8	< 3	< 3.1	< 2.9	< 2.3	< 2.3	< 2.5	< 2.6
Chlorobenzene	31,000 {nc}	860,000 {sat}	- -	µg/kg	< 2.7	< 2.5	< 2.8	< 2.6	< 2.3	< 2.5	< 2.6	< 2.8	< 2.9	< 2.7	< 2.2	< 2.2	< 2.4	< 2.4
Chloroethane	2,200 {sat}	2,200 {sat}	- -	µg/kg	< 3	< 2.8	< 3.1	< 2.9	< 2.5	< 2.8	< 2.9	< 3.1	< 3.2	< 3	< 2.4	< 2.5	< 2.7	< 2.7
Chloroform	300 {ca}	1,500 {ca}	- -	µg/kg	< 2.9	< 2.6	< 2.9	< 2.8	< 2.4	< 2.6	< 2.8	< 3	< 3.1	< 2.9	< 2.3	< 2.3	< 2.5	< 2.6
Chloromethane	1,700 {ca*}	8,400 {ca*}	- -	µg/kg	< 2.9	< 2.6	< 2.9	< 2.8	< 2.4	< 2.6	< 2.8	< 3	< 3.1	< 2.9	< 2.3	< 2.3	< 2.5	< 2.6
cis-12-Dichloroethene	7,800 {nc}	1,400,000 {sat}	- -	µg/kg	< 2.7	< 2.5	< 2.8	< 2.6	< 2.3	< 2.5	< 2.6	< 2.8	< 2.9	< 2.7	< 2.2	< 2.2	< 2.4	< 2.4
cis-13-Dichloropropene	- -	- -	- -	µg/kg	< 1.8	< 1.7	< 1.8	< 1.8	< 1.5	< 1.7	< 1.8	< 1.9	< 2	< 1.8	< 1.5	< 1.5	< 1.6	< 1.6
Dibromochloromethane	5,800 {ca}	2,100 {ca}	- -	µg/kg	< 2.3	< 2.1	< 2.3	< 2.2	< 1.9	< 2.1	< 2.2	< 2.4	< 2.4	< 2.3	< 1.8	< 1.8	< 2	< 2
Ethylbenzene	5,700 {ca}	29,000 {ca}	- -	µg/kg	< 2.9	< 2.6	< 2.9	< 2.8	< 2.4	< 2.6	< 2.8	< 3	< 3.1	< 2.9	< 2.3	< 2.3	< 2.5	< 2.6
Methylene Chloride	11,000 {ca}	54,000 {ca}	- -	µg/kg	**10**	**8.1**	**14**	**15**	**13**	**8.2**	**7.3**	**9**	**16**	**16**	**7**	**8.5**	**9.8**	**10**
mp-Xylenes	- -	- -	- -	µg/kg	< 5.3	< 4.8	< 5.4	< 5.1	< 4.4	< 4.8	< 5.1	< 5.5	< 5.7	< 5.3	< 4.2	< 4.3	< 4.7	< 4.7
o-Xylene	300,000 {sat}	300,000 {sat}	- -	µg/kg	< 2.4	< 2.2	< 2.5	< 2.3	< 2	< 2.2	< 2.3	< 2.5	< 2.6	< 2.4	< 1.9	< 2	< 2.1	< 2.2
Styrene	1,000,000 {sat}	1,000,000 {sat}	- -	µg/kg	< 2.6	< 2.4	< 2.6	< 2.5	< 2.1	< 2.3	< 2.5	< 2.7	< 2.8	< 2.6	< 2.1	< 2.1	< 2.3	< 2.3
Tetrachloroethene	570 {ca}	2,700 {ca}	- -	µg/kg	< 2.7	< 2.5	< 2.8	< 2.6	< 2.3	< 2.5	< 2.6	< 2.8	< 2.9	< 2.7	< 2.2	< 2.2	< 2.4	< 2.4
Toluene	930 {sat}	930 {sat}	- -	µg/kg	< 2.4	< 2.2	< 2.5	< 2.3	< 2	< 2.2	< 2.3	< 2.5	< 2.6	< 2.4	< 1.9	< 2	< 2.1	< 2.2
trans-1,2-dichloroethene	11 {nc}	50 {nc}	- -	µg/kg	< 2.1	< 1.9	< 2.2	< 2	< 1.8	< 1.9	< 2	< 2.2	< 2.3	< 2.1	< 1.7	< 1.7	< 1.9	< 1.9
trans-1,3-dichloropropene	- -	- -	- -	µg/kg	< 1.8	< 1.7	< 1.8	< 1.8	< 1.5	< 1.7	< 1.8	< 1.9	< 2	< 1.8	< 1.5	< 1.5	< 1.6	< 1.6
Trichloroethene	2.8 {ca}	14 {ca}	- -	µg/kg	< 1.7	< 1.6	< 1.8	< 1.7	< 1.4	< 1.6	< 1.7	< 1.8	< 1.9	< 1.7	< 1.4	< 1.4	< 1.5	< 1.5
Vinyl Chloride	0.06 {ca}	1.7 {ca}	- -	µg/kg	< 3	< 2.8	< 3.1	< 2.9	< 2.5	< 2.8	< 2.9	< 3.1	< 3.2	< 3	< 2.4	< 2.5	< 2.7	< 2.7

Notes found at end of table.

Table 7-6. Conductive Flooring Analytical Results, Igniter Assembly Area, 2002 US Army Corp of Engineers Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	RFAAP-502 Flooring	RFAAP-504 Flooring	RFAAP-509 Flooring	RFAAP-522 Flooring	RFAAP-529 Flooring	RFAAP-8102-2 Flooring	RFAAP-8102-7A Flooring	RFAAP-8102-7B Flooring	RFAAP-8102A Flooring	RFAAP-XXXX Flooring	RFAAP-1 Flooring	RFAAP-562 Flooring	RFAAP-565 Flooring	RFAAP-571 Flooring
Pesticides																		
4,4-DDD	2,000 {ca**}	7,200 {ca**}	- -	µg/kg	< 0.56	< 1.3	< 0.56	< 1.3	< 1.2	< 0.25	< 0.27	< 0.29	< 0.3	< 0.27	< 0.22	< 0.23	< 0.24	< 0.25
4,4-DDE	1,400 {ca**}	5,100 {ca**}	- -	µg/kg	< 0.48	< 1.1	**46**	< 1.2	< 1	< 0.22	< 0.23	< 0.25	< 0.26	**8.4**	< 0.19	< 0.2	< 0.21	< 0.22
4,4-DDT	1,700 {ca*}	7,000 {ca*}	- -	µg/kg	**99**	**140**	**62**	**180**	**110**	< 0.28	**9.4**	< 0.32	**1.2**	**33**	< 0.25	< 0.25	**16**	< 0.28
Aldrin	29 {ca*}	100 {ca}	- -	µg/kg	< 0.71	< 1.6	< 0.72	< 1.7	< 1.5	< 0.32	< 0.34	< 0.37	< 0.38	< 0.35	< 0.28	< 0.29	< 0.31	< 0.32
Alpha-BHC	77 {ca**}	270{ca**}	- -	µg/kg	< 0.56	< 1.3	< 0.56	< 1.3	< 1.2	< 0.25	< 0.27	< 0.29	< 0.3	< 0.27	< 0.22	< 0.23	< 0.24	< 0.25
Alpha-Chlordane	- -	- -	- -	µg/kg	< 3.2	< 7.3	< 3.3	< 7.7	< 6.6	< 1.5	< 1.5	< 1.7	< 1.7	< 1.6	< 1.3	< 1.3	< 1.4	< 1.4
Beta-BHC	270 {ca**}	960 {ca**}	- -	µg/kg	< 0.48	< 1.1	< 0.49	< 1.2	< 1	< 0.22	< 0.23	< 0.25	< 0.26	< 0.24	< 0.19	< 0.2	< 0.21	< 0.22
Chlordane			- -	µg/kg	< 3.2	< 7.3	< 3.3	< 7.7	< 6.6	< 1.5	< 1.5	< 1.7	< 1.7	< 1.6	< 1.3	< 1.3	< 1.4	< 1.4
Delta-BHC	- -	- -	- -	µg/kg	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17
Dieldrin	30 {ca}	110 {ca}	- -	µg/kg	**30**	**34**	**30**	**64**	**66**	< 0.35	< 0.37	< 0.4	< 0.41	**10**	< 0.31	< 0.31	**4.1**	< 0.34
Endosulfan I	- -	- -	- -	µg/kg	< 0.68	< 1.6	< 0.69	< 1.6	< 1.4	< 0.31	< 0.33	< 0.35	< 0.36	< 0.33	< 0.27	< 0.27	< 0.3	< 0.3
Endosulfan II	37,000 {nc}	370,000 {nc}	- -	µg/kg	< 0.48	< 1.1	< 0.49	< 1.2	< 1	< 0.22	< 0.23	< 0.25	< 0.26	< 0.24	< 0.19	< 0.2	< 0.21	< 0.22
Endosulfan Sulfate	- -	- -	- -	µg/kg	< 0.42	< 0.97	< 0.43	< 1	< 0.88	< 0.19	< 0.2	< 0.22	< 0.23	< 0.21	< 0.17	< 0.17	< 0.19	< 0.19
Endrin	180 {nc}	18,000 {nc}	- -	µg/kg	**10**	**17**	**5.6**	**25**	**16**	< 0.21	**2.1**	< 0.24	< 0.24	**3.8**	< 0.18	< 0.18	**2.1**	< 0.2
Endrin Aldehyde	180 {nc}	18,000 {nc}	- -	µg/kg	< 0.59	< 1.3	< 0.59	< 1.4	< 1.2	< 0.27	< 0.28	< 0.3	< 0.31	< 0.29	< 0.23	< 0.24	< 0.26	< 0.26
Endrin Ketone	- -	- -	- -	µg/kg	< 0.36	< 0.83	< 0.37	< 0.87	< 0.75	< 0.17	< 0.17	< 0.19	< 0.19	< 0.18	< 0.14	< 0.15	< 0.16	< 0.16
Gamma-BHC (Lindane)	520 {ca*}	2,100 {ca}	- -	µg/kg	< 1	< 2.4	< 1.1	< 2.5	< 2.2	**0.77**	< 0.5	< 0.54	< 0.56	< 0.51	< 0.41	< 0.42	< 0.46	< 0.46
Gamma-Chlordane	- -	- -	- -	µg/kg	< 0.68	< 1.6	< 0.69	< 1.6	< 1.4	< 0.31	< 0.33	< 0.35	< 0.36	< 0.33	< 0.27	< 0.27	< 0.3	**0.63**
Heptachlor	110 {ca}	380 {ca}	- -	µg/kg	< 0.77	< 1.8	< 0.78	< 1.8	< 1.6	< 0.35	< 0.37	< 0.4	< 0.41	< 0.38	< 0.31	< 0.31	< 0.34	< 0.34
Heptachlor Epoxide	53 {ca*}	190 {ca*}	- -	µg/kg	< 2.2	< 5.1	< 2.3	< 5.3	< 4.6	< 1	< 1.1	< 1.2	< 1.2	< 1.1	< 0.88	< 0.9	< 0.98	< 0.99
Methoxychlor	31,000 {nc}	310,000 {nc}	- -	µg/kg	< 0.71	< 1.6	< 0.72	< 1.7	< 1.5	< 0.32	< 0.34	< 0.37	< 0.38	< 0.35	< 0.28	< 0.29	< 0.31	< 0.32
Toxaphene	440 {ca**}	1,600 {ca**}	- -	µg/kg	< 39	< 90	< 40	< 95	< 81	< 18	< 19	< 20	< 21	< 19	< 16	< 16	< 17	< 18
Explosives																		
1,3,5-Trinitrobenzene	180,000 {nc}	1,800,000 {nc}	- -	µg/kg	< 3	< 2.8	< 3.1	< 2.9	< 2.5	< 2.8	< 2.9	< 3.1	< 3.2	< 3	< 2.4	< 2.5	< 2.7	<2.7
1,3-Dinitrobenzene	610 {nc}	6,200 {nc}	- -	µg/kg	< 3	< 2.8	< 3.1	< 2.9	< 2.5	< 2.8	< 2.9	< 3.1	< 3.2	< 3	< 2.4	< 2.5	< 2.7	<2.7
2,4,6-Trinitrotoluene	16,000 {ca**}	57,000 {ca**}	- -	µg/kg	< 3	< 2.8	< 3.1	< 2.9	< 2.5	< 2.8	< 2.9	< 3.1	< 3.2	< 3	< 2.4	< 2.5	< 2.7	<2.7
2,4-Dinitrotoluene	12,000 {nc}	120,000 {nc}	- -	µg/kg	< 3	< 2.8	< 3.1	< 2.9	< 2.5	< 2.8	< 2.9	< 3.1	< 3.2	< 3	< 2.4	< 2.5	< 2.7	<2.7
2,6-Dinitrotoluene	6,100 {nc}	62,000 {nc}	- -	µg/kg	< 3	< 2.8	< 3.1	< 2.9	< 2.5	< 2.8	< 2.9	< 3.1	< 3.2	< 3	< 2.4	< 2.5	< 2.7	<2.7
2-Amino-4,6-Dinitrotoluene	12,000 {nc}	120,000 {nc}	- -	µg/kg	< 3	< 2.8	< 3.1	< 2.9	< 2.5	< 2.8	< 2.9	< 3.1	< 3.2	< 3	< 2.4	< 2.5	< 2.7	<2.7
4-Amino-2,6-Dinitrotoluene	12,000 {nc}	120,000 {nc}	- -	µg/kg	< 3	< 2.8	< 3.1	< 2.9	< 2.5	< 2.8	< 2.9	< 3.1	< 3.2	< 3	< 2.4	< 2.5	< 2.7	<2.7
HMX	310,000 {nc}	3,100,000 {nc}	- -	µg/kg	< 12	< 11	< 12	< 12	< 10	< 11	< 12	< 13	< 13	< 12	< 9.6	< 9.8	< 11	< 11
m-Nitrotoluene	- -	- -	- -	µg/kg	< 1.5	< 1.4	< 1.5	< 1.5	< 1.3	< 1.4	< 1.5	< 1.6	< 1.6	< 1.5	< 1.2	< 1.2	< 1.3	< 1.4
Nitrobenzene	3,100 {nc}	28,000 {nc}	- -	µg/kg	< 1.5	< 1.4	< 1.5	< 1.5	< 1.3	< 1.4	< 1.5	< 1.6	< 1.6	< 1.5	< 1.2	< 1.2	< 1.3	< 1.4
Nitroglycerine	610 {nc}	6,200 {nc}	- -	µg/kg	< 3	< 2.8	< 3.1	< 2.9	< 2.5	< 2.8	< 2.9	< 3.1	< 3.2	< 3	< 2.4	< 2.5	< 2.7	< 2.7
o-Nitrotoluene	78,000 {nc}	1,300,000 {sat}	- -	µg/kg	< 1.5	< 1.4	< 1.5	< 1.5	< 1.3	< 1.4	< 1.5	< 1.6	< 1.6	< 1.5	< 1.2	< 1.2	< 1.3	< 1.4
Pentaerythritol Tetranitrate	- -	- -	- -	µg/kg	< 12	< 11	< 12	< 12	< 10	< 11	< 12	< 13	< 13	< 12	< 9.6	< 9.8	< 11	< 11
p-Nitrotoluene	30,000 {ca**}	110,000 {ca*}	- -	µg/kg	< 1.5	< 1.4	< 1.5	< 1.5	< 1.3	< 1.4	< 1.5	< 1.6	< 1.6	< 1.5	< 1.2	< 1.2	< 1.3	< 1.4
RDX	4,400 {ca*}	16,000 {ca}	- -	µg/kg	< 6.1	< 5.5	< 6.1	< 5.8	< 5	< 5.5	< 5.8	< 6.3	< 6.5	< 6	< 4.8	< 4.9	< 5.3	< 5.4
Tetryl	24,000 {nc}	250,000 {nc}	- -	µg/kg	< 12	< 11	< 12	< 12	< 10	< 11	< 12	< 13	< 13	< 12	< 9.6	< 9.8	< 11	< 11
Asbestos																		
Total Asbestos (%)	- -	- -	- -	%	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Chrysotile (%)	- -	- -	- -	%	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Organic (%)	- -	- -	- -	%	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Particulate (%)		- -	- -	%	93	93	93	93	93	93	93	93	93	93	93	93	93	93
TCLP VOCs	**TCLP Standard**																	
1,1-Dichloroethene	700	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 14	NA	NA	NA	NA	NA
1,2-Dichloroethane	500	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 16	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	7,500	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 4.1	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	7,500	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 18	NA	NA	NA	NA	NA
2,4,5-TP (Silvex)	10,000	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 0.07	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	400,000	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 12	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	2,000	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 9	NA	NA	NA	NA	NA
2,4-D	10,000	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 0.09	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	130	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 6	NA	NA	NA	NA	NA
2-Butanone	-	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 38	NA	NA	NA	NA	NA
2-methylphenol	200,000	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 10	NA	NA	NA	NA	NA
3 & 4-Methylphenol	200,000	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 11	NA	NA	NA	NA	NA
Benzene	500	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 18	NA	NA	NA	NA	NA
Carbon Tetrachloride	500	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 19	NA	NA	NA	NA	NA
Chlordane	30	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 1	NA	NA	NA	NA	NA
Chlorobenzene	100,000	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 18	NA	NA	NA	NA	NA
Chloroform	6,000	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 19	NA	NA	NA	NA	NA
Endrin	20	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 1	NA	NA	NA	NA	NA
Flash Point	-	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 1	NA	NA	NA	NA	NA
Gamma-BHC (Lindane)	400	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 1	NA	NA	NA	NA	NA
Heptachlor	8	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 1	NA	NA	NA	NA	NA
Heptachlor Epoxide	8	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 1	NA	NA	NA	NA	NA
Hexachlorobenzene	130	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 9	NA	NA	NA	NA	NA
Hexachlorobutadiene	500	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 6	NA	NA	NA	NA	NA
Hexachloroethane	3,000	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 6.5	NA	NA	NA	NA	NA
Methoxychlor	10,000	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 1	NA	NA	NA	NA	NA
Nitrobenzene	2,000	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 4.3	NA	NA	NA	NA	NA
Pentachlorophenol	100,000	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 24	NA	NA	NA	NA	NA
Pyridine	5,000	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 5	NA	NA	NA	NA	NA
Tetrachloroethylene	700	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	**38**	NA	NA	NA	NA	NA
Toxaphene	500	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 0.02	NA	NA	NA	NA	NA
Trichloroethene	500	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 110	NA	NA	NA	NA	NA
Vinyl Chloride	200	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 20	NA	NA	NA	NA	NA

Notes found at end of table.

Table 7-6. Conductive Flooring Analytical Results, Igniter Assembly Area, 2002 US Army Corp of Engineers Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	RFAAP-502 Flooring	RFAAP-504 Flooring	RFAAP-509 Flooring	RFAAP-522 Flooring	RFAAP-529 Flooring	RFAAP-8102-2 Flooring	RFAAP-8102-7A Flooring	RFAAP-8102-7B Flooring	RFAAP-8102A Flooring	RFAAP-XXXX Flooring	RFAAP-1 Flooring	RFAAP-562 Flooring	RFAAP-565 Flooring	RFAAP-571 Flooring
TCLP Metals	**TCLP Standard**																	
Arsenic	5,000	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 20	NA	NA	NA	NA	NA
Barium	10,000	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 100	NA	NA	NA	NA	NA
Cadmium	1,000	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 3	NA	NA	NA	NA	NA
Chromium	5,000	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 5	NA	NA	NA	NA	NA
Lead	5,000	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 10	NA	NA	NA	NA	NA
Mercury	200	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 1	NA	NA	NA	NA	NA
Selenium	1,000	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 20	NA	NA	NA	NA	NA
Silver	5,000	-	-	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	< 3	NA	NA	NA	NA	NA

mg/kg	Milligrams per kilogram.
µg/kg	Micrograms per kilogram.
µg/L	Micrograms per liter.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
ND	Not Detected.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 7-7. Soil Analytical Results, Igniter Assembly Area, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	IASB06 0 - 0.5 06/10/02	IASB06 4 - 6 06/18/02	IASB06 8 - 10 06/18/02	IASB07 0 - 0.5 06/10/02	IASB07 4 - 6 06/18/02	IASB08 0 - 0.5 06/10/02	IASB08 4 - 6 06/18/02	IASB09 0 - 0.5 06/10/02	IASB09 4 - 6 06/18/02	IASB10 0 - 0.5 06/10/02	IASB10 2 - 4 06/18/02	IASB11 0 - 0.5 06/10/02	IASB11 2 - 4 06/18/02	IASB12 0 - 0.5 06/10/02	IASB12 4 - 6 06/18/02	IASB12 8 - 10 06/18/02	IASB13 0 - 0.5 06/11/02	IASB13 1 - 2 06/18/02	IASB13 2 - 4 06/18/02	IASB14 0 - 0.5 06/11/02
Explosives																								
1,3,5-Trinitrobenzene	180 {nc}	1,800 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dinitrobenzene	0.61 {nc}	6.2 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trinitrotoluene	16 {ca**}	57 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Amino-4,6-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Amino-2,6-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HMX	310 {nc}	3,100 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
m-Nitrotoluene	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitroglycerine	0.61 {nc}	6.2 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
o-Nitrotoluene	78 {nc}	1,300 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentaerythritol Tetranitrate	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Nitrotoluene	30 {ca**}	110 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
RDX	4.4 {ca*}	16 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetryl	24 {nc}	250 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Herbicides																								
2,4,5-T	61 {nc}	620 {nc}	- -	mg/kg	<0.113	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-TP	49 {nc}	490 {nc}	- -	mg/kg	<0.113	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-D	69 {nc}	770 {nc}	- -	mg/kg	<0.226	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-DB	49 {nc}	490 {nc}	- -	mg/kg	<1.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dalapon	180 {nc}	1,800 {nc}	- -	mg/kg	<1.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dicamba	180 {nc}	1,800 {nc}	- -	mg/kg	<0.226	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dichlorprop	- -	- -	- -	mg/kg	<0.226	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dinoseb	6.1 {nc}	62 {nc}	- -	mg/kg	<0.226	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MCPA	3.1 {nc}	31 {nc}	- -	mg/kg	<113	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MCPP	6.1 {nc}	62 {nc}	- -	mg/kg	<11.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Organochlorine Pesticides																								
4,4'-DDD	2 {ca**}	7.2 {ca**}	- -	mg/kg	<0.00755	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDE	1.4 {ca**}	5.1 {ca**}	- -	mg/kg	<0.00755	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDT	1.7 {ca*}	7 {ca*}	- -	mg/kg	<0.00755	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aldrin	0.029 {ca*}	0.1 {ca}	- -	mg/kg	<0.00755	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Alpha-BHC	0.077 {ca**}	0.27 {ca**}	- -	mg/kg	<0.00755	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Alpha-Chlordane	- -	- -	- -	mg/kg	<0.00755	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beta-BHC	0.27 {ca**}	0.96 {ca**}	- -	mg/kg	<0.00755	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Delta-BHC	- -	- -	- -	mg/kg	<0.00755	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dieldrin	0.03 {ca}	0.11 {ca}	- -	mg/kg	<0.00755	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan I	- -	- -	- -	mg/kg	<0.00755	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan II	37 {nc}	370 {nc}	- -	mg/kg	<0.00755	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan Sulfate	- -	- -	- -	mg/kg	<0.00755	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endrin	1.8 {nc}	18 {nc}	- -	mg/kg	<0.00755	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endrin Aldehyde	1.8 {nc}	18 {nc}	- -	mg/kg	<0.00755	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endrin Ketone	- -	- -	- -	mg/kg	<0.00755	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gamma-BHC (Lindane)	0.52 {ca*}	2.1 {ca}	- -	mg/kg	<0.00755	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gamma-Chlordane	- -	- -	- -	mg/kg	<0.00755	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlor	0.11 {ca}	0.38 {ca}	- -	mg/kg	<0.00755	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlor Epoxide	0.053 {ca*}	0.19 {ca*}	- -	mg/kg	<0.00755	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methoxychlor	31 {nc}	310 {nc}	- -	mg/kg	<0.00755	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toxaphene	0.44 {ca**}	1.6 {ca**}	- -	mg/kg	<0.377	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PAHs																								
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	0.0020 B	<0.0019 [<0.0020]	0.0042 B	NA	NA	NA	NA	NA	NA	NA	NA	0.0015 B	<0.0022	0.00092 B	<0.0024	<0.0024	NA	NA	NA	NA
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.0019	<0.0019 [<0.0020]	0.0022 B	NA	NA	NA	NA	NA	NA	NA	NA	<0.0021	<0.0022	<0.0021	<0.0024	<0.0024	NA	NA	NA	NA
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.0019	<0.0019 [<0.0020]	0.0020 J	NA	NA	NA	NA	NA	NA	NA	NA	<0.0021	<0.0022	<0.0021	<0.0024	<0.0024	NA	NA	NA	NA
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	<0.0019	<0.0019 [<0.0020]	0.0011 J	NA	NA	NA	NA	NA	NA	NA	NA	<0.0021	<0.0022	<0.0021	<0.0024	<0.0024	NA	NA	NA	NA
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.0036	<0.0019 [<0.0020]	<0.0023	NA	NA	NA	NA	NA	NA	NA	NA	0.0018 J	<0.0022	0.0028	<0.0024	<0.0024	NA	NA	NA	NA
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	0.0038	<0.0019 [<0.0020]	<0.0023	NA	NA	NA	NA	NA	NA	NA	NA	0.0020 J	<0.0022	0.0028	<0.0024	<0.0024	NA	NA	NA	NA
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.0095	<0.0019 [<0.0020]	<0.0023	NA	NA	NA	NA	NA	NA	NA	NA	0.0049	<0.0022	0.0065	<0.0024	<0.0024	NA	NA	NA	NA
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	0.0068	<0.0019 [<0.0020]	<0.0023	NA	NA	NA	NA	NA	NA	NA	NA	0.0023	<0.0022	0.0023	<0.0024	<0.0024	NA	NA	NA	NA
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	0.0028	<0.0019 [<0.0020]	<0.0023	NA	NA	NA	NA	NA	NA	NA	NA	0.0014 J	<0.0022	0.0022	<0.0024	<0.0024	NA	NA	NA	NA
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	0.0054	<0.0019 [<0.0020]	<0.0023	NA	NA	NA	NA	NA	NA	NA	NA	0.0026	<0.0022	0.0037	<0.0024	<0.0024	NA	NA	NA	NA
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.0019	<0.0019 [<0.0020]	<0.0023	NA	NA	NA	NA	NA	NA	NA	NA	<0.0021	<0.0022	<0.0021	<0.0024	<0.0024	NA	NA	NA	NA
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	0.011	<0.0019 [<0.0020]	<0.0023	NA	NA	NA	NA	NA	NA	NA	NA	0.0047	<0.0022	0.0079	<0.0024	<0.0024	NA	NA	NA	NA
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.0019	<0.0019 [<0.0020]	0.0022 J	NA	NA	NA	NA	NA	NA	NA	NA	<0.0021	<0.0022	<0.0021	<0.0024	<0.0024	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.0043 J	<0.0019 [<0.0020]	<0.0023	NA	NA	NA	NA	NA	NA	NA	NA	0.0017 J	<0.0022	0.0023 J	<0.0024	<0.0024	NA	NA	NA	NA
Naphthalene	15 {nc}	67 {nc}	- -	mg/kg	0.0013 B	<0.0019 [<0.0020]	0.0034 B	NA	NA	NA	NA	NA	NA	NA	NA	0.00088 B	<0.0022	<0.0021	<0.0024	<0.0024	NA	NA	NA	NA
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.0050	0.00084 J [0.0012 J]	0.0014 J	NA	NA	NA	NA	NA	NA	NA	NA	0.0035	<0.0022	0.0034	<0.0024	0.0010 J	NA	NA	NA	NA
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	0.0081	<0.0019 [<0.0020]	<0.0023	NA	NA	NA	NA	NA	NA	NA	NA	0.0033	<0.0022	0.0053	<0.0024	<0.0024	NA	NA	NA	NA
PCBs																								
Aroclor-1016	0.39 {nc}	21 {ca**}	- -	mg/kg	<0.030	<0.030 [<0.030]	<0.040	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.040	<0.040	<0.040	<0.030	<0.040	<0.040	<0.030 [<0.030]
Aroclor-1221	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.070	<0.070 [<0.070]	<0.080	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.080	<0.090	<0.090	<0.070	<0.080	<0.090	<0.070 [<0.070]
Aroclor-1232	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.030	<0.030 [<0.030]	<0.040	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.040	<0.040	<0.040	<0.030	<0.040	<0.040	<0.030 [<0.030]
Aroclor-1242	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.030	<0.030 [<0.030]	<0.040	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.040	<0.040	<0.040	<0.030	<0.040	<0.040	<0.030 [<0.030]
Aroclor-1248	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.030	<0.030 [<0.030]	<0.040	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.040	<0.040	<0.040	<0.030	<0.040	<0.040	<0.030 [<0.030]
Aroclor-1254	0.22 {ca**}	0.74 {ca*}	- -	mg/kg	<0.030	<0.030 [<0.030]	<0.040	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.040	<0.040	<0.040	0.12	<0.040	<0.040	0.050 [0.070]
Aroclor-1260	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.030	<0.030 [<0.030]	<0.040	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.040	<0.040	<0.040	<0.030	<0.040	<0.040	<0.030 [<0.030]
Total PCBs	0.24 {ca**}	0.86 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes found at end of table.

Table 7-7. Soil Analytical Results, Igniter Assembly Area, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values- Residential [a]	Adjusted Soil Screening Values- Industrial [a]	Facility-Wide Background Values [b]	Units	IASB06 0 - 0.5 06/10/02	IASB06 4 - 6 06/18/02	IASB06 8 - 10 06/18/02	IASB07 0 - 0.5 06/10/02	IASB07 4 - 6 06/18/02	IASB08 0 - 0.5 06/10/02	IASB08 4 - 6 06/18/02	IASB09 0 - 0.5 06/10/02	IASB09 4 - 6 06/18/02	IASB10 0 - 0.5 06/10/02	IASB10 2 - 4 06/18/02	IASB11 0 - 0.5 06/10/02	IASB11 2 - 4 06/18/02	IASB12 0 - 0.5 06/10/02	IASB12 4 - 6 06/18/02	IASB12 8 - 10 06/18/02	IASB13 0 - 0.5 06/11/02	IASB13 1 - 2 06/18/02	IASB13 2 - 4 06/18/02	IASB14 0 - 0.5 06/11/02
Volatile Organics																								
1,1,1-Trichloroethane	680 {sat}	680 {sat}	- -	mg/kg	<0.0074	<0.0057 [<0.0052]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062	<0.0070	<0.0071	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	0.59 {ca**}	2.9 {ca**}	- -	mg/kg	<0.0074	<0.0057 [<0.0052]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062	<0.0070	<0.0071	NA	NA	NA	NA
1,1,2-Trichloroethane	1.1 {ca}	5.5 {ca}	- -	mg/kg	<0.0074	<0.0057 [<0.0052]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062	<0.0070	<0.0071	NA	NA	NA	NA
1,1-Dichloroethane	3.4 {ca}	17 {ca}	- -	mg/kg	<0.0074	<0.0057 [<0.0052]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062	<0.0070	<0.0071	NA	NA	NA	NA
1,1-Dichloroethene	25 {nc}	110 {nc}	- -	mg/kg	<0.0074	<0.0057 [<0.0052]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062	<0.0070	<0.0071	NA	NA	NA	NA
1,2-Dichloroethane	0.45 {ca}	2.2 {ca}	- -	mg/kg	<0.0074	<0.0057 [<0.0052]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062	<0.0070	<0.0071	NA	NA	NA	NA
1,2-Dichloropropane	0.93 {ca*}	4.7 {ca*}	- -	mg/kg	<0.0074	<0.0057 [<0.0052]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062	<0.0070	<0.0071	NA	NA	NA	NA
2-Butanone	28,000 {sat}	28,000 {sat}	- -	mg/kg	<0.0074 J	<0.0057 [<0.0052]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062	<0.0070	<0.0071	NA	NA	NA	NA
2-Hexanone	- -	- -	- -	mg/kg	<0.0074 J	<0.0057 [<0.0052]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062	<0.0070	<0.0071	NA	NA	NA	NA
3-Octanone	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methyl-2-pentanone	3,200 {sat}	3,200 {sat}	- -	mg/kg	<0.0074	<0.0057 [<0.0052]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062	<0.0070	<0.0071	NA	NA	NA	NA
Acetone	6,100 {nc}	110,000 {sat}	- -	mg/kg	0.060 B	<0.0057 [<0.0052]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062	<0.0070	<0.0071	NA	NA	NA	NA
Benzene	1.1 {ca*}	5.6 {ca*}	- -	mg/kg	<0.0074	<0.0057 [<0.0052]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062	<0.0070	<0.0071	NA	NA	NA	NA
Bromodichloromethane	10 {ca}	46 {ca}	- -	mg/kg	<0.0074	<0.0057 [<0.0052]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062	<0.0070	<0.0071	NA	NA	NA	NA
Bromoform	61 {ca*}	220 {ca*}	- -	mg/kg	<0.0074	<0.0057 [<0.0052]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062	<0.0070	<0.0071	NA	NA	NA	NA
Bromomethane	0.79 {nc}	3.5 {nc}	- -	mg/kg	<0.0074	<0.0057 [<0.0052]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062	<0.0070	<0.0071	NA	NA	NA	NA
Carbon Disulfide	260 {sat}	260 {sat}	- -	mg/kg	<0.0074	<0.0057 [<0.0052]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062	<0.0070	<0.0071	NA	NA	NA	NA
Carbon Tetrachloride	0.25 {ca}	1.3 {ca}	- -	mg/kg	<0.0074	<0.0057 [<0.0052]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062	<0.0070	<0.0071	NA	NA	NA	NA
Chlorobenzene	31 {nc}	860 {sat}	- -	mg/kg	<0.0074	<0.0057 [<0.0052]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062	<0.0070	<0.0071	NA	NA	NA	NA
Chloroethane	2,200 {sat}	2,200 {sat}	- -	mg/kg	<0.0074	<0.0057 [<0.0052]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062	<0.0070	<0.0071	NA	NA	NA	NA
Chloroform	0.3 {ca}	1.5 {ca}	- -	mg/kg	<0.0074	<0.0057 [<0.0052]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062	<0.0070	<0.0071	NA	NA	NA	NA
Chloromethane	1.7 {ca*}	8.4 {ca*}	- -	mg/kg	<0.0074	<0.0057 [<0.0052]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062 L	<0.0070	<0.0071	NA	NA	NA	NA
cis-1,2-Dichloroethene	78 {nc}	1,400 {sat}	- -	mg/kg	<0.0074	<0.0057 [<0.0052]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062	<0.0070	<0.0071	NA	NA	NA	NA
cis-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.0074	<0.0057 [<0.0052]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062	<0.0070	<0.0071	NA	NA	NA	NA
Dibromochloromethane	5.8 {ca}	21 {ca}	- -	mg/kg	<0.0074	<0.0057 [<0.0052]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062	<0.0070	<0.0071	NA	NA	NA	NA
d-Limonene	- -	- -	- -	mg/kg	0.031 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	5.7 {ca}	29 {ca}	- -	mg/kg	<0.0074	<0.0057 [<0.0052]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062	<0.0070	<0.0071	NA	NA	NA	NA
m,p-Xylene	- -	- -	- -	mg/kg	<0.015	<0.011 [<0.010]	<0.012	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.012	<0.014	<0.014	NA	NA	NA	NA
Methylene Chloride	11 {ca}	54 {ca}	- -	mg/kg	<0.0074	<0.0057 [<0.0052]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062	<0.0070	<0.0071	NA	NA	NA	NA
Naphthalene	15 {nc}	67 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
o-Xylene	300 {sat}	300 {sat}	- -	mg/kg	<0.0074	<0.0057 [<0.0052]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062	<0.0070	<0.0071	NA	NA	NA	NA
Styrene	1,000 {sat}	1,000 {sat}	- -	mg/kg	<0.0074	<0.0057 [<0.0052]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062	<0.0070	<0.0071	NA	NA	NA	NA
Tetrachloroethene	0.57 {ca}	2.7 {ca}	- -	mg/kg	<0.0074	<0.0057 [<0.0052]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062	<0.0070	<0.0071	NA	NA	NA	NA
Toluene	930 {sat}	930 {sat}	- -	mg/kg	<0.0074	<0.0057 [0.00066 B]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062	0.00072 B	0.00083 B	NA	NA	NA	NA
trans-1,2-Dichloroethene	11 {nc}	50 {nc}	- -	mg/kg	<0.0074	<0.0057 [<0.0052]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062	<0.0070	<0.0071	NA	NA	NA	NA
trans-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.0074	<0.0057 [<0.0052]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062	<0.0070	<0.0071	NA	NA	NA	NA
Trichloroethene	2.8 {ca}	14 {ca}	- -	mg/kg	<0.0074	<0.0057 [<0.0052]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062	<0.0070	<0.0071	NA	NA	NA	NA
Vinyl Chloride	0.06 {ca}	1.7 {ca}	- -	mg/kg	<0.0074	<0.0057 [<0.0052]	<0.0060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0062	<0.0070	<0.0071	NA	NA	NA	NA
Xylenes (total)	300 {sat}	300 {sat}	- -	mg/kg	<0.015	<0.011 [<0.010]	<0.012	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.012	<0.014	<0.014	NA	NA	NA	NA
Semivolatile Organics																								
1,2,4-Trichlorobenzene	180 {ca**}	220 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	220 {sat}	220 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Diphenylhydrazine	0.61 {ca**}	2.2 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	2.6 {ca}	13 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1-Methylnaphthalene	22 {ca*}	99 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	610 {nc}	6,200 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	44 {ca**}	160 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	18 {nc}	180 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	120 {nc}	1,200 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	12 {nc}	120 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	210 {sat}	210 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Chlorophenol	39 {nc}	510 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol	310 {nc}	3,100 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitroaniline	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitrophenol	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	1.1 {ca**}	3.8 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes found at end of table.

Table 7-7. Soil Analytical Results, Igniter Assembly Area, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	IASB06 0 - 0.5 06/10/02	IASB06 4 - 6 06/18/02	IASB06 8 - 10 06/18/02	IASB07 0 - 0.5 06/10/02	IASB07 4 - 6 06/18/02	IASB08 0 - 0.5 06/10/02	IASB08 4 - 6 06/18/02	IASB09 0 - 0.5 06/10/02	IASB09 4 - 6 06/18/02	IASB10 0 - 0.5 06/10/02	IASB10 2 - 4 06/18/02	IASB11 0 - 0.5 06/10/02	IASB11 2 - 4 06/18/02	IASB12 0 - 0.5 06/10/02	IASB12 4 - 6 06/18/02	IASB12 8 - 10 06/18/02	IASB13 0 - 0.5 06/11/02	IASB13 1 - 2 06/18/02	IASB13 2 - 4 06/18/02	IASB14 0 - 0.5 06/11/02
Semivolatile Organics																								
3-Nitroaniline	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,6-Dinitro-2-methylphenol	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Bromophenyl-phenylether	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloro-3-Methylphenol	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline	24 {nc}	250 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl-phenylether	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol	31 {nc}	310 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitrophenol	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzoic Acid	240,000 {max}	2,500,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzyl Alcohol	3,100 {nc}	310,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Chloroethoxy)methane	18 {nc}	180 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Chloroethyl)ether	0.19 {ca**}	0.9 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Chloroisopropyl)ether	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	35 {ca*}	120 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Butylbenzylphthalate	1,200 {nc}	120,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole	24 {ca**}	86 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diethylphthalate	4,900 {nc}	490,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dimethylphthalate	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-Butylphthalate	610 {nc}	6,200 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-Octylphthalate	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	0.3 {ca}	1.1 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	6.2 {ca**}	22 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	37 {nc}	370 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane	35 {ca**}	120 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Isophorone	510 {ca*}	1,800 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	3.9 {ca}	20 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	0.069 {ca**}	0.25 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	99 {ca**}	350 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	3 {ca}	9 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenol	1,800 {nc}	180,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyridine	7.8 {nc}	100 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes found at end of table.

Table 7-7. Soil Analytical Results, Igniter Assembly Area, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	IASB06 0 - 0.5 06/10/02	IASB06 4 - 6 06/18/02	IASB06 8 - 10 06/18/02	IASB07 0 - 0.5 06/10/02	IASB07 4 - 6 06/18/02	IASB08 0 - 0.5 06/10/02	IASB08 4 - 6 06/18/02	IASB09 0 - 0.5 06/10/02	IASB09 4 - 6 06/18/02	IASB10 0 - 0.5 06/10/02	IASB10 2 - 4 06/18/02	IASB11 0 - 0.5 06/10/02	IASB11 2 - 4 06/18/02	IASB12 0 - 0.5 06/10/02	IASB12 4 - 6 06/18/02	IASB12 8 - 10 06/18/02	IASB13 0 - 0.5 06/11/02	IASB13 1 - 2 06/18/02	IASB13 2 - 4 06/18/02	IASB14 0 - 0.5 06/11/02
Inorganics																								
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	33,700 J	9,510 [12,000]	25,600	31,200 J	23,500	29,700 J	31,800	23,400 J	20,400	20,400 J	27,200	16,900 J	24,100	21,500 J	29,400	28,300	11,000	13,000	**42,900**	12,400 [12,400]
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	0.240 B	<0.570 L [<0.570 L]	<0.660 L	0.390 B	<0.670 L	0.340 B	<0.660 L	0.460 L	<0.620 L	0.470 L	0.320 B	0.260 B	0.300 B	0.220 B	0.270 B	<0.710 L	0.330 B	<0.640 L	<0.710 L	0.880 L [0.820 L]
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	9.24	2.65 L [2.90 L]	9.66 L	6.29	9.02 L	8.04	10.8 L	11.8	9.96 L	6.73	6.42 L	5.33	9.59 L	6.82	**21.4 L**	13.5 L	0.820 J	4.36 L	9.52 L	3.55 J [2.78 J]
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	37.3	35.5 [34.5]	25.9	31.2	66.7	34.2	24.8	189	17.1	32.0	48.3	48.4	16.6	48.9	15.6	15.1	107	71.6	20.3	88.7 [102]
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	0.750	<0.220 L [<0.230 L]	0.450 B	0.810	**1.60 L**	0.640	0.680 L	0.660	0.950 L	0.550 B	**3.02 L**	0.640	<0.260 L	<0.630	<0.270 L	0.300 B	0.620	0.460 B	0.770 L	0.580 [0.570]
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	<0.110	<0.110 [<0.110]	<0.130	<0.110	<0.130	<0.110	<0.130	0.310	<0.120	<0.120	<0.120	0.100 J	<0.130	<0.120	<0.140	<0.140	**1.15**	0.0600 B	<0.140	0.270 [0.230]
Calcium	- -	- -	- -	mg/kg	1,900	330 [350]	515	1,890	686	1,620	626	4,290	325	1,710	2,310	1,040	446	1,160	33.7 B	45.9	123,000	2,020	1,230	69,500 [59,400]
Chromium	280 {ca**}	1,400 {ca**}	65.3	mg/kg	39.1 J	10.1 [14.5]	41.4	38.1 J	45.0	38.8 J	53.2	39.0 J	43.7	33.6 J	57.0	18.8 J	36.5	45.6 J	59.2	43.8	54.4 L	18.7	32.9	**157 L [173 L]**
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	17.2 J	10.4 J [5.15 J]	3.37 J	**422 J**	36.0 J	11.2 J	4.46 J	15.3 J	57.0 J	9.00 J	18.6 J	57.2 J	1.47 J	4.48 J	1.42 J	1.67 J	6.69 J	4.79 J	70.1 J	6.56 J [6.68 J]
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	**75.6 J**	5.13 [6.63]	17.5	51.1 J	22.2	26.9 J	22.1	**3,310 J**	22.3	27.8 J	31.2	**1,360 J**	16.0	18.1 J	29.5	28.9	38.1	23.0	34.0	40.0 [47.6]
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	36,900	9,620 [13,100]	39,600	36,900	33,400	35,900	50,800	30,000	38,500	31,500	36,800	20,100	35,700	33,500	**77,600**	**66,000**	15,200	17,000	45,400	20,800 [22,200]
Lead	400 {++}	800 {++}	26.8	mg/kg	**50.2**	11.2 J [10.2 J]	19.2 J	**41.7**	**49.2 J**	**32.0**	**33.4 J**	**141**	**35.3 J**	**29.7**	**27.2 J**	**66.2**	14.7 J	22.2	20.7 J	23.9 J	**458**	23.6 J	**116**	**1,480 [1,380]**
Magnesium	- -	- -	- -	mg/kg	1,430	426 [457]	543	1,850	8,060	1,560	680	4,540	890	1,150	16,700	2,960	385	769	234	218	69,700	1,130	689	41,200 [35,700]
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	213 J	199 [111]	30.5	2,510 J	504	79.8 J	38.1	190 J	183	163 J	476	752 J	53.9	270 J	33.3	37.3	180	356	960	225 [214]
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	0.0700	0.0300 J [0.0300 J]	0.110	0.0600	0.100	0.0800	0.120	0.130	0.0600	0.0800	0.0700	0.0500 J	0.100	0.0700	0.0300 J	<0.0700	<0.0500	0.0300 J	0.0800	0.0500 J [0.0600]
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	26.1	5.37 [5.92]	12.7	29.5	39.6	17.0	15.7	29.0	20.6	12.7	51.3	19.6	10.7	8.46	11.0	12.9	11.8	8.70	25.9	12.2 [12.9]
Potassium	- -	- -	- -	mg/kg	909	333 J [394]	496	849	3,250	753	514	860	559	563	3,290	795	231 J	563	368 J	288 J	3,350	341 J	509	2,310 [1,980]
Selenium	39 {nc}	510 {nc}	- -	mg/kg	<1.13 L	0.770 L [<1.16 L]	<1.34 L	<1.18 L	0.660 L	0.430 L	0.580 L	0.480 L	0.730 L	<1.23 L	<1.27 L	<1.21 L	<1.31 L	<1.26 L	<1.40 L	0.560 L	<1.08	<1.30 L	0.610 L	<1.08 [<1.08]
Silver	39 {nc}	510 {nc}	- -	mg/kg	<1.13	<1.14 [<1.16]	<1.34	<1.18	<1.35	<1.19	<1.34	0.700 J	<1.25	<1.23	<1.27	<1.21	<1.31	<1.26	<1.40	<1.42	<1.08	<1.30	<1.42	<1.08 [<1.08]
Sodium	- -	- -	- -	mg/kg	16.7 B	24.9 B [10.9 B]	16.4 B	18.2 B	17.1 B	12.6 B	12.9 B	21.0 B	7.66 B	11.9 B	20.0 B	11.6 B	7.68 B	12.2 B	6.84 B	17.5 B	143 J	10.2 B	7.16 B	88.1 J [79.8 J]
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	0.280 J	0.140 J [0.110 J]	0.270 J	0.250 J	0.450	0.230 J	0.290 J	0.290 J	0.280 J	0.190 J	0.440	0.290 J	0.390 J	0.120 J	0.210 J	0.220 J	0.200 J	0.190 J	0.800	0.160 J [0.160 J]
Vanadium	55 {nc}	720 {nc}	108	mg/kg	59.2	18.7 [25.1]	62.5	63.2	48.8	60.3	86.7	50.2	62.9	54.3	59.9	33.7	59.9	62.9	97.6	78.1	24.3	32.0	80.7	30.7 [30.7]
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	193 J	15.7 [14.2]	17.2	53.3 J	22.5	44.9 J	28.8	**526 J**	22.6	38.7 J	38.3	75.4 J	16.1	42.7 J	28.7	29.5	160 J	25.5	40.1	**264 J [290 J]**
Miscellaneous																								
pH	- -	- -	- -	pH Units	6.17 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Organic Carbon	- -	- -	- -	mg/kg	17,500 K	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes found at end of table.

Table 7-7. Soil Analytical Results, Igniter Assembly Area, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	IASB14 1 - 2 06/18/02	IASB14 2 - 4 06/18/02	IASB15 0 - 0.5 06/11/02	IASB15 1 - 2 06/18/02	IASB15 2 - 4 06/18/02	IASS01 0 - 0.5 06/10/02	IASS02 0 - 0.5 06/10/02	IASS03 0 - 0.5 06/10/02	IASS04 0 - 0.5 06/10/02	IASS05 0 - 0.5 06/10/02	IATR01 0 - 0.5 06/20/02	IATR02 0 - 0.5 06/20/02	IATR03 0 - 0.5 06/20/02	IATR04 0 - 0.5 06/20/02	IATR05 0 - 0.5 06/20/02	IATR06 0 - 0.5 06/20/02	IATR07 0 - 0.5 06/20/02	IATR08 0 - 0.5 06/20/02
Explosives																						
1,3,5-Trinitrobenzene	180 {nc}	1,800 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.1	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dinitrobenzene	0.61 {nc}	6.2 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.1	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trinitrotoluene	16 {ca**}	57 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.2	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.2	NA	NA	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.2	NA	NA	NA	NA	NA	NA	NA	NA
2-Amino-4,6-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.2	NA	NA	NA	NA	NA	NA	NA	NA
4-Amino-2,6-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.05 K	NA	NA	NA	NA	NA	NA	NA	NA
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.2	NA	NA	NA	NA	NA	NA	NA	NA
HMX	310 {nc}	3,100 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.2	NA	NA	NA	NA	NA	NA	NA	NA
m-Nitrotoluene	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.4	NA	NA	NA	NA	NA	NA	NA	NA
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.2	NA	NA	NA	NA	NA	NA	NA	NA
Nitroglycerine	0.61 {nc}	6.2 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.57	NA	NA	NA	NA	NA	NA	NA	NA
o-Nitrotoluene	78 {nc}	1,300 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.4	NA	NA	NA	NA	NA	NA	NA	NA
Pentaerythritol Tetranitrate	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.36	NA	NA	NA	NA	NA	NA	NA	NA
p-Nitrotoluene	30 {ca**}	110 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.4	NA	NA	NA	NA	NA	NA	NA	NA
RDX	4.4 {ca*}	16 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.2	NA	NA	NA	NA	NA	NA	NA	NA
Tetryl	24 {nc}	250 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.2	NA	NA	NA	NA	NA	NA	NA	NA
Herbicides																						
2,4,5-T	61 {nc}	620 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-TP	49 {nc}	490 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-D	69 {nc}	770 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-DB	49 {nc}	490 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dalapon	180 {nc}	1,800 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dicamba	180 {nc}	1,800 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dichlorprop	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dinoseb	6.1 {nc}	62 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MCPA	3.1 {nc}	31 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MCPP	6.1 {nc}	62 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Organochlorine Pesticides																						
4,4'-DDD	2 {ca**}	7.2 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDE	1.4 {ca**}	5.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDT	1.7 {ca*}	7 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aldrin	0.029 {ca*}	0.1 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Alpha-BHC	0.077 {ca**}	0.27 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Alpha-Chlordane	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beta-BHC	0.27 {ca**}	0.96 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Delta-BHC	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dieldrin	0.03 {ca}	0.11 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan I	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan II	37 {nc}	370 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan Sulfate	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endrin	1.8 {nc}	18 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endrin Aldehyde	1.8 {nc}	18 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endrin Ketone	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gamma-BHC (Lindane)	0.52 {ca*}	2.1 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gamma-Chlordane	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlor	0.11 {ca}	0.38 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlor Epoxide	0.053 {ca*}	0.19 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methoxychlor	31 {nc}	310 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toxaphene	0.44 {ca**}	1.6 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PAHs																						
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	0.0019 B	0.0048	0.0032 B	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	<0.0021	<0.0022	0.015 B	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	<0.0021	0.0012 J	<0.0021	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	<0.0021	0.0013 J	0.028	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	0.0052	0.010	0.070	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	0.0059	0.010	0.057	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	0.013	0.024	0.099	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	0.0071	0.018	0.031	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	0.0039	0.0056	0.029	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	0.0073	0.013	0.056	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	<0.0021	0.0024	0.0078	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	0.013	0.022	0.16	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	<0.0021	0.00097 J	0.013	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	0.0056 J	0.0089 J	0.037 J	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	15 {nc}	67 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	0.0014 B	0.0031 B	0.0045 B	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	0.0078	0.0099	0.14	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	0.014	0.019	0.12	NA	NA	NA	NA	NA	NA	NA	NA
PCBs																						
Aroclor-1016	0.39 {nc}	21 {ca**}	- -	mg/kg	<0.030	<0.040	<0.030	<0.040	<0.040	NA	NA	NA	NA	<0.040	<0.030	<0.040	<0.040	<0.040	<0.030	<0.030	<0.030	<0.030
Aroclor-1221	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.070	<0.090	<0.070	<0.080	<0.090	NA	NA	NA	NA	<0.080	<0.070	<0.080	<0.080	<0.080	<0.070	<0.070	<0.070	<0.070
Aroclor-1232	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.030	<0.040	<0.030	<0.040	<0.040	NA	NA	NA	NA	<0.040	<0.030	<0.040	<0.040	<0.040	<0.030	<0.030	<0.030	<0.030
Aroclor-1242	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.030	<0.040	<0.030	<0.040	<0.040	NA	NA	NA	NA	<0.040	<0.030	<0.040	<0.040	<0.040	<0.030	<0.030	<0.030	<0.030
Aroclor-1248	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.030	<0.040	<0.030	<0.040	<0.040	NA	NA	NA	NA	<0.040	<0.030	<0.040	<0.040	<0.040	<0.030	<0.030	<0.030	<0.030
Aroclor-1254	0.22 {ca**}	0.74 {ca*}	- -	mg/kg	<0.030	<0.040	0.040	<0.040	<0.040	NA	NA	NA	NA	12	<0.030	<0.040	<0.040	<0.040	<0.030	<0.030	<0.030	<0.030
Aroclor-1260	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.030	<0.040	<0.030	<0.040	<0.040	NA	NA	NA	NA	<0.040	<0.030	<0.040	<0.040	<0.040	<0.030	<0.030	0.40	<0.030
Total PCBs	0.24 {ca**}	0.86 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes found at end of table.

Table 7-7. Soil Analytical Results, Igniter Assembly Area, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: / Sample Depth(Feet): / Date Collected:	Adjusted Soil Screening Values- Residential [a]	Adjusted Soil Screening Values- Industrial [a]	Facility-Wide Background Values [b]	Units	IASB14 1 - 2 06/18/02	IASB14 2 - 4 06/18/02	IASB15 0 - 0.5 06/11/02	IASB15 1 - 2 06/18/02	IASB15 2 - 4 06/18/02	IASS01 0 - 0.5 06/10/02	IASS02 0 - 0.5 06/10/02	IASS03 0 - 0.5 06/10/02	IASS04 0 - 0.5 06/10/02	IASS05 0 - 0.5 06/10/02	IATR01 0 - 0.5 06/20/02	IATR02 0 - 0.5 06/20/02	IATR03 0 - 0.5 06/20/02	IATR04 0 - 0.5 06/20/02	IATR05 0 - 0.5 06/20/02	IATR06 0 - 0.5 06/20/02	IATR07 0 - 0.5 06/20/02	IATR08 0 - 0.5 06/20/02
Volatile Organics																						
1,1,1-Trichloroethane	680 {sat}	680 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0073	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	0.59 {ca**}	2.9 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0073	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	1.1 {ca}	5.5 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0073	NA	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	3.4 {ca}	17 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0073	NA	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	25 {nc}	110 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0073	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	0.45 {ca}	2.2 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0073	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	0.93 {ca*}	4.7 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0073	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone	28,000 {sat}	28,000 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0073 J	NA	NA	NA	NA	NA	NA	NA	NA
2-Hexanone	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0073 J	NA	NA	NA	NA	NA	NA	NA	NA
3-Octanone	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.013 J	NA	NA	NA	NA	NA	NA	NA	NA
4-Methyl-2-pentanone	3,200 {sat}	3,200 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0073	NA	NA	NA	NA	NA	NA	NA	NA
Acetone	6,100 {nc}	110,000 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.032 B	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	1.1 {ca*}	5.6 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0073	NA	NA	NA	NA	NA	NA	NA	NA
Bromodichloromethane	10 {ca}	46 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0073	NA	NA	NA	NA	NA	NA	NA	NA
Bromoform	61 {ca*}	220 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0073	NA	NA	NA	NA	NA	NA	NA	NA
Bromomethane	0.79 {nc}	3.5 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0073	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	260 {sat}	260 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0073	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Tetrachloride	0.25 {ca}	1.3 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0073	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	31 {nc}	860 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0073	NA	NA	NA	NA	NA	NA	NA	NA
Chloroethane	2,200 {sat}	2,200 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0073	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	0.3 {ca}	1.5 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0073	NA	NA	NA	NA	NA	NA	NA	NA
Chloromethane	1.7 {ca*}	8.4 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0073	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,2-Dichloroethene	78 {nc}	1,400 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0073	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,3-Dichloropropene	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0073	NA	NA	NA	NA	NA	NA	NA	NA
Dibromochloromethane	5.8 {ca}	21 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0073	NA	NA	NA	NA	NA	NA	NA	NA
d-Limonene	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	5.7 {ca}	29 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0073	NA	NA	NA	NA	NA	NA	NA	NA
m,p-Xylene	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.015	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	11 {ca}	54 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0073	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	15 {nc}	67 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
o-Xylene	300 {sat}	300 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0073	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	1,000 {sat}	1,000 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0073	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	0.57 {ca}	2.7 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0073	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	930 {sat}	930 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0073	NA	NA	NA	NA	NA	NA	NA	NA
trans-1,2-Dichloroethene	11 {nc}	50 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0073	NA	NA	NA	NA	NA	NA	NA	NA
trans-1,3-Dichloropropene	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0073	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	2.8 {ca}	14 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0073	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	0.06 {ca}	1.7 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0073	NA	NA	NA	NA	NA	NA	NA	NA
Xylenes (total)	300 {sat}	300 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.015	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organics																						
1,2,4-Trichlorobenzene	180 {ca**}	220 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	220 {sat}	220 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Diphenylhydrazine	0.61 {ca**}	2.2 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	2.6 {ca}	13 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
1-Methylnaphthalene	22 {ca*}	99 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	610 {nc}	6,200 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	44 {ca**}	160 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	18 {nc}	180 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	120 {nc}	1,200 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	12 {nc}	120 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<1.0	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	210 {sat}	210 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
2-Chlorophenol	39 {nc}	510 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol	310 {nc}	3,100 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitroaniline	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitrophenol	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	1.1 {ca**}	3.8 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA

Notes found at end of table.

Table 7-7. Soil Analytical Results, Igniter Assembly Area, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: / Sample Depth(Feet): / Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	IASB14 1 - 2 06/18/02	IASB14 2 - 4 06/18/02	IASB15 0 - 0.5 06/11/02	IASB15 1 - 2 06/18/02	IASB15 2 - 4 06/18/02	IASS01 0 - 0.5 06/10/02	IASS02 0 - 0.5 06/10/02	IASS03 0 - 0.5 06/10/02	IASS04 0 - 0.5 06/10/02	IASS05 0 - 0.5 06/10/02	IATR01 0 - 0.5 06/20/02	IATR02 0 - 0.5 06/20/02	IATR03 0 - 0.5 06/20/02	IATR04 0 - 0.5 06/20/02	IATR05 0 - 0.5 06/20/02	IATR06 0 - 0.5 06/20/02	IATR07 0 - 0.5 06/20/02	IATR08 0 - 0.5 06/20/02
Semivolatile Organics																						
3-Nitroaniline	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21 J	NA	NA	NA	NA	NA	NA	NA	NA
4,6-Dinitro-2-methylphenol	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<1.0	NA	NA	NA	NA	NA	NA	NA	NA
4-Bromophenyl-phenylether	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloro-3-Methylphenol	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline	24 {nc}	250 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21 J	NA	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl-phenylether	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol	31 {nc}	310 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21 J	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitrophenol	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<1.0	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.095 J	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.16 J	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.39	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.35	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.49	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.24	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.19 J	NA	NA	NA	NA	NA	NA	NA	NA
Benzoic Acid	240,000 {max}	2,500,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.27 B	NA	NA	NA	NA	NA	NA	NA	NA
Benzyl Alcohol	3,100 {nc}	310,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21 J	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Chloroethoxy)methane	18 {nc}	180 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Chloroethyl)ether	0.19 {ca**}	0.9 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Chloroisopropyl)ether	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	35 {ca*}	120 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.18 B	NA	NA	NA	NA	NA	NA	NA	NA
Butylbenzylphthalate	1,200 {nc}	120,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole	24 {ca**}	86 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.11 J	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.39	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.078 J	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.031 J	NA	NA	NA	NA	NA	NA	NA	NA
Diethylphthalate	4,900 {nc}	490,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
Dimethylphthalate	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-Butylphthalate	610 {nc}	6,200 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.31 B	NA	NA	NA	NA	NA	NA	NA	NA
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-Octylphthalate	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.94 L	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.079 J	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	0.3 {ca}	1.1 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	6.2 {ca**}	22 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	37 {nc}	370 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21 L	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane	35 {ca**}	120 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.29	NA	NA	NA	NA	NA	NA	NA	NA
Isophorone	510 {ca*}	1,800 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	3.9 {ca}	20 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.015 J	NA	NA	NA	NA	NA	NA	NA	NA
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	0.069 {ca**}	0.25 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	99 {ca**}	350 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	3 {ca}	9 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<1.0	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.69 L	NA	NA	NA	NA	NA	NA	NA	NA
Phenol	1,800 {nc}	180,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.67	NA	NA	NA	NA	NA	NA	NA	NA
Pyridine	7.8 {nc}	100 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.21	NA	NA	NA	NA	NA	NA	NA	NA

Notes found at end of table.

Table 7-7. Soil Analytical Results, Igniter Assembly Area, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	IASB14 1 - 2 06/18/02	IASB14 2 - 4 06/18/02	IASB15 0 - 0.5 06/11/02	IASB15 1 - 2 06/18/02	IASB15 2 - 4 06/18/02	IASS01 0 - 0.5 06/10/02	IASS02 0 - 0.5 06/10/02	IASS03 0 - 0.5 06/10/02	IASS04 0 - 0.5 06/10/02	IASS05 0 - 0.5 06/10/02	IATR01 0 - 0.5 06/20/02	IATR02 0 - 0.5 06/20/02	IATR03 0 - 0.5 06/20/02	IATR04 0 - 0.5 06/20/02	IATR05 0 - 0.5 06/20/02	IATR06 0 - 0.5 06/20/02	IATR07 0 - 0.5 06/20/02	IATR08 0 - 0.5 06/20/02
Inorganics																						
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	27,600	32,200	12,700	33,000	30,200	32,700 J	24,200 J	28,200 J	16,900 J	26,500 J	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	<0.590 L	<0.710 L	0.310 B	<0.650 L	<0.690 L	0.240 B	0.580 L	0.310 B	0.350 B	<0.600 L	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	5.82 L	6.12 L	0.550 J	8.67 L	6.27 L	8.33	8.33	8.02	8.66	8.35	NA	NA	NA	NA	NA	NA	NA	NA
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	11.8	13.8	56.6	48.4	19.0	42.6	72.9	159	**277**	38.8	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	0.360 B	0.830 L	0.630	0.480 B	0.730 L	0.390 B	0.480 B	0.830	0.670	0.560 B	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	<0.110	<0.140	0.500	<0.130	<0.140	<0.120	<0.120	0.130	0.380	<0.120	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	- -	- -	- -	mg/kg	1,060	1,450	105,000	1,240	1,440	3,170	1,900	2,140	1,420	807	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	280 {ca**}	1,400 {ca**}	65.3	mg/kg	49.8	**66.1**	57.4 L	38.0	34.8	40.5 J	36.8 J	28.0 J	29.1 J	41.9 J	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	3.43 J	2.93 J	7.70 J	5.96 J	4.20 J	5.29 J	8.73 J	22.7 J	14.6 J	6.97 J	NA	NA	NA	NA	NA	NA	NA	NA
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	25.8	27.8	32.6	**61.4**	31.5	45.3 J	**97.2 J**	**164 J**	**661 J**	18.7 J	NA	NA	NA	NA	NA	NA	NA	NA
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	43,700	49,800	15,900	39,100	45,300	34,800	32,000	23,100	16,700	32,600	NA	NA	NA	NA	NA	NA	NA	NA
Lead	400 {++}	800 {++}	26.8	mg/kg	24.3 J	**29.0 J**	**476**	**127**	**41.7 J**	**30.2**	**49.1**	**95.6**	**144**	**31.1**	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	- -	- -	- -	mg/kg	652	767	63,200	923	825	1,530	1,330	3,330	4,110	895	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	54.1	60.5	174	166	100	75.5 J	125 J	621 J	452 J	219 J	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	0.0300 J	0.110	<0.0500	0.0800	**0.850**	0.0900	0.100	0.100	0.0500 J	0.0800	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	19.8	22.0	12.9	21.8	20.0	17.2	14.9	21.7	17.4	17.2	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	- -	- -	- -	mg/kg	441	511	3,950	658	491	809	847	1,080	863	817	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	39 {nc}	510 {nc}	- -	mg/kg	<1.19 L	<1.44 L	<1.10	0.480 L	<1.40 L	<1.26 L	<1.24 L	<1.21 L	<1.32 L	<1.22 L	NA	NA	NA	NA	NA	NA	NA	NA
Silver	39 {nc}	510 {nc}	- -	mg/kg	<1.19	<1.44	<1.10	<1.31	<1.40	<1.26	<1.24	<1.21	<1.32	<1.22	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	- -	- -	- -	mg/kg	6.28 B	7.19 B	133 J	13.9 B	9.24 B	22.0 B	14.9 B	22.2 B	18.2 B	12.7 B	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	0.160 J	0.250 J	0.130 J	0.280 J	0.300 J	0.350 J	0.180 J	0.250 J	0.250 J	0.150 J	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	55 {nc}	720 {nc}	108	mg/kg	76.6	90.6	27.4	71.1	77.9	61.6	56.7	44.8	34.0	56.4	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	44.5	47.2	**277 J**	79.5	47.0	48.2 J	88.1 J	**232 J**	**670 J**	87.9 J	NA	NA	NA	NA	NA	NA	NA	NA
Miscellaneous																						
pH	- -	- -	- -	pH Units	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Organic Carbon	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

mg/kg	Milligrams per kilogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 7-8. Sediment Analytical Results, Igniter Assembly Area, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	IASD04 0 - 0.5 06/18/02	IASD05 0 - 0.5 06/19/02	IASD06 0 - 0.5 06/19/02	IASD07 0 - 0.5 06/19/02	IASD08 0 - 0.5 06/19/02	IASD09 0 - 0.5 06/19/02	IASD10 0 - 0.5 06/19/02	IASD11 0 - 0.5 06/19/02	IASD12 0 - 0.5 06/19/02
Explosives													
1,3,5-Trinitrobenzene	180 {nc}	1,800 {nc}	- -	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.07 J	<0.1
1,3-Dinitrobenzene	0.61 {nc}	6.2 {nc}	- -	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2,4,6-Trinitrotoluene	16 {ca**}	57 {ca**}	- -	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
2-Amino-4,6-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
4-Amino-2,6-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.2	0.04 J	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
HMX	310 {nc}	3,100 {nc}	- -	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
m-Nitrotoluene	- -	- -	- -	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Nitroglycerine	0.61 {nc}	6.2 {nc}	- -	mg/kg	<0.36	<0.39	<0.36	<0.36	<0.36	<0.37	<0.32	<0.36	<0.36
o-Nitrotoluene	78 {nc}	1,300 {sat}	- -	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Pentaerythritol Tetranitrate	- -	- -	- -	mg/kg	<0.36	<0.39	<0.36	<0.36	<0.36	<0.37	<0.32	<0.36	<0.36
p-Nitrotoluene	30 {ca**}	110 {ca*}	- -	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
RDX	4.4 {ca*}	16 {ca}	- -	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Tetryl	24 {nc}	250 {nc}	- -	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Herbicides													
2,4,5-T	61 {nc}	620 {nc}	- -	mg/kg	<0.0121	<1.3 J	<0.121 J	<1.2 J	<0.123 J	<0.124 J	<1.09 J	NA	<0.12 J
2,4,5-TP	49 {nc}	490 {nc}	- -	mg/kg	<0.0121	<1.3 L	<0.121	<1.2 L	<0.123	<0.124	<1.09 L	NA	<0.12
2,4-D	69 {nc}	770 {nc}	- -	mg/kg	<0.0242	<2.6 L	<0.242	<2.41 L	<0.246	<0.248	<2.19 L	NA	<0.24
2,4-DB	49 {nc}	490 {nc}	- -	mg/kg	<0.121	<13 J	<1.21 J	<12 J	<1.23 J	<1.24 J	<10.9 J	NA	<1.2 J
Dalapon	180 {nc}	1,800 {nc}	- -	mg/kg	<0.121	<13 L	<1.21	<12 L	<1.23	<1.24	<10.9 L	NA	<1.2
Dicamba	180 {nc}	1,800 {nc}	- -	mg/kg	<0.0242	<2.6 L	<0.242	<2.41 L	<0.246	<0.248	<2.19 L	NA	<0.24
Dichlorprop	- -	- -	- -	mg/kg	<0.0242	<2.6 L	<0.242	<2.41 L	<0.246	<0.248	<2.19 L	NA	<0.24
Dinoseb	6.1 {nc}	62 {nc}	- -	mg/kg	<0.0242	<2.6 L	<0.242	<2.41 L	<0.246	<0.248	<2.19 L	NA	<0.24
MCPA	3.1 {nc}	31 {nc}	- -	mg/kg	<12.1	<1,300 L	<121	<1,200 L	<123	<124	<1,090 L	NA	<120
MCPP	6.1 {nc}	62 {nc}	- -	mg/kg	<12.1	<1,300 L	<121	<1,200 L	<123	<124	<1,090 L	NA	<120
Organochlorine Pesticides													
4,4'-DDD	2 {ca**}	7.2 {ca**}	- -	mg/kg	0.00111	<0.00086	0.00079 J	0.00068 J	0.00248	<0.00082	0.00242	NA	0.00191
4,4'-DDE	1.4 {ca**}	5.1 {ca**}	- -	mg/kg	<0.0008	0.00301	0.00066 B	0.00072 B	<0.00082	0.00074 B	<0.00072	NA	0.00075 B
4,4'-DDT	1.7 {ca*}	7 {ca*}	- -	mg/kg	0.00089 B	0.00385	0.00362	0.00386	0.0067	0.00076 B	0.00233	NA	0.00297
Aldrin	0.029 {ca*}	0.1 {ca}	- -	mg/kg	<0.0008	<0.00086	<0.0008	<0.0008	<0.00082	<0.00082	<0.00072	NA	<0.0008
Alpha-BHC	0.077 {ca**}	0.27 {ca**}	- -	mg/kg	<0.0008	<0.00086	<0.0008	<0.0008	<0.00082	<0.00082	<0.00072	NA	<0.0008
Alpha-Chlordane	- -	- -	- -	mg/kg	0.00056 J	0.00301	<0.0008	0.00038 J	<0.00082	<0.00082	<0.00072	NA	<0.0008
Beta-BHC	0.27 {ca**}	0.96 {ca**}	- -	mg/kg	<0.0008	<0.00086	<0.0008	0.00017 J	<0.00082	<0.00082	<0.00072	NA	<0.0008
Delta-BHC	- -	- -	- -	mg/kg	<0.0008	<0.00086	<0.0008	<0.0008	<0.00082	<0.00082	0.00104	NA	<0.0008
Dieldrin	0.03 {ca}	0.11 {ca}	- -	mg/kg	0.00442	0.00151	0.00074 J	0.00108	<0.00082	0.00089	0.00909	NA	0.00061 J
Endosulfan I	- -	- -	- -	mg/kg	<0.0008	<0.00086	<0.0008	<0.0008	<0.00082	<0.00082	<0.00072	NA	<0.0008
Endosulfan II	37 {nc}	370 {nc}	- -	mg/kg	0.00135	0.00052 J	<0.0008	0.00049 J	0.00378	0.00218	0.00123	NA	0.00038 J
Endosulfan Sulfate	- -	- -	- -	mg/kg	<0.0008	<0.00086	<0.0008	<0.0008	<0.00082	<0.00082	<0.00072	NA	<0.0008
Endrin	1.8 {nc}	18 {nc}	- -	mg/kg	<0.0008	0.00328	0.00062 J	0.003	<0.00082	<0.00082	<0.00072	NA	<0.0008
Endrin Aldehyde	1.8 {nc}	18 {nc}	- -	mg/kg	<0.0008	<0.00086 L	<0.0008 L	<0.0008 L	<0.00082 L	<0.00082 L	<0.00072 L	NA	<0.0008 L
Endrin Ketone	- -	- -	- -	mg/kg	<0.0008	0.00424	<0.0008	0.00148	<0.00082	<0.00082	0.00423	NA	<0.0008
Gamma-BHC (Lindane)	0.52 {ca*}	2.1 {ca}	- -	mg/kg	<0.0008	<0.00086	<0.0008	<0.0008	<0.00082	<0.00082	<0.00072	NA	<0.0008
Gamma-Chlordane	- -	- -	- -	mg/kg	<0.0008	0.00408	<0.0008	0.00102	<0.00082	0.00062 J	0.00136	NA	<0.0008
Heptachlor	0.11 {ca}	0.38 {ca}	- -	mg/kg	<0.0008	<0.00086	<0.0008	<0.0008	<0.00082	<0.00082	<0.00072	NA	<0.0008
Heptachlor Epoxide	0.053 {ca*}	0.19 {ca*}	- -	mg/kg	<0.0008	<0.00086	<0.0008	<0.0008	0.00101	<0.00082	<0.00072	NA	<0.0008
Methoxychlor	31 {nc}	310 {nc}	- -	mg/kg	0.00757	0.00257	0.00117	0.00107	0.0105	<0.00082	0.0122	NA	0.0027
Toxaphene	0.44 {ca**}	1.6 {ca**}	- -	mg/kg	<0.0402	<0.0434	<0.0404	<0.0401	<0.041	<0.0413	<0.0364	NA	<0.04
PAHs													
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	0.36	0.012
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	0.0043 B	0.0014 B
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	0.0085	0.0028
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	0.014	0.0029
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	0.060	0.018
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	0.040	0.018
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	0.10	0.055
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	0.051	0.022
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	0.027	0.018
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	0.098	0.041
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	0.012	0.0046
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	0.11 L	0.074 L
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	0.010	0.0013 J
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	0.038	0.023
Naphthalene	15 {nc}	67 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	0.20	0.0082 B
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	0.25	0.019
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	0.11	0.050
PCBs													
Aroclor-1016	0.39 {nc}	21 {ca**}	- -	mg/kg	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.030	<0.040	<0.040
Aroclor-1221	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.070	<0.080	<0.080
Aroclor-1232	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.030	<0.040	<0.040
Aroclor-1242	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.030	<0.040	<0.040
Aroclor-1248	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.030	<0.040	<0.040
Aroclor-1254	0.22 {ca**}	0.74 {ca*}	- -	mg/kg	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.030	<0.040	<0.040
Aroclor-1260	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.030	<0.040	<0.040
Total PCBs	0.24 {ca**}	0.86 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes found at end of table.

Table 7-8. Sediment Analytical Results, Igniter Assembly Area, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	IASD04 0 - 0.5 06/18/02	IASD05 0 - 0.5 06/19/02	IASD06 0 - 0.5 06/19/02	IASD07 0 - 0.5 06/19/02	IASD08 0 - 0.5 06/19/02	IASD09 0 - 0.5 06/19/02	IASD10 0 - 0.5 06/19/02	IASD11 0 - 0.5 06/19/02	IASD12 0 - 0.5 06/19/02
Volatile Organics													
1,1,1-Trichloroethane	680 {sat}	680 {sat}	- -	mg/kg	<0.0060	<0.0059	<0.0061	<0.0054	<0.0062	<0.0062	<0.0055	<0.0066	<0.0066
1,1,2,2-Tetrachloroethane	0.59 {ca**}	2.9 {ca**}	- -	mg/kg	<0.0060	<0.0059 L	<0.0061 L	<0.0054 L	<0.0062 L	<0.0062 L	<0.0055 L	<0.0066 L	<0.0066 L
1,1,2-Trichloroethane	1.1 {ca}	5.5 {ca}	- -	mg/kg	<0.0060	<0.0059	<0.0061	<0.0054	<0.0062	<0.0062	<0.0055	<0.0066	<0.0066
1,1-Dichloroethane	3.4 {ca}	17 {ca}	- -	mg/kg	<0.0060	<0.0059	<0.0061	<0.0054	<0.0062	<0.0062	<0.0055	<0.0066	<0.0066
1,1-Dichloroethene	25 {nc}	110 {nc}	- -	mg/kg	<0.0060	<0.0059	<0.0061	<0.0054	<0.0062	<0.0062	<0.0055	<0.0066	<0.0066
1,2-Dichloroethane	0.45 {ca}	2.2 {ca}	- -	mg/kg	<0.0060	<0.0059	<0.0061	<0.0054	<0.0062	<0.0062	<0.0055	<0.0066	<0.0066
1,2-Dichloropropane	0.93 {ca*}	4.7 {ca*}	- -	mg/kg	<0.0060	<0.0059	<0.0061	<0.0054	<0.0062	<0.0062	<0.0055	<0.0066	<0.0066
2-Butanone	28,000 {sat}	28,000 {sat}	- -	mg/kg	<0.0060	<0.0059	<0.0061	<0.0054	<0.0062	<0.0062	<0.0055	<0.0066	<0.0066
2-Hexanone	- -	- -	- -	mg/kg	<0.0060	<0.0059 L	<0.0061 L	<0.0054 L	<0.0062 L	<0.0062 L	<0.0055 L	<0.0066 L	<0.0066 L
3-Octanone	- -	- -	- -	mg/kg	NA	NA	NA	NA	0.012 J	NA	0.0060 J	NA	0.015 J
4-Methyl-2-pentanone	3,200 {sat}	3,200 {sat}	- -	mg/kg	<0.0060	<0.0059	<0.0061	<0.0054	<0.0062	<0.0062	<0.0055	<0.0066	<0.0066
Acetone	6,100 {nc}	110,000 {sat}	- -	mg/kg	<0.0060	<0.0059	<0.0061	0.011 B	0.033 B	0.022 B	<0.0055	0.045 B	0.16 B
Benzene	1.1 {ca*}	5.6 {ca*}	- -	mg/kg	<0.0060	<0.0059	<0.0061	<0.0054	<0.0062	<0.0062	<0.0055	<0.0066	<0.0066
Bromodichloromethane	10 {ca}	46 {ca}	- -	mg/kg	<0.0060	<0.0059	<0.0061	<0.0054	<0.0062	<0.0062	<0.0055	<0.0066	<0.0066
Bromoform	61 {ca*}	220 {ca*}	- -	mg/kg	<0.0060	<0.0059 L	<0.0061 L	<0.0054 L	<0.0062 L	<0.0062 L	<0.0055 L	<0.0066 L	<0.0066 L
Bromomethane	0.79 {nc}	3.5 {nc}	- -	mg/kg	<0.0060	<0.0059 L	<0.0061 L	<0.0054 L	<0.0062 L	<0.0062 L	<0.0055 L	<0.0066 L	<0.0066 L
Carbon Disulfide	260 {sat}	260 {sat}	- -	mg/kg	<0.0060	<0.0059	<0.0061	<0.0054	<0.0062	<0.0062	<0.0055	<0.0066	<0.0066
Carbon Tetrachloride	0.25 {ca}	1.3 {ca}	- -	mg/kg	<0.0060	<0.0059	<0.0061	<0.0054	<0.0062	<0.0062	<0.0055	<0.0066	<0.0066
Chlorobenzene	31 {nc}	860 {sat}	- -	mg/kg	<0.0060	<0.0059 L	<0.0061 L	<0.0054 L	<0.0062 L	<0.0062 L	<0.0055 L	<0.0066 L	<0.0066 L
Chloroethane	2,200 {sat}	2,200 {sat}	- -	mg/kg	<0.0060	<0.0059	<0.0061	<0.0054	<0.0062	<0.0062	<0.0055	<0.0066	<0.0066
Chloroform	0.3 {ca}	1.5 {ca}	- -	mg/kg	<0.0060	<0.0059	<0.0061	<0.0054	<0.0062	<0.0062	<0.0055	<0.0066	<0.0066
Chloromethane	1.7 {ca*}	8.4 {ca*}	- -	mg/kg	<0.0060	<0.0059 L	<0.0061 L	<0.0054 L	<0.0062 L	<0.0062 L	<0.0055 L	<0.0066 L	<0.0066 L
cis-1,2-Dichloroethene	78 {nc}	1,400 {sat}	- -	mg/kg	<0.0060	<0.0059	<0.0061	<0.0054	<0.0062	<0.0062	<0.0055	<0.0066	<0.0066
cis-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.0060	<0.0059	<0.0061	<0.0054	<0.0062	<0.0062	<0.0055	<0.0066	<0.0066
Dibromochloromethane	5.8 {ca}	21 {ca}	- -	mg/kg	<0.0060	<0.0059	<0.0061	<0.0054	<0.0062	<0.0062	<0.0055	<0.0066	<0.0066
d-Limonene	- -	- -	- -	mg/kg	NA	NA	NA	0.037 J	0.084 J	NA	NA	NA	NA
Ethylbenzene	5.7 {ca}	29 {ca}	- -	mg/kg	<0.0060	<0.0059 L	<0.0061 L	<0.0054 L	<0.0062 L	<0.0062 L	<0.0055 L	<0.0066 L	<0.0066 L
m,p-Xylene	- -	- -	- -	mg/kg	<0.012	<0.012 L	<0.012 L	<0.011 L	<0.012 L	<0.012 L	<0.011 L	<0.013 L	<0.013 L
Methylene Chloride	11 {ca}	54 {ca}	- -	mg/kg	<0.0060	<0.0059	<0.0061	<0.0054	<0.0062	<0.0062	<0.0055	<0.0066	<0.0066
Naphthalene	15 {nc}	67 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA
o-Xylene	300 {sat}	300 {sat}	- -	mg/kg	<0.0060	<0.0059 L	<0.0061 L	<0.0054 L	<0.0062 L	<0.0062 L	<0.0055 L	<0.0066 L	<0.0066 L
Styrene	1,000 {sat}	1,000 {sat}	- -	mg/kg	<0.0060	<0.0059 L	<0.0061 L	<0.0054 L	<0.0062 L	<0.0062 L	<0.0055 L	<0.0066 L	<0.0066 L
Tetrachloroethene	0.57 {ca}	2.7 {ca}	- -	mg/kg	<0.0060	<0.0059 L	<0.0061 L	<0.0054 L	<0.0062 L	<0.0062 L	<0.0055 L	<0.0066 L	<0.0066 L
Toluene	930 {sat}	930 {sat}	- -	mg/kg	<0.0060	<0.0059 L	<0.0061 L	<0.0054 L	<0.0062 L	<0.0062 L	<0.0055 L	<0.0066 L	<0.0066 L
trans-1,2-Dichloroethene	11 {nc}	50 {nc}	- -	mg/kg	<0.0060	<0.0059	<0.0061	<0.0054	<0.0062	<0.0062	<0.0055	<0.0066	<0.0066
trans-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.0060	<0.0059	<0.0061	<0.0054	<0.0062	<0.0062	<0.0055	<0.0066	<0.0066
Trichloroethene	2.8 {ca}	14 {ca}	- -	mg/kg	<0.0060	<0.0059	<0.0061	<0.0054	<0.0062	<0.0062	<0.0055	<0.0066	<0.0066
Vinyl Chloride	0.06 {ca}	1.7 {ca}	- -	mg/kg	<0.0060	<0.0059	<0.0061	<0.0054	<0.0062	<0.0062	<0.0055	<0.0066	<0.0066
Xylenes (total)	300 {sat}	300 {sat}	- -	mg/kg	<0.012	<0.012	<0.012	<0.011	<0.012	<0.012	<0.011	<0.013	<0.013
Semivolatile Organics													
1,2,4-Trichlorobenzene	180 {ca**}	220 {sat}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
1,2-Dichlorobenzene	220 {sat}	220 {sat}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
1,2-Diphenylhydrazine	0.61 {ca**}	2.2 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
1,4-Dichlorobenzene	2.6 {ca}	13 {ca}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
1-Methylnaphthalene	22 {ca*}	99 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	610 {nc}	6,200 {nc}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
2,4,6-Trichlorophenol	44 {ca**}	160 {ca**}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
2,4-Dichlorophenol	18 {nc}	180 {nc}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
2,4-Dimethylphenol	120 {nc}	1,200 {nc}	- -	mg/kg	<0.21 L	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
2,4-Dinitrophenol	12 {nc}	120 {nc}	- -	mg/kg	<1.0	<2.2	<1.0	<2.0	<1.0	<8.2	<0.91	<1.0	<1.0
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
2-Chloronaphthalene	210 {sat}	210 {sat}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
2-Chlorophenol	39 {nc}	510 {nc}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	0.014 J	<0.44	<0.21	0.059 J	<0.21	0.22 J	<0.19	0.32	0.0095 J
2-Methylphenol	310 {nc}	3,100 {nc}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
2-Nitroaniline	- -	- -	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
2-Nitrophenol	- -	- -	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
3,3'-Dichlorobenzidine	1.1 {ca**}	3.8 {ca**}	- -	mg/kg	<0.21	<0.44 J	<0.21 J	<0.41	<0.21 J	<1.7	<0.19 J	<0.21 J	<0.20 J
3-Nitroaniline	- -	- -	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
4,6-Dinitro-2-methylphenol	- -	- -	- -	mg/kg	<1.0	<2.2	<1.0	<2.0	<1.0	<8.2	<0.91	<1.0	<1.0
4-Bromophenyl-phenylether	- -	- -	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
4-Chloro-3-Methylphenol	- -	- -	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
4-Chloroaniline	24 {nc}	250 {nc}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
4-Chlorophenyl-phenylether	- -	- -	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
4-Methylphenol	31 {nc}	310 {nc}	- -	mg/kg	<0.21 L	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
4-Nitroaniline	- -	- -	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
4-Nitrophenol	- -	- -	- -	mg/kg	<1.0	<2.2	<1.0	<2.0	<1.0	<8.2	<0.91	<1.0	<1.0
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	1.0 J	<0.19	<0.21	<0.20
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	0.061 J	<0.19	<0.21	<0.20
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	2.1	0.032 J	0.014 J	<0.20
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.21	0.051 J	0.016 J	0.046 J	<0.21	6.9	0.25 J	0.064 J	0.020 J
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.21	0.042 J	0.018 J	<0.41	<0.21	5.9	0.24 J	0.047 J	0.023 J
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.21	0.072 J	0.040 J	<0.41	<0.21	11	0.37 J	0.096 J	0.053 J
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	<0.21	0.12 J	<0.21	<0.41	<0.21	3.5	0.24 J	0.062 J	0.042 J
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	<0.21	0.023 J	0.011 J	<0.41	<0.21	2.6	0.099 J	0.028 J	0.021 J
Benzoic Acid	240,000 {max}	2,500,000 {max}	- -	mg/kg	<1.0	<2.2	<1.0	<2.0	0.17 B	<8.2	0.13 B	0.17 B	0.16 B
Benzyl Alcohol	3,100 {nc}	310,000 {max}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20

Notes found at end of table.

Table 7-8. Sediment Analytical Results, Igniter Assembly Area, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	IASD04 0 - 0.5 06/18/02	IASD05 0 - 0.5 06/19/02	IASD06 0 - 0.5 06/19/02	IASD07 0 - 0.5 06/19/02	IASD08 0 - 0.5 06/19/02	IASD09 0 - 0.5 06/19/02	IASD10 0 - 0.5 06/19/02	IASD11 0 - 0.5 06/19/02	IASD12 0 - 0.5 06/19/02
Semivolatile Organics													
bis(2-Chloroethoxy)methane	18 {nc}	180 {nc}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
bis(2-Chloroethyl)ether	0.19 {ca**}	0.9 {ca**}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
bis(2-Chloroisopropyl)ether	- -	- -	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
bis(2-Ethylhexyl)phthalate	35 {ca*}	120 {ca*}	- -	mg/kg	0.26 B	1.2 B	0.30 B	0.96 B	0.53 B	0.90 B	0.46 B	0.52 B	0.34 B
Butylbenzylphthalate	1,200 {nc}	120,000 {max}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19 J	<0.21	<0.20
Carbazole	24 {ca**}	86 {ca**}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	2.4	0.032 J	0.016 J	<0.20
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	<0.21	0.070 J	0.034 J	0.028 J	<0.21	7.7	0.30 J	0.10 J	0.049 J
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	0.97 J	0.058 J	<0.21	<0.20
Dibenzofuran	- -	- -	- -	mg/kg	<0.21	<0.44	<0.21	0.018 J	<0.21	0.74 J	<0.19	0.11 J	<0.20
Diethylphthalate	4,900 {nc}	490,000 {max}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
Dimethylphthalate	- -	- -	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
Di-n-Butylphthalate	610 {nc}	6,200 {nc}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
Di-n-Octylphthalate	- -	- -	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19 J	<0.21	<0.20
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	0.019 J	0.10 J	0.042 J	0.039 J	0.0092 J	22 J	0.52 J	0.12 J	0.049 J
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	1.3 J	0.011 J	<0.21	<0.20
Hexachlorobenzene	0.3 {ca}	1.1 {ca}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
Hexachlorobutadiene	6.2 {ca**}	22 {ca*}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
Hexachlorocyclopentadiene	37 {nc}	370 {nc}	- -	mg/kg	<0.21	<0.44 L	<0.21 L	<0.41 L	<0.21 L	<1.7 L	<0.19 L	<0.21 L	<0.20 L
Hexachloroethane	35 {ca**}	120 {ca**}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.21	0.060 J	<0.21	<0.41	<0.21	4.2	0.25 J	0.043 J	0.034 J
Isophorone	510 {ca*}	1,800 {ca*}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
Naphthalene	3.9 {ca}	20 {ca}	- -	mg/kg	0.010 J	<0.44	<0.21	0.043 J	<0.21	0.75 J	0.0081 J	0.17 J	<0.20
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
N-Nitroso-di-n-propylamine	0.069 {ca**}	0.25 {ca**}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
N-Nitrosodiphenylamine	99 {ca**}	350 {ca**}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
Pentachlorophenol	3 {ca}	9 {ca}	- -	mg/kg	<1.0	<2.2	<1.0	<2.0	<1.0	<8.2	<0.91	<1.0	<1.0
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.014 J	0.051 J	0.023 J	0.053 J	<0.21 J	16 J	0.24 J	0.28 J	0.022 J
Phenol	1,800 {nc}	180,000 {max}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	0.026 J	0.078 J	0.035 J	0.059 J	0.0088 J	16	0.47 J	0.11 J	0.045 J
Pyridine	7.8 {nc}	100 {nc}	- -	mg/kg	<0.21	<0.44	<0.21	<0.41	<0.21	<1.7	<0.19	<0.21	<0.20
Inorganics													
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	31,400	21,900 J	20,700 J	12,400 J	17,200 J	22,800 J	17,500 J	16,400 J	19,800 J
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	0.320 B	0.340 B	0.340 B	0.590 B	<0.610 L	<0.620 L	<0.540 L	<0.600 L	0.250 B
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	7.94 J	7.56 L	6.93 L	6.20 L	9.43 L	10.5 L	6.21 L	6.60 L	9.10 L
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	38.4	34.1	41.7	31.4	18.6	57.3	36.8	37.5	36.9
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	0.390 B	0.590 B	0.390 B	0.650 K	0.460 B	0.430 B	0.500 B	0.650 K	0.650 K
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	0.0800 J	0.260	0.270	0.380	<0.120	**2.54**	0.0800 J	<0.120	0.200
Calcium	- -	- -	- -	mg/kg	24,400 J	3,330 J	40,400 J	118,000 J	1,580 J	3,200 J	2,420 J	1,150 J	4,950 J
Chromium	280 {ca**}	1,400 {ca**}	65.3	mg/kg	36.4 J	39.9	28.4	23.5	31.2	40.4	28.5	31.2	39.0
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	3.90 J	14.8 J	7.69 J	5.90 J	3.50 J	6.48 J	6.99 J	15.1 J	34.5 J
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	16.7 L	31.2	18.8	10.8	14.8	27.9	16.4	30.6	32.1
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	29,600 J	42,600 J	24,100 J	15,000 J	30,800 J	37,900 J	24,700 J	30,400 J	30,600 J
Lead	400 {++}	800 {++}	26.8	mg/kg	24.6	**58.9 J**	**884**	**46.4 J**	19.7	**61.8 J**	22.9 J	**53.0 J**	**643 J**
Magnesium	- -	- -	- -	mg/kg	14,400 J	2,400	30,300	77,100	743	1,400	1,320	1,420	2,630
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	102 J	337 J	217 J	107 J	69.3 J	302 J	156 J	255 J	569 J
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	0.0900	0.0600 L	0.0500 L	0.0700 L	0.0500 L	0.0500 L	0.0300 L	0.0500 L	0.0500 L
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	12.7	18.8	13.2	9.25	7.93	14.2	13.0	16.5	19.7
Potassium	- -	- -	- -	mg/kg	836	542	2,800	740	388	658	534	651	817
Selenium	39 {nc}	510 {nc}	- -	mg/kg	<1.21 L	<1.30 L	<1.21 L	<1.20 L	<1.23 L	<1.24 L	<1.09 L	<1.21 L	0.410 L
Silver	39 {nc}	510 {nc}	- -	mg/kg	<1.21	<1.30	<1.21	<1.20	<1.23	<1.24	<1.09	<1.21	<1.20
Sodium	- -	- -	- -	mg/kg	61.9	13.0 B	75.5	173	7.50 B	17.0 B	12.0 B	17.0 B	14.0 B
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	0.140 J	0.270 B	0.280 J	0.220 B	0.220 B	0.200 B	0.210 B	0.220 B	0.270 B
Vanadium	55 {nc}	720 {nc}	108	mg/kg	54.3 J	71.6	46.8	34.9	56.5	76.3	48.0	50.8	49.8
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	49.8 J	171 J	57.5 J	52.0 J	22.7 J	**1,110 J**	55.7 J	99.6 J	**459 J**
Miscellaneous													
pH	- -	- -	- -	pH Units	NA	NA	NA	NA	NA	NA	NA	NA	7.2 J
Total Organic Carbon	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	15,500

mg/kg	Milligrams per kilogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 7-9. Soil Analytical Results, Igniter Assembly Area, 2005 Shaw Soil Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values- Residential [a]	Adjusted Soil Screening Values- Industrial [a]	Units	BPASS01 0 - 0.5 01/26/05	BPASS02 0 - 0.5 01/26/05	BPASS03 0 - 0.5 01/26/05	IASS06 0 - 0.5 01/26/05	IASS07 0 - 0.5 01/26/05	IASS08 0 - 0.5 01/26/05	IASS09 0 - 0.5 01/26/05	IASS10 0 - 0.5 01/26/05	IASS11 0 - 0.5 01/26/05
Sample Components												
Acid Soluble	--	--	%	0.8	0.4	0.3	20	5.7	0.9	13.4	15.5	5.9
Organics	--	--	%	7.3	6.5	6.1	25.1	20.3	6.3	12.5	9.7	9.2
Other	--	--	%	91.2	91.2	93.6	49.4	66.6	92.7	66.7	59.9	83.2
Asbestos												
Actinolite	--	--	%	<0	<0	<0	<0	<0	<0	<0	<0	<0
Amosite	--	--	%	<0	<0	<0	<0	<0	<0	<0	<0	<0
Anthophyllite	--	--	%	<0	<0	<0	<0	<0	<0	<0	<0	<0
Chrysotile	--	--	%	0.8	1.9	<0	5.5	7.4	0.1	7.4	15	1.7
Crocidolite	--	--	%	<0	<0	<0	<0	<0	<0	<0	<0	<0
Tremolite	--	--	%	<0	<0	<0	<0	<0	<0	<0	<0	<0
Total Asbestos	--	--	%	0.8	1.9	<0	5.5	7.4	0.1	7.4	15	1.7

[a] USEPA Regional Screening Levels (USEPA 2008a).
% Percentage composition.

Table 7-10. Conductive Flooring and Building Materials Analytical Results, Igniter Assembly Area, 2005 Shaw Soil Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Sample Name: Sample Matrix: Sample Type/Paint Color: Distance from Building (in): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Units	BPADF01 Flooring Deteriorated - 01/26/05	BPAIF01 Flooring Intact - 01/26/05	BPAW01 Wipe - - 01/26/05	IADF01 Flooring Deteriorated - 01/26/05	IADF02 Flooring Deteriorated - 01/26/05	IAIF01 Flooring Intact - 01/26/05	IAIF02 Flooring Intact - 01/26/05	IAWM01 Wall Intact - 01/26/05	IAW01 Wipe - - 01/26/05	IAW02 Wipe - - 01/26/05	IAPC01 Paint Gray - 01/26/05	IAPC02 Paint Light Blue/Green - 01/26/05	IAPC03 Paint Desert Sand - 01/26/05
Sample Components																
Acid Soluble	--	--	%	36.7	21.3	NA	26.3	31.1	24.8	30.1	68.4	NA	NA	NA	NA	NA
Organics	--	--	%	34.7	33.2	NA	20.4	28.2	23.2	22.4	4.3	NA	NA	NA	NA	NA
Other	--	--	%	21.4	31.8	NA	37.3	30.5	6.4	23.7	27.3	NA	NA	NA	NA	NA
Asbestos																
Actinolite	--	--	%	0.0	0.0	NA	0.0	0.0	0.0	0.0	0.0	NA	NA	NA	NA	NA
Amosite	--	--	%	0.0	0.0	NA	0.0	0.0	0.0	0.0	0.0	NA	NA	NA	NA	NA
Anthophyllite	--	--	%	0.0	0.0	NA	0.0	0.0	0.0	0.0	0.0	NA	NA	NA	NA	NA
Chrysotile	--	--	%	7.1	13.6	NA	16.0	10.2	15.6	23.7	0.0	NA	NA	NA	NA	NA
Crocidolite	--	--	%	0.0	0.0	NA	0.0	0.0	0.0	0.0	0.0	NA	NA	NA	NA	NA
Tremolite	--	--	%	0.0	0.0	NA	0.0	0.0	0.0	0.0	0.0	NA	NA	NA	NA	NA
Total Asbestos	--	--	%	7.1	13.6	NA	16.0	10.2	15.6	23.7	0.0	NA	NA	NA	NA	NA
Total Asbestos	--	--	s/cm^2	NA	NA	11,500,000	NA	NA	NA	NA	NA	1,090,000	9,820,000	NA	NA	NA
Inorganics																
Lead	400 {++}	800 {++}	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,100	37,200	49,500

[a]	USEPA Regional Screening Levels (USEPA 2008a).
in	Inches.
%	Percent composition
s/cm^2	Structures per square centimeter.
mg/kg	Milligrams per kilogram.
NA	Not Analyzed.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).

Table 7-11. XRF Screening Results for Soil, Sediment, and Conductive Flooring, Igniter Assembly Area, 2008 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID	Sample Depth (ft)	Date Collected	Distance From Building (ft)	Lead Result
			Adjusted Soil Screening Values-Residential [a]:	400 {++}
			Adjusted Soil Screening Values-Industrial [a]:	800 {++}
			Facility-Wide Background Values [b]:	26.8
			Units:	mg/kg
Building 8102-1				
IAA-R60A	0 - 0.5	07/31/08	1	**268**
IAA-R60B	0 - 0.5	07/31/08	5	25
IAA-R60C	0 - 0.5	07/31/08	10	22
IAA-R61A	0 - 0.5	07/31/08	1	**52**
IAA-R61B	0 - 0.5	07/31/08	5	25
IAA-R61C	0 - 0.5	07/31/08	10	**45**
IAA-R62A	0 - 0.5	07/31/08	1	**55**
IAA-R62B	0 - 0.5	07/31/08	5	**38**
IAA-R62C	0 - 0.5	07/31/08	10	**41**
IAA-R63A	0 - 0.5	07/31/08	1	**58**
IAA-R63B	0 - 0.5	07/31/08	5	**91**
IAA-R63C	0 - 0.5	07/31/08	10	**62**
IAA-R64A	0 - 0.5	07/31/08	1	**105**
IAA-R64B	0 - 0.5	07/31/08	5	**36**
IAA-R64C	0 - 0.5	07/31/08	10	**35**
IAA-R65A	0 - 0.5	07/31/08	1	**291**
IAA-R65B	0 - 0.5	07/31/08	5	**42**
IAA-R65C	0 - 0.5	07/31/08	10	16
IAA-R66A	0 - 0.5	07/31/08	1	**269**
IAA-R66B	0 - 0.5	07/31/08	5	**119**
IAA-R66C	0 - 0.5	07/31/08	10	**49**
IAA-R67A	0 - 0.5	07/31/08	1	**135**
IAA-R67B	0 - 0.5	07/31/08	5	**75**
IAA-R67C	0 - 0.5	07/31/08	10	**34**
IAA-R68A	0 - 0.5	07/31/08	1	**31**
IAA-R68B	0 - 0.5	07/31/08	5	**57**
IAA-R68C	0 - 0.5	07/31/08	10	**31**
IAA-R69A	0 - 0.5	07/31/08	1	19
IAA-R69B	0 - 0.5	07/31/08	5	**53**
IAA-R69C	0 - 0.5	07/31/08	10	**32**
Building 8102-2				
IAA-R52A	0 - 0.5	07/30/08	1	**201**
IAA-R52B	0 - 0.5	07/30/08	5	**157**
IAA-R52C	0 - 0.5	07/30/08	10	21
IAA-R53A	0 - 0.5	07/30/08	1	**102**
IAA-R53B	0 - 0.5	07/30/08	5	**56**
IAA-R53C	0 - 0.5	07/30/08	10	**54**
IAA-R54A	0 - 0.5	07/30/08	1	**167**
IAA-R54B	0 - 0.5	07/30/08	5	**167**
IAA-R54C	0 - 0.5	07/30/08	10	25
IAA-R55A	0 - 0.5	07/30/08	1	**37**
IAA-R55B	0 - 0.5	07/30/08	5	14
IAA-R55C	0 - 0.5	07/30/08	10	18
IAA-R56A	0 - 0.5	07/30/08	1	**109**
IAA-R56B	0 - 0.5	07/30/08	5	**32**
IAA-R56C	0 - 0.5	07/30/08	10	21
IAA-R57A	0 - 0.5	07/30/08	1	**59**
IAA-R57B	0 - 0.5	07/30/08	5	**73**
IAA-R57C	0 - 0.5	07/30/08	10	**53**
IAA-R58A	0 - 0.5	07/30/08	1	**277**
IAA-R58B	0 - 0.5	07/30/08	5	**79**
IAA-R58C	0 - 0.5	07/30/08	10	**33**
IAA-R59A	0 - 0.5	07/30/08	1	**194**
IAA-R59B	0 - 0.5	07/30/08	5	**93**
IAA-R59C	0 - 0.5	07/30/08	10	**56**

Notes found at end of table.

Table 7-11. XRF Screening Results for Soil, Sediment, and Conductive Flooring, Igniter Assembly Area, 2008 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID	Sample Depth (ft)	Date Collected	Distance From Building (ft)	Lead Result
			Adjusted Soil Screening Values-Residential [a]:	400 {++}
			Adjusted Soil Screening Values-Industrial [a]:	800 {++}
			Facility-Wide Background Values [b]:	26.8
			Units:	mg/kg
		Building 8102-3		
IAA-R44A	0 - 0.5	07/30/08	1	**71**
IAA-R44B	0 - 0.5	07/30/08	5	**94**
IAA-R44C	0 - 0.5	07/30/08	10	18
IAA-R45A	0 - 0.5	07/30/08	1	**1,156**
IAA-R45B	0 - 0.5	07/30/08	5	**56**
IAA-R45C	0 - 0.5	07/30/08	10	**73**
IAA-R46A	0 - 0.5	07/30/08	1	**1,340**
IAA-R46B	0 - 0.5	07/30/08	5	**248**
IAA-R46C	0 - 0.5	07/30/08	10	12
IAA-R47A	0 - 0.5	07/30/08	1	**134**
IAA-R47B	0 - 0.5	07/30/08	5	**54**
IAA-R47C	0 - 0.5	07/30/08	10	**41**
IAA-R48A	0 - 0.5	07/30/08	1	**123**
IAA-R48B	0 - 0.5	07/30/08	5	**90**
IAA-R48C	0 - 0.5	07/30/08	10	**43**
IAA-R49A	0 - 0.5	07/30/08	1	**286**
IAA-R49B	0 - 0.5	07/30/08	5	**62**
IAA-R49C	0 - 0.5	07/30/08	10	**45**
IAA-R50A	0 - 0.5	07/30/08	1	**109**
IAA-R50B	0 - 0.5	07/30/08	5	**27**
IAA-R50C	0 - 0.5	07/30/08	10	**54**
IAA-R51A	0 - 0.5	07/30/08	1	**970**
IAA-R51B	0 - 0.5	07/30/08	5	**57**
IAA-R51C	0 - 0.5	07/30/08	10	**40**
		Building 8102-4		
IAA-R36A	0 - 0.5	07/30/08	1	26
IAA-R36B	0 - 0.5	07/30/08	5	16
IAA-R36C	0 - 0.5	07/30/08	10	**29**
IAA-R37A	0 - 0.5	07/30/08	1	**187**
IAA-R37B	0 - 0.5	07/30/08	5	**50**
IAA-R37C	0 - 0.5	07/30/08	10	**36**
IAA-R38A	0 - 0.5	07/30/08	1	**487**
IAA-R38B	0 - 0.5	07/30/08	5	**159**
IAA-R38C	0 - 0.5	07/30/08	10	**53**
IAA-R39A	0 - 0.5	07/30/08	1	**1,185**
IAA-R39B	0 - 0.5	07/30/08	5	**101**
IAA-R39C	0 - 0.5	07/30/08	10	**60**
IAA-R40A	0 - 0.5	07/30/08	1	**152**
IAA-R40B	0 - 0.5	07/30/08	5	**87**
IAA-R40C	0 - 0.5	07/30/08	10	**98**
IAA-R41A	0 - 0.5	07/30/08	1	**85**
IAA-R41B	0 - 0.5	07/30/08	5	**55**
IAA-R41C	0 - 0.5	07/30/08	10	**57**
IAA-R42A	0 - 0.5	07/30/08	1	**299**
IAA-R42B	0 - 0.5	07/30/08	5	**123**
IAA-R42C	0 - 0.5	07/30/08	10	**59**
IAA-R43A	0 - 0.5	07/30/08	1	**58**
IAA-R43B	0 - 0.5	07/30/08	5	**88**
IAA-R43C	0 - 0.5	07/30/08	10	**80**

Notes found at end of table.

Table 7-11. XRF Screening Results for Soil, Sediment, and Conductive Flooring, Igniter Assembly Area, 2008 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID	Sample Depth (ft)	Date Collected	Distance From Building (ft)	Lead Result
			Adjusted Soil Screening Values-Residential [a]:	400 {++}
			Adjusted Soil Screening Values-Industrial [a]:	800 {++}
			Facility-Wide Background Values [b]:	26.8
			Units:	mg/kg
Building 8102-5				
IAA-R28A	0 - 0.5	07/30/08	1	**380**
IAA-R28B	0 - 0.5	07/30/08	5	**98**
IAA-R28C	0 - 0.5	07/30/08	10	15
IAA-R29A	0 - 0.5	07/30/08	1	**159**
IAA-R29B	0 - 0.5	07/30/08	5	**68**
IAA-R29C	0 - 0.5	07/30/08	10	**54**
IAA-R30A	0 - 0.5	07/30/08	1	**201**
IAA-R30B	0 - 0.5	07/30/08	5	**53**
IAA-R30C	0 - 0.5	07/30/08	10	**53**
IAA-R31A	0 - 0.5	07/30/08	1	**290**
IAA-R31B	0 - 0.5	07/30/08	5	**38**
IAA-R31C	0 - 0.5	07/30/08	10	**36**
IAA-R32A	0 - 0.5	07/30/08	1	**338**
IAA-R32B	0 - 0.5	07/30/08	5	**48**
IAA-R32C	0 - 0.5	07/30/08	10	**59**
IAA-R33A	0 - 0.5	07/30/08	1	**164**
IAA-R33B	0 - 0.5	07/30/08	5	**38**
IAA-R33C	0 - 0.5	07/30/08	10	10
IAA-R34A	0 - 0.5	07/30/08	1	**154**
IAA-R34B	0 - 0.5	07/30/08	5	**132**
IAA-R34C	0 - 0.5	07/30/08	10	**35**
IAA-R35A	0 - 0.5	07/30/08	1	**201**
IAA-R35B	0 - 0.5	07/30/08	5	**101**
IAA-R35C	0 - 0.5	07/30/08	10	**58**
Building 8102-6				
IAA-R20A	0 - 0.5	07/30/08	1	**125**
IAA-R20B	0 - 0.5	07/30/08	5	**36**
IAA-R20C	0 - 0.5	07/30/08	10	13
IAA-R21A	0 - 0.5	07/30/08	1	21
IAA-R21B	0 - 0.5	07/30/08	5	**120**
IAA-R21C	0 - 0.5	07/30/08	10	**38**
IAA-R22A	0 - 0.5	07/30/08	1	**92**
IAA-R22B	0 - 0.5	07/30/08	5	**124**
IAA-R22C	0 - 0.5	07/30/08	10	**30**
IAA-R23A	0 - 0.5	07/30/08	1	**74**
IAA-R23B	0 - 0.5	07/30/08	5	**35**
IAA-R23C	0 - 0.5	07/30/08	10	**44**
IAA-R24A	0 - 0.5	07/30/08	1	**150**
IAA-R24B	0 - 0.5	07/30/08	5	**45**
IAA-R24C	0 - 0.5	07/30/08	10	**58**
IAA-R25A	0 - 0.5	07/30/08	1	**114**
IAA-R25B	0 - 0.5	07/30/08	5	**169**
IAA-R25C	0 - 0.5	07/30/08	10	**45**
IAA-R26A	0 - 0.5	07/30/08	1	**85**
IAA-R26B	0 - 0.5	07/30/08	5	**70**
IAA-R26C	0 - 0.5	07/30/08	10	**33**
IAA-R27A	0 - 0.5	07/30/08	1	**54**
IAA-R27B	0 - 0.5	07/30/08	5	**79**
IAA-R27C	0 - 0.5	07/30/08	10	**68**

Notes found at end of table.

Table 7-11. XRF Screening Results for Soil, Sediment, and Conductive Flooring, Igniter Assembly Area, 2008 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID	Sample Depth (ft)	Date Collected	Distance From Building (ft)	Lead Result
			Adjusted Soil Screening Values-Residential [a]:	400 {++}
			Adjusted Soil Screening Values-Industrial [a]:	800 {++}
			Facility-Wide Background Values [b]:	26.8
			Units:	mg/kg
		Building 8102-7		
IAA-R12A	0 - 0.5	07/29/08	1	**55**
IAA-R12B	0 - 0.5	07/29/08	5	**53**
IAA-R12C	0 - 0.5	07/29/08	10	**31**
IAA-R13A	0 - 0.5	07/29/08	1	**40**
IAA-R13B	0 - 0.5	07/29/08	5	**30**
IAA-R13C	0 - 0.5	07/29/08	10	26
IAA-R14A	0 - 0.5	07/29/08	1	**116**
IAA-R14B	0 - 0.5	07/29/08	5	**123**
IAA-R14C	0 - 0.5	07/29/08	10	**42**
IAA-R15A	0 - 0.5	07/29/08	1	**317**
IAA-R15B	0 - 0.5	07/29/08	5	**54**
IAA-R15C	0 - 0.5	07/29/08	10	**38**
IAA-R16A	0 - 0.5	07/29/08	1	**192**
IAA-R16B	0 - 0.5	07/29/08	5	**61**
IAA-R16C	0 - 0.5	07/29/08	10	**29**
IAA-R17A	0 - 0.5	07/30/08	1	**176**
IAA-R17B	0 - 0.5	07/30/08	5	**96**
IAA-R17C	0 - 0.5	07/30/08	10	**74**
IAA-R18A	0 - 0.5	07/30/08	1	**194**
IAA-R18B	0 - 0.5	07/30/08	5	**96**
IAA-R18C	0 - 0.5	07/30/08	10	**47**
IAA-R19A	0 - 0.5	07/30/08	1	**125**
IAA-R19B	0 - 0.5	07/30/08	5	**54**
IAA-R19C	0 - 0.5	07/30/08	10	**28**
		Building 8102-8		
IAA-R1A	0 - 0.5	07/29/08	1	**348**
IAA-R1B	0 - 0.5	07/29/08	5	**201**
IAA-R1C	0 - 0.5	07/29/08	10	13
IAA-R2A	0 - 0.5	07/29/08	1	**146**
IAA-R2B	0 - 0.5	07/29/08	5	**28**
IAA-R2C	0 - 0.5	07/29/08	10	13
IAA-R3A	0 - 0.5	07/29/08	1	**139**
IAA-R3B	0 - 0.5	07/29/08	5	**62**
IAA-R3C	0 - 0.5	07/29/08	10	**55**
IAA-R4A	0 - 0.5	07/29/08	1	20
IAA-R4B	0 - 0.5	07/29/08	5	**107**
IAA-R4C	0 - 0.5	07/29/08	10	**47**
IAA-R5A	0 - 0.5	07/29/08	1	**41**
IAA-R5B	0 - 0.5	07/29/08	5	**34**
IAA-R5C	0 - 0.5	07/29/08	10	**105**
IAA-R6A	0 - 0.5	07/29/08	1	**55**
IAA-R6B	0 - 0.5	07/29/08	5	**72**
IAA-R6C	0 - 0.5	07/29/08	10	**32**
IAA-R7A	0 - 0.5	07/29/08	1	**76**
IAA-R7B	0 - 0.5	07/29/08	5	24
IAA-R7C	0 - 0.5	07/29/08	10	**35**
IAA-R8A	0 - 0.5	07/29/08	1	**306**
IAA-R8B	0 - 0.5	07/29/08	5	**81**
IAA-R8C	0 - 0.5	07/29/08	10	**67**
IAA-R9A	0 - 0.5	07/29/08	1	**162**
IAA-R9B	0 - 0.5	07/29/08	5	9
IAA-R9C	0 - 0.5	07/29/08	10	**43**
IAA-R10A	0 - 0.5	07/29/08	1	**201**
IAA-R10B	0 - 0.5	07/29/08	5	**55**
IAA-R10C	0 - 0.5	07/29/08	10	**32**
IAA-R11A	0 - 0.5	07/29/08	1	**76**
IAA-R11B	0 - 0.5	07/29/08	5	**43**
IAA-R11C	0 - 0.5	07/29/08	10	**54**

Notes found at end of table.

Table 7-11. XRF Screening Results for Soil, Sediment, and Conductive Flooring, Igniter Assembly Area, 2008 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID	Sample Depth (ft)	Date Collected	Distance From Building (ft)	Lead Result
			Adjusted Soil Screening Values-Residential [a]:	400 {++}
			Adjusted Soil Screening Values-Industrial [a]:	800 {++}
			Facility-Wide Background Values [b]:	26.8
			Units:	mg/kg
Building 528				
IAA-R70A	0 - 0.5	07/31/08	1	**34**
IAA-R70B	0 - 0.5	07/31/08	5	**31**
IAA-R70C	0 - 0.5	07/31/08	10	**27**
IAA-R71A	0 - 0.5	07/31/08	1	19
IAA-R71B	0 - 0.5	07/31/08	5	**35**
IAA-R71C	0 - 0.5	07/31/08	10	21
IAA-R72A	0 - 0.5	07/31/08	1	**66**
IAA-R72B	0 - 0.5	07/31/08	5	**180**
IAA-R72C	0 - 0.5	07/31/08	10	11
IAA-R73A	0 - 0.5	07/31/08	1	**34**
IAA-R73B	0 - 0.5	07/31/08	5	**38**
IAA-R73C	0 - 0.5	07/31/08	10	24
Building 529				
IAA-R74A	0 - 0.5	07/31/08	1	26
IAA-R74B	0 - 0.5	07/31/08	5	14
IAA-R74C	0 - 0.5	07/31/08	10	26
IAA-R75A	0 - 0.5	07/31/08	1	20
IAA-R75B	0 - 0.5	07/31/08	5	26
IAA-R75C	0 - 0.5	07/31/08	10	**45**
IAA-R76A	0 - 0.5	07/31/08	1	**37**
IAA-R76B	0 - 0.5	07/31/08	5	24
IAA-R76C	0 - 0.5	07/31/08	10	25
IAA-R77A	0 - 0.5	07/31/08	1	**40**
IAA-R77B	0 - 0.5	07/31/08	5	**37**
IAA-R77C	0 - 0.5	07/31/08	10	**29**
Building XXXX				
IAA-R78A	0 - 0.5	07/31/08	1	**30**
IAA-R78B	0 - 0.5	07/31/08	5	**32**
IAA-R78C	0 - 0.5	07/31/08	10	23
IAA-R79A	0 - 0.5	07/31/08	1	**30**
IAA-R79B	0 - 0.5	07/31/08	5	20
IAA-R79C	0 - 0.5	07/31/08	10	13
Building 522				
IAA-R80A	0 - 0.5	07/31/08	1	**476**
IAA-R80B	0 - 0.5	07/31/08	5	**58**
IAA-R80C	0 - 0.5	07/31/08	10	**44**
IAA-R81A	0 - 0.5	07/31/08	1	**405**
IAA-R81B	0 - 0.5	07/31/08	5	**364**
IAA-R81C	0 - 0.5	07/31/08	10	**104**
IAA-R82A	0 - 0.5	07/31/08	1	**717**
IAA-R82B	0 - 0.5	07/31/08	5	**378**
IAA-R82C	0 - 0.5	07/31/08	10	**134**
IAA-R83A	0 - 0.5	07/31/08	1	**2,568**
IAA-R83B	0 - 0.5	07/31/08	5	**290**
IAA-R83C	0 - 0.5	07/31/08	10	**104**
IAA-R84A	0 - 0.5	07/31/08	1	**53**
IAA-R84B	0 - 0.5	07/31/08	5	**53**
IAA-R84C	0 - 0.5	07/31/08	10	**30**
IAA-R85A	0 - 0.5	07/31/08	1	**1,880**
IAA-R85B	0 - 0.5	07/31/08	5	**1,480**
IAA-R85C	0 - 0.5	07/31/08	10	**1,039**
IAA-R85D	0 - 0.5	07/31/08	15	**40**
IAA-R86A	0 - 0.5	07/31/08	1	**725**
IAA-R86B	0 - 0.5	07/31/08	5	**378**
IAA-R86C	0 - 0.5	07/31/08	10	**108**

Notes found at end of table.

Table 7-11. XRF Screening Results for Soil, Sediment, and Conductive Flooring, Igniter Assembly Area, 2008 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID	Sample Depth (ft)	Date Collected	Distance From Building (ft)	Lead Result
			Adjusted Soil Screening Values-Residential [a]:	400 {++}
			Adjusted Soil Screening Values-Industrial [a]:	800 {++}
			Facility-Wide Background Values [b]:	26.8
			Units:	mg/kg
		Building 522A		
IAA-R87A	0 - 0.5	07/31/08	1	**49**
IAA-R87B	0 - 0.5	07/31/08	5	19
IAA-R87C	0 - 0.5	07/31/08	10	**29**
IAA-R88A	0 - 0.5	07/31/08	1	**1,532**
IAA-R88B	0 - 0.5	07/31/08	5	**352**
IAA-R88C	0 - 0.5	07/31/08	10	**133**
IAA-R89A	0 - 0.5	07/31/08	1	**1,414**
IAA-R89B	0 - 0.5	07/31/08	5	**239**
IAA-R89C	0 - 0.5	07/31/08	10	**136**
IAA-R90A	0 - 0.5	07/31/08	1	**1,116**
IAA-R90B	0 - 0.5	07/31/08	5	**416**
IAA-R90C	0 - 0.5	07/31/08	10	**132**
IAA-R91A	0 - 0.5	07/31/08	1	**378**
IAA-R91B	0 - 0.5	07/31/08	5	**267**
IAA-R91C	0 - 0.5	07/31/08	10	**149**
IAA-R92A	0 - 0.5	07/31/08	1	**532**
IAA-R92B	0 - 0.5	07/31/08	5	**397**
IAA-R92C	0 - 0.5	07/31/08	10	**114**
IAA-R93A	0 - 0.5	07/31/08	1	**1,516**
IAA-R93B	0 - 0.5	07/31/08	5	**384**
IAA-R93C	0 - 0.5	07/31/08	10	**52**
		Building 509		
IAA-R94A	0 - 0.5	07/31/08	1	**191**
IAA-R94B	0 - 0.5	07/31/08	5	26
IAA-R94C	0 - 0.5	07/31/08	10	23
IAA-R95A	0 - 0.5	07/31/08	1	**93**
IAA-R95B	0 - 0.5	07/31/08	5	**48**
IAA-R95C	0 - 0.5	07/31/08	10	17
IAA-R96A	0 - 0.5	07/31/08	1	19
IAA-R96B	0 - 0.5	07/31/08	5	**27**
IAA-R96C	0 - 0.5	07/31/08	10	16
IAA-R97A	0 - 0.5	07/31/08	1	**34**
IAA-R97B	0 - 0.5	07/31/08	5	**33**
IAA-R97C	0 - 0.5	07/31/08	10	**57**
		Building 508		
IAA-R98A	0 - 0.5	07/31/08	1	10
IAA-R98B	0 - 0.5	07/31/08	5	16
IAA-R98C	0 - 0.5	07/31/08	10	**38**
IAA-R99A	0 - 0.5	07/31/08	1	**29**
IAA-R99B	0 - 0.5	07/31/08	5	**31**
IAA-R99C	0 - 0.5	07/31/08	10	26
IAA-R100A	0 - 0.5	08/01/08	1	21
IAA-R100B	0 - 0.5	08/01/08	5	**123**
IAA-R100C	0 - 0.5	08/01/08	10	15
IAA-R101A	0 - 0.5	08/01/08	1	**89**
IAA-R101B	0 - 0.5	08/01/08	5	**43**
IAA-R101C	0 - 0.5	08/01/08	10	**85**
		Building YYYY		
IAA-R102A	0 - 0.5	08/01/08	1	**41**
IAA-R102B	0 - 0.5	08/01/08	5	**28**
IAA-R102C	0 - 0.5	08/01/08	10	18
IAA-R103A	0 - 0.5	08/01/08	1	**175**
IAA-R103B	0 - 0.5	08/01/08	5	**42**
IAA-R103C	0 - 0.5	08/01/08	10	**29**

Notes found at end of table.

Table 7-11. XRF Screening Results for Soil, Sediment, and Conductive Flooring, Igniter Assembly Area, 2008 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID	Sample Depth (ft)	Date Collected	Distance From Building (ft)	Lead Result
			Adjusted Soil Screening Values-Residential [a]:	400 {++}
			Adjusted Soil Screening Values-Industrial [a]:	800 {++}
			Facility-Wide Background Values [b]:	26.8
			Units:	mg/kg
		Building 504		
IAA-R104A	0 - 0.5	08/01/08	1	**165**
IAA-R104B	0 - 0.5	08/01/08	5	**98**
IAA-R104C	0 - 0.5	08/01/08	10	**52**
IAA-R105A	0 - 0.5	08/01/08	1	**4,896**
IAA-R105B	0 - 0.5	08/01/08	5	**668**
IAA-R105C	0 - 0.5	08/01/08	10	**477**
IAA-R105D	0 - 0.5	08/01/08	15	**313**
IAA-R106A	0 - 0.5	08/01/08	1	**16,597**
IAA-R106B	0 - 0.5	08/01/08	5	**8,329**
IAA-R106C	0 - 0.5	08/01/08	10	**1,107**
IAA-R106D	0 - 0.5	08/01/08	15	**1,896**
IAA-R107A	0 - 0.5	08/01/08	1	**330**
IAA-R107B	0 - 0.5	08/01/08	5	**107**
IAA-R107C	0 - 0.5	08/01/08	10	**67**
IAA-R108A	0 - 0.5	08/01/08	1	**3,315**
IAA-R108B	0 - 0.5	08/01/08	5	**3,357**
IAA-R108C	0 - 0.5	08/01/08	10	**444**
IAA-R108D	0 - 0.5	08/01/08	15	**230**
IAA-R109A	0 - 0.5	08/01/08	1	**5,583**
IAA-R109B	0 - 0.5	08/01/08	5	**1,355**
IAA-R109C	0 - 0.5	08/01/08	10	**135**
IAA-R110A	0 - 0.5	08/01/08	1	**938**
IAA-R110B	0 - 0.5	08/01/08	5	**857**
IAA-R110C	0 - 0.5	08/01/08	10	**122**
		Building 502		
IAA-R111A	0 - 0.5	08/01/08	1	**30**
IAA-R111B	0 - 0.5	08/01/08	5	**49**
IAA-R111C	0 - 0.5	08/01/08	10	19
IAA-R112A	0 - 0.5	08/01/08	1	**10,280**
IAA-R112B	0 - 0.5	08/01/08	5	**8,530**
IAA-R112C	0 - 0.5	08/01/08	10	**4,657**
IAA-R112D	0 - 0.5	08/01/08	15	**2,121**
IAA-R112E	0 - 0.2	08/01/08	20	**9,500**
IAA-R112E	0.2 - 0.5	08/01/08	20	**15,379**
IAA-R113A	0 - 0.5	08/01/08	1	**2,364**
IAA-R113B	0 - 0.5	08/01/08	5	**3,772**
IAA-R113C	0 - 0.5	08/01/08	10	**1,183**
IAA-R114A	0 - 0.5	08/01/08	1	**50,000**
IAA-R114B	0 - 0.5	08/01/08	5	**1,330**
IAA-R114C	0 - 0.5	08/01/08	10	**860**
IAA-R114D	0 - 0.5	08/01/08	15	**291**
IAA-R115A	0 - 0.5	08/01/08	1	**14,036**
IAA-R115B	0 - 0.5	08/01/08	5	**5,449**
IAA-R115C	0 - 0.5	08/01/08	10	**1,175**
IAA-R116A	0 - 0.5	08/01/08	1	**6,951**
IAA-R116B	0 - 0.5	08/01/08	5	**16,953**
IAA-R116C	0 - 0.5	08/01/08	10	**2,405**
IAA-R117A	0 - 0.5	08/01/08	1	**6,651**
IAA-R117B	0 - 0.5	08/01/08	5	**1,818**
IAA-R117C	0 - 0.5	08/01/08	10	**7,175**

Notes found at end of table.

Table 7-11. XRF Screening Results for Soil, Sediment, and Conductive Flooring, Igniter Assembly Area, 2008 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID	Sample Depth (ft)	Date Collected	Distance From Building (ft)	Lead Result
			Adjusted Soil Screening Values-Residential [a]:	400 {++}
			Adjusted Soil Screening Values-Industrial [a]:	800 {++}
			Facility-Wide Background Values [b]:	26.8
			Units:	mg/kg
Building 4				
IAA-R118A	0 - 0.5	08/01/08	1	**188**
IAA-R118B	0 - 0.5	08/01/08	5	**27**
IAA-R118C	0 - 0.5	08/01/08	10	**40**
IAA-R119A	0 - 0.5	08/01/08	1	**37**
IAA-R119B	0 - 0.5	08/01/08	5	22
IAA-R119C	0 - 0.5	08/01/08	10	**34**
IAA-R120A	0 - 0.5	08/01/08	1	**176**
IAA-R120B	0 - 0.5	08/01/08	5	**29**
IAA-R120C	0 - 0.5	08/01/08	10	**39**
IAA-R121A	0 - 0.5	08/01/08	1	**130**
IAA-R121B	0 - 0.5	08/01/08	5	**200**
IAA-R121C	0 - 0.5	08/01/08	10	23
IAA-R122A	0 - 0.5	08/01/08	1	**65**
IAA-R122B	0 - 0.5	08/01/08	5	**28**
IAA-R122C	0 - 0.5	08/01/08	10	**52**
IAA-R123A	0 - 0.5	08/01/08	1	**588**
IAA-R123B	0 - 0.5	08/01/08	5	21
IAA-R123C	0 - 0.5	08/01/08	10	**27**
Building 5				
IAA-R124A	0 - 0.5	08/01/08	1	**61**
IAA-R124B	0 - 0.5	08/01/08	5	**48**
IAA-R124C	0 - 0.5	08/01/08	10	**50**
IAA-R125A	0 - 0.5	08/01/08	1	**156**
IAA-R125B	0 - 0.5	08/01/08	5	**104**
IAA-R125C	0 - 0.5	08/01/08	10	**341**
IAA-R126A	0 - 0.5	08/01/08	1	**1,046**
IAA-R126B	0 - 0.5	08/01/08	5	**885**
IAA-R126C	0 - 0.5	08/01/08	10	**1,425**
IAA-R126D	0 - 0.5	08/01/08	15	**121**
IAA-R127A	0 - 0.5	08/01/08	1	**186**
IAA-R127B	0 - 0.5	08/01/08	5	**147**
IAA-R127C	0 - 0.5	08/01/08	10	**287**
Building AE (2)				
IAA-R128A	0 - 0.5	08/01/08	1	**137**
IAA-R128B	0 - 0.5	08/01/08	5	**104**
IAA-R129A	0 - 0.5	08/01/08	1	**178**
IAA-R129B	0 - 0.5	08/01/08	5	**57**
IAA-R129C	0 - 0.5	08/01/08	10	**72**
IAA-R130A	0 - 0.5	08/01/08	1	**80**
IAA-R130B	0 - 0.5	08/01/08	5	**76**
IAA-R130C	0 - 0.5	08/01/08	10	**61**
IAA-R131A	0 - 0.5	08/01/08	1	**259**
IAA-R131B	0 - 0.5	08/01/08	5	**114**
IAA-R131C	0 - 0.5	08/01/08	10	**48**
Building AF (1)				
IAA-R132A	0 - 0.5	08/01/08	1	**36**
IAA-R132B	0 - 0.5	08/01/08	5	**42**
IAA-R132C	0 - 0.5	08/01/08	10	**31**
IAA-R133A	0 - 0.5	08/01/08	1	**35**
IAA-R133B	0 - 0.5	08/01/08	5	**57**
IAA-R133C	0 - 0.5	08/01/08	10	**37**
IAA-R134A	0 - 0.5	08/01/08	1	**49**
IAA-R134B	0 - 0.5	08/01/08	5	**37**
IAA-R134C	0 - 0.5	08/01/08	10	**40**
Building 570				
IAA-R135A	0 - 0.5	08/01/08	1	**43**
IAA-R135B	0 - 0.5	08/01/08	5	26
IAA-R135C	0 - 0.5	08/01/08	10	17
IAA-R136A	0 - 0.5	08/01/08	1	**54**
IAA-R136B	0 - 0.5	08/01/08	5	20
IAA-R136C	0 - 0.5	08/01/08	10	23

Notes found at end of table.

Table 7-11. XRF Screening Results for Soil, Sediment, and Conductive Flooring, Igniter Assembly Area, 2008 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID	Sample Depth (ft)	Date Collected	Distance From Building (ft)	Lead Result
			Adjusted Soil Screening Values-Residential [a]:	400 {++}
			Adjusted Soil Screening Values-Industrial [a]:	800 {++}
			Facility-Wide Background Values [b]:	26.8
			Units:	mg/kg
Building 562				
IAA-R137A	0 - 0.5	08/01/08	1	**2,695**
IAA-R137B	0 - 0.5	08/01/08	5	**274**
IAA-R137C	0 - 0.5	08/01/08	10	**258**
IAA-R138A	0 - 0.5	08/01/08	1	**67**
IAA-R138B	0 - 0.5	08/01/08	5	**62**
IAA-R138C	0 - 0.5	08/01/08	10	26
IAA-R139A	0 - 0.5	08/01/08	1	**49**
IAA-R139B	0 - 0.5	08/01/08	5	24
IAA-R139C	0 - 0.5	08/01/08	10	19
IAA-R140A	0 - 0.5	08/01/08	1	**64**
IAA-R140B	0 - 0.5	08/01/08	5	12
IAA-R140C	0 - 0.5	08/01/08	10	23
Building 571				
IAA-R141A	0 - 0.5	08/01/08	1	**27**
IAA-R141B	0 - 0.5	08/01/08	5	17
IAA-R141C	0 - 0.5	08/01/08	10	22
IAA-R142A	0 - 0.5	08/01/08	1	**60**
IAA-R142B	0 - 0.5	08/01/08	5	**42**
IAA-R142C	0 - 0.5	08/01/08	10	25
IAA-R143A	0 - 0.5	08/01/08	1	**28**
IAA-R143B	0 - 0.5	08/01/08	5	19
IAA-R143C	0 - 0.5	08/01/08	10	12
Building 565B				
IAA-R144A	0 - 0.5	08/01/08	1	**58**
IAA-R144B	0 - 0.5	08/01/08	5	**42**
IAA-R144C	0 - 0.5	08/01/08	10	**31**
IAA-R145A	0 - 0.5	08/01/08	1	**133**
IAA-R146A	0 - 0.5	08/01/08	1	**43**
IAA-R146B	0 - 0.5	08/01/08	5	**57**
IAA-R146C	0 - 0.5	08/01/08	10	**53**
IAA-R147A	0 - 0.5	08/01/08	1	**31**
IAA-R147B	0 - 0.5	08/01/08	5	18
IAA-R147C	0 - 0.5	08/01/08	10	20
Building 565B				
IAA-R148A	0 - 0.5	08/01/08	1	**167**
IAA-R148B	0 - 0.5	08/01/08	5	**34**
IAA-R148C	0 - 0.5	08/01/08	10	**35**
IAA-R149A	0 - 0.5	08/01/08	1	**945**
IAA-R149B	0 - 0.5	08/01/08	5	**122**
IAA-R149C	0 - 0.5	08/01/08	10	12
IAA-R150A	0 - 0.5	08/01/08	1	**27**
IAA-R150B	0 - 0.5	08/01/08	5	**41**
IAA-R150C	0 - 0.5	08/01/08	10	22
IAA-R151A	0 - 0.5	08/01/08	1	**377**
IAA-R151B	0 - 0.5	08/01/08	5	**53**
IAA-R151C	0 - 0.5	08/01/08	10	**48**
IAA-R152A	0 - 0.5	08/01/08	1	**247**
IAA-R152B	0 - 0.5	08/01/08	5	**48**
IAA-R152C	0 - 0.5	08/01/08	10	22
Building 8102-A				
IAA-R153A	0 - 0.5	08/01/08	1	**68**
IAA-R153B	0 - 0.5	08/01/08	5	**29**
IAA-R153C	0 - 0.5	08/01/08	10	22
IAA-R154A	0 - 0.5	08/01/08	1	**113**
IAA-R154B	0 - 0.5	08/01/08	5	20
IAA-R154C	0 - 0.5	08/01/08	10	23
IAA-R155A	0 - 0.5	08/01/08	1	**56**
BuildingAD				
IAA-R156A	0 - 0.5	08/01/08	1	**66**
IAA-R156B	0 - 0.5	08/01/08	5	**40**
IAA-R156C	0 - 0.5	08/01/08	10	19
IAA-R157A	0 - 0.5	08/01/08	1	**64**
IAA-R157B	0 - 0.5	08/01/08	5	**68**
IAA-R157C	0 - 0.5	08/01/08	10	**77**

Notes found at end of table.

Table 7-11. XRF Screening Results for Soil, Sediment, and Conductive Flooring, Igniter Assembly Area, 2008 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID	Sample Depth (ft)	Date Collected	Distance From Building (ft)	Lead Result
			Adjusted Soil Screening Values-Residential [a]:	400 {++}
			Adjusted Soil Screening Values-Industrial [a]:	800 {++}
			Facility-Wide Background Values [b]:	26.8
			Units:	mg/kg
In-Situ Sediment Screening Results				
IAA-SE001X	0 - 0.5	08/01/08	--	**48**
IAA-SE002X	0 - 0.5	08/01/08	--	**35**
IAA-SE003X	0 - 0.5	08/01/08	--	**43**
IAA-SE004X	0 - 0.5	08/01/08	--	**39**
IAA-SE005X	0 - 0.5	08/01/08	--	25
IAA-SE006X	0 - 0.5	08/01/08	--	21
IAA-SE007X	0.33	08/01/08	--	21
IAA-SE008X	0.17	08/01/08	--	24
IAA-SE009X	0.17	08/01/08	--	**40**

[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
ft	Feet.
mg/kg	Milligrams per kilogram.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 7-12. Soil Analytical Results, Igniter Assembly Area, 2008 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected: Corresponding XRF Screening Location: Building :	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	IAA-SB001 2 - 3 07/29/08 NA 8101	IAA-SS001 0 - 0.5 07/29/08 NA 8101	IAA-SS002 0 - 0.5 07/29/08 NA 8101	IAA-SS003 0 - 0.5 07/31/08 IAA-R62A 8102-1	IAA-SS004 0 - 0.5 07/31/08 IAA-R64A 8102-1	IAA-SS005 0 - 0.5 07/31/08 IAA-R67B 8102-1	IAA-SS006 0 - 0.5 07/31/08 IAA-R52A 8102-2	IAA-SS007 0 - 0.5 07/31/08 IAA-R56B 8102-2	IAA-SS008 0 - 0.5 07/31/08 IAA-R59A 8102-2	IAA-SS009 0 - 0.5 07/31/08 IAA-R52A 8102-3	IAA-SS010 0 - 0.5 07/31/08 IAA-R47A 8102-3	IAA-SS011 0 - 0.5 07/31/08 IAA-R37A 8102-4	IAA-SS012 0 - 0.5 07/31/08 IAA-R39A 8102-4	IAA-SS013 0 - 0.5 07/31/08 IAA-R42B 8102-4	IAA-SS014 0 - 0.5 07/31/08 IAA-R29B 8102-5	IAA-SS015 0 - 0.5 07/31/08 IAA-R32A 8102-5	IAA-SS016 0 - 0.5 07/31/08 IAA-R21B 8102-6	IAA-SS017 0 - 0.5 07/31/08 IAA-R24B 8102-6	IAA-SS018 0 - 0.5 07/31/08 IAA-R12A 8102-7	IAA-SS019 0 - 0.5 07/31/08 IAA-R17B 8102-7	IAA-SS020 0 - 0.5 07/31/08 IAA-R3B 8102-8	IAA-SS021 0 - 0.5 07/31/08 IAA-R5C 8102-8	IAA-SS022 0 - 0.5 07/31/08 IAA-R8A 8102-H	IAA-SS023 0 - 0.5 08/01/08 IAA-R95B 509
XRF Metals																												
Lead	400 {++}	800 {++}	26.8	mg/kg	NA	NA	NA	**105**	**122**	**88**	**201**	**39**	**126**	**1,340**	**86**	**322**	**4,585**	**123**	**68**	**169**	**48**	1,169	**40**	**73**	**153**	**105**	**254**	**48**
PCBs																												
Aroclor-1016	0.39 {nc}	21 {ca**}	- -	mg/kg	<0.030	<0.022	<0.020	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1221	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.030	<0.022	<0.020	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1232	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.030	<0.022	<0.020	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1242	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.030	<0.022	<0.020	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1248	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.030	<0.022	<0.020	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1254	0.22 {ca**}	0.74 {ca*}	- -	mg/kg	<0.030	<0.022	0.090	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1260	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.030	<0.022	<0.020	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total PCBs	0.24 {ca**}	0.86 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Inorganics																												
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	NA	NA	NA	16,200	18,300	12,400	4,930	12,500	19,700	8,910	22,000	12,000	12,100 [14,800]	12,400	22,500	25,900	19,400	23,100	13,000	15,200	19,100	21,000	10,500	15,000
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	NA	NA	NA	<4.00 J	<4.60 J	<4.50 J	<3.40 J	<4.50 J	<4.30 J	1.90 J	<3.70 J	<4.80 J	5.70 J [7.10 J]	<4.10 J	<4.20 J	<4.20 J	<3.90 J	<4.20 J	<3.90 J	<4.10 J	<4.10 J	<3.70 J	<4.60 J	<3.60 J
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	NA	NA	NA	10.7	8.90	6.90	**27.4**	7.10	9.60	**24.3**	10.8	13.4	**26.6 [19.0]**	12.2	8.80	11.4	11.7	12.9	8.10	**16.1**	12.7	15.8	**29.1**	12.4
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	NA	NA	NA	**239**	88.2	**214**	**869**	119	160	**5,740**	84.6	**511**	**2,050 [1,260]**	**246**	82.4	97.9	40.0	57.7	99.2	129	85.8	57.5	**4,030**	29.0
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	NA	NA	NA	0.570 J	0.520 J	0.680 J	0.500 J	0.630 J	0.630 J	0.710 J	0.810 J	**1.10 J**	0.950 J [0.950 J]	0.840 J	**1.30 J**	0.840 J	0.860 J	**1.10 J**	0.620 J	**1.10 J**	**1.30 J**	**1.20 J**	**1.10 J**	0.560 J
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	NA	NA	NA	0.380 J	<1.50	**1.10 J**	**1.30**	**1.80**	<1.40	**1.30 J**	<1.20	**1.80**	**1.70 [1.90]**	<1.40	<1.40	**15.2**	0.300 J	0.480 J	0.320 J	0.410 J	0.530 J	0.340 J	**2.60**	0.330 J
Calcium	- -	- -	- -	mg/kg	NA	NA	NA	2,700	1,190 J	2,120	197,000	1,330 J	6,640	21,100	682 J	4,400	5,570 [4,520 J]	2,870	1,170 J	1,450	1,540 J	1,190 J	2,940 J	2,070 J	1,810 J	1,430 J	11,500 J	1,060 J
Chromium	280 {ca**}	1,400 {ca**}	65.3	mg/kg	NA	NA	NA	39.9	38.0	22.0	27.7	25.6	36.7	44.0	37.1	43.4	36.5 [34.6]	26.5	24.3	44.6	35.7	36.8	25.7	27.0	37.1	34.5	**71.5**	31.0
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	NA	NA	NA	5.20	<4.60	6.40	14.9	6.30	3.50 J	19.5 J	3.20 J	14.8	16.1 J [15.9]	12.5	32.3	4.30	9.30	8.60	22.5	22.7	62.4	12.2	30.5	7.20
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	NA	NA	NA	**429**	46.4	**336**	**14,000**	**63.0**	**366**	**13,200**	**207**	**606**	**2,950 [3,470]**	**1,060**	**105**	**363 J**	52.2	**291**	**388**	**639**	**201**	**139**	**14,600**	15.6
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	NA	NA	NA	31,900	39,000	19,400	13,800	23,100	33,500	20,800	35,900	24,500	20,500 [24,000]	19,600	29,200	44,800	38,500	42,400	25,500	33,800	37,200	40,400	26,900	27,900
Lead	400 {++}	800 {++}	26.8	mg/kg	NA	NA	NA	**82.9 J**	26.1 J	**122 J**	**121 J**	**33.6 J**	**92.4 J**	**1,170 J**	**31.3 J**	**270 J**	**14,400 J [7,760 J]**	**184 J**	**567 J**	**98.0 J**	**32.6 J**	**6,160 J**	**46.1 J**	**105 J**	**77.0 J**	**155 J**	**360 J**	**54.9 J**
Magnesium	- -	- -	- -	mg/kg	NA	NA	NA	2,920	595 J	1,560	59,100	742 J	4,560	17,400	1,040 J	6,040	8,150 [5,550]	3,070	3,180	1,030 J	833 J	1,380 J	2,290	1,620	2,030	1,010 J	17,400	580 J
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	NA	NA	NA	230	68.8	397	178	343	160	488	98.6	802	456 [448]	609	740	82.8 J	222	111	1,570	312	550	226	862	363
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	NA	NA	NA	0.0960	0.0810	0.0820	0.0480	0.0760	**0.450**	0.0930	**0.250**	0.0960	**0.140 [0.110]**	**0.240**	0.0850	**0.150**	0.0680	0.0870	0.130	0.0820	0.0840	0.0540	**79.5**	0.0640
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	NA	NA	NA	10.6	5.60	8.30	36.3	6.30	10.1	42.4	12.3	28.1	34.2 [31.4]	14.6	22.7	16.8	12.3	18.4	8.90	21.1	22.7	19.5	**73.1**	9.90
Potassium	- -	- -	- -	mg/kg	NA	NA	NA	393 J	627 J	485 J	926 J	587 J	495 J	423 J	465 J	880 J	443 J [552 J]	546 J	1,070 J	663 J	612 J	785 J	605 J	847 J	899 J	815 J	680 J	500 J
Selenium	39 {nc}	510 {nc}	- -	mg/kg	NA	NA	NA	<1.30	<1.50	<1.50	<1.10	<1.50	<1.40	<1.50	<1.20	<1.60	<1.30 [<1.40]	<1.40	<1.40	<1.40	<1.30	<1.40	<1.30	<1.40	<1.40	<1.20	<1.50	<1.20
Silver	39 {nc}	510 {nc}	- -	mg/kg	NA	NA	NA	<2.70	<3.10	<3.00	3.90	<3.00	<2.90	3.30	<2.50	<3.20	0.710 J [0.340 J]	<2.80	<2.80	<2.80	<2.60	<2.80	<2.60	<2.70	<2.70	<2.40	3.90	<2.40
Sodium	- -	- -	- -	mg/kg	NA	NA	NA	<1,330	<1,550	<1,510	<1,150	<1,500	<1,430	<1,460	<1,230	<1,600	<1,350 [<1,390]	<1,380	<1,410	<1,390	<1,320	<1,410	<1,290	<1,360	<1,370	<1,220	<1,550	<1,200
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	NA	NA	NA	<2.70	<3.10	<3.00	<2.30	<3.00	<2.90	<2.90	<2.50	<3.20	<2.70 [<2.80]	<2.80	<2.80	<2.80	<2.60	<2.80	<2.60	<2.70	<2.70	<2.40	<3.10	<2.40
Vanadium	55 {nc}	720 {nc}	108	mg/kg	NA	NA	NA	59.5	70.9	37.3	13.9	42.0	64.2	31.1	64.3	45.3	32.6 [38.2]	35.1	51.4	79.9	62.6	68.3	44.9	50.3	57.1	64.9	27.1	56.5
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	NA	NA	NA	**567 J**	172 J	**347 J**	**2,620 J**	**209 J**	**904 J**	**6,430 J**	**634 J**	**1,360 J**	**4,860 J [4,220 J]**	**689 J**	131 J	**509 J**	67.8 J	126 J	42.3 J	**238 J**	**277 J**	169 J	**2,680 J**	39.0 J
Asbestos																												
Asbestos (Yes/No)	- -	- -	- -	- -	NA	NA	NA	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	No	No	Yes	Yes	No	Yes	No
Semivolatile Organics																												
1-Methylnaphthalene	22 {ca*}	99 {ca*}	- -	mg/kg	<0.0060	<0.0044	0.037	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	<0.0060	<0.0044	0.058	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.0060	<0.0044	0.16	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.0060	<0.0044	<0.0040	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	<0.0060	<0.0044	0.15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.0060	<0.0044	0.23	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.0060	<0.0044	0.18	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.0060	<0.0044	0.22	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	<0.0060	<0.0044	0.12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	<0.0060	<0.0044	0.11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	<0.0060	<0.0044	0.21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.0060	<0.0044	<0.0040	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.0060	<0.0044	0.60	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.0060	<0.0044	0.15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.0060 J	<0.0044 J	0.13 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	3.9 {ca}	20 {ca}	- -	mg/kg	<0.0060	<0.0044	0.12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	<0.0060	<0.0044	0.65	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	<0.0060	<0.0044	0.39	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Inorganics-TCLP	**TCLP Standard**																											
Arsenic	5,000	- -	- -	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	49.9 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<100	NA	NA
Barium	10,000	- -	- -	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	3,150	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	626	NA	NA
Cadmium	1,000	- -	- -	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	31.3 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<50	NA	NA
Chromium	5,000	- -	- -	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	<100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<100	NA	NA
Lead	5,000	- -	- -	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	3,300 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	382 J	NA	NA
Mercury	200	- -	- -	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	<2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<2	NA	NA
Selenium	1,000	- -	- -	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	<50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<50	NA	NA
Silver	5,000	- -	- -	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	<100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<100	NA	NA

Notes found at end of table.

Table 7-12. Soil Analytical Results, Igniter Assembly Area, 2008 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	IAA-SS024	IAA-SS025	IAA-SS026	IAA-SS027	IAA-SS028	IAA-SS029	IAA-SS030	IAA-SS031	IAA-SS032	IAA-SS033	IAA-SS034	IAA-SS035	IAA-SS036	IAA-SS037	IAA-SS038	IAA-SS039	IAA-SS040	IAA-SS041	IAA-SS042	IAA-SS043
Sample Depth(Feet):					0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5
Date Collected:					08/01/08	08/01/08	08/01/08	08/01/08	08/01/08	08/01/08	08/01/08	08/01/08	08/01/08	08/01/08	08/01/08	08/05/08	08/05/08	08/05/08	08/05/08	08/05/08	08/05/08	08/05/08	08/05/08	08/05/08
Corresponding XRF Screening Location:					IAA-R100B	IAA-R103A	IAA-R106B	IAA-R108B	IAA-R112B	IAA-R115C	IAA-R73C	IAA-R76A	IAA-R85B	IAA-R89A	IAA-R92B	IAA-R154A	IAA-R142A	IAA-R146A	IAA-R151A	IAA-R138A	IAA-R133B	IAA-R131A	IAA-R125C	IAA-R121B
Building :					508	YYYY	504	504	502	502	528	529	522	522A	522A	8102A	571	565B	565	562	1	2	5	4
XRF Metals																								
Lead	400 {++}	800 {++}	26.8	mg/kg	**280**	**193**	**8,329**	**1,779**	**8,530**	**1,175**	**35**	**37**	**830**	**1,414**	**397**	**101**	**181**	**49**	**377**	**67**	**57**	**259**	**341**	**23**
PCBs																								
Aroclor-1016	0.39 {nc}	21 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1221	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1232	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1242	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1248	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1254	0.22 {ca**}	0.74 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1260	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total PCBs	0.24 {ca**}	0.86 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Inorganics																								
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	21,000	12,500	9,420 [8,330]	11,800	881	9,850	20,200	22,900	5,140	8,330	6,850	22,600	15,400	18,600	27,300 [20,300]	17,700	17,500	16,900	25,200	17,000
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	<3.40 J	<5.60 J	3.00 J [2.70 J]	<3.70 J	16.9 J	<3.70 J	<3.80 J	<4.30 J	<3.10 J	<3.20 J	<2.90 J	<4.20 J	<4.20 J	<4.30 J	<4.50 J [<3.80 J]	<4.10 J	<5.00 J	<4.20 J	<4.20 J	<3.90 J
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	**56.0**	8.10	12.0 [9.70]	11.8	**62.9**	9.00	13.5	**23.8**	2.60	5.20	1.60	8.70	6.80	12.0	12.0 [9.20]	6.80	9.90	**25.8**	**18.9**	9.60
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	37.7	**3,980**	**714 [548]**	**223 J**	**310**	**288**	25.5	35.7	**537**	**3,210**	98.5	48.8	74.1	48.1	**330 J [127 J]**	166	33.0	122	40.2	39.9
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	0.740 J	0.410 J	0.690 J [0.600 J]	1.00 J	<1.20	0.510 J	0.780 J	0.810 J	0.500 J	0.720 J	0.570 J	0.910 J	0.490 J	0.560 J	0.950 J [0.750 J]	0.460 J	0.750 J	0.660 J	**1.70**	0.470 J
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	0.650 J	**1.40 J**	**3.30 [2.10]**	**2.20**	<6.20	**0.850 J**	<1.30	<1.40	**1.30**	**9.20**	**2.30**	<1.40	<1.40	<1.40	<1.50 [<1.30]	<1.40	<1.70	**2.10**	0.320 J	<1.30
Calcium	- -	- -	- -	mg/kg	1,160	5,340 J	190,000 J [167,000]	74,000 J	4,130 J	2,330 J	513 J	2,070	165,000	144,000	156,000	1,530	2,150	1,770	1,200 J [1,360]	2,680	8,860	16,900	2,500	1,550
Chromium	280 {ca**}	1,400 {ca**}	65.3	mg/kg	**89.3**	38.3	**1,110 [860]**	31.0	**986**	**262**	35.9	43.5	13.3	25.0	11.9	38.9	25.3	36.2	46.1 [35.0]	33.7	35.1	43.9	49.7	29.8
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	5.70	<27.8	15.3 [12.1]	16.2 J	26.7	6.70	3.70 J	3.80 J	2.70 J	6.00 J	3.60	9.10	2.80 J	4.50	7.20 [6.60]	2.00 J	5.00	45.3	30.7	3.40 J
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	**152**	**8,670**	**697 [645]**	**94.6**	**1,170**	**374**	**56.7**	42.4	**833**	**5,690**	32.9	**166**	**137**	**108**	**158 J [435 J]**	**275**	**139**	**8,930**	**110**	**125**
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	45,600	25,600	**90,900 [74,200]**	29,800	**328,000**	37,200	35,300	44,700	9,450	15,800	10,100	35,100	29,000	33,800	44,500 [32,900]	29,000	33,200	37,300	**53,900**	29,700
Lead	400 {++}	800 {++}	26.8	mg/kg	**118 J**	**299 J**	**9,450 J [6,820 J]**	**744 J**	**6,160 J**	**1,750 J**	23.4 J	**38.0 J**	**898 J**	**905 J**	**294 J**	**35.0 J**	**101 J**	**94.5 J**	**71.4 J [33.9 J]**	**111 J**	**139 J**	**302 J**	**199 J**	**46.7 J**
Magnesium	- -	- -	- -	mg/kg	636 J	5,410	45,800 [63,800]	37,100 J	2,200	1,530	576 J	920 J	82,500	86,100	73,100	2,740	1,190 J	1,180 J	1,090 J [1,230 J]	1,170 J	5,220	9,880	1,240 J	1,230 J
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	293	394	539 [435]	889 J	1,470	363	104	134	166	191	139	518	177	231	173 [184]	88.9	108	703	954	220
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	0.0590	0.0640	**1.90 [1.40]**	0.0690	0.130	0.0310 J	0.0460	0.0570	0.0150 J	0.0350	0.0150 J	0.0660	0.0610	0.0640	0.110 [0.0830]	0.0570	0.0510	0.0720	0.0760	0.0590
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	13.3	24.5	48.3 [37.2]	22.7	**213**	22.2	12.3	11.7	8.30	22.9	7.40	14.0	8.70	9.20	16.6 [12.6]	6.20	13.3	29.6	31.4	7.60
Potassium	- -	- -	- -	mg/kg	551 J	585 J	2,640 [2,370]	481 J	<1,250	428 J	484 J	536 J	1,560	2,860	2,580	1,000 J	857 J	622 J	910 J [769 J]	493 J	587 J	607 J	802 J	565 J
Selenium	39 {nc}	510 {nc}	- -	mg/kg	<1.10	<1.90	<1.30 [<1.10]	<1.20	<6.20	<1.20	<1.30	<1.40	<1.00	<1.10	<0.970	<1.40	<1.40	<1.40	<1.50 [<1.30]	<1.40	<1.70	<1.40	<1.40	<1.30
Silver	39 {nc}	510 {nc}	- -	mg/kg	<2.30	<3.70	<2.50 [<2.20]	<2.50	0.380 J	<2.40	<2.50	<2.90	<2.10	<2.10	<1.90	<2.80	<2.80	<2.90	<3.00 [<2.60]	<2.70	<3.30	0.490 J	<2.80	<2.60
Sodium	- -	- -	- -	mg/kg	<1,140	<1,850	<1,260 [<1,110]	<1,230	<1,250	<1,220	<1,270	<1,430	<1,030	<1,060	<972	<1,390	<1,400	<1,450	<1,500 [<1,280]	<1,360	<1,660	<1,390	<1,400	<1,300
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	<2.30	<3.70	<2.50 [<2.20]	<2.50	<12.5	<2.40	<2.50	<2.90	<2.10	<2.10	<1.90	<2.80	<2.80	<2.90	<3.00 [<2.60]	<2.70	<3.30	<2.80	<2.80	<2.60
Vanadium	55 {nc}	720 {nc}	108	mg/kg	83.4	47.8	28.3 [25.8]	43.5	81.0	31.4	67.9	81.4	14.9	20.3	15.7	64.2	47.5	62.2	79.8 [59.3]	58.2	63.4	60.2	74.4	55.4
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	82.6 J	**862 J**	**2,120 J [1,720 J]**	195 J	**1,360 J**	**495 J**	27.7 J	69.3 J	**227 J**	**1,210 J**	70.1 J	62.9 J	50.9 J	83.5 J	132 J [103 J]	79.1 J	163 J	**839 J**	**326 J**	106 J
Asbestos																								
Asbestos (Yes/No)	- -	- -	- -	- -	No	No	No	No	No	No	No	No	No	Yes	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes
Semivolatile Organics																								
1-Methylnaphthalene	22 {ca*}	99 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	3.9 {ca}	20 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Inorganics-TCLP	**TCLP Standard**																							
Arsenic	5,000	- -	- -	µg/L	NA	NA	NA	NA	<100	NA	NA	NA	NA	<100	NA	NA	NA	NA	NA	NA	NA	NA	NA	<100
Barium	10,000	- -	- -	µg/L	NA	NA	NA	NA	2,280	NA	NA	NA	NA	2,440	NA	NA	NA	NA	NA	NA	NA	NA	NA	676
Cadmium	1,000	- -	- -	µg/L	NA	NA	NA	NA	13.8 J	NA	NA	NA	NA	170	NA	NA	NA	NA	NA	NA	NA	NA	NA	<50
Chromium	5,000	- -	- -	µg/L	NA	NA	NA	NA	28.2 J	NA	NA	NA	NA	<100	NA	NA	NA	NA	NA	NA	NA	NA	NA	47.7 J
Lead	5,000	- -	- -	µg/L	NA	NA	NA	NA	3,270 J	NA	NA	NA	NA	3,520 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	35.9 J
Mercury	200	- -	- -	µg/L	NA	NA	NA	NA	<2	NA	NA	NA	NA	<2	NA	NA	NA	NA	NA	NA	NA	NA	NA	<2
Selenium	1,000	- -	- -	µg/L	NA	NA	NA	NA	<50	NA	NA	NA	NA	<50	NA	NA	NA	NA	NA	NA	NA	NA	NA	<50
Silver	5,000	- -	- -	µg/L	NA	NA	NA	NA	<100	NA	NA	NA	NA	<100	NA	NA	NA	NA	NA	NA	NA	NA	NA	<100

mg/kg	Milligrams per kilogram.
µg/kg	Micrograms per kilogram.
µg/L	Micrograms per liter.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 7-13. Sediment Analytical Results, Igniter Assembly Area, 2008 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values- Residential [a]	Adjusted Soil Screening Values- Industrial [a]	Facility-Wide Background Values [b]	Units	IAA-SE001 0 - 0.5 08/01/08	IAA-SE002 0 - 0.5 08/01/08	IAA-SE003 0 - 0.5 08/01/08	IAA-SE004 0 - 0.5 08/01/08
XRF Metals								
Lead	400 {++}	800 {++}	26.8	mg/kg	**48** 1	**35** 1	**43** 1	**39** 1
Inorganics								
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	19,000	16,600	21,200	20,000
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	<4.20 J	<3.90 J	<3.80 J	<3.70 J
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	10.3	9.30	9.50	8.40
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	36.8	44.4	48.5	48.9
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	0.660 J	0.610 J	**1.20 J**	0.960 J
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	<1.40	<1.30	0.420 J	0.470 J
Calcium	- -	- -	- -	mg/kg	8,650 J	3,840 J	1,450 J	1,350 J
Chromium	280 {ca**}	1,400 {ca**}	65.3	mg/kg	32.7	28.6	25.1	25.8
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	4.60	4.00	13.0	10.1
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	19.6	19.0	24.8	23.2
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	32,300	29,000	30,100	27,900
Lead	400 {++}	800 {++}	26.8	mg/kg	**35.0 J**	**31.8 J**	**44.4 J**	**31.9 J**
Magnesium	- -	- -	- -	mg/kg	4,580	1,840	1,810	1,800
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	186	264	369	351
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	0.0820	0.0930	0.0590	0.0540
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	9.50	7.70	15.2	12.8
Potassium	- -	- -	- -	mg/kg	668 J	643 J	880 J	813 J
Selenium	39 {nc}	510 {nc}	- -	mg/kg	<1.40	<1.30	<1.30	<1.20
Silver	39 {nc}	510 {nc}	- -	mg/kg	<2.80	<2.60	<2.50	<2.50
Sodium	- -	- -	- -	mg/kg	<1,390	<1,290	<1,260	<1,230
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	<2.80	<2.60	<2.50	<2.50
Vanadium	55 {nc}	720 {nc}	108	mg/kg	62.6	55.3	53.9	50.7
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	58.5 J	54.5 J	107 J	79.3 J

mg/kg	Milligrams per kilogram.
µg/kg	Micrograms per kilogram.
µg/L	Micrograms per liter.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
1	XRF screening value was from associated in-situ screening point (e.g. IAA-SE001X)
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
J	Constituent concentration quanitified as estimated.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 7-14. Surface Water Analytical Results, Igniter Assembly Area, 2008 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Date Collected:	Tapwater Screening Values [b]	Units	IAA-VLTW01 08/01/08
Volatile Organics			
1,1,1-Trichloroethane	9,100 {nc}	µg/L	<1.0
1,1,2,2-Tetrachloroethane	0.067 {ca**}	µg/L	<1.0
1,1,2-trichloro-1,2,2-trifluoroethane	59,000 {nc}	µg/L	<1.0
1,1,2-Trichloroethane	0.24 {ca}	µg/L	<1.0
1,1-Dichloroethane	2.4 {ca}	µg/L	<1.0
1,1-Dichloroethene	340 {nc}	µg/L	<1.0
1,2,3-Trichlorobenzene	- -	µg/L	<1.0
1,2,4-Trichlorobenzene	19 {ca*}	µg/L	<1.0
1,2-Dibromo-3-chloropropane	0.00032 {ca}	µg/L	<1.0
1,2-Dibromoethane	0.0065 {ca}	µg/L	<1.0
1,2-Dichlorobenzene	370 {nc}	µg/L	<1.0
1,2-Dichloroethane	0.15 {ca}	µg/L	<1.0
1,2-Dichloropropane	0.39 {ca*}	µg/L	<1.0
1,3-Dichlorobenzene	- -	µg/L	<1.0
1,4-Dichlorobenzene	0.43 {ca}	µg/L	<1.0
1,4-Dioxane	6.1 {ca**}	µg/L	<5.0
2-Butanone	7,100 {nc}	µg/L	<10
2-Hexanone	- -	µg/L	<5.0
4-Methyl-2-pentanone	2,000 {nc}	µg/L	<5.0
Acetone	22,000 {nc}	µg/L	5.1 J
Benzene	0.41 {ca}	µg/L	<1.0
Bromochloromethane	- -	µg/L	<1.0
Bromodichloromethane	1.1 {ca}	µg/L	<1.0
Bromoform	8.5 {ca*}	µg/L	<1.0
Bromomethane	8.7 {nc}	µg/L	<1.0
Carbon Disulfide	1,000 {nc}	µg/L	<1.0
Carbon Tetrachloride	0.2 {ca}	µg/L	<1.0
Chlorobenzene	91 {nc}	µg/L	<1.0
Chloroethane	21,000 {nc}	µg/L	<1.0
Chloroform	0.19 {ca}	µg/L	<1.0
Chloromethane	1.8 {ca}	µg/L	<1.0
cis-1,2-Dichloroethene	370 {nc}	µg/L	<1.0
cis-1,3-Dichloropropene	- -	µg/L	<1.0
Cyclohexane	13,000 {nc}	µg/L	<1.0
Dibromochloromethane	0.8 {ca}	µg/L	<1.0
Dichlorodifluoromethane	390 {nc}	µg/L	<1.0
Ethylbenzene	1.5 {ca}	µg/L	<1.0
Isopropylbenzene	680 {nc}	µg/L	<1.0
Methyl acetate	37,000 {nc}	µg/L	<1.0
Methyl tert-butyl ether	12 {ca}	µg/L	<1.0
Methylcylohexane	6,300 {nc}	µg/L	<1.0
Methylene Chloride	4.8 {ca}	µg/L	<1.0
Styrene	1,600 {nc}	µg/L	<1.0
Tetrachloroethene	0.11 {ca}	µg/L	<1.0
Toluene	2,300 {nc}	µg/L	<1.0
trans-1,2-Dichloroethene	110 {nc}	µg/L	<1.0
trans-1,3-Dichloropropene	- -	µg/L	<1.0
Trichloroethene	1.7 {ca}	µg/L	<1.0
Trichlorofluoromethane	1,300 {nc}	µg/L	<1.0
Vinyl Chloride	0.016 {ca}	µg/L	<1.0
Xylenes (total)	200 {nc}	µg/L	<1.0

Notes found at end of table.

Table 7-14. Surface Water Analytical Results, Igniter Assembly Area, 2008 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: / Date Collected:	Tapwater Screening Values [b]	Units	IAA-VLTW01 08/01/08
Semivolatile Organics			
1-Methylnaphthalene	2.3 {ca}	µg/L	<0.046
2-Methylnaphthalene	150 {nc}	µg/L	<0.046
Acenaphthene	2,200 {nc}	µg/L	<0.046
Acenaphthylene	- -	µg/L	<0.046
Anthracene	11,000 {nc}	µg/L	<0.046
Benzo(a)anthracene	0.029 {ca**}	µg/L	<0.046
Benzo(a)pyrene	0.0029 {ca**}	µg/L	<0.046
Benzo(b)fluoranthene	0.029 {ca**}	µg/L	<0.046
Benzo(g,h,i)perylene	- -	µg/L	<0.046
Benzo(k)fluoranthene	0.29 {ca**}	µg/L	<0.046
Chrysene	2.9 {ca**}	µg/L	<0.046
Dibenzo(a,h)anthracene	0.0029 {ca**}	µg/L	<0.046
Fluoranthene	1,500 {nc}	µg/L	<0.046
Fluorene	1,500 {nc}	µg/L	<0.046
Indeno(1,2,3-cd)pyrene	0.029 {ca**}	µg/L	<0.046 J
Naphthalene	6.2 {nc}	µg/L	<0.046
Phenanthrene	- -	µg/L	<0.046
Pyrene	1,100 {nc}	µg/L	<0.046
Inorganics			
Aluminum	37,000 {nc}	µg/L	3,710
Antimony	15 {nc}	µg/L	<15.0
Arsenic	0.045 {ca}	µg/L	<5.00
Barium	7,300 {nc}	µg/L	372
Beryllium	73 {nc}	µg/L	<5.00
Cadmium	18 {nc}	µg/L	3.00 J
Calcium	- -	µg/L	43,700
Chromium	- -	µg/L	8.40 J
Cobalt	- -	µg/L	<15.0
Copper	1,500 {nc}	µg/L	1,460
Iron	26,000 {nc}	µg/L	10,700
Lead	- -	µg/L	6,160
Magnesium	- -	µg/L	20,900
Manganese	880 {nc}	µg/L	236
Mercury	0.63 {nc}	µg/L	0.0880 J
Nickel	730 {nc}	µg/L	5.10 J
Potassium	- -	µg/L	35,100
Selenium	180 {nc}	µg/L	<5.00
Silver	180 {nc}	µg/L	<10.0
Sodium	- -	µg/L	17,600
Thallium	2.4 {nc}	µg/L	<10.0
Vanadium	180 {nc}	µg/L	10.2 J
Zinc	11,000 {nc}	µg/L	761

µg/L	Micrograms per liter.
[a]	USEPA Regional Screening Levels (USEPA 2008a). Adjusted tap-water screening levels used to assess surface water at the NRU.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
J	Constituent concentration quanitified as estimated.
24,400	Highlighted value indicates constituent concentration is above tapwater screening value.

Table 7-15. Surface Soil Analytical Results, 2009 ARCADIS Supplemental Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(): Date Collected:	Units	IAA5-SS001A 0-0.25 07/15/09	IAA5-SS001B 0-0.25 07/15/09	IAA5-SS001C 0-0.25 07/15/09	IAA5-SS001D 0-0.25 07/15/09	IAA5-SS001E 0-0.25 07/15/09	IAA8102-SS001A 0-0.25 07/13/09	IAA8102-SS001B 0-0.25 07/13/09	IAA8102-SS001C 0-0.25 07/13/09	IAA8102-SS001D 0-0.25 07/13/09	IAA8102-SS001E 0-0.25 07/13/09	IAA-SS044A 0-0.5 07/14/08	IAA-SS044B 0-0.5 07/14/08	IAA-SS045A 0-0.5 07/14/08	IAA-SS045B 0-0.5 07/14/08
Asbestos															
Asbestos weight percent	%	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	17.2	0.1	0.1 U	0.1 U	0.1 U	2.2	0.1 U	2.4	0.1
Chrysotile	struc.	41	2	23	2	3	53	56	2	2	3	96	56	63	52
Percent Moisture															
Percent Moisture	%	24	22	20	24	22	58	20	16	16	16				
Soil Particle Size															
3/4"	%	0	0	0	0	0	0	0	0	0.26	0	NA	NA	NA	NA
3/8"	%	7.8	0	10	25	4.1	0.76	0.019	0	2.0	3.8	NA	NA	NA	NA
d < 75 µm	%	4.0	2.1	2.6	4.7	4.2	7.3	6.2	6.1	6.6	5.2	NA	NA	NA	NA
No. 10	%	31	34	30	20	26	8.3	31	32	23	23	NA	NA	NA	NA
No. 200	%	4.3	8.8	5.1	12	14	30	13	9.8	18	17	NA	NA	NA	NA
No. 4	%	38	12	35	12	15	3.3	15	25	11	13	NA	NA	NA	NA
No. 40	%	15	43	17	27	36	51	34	27	40	38	NA	NA	NA	NA

U - The compound was analyzed for but not detected.
The associated value is the compound quantitation limit.
NA - Not Analyzed
ND - Not Detected

Table 7-15. Surface Soil Analytical Results, 2009 ARCADIS Supplemental Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(): Date Collected:	Units	IAA-SS046A 0-0.5 07/14/08	IAA-SS046B 0-0.5 07/14/08	IAA-SS047A 0-0.5 07/14/08	IAA-SS047B 0-0.5 07/14/08	IAA-SS048A 0-0.5 07/14/08	IAA-SS048B 0-0.5 07/14/08	IAA-SS049A 0-0.5 07/14/08	IAA-SS049B 0-0.5 07/14/08
Asbestos									
Asbestos weight percent	%	0.2	0.2	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Chrysotile	struc.	51	60	24	11	9	1	14	8
Percent Moisture									
Percent Moisture	%								
Soil Particle Size									
3/4"	%	NA	NA	NA	NA	NA	NA	NA	NA
3/8"	%	NA	NA	NA	NA	NA	NA	NA	NA
d < 75 µm	%	NA	NA	NA	NA	NA	NA	NA	NA
No. 10	%	NA	NA	NA	NA	NA	NA	NA	NA
No. 200	%	NA	NA	NA	NA	NA	NA	NA	NA
No. 4	%	NA	NA	NA	NA	NA	NA	NA	NA
No. 40	%	NA	NA	NA	NA	NA	NA	NA	NA

U - The compound was analyzed for but not detected.
The associated value is the compound quantitation limit.
NA - Not Analyzed
ND - Not Detected

Table 7-16. Activity Based Air Sampling Results, 2009 ARCADIS Supplemental Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Date Collected:	Method	Units	IAA5-AA1 07/15/09	IAA5-AP1 07/15/09	IAA5-AA2 07/15/09	IAA5-AP2 07/15/09	IAA5-BK2 07/15/09	IAA8102-AA1 07/14/09	IAA8102-AP1 07/15/09	IAA8102-AA2 No Date	IAA8102-AP2 07/13/09	IAA8102-BK2 07/13/09
Asbestos												
Air Concentration	AHERA	s/cc	0	0	0	0	0	0.00588	0.050	0	0	0
Loading on Filter	AHERA	s/mm2	0	0	0	0	0	11.0	26.2	0	0	0
Number of structures	AHERA	struc.	0	0	0	0	0	6.0	17.0	0	0	0
Air Concentration	PCME	s/cc	0	0	0	0	0	0.00098	0	0	0	0
Loading on Filter	PCME	s/mm2	0	0	0	0	0	1.8	0	0	0	0
Number of structures	PCME	struc.	0	0	0	0	0	1	0	0	0	0
Air Concentration	TEM	s/cc	0	0	0	0	0	0.00783	0.053	0	0	0
Loading on Filter	TEM	s/mm2	0	0	0	0	0	14.7	27.7	0	0	0
Number of structures	TEM	struc.	0	0	0	0	0	8.0	18.0	0	0	0

s/cc: structures per cubic centimeter
S/mm2: structures per square millimeter
struc: structures
AHERA - Asbestos hazard emergency response act
PCE - Phase contrast microscopy
TEM - Transmission electron microscopy

Table 7-17
Soil Risk Assessment Dataset
Surface Soil (0-1 foot Depth Interval)
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)		Detects Max (mg/kg)	Detection Limits Min (mg/kg)		Detection Limits Max (mg/kg)	Maximum Location
Volatile Organic Compounds												
3-Octanone	106-68-3	4	-	4	100	0.006	-	0.015	–	-	–	IASD12
Acetone	67-64-1	8	-	14	57	0.009	-	0.16	0.0055	-	0.0062	IASD12
d-Limonene	5989-27-5	3	-	3	100	0.031	-	0.084	–	-	–	IASD08
Methylene Chloride	75-09-2	2	-	14	14	0.002	-	0.004	0.0054	-	0.0074	SS-11
Semi-Volatile Organic Compounds												
2,4-Dinitrotoluene	121-14-2	1	-	27	4	48	-	48	0.2	-	0.46	504360
Benzoic Acid	65-85-0	7	-	22	32	0.1	-	0.3	1	-	8.2	TR-01A
bis(2-Ethylhexyl)phthalate	117-81-7	23	-	31	74	0.03	-	750	0.38	-	0.49	504312
Butylbenzylphthalate	85-68-7	1	-	22	5	0.13	-	0.13	0.19	-	1.7	SS-11
Carbazole	86-74-8	5	-	22	23	0.016	-	2.4	0.2	-	0.49	IASD09
Dibenzofuran	132-64-9	4	-	20	20	0.018	-	0.74	0.19	-	0.49	IASD09
Diethylphthalate	84-66-2	4	-	25	16	0.07	-	250	0.19	-	1.7	504360
Di-n-Butylphthalate	84-74-2	2	-	22	9	0.07	-	0.31	0.19	-	1.7	IASS05
Di-n-Octylphthalate	117-84-0	1	-	20	5	0.04	-	0.04	0.19	-	1.7	IATP2A/C
Explosives												
1,3,5-Trinitrobenzene	99-35-4	1	-	19	5	0.07	-	0.07	0.1	-	0.3	IASD11
4-Amino-2,6-Dinitrotoluene	19406-51-0	2	-	19	11	0.04	-	0.05	0.2	-	0.3	IASS05
Nitroglycerine	55-63-0	1	-	19	5	0.57	-	0.57	0.32	-	1.3	IASS05
Pesticides												
4,4'-DDD	72-54-8	6	-	9	67	0.00068	-	0.00248	0.00082	-	0.00755	IASD08
4,4'-DDE	72-55-9	5	-	9	56	0.00066	-	0.00301	0.00072	-	0.00755	IASD05
4,4'-DDT	50-29-3	11	-	14	79	0.00062	-	0.0067	0.00755	-	0.00755	IASD08
Beta-BHC	319-85-7	1	-	9	11	0.00017	-	0.00017	0.00072	-	0.00755	IASD07
Delta-BHC	319-86-8	1	-	9	11	0.00104	-	0.00104	0.0008	-	0.00755	IASD10
Alpha-Chlordane	5103-71-9	3	-	9	33	0.00038	-	0.00301	0.00072	-	0.00755	IASD05
Gamma-Chlordane	5566-34-7	4	-	9	44	0.00062	-	0.00408	0.0008	-	0.00755	IASD05
Dieldrin	60-57-1	7	-	9	78	0.00061	-	0.00909	0.00082	-	0.00755	IASD10
Endosulfan II	33213-65-9	7	-	13	54	0.00038	-	0.00378	0.0008	-	0.00755	IASD08
Endrin	72-20-8	5	-	15	33	0.00062	-	0.02	0.00072	-	0.00755	TR-01A
Endrin Ketone	53494-70-5	3	-	9	33	0.00148	-	0.00424	0.0008	-	0.00755	IASD05
Heptachlor Epoxide	1024-57-3	1	-	9	11	0.00101	-	0.00101	0.00072	-	0.00755	IASD08
Methoxychlor	72-43-5	7	-	10	70	0.00107	-	0.0122	0.00082	-	0.00755	IASD10
Polycyclic Aromatic Hydrocarbons												
1-Methylnaphthalene	90-12-0	1	-	2	50	0.037	-	0.037	0.0044	-	0.0044	IAA-SS002
2-Methylnaphthalene	91-57-6	12	-	27	44	0.00092	-	0.36	0.0044	-	0.49	IASD11
Acenaphthene	83-32-9	5	-	27	19	0.0014	-	1	0.0019	-	0.49	IASD09
Acenaphthylene	208-96-8	5	-	29	17	0.0012	-	0.3	0.0019	-	0.49	TR-01A
Anthracene	120-12-7	8	-	29	28	0.0013	-	2.1	0.0019	-	0.49	IASD09
Benzo(a)anthracene	56-55-3	18	-	31	58	0.0018	-	6.9	0.0044	-	0.49	IASD09

Table 7-17
Soil Risk Assessment Dataset
Surface Soil (0-1 foot Depth Interval)
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b]				Detects			Detection Limits			Maximum Location
		number of detects / number of samples			FOD %	Min - Max (mg/kg)		(mg/kg)	Min - Max (mg/kg)		(mg/kg)	
Benzo(a)pyrene	50-32-8	17	-	31	55	0.002	-	5.9	0.0044	-	0.49	IASD09
Benzo(b)fluoranthene	205-99-2	17	-	31	55	0.0049	-	13	0.0044	-	0.49	TR-01A
Benzo(g,h,i)perylene	191-24-2	14	-	32	44	0.0023	-	3.5	0.0044	-	0.49	IASD09
Benzo(k)fluoranthene	207-08-9	17	-	31	55	0.0014	-	6.5	0.0044	-	0.49	TR-01A
Chrysene	218-01-9	19	-	34	56	0.0026	-	7.7	0.0044	-	0.49	IASD09,TR-01A
Dibenzo(a,h)anthracene	53-70-3	7	-	29	24	0.0024	-	0.97	0.0019	-	0.49	IASD09
Fluoranthene	206-44-0	20	-	34	59	0.0047	-	22	0.0044	-	0.49	IASD09
Fluorene	86-73-7	7	-	27	26	0.00097	-	1.3	0.0019	-	0.49	IASD09
Indeno(1,2,3-cd)pyrene	193-39-5	13	-	29	45	0.0017	-	6.1	0.0044	-	0.49	TR-01A
Naphthalene	91-20-3	13	-	29	45	0.00088	-	0.75	0.0021	-	0.49	IASD09
Phenanthrene	85-01-8	19	-	31	61	0.0034	-	16	0.0044	-	0.49	IASD09
Pyrene	129-00-0	20	-	34	59	0.0033	-	16	0.0044	-	0.49	IASD09
Polychlorinated Biphenyls												
Aroclor 1254	11097-69-1	12	-	35	34	0.0049	-	12	0.022	-	0.04	IASS05
Aroclor 1260	11096-82-5	3	-	27	11	0.37	-	1	0.02	-	0.04	SS-11
Inorganics												
Aluminum	7429-90-5	99	-	99	100	881	-	39000	–	-	–	50240
Antimony	7440-36-0	30	-	96	31	0.21	-	16.9	0.54	-	5.6	IAA-SS028
Arsenic	7440-38-2	98	-	99	99	0.55	-	164	–	-	–	SS-12
Barium	7440-39-3	99	-	99	100	12.3	-	11800	–	-	–	SS-11a
Beryllium	7440-41-7	87	-	99	88	0.36	-	2.3	0.11	-	1.2	IASB4
Cadmium	7440-43-9	52	-	90	58	0.08	-	15.2	0.11	-	6.2	IAA-SS015
Calcium	7440-70-2	99	-	99	100	508	-	197000	–	-	–	IAA-SS006
Chromium	7440-47-3	99	-	99	100	11.9	-	1110	–	-	–	IAA-SS026
Cobalt	7440-48-4	97	-	99	98	0.26	-	422	4.6	-	27.8	IASB07
Copper	7440-50-8	99	-	99	100	9.1	-	56500	–	-	–	SS-12
Iron	7439-89-6	99	-	99	100	9450	-	328000	–	-	–	IAA-SS028
Lead	7439-92-1	99	-	99	100	6.4	-	14400	–	-	–	IAA-SS012
Magnesium	7439-95-4	99	-	99	100	296	-	86100	–	-	–	IAA-SS033
Manganese	7439-96-5	99	-	99	100	8.6	-	2510	–	-	–	IASB07
Mercury	7439-97-6	75	-	94	80	0.015	-	79.5	0.05	-	0.14	IAA-SS022
Nickel	7440-02-0	98	-	99	99	0.47	-	213	0.12	-	0.12	IAA-SS028
Potassium	7440-09-7	98	-	99	99	173	-	5570	1250	-	1250	IATP2B/D
Selenium	7782-49-2	18	-	96	19	0.41	-	1.9	0.55	-	6.2	50240

Table 7-17
Soil Risk Assessment Dataset
Surface Soil (0-1 foot Depth Interval)
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b]				Detects			Detection Limits			Maximum Location
		number of detects / number of samples			FOD %	Min - Max			Min - Max			
						(mg/kg)		(mg/kg)	(mg/kg)		(mg/kg)	
Silver	7440-22-4	15	-	87	17	0.3	-	22.5	0.22	-	3.7	SS-12
Sodium	7440-23-5	54	-	97	56	7.5	-	1350	972	-	1850	IATP2B/D
Thallium	7440-28-0	36	-	99	36	0.12	-	1	0.22	-	12.5	SS-03,SS-11
Vanadium	7440-62-2	99	-	99	100	10.8	-	98.4	–	-	–	50240
Zinc	7440-66-6	99	-	99	100	6	-	21800	–	-	–	SS-11

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilogram.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table 7-18
Soil Risk Assessment Dataset
Surface Soil (0-2 foot Depth Interval)
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects /	number of samples	FOD %	Detects Min (mg/kg)		Detects Max (mg/kg)	Detection Limits Min (mg/kg)		Detection Limits Max (mg/kg)	Maximum Location
Volatile Organic Compounds											
3-Octanone	106-68-3	4 -	4	100	0.006	-	0.015	–	-	–	IASD12
Acetone	67-64-1	8 -	14	57	0.009	-	0.16	0.0055	-	0.0062	IASD12
d-Limonene	5989-27-5	3 -	3	100	0.031	-	0.084	–	-	–	IASD08
Methylene Chloride	75-09-2	2 -	14	14	0.002	-	0.004	0.0054	-	0.0074	SS-11
Semi-Volatile Organic Compounds											
2,4-Dinitrotoluene	121-14-2	2 -	30	7	48	-	210	0.2	-	0.46	504360
Benzoic Acid	65-85-0	7 -	22	32	0.1	-	0.3	1	-	8.2	TR-01A
bis(2-Ethylhexyl)phthalate	117-81-7	27 -	39	69	0.03	-	750	0.38	-	0.49	504312
Butylbenzylphthalate	85-68-7	1 -	22	5	0.13	-	0.13	0.19	-	1.7	SS-11
Carbazole	86-74-8	5 -	22	23	0.016	-	2.4	0.2	-	0.49	IASD09
Dibenzofuran	132-64-9	4 -	20	20	0.018	-	0.74	0.19	-	0.49	IASD09
Diethylphthalate	84-66-2	4 -	28	14	0.07	-	250	0.19	-	1.7	504360
Di-n-Butylphthalate	84-74-2	2 -	22	9	0.07	-	0.31	0.19	-	1.7	IASS05
Di-n-Octylphthalate	117-84-0	1 -	20	5	0.04	-	0.04	0.19	-	1.7	IATP2A/C
Explosives											
1,3,5-Trinitrobenzene	99-35-4	1 -	19	5	0.07	-	0.07	0.1	-	0.3	IASD11
4-Amino-2,6-Dinitrotoluene	19406-51-0	2 -	19	11	0.04	-	0.05	0.2	-	0.3	IASS05
Nitroglycerine	55-63-0	1 -	19	5	0.57	-	0.57	0.32	-	1.3	IASS05
Pesticides											
4,4'-DDD	72-54-8	6 -	9	67	0.00068	-	0.00248	0.00082	-	0.00755	IASD08
4,4'-DDE	72-55-9	5 -	9	56	0.00066	-	0.00301	0.00072	-	0.00755	IASD05
4,4'-DDT	50-29-3	13 -	19	68	0.00049	-	0.0067	0.00755	-	0.00755	IASD08
Beta-BHC	319-85-7	1 -	9	11	0.00017	-	0.00017	0.00072	-	0.00755	IASD07
Delta-BHC	319-86-8	1 -	9	11	0.00104	-	0.00104	0.0008	-	0.00755	IASD10
Alpha-Chlordane	5103-71-9	3 -	9	33	0.00038	-	0.00301	0.00072	-	0.00755	IASD05
Gamma-Chlordane	5566-34-7	4 -	9	44	0.00062	-	0.00408	0.0008	-	0.00755	IASD05
Dieldrin	60-57-1	7 -	9	78	0.00061	-	0.00909	0.00082	-	0.00755	IASD10
Endosulfan II	33213-65-9	7 -	18	39	0.00038	-	0.00378	0.0008	-	0.00755	IASD08
Endrin	72-20-8	6 -	20	30	0.00024	-	0.02	0.00072	-	0.00755	TR-01A
Endrin Ketone	53494-70-5	3 -	9	33	0.00148	-	0.00424	0.0008	-	0.00755	IASD05
Heptachlor Epoxide	1024-57-3	1 -	9	11	0.00101	-	0.00101	0.00072	-	0.00755	IASD08
Methoxychlor	72-43-5	7 -	10	70	0.00107	-	0.0122	0.00082	-	0.00755	IASD10
Polycyclic Aromatic Hydrocarbons											
1-Methylnaphthalene	90-12-0	1 -	2	50	0.037	-	0.037	0.0044	-	0.0044	IAA-SS002
2-Methylnaphthalene	91-57-6	12 -	27	44	0.00092	-	0.36	0.0044	-	0.49	IASD11
Acenaphthene	83-32-9	5 -	27	19	0.0014	-	1	0.0019	-	0.49	IASD09
Acenaphthylene	208-96-8	5 -	29	17	0.0012	-	0.3	0.0019	-	0.49	TR-01A
Anthracene	120-12-7	8 -	29	28	0.0013	-	2.1	0.0019	-	0.49	IASD09

Table 7-18
Soil Risk Assessment Dataset
Surface Soil (0-2 foot Depth Interval)
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)		Detects Max (mg/kg)	Detection Limits Min (mg/kg)		Detection Limits Max (mg/kg)	Maximum Location
Benzo(a)anthracene	56-55-3	18	-	31	58	0.0018	-	6.9	0.0044	-	0.49	IASD09
Benzo(a)pyrene	50-32-8	17	-	31	55	0.002	-	5.9	0.0044	-	0.49	IASD09
Benzo(b)fluoranthene	205-99-2	17	-	31	55	0.0049	-	13	0.0044	-	0.49	TR-01A
Benzo(g,h,i)perylene	191-24-2	15	-	35	43	0.0023	-	41	0.0044	-	0.49	504360
Benzo(k)fluoranthene	207-08-9	17	-	31	55	0.0014	-	6.5	0.0044	-	0.49	TR-01A
Chrysene	218-01-9	20	-	37	54	0.0026	-	44	0.0044	-	0.49	504360
Dibenzo(a,h)anthracene	53-70-3	7	-	29	24	0.0024	-	0.97	0.0019	-	0.49	IASD09
Fluoranthene	206-44-0	21	-	37	57	0.0047	-	59	0.0044	-	0.49	504360
Fluorene	86-73-7	7	-	27	26	0.00097	-	1.3	0.0019	-	0.49	IASD09
Indeno(1,2,3-cd)pyrene	193-39-5	13	-	29	45	0.0017	-	6.1	0.0044	-	0.49	TR-01A
Naphthalene	91-20-3	13	-	29	45	0.00088	-	0.75	0.0021	-	0.49	IASD09
Phenanthrene	85-01-8	19	-	31	61	0.0034	-	16	0.0044	-	0.49	IASD09
Pyrene	129-00-0	21	-	37	57	0.0033	-	48	0.0044	-	0.49	504360
Polychlorinated Biphenyls												
Aroclor 1254	11097-69-1	16	-	49	33	0.0049	-	12	0.022	-	0.04	IASS05
Aroclor 1260	11096-82-5	3	-	30	10	0.37	-	1	0.02	-	0.04	SS-11
Inorganics												
Aluminum	7429-90-5	117	-	117	100	881	-	46900	–	-	–	81027160
Antimony	7440-36-0	35	-	114	31	0.21	-	16.9	0.54	-	5.6	IAA-SS028
Arsenic	7440-38-2	116	-	117	99	0.55	-	164	–	-	–	SS-12
Barium	7440-39-3	117	-	117	100	8.5	-	11800	–	-	–	SS-11a
Beryllium	7440-41-7	103	-	117	88	0.34	-	3.8	0.11	-	1.2	81027260
Cadmium	7440-43-9	55	-	99	56	0.06	-	15.2	0.11	-	6.2	IAA-SS015
Calcium	7440-70-2	117	-	117	100	275	-	197000	–	-	–	IAA-SS006
Chromium	7440-47-3	117	-	117	100	11.9	-	1920	–	-	–	504360
Cobalt	7440-48-4	115	-	117	98	0.26	-	422	4.6	-	27.8	IASB07
Copper	7440-50-8	117	-	117	100	9.1	-	56500	–	-	–	SS-12
Iron	7439-89-6	117	-	117	100	9450	-	328000	–	-	–	IAA-SS028
Lead	7439-92-1	117	-	117	100	6.4	-	16200	–	-	–	504360
Magnesium	7439-95-4	117	-	117	100	296	-	86100	–	-	–	IAA-SS033
Manganese	7439-96-5	117	-	117	100	8.6	-	2510	–	-	–	IASB07
Mercury	7439-97-6	81	-	109	74	0.015	-	79.5	0.05	-	0.14	IAA-SS022
Nickel	7440-02-0	116	-	117	99	0.47	-	213	0.12	-	0.12	IAA-SS028
Potassium	7440-09-7	116	-	117	99	173	-	5570	1250	-	1250	IATP2B/D
Selenium	7782-49-2	32	-	114	28	0.41	-	1.9	0.55	-	6.2	5.02408E+12
Silver	7440-22-4	16	-	93	17	0.18	-	22.5	0.22	-	3.7	SS-12
Sodium	7440-23-5	72	-	115	63	6.28	-	1350	972	-	1850	IATP2B/D
Thallium	7440-28-0	45	-	117	38	0.12	-	1	0.22	-	12.5	SS-03,SS-11
Vanadium	7440-62-2	116	-	117	99	10.8	-	98.4	–	-	–	50240
Zinc	7440-66-6	116	-	117	99	6	-	21800	–	-	–	SS-11

Table 7-18
Soil Risk Assessment Dataset
Surface Soil (0-2 foot Depth Interval)
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b]		Detects		Detection Limits		Maximum Location
		number of detects / number of samples	FOD %	Min (mg/kg)	Max (mg/kg)	Min (mg/kg)	Max (mg/kg)	

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilogram.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.

[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table 7-19
Soil Risk Assessment Dataset
Combined Surface and Subsurface Soil
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Volatile Organic Compounds												
3-Octanone	106-68-3	4	-	4	100	0.006	-	0.015	–	-	–	IASD12
Acetone	67-64-1	8	-	18	44	0.009	-	0.16	0.0052	-	0.0071	IASD12
d-Limonene	5989-27-5	3	-	3	100	0.031	-	0.084	–	-	–	IASD08
Methylene Chloride	75-09-2	2	-	18	11	0.002	-	0.004	0.0052	-	0.0074	SS-11
Toluene	108-88-3	3	-	16	19	0.00066	-	0.00083	0.0054	-	0.0074	IASB12
Semi-Volatile Organic Compounds												
2,4-Dinitrotoluene	121-14-2	2	-	36	6	48	-	210	0.2	-	0.49	504360
Benzoic Acid	65-85-0	7	-	27	26	0.1	-	0.3	1	-	8.2	TR-01A
bis(2-Ethylhexyl)phthalate	117-81-7	28	-	47	60	0.03	-	750	0.38	-	0.49	504312
Butylbenzylphthalate	85-68-7	1	-	27	4	0.13	-	0.13	0.19	-	1.7	SS-11
Carbazole	86-74-8	5	-	27	19	0.016	-	2.4	0.2	-	0.49	IASD09
Dibenzofuran	132-64-9	4	-	25	16	0.018	-	0.74	0.19	-	0.49	IASD09
Diethylphthalate	84-66-2	4	-	34	12	0.07	-	250	0.19	-	1.7	504360
Di-n-Butylphthalate	84-74-2	4	-	27	15	0.07	-	0.31	0.19	-	1.7	IASS05
Di-n-Octylphthalate	117-84-0	1	-	25	4	0.04	-	0.04	0.19	-	1.7	IATP2A/C
Explosives												
1,3,5-Trinitrobenzene	99-35-4	1	-	19	5	0.07	-	0.07	0.1	-	0.3	IASD11
4-Amino-2,6-Dinitrotoluene	19406-51-0	2	-	19	11	0.04	-	0.05	0.2	-	0.3	IASS05
Nitroglycerine	55-63-0	1	-	19	5	0.57	-	0.57	0.32	-	1.3	IASS05
Pesticides												
4,4'-DDD	72-54-8	6	-	9	67	0.00068	-	0.00248	0.00082	-	0.00755	IASD08
4,4'-DDE	72-55-9	5	-	9	56	0.00066	-	0.00301	0.00072	-	0.00755	IASD05
4,4'-DDT	50-29-3	14	-	21	67	0.00042	-	0.0067	0.00755	-	0.00755	IASD08
Beta-BHC	319-85-7	1	-	9	11	0.00017	-	0.00017	0.00072	-	0.00755	IASD07
Delta-BHC	319-86-8	1	-	9	11	0.00104	-	0.00104	0.0008	-	0.00755	IASD10
Alpha-Chlordane	5103-71-9	3	-	9	33	0.00038	-	0.00301	0.00072	-	0.00755	IASD05
Gamma-Chlordane	5566-34-7	4	-	9	44	0.00062	-	0.00408	0.0008	-	0.00755	IASD05
Dieldrin	60-57-1	7	-	9	78	0.00061	-	0.00909	0.00082	-	0.00755	IASD10
Endosulfan II	33213-65-9	8	-	20	40	0.0003	-	0.00378	0.0008	-	0.00755	IASD08
Endrin	72-20-8	8	-	22	36	0.00024	-	0.02	0.00072	-	0.00755	TR-01A
Endrin Ketone	53494-70-5	3	-	9	33	0.00148	-	0.00424	0.0008	-	0.00755	IASD05
Heptachlor Epoxide	1024-57-3	1	-	9	11	0.00101	-	0.00101	0.00072	-	0.00755	IASD08
Methoxychlor	72-43-5	7	-	10	70	0.00107	-	0.0122	0.00082	-	0.00755	IASD10
Polycyclic Aromatic Hydrocarbons												
1-Methylnaphthalene	90-12-0	1	-	3	33	0.037	-	0.037	0.0044	-	0.006	IAA-SS002
2-Methylnaphthalene	91-57-6	13	-	38	34	0.00092	-	0.36	0.0019	-	0.49	IASD11
Acenaphthene	83-32-9	6	-	38	16	0.0014	-	1	0.0019	-	0.49	IASD09

Table 7-19
Soil Risk Assessment Dataset
Combined Surface and Subsurface Soil
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b]				Detects			Detection Limits			Maximum Location
		number of detects / number of samples			FOD %	Min	-	Max	Min	-	Max	
						(mg/kg)		(mg/kg)	(mg/kg)		(mg/kg)	
Acenaphthylene	208-96-8	6	-	40	15	0.0012	-	0.3	0.0019	-	0.49	TR-01A
Anthracene	120-12-7	9	-	40	22	0.0011	-	2.1	0.0019	-	0.49	IASD09
Benzo(a)anthracene	56-55-3	18	-	42	43	0.0018	-	6.9	0.0019	-	0.49	IASD09
Benzo(a)pyrene	50-32-8	17	-	42	40	0.002	-	5.9	0.0019	-	0.49	IASD09
Benzo(b)fluoranthene	205-99-2	17	-	42	40	0.0049	-	13	0.0019	-	0.49	TR-01A
Benzo(g,h,i)perylene	191-24-2	15	-	47	32	0.0023	-	41	0.0019	-	0.49	504360
Benzo(k)fluoranthene	207-08-9	18	-	42	43	0.0014	-	6.5	0.0019	-	0.49	TR-01A
Chrysene	218-01-9	20	-	49	41	0.0026	-	44	0.0019	-	0.49	504360
Dibenzo(a,h)anthracene	53-70-3	7	-	40	18	0.0024	-	0.97	0.0019	-	0.49	IASD09
Fluoranthene	206-44-0	22	-	49	45	0.0047	-	59	0.0019	-	0.49	504360
Fluorene	86-73-7	8	-	38	21	0.00097	-	1.3	0.0019	-	0.49	IASD09
Indeno(1,2,3-cd)pyrene	193-39-5	13	-	40	32	0.0017	-	6.1	0.0019	-	0.49	TR-01A
Naphthalene	91-20-3	14	-	40	35	0.00088	-	0.75	0.0019	-	0.49	IASD09
Phenanthrene	85-01-8	23	-	42	55	0.00084	-	16	0.0022	-	0.49	IASD09
Pyrene	129-00-0	22	-	49	45	0.0033	-	48	0.0019	-	0.49	504360
Polychlorinated Biphenyls												
Aroclor 1254	11097-69-1	18	-	61	30	0.0049	-	12	0.022	-	0.04	IASS05
Aroclor 1260	11096-82-5	3	-	38	8	0.37	-	1	0.02	-	0.04	SS-11
Inorganics												
Aluminum	7429-90-5	139	-	139	100	881	-	46900	–	-	–	81027160
Antimony	7440-36-0	39	-	136	29	0.21	-	16.9	0.54	-	5.6	IAA-SS028
Arsenic	7440-38-2	138	-	139	99	0.55	-	164	–	-	–	SS-12
Barium	7440-39-3	139	-	139	100	8.5	-	11800	–	-	–	SS-11a
Beryllium	7440-41-7	118	-	139	85	0.28	-	4.3	0.11	-	1.2	IASB4
Cadmium	7440-43-9	55	-	118	47	0.06	-	15.2	0.11	-	6.2	IAA-SS015
Calcium	7440-70-2	139	-	139	100	33.7	-	197000	–	-	–	IAA-SS006
Chromium	7440-47-3	139	-	139	100	10.1	-	1920	–	-	–	504360
Cobalt	7440-48-4	137	-	139	99	0.26	-	422	4.6	-	27.8	IASB07
Copper	7440-50-8	139	-	139	100	5.13	-	56500	–	-	–	SS-12
Iron	7439-89-6	139	-	139	100	9450	-	328000	–	-	–	IAA-SS028
Lead	7439-92-1	139	-	139	100	6.4	-	16200	–	-	–	504360
Magnesium	7439-95-4	139	-	139	100	120	-	86100	–	-	–	IAA-SS033
Manganese	7439-96-5	139	-	139	100	8.6	-	2510	–	-	–	IASB07
Mercury	7439-97-6	92	-	130	71	0.015	-	79.5	0.05	-	0.15	IAA-SS022
Nickel	7440-02-0	138	-	139	99	0.47	-	213	0.12	-	0.12	IAA-SS028
Potassium	7440-09-7	138	-	139	99	173	-	5570	1250	-	1250	IATP2B/D
Selenium	7782-49-2	45	-	136	33	0.41	-	1.9	0.55	-	6.2	50240,81022636
Silver	7440-22-4	17	-	111	15	0.18	-	22.5	0.22	-	3.7	SS-12
Sodium	7440-23-5	94	-	137	69	6.28	-	1350	972	-	1850	IATP2B/D
Thallium	7440-28-0	59	-	139	42	0.11	-	1	0.22	-	12.5	SS-03,SS-11

Table 7-19
Soil Risk Assessment Dataset
Combined Surface and Subsurface Soil
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b]				Detects			Detection Limits			Maximum Location
		number of detects / number of samples			FOD %	Min (mg/kg)	-	Max (mg/kg)	Min (mg/kg)	-	Max (mg/kg)	
Vanadium	7440-62-2	137	-	139	99	10.8	-	98.4	–	-	–	50240
Zinc	7440-66-6	137	-	139	99	6	-	21800	–	-	–	SS-11

Notes:
– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilogram.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table 7-20
Sediment Risk Assessment Dataset
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Inorganics										-		
Aluminum	7429-90-5	4	-	4	100	16600	-	21200	–	-	–	IAA-SE003
Arsenic	7440-38-2	4	-	4	100	8.4	-	10.3	–	-	–	IAA-SE001
Barium	7440-39-3	4	-	4	100	36.8	-	48.9	–	-	–	IAA-SE004
Beryllium	7440-41-7	4	-	4	100	0.61	-	1.2	–	-	–	IAA-SE003
Cadmium	7440-43-9	2	-	4	50	0.42	-	0.47	1.3	-	1.4	IAA-SE004
Calcium	7440-70-2	4	-	4	100	1350	-	8650	–	-	–	IAA-SE001
Chromium	7440-47-3	4	-	4	100	25.1	-	32.7	–	-	–	IAA-SE001
Cobalt	7440-48-4	4	-	4	100	4	-	13	–	-	–	IAA-SE003
Copper	7440-50-8	4	-	4	100	19	-	24.8	–	-	–	IAA-SE003
Iron	7439-89-6	4	-	4	100	27900	-	32300	–	-	–	IAA-SE001
Lead	7439-92-1	4	-	4	100	31.8	-	44.4	–	-	–	IAA-SE003
Magnesium	7439-95-4	4	-	4	100	1800	-	4580	–	-	–	IAA-SE001
Manganese	7439-96-5	4	-	4	100	186	-	369	–	-	–	IAA-SE003
Mercury	7439-97-6	4	-	4	100	0.054	-	0.093	–	-	–	IAA-SE002
Nickel	7440-02-0	4	-	4	100	7.7	-	15.2	–	-	–	IAA-SE003
Potassium	7440-09-7	4	-	4	100	643	-	880	–	-	–	IAA-SE003
Vanadium	7440-62-2	4	-	4	100	50.7	-	62.6	–	-	–	IAA-SE001
Zinc	7440-66-6	4	-	4	100	54.5	-	107	–	-	–	IAA-SE003

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilograms.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table 7-21
Selection of Constituents of Potential Concern for Surface Soil (0-2 foot Depth Interval)
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b] Industrial Scenario		Residential Scenario		Surrogate	Background Level [c]	Does Maximum Exceed RSL? Industrial	Residential	Is Constituent a Surface Soil COPC? [d]
		(mg/kg)	(mg/kg)		(mg/kg)			(mg/kg)	(YES, no)	(YES, no)	(YES, no)
Volatile Organic Compounds											
3-Octanone	106-68-3	1.50E-02	NA		NA			–	NA	NA	**YES**
Acetone	67-64-1	1.60E-01	6.10E+04	nms	6.10E+03	n		–	no	no	no
d-Limonene	5989-27-5	8.40E-02	NA		NA			–	NA	NA	**YES**
Methylene Chloride	75-09-2	4.00E-03	5.40E+01	c	1.10E+01	c		–	no	no	no
Semi-Volatile Organic Compounds											
2,4-Dinitrotoluene	121-14-2	2.10E+02	1.20E+02	n	1.20E+01	n		–	**YES**	**YES**	**YES**
Benzoic Acid	65-85-0	3.00E-01	2.50E+05	nm	2.40E+04	nm		–	no	no	no
bis(2-Ethylhexyl)phthalate	117-81-7	7.50E+02	1.20E+02	c*	3.50E+01	c*		–	**YES**	**YES**	**YES**
Butylbenzylphthalate	85-68-7	1.30E-01	9.10E+02	c	2.60E+02	c*		–	no	no	no
Carbazole	86-74-8	2.40E+00	NA		NA			–	NA	NA	**YES**
Dibenzofuran	132-64-9	7.40E-01	1.00E+02	n	7.80E+00	n	Furan	–	no	no	no
Diethylphthalate	84-66-2	2.50E+02	4.90E+04	nm	4.90E+03	n		–	no	no	no
Di-n-Butylphthalate	84-74-2	3.10E-01	6.20E+03	n	6.10E+02	n		–	no	no	no
Di-n-Octylphthalate	117-84-0	4.00E-02	6.20E+03	n	6.10E+02	n	di-n-Butylphthalate	–	no	no	no
Explosives											
1,3,5-Trinitrobenzene	99-35-4	7.00E-02	2.70E+03	n	2.20E+02	n		–	no	no	no
4-Amino-2,6-Dinitrotoluene	19406-51-0	5.00E-02	1.90E+02	n	1.50E+01	n		–	no	no	no
Nitroglycerine	55-63-0	5.70E-01	6.20E+00	n	6.10E-01	n		–	no	no	no
Pesticides											
4,4'-DDD	72-54-8	2.48E-03	7.20E+00	c	2.00E+00	c		–	no	no	no
4,4'-DDE	72-55-9	3.01E-03	5.10E+00	c	1.40E+00	c		–	no	no	no
4,4'-DDT	50-29-3	6.70E-03	7.00E+00	c*	1.70E+00	c*		–	no	no	no
Beta-BHC	319-85-7	1.70E-04	9.60E-01	c	2.70E-01	c		–	no	no	no
Delta-BHC	319-86-8	1.04E-03	2.10E+00	c	5.20E-01	c*	gamma-BHC	–	no	no	no
Alpha-Chlordane	5103-71-9	3.01E-03	6.50E+00	c*	1.60E+00	c*	Chlordane	–	no	no	no
Gamma-Chlordane	5566-34-7	4.08E-03	6.50E+00	c*	1.60E+00	c*	Chlordane	–	no	no	no
Dieldrin	60-57-1	9.09E-03	1.10E-01	c	3.00E-02	c		–	no	no	no
Endosulfan II	33213-65-9	3.78E-03	3.70E+02	n	3.70E+01	n	Endosulfan	–	no	no	no
Endrin	72-20-8	2.00E-02	1.80E+01	n	1.80E+00	n		–	no	no	no
Endrin Ketone	53494-70-5	4.24E-03	1.80E+01	n	1.80E+00	n	Endrin	–	no	no	no
Heptachlor Epoxide	1024-57-3	1.01E-03	1.90E-01	c*	5.30E-02	c*		–	no	no	no
Methoxychlor	72-43-5	1.22E-02	3.10E+02	n	3.10E+01	n		–	no	no	no
Polycyclic Aromatic Hydrocarbons											
1-Methylnaphthalene	90-12-0	3.70E-02	9.90E+01	c	2.20E+01	c		–	no	no	no
2-Methylnaphthalene	91-57-6	3.60E-01	4.10E+02	ns	3.10E+01	n		–	no	no	no
Acenaphthene	83-32-9	1.00E+00	3.30E+03	n	3.40E+02	n		–	no	no	no
Acenaphthylene	208-96-8	3.00E-01	3.30E+03	n	3.40E+02	n	Acenaphthene	–	no	no	no
Anthracene	120-12-7	2.10E+00	1.70E+04	nm	1.70E+03	n		–	no	no	no
Benzo(a)anthracene	56-55-3	6.90E+00	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Benzo(a)pyrene	50-32-8	5.90E+00	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Benzo(b)fluoranthene	205-99-2	1.30E+01	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Benzo(g,h,i)perylene	191-24-2	4.10E+01	1.70E+03	n	1.70E+02	n	Pyrene	–	no	no	no
Benzo(k)fluoranthene	207-08-9	6.50E+00	2.10E+01	c	1.50E+00	c		–	no	**YES**	**YES**
Chrysene	218-01-9	4.40E+01	2.10E+02	c	1.50E+01	c		–	no	**YES**	**YES**

Table 7-21
Selection of Constituents of Potential Concern for Surface Soil (0-2 foot Depth Interval)
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a] (mg/kg)	Adjusted Soil Regional Screening Level (RSL) [b] Industrial Scenario (mg/kg)		Residential Scenario (mg/kg)		Surrogate	Background Level [c] (mg/kg)	Does Maximum Exceed RSL? Industrial (YES, no)	Residential (YES, no)	Is Constituent a Surface Soil COPC? [d] (YES, no)
Dibenzo(a,h)anthracene	53-70-3	9.70E-01	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Fluoranthene	206-44-0	5.90E+01	2.20E+03	n	2.30E+02	n		–	no	no	no
Fluorene	86-73-7	1.30E+00	2.20E+03	n	2.30E+02	n		–	no	no	no
Indeno(1,2,3-cd)pyrene	193-39-5	6.10E+00	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Naphthalene	91-20-3	7.50E-01	2.00E+01	c*	3.90E+00	c*		–	no	no	no
Phenanthrene	85-01-8	1.60E+01	1.70E+04	nm	1.70E+03	n	Anthracene	–	no	no	no
Pyrene	129-00-0	4.80E+01	1.70E+03	n	1.70E+02	n		–	no	no	no
Polychlorinated Biphenyls											
Aroclor 1254	11097-69-1	1.20E+01	7.40E-01	c*	1.10E-01	n		–	**YES**	**YES**	**YES**
Aroclor 1260	11096-82-5	1.00E+00	7.40E-01	c	2.20E-01	c		–	**YES**	**YES**	**YES**
Inorganics											
Aluminum	7429-90-5	4.69E+04	9.90E+04	nm	7.70E+03	n		4.00E+04	no	**YES**	**YES**
Antimony	7440-36-0	1.69E+01	4.10E+01	n	3.10E+00	n		–	no	**YES**	**YES**
Arsenic	7440-38-2	1.64E+02	1.60E+00	c	3.90E-01	c*		1.58E+01	**YES**	**YES**	**YES**
Barium	7440-39-3	1.18E+04	1.90E+04	nm	1.50E+03	n		2.09E+02	no	**YES**	**YES**
Beryllium	7440-41-7	3.80E+00	2.00E+02	n	1.60E+01	n		1.02E+00	no	no	no
Cadmium	7440-43-9	1.52E+01	8.10E+01	n	7.00E+00	n		6.90E-01	no	**YES**	**YES**
Calcium	7440-70-2	1.97E+05	NA		NA			–	NA	NA	no
Chromium	7440-47-3	1.92E+03	1.40E+03	c	2.80E+02	c		6.53E+01	**YES**	**YES**	**YES**
Cobalt	7440-48-4	4.22E+02	3.00E+01	n	2.30E+00	n		7.23E+01	**YES**	**YES**	**YES**
Copper	7440-50-8	5.65E+04	4.10E+03	n	3.10E+02	n		5.35E+01	**YES**	**YES**	**YES**
Iron	7439-89-6	3.28E+05	7.20E+04	nm	5.50E+03	n		5.10E+04	**YES**	**YES**	**YES**
Lead	7439-92-1	1.62E+04	8.00E+02	«	4.00E+02	«		2.68E+01	**YES**	**YES**	**YES**
Magnesium	7439-95-4	8.61E+04	NA		NA			–	NA	NA	no
Manganese	7439-96-5	2.51E+03	2.30E+03	n	1.80E+02	n		2.54E+03	**YES**	**YES**	no
Mercury	7439-97-6	7.95E+01	3.10E+01	n	2.30E+00	n		1.30E-01	**YES**	**YES**	**YES**
Nickel	7440-02-0	2.13E+02	2.00E+03	n	1.60E+02	n		6.28E+01	no	**YES**	**YES**
Potassium	7440-09-7	5.57E+03	NA		NA			–	NA	NA	no
Selenium	7782-49-2	1.90E+00	5.10E+02	n	3.90E+01	n		–	no	no	no
Silver	7440-22-4	2.25E+01	5.10E+02	n	3.90E+01	n		–	no	no	no
Sodium	7440-23-5	1.35E+03	NA		NA			–	NA	NA	no
Thallium	7440-28-0	1.00E+00	6.60E+00	n	5.10E-01	n		2.11E+00	no	**YES**	no
Vanadium	7440-62-2	9.84E+01	7.20E+02	n	5.50E+01	n		1.08E+02	no	**YES**	no
Zinc	7440-66-6	2.18E+04	3.10E+04	nm	2.30E+03	n		2.02E+02	no	**YES**	**YES**

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
mg/kg = Milligrams per kilogram.
NA = Not available or not applicable.
RSL = Regional Screening Level.
USEPA = United States Environmental Protection Agency.

[a] Maximum concentration in surface soil (0-2 foot depth interval).

[b] The screening levels used were from USEPA (2008a). Screening levels based on non-cancer effects were adjusted downward by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = concentration may exceed ceiling limit; s = Concentration may exceed saturation concentration (Csat).
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.

[c] Background levels for metals are facility-wide soil background point estimates taken from Facility-Wide Background Study Report (IT Corporation, 2001).

[d] Constituents detected with maximum concentrations greater than adjusted residential screening levels were considered COPCs unless they were metals detected at concentrations lower than background, or are essential nutrients (i.e., calcium, magnesium, potassium, sodium), or they were known laboratory contaminants (i.e. acetone).

Table 7-22
Selection of Constituents of Potential Concern for Combined Surface and Subsurface Soil
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b]					Background Level [c]	Does Maximum Exceed RSL?		Is Constituent a Surface/ Subsurface Soil COPC? [d]
			Industrial Scenario		Residential Scenario		Surrogate		Industrial	Residential	
		(mg/kg)	(mg/kg)		(mg/kg)			(mg/kg)	(YES, no)	(YES, no)	(YES, no)
Volatile Organic Compounds											
3-Octanone	106-68-3	1.50E-02	NA		NA			–	NA	NA	**YES**
Acetone	67-64-1	1.60E-01	6.10E+04	nms	6.10E+03	n		–	no	no	no
d-Limonene	5989-27-5	8.40E-02	NA		NA			–	NA	NA	**YES**
Methylene Chloride	75-09-2	4.00E-03	5.40E+01	c	1.10E+01	c		–	no	no	no
Toluene	108-88-3	8.30E-04	4.60E+03	ns	5.00E+02	ns		–	no	no	no
Semi-Volatile Organic Compounds											
2,4-Dinitrotoluene	121-14-2	2.10E+02	1.20E+02	n	1.20E+01	n		–	**YES**	**YES**	**YES**
Benzoic Acid	65-85-0	3.00E-01	2.50E+05	nm	2.40E+04	nm		–	no	no	no
bis(2-Ethylhexyl)phthalate	117-81-7	7.50E+02	1.20E+02	c*	3.50E+01	c*		–	**YES**	**YES**	**YES**
Butylbenzylphthalate	85-68-7	1.30E-01	9.10E+02	c	2.60E+02	c*		–	no	no	no
Carbazole	86-74-8	2.40E+00	NA		NA			–	NA	NA	**YES**
Dibenzofuran	132-64-9	7.40E-01	1.00E+02	n	7.80E+00	n	Furan	–	no	no	no
Diethylphthalate	84-66-2	2.50E+02	4.90E+04	nm	4.90E+03	n		–	no	no	no
Di-n-Butylphthalate	84-74-2	3.10E-01	6.20E+03	n	6.10E+02	n		–	no	no	no
Di-n-Octylphthalate	117-84-0	4.00E-02	6.20E+03	n	6.10E+02	n	di-n-Butylphthalate	–	no	no	no
Explosives											
1,3,5-Trinitrobenzene	99-35-4	7.00E-02	2.70E+03	n	2.20E+02	n		–	no	no	no
4-Amino-2,6-Dinitrotoluene	19406-51-0	5.00E-02	1.90E+02	n	1.50E+01	n		–	no	no	no
Nitroglycerine	55-63-0	5.70E-01	6.20E+00	n	6.10E-01	n		–	no	no	no
Pesticides											
4,4'-DDD	72-54-8	2.48E-03	7.20E+00	c	2.00E+00	c		–	no	no	no
4,4'-DDE	72-55-9	3.01E-03	5.10E+00	c	1.40E+00	c		–	no	no	no
4,4'-DDT	50-29-3	6.70E-03	7.00E+00	c*	1.70E+00	c*		–	no	no	no
Beta-BHC	319-85-7	1.70E-04	9.60E-01	c	2.70E-01	c		–	no	no	no
Delta-BHC	319-86-8	1.04E-03	2.10E+00	c	5.20E-01	c*	gamma-BHC	–	no	no	no
Alpha-Chlordane	5103-71-9	3.01E-03	6.50E+00	c*	1.60E+00	c*	Chlordane	–	no	no	no
Gamma-Chlordane	5566-34-7	4.08E-03	6.50E+00	c*	1.60E+00	c*	Chlordane	–	no	no	no
Dieldrin	60-57-1	9.09E-03	1.10E-01	c	3.00E-02	c		–	no	no	no
Endosulfan II	33213-65-9	3.78E-03	3.70E+02	n	3.70E+01	n	Endosulfan	–	no	no	no
Endrin	72-20-8	2.00E-02	1.80E+01	n	1.80E+00	n		–	no	no	no
Endrin Ketone	53494-70-5	4.24E-03	1.80E+01	n	1.80E+00	n	Endrin	–	no	no	no
Heptachlor Epoxide	1024-57-3	1.01E-03	1.90E-01	c*	5.30E-02	c*		–	no	no	no
Methoxychlor	72-43-5	1.22E-02	3.10E+02	n	3.10E+01	n		–	no	no	no
Polycyclic Aromatic Hydrocarbons											
1-Methylnaphthalene	90-12-0	3.70E-02	9.90E+01	c	2.20E+01	c		–	no	no	no
2-Methylnaphthalene	91-57-6	3.60E-01	4.10E+02	ns	3.10E+01	n		–	no	no	no
Acenaphthene	83-32-9	1.00E+00	3.30E+03	n	3.40E+02	n		–	no	no	no
Acenaphthylene	208-96-8	3.00E-01	3.30E+03	n	3.40E+02	n	Acenaphthene	–	no	no	no
Anthracene	120-12-7	2.10E+00	1.70E+04	nm	1.70E+03	n		–	no	no	no
Benzo(a)anthracene	56-55-3	6.90E+00	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Benzo(a)pyrene	50-32-8	5.90E+00	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Benzo(b)fluoranthene	205-99-2	1.30E+01	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Benzo(g,h,i)perylene	191-24-2	4.10E+01	1.70E+03	n	1.70E+02	n	Pyrene	–	no	no	no
Benzo(k)fluoranthene	207-08-9	6.50E+00	2.10E+01	c	1.50E+00	c		–	no	**YES**	**YES**
Chrysene	218-01-9	4.40E+01	2.10E+02	c	1.50E+01	c		–	no	**YES**	**YES**
Dibenzo(a,h)anthracene	53-70-3	9.70E-01	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Fluoranthene	206-44-0	5.90E+01	2.20E+03	n	2.30E+02	n		–	no	no	no
Fluorene	86-73-7	1.30E+00	2.20E+03	n	2.30E+02	n		–	no	no	no
Indeno(1,2,3-cd)pyrene	193-39-5	6.10E+00	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**

Table 7-22
Selection of Constituents of Potential Concern for Combined Surface and Subsurface Soil
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a] (mg/kg)	Adjusted Soil Regional Screening Level (RSL) [b]: Industrial Scenario (mg/kg)		Residential Scenario (mg/kg)		Surrogate	Background Level [c] (mg/kg)	Does Maximum Exceed RSL?: Industrial (YES, no)	Residential (YES, no)	Is Constituent a Surface/ Subsurface Soil COPC? [d] (YES, no)
Naphthalene	91-20-3	7.50E-01	2.00E+01	c*	3.90E+00	c*		–	no	no	no
Phenanthrene	85-01-8	1.60E+01	1.70E+04	nm	1.70E+03	n	Anthracene	–	no	no	no
Pyrene	129-00-0	4.80E+01	1.70E+03	n	1.70E+02	n		–	no	no	no
Polychlorinated Biphenyls											
Aroclor 1254	11097-69-1	1.20E+01	7.40E-01	c*	1.10E-01	n		–	**YES**	**YES**	**YES**
Aroclor 1260	11096-82-5	1.00E+00	7.40E-01	c	2.20E-01	c		–	**YES**	**YES**	**YES**
Inorganics											
Aluminum	7429-90-5	4.69E+04	9.90E+04	nm	7.70E+03	n		4.00E+04	no	**YES**	**YES**
Antimony	7440-36-0	1.69E+01	4.10E+01	n	3.10E+00	n		–	no	**YES**	**YES**
Arsenic	7440-38-2	1.64E+02	1.60E+00	c	3.90E-01	c*		1.58E+01	**YES**	**YES**	**YES**
Barium	7440-39-3	1.18E+04	1.90E+04	nm	1.50E+03	n		2.09E+02	no	**YES**	**YES**
Beryllium	7440-41-7	4.30E+00	2.00E+02	n	1.60E+01	n		1.02E+00	no	no	no
Cadmium	7440-43-9	1.52E+01	8.10E+01	n	7.00E+00	n		6.90E-01	no	**YES**	**YES**
Calcium	7440-70-2	1.97E+05	NA		NA			–	NA	NA	no
Chromium	7440-47-3	1.92E+03	1.40E+03	c	2.80E+02	c		6.53E+01	**YES**	**YES**	**YES**
Cobalt	7440-48-4	4.22E+02	3.00E+01	n	2.30E+00	n		7.23E+01	**YES**	**YES**	**YES**
Copper	7440-50-8	5.65E+04	4.10E+03	n	3.10E+02	n		5.35E+01	**YES**	**YES**	**YES**
Iron	7439-89-6	3.28E+05	7.20E+04	nm	5.50E+03	n		5.10E+04	**YES**	**YES**	**YES**
Lead	7439-92-1	1.62E+04	8.00E+02	«	4.00E+02	«		2.68E+01	**YES**	**YES**	**YES**
Magnesium	7439-95-4	8.61E+04	NA		NA			–	NA	NA	no
Manganese	7439-96-5	2.51E+03	2.30E+03	n	1.80E+02	n		2.54E+03	**YES**	**YES**	no
Mercury	7439-97-6	7.95E+01	3.10E+01	n	2.30E+00	n		1.30E-01	**YES**	**YES**	**YES**
Nickel	7440-02-0	2.13E+02	2.00E+03	n	1.60E+02	n		6.28E+01	no	**YES**	**YES**
Potassium	7440-09-7	5.57E+03	NA		NA			–	NA	NA	no
Selenium	7782-49-2	1.90E+00	5.10E+02	n	3.90E+01	n		–	no	no	no
Silver	7440-22-4	2.25E+01	5.10E+02	n	3.90E+01	n		–	no	no	no
Sodium	7440-23-5	1.35E+03	NA		NA			–	NA	NA	no
Thallium	7440-28-0	1.00E+00	6.60E+00	n	5.10E-01	n		2.11E+00	no	**YES**	no
Vanadium	7440-62-2	9.84E+01	7.20E+02	n	5.50E+01	n		1.08E+02	no	**YES**	no
Zinc	7440-66-6	2.18E+04	3.10E+04	nm	2.30E+03	n		2.02E+02	no	**YES**	**YES**

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
mg/kg = Milligrams per kilogram.
NA = Not available or not applicable.
RSL = Regional Screening Level.
USEPA = United States Environmental Protection Agency.

[a] Maximum concentration in combined surface and subsurface soil.

[b] The screening levels used were from USEPA (2008a). Screening levels based on non-cancer effects were adjusted downward by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = Concentration may exceed ceiling limit; s = Concentration may exceed saturation concentration (Csat).
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.

[c] Background levels for metals are facility-wide soil background point estimates taken from Facility-Wide Background Study Report (IT Corporation, 2001).

[d] Constituents detected with maximum concentrations greater than adjusted residential screening levels were considered COPCs unless they were metals detected at concentrations lower than background, or are essential nutrients (i.e., calcium, magnesium, potassium, sodium), or they were known laboratory contaminants (i.e. acetone).

Table 7-23
Selection of Constituents of Potential Concern for Sediment
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a] (mg/kg)	Adjusted Soil Regional Screening Level (RSL) [b] Residential Scenario (mg/kg)		Surrogate	Is Constituent a Sediment COPC? [c] (YES, no)
Inorganics						
Aluminum	7429-90-5	2.12E+04	7.70E+03	n		**YES**
Arsenic	7440-38-2	1.03E+01	3.90E-01	c*		**YES**
Barium	7440-39-3	4.89E+01	1.50E+03	n		no
Beryllium	7440-41-7	1.20E+00	1.60E+01	n		no
Cadmium	7440-43-9	4.70E-01	7.00E+00	n		no
Calcium	7440-70-2	8.65E+03	NA			no
Chromium	7440-47-3	3.27E+01	2.80E+02	c		no
Cobalt	7440-48-4	1.30E+01	2.30E+00	n		**YES**
Copper	7440-50-8	2.48E+01	3.10E+02	n		no
Iron	7439-89-6	3.23E+04	5.50E+03	n		**YES**
Lead	7439-92-1	4.44E+01	4.00E+02	«		no
Magnesium	7439-95-4	4.58E+03	NA			no
Manganese	7439-96-5	3.69E+02	1.80E+02	n		**YES**
Mercury	7439-97-6	9.30E-02	2.30E+00	n		no
Nickel	7440-02-0	1.52E+01	1.60E+02	n		no
Potassium	7440-09-7	8.80E+02	NA			no
Vanadium	7440-62-2	6.26E+01	5.50E+01	n		**YES**
Zinc	7440-66-6	1.07E+02	2.30E+03	n		no

Notes:

CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
mg/kg = Milligrams per kilogram.
NA = Not available or not applicable.
RSL = Regional Screening Level.
USEPA = United States Environmental Protection Agency.

[a] Maximum concentration in sediment.

[b] The screening levels used were risk screening levels for the residential scenario from USEPA (2008a). Screening levels based on non-cancer effects were adjusted downward by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = Concentration may exceed ceiling limit; s = Concentration may exceed saturation concentration (Csat).
Some RSL values were based on surrogates as identified next to each value.
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.

[c] Constituents detected with maximum concentrations greater than adjusted residential screening levels were considered COPCs unless they were metals detected at concentrations lower than background, or are essential nutrients (i.e., calcium, magnesium, potassium, sodium), or they were known laboratory contaminants (i.e. acetone).

Table 7-24
Exposure Point Concentrations
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a]			Exposure Point Concentrations [b]		
		Surface Soil	Combined Surface and Subsurface Soil	Sediment	Surface Soil (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Sediment (mg/kg)
Volatile Organic Compounds							
1,2,3-Trichloropropane	96-18-4	no	no	no	–	–	–
1,2,4-Trimethylbenzene	95-63-6	no	no	no	–	–	–
2-Butanone	78-93-3	no	no	no	–	–	–
3-Octanone	106-68-3	**YES**	**YES**	no	1.50E-02 m	1.50E-02 m	–
4-Methyl-2-pentanone	108-10-1	no	no	no	–	–	–
Acetone	67-64-1	no	no	no	–	–	–
Bromodichloromethane	75-27-4	no	no	no	–	–	–
Carbon Disulfide	75-15-0	no	no	no	–	–	–
Chloroform	67-66-3	no	no	no	–	–	–
cis-1,2-Dichloroethene	156-59-2	no	no	no	–	–	–
d-Limonene	5989-27-5	**YES**	**YES**	no	8.40E-02 m	8.40E-02 m	–
Ethanol	64-17-5	no	no	no	–	–	–
m,p-Xylene	136777612	no	no	no	–	–	–
Methylene Chloride	75-09-2	no	no	no	–	–	–
p-Isopropyltoluene	99-87-6	no	no	no	–	–	–
Tetrachloroethene	127-18-4	no	no	no	–	–	–
Toluene	108-88-3	no	no	no	–	–	–
Trichloroethene	79-01-6	no	no	no	–	–	–
Xylenes (total)	1330-20-7	no	no	no	–	–	–
Semi-Volatile Organic Compounds							
1,2,4-Trichlorobenzene	120-82-1	no	no	no	–	–	–
1,2-Dichlorobenzene	95-50-1	no	no	no	–	–	–
1,3-Dichlorobenzene	541-73-1	no	no	no	–	–	–
1,4-Dichlorobenzene	106-46-7	no	no	no	–	–	–
2,4-Dinitrotoluene	121-14-2	**YES**	**YES**	no	2.10E+02 m	2.10E+02 m	–
2,6-Dinitrotoluene	606-20-2	no	no	no	–	–	–
3,3'-Dichlorobenzidine	91-94-1	no	no	no	–	–	–
4-Methylphenol	106-44-5	no	no	no	–	–	–
Benzoic Acid	65-85-0	no	no	no	–	–	–
bis(2-Ethylhexyl)phthalate	117-81-7	**YES**	**YES**	no	2.84E+02	2.44E+02	–
Butylbenzylphthalate	85-68-7	no	no	no	–	–	–
Carbazole	86-74-8	**YES**	**YES**	no	4.02E-01	3.36E-01	–
Dibenzofuran	132-64-9	no	no	no	–	–	–
Diethylphthalate	84-66-2	no	no	no	–	–	–
Di-n-Butylphthalate	84-74-2	no	no	no	–	–	–
Di-n-Octylphthalate	117-84-0	no	no	no	–	–	–
N-Nitrosodiphenylamine	86-30-6	no	no	no	–	–	–
Pentachlorophenol	87-86-5	no	no	no	–	–	–
Phenol	108-95-2	no	no	no	–	–	–
Dioxin/Furan Compounds							
1,2,3,4,6,7,8-HpCDD	35822-46-9	no	no	no	–	–	–

Table 7-24
Exposure Point Concentrations
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a]			Exposure Point Concentrations [b]		
		Surface Soil	Combined Surface and Subsurface Soil	Sediment	Surface Soil (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Sediment (mg/kg)
1,2,3,4,6,7,8-HpCDF	67562-39-4	no	no	no	–	–	–
1,2,3,4,7,8,9-HpCDF	55673-89-7	no	no	no	–	–	–
1,2,3,4,7,8-HxCDD	39227-28-6	no	no	no	–	–	–
1,2,3,4,7,8-HxCDF	70648-26-9	no	no	no	–	–	–
1,2,3,6,7,8-HxCDD	57653-85-7	no	no	no	–	–	–
1,2,3,6,7,8-HxCDF	57117-44-9	no	no	no	–	–	–
1,2,3,7,8,9-HxCDD	19408-74-3	no	no	no	–	–	–
1,2,3,7,8,9-HxCDF	72918-21-9	no	no	no	–	–	–
1,2,3,7,8-PeCDD	40321-76-4	no	no	no	–	–	–
1,2,3,7,8-PeCDF	57117-41-6	no	no	no	–	–	–
2,3,4,6,7,8-HxCDF	60851-34-5	no	no	no	–	–	–
2,3,4,7,8-PeCDF	57117-31-4	no	no	no	–	–	–
2,3,7,8-TCDD	1746-01-6	no	no	no	–	–	–
2,3,7,8-TCDF	51207-31-9	no	no	no	–	–	–
OCDD	3268-87-9	no	no	no	–	–	–
OCDF	39001-02-0	no	no	no	–	–	–
Explosives							
1,3,5-Trinitrobenzene	99-35-4	no	no	no	–	–	–
1,3-Dinitrobenzene	99-65-0	no	no	no	–	–	–
2,4,6-Trinitrotoluene	118-96-7	no	no	no	–	–	–
4-Amino-2,6-Dinitrotoluene	19406-51-0	no	no	no	–	–	–
m-Nitrotoluene	99-08-1	no	no	no	–	–	–
Nitrobenzene	98-95-3	no	no	no	–	–	–
Nitroglycerine	55-63-0	no	no	no	–	–	–
Pentaerythritol Tetranitrate	78-11-5	no	no	no	–	–	–
Perchlorate	14797-73-0	no	no	no	–	–	–
Herbicides							
2,4,5-T	93-76-5	no	no	no	–	–	–
2,4,5-TP	93-72-1	no	no	no	–	–	–
2,4-D	94-75-7	no	no	no	–	–	–
2,4-DB	94-82-6	no	no	no	–	–	–
Dalapon	75-99-0	no	no	no	–	–	–
Dicamba	1918-00-9	no	no	no	–	–	–
Dichlorprop	120-36-5	no	no	no	–	–	–
MCPA	94-74-6	no	no	no	–	–	–
MCPP	93-65-2	no	no	no	–	–	–
Pesticides							
4,4'-DDD	72-54-8	no	no	no	–	–	–
4,4'-DDE	72-55-9	no	no	no	–	–	–
4,4'-DDT	50-29-3	no	no	no	–	–	–
Alpha-BHC	319-84-6	no	no	no	–	–	–
Beta-BHC	319-85-7	no	no	no	–	–	–

Table 7-24
Exposure Point Concentrations
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a]			Exposure Point Concentrations [b]		
		Surface Soil	Combined Surface and Subsurface Soil	Sediment	Surface Soil (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Sediment (mg/kg)
Delta-BHC	319-86-8	no	no	no	–	–	–
Gamma-BHC (Lindane)	58-89-9	no	no	no	–	–	–
Alpha-Chlordane	5103-71-9	no	no	no	–	–	–
Gamma-Chlordane	5566-34-7	no	no	no	–	–	–
Dieldrin	60-57-1	no	no	no	–	–	–
Endosulfan I	115-29-7	no	no	no	–	–	–
Endosulfan II	33213-65-9	no	no	no	–	–	–
Endosulfan Sulfate	1031-07-8	no	no	no	–	–	–
Endrin	72-20-8	no	no	no	–	–	–
Endrin Aldehyde	7421-93-4	no	no	no	–	–	–
Endrin Ketone	53494-70-5	no	no	no	–	–	–
Heptachlor	76-44-8	no	no	no	–	–	–
Heptachlor Epoxide	1024-57-3	no	no	no	–	–	–
Methoxychlor	72-43-5	no	no	no	–	–	–
Polycyclic Aromatic Hydrocarbons							
1-Methylnaphthalene	90-12-0	no	no	no	–	–	–
2-Methylnaphthalene	91-57-6	no	no	no	–	–	–
Acenaphthene	83-32-9	no	no	no	–	–	–
Acenaphthylene	208-96-8	no	no	no	–	–	–
Anthracene	120-12-7	no	no	no	–	–	–
Benzo(a)anthracene	56-55-3	**YES**	**YES**	no	2.94E+00	2.17E+00	–
Benzo(a)pyrene	50-32-8	**YES**	**YES**	no	3.00E+00	2.22E+00	–
Benzo(b)fluoranthene	205-99-2	**YES**	**YES**	no	6.47E+00	4.78E+00	–
Benzo(g,h,i)perylene	191-24-2	no	no	no	–	–	–
Benzo(k)fluoranthene	207-08-9	**YES**	**YES**	no	2.65E+00	1.96E+00	–
Chrysene	218-01-9	**YES**	**YES**	no	1.60E+01	1.20E+01	–
Dibenzo(a,h)anthracene	53-70-3	**YES**	**YES**	no	1.62E-01	1.17E-01	–
Fluoranthene	206-44-0	no	no	no	–	–	–
Fluorene	86-73-7	no	no	no	–	–	–
Indeno(1,2,3-cd)pyrene	193-39-5	**YES**	**YES**	no	3.04E+00	2.20E+00	–
Naphthalene	91-20-3	no	no	no	–	–	–
Phenanthrene	85-01-8	no	no	no	–	–	–
Pyrene	129-00-0	no	no	no	–	–	–
Polychlorinated Biphenyls							
Aroclor 1254	11097-69-1	**YES**	**YES**	no	4.63E+00	3.70E+00	–
Aroclor 1260	11096-82-5	**YES**	**YES**	no	1.00E+00 m	1.00E+00 m	–
Inorganics							
Aluminum	7429-90-5	**YES**	**YES**	**YES**	1.97E+04	2.05E+04	2.12E+04 m
Antimony	7440-36-0	**YES**	**YES**	no	1.20E+00	1.07E+00	–
Arsenic	7440-38-2	**YES**	**YES**	**YES**	2.15E+01	1.94E+01	1.03E+01 m
Barium	7440-39-3	**YES**	**YES**	no	1.48E+03	1.26E+03	–
Beryllium	7440-41-7	no	no	no	–	–	–

Table 7-24
Exposure Point Concentrations
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a]			Exposure Point Concentrations [b]		
		Surface Soil	Combined Surface and Subsurface Soil	Sediment	Surface Soil (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Sediment (mg/kg)
Cadmium	7440-43-9	**YES**	**YES**	no	2.12E+00	1.81E+00	–
Calcium	7440-70-2	no	no	no	–	–	–
Chromium	7440-47-3	**YES**	**YES**	no	1.86E+02	1.64E+02	–
Cobalt	7440-48-4	**YES**	**YES**	**YES**	3.40E+01	3.08E+01	1.30E+01 m
Copper	7440-50-8	**YES**	**YES**	no	1.13E+04	9.52E+03	–
Iron	7439-89-6	**YES**	**YES**	**YES**	4.04E+04	4.03E+04	3.23E+04 m
Lead	7439-92-1	**YES**	**YES**	no	7.57E+02 avg	6.42E+02 avg	–
Magnesium	7439-95-4	no	no	no	–	–	–
Manganese	7439-96-5	no	no	**YES**	–	–	3.69E+02 m
Mercury	7439-97-6	**YES**	**YES**	no	4.90E+00	4.14E+00	–
Nickel	7440-02-0	**YES**	**YES**	no	2.82E+01	2.62E+01	–
Potassium	7440-09-7	no	no	no	–	–	–
Selenium	7782-49-2	no	no	no	–	–	–
Silver	7440-22-4	no	no	no	–	–	–
Sodium	7440-23-5	no	no	no	–	–	–
Thallium	7440-28-0	no	no	no	–	–	–
Vanadium	7440-62-2	no	no	**YES**	–	–	6.26E+01 m
Zinc	7440-66-6	**YES**	**YES**	no	2.55E+03	2.17E+03	–

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilogram.
mg/L = Milligrams per liter.

[a] Constituent of Potential Concern.
[b] The exposure point concentration (EPC) was the upper confidence level on the mean (UCL) or the maximum concentration where the UCL was incalculable.
EPCs marked with "m" are based on the maximum detected concentration.
Exposure to lead is evaluated by predicting resultant blood lead levels using the arithmetic average (avg).
The UCLs were calculated using ProUCL 4.0. The UCL used is the one recommended by ProUCL 4.0.

Table 7-25
Summary of Calculated Human Health Risks and Hazards
IGNITER ASSEMBLY AREA
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

RECEPTOR Exposure Medium - Scenario	Total Excess Lifetime Cancer Risk	Total Non-Cancer Hazard
Site Worker		
Surface Soil - Direct Contact	1E-04	1
Sediment - Wading	8E-07	0.01
TOTAL SITE RISKS (Site Worker):	1E-04	1
Hypothetical Future Construction Worker		
Combined Surface and Subsurface Soil - Direct Contact	6E-06	3
TOTAL SITE RISKS (Construction Worker):	6E-06	3
Hypothetical Future Adult Resident		
Combined Surface and Subsurface Soil - Direct Contact	1E-04	1
Sediment - Wading	1E-06	0.02
TOTAL SITE RISKS (Adult Resident):	1E-04	1
Hypothetical Future Child Resident		
Combined Surface and Subsurface Soil - Direct Contact	4E-04	13
Sediment - Wading	1E-06	0.1
TOTAL SITE RISKS (Child Resident):	4E-04	13
Hypothetical Future Aggregate Resident (Adult + Child)		
Combined Surface and Subsurface Soil - Direct Contact	5E-04	--
Sediment - Wading	3E-06	--
TOTAL SITE RISKS (Aggregate Resident):	5E-04	--

Table 7-26
Summary of Calculated Blood Lead Level Estimates
IGNITER ASSEMBLY AREA
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Exposure Medium/Receptor	Model Used [a]	Receptor Blood Lead Level[b]		Fetus Blood Level [b]
		Adult	Child	
		50th Percentile/ Geometric Mean (µg/dL)	range in seven years (µg/dL)	95th Percentile (µg/dL)
IGNITER ASSEMBLY AREA				
Surface Soil (0-1 feet below ground surface)				
Hypothetical Current Commercial/Industrial Worker Receptor	USEPA ALM	2.8	–	9.9
Surface and Subsurface Soil				
Hypothetical Construction Worker Receptor	USEPA ALM	2.8	–	9.9
Hypothetical Future Child Resident Receptor	IEUBK	–	4.4 - 8.2	–
Hypothetical Future Adult Resident Receptor	USEPA ALM	3.2	–	11

Notes:
– = Not applicable.
µg/dL = Microgram(s) per deciliter.

[a] USEPA ALM: USEPA Adult Lead Methodology Spreadsheet.
USEPA Technical Review Workgroup for Lead, Adult Lead Committee (USEPA, 2003b).
USEPA IEUBK: USEPA Integrated Exposure Uptake Biogenetic Model for Lead in Children (USEPA 2005).
[b] Compare to a target blood lead level of 10 mg/dL.

Table 7-27
Screening Level -Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Background Concentration [a] (mg/kg)	Ecological Screening Level (ESLs) [b] (mg/kg)		Maximum HQ [c] (unitless)	Bioaccumulative Chemical?[d] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [e]	
			Value	*Source*			(YES/no)	Rationale
Volatile Organic Compounds								
3-Octanone	0.015	–	NA		NA	no	**YES**	**NSL**
Acetone	0.16	–	2.5	*R5*	0.06	no	no	HQ • 1
d-Limonene	0.084	–	NA		NA	no	**YES**	**NSL**
Methylene Chloride	0.004	–	4.05	*R5*	0.001	no	no	HQ • 1
Semi-Volatile Organic Compounds								
2,4-Dinitrotoluene	48	–	1.28	*R5*	40	no	**YES**	**HQ > 1**
Benzoic Acid	0.3	–	NA		NA	no	**YES**	**NSL**
bis(2-Ethylhexyl)phthalate	750	–	0.92594	*R5*	800	no	**YES**	**HQ > 1**
Butylbenzylphthalate	0.13	–	0.23889	*R5*	0.5	no	no	HQ • 1
Carbazole	2.4	–	NA		NA	no	**YES**	**NSL**
Dibenzofuran	0.74	–	NA		NA	no	**YES**	**NSL**
Diethylphthalate	250	–	24.8	*R5*	10	no	**YES**	**HQ > 1**
Di-n-Butylphthalate	0.31	–	0.15	*R5*	2	no	**YES**	**HQ > 1**
Di-n-Octylphthalate	0.04	–	709	*R5*	0.00006	no	no	HQ • 1
Explosives								
1,3,5-Trinitrobenzene	0.07	–	0.376	*R5*	0.2	no	no	HQ • 1
4-Amino-2,6-Dinitrotoluene	0.05	–	80	*T*	0.0006	no	no	HQ • 1
Nitroglycerine	0.57	–	NA		NA	no	**YES**	**NSL**
Pesticides								
4,4'-DDD	0.00248	–	0.021	*EcoSSL*	0.1	YES	**YES**	**Bioaccumulative**
4,4'-DDE	0.00301	–	0.021	*EcoSSL*	0.1	YES	**YES**	**Bioaccumulative**
4,4'-DDT	0.0067	–	0.021	*EcoSSL*	0.3	YES	**YES**	**Bioaccumulative**
BHC, beta-	0.00017	–	0.00398	*R5*	0.04	YES	**YES**	**Bioaccumulative**
BHC, delta-	0.00104	–	9.94	*R5*	0.0001	YES	**YES**	**Bioaccumulative**
BHC, gamma- (Lindane)	–	–	0.005	*R5*	NA	YES	no	HQ • 1
Chlordane, alpha-	0.00301	–	0.224	*R5*	0.01	YES	**YES**	**Bioaccumulative**
Chlordane, gamma-	0.00408	–	0.224	*R5s*	0.02	no	no	HQ • 1
Dieldrin	0.00909	–	0.0049	*EcoSSL*	2	YES	**YES**	**HQ > 1**
Endosulfan II	0.00378	–	0.119	*R5*	0.03	YES	**YES**	**Bioaccumulative**
Endrin	0.02	–	0.0101	*R5*	2	YES	**YES**	**HQ > 1**
Endrin Ketone	0.00424	–	0.0101	*R5s*	0.4	no	no	HQ • 1
Heptachlor Epoxide	0.00101	–	0.152	*R5*	0.007	YES	**YES**	**Bioaccumulative**
Methoxychlor	0.0122	–	0.0199	*R5*	0.6	YES	**YES**	**Bioaccumulative**

Table 7-27
Screening Level -Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Background Concentration [a] (mg/kg)	Ecological Screening Level (ESLs) [b] (mg/kg) Value	Ecological Screening Level (ESLs) [b] (mg/kg) *Source*	Maximum HQ [c] (unitless)	Bioaccumulative Chemical?[d] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [e] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [e] Rationale
Polycyclic Aromatic Hydrocarbons								
1-Methylnaphthalene	0.037	–	3.24	*R5s*	0.01	no	no	HQ • 1
2-Methylnaphthalene	0.36	–	3.24	*R5*	0.1	no	no	HQ • 1
Acenaphthene	1	–	682	*R5*	0.001	YES	**YES**	**Bioaccumulative**
Acenaphthylene	0.3	–	682	*R5*	0.0004	YES	**YES**	**Bioaccumulative**
Anthracene	2.1	–	1,480	*R5*	0.001	YES	**YES**	**Bioaccumulative**
Benzo(a)anthracene	6.9	–	5.21	*R5*	1	YES	**YES**	**Bioaccumulative**
Benzo(a)pyrene	5.9	–	1.52	*R5*	4	YES	**YES**	**HQ > 1**
Benzo(b)fluoranthene	13	–	59.8	*R5*	0.2	YES	**YES**	**Bioaccumulative**
Benzo(g,h,i)perylene	3.5	–	119	*R5*	0.03	YES	**YES**	**Bioaccumulative**
Benzo(k)fluoranthene	6.5	–	148	*R5*	0.04	YES	**YES**	**Bioaccumulative**
Chrysene	7.7	–	4.73	*R5*	2	YES	**YES**	**HQ > 1**
Dibenzo(a,h)anthracene	0.97	–	18.4	*R5*	0.05	YES	**YES**	**Bioaccumulative**
Fluoranthene	22	–	122	*R5*	0.2	YES	**YES**	**Bioaccumulative**
Fluorene	1.3	–	122	*R5*	0.01	YES	**YES**	**Bioaccumulative**
Indeno(1,2,3-cd)pyrene	6.1	–	109	*R5*	0.06	YES	**YES**	**Bioaccumulative**
Naphthalene	0.75	–	0.0994	*R5*	8	no	**YES**	**HQ > 1**
Phenanthrene	16	–	45.7	*R5*	0.4	YES	**YES**	**Bioaccumulative**
Pyrene	16	–	78.5	*R5*	0.2	YES	**YES**	**Bioaccumulative**
Polychlorinated Biphenyls								
Aroclor 1254	12	–	NA		NA	YES	**YES**	**Bioaccumulative**
Aroclor 1260	1	–	NA		NA	YES	**YES**	**Bioaccumulative**
Inorganics								
Aluminum	39,000	40,041	50	*ORNL*	800	no	no	max • BKGD
Antimony	16.9	NA	0.27	*EcoSSL*	60	no	**YES**	**HQ > 1**
Arsenic	164	15.8	18	*EcoSSL*	9	YES	**YES**	**HQ > 1**
Barium	11,800	209	330	*EcoSSL*	40	no	**YES**	**HQ > 1**
Beryllium	2.3	1.02	21	*EcoSSL*	0.1	no	no	HQ • 1
Cadmium	15.2	0.69	0.36	*EcoSSL*	40	YES	**YES**	**HQ > 1**
Calcium	197,000	NA	NA		NA	no	no	NT
Chromium	1,110	65.3	26	*EcoSSL*	40	YES	**YES**	**HQ > 1**
Cobalt	422	72.3	13	*EcoSSL*	30	no	**YES**	**HQ > 1**
Copper	56,500	53.5	28	*EcoSSL*	2000	YES	**YES**	**HQ > 1**
Iron	328,000	50,962	NA		NA	no	**YES**	**NSL**
Lead	14,400	26.8	11	*EcoSSL*	1000	YES	**YES**	**HQ > 1**
Magnesium	86,100	NA	NA		NA	no	no	NT
Manganese	2,510	2,543	220	*EcoSSL*	10	no	no	max • BKGD
Mercury	79.5	0.13	0.1	*R5*	800	no	**YES**	**HQ > 1**
Nickel	213	62.8	38	*EcoSSL*	6	YES	**YES**	**HQ > 1**

Table 7-27
Screening Level -Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Background Concentration [a] (mg/kg)	Ecological Screening Level (ESLs) [b] (mg/kg) Value	*Source*	Maximum HQ [c] (unitless)	Bioaccumulative Chemical?[d] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [e] (YES/no)	Rationale
Potassium	5,570	NA	NA		NA	no	no	NT
Selenium	1.9	NA	0.52	*EcoSSL*	4	YES	**YES**	**HQ > 1**
Silver	22.5	NA	4.2	*EcoSSL*	5	YES	**YES**	**HQ > 1**
Sodium	1,350	NA	NA		NA	no	no	NT
Thallium	1	2.11	0.05692	*R5*	20	no	no	max • BKGD
Vanadium	98.4	108	7.8	*EcoSSL*	10	no	no	max • BKGD
Zinc	21,800	202	46	*EcoSSL*	500	YES	**YES**	**HQ > 1**

Notes:
– = Not available or applicable.
mg/kg = Milligrams per kilogram.
NA = Not available or applicable.

[a] Background levels for inorganics are facility-wide soil background point estimates taken from Facility-Wide Background Study Report (IT Corporation 2001).
[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[c] The maximum hazard quotient (HQ) is the ratio of the maximum constituent concentration to the surface soil screening level. HQs are rounded to one significant figure.
[d] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.
[e] Constituents with a hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for screening level assessment unless they were essential nutrients and thus considered non-toxic (NT), or were inorganics present at concentrations below background (max • BKGD).

Table 7-28
Screening Level - Constituents of Potential Ecological Concern in Sediment
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Ecological Screening Level (ESLs) [a] (mg/kg)		Maximum HQ [b] (unitless)	Bioaccumulative Chemical? [c] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [d]	
		Value	*Source*			(YES/no)	Rationale
Inorganics							
Aluminum	21,200	58,000	*ARCS_PEC*	0.4	no	no	HQ • 1
Arsenic	10.3	9.8	*R3*	1	YES	**YES**	**Bioaccumulative**
Barium	48.9	NA		NA	no	**YES**	**NSL**
Beryllium	1.2	NA		NA	no	**YES**	**NSL**
Cadmium	0.47	0.99	*R3*	0.5	YES	**YES**	**Bioaccumulative**
Calcium	8,650	NA		NA	no	no	NT
Chromium	32.7	43.4	*R3*	0.8	YES	**YES**	**Bioaccumulative**
Cobalt	13	50	*R3*	0.3	no	no	HQ • 1
Copper	24.8	31.6	*R3*	0.8	YES	**YES**	**Bioaccumulative**
Iron	32,300	20,000	*R3*	2	no	**YES**	**HQ > 1**
Lead	44.4	35.8	*R3*	1	YES	**YES**	**Bioaccumulative**
Magnesium	4,580	NA		NA	no	no	NT
Manganese	369	460	*R3*	0.8	no	no	HQ • 1
Mercury	0.093	0.18	*R3*	0.5	no	no	HQ • 1
Nickel	15.2	22.7	*R3*	0.7	YES	**YES**	**Bioaccumulative**
Potassium	880	NA		NA	no	no	NT
Vanadium	62.6	NA		NA	no	**YES**	**NSL**
Zinc	107	121	*R3*	0.9	YES	**YES**	**Bioaccumulative**

Notes:
– = Not available or applicable.
mg/kg = Milligrams per kilogram.
NA = Not available or applicable.

[a] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[b] The maximum hazard quotient (HQ) is the ratio of the maximum constituent concentration to the sediment screening level. HQs are rounded to one significant figure.
[c] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.
[d] Constituents with a hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for screening level assessment unless they were essential nutrients and thus considered non-toxic (NT), or were inorganics present at concentrations below background (max • BKGD).

Table 7-29
Baseline Level - Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)		Ecological Screening Level (ESLs) [b] (mg/kg) Value	*Source*	Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rationale	Bioaccumulative ? [e] (YES/no)
Volatile Organic Compounds								
3-Octanone	0.015	m	NA		NA	**YES**	**NSL**	no
d-Limonene	0.084	m	NA		NA	**YES**	**NSL**	no
Semi-Volatile Organic Compounds								
2,4-Dinitrotoluene	48	m	1.28	*R5*	40	**YES**	**HQ > 1**	no
Benzoic Acid	0.233		NA		NA	**YES**	**NSL**	no
bis(2-Ethylhexyl)phthalate	303.3		0.92594	*R5*	300	**YES**	**HQ > 1**	no
Carbazole	0.402		NA		NA	**YES**	**NSL**	no
Dibenzofuran	0.74	m	NA		NA	**YES**	**NSL**	no
Diethylphthalate	250	m	24.8	*R5*	10	**YES**	**HQ > 1**	no
Di-n-Butylphthalate	0.31	m	0.15	*R5*	2	**YES**	**HQ > 1**	no
Explosives								
Nitroglycerine	0.57	m	NA		NA	**YES**	**NSL**	no
Pesticides								
4,4'-DDD	0.0019		0.021	*EcoSSL*	0.09	**YES**	**Bioaccumulative**	**YES**
4,4'-DDE	0.00156		0.021	*EcoSSL*	0.07	**YES**	**Bioaccumulative**	**YES**
4,4'-DDT	0.0037		0.021	*EcoSSL*	0.2	**YES**	**Bioaccumulative**	**YES**
BHC, beta-	0.00017	m	0.00398	*R5*	0.04	**YES**	**Bioaccumulative**	**YES**
BHC, delta-	0.00104	m	9.94	*R5*	0.0001	**YES**	**Bioaccumulative**	**YES**
Chlordane, alpha-	0.00301	m	0.224	*R5*	0.01	**YES**	**Bioaccumulative**	**YES**
Dieldrin	0.00655		0.0049	*EcoSSL*	1	**YES**	**Bioaccumulative**	**YES**
Endosulfan II	0.00208		0.119	*R5*	0.02	**YES**	**Bioaccumulative**	**YES**
Endrin	0.00635		0.0101	*R5*	0.6	**YES**	**Bioaccumulative**	**YES**
Heptachlor Epoxide	0.00101	m	0.152	*R5*	0.007	**YES**	**Bioaccumulative**	**YES**
Methoxychlor	0.00729		0.0199	*R5*	0.4	**YES**	**Bioaccumulative**	**YES**
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	0.129		682	*R5*	0.0002	**YES**	**Bioaccumulative**	**YES**
Acenaphthylene	0.0607		682	*R5*	0.00009	**YES**	**Bioaccumulative**	**YES**
Anthracene	0.277		1,480	*R5*	0.0002	**YES**	**Bioaccumulative**	**YES**
Benzo(a)anthracene	2.939		5.21	*R5*	0.6	**YES**	**Bioaccumulative**	**YES**
Benzo(a)pyrene	2.998		1.52	*R5*	2	**YES**	**HQ > 1**	**YES**
Benzo(b)fluoranthene	6.47		59.8	*R5*	0.1	**YES**	**Bioaccumulative**	**YES**
Benzo(g,h,i)perylene	1.434		119	*R5*	0.01	**YES**	**Bioaccumulative**	**YES**
Benzo(k)fluoranthene	2.654		148	*R5*	0.02	**YES**	**Bioaccumulative**	**YES**
Chrysene	4.008		4.73	*R5*	0.8	**YES**	**Bioaccumulative**	**YES**
Dibenzo(a,h)anthracene	0.162		18.4	*R5*	0.009	**YES**	**Bioaccumulative**	**YES**
Fluoranthene	8.402		122	*R5*	0.07	**YES**	**Bioaccumulative**	**YES**
Fluorene	0.154		122	*R5*	0.001	**YES**	**Bioaccumulative**	**YES**
Indeno(1,2,3-cd)pyrene	3.035		109	*R5*	0.03	**YES**	**Bioaccumulative**	**YES**
Naphthalene	0.357		0.0994	*R5*	4	**YES**	**HQ > 1**	no
Phenanthrene	5.962		45.7	*R5*	0.1	**YES**	**Bioaccumulative**	**YES**
Pyrene	6.298		78.5	*R5*	0.08	**YES**	**Bioaccumulative**	**YES**

Table 7-29
Baseline Level - Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)		Ecological Screening Level (ESLs) [b] (mg/kg) Value	*Source*	Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rationale	Bioaccumulative ? [e] (YES/no)
Polychlorinated Biphenyls								
Aroclor 1254	2.857		NA		NA	**YES**	**NSL**	**YES**
Aroclor 1260	1	m	NA		NA	**YES**	**NSL**	**YES**
Inorganics								
Antimony	1.221		0.27	*EcoSSL*	5	**YES**	**HQ > 1**	no
Arsenic	23.99		18	*EcoSSL*	1	**YES**	**Bioaccumulative**	**YES**
Barium	1,724		330	*EcoSSL*	5	**YES**	**HQ > 1**	no
Cadmium	2.198		0.36	*EcoSSL*	6	**YES**	**HQ > 1**	**YES**
Chromium	157.4		26	*EcoSSL*	6	**YES**	**HQ > 1**	no
Cobalt	38.29		13	*EcoSSL*	3	**YES**	**HQ > 1**	no
Copper	13,224		28	*EcoSSL*	500	**YES**	**HQ > 1**	**YES**
Iron	40,291		NA		NA	**YES**	**NSL**	no
Lead	2,016	avg	11	*EcoSSL*	200	**YES**	**HQ > 1**	**YES**
Mercury	5.234		0.1	*R5*	50	**YES**	**HQ > 1**	no
Nickel	29.05		38	*EcoSSL*	0.8	**YES**	**Bioaccumulative**	**YES**
Selenium	0.701		0.52	*EcoSSL*	1	**YES**	**Bioaccumulative**	**YES**
Silver	1.815		4.2	*EcoSSL*	0.4	**YES**	**Bioaccumulative**	**YES**
Zinc	2,929		46	*EcoSSL*	60	**YES**	**HQ > 1**	**YES**

Notes:
– = Not available or applicable.
mg/kg = Milligrams per kilogram.
NA = Not available or applicable.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[c] The refined hazard quotient (HQ) is the ratio of the EPC to the surface soil screening level. HQs are rounded to one significant figure.
[d] Constituents with a refined hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for baseline risk assessment.
[e] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.

Table 7-30
Baseline Level - Constituents of Potential Ecological Concern in Sediment
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	**Exposure Point Concentration [a] (mg/kg)**		**Ecological Screening Level (ESLs) [b] (mg/kg)**		**Refined HQ [c] (unitless)**	**Baseline Level Constituent of Potential Ecological Concern? [d]**		**Bioaccumulative ? [e] (YES/no)**
			Value	***Source***		**(YES/no)**	**Rationale**	
Inorganics								
Arsenic	10.3	m	9.8	*R3*	1	**YES**	**Bioaccumulative**	**YES**
Barium	48.9	m	NA		NA	**YES**	**NSL**	no
Beryllium	1.2	m	NA		NA	**YES**	**NSL**	no
Cadmium	0.47	m	0.99	*R3*	0.5	**YES**	**Bioaccumulative**	**YES**
Chromium	32.7	m	43.4	*R3*	0.8	no	**HQ • 1**	no
Copper	24.8	m	31.6	*R3*	0.8	**YES**	**Bioaccumulative**	**YES**
Iron	32,300	m	20,000	*R3*	2	**YES**	**HQ > 1**	no
Lead	35.8	avg	35.8	*R3*	1	**YES**	**Bioaccumulative**	**YES**
Nickel	15.2	m	22.7	*R3*	0.7	**YES**	**Bioaccumulative**	**YES**
Vanadium	62.6	m	NA		NA	**YES**	**NSL**	no
Zinc	107	m	121	*R3*	0.9	**YES**	**Bioaccumulative**	**YES**

Notes:

– = Not available or applicable.
mg/kg = Milligrams per kilogram.
NA = Not available or applicable.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
[b] See Table A.2-17 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[c] The refined hazard quotient (HQ) is the ratio of the EPC to the sediment screening level. HQs are rounded to one significant figure.
[d] Constituents with a refined hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for baseline risk assessment.
[e] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.

Table 7-31
Summary of Ecological Risk Characterization Results - Terrestrial Habitat
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

	Soil					Baseline Level Assessment				Results of Refined Food Chain Models [c]			
	Frequency of Detection		EPC		Hazard Quotient	Ecological Screening Level [b]		Bioaccum-ulative ?	Short-tailed Shrew		American Robin	
Constituent	# detects / n samples	%	(mg/kg)		[a]	Source	Basis	(YES/no)	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ
Volatile Organic Compounds												
3-Octanone	4 - 4	100%	0.015	m	NA			no	–	–	–	–
d-Limonene	3 - 3	100%	0.084	m	NA			no	–	–	–	–
Semi-Volatile Organic Compounds												
2,4-Dinitrotoluene	2 - 36	6%	48	m	**40**	R5		no	–	–	–	–
Benzoic Acid	7 - 27	26%	0.233		NA			no	–	–	–	–
bis(2-Ethylhexyl)phthalate	28 - 47	60%	303.3		**300**	R5		no	–	–	–	–
Carbazole	5 - 27	19%	0.402		NA			no	–	–	–	–
Dibenzofuran	4 - 25	16%	0.74	m	NA			no	–	–	–	–
Diethylphthalate	4 - 34	12%	250	m	**10**	R5		no	–	–	–	–
Di-n-Butylphthalate	4 - 27	15%	0.31	m	**2**	R5		no	–	–	–	–
Explosives												
Nitroglycerine	1 - 19	5%	0.57	m	NA			no	–	–	–	–
Pesticides												
4,4'-DDD	6 - 9	67%	0.0019		0.09	EcoSSL	mam	YES	0.00005	0.0003	0.006	0.06
4,4'-DDE	5 - 9	56%	0.0016		0.07	EcoSSL	mam	YES	0.00004	0.0002	0.005	0.05
4,4'-DDT	14 - 21	67%	0.0037		0.2	EcoSSL	mam	YES	0.0001	0.0005	0.01	0.1
BHC, beta-	1 - 9	11%	0.0002	m	0.04	R5		YES	0.000007	0.00003	0.000006	0.00002
BHC, delta-	1 - 9	11%	0.001	m	0.0001	R5		YES	0.00003	0.00005	0.00004	0.0002
Chlordane, alpha-	3 - 9	33%	0.003	m	0.01	R5		YES	0.00001	0.0001	0.00001	0.0001
Dieldrin	7 - 9	78%	0.0066		1	EcoSSL	mam	YES	0.003	0.03	0.0006	0.006
Endosulfan II	8 - 20	40%	0.0021		0.02	R5		YES	0.0001	0.001	0.000002	0.00002
Endrin	8 - 22	36%	0.0064		0.6	R5		YES	0.001	0.01	0.0002	0.002
Heptachlor Epoxide	1 - 9	11%	0.001	m	0.007	R5		YES	0.00006	0.0006	–	–
Methoxychlor	7 - 10	70%	0.0073		0.4	R5		YES	0.0003	0.0007	–	–
Polycyclic Aromatic Hydrocarbons												
Acenaphthene	6 - 38	16%	0.129		0.0002	R5		YES	0.0004	0.004	0.00005	0.0005
Acenaphthylene	6 - 40	15%	0.0607		0.00009	R5		YES	0.00003	0.000003	0.00002	0.0002
Anthracene	9 - 40	23%	0.277		0.0002	R5		YES	0.0000004	0.000004	0.00004	0.0004
Benzo(a)anthracene	18 - 42	43%	2.939		0.6	R5		YES	0.009	0.09	0.0004	0.004
Benzo(a)pyrene	17 - 42	40%	2.998		**2**	R5		YES	0.005	0.05	0.0005	0.005
Benzo(b)fluoranthene	17 - 42	40%	6.47		0.1	R5		YES	0.004	0.09	0.001	0.01
Benzo(g,h,i)perylene	15 - 47	32%	1.434		0.01	R5		YES	0.05	0.5	0.0002	0.002
Benzo(k)fluoranthene	18 - 42	43%	2.654		0.02	R5		YES	0.002	0.04	0.0004	0.004
Chrysene	20 - 49	41%	4.008		0.8	R5		YES	0.0003	0.003	0.0006	0.006
Dibenzo(a,h)anthracene	7 - 40	18%	0.162		0.009	R5		YES	0.3	**3**	0.00003	0.0003
Fluoranthene	22 - 49	45%	8.402		0.07	R5		YES	0.006	0.06	0.003	0.03
Fluorene	8 - 38	21%	0.154		0.001	R5		YES	0.00003	0.00009	0.00005	0.0005
Indeno(1,2,3-cd)pyrene	13 - 40	33%	3.035		0.03	R5		YES	0.3	**3**	0.0005	0.005
Naphthalene	14 - 40	35%	0.357		**4**	R5		no	–	–	–	–
Phenanthrene	23 - 42	55%	5.962		0.1	R5		YES	0.003	0.03	0.0009	0.009
Pyrene	22 - 49	45%	6.298		0.08	R5		YES	0.004	0.04	0.0009	0.009

Table 7-31
Summary of Ecological Risk Characterization Results - Terrestrial Habitat
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Soil: Frequency of Detection # detects / n samples	%	EPC (mg/kg)	Baseline Level Assessment: Hazard Quotient [a]	Ecological Screening Level [b] Source	Basis	Bioaccum-ulative ? (YES/no)	Results of Refined Food Chain Models [c]: Short-tailed Shrew LOAEL HQ	Short-tailed Shrew NOAEL HQ	American Robin LOAEL HQ	American Robin NOAEL HQ
Polychlorinated Biphenyls											
Aroclor 1254	18 - 61	30%	2.857	NA			YES	0.7	**7**	0.1	1
Aroclor 1260	3 - 38	8%	1 m	NA			YES	0.2	**2**	0.04	0.4
Inorganics											
Antimony	39 - 136	29%	1.221	**5**	EcoSSL	mam	no	–	–	–	–
Arsenic	138 - 139	99%	23.99	1	EcoSSL	veg	YES	0.1	1	0.05	0.1
Barium	139 - 139	100%	1,724	**5**	EcoSSL	inv	no	–	–	–	–
Cadmium	55 - 118	47%	2.198	**6**	EcoSSL	mam	YES	0.2	**2**	0.02	0.2
Chromium	139 - 139	100%	157.4	**6**	EcoSSL	avi	no	–	–	–	–
Cobalt	137 - 139	99%	38.29	**3**	EcoSSL	veg	no	–	–	–	–
Copper	139 - 139	100%	13,224	**500**	EcoSSL	avi	YES	**6**	**8**	**5**	**6**
Iron	139 - 139	100%	40,291	NA			no	–	–	–	–
Lead	139 - 139	100%	2,016	**200**	EcoSSL	avi	YES	0.2	**2**	0.8	**8**
Mercury	92 - 130	71%	5.234	**50**	R5		no	–	–	–	–
Nickel	138 - 139	99%	29.05	0.8	EcoSSL	veg	YES	0.003	0.03	0.004	0.006
Selenium	45 - 136	33%	0.701	1	EcoSSL	veg	YES	0.06	0.1	0.02	0.04
Silver	17 - 111	15%	1.815	0.4	EcoSSL	avi	YES	0.0003	0.003	0.06	0.1
Zinc	137 - 139	99%	2,929	**60**	EcoSSL	avi	YES	**4**	**40**	1	**10**

Notes:

– =	Not applicable.
COPEC =	Constituent of Potential Ecological Concern.
EPC =	Exposure point concentrations - the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
LOAEL HQ =	Lowest observed adverse effect level hazard quotient.
mg/kg =	Milligrams per kilogram.
NA =	Not available.
NOAEL HQ =	No observed adverse effect level hazard quotient.
[a]	Hazard quotients (HQs) greater than one are presented in bold font. HQs are rounded to one significant figure (unitless).
[b]	See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate. R5: Region 5 Ecological Screening Levels (USEPA 2003e; R5). EcoSSL: USEPA Ecological Soil Screening Levels (USEPA 2005b, EcoSSL). Where readily available (i.e., EcoSSLs), the basis of the ESL is presented.
[c]	Foodchain modeling was conducted for bioaccumulative COPECs.

Table 7-32

Summary of Ecological Risk Characterization Results - Aquatic Habitat

IGNITER ASSEMBLY AREA

New River Unit, Radford Army Ammunition Plant, Radford, Virginia

	Baseline Level Assessment												
	Sediment						Sediment						
	Frequency of Detection				EPC		Hazard Quotient	Bioaccum-ulative ?	Results of Refined Food Web Models [b]				
									Mink		Great Blue Heron		
Constituent	# detects / n samples			%	(mg/kg)		[a]	(YES/no)	LOAEL	NOAEL	LOAEL	NOAEL	
Inorganics													
Arsenic	4	-	4	100%	10.3	m	1	YES	0.1	1	0.05	0.1	
Barium	4	-	4	100%	48.9	m	NA	no	–	–	–	–	
Beryllium	4	-	4	100%	1.2	m	NA	no	–	–	–	–	
Cadmium	2	-	4	50%	0.47	m	0.5	YES	0.03	0.3	0.002	0.02	
Copper	4	-	4	100%	24.8	m	0.8	YES	0.06	0.07	0.02	0.02	
Iron	4	-	4	100%	32,300	m	**2**	no	–	–	–	–	
Lead	4	-	4	100%	35.8	avg	1	YES	0.03	0.3	0.05	0.5	
Nickel	4	-	4	100%	15.2	m	0.7	YES	0.01	0.03	0.007	0.01	
Vanadium	4	-	4	100%	62.6	m	NA	no	–	–	–	–	
Zinc	4	-	4	100%	107	m	0.9	YES	0.2	**2**	0.05	0.4	

Notes:

–	Not applicable.
EPC	Exposure point concentrations - the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
FOD	Frequency of Detection.
LOAEL	Lowest observed adverse effect level.
mg/kg	Milligrams per kilogram.
mg/L	Milligrams per liter.
NOAEL	No observed adverse effect level.
[a]	Hazard Quotients greater than one are presented in bold font.
[b]	Food Web modeling was conducted for bioaccumulative COPECs.

Table 8-1. Soil Analytical Results, Rail Yard, 1997 and 1998 Gannett Fleming Independent Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	SS-07 0 - 0.5 06/04/97	SS-08 0 - 0.5 06/04/97	SS-08a 0.25 - 0.5 03/30/98	TR-02A 0 - 0.16 04/02/98	TR-02C 0 - 0.16 04/02/98
Explosives									
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	ND	0.32 C	NA	NA	NA
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	<0	0.32	NA	NA	NA
Organochlorine Pesticides									
4,4'-DDD	2 {ca**}	7.2 {ca**}	- -	mg/kg	NA	NA	ND	ND	R
4,4'-DDE	1.4 {ca**}	5.1 {ca**}	- -	mg/kg	ND	R	0.01 I	0.04	ND
4,4'-DDT	1.7 {ca*}	7 {ca*}	- -	mg/kg	NA	NA	ND	ND	R
Alpha-Chlordane	1.6 {ca**}	6.5 {ca**}	- -	mg/kg	ND	0.03 J	0.02 I	ND	R
Delta-BHC	0.52 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	ND	ND	R
Dieldrin	0.03 {ca}	0.11 {ca}	- -	mg/kg	ND	R	R	ND	0.27
Endosulfan I	- -	- -	- -	mg/kg	NA	NA	ND	ND	R
Endosulfan II	37 {nc}	370 {nc}	- -	mg/kg	NA	NA	R	ND	ND
Endrin	1.8 {nc}	18 {nc}	- -	mg/kg	NA	NA	R	ND	ND
Endrin Aldehyde	1.8 {nc}	18 {nc}	- -	mg/kg	ND	0.04	NA	NA	NA
Heptachlor	0.11 {ca}	0.38 {ca}	- -	mg/kg	NA	NA	ND	ND	R
PCBs									
Aroclor-1254	0.22 {ca**}	0.74 {ca*}	- -	mg/kg	ND	1.7	1.0	ND	ND
Volatile Organics									
Methylene Chloride	11 {ca}	54 {ca}	- -	mg/kg	0.00070 B	0.0030 B	3.0 B	ND	ND
Semivolatile Organics									
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	ND	0.40 J	NA	NA	NA
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	ND	0.040 J	NA	NA	NA
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	NA	NA	ND	0.070 J	ND
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	NA	NA	ND	0.10 J	ND
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	ND	0.080 J	ND	0.40 J	ND
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	ND	0.080 J	ND	0.40 J	ND
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	ND	0.080 J	ND	1.0	ND
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	ND	0.090 J	ND	0.56	ND
bis(2-Ethylhexyl)phthalate	35 {ca*}	120 {ca*}	- -	mg/kg	1.8	0.10 J	ND	0.11 J	ND
Carbazole	24 {ca**}	86 {ca**}	- -	mg/kg	NA	NA	ND	0.10 J	ND
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	ND	0.090 J	ND	0.66	ND
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	NA	NA	ND	0.050 J	ND
Di-n-Butylphthalate	610 {nc}	6,200 {nc}	- -	mg/kg	ND	1.1	NA	NA	NA
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	<0	0.40 J	NA	NA	NA
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	ND	0.30 J	ND	0.39	ND
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	ND	0.11 J	ND
Pentachlorophenol	3 {ca}	9 {ca}	- -	mg/kg	NA	NA	ND	0.11 J	830 C
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	ND	0.10 J	ND	0.060 J	ND
Phenol	1,800 {nc}	180,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	ND	0.10 J	ND	0.86	ND
Inorganics									
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	338	18,100	24,800	NA	NA
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	1.80	**20.8**	8.90	NA	NA
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	**1,770 J**	147	53.7	NA	NA
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	ND	**1.30**	**1.40**	NA	NA
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	ND	**1.80**	**0.800**	NA	NA
Calcium	- -	- -	- -	mg/kg	196,000	28,500	4,720	NA	NA
Chromium	280 {ca}	1,460 {ca}	65.3	mg/kg	ND	39.8	41.1	NA	NA
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	ND	25.8	32.1	NA	NA
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	ND	**60.2**	31.0	NA	NA
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	2,780	39,600	48,400	NA	NA
Lead	400 {++}	800 {++}	26.8	mg/kg	1.80	**149**	**52.6**	NA	NA
Magnesium	- -	- -	- -	mg/kg	104,000	15,200	2,710	NA	NA
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	94.0	203	233	NA	NA
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	NA	NA	**0.200**	NA	NA
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	ND	17.5	21.1	NA	NA
Potassium	- -	- -	- -	mg/kg	ND	1,110	985	NA	NA
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	ND	0.400	0.400	NA	NA
Vanadium	55 {nc}	720 {nc}	108	mg/kg	31.8	75.9	91.5	NA	NA
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	12.5	**752**	159	NA	NA

mg/kg	Milligrams per kilogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide

Table 8-2. Sediment and Sludge Analytical Results, Rail Yard, 1997 and 1998 Gannett Fleming Independent Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	SL-05 - 06/04/97	SL-08 03/30/98	SD-03 0 - 0.5 04/01/98	SD-04 0 - 0.5 04/01/98	SD-05 0 - 0.5 04/01/98
Organochlorine Pesticides									
4,4'-DDT	1.7 {ca*}	7 {ca*}	- -	mg/kg	R	NA	NA	NA	NA
Endrin Aldehyde	1.8 {nc}	18 {nc}	- -	mg/kg	0.01	NA	ND	0.04	ND
Volatile Organics									
2-Butanone	28,000 {sat}	28,000 {sat}	- -	mg/kg	NA	ND	ND	0.010	ND
Acetone	6,100 {nc}	61,000 {nc}	- -	mg/kg	NA	ND	0.0030 J	0.048	ND
Methylene Chloride	11 {ca}	54 {ca}	- -	mg/kg	0.0010 B	0.0030 B	0.0030 B	0.0010 B	0.0030 B
Semivolatile Organics									
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.070 J	NA	NA	NA	NA
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	0.070 J	NA	NA	NA	NA
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.070 J	NA	NA	NA	NA
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	0.070 J	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	35 {ca*}	120 {ca*}	- -	mg/kg	0.30 J	ND	ND	ND	0.10 J
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	0.090 J	NA	NA	NA	NA
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	0.10 J	0.070 J	ND	0.060 J	ND
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.090 J	NA	NA	NA	NA
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	0.12 J	0.040 J	NA	NA	NA
Inorganics									
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	8,190	21,600	9,370	11,000	27,000
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	1.00	NA	NA	NA	NA
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	**22.3**	9.20	4.90	4.60	2.20
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	69.1 J	75.2	81.7	113	52.4
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	**1.10**	**1.10**	0.600	0.800	**1.30**
Calcium	- -	- -	- -	mg/kg	14,900	8,550	176,000	129,000	3,200
Chromium	280 {ca}	1,460 {ca}	65.3	mg/kg	**103**	34.0	24.6	21.2	32.9
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	26.8	18.4	5.90	6.60	11.8
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	**373**	34.4	47.6	21.9	20.9
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	**120,000**	42,600	12,500	14,200	22,000
Lead	400 {++}	800 {++}	26.8	mg/kg	**161**	**94.1**	10.9	11.2	**28.4**
Magnesium	- -	- -	- -	mg/kg	4,560	2,430	3,600	2,840	3,590
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	908	249	446	1,220	90.9
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	**116**	17.2	6.70	9.00	19.7
Potassium	- -	- -	- -	mg/kg	593	1,100	553	666	1,870
Selenium	39 {nc}	510 {nc}	- -	mg/kg	NA	ND	ND	ND	1.70
Sodium	- -	- -	- -	mg/kg	NA	ND	ND	110	ND
Vanadium	55 {nc}	720 {nc}	108	mg/kg	72.2	72.0	26.1	20.8	50.7
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	56.3	675	16.2	27.8	93.6

mg/kg	Milligrams per kilogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 8-3. Surface Water Analytical Results, Rail Yard, 1997 and 1998 Gannett Fleming Independent Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Date Collected:	Tapwater Screening Values [a]	Units	WW-04 03/30/98
Inorganics			
Aluminum	37,000 {nc}	µg/L	258
Calcium	- -	µg/L	26,600
Copper	1,500 {nc}	µg/L	38
Iron	26,000 {nc}	µg/L	4,470
Lead	15 {nc}	µg/L	31
Magnesium	- -	µg/L	6,530
Manganese	880 {nc}	µg/L	102
Potassium	- -	µg/L	2,780
Sodium	- -	µg/L	1,660
Zinc	11,000 {nc}	µg/L	274

µg/L	Micrograms per liter.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
	Adjusted tap-water screening levels used to assess surface water at the NRU.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
24,400	Highlighted value indicates constituent concentration is above adjusted tap water RSL.

Table 8-4. Soil Analytical Results, Rail Yard, 1998 ICF KE Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	RYSB1 0 - 2 08/03/98	RYSB1 4 - 8 08/03/98	RYSB1 19 - 23 08/03/98	RYSB2 0 - 2 08/03/98	RYSB2 4 - 6 08/03/98	RYSB3 1 - 3 08/03/98	RYSB3 3 - 4.2 08/03/98	RYSB4 0 - 4 08/03/98	RYSB4 4 - 6 08/03/98	RYSB5 0 - 4 08/03/98	RYSB5 4 - 6 08/03/98	RYSB6 0 - 4 08/03/98	RYSB6 4 - 6 08/03/98	RYSB7 0 - 4 08/03/98	RYSB7 4 - 6 08/03/98
Explosives																			
1,3,5-Trinitrobenzene	220 {nc}	2,700 {nc}	- -	mg/kg	<0.3	<0.3	<0.3	<0.3	<0.2	<0.2	<0.2	<0.3	<0.3	<0.2	<0.3	<0.3	<0.3	<0.3 [<0.3]	<0.3
1,3-Dinitrobenzene	0.61 {nc}	6.2 {nc}	- -	mg/kg	<0.3	<0.3	<0.3	<0.3	<0.2	<0.2	<0.2	<0.3	<0.3	<0.2	<0.3	<0.3	<0.87	<0.3 [<0.3]	<0.3
2,4,6-Trinitrotoluene	3.6 {ca**}	42 {ca**}	- -	mg/kg	<0.3	<0.3	<0.3	<0.3	<0.2	<0.2	<0.2	<0.3	<0.3	<0.2	<0.3	<0.3	<0.3	<0.3 [<0.3]	<0.3
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.3	<0.3	<0.3	<0.3	<0.2	<0.2	<0.2	<0.3	<0.3	<0.2	<0.3	<0.3	<0.3	<0.3 [<0.3]	<0.3
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	<0.3	<0.3	<0.3	<0.3	<0.2	<0.2	<0.2	<0.3	<0.3	<0.2	<0.3	<0.3	<0.3	<0.3 [<0.3]	<0.3
2-Amino-4,6-Dinitrotoluene	15 {nc}	190 {nc}	- -	mg/kg	<0.3	<0.3	<0.3	<0.3	<0.2	<0.2	<0.2	<0.3	<0.3	<0.2	<0.3	<0.3	<0.3	<0.3 [<0.3]	<0.3
4-Amino-2,6-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.3	<0.3	<0.3	<0.3	<0.2	<0.2	<0.2	<0.3	<0.3	<0.2	<0.3	<0.3	<0.3	<0.3 [<0.3]	<0.3
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	<0.3	<0.3	<0.3	<0.3	<0.2	<0.2	<0.2	<0.3	<0.3	<0.2	<0.3	<0.3	<0.3	<0.3 [<0.3]	<0.3
HMX	310 {nc}	3,100 {nc}	- -	mg/kg	<3	<3	<3	<3	<2	<2	<2	<3	<3	<2	<3	<3	<3	<3 [<3]	<3
m-Nitrotoluene	- -	- -	- -	mg/kg	<0.3	<0.3	<0.3	<0.3	<0.2	<0.2	<0.2	<0.3	<0.3	<0.2	<0.3	<0.3	<0.3	<0.3 [<0.3]	<0.3
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	<0.3	<0.3	<0.3	<0.3	<0.2	<0.2	<0.2	<0.3	<0.3	<0.2	<0.3	<0.3	<0.3	<0.3 [<0.3]	<0.3
Nitroglycerine	0.61 {nc}	6.2 {nc}	- -	mg/kg	<1.3	<1.3	<1.3	<1.3	<1.2	<1.2	<1.2	<1.3	<1.3	<1.2	<1.3	<1.3	<1.3	<1.3 [<1.3]	<1.3
o-Nitrotoluene	78 {nc}	1,300 {sat}	- -	mg/kg	<0.3	<0.3	<0.3	<0.3	<0.2	<0.2	<0.2	<0.3	<0.3	<0.2	<0.3	<0.3	<0.3	<0.3 [<0.3]	<0.3
Pentaerythritol Tetranitrate	- -	- -	- -	mg/kg	<1.3	<1.3	<1.3	<1.3	<1.2	<1.2	<1.2	<1.3	<1.3	<1.2	<1.3	<1.3	<1.3	<1.3 [<1.3]	<1.3
p-Nitrotoluene	30 {ca**}	110 {ca*}	- -	mg/kg	<0.3	<0.3	<0.3	<0.3	<0.2	<0.2	<0.2	<0.3	<0.3	<0.2	<0.3	<0.3	<0.3	<0.3 [<0.3]	<0.3
RDX	4.4 {ca*}	16 {ca}	- -	mg/kg	<0.3	<0.3	<0.3	<0.3	<0.2	<0.2	<0.2	<0.3	<0.3	<0.2	<0.3	<0.3	<0.3	<0.3 [<0.3]	<0.3
Tetryl	24 {nc}	250 {nc}	- -	mg/kg	<0.3	<0.3	<0.3	<0.3	<0.2	<0.2	<0.2	<0.3	<0.3	<0.2	<0.3	<0.3	<0.3	<0.3 [<0.3]	<0.3
Semivolatile Organics																			
1,2,4-Trichlorobenzene	180 {ca**}	220 {sat}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
1,2-Dichlorobenzene	220 {sat}	220 {sat}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
1,2-Diphenylhydrazine	0.61 {ca**}	2.2 {ca**}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
1,4-Dichlorobenzene	2.6 {ca}	13 {ca}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
2,4,5-Trichlorophenol	610 {nc}	6,200 {nc}	- -	mg/kg	<0.85	<1.1	<1.1	<1.0	<1.1	<1.0	<0.99	<1.3	<1.1	<1.1	<0.99	<1.1	<1.1	<1.0 [<0.96]	<1.1
2,4,6-Trichlorophenol	44 {ca**}	160 {ca**}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
2,4-Dichlorophenol	18 {nc}	180 {nc}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
2,4-Dimethylphenol	120 {nc}	1,200 {nc}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
2,4-Dinitrophenol	12 {nc}	120 {nc}	- -	mg/kg	<1.8	<2.3	<2.3	<2.1	<2.3	<2.1	<2.0	<2.6	<2.3	<2.2	<2.0	<2.2	<2.3	<2.1 [<2.0]	<2.2
2-Chloronaphthalene	210 {sat}	210 {sat}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
2-Chlorophenol	39 {nc}	510 {nc}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
2-Methylphenol	310 {nc}	3,100 {nc}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
2-Nitroaniline	- -	- -	- -	mg/kg	<1.8	<2.3	<2.3	<2.1	<2.3	<2.1	<2.0	<2.6	<2.3	<2.2	<2.0	<2.2	<2.3	<2.1 [<2.0]	<2.2
2-Nitrophenol	- -	- -	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
3,3'-Dichlorobenzidine	1.1 {ca**}	3.8 {ca**}	- -	mg/kg	<0.69	<0.92	<0.90	<0.82	<0.90	<0.81	<0.80	<1.0	<0.92	<0.86	<0.80	<0.86	<0.90	<0.81 [<0.78]	<0.86
3-Nitroaniline	- -	- -	- -	mg/kg	<1.8	<2.3	<2.3	<2.1	<2.3	<2.1	<2.0	<2.6	<2.3	<2.2	<2.0	<2.2	<2.3	<2.1 [<2.0]	<2.2
4,6-Dinitro-2-methylphenol	- -	- -	- -	mg/kg	<1.8	<2.3	<2.3	<2.1	<2.3	<2.1	<2.0	<2.6	<2.3	<2.2	<2.0	<2.2	<2.3	<2.1 [<2.0]	<2.2
4-Bromophenyl-phenylether	- -	- -	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
4-Chloro-3-Methylphenol	- -	- -	- -	mg/kg	<0.69	<0.92	<0.90	<0.82	<0.90	<0.81	<0.80	<1.0	<0.92	<0.86	<0.80	<0.86	<0.90	<0.81 [<0.78]	<0.86
4-Chloroaniline	24 {nc}	250 {nc}	- -	mg/kg	<0.69	<0.92	<0.90	<0.82	<0.90	<0.81	<0.80	<1.0	<0.92	<0.86	<0.80	<0.86	<0.90	<0.81 [<0.78]	<0.86
4-Chlorophenyl-phenylether	- -	- -	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
4-Methylphenol	31 {nc}	310 {nc}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
4-Nitroaniline	- -	- -	- -	mg/kg	<1.8	<2.3	<2.3	<2.1	<2.3	<2.1	<2.0	<2.6	<2.3	<2.2	<2.0	<2.2	<2.3	<2.1 [<2.0]	<2.2
4-Nitrophenol	- -	- -	- -	mg/kg	<1.8	<2.3	<2.3	<2.1	<2.3	<2.1	<2.0	<2.6	<2.3	<2.2	<2.0	<2.2	<2.3	<2.1 [<2.0]	<2.2
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
Benzoic Acid	240,000 {max}	2,500,000 {max}	- -	mg/kg	<1.8	<2.3	<2.3	<2.1	<2.3	<2.1	<2.0	<2.6	<2.3	<2.2	<2.0	<2.2	<2.3	<2.1 [<2.0]	<2.2
Benzyl Alcohol	3,100 {nc}	310,000 {max}	- -	mg/kg	<0.69	<0.92	<0.90	<0.82	<0.90	<0.81	<0.80	<1.0	<0.92	<0.86	<0.80	<0.86	<0.90	<0.81 [<0.78]	<0.86
bis(2-Chloroethoxy)methane	18 {nc}	180 {nc}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
bis(2-Chloroethyl)ether	0.19 {ca**}	0.9 {ca**}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
bis(2-Chloroisopropyl)ether	- -	- -	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
bis(2-Ethylhexyl)phthalate	35 {ca*}	120 {ca*}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
Butylbenzylphthalate	1,200 {nc}	120,000 {max}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
Carbazole	24 {ca**}	86 {ca**}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
Dibenzofuran	- -	- -	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
Diethylphthalate	4,900 {nc}	490,000 {max}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	0.32 J	<0.43	<0.41	<0.43	1.1	0.090 J [<0.40]	<0.43
Dimethylphthalate	- -	- -	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
Di-n-Butylphthalate	610 {nc}	6,200 {nc}	- -	mg/kg	<0.35	<0.46	<0.46	0.11 B	<0.46	0.060 B	<0.41	<0.52	<0.46	<0.43	<0.41	0.060 B	<0.46	0.090 B [<0.40]	0.11 B
Di-n-Octylphthalate	- -	- -	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
Hexachlorobenzene	0.3 {ca}	1.1 {ca}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
Hexachlorobutadiene	6.2 {ca**}	22 {ca*}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
Hexachlorocyclopentadiene	37 {nc}	370 {nc}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
Hexachloroethane	35 {ca**}	120 {ca**}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
Isophorone	510 {ca*}	1,800 {ca*}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
Naphthalene	15 {nc}	67 {nc}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
N-Nitroso-di-n-propylamine	0.069 {ca**}	0.25 {ca**}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
N-Nitrosodiphenylamine	99 {ca**}	350 {ca**}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
Pentachlorophenol	3 {ca}	9 {ca}	- -	mg/kg	<1.8	<2.3	<2.3	<2.1	<2.3	<2.1	<2.0	<2.6	<2.3	<2.2	<2.0	<2.2	<2.3	<2.1 [<2.0]	<2.2
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
Phenol	1,800 {nc}	180,000 {max}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	<0.35	<0.46	<0.46	<0.42	<0.46	<0.41	<0.41	<0.52	<0.46	<0.43	<0.41	<0.43	<0.46	<0.41 [<0.40]	<0.43
Pyridine	7.8 {nc}	100 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes found at end of table.

Table 8-4. Soil Analytical Results, Rail Yard, 1998 ICF KE Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	RYSB1 0 - 2 08/03/98	RYSB1 4 - 8 08/03/98	RYSB1 19 - 23 08/03/98	RYSB2 0 - 2 08/03/98	RYSB2 4 - 6 08/03/98	RYSB3 1 - 3 08/03/98	RYSB3 3 - 4.2 08/03/98	RYSB4 0 - 4 08/03/98	RYSB4 4 - 6 08/03/98	RYSB5 0 - 4 08/03/98	RYSB5 4 - 6 08/03/98	RYSB6 0 - 4 08/03/98	RYSB6 4 - 6 08/03/98	RYSB7 0 - 4 08/03/98	RYSB7 4 - 6 08/03/98
Inorganics																			
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	817	12,400	10,400	5,630	12,700	7,470	11,100	17,500	23,300	14,200	10,200	12,100	15,400	8,180 [10,400]	11,400
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	<0.510	<0.700	<0.690	<0.610	<0.690	<0.600	<0.590	<0.780	<0.670	<0.630	<0.620	<0.630	<0.680	<0.630 [<0.580]	<0.640
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	1.60 K	4.90 K	4.50 K	2.90 K	4.90 K	2.10 K	3.90 K	5.60 K	4.90 K	7.00 K	4.30 K	7.80 K	5.40 K	3.20 K [3.60 K]	5.50 K
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	94.1 K	27.5 K	38.6 K	22.7 K	17.6 K	15.4 K	17.4 K	20.8 K	41.1 K	22.4 K	19.9 K	29.9 K	24.8 K	52.7 K [49.5 K]	75.3 K
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	<0.100	0.250 J	**4.30**	0.210 J	0.520 J	0.130 J	0.500 J	0.230 J	0.550 J	0.660	0.980	**1.50**	0.840	**1.40 [1.50]**	**2.10**
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	0.130 J	<0.140	<0.140	<0.120	<0.140	<0.120	<0.120	<0.160	<0.130	<0.130	<0.120	<0.130	<0.140	<0.130 [<0.120]	<0.130
Calcium	- -	- -	- -	mg/kg	177,000	5,130	1,850	1,390	152 J	761	8,340	1,660	2,650	1,670	2,540	4,950	1,520	1,290 [1,320]	2,100
Chromium	280 {ca}	1,460 {ca}	65.3	mg/kg	3.10	20.0	21.3	7.00	46.3	9.90	19.4	21.8	20.3	21.4	11.2	19.8	26.9	14.7 [18.7]	16.3
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	1.30 K	9.80 K	5.80 K	17.1 K	2.10 K	4.90 K	7.40 K	**74.9 K**	**74.5 K**	8.40 K	39.1 K	22.7 K	11.5 K	25.9 K [11.8 K]	8.20 K
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	2.30 B	4.70 B	15.1 K	3.20 B	9.10 B	4.80 B	14.8 K	8.50 B	14.0 K	11.7 K	9.00 B	12.8 K	8.80 B	4.50 B [5.80 B]	10.5 K
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	2,600	24,700	20,200	7,120	31,900	11,200	21,800	27,700	23,600	31,200	14,800 L	27,200	30,300	14,900 [19,300]	18,500
Lead	400 {++}	800 {++}	26.8	mg/kg	9.70 L	15.4 L	25.4 L	25.2 L	18.0 L	7.20 L	15.9 L	**33.7 L**	**42.1 L**	25.2 L	**49.2**	25.3 L	22.2 L	**33.9 L [20.7 L]**	15.5 L
Magnesium	- -	- -	- -	mg/kg	90,700	2,710	994	660	190 J	266 J	4,620	606 J	1,700	1,030	1,520	3,140	680	617 J [769]	1,780
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	105 K	151 K	235 K	202 K	70.9 K	36.6 K	154 K	301 K	342 K	108 K	405 K	213 K	133 K	709 K [502 K]	395 K
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	<0.110	**0.460**	<0.140	**0.140**	**0.150**	<0.130	<0.120	<0.140	**0.150**	<0.120	**0.140**	<0.130	<0.130	**0.410 [<0.120]**	<0.130
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	2.90 K	2.50 K	8.90 K	1.60 K	3.30 K	2.80 K	10.5 K	7.90 K	25.5 K	8.00 K	7.20 K	10.8 K	4.70 K	3.90 K [5.00 K]	10.6 K
Potassium	- -	- -	- -	mg/kg	448 K	382 K	367 K	162 K	249 K	412 K	504 K	501 K	702 K	437 K	329 K	747 K	750 K	282 K [384 K]	545 K
Selenium	39 {nc}	510 {nc}	- -	mg/kg	1.00 K	<0.700	<0.690	<0.610	<0.690	<0.600	<0.590	<0.780	<0.670	<0.630	<0.620	<0.630	<0.680	<0.630 [<0.580]	<0.640
Silver	39 {nc}	510 {nc}	- -	mg/kg	<0.210 L	<0.280 L	<0.270 L	<0.240 L	<0.280 L	<0.240 L	<0.240 L	<0.310 L	<0.270 L	<0.250 L	<0.250 L	<0.250 L	<0.270 L	<0.250 L [<0.230 L]	<0.250 L
Sodium	- -	- -	- -	mg/kg	331 B	41.4 B	40.4 B	43.0 B	30.0 B	33.1 B	46.7 B	41.6 B	46.2 B	59.1 B	82.3 B	52.8 B	70.3 B	35.4 B [32.5 B]	42.9 B
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	<0.210 L	<0.280 L	0.440 B	<0.240 L	<0.280 L	<0.240 L	<0.240 L	<0.310 L	0.700 B	0.420 B	0.860 B	<0.250 L	<0.270 L	0.890 B [<0.230 L]	<0.250 L
Vanadium	55 {nc}	720 {nc}	108	mg/kg	5.00 K	44.0 K	49.1 K	23.7 K	72.4 K	19.7 K	38.7 K	60.4 K	42.6 K	57.1 K	36.3 K	48.4 K	55.9 K	34.2 K [38.6 K]	34.9 K
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	12.5	8.20	9.60	7.40	13.3	6.10	30.5	10.3	23.7	33.3	14.4	15.3	8.00	7.10 [8.90]	15.6

mg/kg	Milligrams per kilogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 8-5. Soil Analytical Results, Rail Yard, 2002 Shaw Baseline Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	RYSS04 0 - 0.5 07/25/02	RYSS05 0 - 0.5 07/25/02	RYSS06 0 - 0.5 07/25/02	RYSS07 0 - 0.5 07/25/02	RYSS08 0 - 0.5 07/25/02	RYSS09 0 - 0.5 07/25/02	RYSS10 0 - 0.5 07/25/02	RYSS11 0 - 0.5 07/25/02	RYSS12 0 - 0.5 07/25/02	RYSS13 0 - 0.5 07/25/02	RYSS14 0 - 0.5 07/25/02	RYSS15 0 - 0.5 07/25/02	RYSS16 0 - 0.5 07/25/02
Explosives																	
1,3,5-Trinitrobenzene	220 {nc}	2,700 {nc}	- -	mg/kg	<0.1 [<0.1]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,3-Dinitrobenzene	0.61 {nc}	6.2 {nc}	- -	mg/kg	<0.1 [<0.1]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2,4,6-Trinitrotoluene	3.6 {ca**}	42 {ca**}	- -	mg/kg	<0.2 [<0.2]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.2 [<0.2]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	<0.2 [<0.2]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
2-Amino-4,6-Dinitrotoluene	15 {nc}	190 {nc}	- -	mg/kg	<0.2 [<0.2]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
4-Amino-2,6-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.2 [0.05 J]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	<0.2 [<0.2]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
HMX	310 {nc}	3,100 {nc}	- -	mg/kg	<0.2 [<0.2]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
m-Nitrotoluene	- -	- -	- -	mg/kg	<0.4 [<0.4]	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	<0.2 [<0.2]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Nitroglycerine	0.61 {nc}	6.2 {nc}	- -	mg/kg	<0.4 [<0.4]	<0.37	<0.38	<0.39	<0.35	<0.37	<0.38	<0.36	<0.38	<0.36	<0.35	<0.38	<0.39
o-Nitrotoluene	78 {nc}	1,300 {sat}	- -	mg/kg	<0.4 [<0.4]	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Pentaerythritol Tetranitrate	- -	- -	- -	mg/kg	<0.4 [<0.4]	<0.37	<0.38	<0.39	<0.35	<0.37	<0.38	<0.36	<0.38	<0.36	<0.35	<0.38	<0.39
p-Nitrotoluene	30 {ca**}	110 {ca*}	- -	mg/kg	<0.4 [<0.4]	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
RDX	4.4 {ca*}	16 {ca}	- -	mg/kg	<0.2 [<0.2]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Tetryl	24 {nc}	250 {nc}	- -	mg/kg	<0.2 L [<0.2 L]	<0.2 L	<0.2 L	<0.2 L	<0.2 L	<0.2 L	<0.2 L	<0.2 L	<0.2 L	<0.2 L	<0.2 L	<0.2 L	<0.2 L
Herbicides																	
2,4,5-T	61 {nc}	620 {nc}	- -	mg/kg	NA	<0.125	NA	NA	NA	<0.125	<0.127	NA	NA	NA	NA	<0.128	NA
2,4,5-TP	49 {nc}	490 {nc}	- -	mg/kg	NA	<0.125	NA	NA	NA	<0.125	<0.127	NA	NA	NA	NA	<0.128	NA
2,4-D	69 {nc}	770 {nc}	- -	mg/kg	NA	<0.249	NA	NA	NA	<0.249	<0.254	NA	NA	NA	NA	<0.255	NA
2,4-DB	49 {nc}	490 {nc}	- -	mg/kg	NA	<1.25	NA	NA	NA	<1.25	<1.27	NA	NA	NA	NA	<1.28	NA
Dalapon	180 {nc}	1,800 {nc}	- -	mg/kg	NA	<1.25	NA	NA	NA	<1.25	<1.27	NA	NA	NA	NA	<1.28	NA
Dicamba	180 {nc}	1,800 {nc}	- -	mg/kg	NA	<0.249 L	NA	NA	NA	<0.249 L	<0.254 L	NA	NA	NA	NA	<0.255 L	NA
Dichlorprop	- -	- -	- -	mg/kg	NA	<0.249	NA	NA	NA	<0.249	<0.254	NA	NA	NA	NA	<0.255	NA
Dinoseb	6.1 {nc}	62 {nc}	- -	mg/kg	NA	<0.249 L	NA	NA	NA	<0.249 L	<0.254 L	NA	NA	NA	NA	<0.255 L	NA
MCPA	3.1 {nc}	31 {nc}	- -	mg/kg	NA	<125	NA	NA	NA	<125	<127	NA	NA	NA	NA	<128	NA
MCPP	6.1 {nc}	62 {nc}	- -	mg/kg	NA	<125	NA	NA	NA	<125	<127	NA	NA	NA	NA	<128	NA
Organochlorine Pesticides																	
4,4'-DDD	2 {ca**}	7.2 {ca**}	- -	mg/kg	NA	<0.00083	NA	NA	NA	<0.00083	<0.00084	NA	NA	NA	NA	<0.00085	NA
4,4'-DDE	1.4 {ca**}	5.1 {ca**}	- -	mg/kg	NA	<0.00083	NA	NA	NA	<0.00083	<0.00084	NA	NA	NA	NA	<0.00085	NA
4,4'-DDT	1.7 {ca*}	7 {ca*}	- -	mg/kg	NA	<0.00083	NA	NA	NA	<0.00083	<0.00084	NA	NA	NA	NA	<0.00085	NA
Aldrin	0.029 {ca*}	0.1 {ca}	- -	mg/kg	NA	<0.00083	NA	NA	NA	<0.00083	<0.00084	NA	NA	NA	NA	<0.00085	NA
Alpha-BHC	0.077 {ca**}	0.27 {ca**}	- -	mg/kg	NA	0.0006 J	NA	NA	NA	0.00052 J	0.00077 J	NA	NA	NA	NA	0.00066 J	NA
Alpha-Chlordane	1.6 {ca**}	6.5 {ca**}	- -	mg/kg	NA	<0.00083	NA	NA	NA	<0.00083	<0.00084	NA	NA	NA	NA	<0.00085	NA
Beta-BHC	0.27 {ca**}	0.96 {ca**}	- -	mg/kg	NA	0.00017 J	NA	NA	NA	<0.00083	0.00025 J	NA	NA	NA	NA	<0.00085	NA
Delta-BHC	0.52 {ca**}	2.1 {ca**}	- -	mg/kg	NA	<0.00083	NA	NA	NA	<0.00083	<0.00084	NA	NA	NA	NA	<0.00085	NA
Dieldrin	0.03 {ca}	0.11 {ca}	- -	mg/kg	NA	<0.00083	NA	NA	NA	<0.00083	<0.00084	NA	NA	NA	NA	<0.00085	NA
Endosulfan I	- -	- -	- -	mg/kg	NA	<0.00083	NA	NA	NA	<0.00083	<0.00084	NA	NA	NA	NA	<0.00085	NA
Endosulfan II	37 {nc}	370 {nc}	- -	mg/kg	NA	<0.00083	NA	NA	NA	<0.00083	<0.00084	NA	NA	NA	NA	<0.00085	NA
Endosulfan Sulfate	- -	- -	- -	mg/kg	NA	<0.00083	NA	NA	NA	<0.00083	<0.00084	NA	NA	NA	NA	<0.00085	NA
Endrin	1.8 {nc}	18 {nc}	- -	mg/kg	NA	<0.00083	NA	NA	NA	<0.00083	<0.00084	NA	NA	NA	NA	<0.00085	NA
Endrin Aldehyde	1.8 {nc}	18 {nc}	- -	mg/kg	NA	<0.00083	NA	NA	NA	<0.00083	<0.00084	NA	NA	NA	NA	<0.00085	NA
Endrin Ketone	- -	- -	- -	mg/kg	NA	<0.00083	NA	NA	NA	<0.00083	<0.00084	NA	NA	NA	NA	<0.00085	NA
Gamma-BHC (Lindane)	0.52 {ca*}	2.1 {ca}	- -	mg/kg	NA	<0.00083	NA	NA	NA	<0.00083	<0.00084	NA	NA	NA	NA	<0.00085	NA
Gamma-Chlordane	1.6 {ca**}	6.5 {ca**}	- -	mg/kg	NA	<0.00083	NA	NA	NA	<0.00083	<0.00084	NA	NA	NA	NA	<0.00085	NA
Heptachlor	0.11 {ca}	0.38 {ca}	- -	mg/kg	NA	<0.00083	NA	NA	NA	<0.00083	<0.00084	NA	NA	NA	NA	<0.00085	NA
Heptachlor Epoxide	0.053 {ca*}	0.19 {ca*}	- -	mg/kg	NA	<0.00083	NA	NA	NA	<0.00083	<0.00084	NA	NA	NA	NA	<0.00085	NA
Methoxychlor	31 {nc}	310 {nc}	- -	mg/kg	NA	<0.00083	NA	NA	NA	<0.00083	<0.00084	NA	NA	NA	NA	<0.00085	NA
Toxaphene	0.44 {ca**}	1.6 {ca**}	- -	mg/kg	NA	<0.0415	NA	NA	NA	<0.0415	<0.0424	NA	NA	NA	NA	<0.0425	NA

Notes found at end of table.

Table 8-5. Soil Analytical Results, Rail Yard, 2002 Shaw Baseline Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	RYSS04 0 - 0.5 07/25/02	RYSS05 0 - 0.5 07/25/02	RYSS06 0 - 0.5 07/25/02	RYSS07 0 - 0.5 07/25/02	RYSS08 0 - 0.5 07/25/02	RYSS09 0 - 0.5 07/25/02	RYSS10 0 - 0.5 07/25/02	RYSS11 0 - 0.5 07/25/02	RYSS12 0 - 0.5 07/25/02	RYSS13 0 - 0.5 07/25/02	RYSS14 0 - 0.5 07/25/02	RYSS15 0 - 0.5 07/25/02	RYSS16 0 - 0.5 07/25/02
PAHs																	
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	<0.0023 [0.0066]	0.0047	<0.0022	0.0010 J	0.00088 J	<0.0021	0.00098 J	0.00093 J	0.0012 J	0.0015 J	0.0019 J	<0.0022	0.0011 J
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.0023 [0.0042]	<0.0021	<0.0022	0.0065	<0.0020	<0.0021	<0.0022	<0.0021	<0.0022	<0.0021	0.0011 J	<0.0022	<0.0023
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.0023 [0.0039]	0.0030	<0.0022	<0.0022	<0.0020	<0.0021	<0.0022	<0.0021	<0.0022	0.00097 J	<0.0020	<0.0022	<0.0023
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	<0.0023 [0.0019 J]	0.0051	0.0015 J	0.0094	<0.0020	<0.0021	<0.0022	<0.0021	<0.0022	0.0031	0.0021	<0.0022	<0.0023
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.0013 J [<0.0023]	0.019	0.0078	0.027	0.0011 J	0.0012 J	0.0034	0.0019 J	0.0014 J	0.012	0.0085	<0.0022	<0.0023
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	0.0012 J [<0.0023]	0.027	0.0059	0.019	0.0013 J	0.0011 J	0.0018 J	0.0018 J	0.0013 J	0.011	0.0078	<0.0022	<0.0023
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.0020 J [<0.0023]	0.070	0.022	0.030	0.0030	0.0030	0.0047	0.0031	0.0040	0.034	0.014	<0.0022	<0.0023
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	0.0017 J [<0.0023]	0.037	0.0073	0.017	0.0016 J	0.0017 J	0.0028	0.0020 J	0.0022	0.016	0.0080	<0.0022	<0.0023
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	<0.0023 [<0.0023]	0.020	0.0062	0.0088	0.00084 J	0.00083 J	0.0012 J	0.00089 J	0.0011 J	0.0098	0.0041	<0.0022	<0.0023
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	0.0013 J [<0.0023]	0.037	0.018	0.022	0.0021	0.0021	0.0030	0.0021	0.0027	0.023	0.0091	<0.0022	<0.0023
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.0023 [<0.0023]	0.011	0.0016 J	0.0043	<0.0020	<0.0021	<0.0022	<0.0021	<0.0022	0.0034	0.0018 J	<0.0022	<0.0023
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	0.0028 [0.0015 J]	0.037	0.051	0.071	0.0034	0.0044	0.0036	0.0039	0.0043	0.036	0.022	<0.0022	<0.0023
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.0023 [0.0041]	<0.0021	<0.0022	0.0067	<0.0020	<0.0021	<0.0022	<0.0021	<0.0022	<0.0021	0.0011 J	<0.0022	<0.0023
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.0016 J [<0.0023]	0.040	0.0086	0.018	0.0016 J	0.0014 J	0.0028	0.0021	0.0023	0.017	0.0085	<0.0022	<0.0023
Naphthalene	3.9 {nc}	20 {nc}	- -	mg/kg	<0.0023 [0.0069 B]	0.0041 B	<0.0022	0.0014 B	0.0012 B	<0.0021	0.0012 B	0.0012 B	0.0015 B	0.0021 B	0.0019 B	<0.0022	0.0015 B
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.0013 J [0.0024]	0.012	0.012	0.057	0.0013 J	0.0020 J	0.0022	0.0021	0.0018 J	0.0093	0.012	<0.0022	<0.0023
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	0.0017 J [0.0010 J]	0.026	0.028	0.043	0.0022	0.0027	0.0028	0.0027	0.0028	0.023	0.013	<0.0022	<0.0023
PCBs																	
Aroclor-1016	0.39 {nc}	21 {ca**}	- -	mg/kg	<0.040 [<0.040]	<0.040	<0.040	<0.040	<0.030	<0.040	<0.040	<0.040	<0.040	<0.040	<0.030	<0.040	<0.040
Aroclor-1221	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.080 [<0.090]	<0.080	<0.080	<0.080	<0.070	<0.080	<0.080	<0.080	<0.080	<0.080	<0.070	<0.080	<0.080
Aroclor-1232	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.040 [<0.040]	<0.040	<0.040	<0.040	<0.030	<0.040	<0.040	<0.040	<0.040	<0.040	<0.030	<0.040	<0.040
Aroclor-1242	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.040 [<0.040]	<0.040	<0.040	<0.040	<0.030	<0.040	<0.040	<0.040	<0.040	<0.040	<0.030	<0.040	<0.040
Aroclor-1248	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.040 [<0.040]	<0.040	<0.040	<0.040	<0.030	<0.040	<0.040	<0.040	<0.040	<0.040	<0.030	<0.040	<0.040
Aroclor-1254	0.22 {ca**}	0.74 {ca*}	- -	mg/kg	<0.040 [<0.040]	0.020 J	<0.040	1.2	<0.030	<0.040	<0.040	0.10	<0.040	<0.040	<0.030	<0.040	<0.040
Aroclor-1260	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.040 [<0.040]	<0.040	<0.040	<0.040	<0.030	<0.040	<0.040	<0.040	<0.040	<0.040	<0.030	<0.040	<0.040
Volatile Organics																	
1,1,1-Trichloroethane	680 {sat}	680 {sat}	- -	mg/kg	<0.0067 [<0.0061]	<0.0056	<0.0063	<0.0059	<0.0054	<0.0056	<0.0057	<0.0061	<0.0064	<0.0067	<0.0053	<0.0057	<0.0060
1,1,2,2-Tetrachloroethane	0.59 {ca**}	2.9 {ca**}	- -	mg/kg	<0.0067 [<0.0061]	<0.0056	<0.0063	<0.0059	<0.0054	<0.0056	<0.0057	<0.0061	<0.0064	<0.0067	<0.0053	<0.0057	<0.0060
1,1,2-Trichloroethane	1.1 {ca}	5.5 {ca}	- -	mg/kg	<0.0067 [<0.0061]	<0.0056	<0.0063	<0.0059	<0.0054	<0.0056	<0.0057	<0.0061	<0.0064	<0.0067	<0.0053	<0.0057	<0.0060
1,1-Dichloroethane	3.4 {ca}	17 {ca}	- -	mg/kg	<0.0067 [<0.0061]	<0.0056	<0.0063	<0.0059	<0.0054	<0.0056	<0.0057	<0.0061	<0.0064	<0.0067	<0.0053	<0.0057	<0.0060
1,1-Dichloroethene	25 {nc}	110 {nc}	- -	mg/kg	<0.0067 [<0.0061]	<0.0056	<0.0063	<0.0059	<0.0054	<0.0056	<0.0057	<0.0061	<0.0064	<0.0067	<0.0053	<0.0057	<0.0060
1,2-Dichloroethane	0.45 {ca}	2.2 {ca}	- -	mg/kg	<0.0067 [<0.0061]	<0.0056	<0.0063	<0.0059	<0.0054	<0.0056	<0.0057	<0.0061	<0.0064	<0.0067	<0.0053	<0.0057	<0.0060
1,2-Dichloropropane	0.93 {ca*}	4.7 {ca*}	- -	mg/kg	<0.0067 [<0.0061]	<0.0056	<0.0063	<0.0059	<0.0054	<0.0056	<0.0057	<0.0061	<0.0064	<0.0067	<0.0053	<0.0057	<0.0060
2-Butanone	28,000 {sat}	28,000 {sat}	- -	mg/kg	<0.0067 [<0.0061]	<0.0056	0.016 K	<0.0059	<0.0054	<0.0056	<0.0057	<0.0061	<0.0064	<0.0067	<0.0053	<0.0057	<0.0060
2-Hexanone	- -	- -	- -	mg/kg	<0.0067 [<0.0061]	<0.0056	<0.0063	<0.0059	<0.0054	<0.0056	<0.0057	<0.0061	<0.0064	<0.0067	<0.0053	<0.0057	<0.0060
3-Octanone	- -	- -	- -	mg/kg	0.014 J	NA	0.15 J	0.0090 J	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methyl-2-pentanone	3,200 {sat}	3,200 {sat}	- -	mg/kg	<0.0067 [<0.0061]	<0.0056	<0.0063	<0.0059	<0.0054	<0.0056	<0.0057	<0.0061	<0.0064	<0.0067	<0.0053	<0.0057	<0.0060
Acetone	6,100 {nc}	61,000 {nc}	- -	mg/kg	0.060 J [0.017 B]	<0.0056 L	0.31 J	<0.0059 L	0.045 B	<0.0056 L	<0.0057 L	0.040 B	<0.0064 L	<0.0067 L	<0.0053 L	<0.0057 L	<0.0060 L
Benzene	1.1 {ca*}	5.6 {ca*}	- -	mg/kg	<0.0067 [<0.0061]	<0.0056	<0.0063	<0.0059	<0.0054	<0.0056	<0.0057	<0.0061	<0.0064	<0.0067	<0.0053	<0.0057	<0.0060
Bromodichloromethane	10 {ca}	46 {ca}	- -	mg/kg	<0.0067 [<0.0061]	<0.0056	<0.0063	<0.0059	<0.0054	<0.0056	<0.0057	<0.0061	<0.0064	<0.0067	<0.0053	<0.0057	<0.0060
Bromoform	61 {ca*}	220 {ca*}	- -	mg/kg	<0.0067 [<0.0061]	<0.0056	<0.0063	<0.0059	<0.0054	<0.0056	<0.0057	<0.0061	<0.0064	<0.0067	<0.0053	<0.0057	<0.0060
Bromomethane	0.79 {nc}	3.5 {nc}	- -	mg/kg	<0.0067 [<0.0061]	<0.0056	<0.0063	<0.0059	<0.0054	<0.0056	<0.0057	<0.0061	<0.0064	<0.0067	<0.0053	<0.0057	<0.0060
Carbon Disulfide	260 {sat}	260 {sat}	- -	mg/kg	<0.0067 [<0.0061]	<0.0056	<0.0063	<0.0059	<0.0054	<0.0056	<0.0057	<0.0061	<0.0064	<0.0067	<0.0053	<0.0057	<0.0060
Carbon Tetrachloride	0.25 {ca}	1.3 {ca}	- -	mg/kg	<0.0067 [<0.0061]	<0.0056	<0.0063	<0.0059	<0.0054	<0.0056	<0.0057	<0.0061	<0.0064	<0.0067	<0.0053	<0.0057	<0.0060
Chlorobenzene	31 {nc}	860 {sat}	- -	mg/kg	<0.0067 [<0.0061]	<0.0056	<0.0063	<0.0059	<0.0054	<0.0056	<0.0057	<0.0061	<0.0064	<0.0067	<0.0053	<0.0057	<0.0060
Chloroethane	2,200 {sat}	2,200 {sat}	- -	mg/kg	<0.0067 [<0.0061]	<0.0056	<0.0063	<0.0059	<0.0054	<0.0056	<0.0057	<0.0061	<0.0064	<0.0067	<0.0053	<0.0057	<0.0060
Chloroform	0.3 {ca}	1.5 {ca}	- -	mg/kg	<0.0067 [<0.0061]	<0.0056	<0.0063	<0.0059	<0.0054	<0.0056	<0.0057	<0.0061	<0.0064	<0.0067	<0.0053	<0.0057	<0.0060
Chloromethane	1.7 {ca*}	8.4 {ca*}	- -	mg/kg	<0.0067 [<0.0061]	<0.0056	<0.0063	<0.0059	<0.0054	<0.0056	<0.0057	<0.0061	<0.0064	<0.0067	<0.0053	<0.0057	<0.0060
cis-1,2-Dichloroethene	78 {nc}	1,400 {sat}	- -	mg/kg	<0.0067 [<0.0061]	<0.0056	<0.0063	<0.0059	<0.0054	<0.0056	<0.0057	<0.0061	<0.0064	<0.0067	<0.0053	<0.0057	<0.0060
cis-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.0067 [<0.0061]	<0.0056	<0.0063	<0.0059	<0.0054	<0.0056	<0.0057	<0.0061	<0.0064	<0.0067	<0.0053	<0.0057	<0.0060
Dibromochloromethane	5.8 {ca}	21 {ca}	- -	mg/kg	<0.0067 [<0.0061]	<0.0056	<0.0063	<0.0059	<0.0054	<0.0056	<0.0057	<0.0061	<0.0064	<0.0067	<0.0053	<0.0057	<0.0060
Ethanol	- -	- -	- -	mg/kg	0.018 J [0.0062 J]	NA	0.087 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	5.7 {ca}	29 {ca}	- -	mg/kg	<0.0067 [<0.0061]	<0.0056	<0.0063	<0.0059	<0.0054	<0.0056	<0.0057	<0.0061	<0.0064	<0.0067	<0.0053	<0.0057	<0.0060
m,p-Xylene	- -	- -	- -	mg/kg	<0.013 [<0.012]	<0.011	<0.013	<0.012	<0.011	<0.011	<0.011	<0.012	<0.013	<0.013	<0.011	<0.011	<0.012
Methylene Chloride	11 {ca}	54 {ca}	- -	mg/kg	<0.0067 [<0.0061]	<0.0056	<0.0063	<0.0059	0.00061 B	<0.0056	<0.0057	<0.0061	<0.0064	<0.0067	0.00097 B	<0.0057	<0.0060
o-Xylene	300 {sat}	300 {sat}	- -	mg/kg	<0.0067 [<0.0061]	<0.0056	<0.0063	<0.0059	<0.0054	<0.0056	<0.0057	<0.0061	<0.0064	<0.0067	<0.0053	<0.0057	<0.0060
Styrene	1,000 {sat}	1,000 {sat}	- -	mg/kg	<0.0067 [<0.0061]	<0.0056	<0.0063	<0.0059	<0.0054	<0.0056	<0.0057	<0.0061	<0.0064	<0.0067	<0.0053	<0.0057	<0.0060
Tetrachloroethene	0.57 {ca}	2.7 {ca}	- -	mg/kg	<0.0067 [<0.0061]	<0.0056	<0.0063	<0.0059	<0.0054	<0.0056	<0.0057	<0.0061	<0.0064	<0.0067	<0.0053	<0.0057	<0.0060
Toluene	930 {sat}	930 {sat}	- -	mg/kg	<0.0067 [<0.0061]	<0.0056	<0.0063	<0.0059	<0.0054	<0.0056	<0.0057	<0.0061	<0.0064	<0.0067	<0.0053	<0.0057	<0.0060
trans-1,2-Dichloroethene	11 {nc}	50 {nc}	- -	mg/kg	<0.0067 [<0.0061]	<0.0056	<0.0063	<0.0059	<0.0054	<0.0056	<0.0057	<0.0061	<0.0064	<0.0067	<0.0053	<0.0057	<0.0060
trans-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.0067 [<0.0061]	<0.0056	<0.0063	<0.0059	<0.0054	<0.0056	<0.0057	<0.0061	<0.0064	<0.0067	<0.0053	<0.0057	<0.0060
Trichloroethene	2.8 {ca}	14 {ca}	- -	mg/kg	<0.0067 [<0.0061]	<0.0056	<0.0063	<0.0059	<0.0054	<0.0056	<0.0057	<0.0061	<0.0064	<0.0067	<0.0053	<0.0057	<0.0060
Vinyl Chloride	0.06 {ca}	1.7 {ca}	- -	mg/kg	<0.0067 [<0.0061]	<0.0056	<0.0063	<0.0059	<0.0054	<0.0056	<0.0057	<0.0061	<0.0064	<0.0067	<0.0053	<0.0057	<0.0060
Xylenes (total)	300 {sat}	300 {sat}	- -	mg/kg	<0.013 [<0.012]	<0.011	<0.013	<0.012	<0.011	<0.011	<0.011	<0.012	<0.013	<0.013	<0.011	<0.011	<0.012

Notes found at end of table.

Table 8-5. Soil Analytical Results, Rail Yard, 2002 Shaw Baseline Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: / Sample Depth(Feet): / Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	RYSS04 0 - 0.5 07/25/02	RYSS05 0 - 0.5 07/25/02	RYSS06 0 - 0.5 07/25/02	RYSS07 0 - 0.5 07/25/02	RYSS08 0 - 0.5 07/25/02	RYSS09 0 - 0.5 07/25/02	RYSS10 0 - 0.5 07/25/02	RYSS11 0 - 0.5 07/25/02	RYSS12 0 - 0.5 07/25/02	RYSS13 0 - 0.5 07/25/02	RYSS14 0 - 0.5 07/25/02	RYSS15 0 - 0.5 07/25/02	RYSS16 0 - 0.5 07/25/02
Semivolatile Organics																	
1,2,4-Trichlorobenzene	180 {ca**}	220 {sat}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
1,2-Dichlorobenzene	220 {sat}	220 {sat}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
1,4-Dichlorobenzene	2.6 {ca}	13 {ca}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
2,4,5-Trichlorophenol	610 {nc}	6,200 {nc}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
2,4,6-Trichlorophenol	44 {ca**}	160 {ca**}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
2,4-Dichlorophenol	18 {nc}	180 {nc}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
2,4-Dimethylphenol	120 {nc}	1,200 {nc}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
2,4-Dinitrophenol	12 {nc}	120 {nc}	- -	mg/kg	<1.1 [<1.1]	<1.0	<1.1	<1.1	<0.99	<1.0	<1.1	<1.0	<1.1	<1.0	<0.97	<1.1	<1.1
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
2-Chloronaphthalene	210 {sat}	210 {sat}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
2-Chlorophenol	39 {nc}	510 {nc}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	<0.23 [<0.23]	0.014 J	<0.22	0.012 J	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
2-Methylphenol	310 {nc}	3,100 {nc}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
2-Nitroaniline	- -	- -	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
2-Nitrophenol	- -	- -	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
3,3'-Dichlorobenzidine	1.1 {ca**}	3.8 {ca**}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
3-Nitroaniline	- -	- -	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
4,6-Dinitro-2-methylphenol	- -	- -	- -	mg/kg	<1.1 [<1.1]	<1.0	<1.1	<1.1	<0.99	<1.0	<1.1	<1.0	<1.1	<1.0	<0.97	<1.1	<1.1
4-Bromophenyl-phenylether	- -	- -	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
4-Chloro-3-Methylphenol	- -	- -	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
4-Chloroaniline	24 {nc}	250 {nc}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
4-Chlorophenyl-phenylether	- -	- -	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
4-Methylphenol	31 {nc}	310 {nc}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
4-Nitroaniline	- -	- -	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
4-Nitrophenol	- -	- -	- -	mg/kg	<1.1 [<1.1]	<1.0	<1.1	<1.1	<0.99	<1.0	<1.1	<1.0	<1.1	<1.0	<0.97	<1.1	<1.1
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	0.12 J	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	0.21 J	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.23 [<0.23]	0.024 J	<0.22	0.60	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.23 [<0.23]	0.032 J	<0.22	0.55	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.23 [<0.23]	0.084 J	<0.22	0.73	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	0.35	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	<0.23 [<0.23]	0.027 J	<0.22	0.23	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
Benzoic Acid	240,000 {max}	2,500,000 {max}	- -	mg/kg	<1.1 [<1.1]	<1.0	<1.1	<1.1	<0.99	<1.0	<1.1	<1.0	<1.1	<1.0	0.17 J	<1.1	<1.1
Benzyl Alcohol	3,100 {nc}	310,000 {max}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
bis(2-Chloroethoxy)methane	18 {nc}	180 {nc}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
bis(2-Chloroethyl)ether	0.19 {ca**}	0.9 {ca**}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
bis(2-Chloroisopropyl)ether	- -	- -	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
bis(2-Ethylhexyl)phthalate	35 {ca*}	120 {ca*}	- -	mg/kg	<0.23 [<0.23]	0.097 B	0.12 B	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	0.087 B	<0.20	<0.22	<0.23
Butylbenzylphthalate	1,200 {nc}	120,000 {max}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
Carbazole	24 {ca**}	86 {ca**}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	0.12 J	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	<0.23 [<0.23]	0.048 J	<0.22	0.54	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	0.083 J	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
Dibenzofuran	- -	- -	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	0.045 J	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
Diethylphthalate	4,900 {nc}	490,000 {max}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
Dimethylphthalate	- -	- -	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
Di-n-Butylphthalate	610 {nc}	6,200 {nc}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
Di-n-Octylphthalate	- -	- -	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.23 [<0.23]	0.058 J	0.059 J	1.6	<0.20	<0.21	<0.22	<0.21	<0.22	0.036 J	0.019 J	<0.22	<0.23
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	0.12 J	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
Hexachlorobenzene	0.3 {ca}	1.1 {ca}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
Hexachlorobutadiene	6.2 {ca**}	22 {ca*}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
Hexachlorocyclopentadiene	37 {nc}	370 {nc}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
Hexachloroethane	35 {ca**}	120 {ca**}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	0.39	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
Isophorone	510 {ca*}	1,800 {ca*}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
Naphthalene	15 {nc}	67 {nc}	- -	mg/kg	<0.23 [<0.23]	0.0092 J	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
N-Nitroso-di-n-propylamine	0.069 {ca**}	0.25 {ca**}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
N-Nitrosodiphenylamine	99 {ca**}	350 {ca**}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
Pentachlorophenol	3 {ca}	9 {ca}	- -	mg/kg	<1.1 [<1.1]	<1.0	<1.1	<1.1	<0.99	<1.0	<1.1	<1.0	<1.1	<1.0	<0.97	<1.1	<1.1
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	<0.23 [<0.23]	0.038 J	0.037 J	1.1	<0.20	<0.21	<0.22	<0.21	<0.22	0.010 J	0.012 J	<0.22	<0.23
Phenol	1,800 {nc}	180,000 {max}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	<0.23 [<0.23]	0.046 J	0.040 J	1.2	<0.20	<0.21	<0.22	<0.21	<0.22	0.028 J	0.015 J	<0.22	<0.23
Pyridine	7.8 {nc}	100 {nc}	- -	mg/kg	<0.23 [<0.23]	<0.21	<0.22	<0.22	<0.20	<0.21	<0.22	<0.21	<0.22	<0.21	<0.20	<0.22	<0.23

Notes found at end of table.

Table 8-5. Soil Analytical Results, Rail Yard, 2002 Shaw Baseline Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	RYSS04 0 - 0.5 07/25/02	RYSS05 0 - 0.5 07/25/02	RYSS06 0 - 0.5 07/25/02	RYSS07 0 - 0.5 07/25/02	RYSS08 0 - 0.5 07/25/02	RYSS09 0 - 0.5 07/25/02	RYSS10 0 - 0.5 07/25/02	RYSS11 0 - 0.5 07/25/02	RYSS12 0 - 0.5 07/25/02	RYSS13 0 - 0.5 07/25/02	RYSS14 0 - 0.5 07/25/02	RYSS15 0 - 0.5 07/25/02	RYSS16 0 - 0.5 07/25/02
Inorganics																	
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	39,000 [33,000]	19,300	31,800	25,100	28,000	24,800	30,300	20,400	31,100	30,300	19,500	**43,600**	12,700
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	0.280 J [<0.670 L]	0.240 J	0.320 J	0.460 J	0.210 J	<0.620 L	<0.630 L	<0.600 L	0.580 J	0.340 J	0.270 J	<0.630 L	0.240 J
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	8.83 J [7.71 J]	6.75 J	13.2 J	6.11 J	8.58 J	5.15 J	10.7 J	7.23 J	9.31 J	11.6 J	7.58 J	9.86 J	3.33 J
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	36.3 [32.2]	44.1	30.4	49.4	42.7	33.6	45.3	52.3	48.2	45.5	42.9	57.2	11.1
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	**1.50 [1.47]**	0.910 B	**1.46**	**1.56**	0.800 B	**1.63**	**2.46**	**1.72**	**1.47**	**1.42**	0.930 B	**1.84**	**1.50**
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	<0.130 [<0.130]	0.0900 J	<0.120	<0.130	0.260	<0.120	<0.120	<0.120	<0.120	<0.120	0.0600 J	<0.120	<0.130
Calcium	- -	- -	- -	mg/kg	1,060 J [1,040 J]	1,130 J	731 J	1,410 J	685 J	4,860 J	38,900 J	611 J	1,550 J	1,510 J	922 J	1,670 J	1,460 J
Chromium	280 {ca}	1,460 {ca}	65.3	mg/kg	59.0 L [45.4 L]	23.9 L	52.9 L	35.1 L	29.5 L	32.2 L	32.0 L	30.1 L	36.3 L	45.2 L	33.9 L	48.8 L	28.9 L
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	16.4 J [13.1 J]	12.1 J	9.38 J	19.0 J	7.23 J	19.5 J	32.5 J	38.3 J	25.1 J	14.8 J	36.3 J	8.34 J	9.59 J
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	33.5 J [33.9 J]	15.8 J	31.3 J	27.6 J	18.5 J	25.2 J	27.4 J	20.5 J	26.6 J	24.8 J	11.6 J	25.6 J	32.8 J
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	50,100 [44,500]	20,400	48,400	38,200	27,900	35,700	33,000	26,100	35,800	39,800	25,700	46,200	43,100
Lead	400 {++}	800 {++}	26.8	mg/kg	**25.1 K [27.1 K]**	**26.9 K**	20.9 K	26.3 K	13.0 K	23.2 K	**37.1 K**	22.6 K	**32.6 K**	**29.3 K**	19.5 K	21.5 K	14.0 K
Magnesium	- -	- -	- -	mg/kg	1,870 [2,020]	2,040	1,340	1,960	1,480	3,720	26,500	2,170	1,710	1,740	961	2,950	760
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	168 J [118 J]	218 J	92.7 J	235 J	105 J	278 J	288 J	395 J	329 J	276 J	791 J	133 J	107 J
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	**0.190 [0.140]**	0.0500 J	0.100	0.0700	0.0600	0.0800	0.100	0.0300 J	0.120	0.130	0.0400 J	**0.160**	0.110
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	27.7 [26.6]	16.1	29.4	29.2	17.0	24.5	27.1	17.0	27.7	24.6	12.6	32.5	40.3
Potassium	- -	- -	- -	mg/kg	1,440 J [1,380 J]	1,530 J	1,720 J	1,310 J	1,440 J	1,030 J	1,540 J	2,040 J	1,250 J	1,530 J	974 J	2,160 J	439 J
Selenium	39 {nc}	510 {nc}	- -	mg/kg	<1.35 L [<1.36 L]	<1.25 L	<1.27 L	<1.31 L	<1.20 L	<1.25 L	<1.27 L	<1.21 L	<1.28 L	<1.21 L	<1.17 L	<1.28 L	<1.33 L
Silver	39 {nc}	510 {nc}	- -	mg/kg	<1.35 L [<1.36 L]	<1.25 L	<1.27 L	<1.31 L	<1.20 L	<1.25 L	<1.27 L	<1.21 L	<1.28 L	<1.21 L	<1.17 L	<1.28 L	<1.33 L
Sodium	- -	- -	- -	mg/kg	16.0 J [10.0 J]	15.0 J	13.0 J	15.0 J	19.0 J	19.0 J	58.0 J	21.0 J	26.7 J	20.0 J	20.0 J	35.2 J	5.10 J
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	0.560 [0.440]	0.250 J	0.310 J	0.390 J	0.220 J	0.270 J	0.400	0.270 J	0.360 J	0.330 J	0.170 J	0.260 J	0.0900 J
Vanadium	55 {nc}	720 {nc}	108	mg/kg	90.4 J [82.9 J]	39.8 J	78.6 J	61.7 J	49.5 J	63.1 J	63.4 J	48.1 J	65.5 J	69.9 J	53.6 J	89.3 J	41.5 J
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	50.8 J [50.3 J]	41.0 J	92.0 J	49.6 J	21.0 J	31.9 J	35.8 J	26.2 J	32.5 J	26.5 J	23.6 J	31.8 J	49.8 J

mg/kg	Milligrams per kilogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 8-6. Soil Analytical Results, Rail Yard, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	RYSB08 0 - 0.5 06/17/02	RYSB08 4 - 6 06/17/02	RYSB09 0 - 0.5 06/17/02	RYSB09 4 - 6 06/17/02	RYSB09 8 - 10 06/17/02	RYSS01 0 - 0.5 06/17/02	RYSS02 0 - 0.5 06/17/02	RYSS03 0 - 0.5 06/17/02	RYTR01 0 - 0.5 06/18/02	RYTR02 0 - 0.5 06/18/02	RYTR03 0 - 0.5 06/18/02
Explosives															
1,3,5-Trinitrobenzene	220 {nc}	2,700 {nc}	- -	mg/kg	<0.1	<0.1	NA	NA	NA	<0.1 [<0.1]	NA	<0.1	NA	NA	NA
1,3-Dinitrobenzene	0.61 {nc}	6.2 {nc}	- -	mg/kg	<0.1	<0.1	NA	NA	NA	<0.1 [<0.1]	NA	<0.1	NA	NA	NA
2,4,6-Trinitrotoluene	3.6 {ca**}	42 {ca**}	- -	mg/kg	<0.2	<0.2	NA	NA	NA	<0.2 [<0.2]	NA	<0.2	NA	NA	NA
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.2	<0.2	NA	NA	NA	<0.2 [<0.2]	NA	0.06 J	NA	NA	NA
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	<0.2	<0.2	NA	NA	NA	<0.2 [<0.2]	NA	<0.2	NA	NA	NA
2-Amino-4,6-Dinitrotoluene	15 {nc}	190 {nc}	- -	mg/kg	<0.2	<0.2	NA	NA	NA	<0.2 [<0.2]	NA	<0.2	NA	NA	NA
4-Amino-2,6-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.2	0.04 J	NA	NA	NA	<0.2 [<0.2]	NA	<0.2	NA	NA	NA
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	<0.2	<0.2	NA	NA	NA	<0.2 [<0.2]	NA	0.06 J	NA	NA	NA
HMX	310 {nc}	3,100 {nc}	- -	mg/kg	<0.2	<0.2	NA	NA	NA	<0.2 [<0.2]	NA	<0.2	NA	NA	NA
m-Nitrotoluene	- -	- -	- -	mg/kg	<0.4	<0.4	NA	NA	NA	<0.4 [<0.4]	NA	<0.4	NA	NA	NA
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	<0.2	<0.2	NA	NA	NA	<0.2 [<0.2]	NA	<0.2	NA	NA	NA
Nitroglycerine	0.61 {nc}	6.2 {nc}	- -	mg/kg	<0.39	<0.47	NA	NA	NA	<0.36 [<0.36]	NA	<0.4	NA	NA	NA
o-Nitrotoluene	78 {nc}	1,300 {sat}	- -	mg/kg	<0.4	<0.4	NA	NA	NA	<0.4 [<0.4]	NA	<0.4	NA	NA	NA
Pentaerythritol Tetranitrate	- -	- -	- -	mg/kg	<0.39	<0.47	NA	NA	NA	<0.36 [<0.36]	NA	<0.4	NA	NA	NA
p-Nitrotoluene	30 {ca**}	110 {ca*}	- -	mg/kg	<0.4	<0.4	NA	NA	NA	<0.4 [<0.4]	NA	<0.4	NA	NA	NA
RDX	4.4 {ca*}	16 {ca}	- -	mg/kg	<0.2	<0.2	NA	NA	NA	<0.2 [<0.2]	NA	<0.2	NA	NA	NA
Tetryl	24 {nc}	250 {nc}	- -	mg/kg	<0.2	<0.2	NA	NA	NA	<0.2 [<0.2]	NA	<0.2	NA	NA	NA
Herbicides															
2,4,5-T	61 {nc}	620 {nc}	- -	mg/kg	<0.0132	NA	<0.0118	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-TP	49 {nc}	490 {nc}	- -	mg/kg	<0.0132	NA	<0.0118	NA	NA	NA	NA	NA	NA	NA	NA
2,4-D	69 {nc}	770 {nc}	- -	mg/kg	<0.0265	NA	<0.0237	NA	NA	NA	NA	NA	NA	NA	NA
2,4-DB	49 {nc}	490 {nc}	- -	mg/kg	<0.132	NA	<0.118	NA	NA	NA	NA	NA	NA	NA	NA
Dalapon	180 {nc}	1,800 {nc}	- -	mg/kg	<0.132	NA	<0.118	NA	NA	NA	NA	NA	NA	NA	NA
Dicamba	180 {nc}	1,800 {nc}	- -	mg/kg	<0.0265	NA	<0.0237	NA	NA	NA	NA	NA	NA	NA	NA
Dichlorprop	- -	- -	- -	mg/kg	<0.0265	NA	<0.0237	NA	NA	NA	NA	NA	NA	NA	NA
Dinoseb	6.1 {nc}	62 {nc}	- -	mg/kg	<0.0265	NA	<0.0237	NA	NA	NA	NA	NA	NA	NA	NA
MCPA	3.1 {nc}	31 {nc}	- -	mg/kg	<13.2	NA	<11.8	NA	NA	NA	NA	NA	NA	NA	NA
MCPP	6.1 {nc}	62 {nc}	- -	mg/kg	<13.2	NA	<11.8	NA	NA	NA	NA	NA	NA	NA	NA
Organochlorine Pesticides															
4,4'-DDD	2 {ca**}	7.2 {ca**}	- -	mg/kg	<0.00882	NA	<0.0079	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDE	1.4 {ca**}	5.1 {ca**}	- -	mg/kg	<0.00882	NA	<0.0079	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDT	1.7 {ca*}	7 {ca*}	- -	mg/kg	<0.00882	NA	<0.0079	NA	NA	NA	NA	NA	NA	NA	NA
Aldrin	0.029 {ca*}	0.1 {ca}	- -	mg/kg	<0.00882	NA	<0.0079	NA	NA	NA	NA	NA	NA	NA	NA
Alpha-BHC	0.077 {ca**}	0.27 {ca**}	- -	mg/kg	<0.00882	NA	<0.0079	NA	NA	NA	NA	NA	NA	NA	NA
Alpha-Chlordane	1.6 {ca**}	6.5 {ca**}	- -	mg/kg	<0.00882	NA	<0.0079	NA	NA	NA	NA	NA	NA	NA	NA
Beta-BHC	0.27 {ca**}	0.96 {ca**}	- -	mg/kg	<0.00882	NA	<0.0079	NA	NA	NA	NA	NA	NA	NA	NA
Delta-BHC	0.52 {ca**}	2.1 {ca**}	- -	mg/kg	<0.00882	NA	<0.0079	NA	NA	NA	NA	NA	NA	NA	NA
Dieldrin	0.03 {ca}	0.11 {ca}	- -	mg/kg	<0.00882	NA	<0.0079	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan I	- -	- -	- -	mg/kg	<0.00882	NA	<0.0079	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan II	37 {nc}	370 {nc}	- -	mg/kg	<0.00882	NA	<0.0079	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan Sulfate	- -	- -	- -	mg/kg	<0.00882 J	NA	<0.0079 J	NA	NA	NA	NA	NA	NA	NA	NA
Endrin	1.8 {nc}	18 {nc}	- -	mg/kg	<0.00882	NA	<0.0079	NA	NA	NA	NA	NA	NA	NA	NA
Endrin Aldehyde	1.8 {nc}	18 {nc}	- -	mg/kg	<0.00882	NA	<0.0079	NA	NA	NA	NA	NA	NA	NA	NA
Endrin Ketone	- -	- -	- -	mg/kg	<0.00882	NA	<0.0079	NA	NA	NA	NA	NA	NA	NA	NA
Gamma-BHC (Lindane)	0.52 {ca*}	2.1 {ca}	- -	mg/kg	<0.00882	NA	<0.0079	NA	NA	NA	NA	NA	NA	NA	NA
Gamma-Chlordane	1.6 {ca**}	6.5 {ca**}	- -	mg/kg	<0.00882	NA	<0.0079	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlor	0.11 {ca}	0.38 {ca}	- -	mg/kg	<0.00882	NA	<0.0079	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlor Epoxide	0.053 {ca*}	0.19 {ca*}	- -	mg/kg	<0.00882	NA	<0.0079	NA	NA	NA	NA	NA	NA	NA	NA
Methoxychlor	31 {nc}	310 {nc}	- -	mg/kg	<0.00882	NA	<0.0079	NA	NA	NA	NA	NA	NA	NA	NA
Toxaphene	0.44 {ca**}	1.6 {ca**}	- -	mg/kg	<0.44	NA	<0.395	NA	NA	NA	NA	NA	NA	NA	NA
PAHs															
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	<0.0022	0.0013 B	NA	NA	NA	<0.0021 [0.0015 B]	NA	NA	NA	NA	NA
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.0022	<0.0027	NA	NA	NA	<0.0021 [<0.0021]	NA	NA	NA	NA	NA
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.0022	<0.0027	NA	NA	NA	<0.0021 [<0.0021]	NA	NA	NA	NA	NA
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	<0.0022	<0.0027	NA	NA	NA	0.0020 J [0.0017 J]	NA	NA	NA	NA	NA
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.0017 J	<0.0027	NA	NA	NA	0.0080 [0.0069]	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	0.0016 J	<0.0027	NA	NA	NA	0.0074 [0.0068]	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.0068	<0.0027	NA	NA	NA	0.029 [0.026]	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	0.0016 J	<0.0027	NA	NA	NA	0.0065 J [0.0077 J]	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	0.0023	<0.0027	NA	NA	NA	0.0093 [0.0079]	NA	NA	NA	NA	NA
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	0.0042	<0.0027	NA	NA	NA	0.020 [0.016]	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.0022	<0.0027	NA	NA	NA	0.0021 J [0.0024 J]	NA	NA	NA	NA	NA
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	0.0069	<0.0027	NA	NA	NA	0.031 [0.025]	NA	NA	NA	NA	NA
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.0022	<0.0027	NA	NA	NA	<0.0021 [<0.0021]	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.0017 J	<0.0027	NA	NA	NA	0.0076 J [0.0087 J]	NA	NA	NA	NA	NA
Naphthalene	3.9 {nc}	20 {nc}	- -	mg/kg	0.00097 B	0.0014 B	NA	NA	NA	0.0016 B [0.0017 B]	NA	NA	NA	NA	NA
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.0016 J	<0.0027	NA	NA	NA	0.0089 [0.0082]	NA	NA	NA	NA	NA
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	0.0063	<0.0027	NA	NA	NA	0.028 [0.023]	NA	NA	NA	NA	NA

Notes found at end of table.

Table 8-6. Soil Analytical Results, Rail Yard, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	RYSB08 0 - 0.5 06/17/02	RYSB08 4 - 6 06/17/02	RYSB09 0 - 0.5 06/17/02	RYSB09 4 - 6 06/17/02	RYSB09 8 - 10 06/17/02	RYSS01 0 - 0.5 06/17/02	RYSS02 0 - 0.5 06/17/02	RYSS03 0 - 0.5 06/17/02	RYTR01 0 - 0.5 06/18/02	RYTR02 0 - 0.5 06/18/02	RYTR03 0 - 0.5 06/18/02
PCBs															
Aroclor-1016	0.39 {nc}	21 {ca**}	- -	mg/kg	<0.040	<0.050	<0.030	<0.040	<0.040	<0.040 [<0.040]	<0.030	<0.040	<0.030	<0.030	<0.030
Aroclor-1221	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.080	<0.10	<0.070	<0.090	<0.080	<0.080 [<0.080]	<0.070	<0.090	<0.070	<0.070	<0.070
Aroclor-1232	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.040	<0.050	<0.030	<0.040	<0.040	<0.040 [<0.040]	<0.030	<0.040	<0.030	<0.030	<0.030
Aroclor-1242	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.040	<0.050	<0.030	<0.040	<0.040	<0.040 [<0.040]	<0.030	<0.040	<0.030	<0.030	<0.030
Aroclor-1248	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.040	<0.050	<0.030	<0.040	<0.040	<0.040 [<0.040]	<0.030	<0.040	<0.030	<0.030	<0.030
Aroclor-1254	0.22 {ca**}	0.74 {ca*}	- -	mg/kg	<0.040	<0.050	<0.030	<0.040	<0.040	<0.040 [<0.040]	<0.030	0.37	<0.030	0.22	<0.030
Aroclor-1260	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.040	<0.050	<0.030	<0.040	<0.040	<0.040 [<0.040]	<0.030	<0.040	<0.030	<0.030	<0.030
Volatile Organics															
1,1,1-Trichloroethane	680 {sat}	680 {sat}	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	0.59 {ca**}	2.9 {ca**}	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	1.1 {ca}	5.5 {ca}	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
1,1-Dichloroethane	3.4 {ca}	17 {ca}	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
1,1-Dichloroethene	25 {nc}	110 {nc}	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
1,2-Dichloroethane	0.45 {ca}	2.2 {ca}	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
1,2-Dichloropropane	0.93 {ca*}	4.7 {ca*}	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
2-Butanone	28,000 {sat}	28,000 {sat}	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
2-Hexanone	- -	- -	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
4-Methyl-2-pentanone	3,200 {sat}	3,200 {sat}	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
Acetone	6,100 {nc}	61,000 {nc}	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
Benzene	1.1 {ca*}	5.6 {ca*}	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
Bromodichloromethane	10 {ca}	46 {ca}	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
Bromoform	61 {ca*}	220 {ca*}	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
Bromomethane	0.79 {nc}	3.5 {nc}	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
Carbon Disulfide	260 {sat}	260 {sat}	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
Carbon Tetrachloride	0.25 {ca}	1.3 {ca}	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
Chlorobenzene	31 {nc}	860 {sat}	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
Chloroethane	2,200 {sat}	2,200 {sat}	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
Chloroform	0.3 {ca}	1.5 {ca}	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
Chloromethane	1.7 {ca*}	8.4 {ca*}	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
cis-1,2-Dichloroethene	78 {nc}	1,400 {sat}	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
cis-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
Dibromochloromethane	5.8 {ca}	21 {ca}	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
Ethylbenzene	5.7 {ca}	29 {ca}	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
m,p-Xylene	- -	- -	- -	mg/kg	<0.013	<0.017	<0.012	<0.014	<0.013	<0.012 [<0.012]	NA	NA	NA	NA	NA
Methylene Chloride	11 {ca}	54 {ca}	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
o-Xylene	300 {sat}	300 {sat}	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
Styrene	1,000 {sat}	1,000 {sat}	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
Tetrachloroethene	0.57 {ca}	2.7 {ca}	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
Toluene	930 {sat}	930 {sat}	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
trans-1,2-Dichloroethene	11 {nc}	50 {nc}	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
trans-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
Trichloroethene	2.8 {ca}	14 {ca}	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
Vinyl Chloride	0.06 {ca}	1.7 {ca}	- -	mg/kg	<0.0066	<0.0086	<0.0059	<0.0068	<0.0067	<0.0061 [<0.0061]	NA	NA	NA	NA	NA
Xylenes (total)	300 {sat}	300 {sat}	- -	mg/kg	<0.013	<0.017	<0.012	<0.014	<0.013	<0.012 [<0.012]	NA	NA	NA	NA	NA
Semivolatile Organics															
1,2,4-Trichlorobenzene	180 {ca**}	220 {sat}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	220 {sat}	220 {sat}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	2.6 {ca}	13 {ca}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	610 {nc}	6,200 {nc}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	44 {ca**}	160 {ca**}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
2,4-Dichlorophenol	18 {nc}	180 {nc}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
2,4-Dimethylphenol	120 {nc}	1,200 {nc}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
2,4-Dinitrophenol	12 {nc}	120 {nc}	- -	mg/kg	<1.1	<1.3	NA	NA	NA	<1.0 [<1.0]	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
2-Chloronaphthalene	210 {sat}	210 {sat}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
2-Chlorophenol	39 {nc}	510 {nc}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
2-Methylphenol	310 {nc}	3,100 {nc}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
2-Nitroaniline	- -	- -	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
2-Nitrophenol	- -	- -	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	1.1 {ca**}	3.8 {ca**}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
3-Nitroaniline	- -	- -	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
4,6-Dinitro-2-methylphenol	- -	- -	- -	mg/kg	<1.1	<1.3	NA	NA	NA	<1.0 [<1.0]	NA	NA	NA	NA	NA
4-Bromophenyl-phenylether	- -	- -	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
4-Chloro-3-Methylphenol	- -	- -	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
4-Chloroaniline	24 {nc}	250 {nc}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
4-Chlorophenyl-phenylether	- -	- -	- -	mg/kg	<0.22 J	<0.26 J	NA	NA	NA	<0.20 J [<0.20 J]	NA	NA	NA	NA	NA
4-Methylphenol	31 {nc}	310 {nc}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
4-Nitroaniline	- -	- -	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
4-Nitrophenol	- -	- -	- -	mg/kg	<1.1	<1.3	NA	NA	NA	<1.0 [<1.0]	NA	NA	NA	NA	NA
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	0.014 J [0.010 J]	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA

Notes found at end of table.

Table 8-6. Soil Analytical Results, Rail Yard, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	RYSB08 0 - 0.5 06/17/02	RYSB08 4 - 6 06/17/02	RYSB09 0 - 0.5 06/17/02	RYSB09 4 - 6 06/17/02	RYSB09 8 - 10 06/17/02	RYSS01 0 - 0.5 06/17/02	RYSS02 0 - 0.5 06/17/02	RYSS03 0 - 0.5 06/17/02	RYTR01 0 - 0.5 06/18/02	RYTR02 0 - 0.5 06/18/02	RYTR03 0 - 0.5 06/18/02
Semivolatile Organics															
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	0.039 J [0.033 J]	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	0.013 J [0.0086 J]	NA	NA	NA	NA	NA
Benzoic Acid	240,000 {max}	2,500,000 {max}	- -	mg/kg	0.15 B	<1.3	NA	NA	NA	<1.0 [<1.0]	NA	NA	NA	NA	NA
Benzyl Alcohol	3,100 {nc}	310,000 {max}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
bis(2-Chloroethoxy)methane	18 {nc}	180 {nc}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
bis(2-Chloroethyl)ether	0.19 {ca**}	0.9 {ca**}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
bis(2-Chloroisopropyl)ether	- -	- -	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	35 {ca*}	120 {ca*}	- -	mg/kg	0.038 B	0.060 B	NA	NA	NA	0.20 B [0.21 B]	NA	NA	NA	NA	NA
Butylbenzylphthalate	1,200 {nc}	120,000 {max}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
Carbazole	24 {ca**}	86 {ca**}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	0.022 J [0.020 J]	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
Dibenzofuran	- -	- -	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
Diethylphthalate	4,900 {nc}	490,000 {max}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
Dimethylphthalate	- -	- -	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
Di-n-Butylphthalate	610 {nc}	6,200 {nc}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
Di-n-Octylphthalate	- -	- -	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	0.042 J [0.036 J]	NA	NA	NA	NA	NA
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.22 J	<0.26 J	NA	NA	NA	<0.20 J [<0.20 J]	NA	NA	NA	NA	NA
Hexachlorobenzene	0.3 {ca}	1.1 {ca}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
Hexachlorobutadiene	6.2 {ca**}	22 {ca*}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	37 {nc}	370 {nc}	- -	mg/kg	<0.22 J	<0.26 J	NA	NA	NA	<0.20 J [<0.20 J]	NA	NA	NA	NA	NA
Hexachloroethane	35 {ca**}	120 {ca**}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
Isophorone	510 {ca*}	1,800 {ca*}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
Naphthalene	15 {nc}	67 {nc}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	0.069 {ca**}	0.25 {ca**}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	99 {ca**}	350 {ca**}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
Pentachlorophenol	3 {ca}	9 {ca}	- -	mg/kg	<1.1	<1.3	NA	NA	NA	<1.0 [<1.0]	NA	NA	NA	NA	NA
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	0.012 J [0.011 J]	NA	NA	NA	NA	NA
Phenol	1,800 {nc}	180,000 {max}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	0.035 J [0.028 J]	NA	NA	NA	NA	NA
Pyridine	7.8 {nc}	100 {nc}	- -	mg/kg	<0.22	<0.26	NA	NA	NA	<0.20 [<0.20]	NA	NA	NA	NA	NA
Inorganics															
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	35,800 J	18,200 J	NA	NA	NA	22,000 J [31,100 J]	16,100 J	NA	NA	NA	NA
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	<0.660 L	0.310 B	NA	NA	NA	0.310 L [0.210 B]	0.270 B	NA	NA	NA	NA
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	10.6 L	5.82 L	NA	NA	NA	7.70 L [7.18 L]	1.39 L	NA	NA	NA	NA
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	50.6	32.6	NA	NA	NA	42.0 [52.4]	71.6	NA	NA	NA	NA
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	**1.39**	**1.03**	NA	NA	NA	**2.23 [1.43]**	0.890	NA	NA	NA	NA
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	<0.130	<0.150	NA	NA	NA	<0.120 [<0.120]	<0.100	NA	NA	NA	NA
Calcium	- -	- -	- -	mg/kg	1,310	60.0	NA	NA	NA	2,960 [7,270]	100,000	NA	NA	NA	NA
Chromium	280 {ca}	1,460 {ca}	65.3	mg/kg	38.9 K	19.0 K	NA	NA	NA	34.4 K [36.8 K]	25.7 K	NA	NA	NA	NA
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	30.0 J	32.9 J	NA	NA	NA	23.9 J [24.8 J]	9.42 J	NA	NA	NA	NA
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	30.2 J	35.1 J	NA	NA	NA	27.6 J [30.0 J]	14.6 J	NA	NA	NA	NA
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	42,600	25,700	NA	NA	NA	37,900 [37,200]	16,300	NA	NA	NA	NA
Lead	400 {++}	800 {++}	26.8	mg/kg	**27.0**	11.7	NA	NA	NA	23.8 [20.9]	14.0	NA	NA	NA	NA
Magnesium	- -	- -	- -	mg/kg	2,100	2,330	NA	NA	NA	2,980 [5,680]	55,500	NA	NA	NA	NA
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	384 J	356 J	NA	NA	NA	309 J [758 J]	189 J	NA	NA	NA	NA
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	0.110	<0.0700	NA	NA	NA	0.0600 [0.0600]	0.0200 J	NA	NA	NA	NA
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	31.8 J	33.9 J	NA	NA	NA	26.6 J [42.2 J]	14.9 J	NA	NA	NA	NA
Potassium	- -	- -	- -	mg/kg	1,550	1,420	NA	NA	NA	1,930 [2,240]	4,570	NA	NA	NA	NA
Selenium	39 {nc}	510 {nc}	- -	mg/kg	<1.32	<1.57 L	NA	NA	NA	<1.22 [0.440 B]	0.430 B	NA	NA	NA	NA
Silver	39 {nc}	510 {nc}	- -	mg/kg	<1.32	<1.57	NA	NA	NA	<1.22 [<1.23]	<1.09	NA	NA	NA	NA
Sodium	- -	- -	- -	mg/kg	21.2 B	9.54 B	NA	NA	NA	14.6 B [25.4 B]	113	NA	NA	NA	NA
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	0.390 J	0.490	NA	NA	NA	0.300 J [0.250 J]	0.180 J	NA	NA	NA	NA
Vanadium	55 {nc}	720 {nc}	108	mg/kg	75.3	46.5	NA	NA	NA	62.3 [65.7]	32.0	NA	NA	NA	NA
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	39.2 J	33.9 J	NA	NA	NA	31.1 J [39.5 J]	41.1 J	NA	NA	NA	NA

mg/kg	Milligrams per kilogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 8-7. Sediment Analytical Results, Rail Yard, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	RYSD01 0 - 0.5 06/17/02	RYSD03 0 - 0.5 07/08/02	RYSD04 0 - 0.5 07/08/02	RYSD05 0 - 0.5 06/27/02	RYSD06 0 - 0.5 06/18/02	RYSD07 0 - 0.5 06/17/02	RYSD08 0 - 0.5 06/18/02	RYSD09 0 - 0.5 06/18/02	RYSD10 0 - 0.5 06/18/02	RYSD12 0 - 0.5 06/25/02	RYSD13 0 - 0.5 06/25/02
Explosives															
1,3,5-Trinitrobenzene	220 {nc}	2,700 {nc}	- -	mg/kg	<0.1	<0.1 [<0.1]	<0.1	<0.1 [<0.1]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2 [<0.1]	<0.1
1,3-Dinitrobenzene	0.61 {nc}	6.2 {nc}	- -	mg/kg	<0.1	<0.1 [<0.1]	<0.1	<0.1 [<0.1]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2 [<0.1]	<0.1
2,4,6-Trinitrotoluene	3.6 {ca**}	42 {ca**}	- -	mg/kg	<0.2	<0.2 [<0.2]	<0.2	<0.2 [<0.2]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4 [<0.2]	<0.2
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.2	<0.2 [<0.2]	<0.2	<0.2 [<0.2]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4 [<0.2]	<0.2
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	<0.2	<0.2 [<0.2]	<0.2	<0.2 [<0.2]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4 [<0.2]	<0.2
2-Amino-4,6-Dinitrotoluene	15 {nc}	190 {nc}	- -	mg/kg	<0.2	<0.2 [<0.2]	<0.2	<0.2 [<0.2]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4 [<0.2]	<0.2
4-Amino-2,6-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.2	<0.2 [<0.2]	<0.2	<0.2 [<0.2]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4 [<0.2]	<0.2
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	<0.2	<0.2 [<0.2]	<0.2	<0.2 [<0.2]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4 [<0.2]	<0.2
HMX	310 {nc}	3,100 {nc}	- -	mg/kg	<0.2	<0.2 [<0.2]	<0.2	<0.2 [<0.2]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4 [<0.2]	<0.2
m-Nitrotoluene	- -	- -	- -	mg/kg	<0.4	<0.4 [<0.4]	<0.4	<0.4 [<0.4]	<0.4	<0.4	<0.4	<0.4	<0.4	<0.8 [<0.4]	<0.4
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	<0.2	<0.2 [<0.2]	<0.2	<0.2 [<0.2]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4 [<0.2]	<0.2
Nitroglycerine	0.61 {nc}	6.2 {nc}	- -	mg/kg	<0.36	0.57 J [<0.69]	<0.93	0.26 J [<0.57]	<0.37	<0.36	<0.35	<0.32	<0.36	<0.95 [<0.53]	<0.53
o-Nitrotoluene	78 {nc}	1,300 {sat}	- -	mg/kg	<0.4	<0.4 [<0.4]	<0.4	<0.4 [<0.4]	<0.4	<0.4	<0.4	<0.4	<0.4	<0.8 [<0.4]	<0.4
Pentaerythritol Tetranitrate	- -	- -	- -	mg/kg	<0.36	<0.71 [<0.69]	<0.93	<0.52 [<0.57]	<0.37	<0.36	0.13 J	0.23 J	<0.36	<0.95 [<0.53]	<0.53
p-Nitrotoluene	30 {ca**}	110 {ca*}	- -	mg/kg	<0.4	<0.4 [<0.4]	<0.4	<0.4 [<0.4]	<0.4	<0.4	<0.4	<0.4	<0.4	<0.8 [<0.4]	<0.4
RDX	4.4 {ca*}	16 {ca}	- -	mg/kg	<0.2	<0.2 [<0.2]	<0.2	<0.2 [<0.2]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4 [<0.2]	<0.2
Tetryl	24 {nc}	250 {nc}	- -	mg/kg	<0.2	<0.2 [<0.2]	<0.2	<0.2 [<0.2]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4 [<0.2]	<0.2
Herbicides															
2,4,5-T	61 {nc}	620 {nc}	- -	mg/kg	<0.0123	<0.0239 [<0.0232]	0.0334	0.00567 J [<0.0192]	<0.0125	<0.012	0.0114 J	<1.08 L	<0.12	<0.0159 [<0.0177]	<0.0179
2,4,5-TP	49 {nc}	490 {nc}	- -	mg/kg	<0.0123	<0.0239 J [<0.0232 J]	0.104 J	<0.0175 [<0.0192]	0.00976 J	<0.012	<0.0118	<1.08 L	<0.12	<0.0159 [<0.0177]	<0.0179
2,4-D	69 {nc}	770 {nc}	- -	mg/kg	<0.0246	<0.0478 [<0.0464]	<0.0625	<0.0349 [<0.0383]	<0.025	<0.024	0.209	<2.17 L	<0.24	<0.0317 [<0.0354]	<0.0358
2,4-DB	49 {nc}	490 {nc}	- -	mg/kg	<0.123	<0.239 J [<0.232 J]	<0.313 J	<0.175 L [<0.192 L]	<0.125	<0.12	<0.118	<10.8 L	<1.2	<0.159 L [<0.177 L]	<0.179 L
Dalapon	180 {nc}	1,800 {nc}	- -	mg/kg	<0.123	<0.239 [<0.232]	<0.313	<0.175 [<0.192]	<0.125	0.107 J	<0.118	<10.8 L	<1.2	<0.159 [<0.177]	<0.179
Dicamba	180 {nc}	1,800 {nc}	- -	mg/kg	<0.0246	<0.0478 L [<0.0464 L]	0.0497 J	<0.0349 [<0.0383]	<0.025	<0.024	<0.0235	<2.17 L	<0.24	<0.0317 [<0.0354]	<0.0358
Dichlorprop	- -	- -	- -	mg/kg	<0.0246	<0.0478 L [<0.0464 L]	0.353 J	<0.0349 [<0.0383]	<0.025	<0.024	<0.0235	<2.17 L	<0.24	<0.0317 [<0.0354]	<0.0358
Dinoseb	6.1 {nc}	62 {nc}	- -	mg/kg	<0.0246	<0.0478 L [<0.0464 L]	<0.0625 L	<0.0349 L [<0.0383 L]	<0.025	<0.024	<0.0235	<2.17 L	<0.24	<0.0317 L [<0.0354 L]	<0.0358 L
MCPA	3.1 {nc}	31 {nc}	- -	mg/kg	<12.3	<23.9 [<23.2]	<31.3	<17.5 [<19.2]	<12.5	<12	<11.8	<1,080 L	<120	<15.9 [<17.7]	<17.9
MCPP	6.1 {nc}	62 {nc}	- -	mg/kg	<12.3	<23.9 [<23.2]	<31.3	<17.5 [<19.2]	<12.5	<12	3.53 J	<1,080 L	<120	<15.9 [<17.7]	<17.9
Organochlorine Pesticides															
4,4'-DDD	2 {ca**}	7.2 {ca**}	- -	mg/kg	<0.00819	<0.0016 [0.00068 NJ]	<0.00208	<0.00116 [<0.00128]	0.00071 J	<0.008	<0.00078	<0.00072	<0.0008	0.00194 [0.00209]	0.00174
4,4'-DDE	1.4 {ca**}	5.1 {ca**}	- -	mg/kg	<0.00819	<0.0016 [<0.00155]	0.00245 B	<0.00116 [<0.00128]	0.00031 B	<0.008	0.00112 B	0.00069 B	0.00102 B	0.0084 [0.00731]	0.0052
4,4'-DDT	1.7 {ca*}	7 {ca*}	- -	mg/kg	<0.00819	<0.0016 J [R]	0.00293 B	<0.00116 [<0.00128]	0.00055 B	<0.008	<0.00078	0.00195	0.004	0.0031 [0.00209 B]	0.00281
Aldrin	0.029 {ca*}	0.1 {ca}	- -	mg/kg	<0.00819	<0.0016 [<0.00155]	<0.00208	<0.00116 [<0.00128]	<0.00083	<0.008	<0.00078	<0.00072	<0.0008	<0.00106 [<0.00118]	<0.0012
Alpha-BHC	0.077 {ca**}	0.27 {ca**}	- -	mg/kg	<0.00819	0.00059 J [0.00052 J]	<0.00208	<0.00116 [<0.00128]	<0.00083	<0.008	<0.00078	<0.00072	0.00055 J	<0.00106 [<0.00118]	<0.0012
Alpha-Chlordane	1.6 {ca**}	6.5 {ca**}	- -	mg/kg	<0.00819	<0.0016 [<0.00155]	<0.00208	<0.00116 [<0.00128]	<0.00083	<0.008	<0.00078	0.0101	0.00835	0.00153 [0.00189]	0.00087 J
Beta-BHC	0.27 {ca**}	0.96 {ca**}	- -	mg/kg	<0.00819	<0.0016 [<0.00155]	<0.00208	<0.00116 [<0.00128]	<0.00083	<0.008	<0.00078	<0.00072	<0.0008	<0.00106 [<0.00118]	<0.0012
Delta-BHC	0.52 {ca**}	2.1 {ca**}	- -	mg/kg	<0.00819	<0.0016 [<0.00155]	<0.00208	<0.00116 [<0.00128]	<0.00083	<0.008	<0.00078	0.00099	0.0012	<0.00106 [<0.00118]	<0.0012
Dieldrin	0.03 {ca}	0.11 {ca}	- -	mg/kg	<0.00819	<0.0016 [<0.00155]	<0.00208	<0.00116 [<0.00128]	<0.00083	<0.008	<0.00078	0.00315	0.0041	0.00211 [0.00214]	0.00174
Endosulfan I	- -	- -	- -	mg/kg	<0.00819	<0.0016 [<0.00155]	<0.00208	<0.00116 [<0.00128]	<0.00083	<0.008	<0.00078	<0.00072	<0.0008	<0.00106 [<0.00118]	<0.0012
Endosulfan II	37 {nc}	370 {nc}	- -	mg/kg	<0.00819	<0.0016 [<0.00155]	<0.00208	<0.00116 [<0.00128]	0.00072 J	<0.008	<0.00078	0.00025 J	0.00052 J	<0.00106 [<0.00118]	<0.0012
Endosulfan Sulfate	- -	- -	- -	mg/kg	<0.00819 J	<0.0016 [<0.00155]	<0.00208	<0.00116 [<0.00128]	<0.00083	<0.008 J	<0.00078	<0.00072	<0.0008	<0.00106 [<0.00118]	<0.0012
Endrin	1.8 {nc}	18 {nc}	- -	mg/kg	<0.00819	<0.0016 [<0.00155]	<0.00208	<0.00116 [<0.00128]	<0.00083	<0.008	<0.00078	<0.00072	0.0125	<0.00106 [<0.00118]	<0.0012
Endrin Aldehyde	1.8 {nc}	18 {nc}	- -	mg/kg	<0.00819	<0.0016 [<0.00155]	<0.00208	<0.00116 [<0.00128]	<0.00083	<0.008	<0.00078	<0.00072	<0.0008	<0.00106 [<0.00118]	<0.0012
Endrin Ketone	- -	- -	- -	mg/kg	<0.00819	<0.0016 [<0.00155]	<0.00208	<0.00116 [<0.00128]	<0.00083	<0.008	<0.00078	<0.00072	0.00203	<0.00106 [<0.00118]	<0.0012
Gamma-BHC (Lindane)	0.52 {ca*}	2.1 {ca}	- -	mg/kg	<0.00819	<0.0016 [<0.00155]	<0.00208	<0.00116 [<0.00128]	0.00097 B	<0.008	<0.00078	<0.00072	<0.0008	<0.00106 [<0.00118]	<0.0012
Gamma-Chlordane	1.6 {ca**}	6.5 {ca**}	- -	mg/kg	<0.00819	<0.0016 [<0.00155]	<0.00208	<0.00116 [<0.00128]	<0.00083	<0.008	<0.00078	0.0116	0.013	0.00406 [0.00188]	0.00081 J
Heptachlor	0.11 {ca}	0.38 {ca}	- -	mg/kg	<0.00819	<0.0016 [<0.00155]	<0.00208	<0.00116 [<0.00128]	<0.00083	<0.008	<0.00078	0.00084	0.00213	<0.00106 [<0.00118]	<0.0012
Heptachlor Epoxide	0.053 {ca*}	0.19 {ca*}	- -	mg/kg	<0.00819	<0.0016 [<0.00155]	<0.00208	<0.00116 [<0.00128]	<0.00083	<0.008	<0.00078	0.00726	0.00399	<0.00106 [<0.00118]	<0.0012
Methoxychlor	31 {nc}	310 {nc}	- -	mg/kg	<0.00819	<0.0016 J [0.0026 B]	<0.00208 J	<0.00116 [<0.00128]	<0.00083	<0.008	<0.00078	<0.00072	<0.0008	<0.00106 [<0.00118]	<0.0012
Toxaphene	0.44 {ca**}	1.6 {ca**}	- -	mg/kg	<0.409	<0.0797 [<0.0773]	<0.104	<0.0581 [<0.0638]	<0.0416	<0.399	<0.0392	<0.0361	<0.04	<0.0529 [<0.0589]	<0.0597
PAHs															
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	0.0045	0.0022 B [0.0029 B]	0.040	0.0014 B [<0.0033]	0.012	NA	NA	NA	NA	NA	NA
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	0.0019 B	<0.0041 [<0.0039]	0.025 B	<0.0030 [<0.0033]	0.059 L	NA	NA	NA	NA	NA	NA
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	0.026	0.0026 J [0.0044]	0.026	<0.0030 [<0.0033]	0.0038	NA	NA	NA	NA	NA	NA
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.0093	0.0034 J [0.0080]	0.0093	<0.0030 [<0.0033]	0.081 L	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.090	0.013 [0.035]	0.0038 J	<0.0030 [<0.0033]	0.19 L	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	0.11	0.017 [0.038]	0.0058	<0.0030 [<0.0033]	0.17 L	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.18	0.033 [0.074]	0.011	<0.0030 [<0.0033]	0.25 L	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	0.079 J	0.0085 [0.013]	0.0038 J	<0.0030 [<0.0033]	0.10 L	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	0.048	0.031 [0.024]	0.0029 J	<0.0030 [<0.0033]	0.080 L	NA	NA	NA	NA	NA	NA
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	0.097	0.014 [0.036]	0.0053	<0.0030 [<0.0033]	0.17	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	0.017 J	<0.0041 [0.0036 J]	<0.0053	<0.0030 [<0.0033]	0.026 L	NA	NA	NA	NA	NA	NA
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	0.14	0.019 [0.057 J]	0.0079	<0.0030 [<0.0033]	0.44 L	NA	NA	NA	NA	NA	NA
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	0.0035	<0.0041 [0.0019 J]	0.019	<0.0030 [<0.0033]	0.046 L	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.084 J	0.010 [0.017]	0.0040 J	<0.0030 [<0.0033]	0.12 L	NA	NA	NA	NA	NA	NA
Naphthalene	3.9 {nc}	20 {nc}	- -	mg/kg	0.0050 B	0.0049 B [0.0066 B]	0.043	<0.0030 [<0.0033]	0.027 L	NA	NA	NA	NA	NA	NA
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.045	0.0065 [0.020]	0.010	<0.0030 [<0.0033]	0.36 L	NA	NA	NA	NA	NA	NA
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	0.15	0.027 J [0.072 J]	0.011 J	<0.0030 [<0.0033]	0.30 L	NA	NA	NA	NA	NA	NA
PCBs															
Aroclor-1016	0.39 {nc}	21 {ca**}	- -	mg/kg	<0.040	<0.070 [<0.070]	<0.10	<0.050 [<0.060]	<0.040	<0.030	<0.030	<0.030	<0.040	<0.050 [<0.050]	<0.050
Aroclor-1221	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.080	<0.16 [<0.15]	<0.20	<0.11 [<0.12]	<0.080	<0.080	<0.070	<0.070	<0.080	<0.10 [<0.11]	<0.12
Aroclor-1232	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.040	<0.070 [<0.070]	<0.10	<0.050 [<0.060]	<0.040	<0.030	<0.030	<0.030	<0.040	<0.050 [<0.050]	<0.050
Aroclor-1242	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.040	<0.070 [<0.070]	<0.10	<0.050 [<0.060]	<0.040	<0.030	<0.030	<0.030	<0.040	<0.050 [<0.050]	<0.050
Aroclor-1248	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.040	<0.070 [<0.070]	<0.10	<0.050 [<0.060]	<0.040	<0.030	<0.030	<0.030	<0.040	<0.050 [<0.050]	<0.050
Aroclor-1254	0.22 {ca**}	0.74 {ca*}	- -	mg/kg	<0.040	<0.070 [<0.070]	<0.10	<0.050 [<0.060]	<0.040	<0.030	<0.030	<0.030	<0.040	<0.050 [<0.050]	<0.050
Aroclor-1260	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.040	<0.070 [<0.070]	<0.10	<0.050 [<0.060]	<0.040	<0.030	<0.030	<0.030	<0.040	<0.050 [<0.050]	<0.050

Notes found at end of table.

Table 8-7. Sediment Analytical Results, Rail Yard, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	RYSD01 0 - 0.5 06/17/02	RYSD03 0 - 0.5 07/08/02	RYSD04 0 - 0.5 07/08/02	RYSD05 0 - 0.5 06/27/02	RYSD06 0 - 0.5 06/18/02	RYSD07 0 - 0.5 06/17/02	RYSD08 0 - 0.5 06/18/02	RYSD09 0 - 0.5 06/18/02	RYSD10 0 - 0.5 06/18/02	RYSD12 0 - 0.5 06/25/02	RYSD13 0 - 0.5 06/25/02
Volatile Organics															
1,1,1-Trichloroethane	680 {sat}	680 {sat}	- -	mg/kg	<0.0061	<0.012 [<0.012]	<0.016	<0.0087 [<0.0096]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 [<0.0088]	<0.0090
1,1,2,2-Tetrachloroethane	0.59 {ca**}	2.9 {ca**}	- -	mg/kg	<0.0061	<0.012 [<0.012]	<0.016	<0.0087 [<0.0096]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 [<0.0088]	<0.0090
1,1,2-Trichloroethane	1.1 {ca}	5.5 {ca}	- -	mg/kg	<0.0061	<0.012 [<0.012]	<0.016	<0.0087 [<0.0096]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 [<0.0088]	<0.0090
1,1-Dichloroethane	3.4 {ca}	17 {ca}	- -	mg/kg	<0.0061	<0.012 [<0.012]	<0.016	<0.0087 [<0.0096]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 [<0.0088]	<0.0090
1,1-Dichloroethene	25 {nc}	110 {nc}	- -	mg/kg	<0.0061	<0.012 [<0.012]	<0.016	<0.0087 [<0.0096]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 [<0.0088]	<0.0090
1,2-Dichloroethane	0.45 {ca}	2.2 {ca}	- -	mg/kg	<0.0061	<0.012 [<0.012]	<0.016	<0.0087 [<0.0096]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 [<0.0088]	<0.0090
1,2-Dichloropropane	0.93 {ca*}	4.7 {ca*}	- -	mg/kg	<0.0061	<0.012 [<0.012]	<0.016	<0.0087 [<0.0096]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 [<0.0088]	<0.0090
2-Butanone	28,000 {sat}	28,000 {sat}	- -	mg/kg	<0.0061	<0.012 [<0.012]	0.10 J	<0.0087 [<0.0096]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 [<0.0088]	<0.0090
2-Hexanone	- -	- -	- -	mg/kg	<0.0061	<0.012 [<0.012]	<0.016	<0.0087 [<0.0096]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 [<0.0088]	<0.0090
4-Methyl-2-pentanone	3,200 {sat}	3,200 {sat}	- -	mg/kg	<0.0061	<0.012 [<0.012]	<0.016	<0.0087 [<0.0096]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 [<0.0088]	<0.0090
Acetone	6,100 {nc}	61,000 {nc}	- -	mg/kg	<0.0061	0.049 B [0.031 B]	0.53 B	0.042 B [<0.0096]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 J [<0.0088 J]	<0.0090 J
Benzene	1.1 {ca*}	5.6 {ca*}	- -	mg/kg	<0.0061	<0.012 [<0.012]	<0.016	<0.0087 [<0.0096]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 [<0.0088]	<0.0090
Bromodichloromethane	10 {ca}	46 {ca}	- -	mg/kg	<0.0061	<0.012 [<0.012]	<0.016	<0.0087 [<0.0096]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 [<0.0088]	<0.0090
Bromoform	61 {ca*}	220 {ca*}	- -	mg/kg	<0.0061	<0.012 [<0.012]	<0.016	<0.0087 [<0.0096]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 [<0.0088]	<0.0090
Bromomethane	0.79 {nc}	3.5 {nc}	- -	mg/kg	<0.0061	<0.012 [<0.012]	<0.016	<0.0087 [<0.0096]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 [<0.0088]	<0.0090
Carbon Disulfide	260 {sat}	260 {sat}	- -	mg/kg	<0.0061	0.0010 B [<0.012]	0.0022 B	0.00062 B [<0.0096]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 [<0.0088]	<0.0090
Carbon Tetrachloride	0.25 {ca}	1.3 {ca}	- -	mg/kg	<0.0061	<0.012 [<0.012]	<0.016	<0.0087 [<0.0096]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 [<0.0088]	<0.0090
Chlorobenzene	31 {nc}	860 {sat}	- -	mg/kg	<0.0061	<0.012 [<0.012]	<0.016	<0.0087 [<0.0096]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 [<0.0088]	<0.0090
Chloroethane	2,200 {sat}	2,200 {sat}	- -	mg/kg	<0.0061	<0.012 [<0.012]	<0.016	<0.0087 [<0.0096]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 [<0.0088]	<0.0090
Chloroform	0.3 {ca}	1.5 {ca}	- -	mg/kg	<0.0061	<0.012 [<0.012]	<0.016	<0.0087 [<0.0096]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 [<0.0088]	<0.0090
Chloromethane	1.7 {ca*}	8.4 {ca*}	- -	mg/kg	<0.0061	<0.012 [<0.012]	<0.016	<0.0087 L [<0.0096 L]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 L [<0.0088 L]	<0.0090 L
cis-1,2-Dichloroethene	78 {nc}	1,400 {sat}	- -	mg/kg	<0.0061	<0.012 [<0.012]	<0.016	<0.0087 [<0.0096]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 [<0.0088]	<0.0090
cis-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.0061	<0.012 [<0.012]	<0.016	<0.0087 [<0.0096]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 [<0.0088]	<0.0090
Dibromochloromethane	5.8 {ca}	21 {ca}	- -	mg/kg	<0.0061	<0.012 [<0.012]	<0.016	<0.0087 [<0.0096]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 [<0.0088]	<0.0090
Ethylbenzene	5.7 {ca}	29 {ca}	- -	mg/kg	<0.0061	<0.012 [<0.012]	<0.016	<0.0087 [<0.0096]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 [<0.0088]	<0.0090
m,p-Xylene	- -	- -	- -	mg/kg	<0.012	<0.024 [<0.023]	<0.031	<0.017 [<0.019]	<0.013	<0.012	<0.012	<0.011	<0.012	<0.016 [<0.018]	<0.018
Methylene Chloride	11 {ca}	54 {ca}	- -	mg/kg	<0.0061	<0.012 [<0.012]	<0.016	<0.0087 [<0.0096]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 [<0.0088]	<0.0090
o-Xylene	300 {sat}	300 {sat}	- -	mg/kg	<0.0061	<0.012 [<0.012]	<0.016	<0.0087 [<0.0096]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 [<0.0088]	<0.0090
Styrene	1,000 {sat}	1,000 {sat}	- -	mg/kg	<0.0061	<0.012 [<0.012]	<0.016	<0.0087 [<0.0096]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 [<0.0088]	<0.0090
Tetrachloroethene	0.57 {ca}	2.7 {ca}	- -	mg/kg	<0.0061	<0.012 [<0.012]	<0.016	<0.0087 [<0.0096]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 [<0.0088]	<0.0090
Toluene	930 {sat}	930 {sat}	- -	mg/kg	<0.0061	<0.012 [<0.012]	<0.016	<0.0087 [<0.0096]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 [<0.0088]	<0.0090
trans-1,2-Dichloroethene	11 {nc}	50 {nc}	- -	mg/kg	<0.0061	<0.012 [<0.012]	<0.016	<0.0087 [<0.0096]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 [<0.0088]	<0.0090
trans-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.0061	<0.012 [<0.012]	<0.016	<0.0087 [<0.0096]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 [<0.0088]	<0.0090
Trichloroethene	2.8 {ca}	14 {ca}	- -	mg/kg	<0.0061	<0.012 [<0.012]	<0.016	<0.0087 [<0.0096]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 [<0.0088]	<0.0090
Vinyl Chloride	0.06 {ca}	1.7 {ca}	- -	mg/kg	<0.0061	<0.012 [<0.012]	<0.016	<0.0087 [<0.0096]	<0.0063	<0.0060	<0.0059	<0.0054	<0.0060	<0.0079 [<0.0088]	<0.0090
Xylenes (total)	300 {sat}	300 {sat}	- -	mg/kg	<0.012	<0.024 [<0.023]	<0.031	<0.017 [<0.019]	<0.013	<0.012	<0.012	<0.011	<0.012	<0.016 [<0.018]	<0.018
Semivolatile Organics															
1,2,4-Trichlorobenzene	180 {ca**}	220 {sat}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
1,2-Dichlorobenzene	220 {sat}	220 {sat}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
1,4-Dichlorobenzene	2.6 {ca}	13 {ca}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
2,4,5-Trichlorophenol	610 {nc}	6,200 {nc}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
2,4,6-Trichlorophenol	44 {ca**}	160 {ca**}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
2,4-Dichlorophenol	18 {nc}	180 {nc}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
2,4-Dimethylphenol	120 {nc}	1,200 {nc}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21 L	<0.20	<0.20 L	<0.18 L	<0.20 L	<0.27 L [<0.30 L]	<0.30 L
2,4-Dinitrophenol	12 {nc}	120 {nc}	- -	mg/kg	<1.0	<2.0 [<1.9]	<2.6	<1.4 [<1.6]	<1.0	<1.0	<0.98	<0.90	<1.0	<0.27 [<0.30]	<0.30
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
2-Chloronaphthalene	210 {sat}	210 {sat}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
2-Chlorophenol	39 {nc}	510 {nc}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	0.013 J	<0.20	<0.27 [<0.30]	<0.30
2-Methylphenol	310 {nc}	3,100 {nc}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 L [<0.30 L]	<0.30 L
2-Nitroaniline	- -	- -	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
2-Nitrophenol	- -	- -	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
3,3'-Dichlorobenzidine	1.1 {ca**}	3.8 {ca**}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 L [<0.30 L]	<0.30 L
3-Nitroaniline	- -	- -	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 J [<0.33 J]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 J [<0.30 J]	<0.30 J
4,6-Dinitro-2-methylphenol	- -	- -	- -	mg/kg	<1.0	<2.0 [<1.9]	<2.6	<1.4 [<1.6]	<1.0	<1.0	<0.98	<0.90	<1.0	<1.3 [<1.5]	<1.5
4-Bromophenyl-phenylether	- -	- -	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
4-Chloro-3-Methylphenol	- -	- -	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
4-Chloroaniline	24 {nc}	250 {nc}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
4-Chlorophenyl-phenylether	- -	- -	- -	mg/kg	<0.20 J	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20 J	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
4-Methylphenol	31 {nc}	310 {nc}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	0.036 B [<0.33]	<0.21 L	<0.20	<0.20 L	<0.18 L	<0.20 L	<0.27 L [<0.30 L]	<0.30 L
4-Nitroaniline	- -	- -	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 J [<0.33 J]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 J [<0.30 J]	<0.30 J
4-Nitrophenol	- -	- -	- -	mg/kg	<1.0	<2.0 [<1.9]	<2.6	<1.4 [<1.6]	<1.0	<1.0	<0.98	<0.90	<1.0	<1.3 [<1.5]	<1.5
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	0.028 J	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.013 J	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	0.011 J	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.080 J	0.045 J [0.042 J]	<0.52	<0.30 [<0.33]	0.024 J	0.023 J	<0.20	0.019 J	0.024 J	0.037 J [<0.30]	0.027 J
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	0.14 J	0.042 J [0.034 J]	<0.52	<0.30 J [<0.33]	0.024 J	0.030 J	<0.20	0.019 J	0.033 J	<0.27 [<0.30]	<0.30
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.21	0.048 J [0.051 J]	<0.52	<0.30 J [<0.33]	0.039 J	0.10 J	<0.20	0.038 J	0.045 J	<0.27 [<0.30]	<0.30
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	0.11 J	0.051 J [0.035 J]	<0.52	<0.30 J [<0.33]	<0.21	0.047 J	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	0.067 J	0.026 J [0.014 J]	<0.52	<0.30 J [<0.33]	0.011 J	0.027 J	<0.20	0.011 J	0.014 J	<0.27 [<0.30]	<0.30
Benzoic Acid	240,000 {max}	2,500,000 {max}	- -	mg/kg	<1.0	0.28 B [<1.9]	<2.6	<1.4 [<1.6]	<1.0	<1.0	<0.98	<0.90	<1.0	<1.3 [<1.5]	<1.5
Benzyl Alcohol	3,100 {nc}	310,000 {max}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30

Notes found at end of table.

Table 8-7. Sediment Analytical Results, Rail Yard, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: / Sample Depth(Feet): / Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	RYSD01 0 - 0.5 06/17/02	RYSD03 0 - 0.5 07/08/02	RYSD04 0 - 0.5 07/08/02	RYSD05 0 - 0.5 06/27/02	RYSD06 0 - 0.5 06/18/02	RYSD07 0 - 0.5 06/17/02	RYSD08 0 - 0.5 06/18/02	RYSD09 0 - 0.5 06/18/02	RYSD10 0 - 0.5 06/18/02	RYSD12 0 - 0.5 06/25/02	RYSD13 0 - 0.5 06/25/02
Semivolatile Organics															
bis(2-Chloroethoxy)methane	18 {nc}	180 {nc}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
bis(2-Chloroethyl)ether	0.19 {ca**}	0.9 {ca**}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
bis(2-Chloroisopropyl)ether	- -	- -	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
bis(2-Ethylhexyl)phthalate	35 {ca*}	120 {ca*}	- -	mg/kg	0.20 B	0.10 B [0.092 B]	<0.52	<0.30 [<0.33]	0.16 B	0.22 B	0.16 B	0.33 B	0.31 B	0.088 B [0.069 B]	0.047 B
Butylbenzylphthalate	1,200 {nc}	120,000 {max}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
Carbazole	24 {ca**}	86 {ca**}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 J [<0.33 J]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 J [<0.30 J]	<0.30 J
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	0.11 J	0.035 J [0.032 J]	<0.52	<0.30 [<0.33]	0.019 J	0.060 J	<0.20	0.019 J	0.038 J	0.033 J [<0.30]	0.026 J
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 J [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
Dibenzofuran	- -	- -	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<1.3 [<1.5]	<1.5
Diethylphthalate	4,900 {nc}	490,000 {max}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
Dimethylphthalate	- -	- -	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
Di-n-Butylphthalate	610 {nc}	6,200 {nc}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	0.069 B	<0.27 [<0.30]	<0.30
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
Di-n-Octylphthalate	- -	- -	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 J [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	0.18 J	0.071 J [0.048 J]	<0.52	<0.30 [0.048 J]	0.039 J	0.083 J	<0.20	0.025 J	0.063 J	0.066 J [0.017 J]	0.061 J
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.20 J	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20 J	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
Hexachlorobenzene	0.3 {ca}	1.1 {ca}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
Hexachlorobutadiene	6.2 {ca**}	22 {ca*}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
Hexachlorocyclopentadiene	37 {nc}	370 {nc}	- -	mg/kg	<0.20 J	<0.40 J [<0.39 J]	<0.52 J	<0.30 J [<0.33 J]	<0.21	<0.20 J	<0.20	<0.18	<0.20	<0.27 J [<0.30 J]	<0.30 J
Hexachloroethane	35 {ca**}	120 {ca**}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.093 J	0.039 J [0.035 J]	<0.52	<0.30 J [<0.33]	<0.21	0.044 J	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
Isophorone	510 {ca*}	1,800 {ca*}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
Naphthalene	15 {nc}	67 {nc}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
N-Nitroso-di-n-propylamine	0.069 {ca**}	0.25 {ca**}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
N-Nitrosodiphenylamine	99 {ca**}	350 {ca**}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
Pentachlorophenol	3 {ca}	9 {ca}	- -	mg/kg	<1.0	<2.0 [<1.9]	<2.6	<1.4 [<1.6]	<1.0	<1.0	<0.98	<0.90	<1.0	<1.3 [<1.5]	<1.5
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.066 J	0.037 J [0.022 J]	<0.52	<0.30 [0.019 J]	0.022 J	0.019 J	<0.20	0.021 J	<0.20	0.046 J [0.014 J]	0.051 J
Phenol	1,800 {nc}	180,000 {max}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	0.21	0.060 J [0.043 J]	<0.52	<0.30 [0.030 J]	0.036 J	0.068 J	<0.20	0.026 J	0.054 J	0.066 J [0.016 J]	0.064 J
Pyridine	7.8 {nc}	100 {nc}	- -	mg/kg	<0.20	<0.40 [<0.39]	<0.52	<0.30 [<0.33]	<0.21	<0.20	<0.20	<0.18	<0.20	<0.27 [<0.30]	<0.30
Inorganics															
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	18,200 J	14,600 [13,600]	14,000	20,900 J [13,300 J]	17,000	26,700 J	26,000	12,500	21,100	9,790 [6,660]	21,600
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	0.440 L	0.480 B [1.00 J]	0.620 B	<0.870 L [<0.950 L]	0.340 B	0.400 B	0.540 L	0.450 L	0.600 L	<0.790 L [<0.880 L]	<0.890 L
Arsenic	0.39 {ca*}	1.6 {ca}	15.8 {C}	mg/kg	4.68 L	4.90 J [5.67 J]	2.76 J	8.92 J [7.86 J]	4.66 J	10.1 L	11.8 J	4.65 J	11.8 J	2.76 J [2.72 J]	2.56 J
Barium	1,500 {nc}	190,000 {max}	209 {N}	mg/kg	52.6	43.9 [37.7]	100	105 [30.4]	47.1	38.6	68.0	36.5	49.1	60.4 [38.8]	70.2
Beryllium	16 {nc}	200 {nc}	1.02 {N}	mg/kg	**1.10**	**1.22 J [0.750 J]**	0.680 J	0.990 [0.800 J]	0.940	0.960	**1.67**	0.530 B	0.670	0.860 B [0.420 B]	0.910 B
Cadmium	7 {nc}	81 {nc}	0.69 {N}	mg/kg	0.210	0.170 J [0.140 B]	<0.310 J	<0.170 [<0.190]	0.0900 J	0.170	<0.110	0.0800 J	0.110 J	0.160 J [<0.170]	0.0800 B
Calcium	- -	- -	- -	mg/kg	2,920	16,400 J [12,800]	107,000	3,980 [7,360]	1,850 J	1,970	3,150 J	64,500 J	6,200 J	90,100 J [148,000 J]	78,600 J
Chromium	280 {ca}	1,460 {ca}	65.3 {N}	mg/kg	25.3 K	**80.9 [20.9 J]**	15.6 J	34.8 [29.7]	22.9 J	29.3 K	**79.5 J**	17.7 J	31.2 J	47.4 J [13.6 J]	27.7 J
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	13.2 J	13.5 [8.70 J]	6.70 J	11.3 [7.50 J]	10.4	13.9 J	15.0	7.07	9.53	7.50 J [5.10 J]	8.20 J
Copper	310 {nc}	4,100 {nc}	53.5 {N}	mg/kg	19.8 J	16.2 [11.1]	12.0	15.5 J [11.9 J]	17.8 L	23.4 J	22.8 L	10.8 L	18.9 L	6.67 [4.95]	14.4
Iron	5,500 {nc}	720,000 {max}	50,962 {N}	mg/kg	25,000	23,900 [16,300]	11,500	24,200 [20,400]	22,600 J	30,500	**79,600 J**	14,900 J	30,000 J	27,400 [8,760]	19,200
Lead	400 {++}	800 {++}	26.8	mg/kg	**29.7**	21.3 [21.6]	17.1	**22.1 [27.3]**	19.4	22.2	**33.0**	19.7	**30.3**	21.7 [15.1]	16.0
Magnesium	- -	- -	- -	mg/kg	2,120	4,660 J [3,540 J]	3,940 J	3,670 [5,310]	4,090 J	1,560	5,030 J	42,500 J	4,490 J	3,910 [1,810]	3,840
Manganese	180 {nc}	2,300 {nc}	2,543 {N}	mg/kg	258 J	175 [132]	302	188 [101]	260 J	180 J	831 J	242 J	304 J	451 [266]	365
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	0.0500 J	0.0400 J [<0.110]	<0.150	0.0600 J [0.0700 J]	0.0400 J	0.0800	0.0800	0.0300 J	0.0500 J	<0.0700 [<0.0800]	0.0700 J
Nickel	160 {nc}	2,000 {nc}	62.8 {N}	mg/kg	16.8 J	16.7 J [9.79 J]	7.50 J	16.6 [10.3]	16.9	22.8 J	24.5	10.3	15.6	7.05 [6.00 J]	12.2
Potassium	- -	- -	- -	mg/kg	929	981 [800]	1,130	2,620 [1,000]	2,000	1,450	2,000	1,060	1,050	491 [400 J]	1,820
Selenium	39 {nc}	510 {nc}	- -	mg/kg	0.420 B	<2.39 [<2.32]	1.50 J	<1.75 L [0.800 J]	<1.25 L	0.480 B	<1.18 L	<1.08 L	<1.20 L	<1.59 L [<1.77 L]	<1.79 L
Silver	39 {nc}	510 {nc}	- -	mg/kg	<1.23	<2.39 L [<2.32 L]	<3.13 L	<1.75 L [<1.92 L]	<1.25	<1.20	<1.18	<1.08	<1.20	<1.59 [<1.77]	<1.79
Sodium	- -	- -	- -	mg/kg	14.6 B	15.0 B [17.0 B]	35.0 B	76.4 [26.0 B]	13.0 B	17.8 B	19.0 B	70.8	17.0 B	76.8 J [81.4 J]	86.6 J
Thallium	0.51 {nc}	6.6 {nc}	2.11 {N}	mg/kg	0.290 J	0.450 J [0.200 J]	0.210 J	0.150 J [0.180 J]	0.210 J	0.290 J	0.390 J	0.160 J	0.210 J	0.0700 B [0.0800 B]	0.110 B
Vanadium	55 {nc}	720 {nc}	108 {N}	mg/kg	46.4	50.7 [32.1]	28.8	48.3 [42.7]	42.0 J	57.8	**110 J**	31.3 J	60.1 J	49.9 [16.6]	31.0
Zinc	2,300 {nc}	310,000 {max}	202 {N}	mg/kg	103 J	57.6 J [40.6 J]	45.1 J	96.8 J [82.1 J]	46.6 J	110 J	37.6 J	33.8 J	44.0 J	31.6 J [20.5 J]	28.0 J

mg/kg	Milligrams per kilogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 8-8. Surface Water Analytical Results, Rail Yard, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Date Collected:	Tapwater Screening Values [a]	Units	RYSW02 06/27/02	RYSW03 07/15/02	RYSW04 07/15/02	RYSW05 06/27/02	RYSW12 06/25/02	RYSW13 06/25/02	RYSW15 07/11/02
Explosives									
1,3,5-Trinitrobenzene	1,100 {nc}	µg/L	<0.13	<0.13	<0.13	<0.13 [<0.13]	<0.13 [<0.13]	<0.13	NA
1,3-Dinitrobenzene	3.7 {nc}	µg/L	<0.13	<0.13	<0.13	<0.13 [<0.13]	<0.13 [<0.13]	<0.13	NA
2,4,6-Trinitrotoluene	1.8 {ca**}	µg/L	<0.26	<0.26	<0.26	<0.26 [<0.26]	<0.26 [<0.26]	<0.26	NA
2,4-Dinitrotoluene	73 {nc}	µg/L	<0.13	<0.13	<0.13	<0.13 [<0.13]	<0.13 [<0.13]	<0.13	NA
2,6-Dinitrotoluene	37 {nc}	µg/L	<0.26	<0.26	<0.26	<0.26 [<0.26]	<0.26 [<0.26]	<0.26	NA
2-Amino-4,6-Dinitrotoluene	73 {nc}	µg/L	<0.26	<0.26	<0.26	<0.26 [<0.26]	<0.26 [<0.26]	<0.26	NA
4-Amino-2,6-Dinitrotoluene	73 {nc}	µg/L	<0.26	<0.26	<0.26	<0.26 [<0.26]	<0.26 [<0.26]	<0.26	NA
Dinitrotoluene Mix	0.099 {ca}	µg/L	<0.26	<0.26	<0.26	<0.26 [<0.26]	<0.26 [<0.26]	<0.26	NA
HMX	1,800 {nc}	µg/L	<0.26	<0.26	<0.26	<0.26 [<0.26]	<0.26 [<0.26]	<0.26	NA
m-Nitrotoluene	730 {nc}	µg/L	<0.52	<0.52	1.25	<0.52 [<0.52]	0.4 J [0.45 J]	0.38 J	NA
Nitrobenzene	3.4 {nc}	µg/L	<0.26	0.13 J	0.2 J	0.15 J [0.14 J]	<0.26 [<0.26]	<0.26	NA
Nitroglycerine	3.7 {nc}	µg/L	<0.97 L	0.61 J	<0.97	<0.97 L [<0.97 L]	<0.97 L [<0.97 L]	<0.97 L	NA
o-Nitrotoluene	370 {nc}	µg/L	<0.52	<0.52	<0.52	<0.52 [<0.52]	<0.52 [<0.52]	<0.52	NA
Pentaerythritol Tetranitrate	- -	µg/L	<0.97 L	<0.97	<0.97	<0.97 L [<0.97 L]	<0.97 L [<0.97 L]	<0.97 L	NA
p-Nitrotoluene	4.2 {ca*}	µg/L	<0.52	<0.52	<0.52	<0.52 [<0.52]	<0.52 [<0.52]	<0.52	NA
RDX	0.61 {ca}	µg/L	<0.26	<0.26	<0.26	<0.26 [<0.26]	<0.26 [<0.26]	<0.26	NA
Tetryl	150 {nc}	µg/L	<0.26	<0.26	<0.26	<0.26 [<0.26]	<0.26 [<0.26]	<0.26	NA
Herbicides									
2,4,5-T	370 {nc}	µg/L	<0.1	<0.1	<0.1	<0.1 [<0.1]	<0.1 [<0.1]	<0.1	NA
2,4,5-TP	290 {nc}	µg/L	<0.1	0.05 J	<0.1	<0.1 [<0.1]	<0.1 [<0.1]	<0.1	NA
2,4-D	370 {nc}	µg/L	<0.5	<0.5	<0.5	<0.5 [<0.5]	4.2 [4.66]	4.09	NA
2,4-DB	290 {nc}	µg/L	<2	<2	<2	<2 [<2]	<2 [0.41 J]	<2	NA
Dalapon	1,100 {nc}	µg/L	<2	<2	<2	<2 [<2]	<2 [<2]	<2	NA
Dicamba	1,100 {nc}	µg/L	<0.5 L	<0.5	<0.5	<0.5 L [<0.5 L]	<0.5 [<0.5]	<0.5	NA
Dichlorprop	- -	µg/L	<0.5	<0.5	<0.5	<0.5 [<0.5]	<0.5 [<0.5]	<0.5	NA
Dinoseb	37 {nc}	µg/L	<0.5	<0.5	<0.5	<0.5 [<0.5]	<0.5 [<0.5]	<0.5	NA
MCPA	18 {nc}	µg/L	<125	<125	<125	<125 [<125]	<125 [110 J]	<125	NA
MCPP	37 {nc}	µg/L	<125	<125	<125	<125 [<125]	46.3 J [<125]	<125	NA
Organochlorine Pesticides									
4,4'-DDD	0.28 {ca**}	µg/L	<0.02	<0.02	<0.02	<0.02 [<0.02]	<0.02 [<0.02]	<0.02	NA
4,4'-DDE	0.2 {ca**}	µg/L	<0.02	<0.02	<0.02	<0.02 [<0.02]	<0.02 [<0.02]	<0.02	NA
4,4'-DDT	0.2 {ca*}	µg/L	<0.02	<0.02	<0.02	<0.02 [<0.02]	<0.02 [<0.02]	0.01 J	NA
Aldrin	0.004 {ca}	µg/L	<0.02	<0.02	<0.02	<0.02 [<0.02]	<0.02 [<0.02]	<0.02	NA
Alpha-BHC	0.011 {ca**}	µg/L	<0.02	<0.02	<0.02	<0.02 [<0.02]	<0.02 [<0.02]	<0.02	NA
Alpha-Chlordane	- -	µg/L	<0.02	<0.02	<0.02	<0.02 [<0.02]	<0.02 [<0.02]	<0.02	NA
Beta-BHC	0.037 {ca**}	µg/L	<0.02	<0.02	<0.02	<0.02 [<0.02]	<0.02 [<0.02]	<0.02	NA
Delta-BHC	0.061 {ca}	µg/L	<0.02	0.01 J	<0.02	<0.02 [<0.02]	<0.02 [<0.02]	<0.02	NA
Dieldrin	0.0042 {ca}	µg/L	<0.02	<0.02	<0.02	<0.02 [<0.02]	0.00719 J [0.00672 J]	0.0063 J	NA
Endosulfan I	220 {nc}	µg/L	<0.02	<0.02	<0.02	<0.02 [<0.02]	<0.02 [<0.02]	<0.02	NA
Endosulfan II	220 {nc}	µg/L	<0.02	<0.02	<0.02	<0.02 [<0.02]	<0.02 [<0.02]	<0.02	NA
Endosulfan Sulfate	220 {nc}	µg/L	<0.02	<0.02	<0.02	0.03 [0.02]	<0.02 [<0.02]	<0.02	NA
Endrin	11 {nc}	µg/L	<0.02	<0.02	<0.02	<0.02 [<0.02]	<0.02 [<0.02]	<0.02	NA
Endrin Aldehyde	11 {nc}	µg/L	<0.02	<0.02	<0.02	0.01 J [<0.02]	<0.02 [<0.02]	<0.02	NA
Endrin Ketone	11 {nc}	µg/L	<0.02	<0.02	<0.02	<0.02 [<0.02]	<0.02 [0.00828 J]	<0.02	NA
Gamma-BHC (Lindane)	0.061 {ca}	µg/L	<0.02	<0.02	<0.02	<0.02 [<0.02]	<0.02 [<0.02]	<0.02	NA
Gamma-Chlordane	0.19 {ca}	µg/L	<0.02	<0.02	<0.02	<0.02 [<0.02]	<0.02 [<0.02]	<0.02	NA
Heptachlor	0.015 {ca}	µg/L	<0.02	<0.02	<0.02	<0.02 [<0.02]	<0.02 [<0.02]	<0.02	NA
Heptachlor Epoxide	0.0074 {ca*}	µg/L	<0.02	<0.02	<0.02	<0.02 [<0.02]	<0.02 [<0.02]	<0.02	NA
Methoxychlor	180 {nc}	µg/L	<0.02	<0.02	<0.02	<0.02 [<0.02]	<0.02 [<0.02]	<0.02	NA
Toxaphene	0.061 {ca**}	µg/L	<1	<1	<1	<1 [<1]	<1 [<1]	<1	NA
PAHs									
2-Methylnaphthalene	150 {nc}	µg/L	<0.050	<0.050	<0.050	0.020 J [0.030 J]	NA	NA	NA
Acenaphthene	2,200 {nc}	µg/L	<0.050	<0.050	<0.050	<0.050 [<0.050]	NA	NA	NA
Acenaphthylene	2,200 {nc}	µg/L	<0.050	<0.050	<0.050	<0.050 [<0.050]	NA	NA	NA
Anthracene	11,000 {nc}	µg/L	<0.050	<0.050	<0.050	<0.050 [<0.050]	NA	NA	NA
Benzo(a)anthracene	0.029 {ca**}	µg/L	<0.050	<0.050	<0.050	<0.050 [<0.050]	NA	NA	NA
Benzo(a)pyrene	0.0029 {ca**}	µg/L	<0.050	<0.050	<0.050	<0.050 [<0.050]	NA	NA	NA
Benzo(b)fluoranthene	0.029 {ca**}	µg/L	<0.050	<0.050	<0.050	<0.050 [<0.050]	NA	NA	NA
Benzo(g,h,i)perylene	1,100 {nc}	µg/L	<0.050 J	<0.050 J	<0.050 J	<0.050 J [<0.050 J]	NA	NA	NA
Benzo(k)fluoranthene	0.29 {ca**}	µg/L	<0.050	<0.050	<0.050	<0.050 [<0.050]	NA	NA	NA
Chrysene	2.9 {ca**}	µg/L	<0.050	<0.050	<0.050	<0.050 [<0.050]	NA	NA	NA
Dibenzo(a,h)anthracene	0.0029 {ca**}	µg/L	<0.050 J	<0.050	<0.050	<0.050 J [<0.050 J]	NA	NA	NA
Fluoranthene	1,500 {nc}	µg/L	<0.050	<0.050	<0.050	<0.050 [<0.050]	NA	NA	NA
Fluorene	1,500 {nc}	µg/L	<0.050	<0.050	<0.050	<0.050 [<0.050]	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.029 {ca**}	µg/L	<0.050 J	<0.050	<0.050	<0.050 J [<0.050 J]	NA	NA	NA
Naphthalene	0.14 {ca}	µg/L	0.020 B	0.030 B	0.030 B	0.020 B [0.020 B]	NA	NA	NA
Phenanthrene	11,000 {nc}	µg/L	<0.050	<0.050	<0.050	<0.050 [0.020 J]	NA	NA	NA
Pyrene	1,100 {nc}	µg/L	<0.050	<0.050	<0.050	<0.050 [<0.050]	NA	NA	NA
PCBs									
Aroclor-1016	0.96 {ca**}	µg/L	<0.10	<0.10	<0.10	<0.10 [<0.10]	<0.10 [<0.10]	<0.10	NA
Aroclor-1221	0.0068 {ca**}	µg/L	<0.20	<0.20	<0.20	<0.20 [<0.20]	<0.20 [<0.20]	<0.20	NA
Aroclor-1232	0.0068 {ca**}	µg/L	<0.10	<0.10	<0.10	<0.10 [<0.10]	<0.10 [<0.10]	<0.10	NA
Aroclor-1242	0.034 {ca**}	µg/L	<0.10	<0.10	<0.10	<0.10 [<0.10]	<0.10 [<0.10]	<0.10	NA
Aroclor-1248	0.034 {ca**}	µg/L	<0.10	<0.10	<0.10	<0.10 [<0.10]	<0.10 [<0.10]	<0.10	NA
Aroclor-1254	0.034 {ca*}	µg/L	<0.10	<0.10	<0.10	<0.10 [<0.10]	<0.10 [<0.10]	<0.10	NA
Aroclor-1260	0.034 {ca**}	µg/L	<0.10	<0.10	<0.10	<0.10 [<0.10]	<0.10 [<0.10]	<0.10	NA

Notes found at end of table.

Table 8-8. Surface Water Analytical Results, Rail Yard, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Date Collected:	Tapwater Screening Values [a]	Units	RYSW02 06/27/02	RYSW03 07/15/02	RYSW04 07/15/02	RYSW05 06/27/02	RYSW12 06/25/02	RYSW13 06/25/02	RYSW15 07/11/02
Volatile Organics									
1,1,1-Trichloroethane	9,100 {nc}	µg/L	<1.0	NA	NA	<1.0 [<1.0]	<1.0 [<1.0]	<1.0	NA
1,1,2,2-Tetrachloroethane	0.067 {ca**}	µg/L	<1.0	NA	NA	<1.0 [<1.0]	<1.0 [<1.0]	<1.0	NA
1,1,2-Trichloroethane	0.24 {ca}	µg/L	<1.0	NA	NA	<1.0 [<1.0]	<1.0 [<1.0]	<1.0	NA
1,1-Dichloroethane	2.4 {ca}	µg/L	<1.0	NA	NA	<1.0 [<1.0]	<1.0 [<1.0]	<1.0	NA
1,1-Dichloroethene	340 {nc}	µg/L	<1.0	NA	NA	<1.0 [<1.0]	<1.0 [<1.0]	<1.0	NA
1,2-Dichloroethane	0.15 {ca}	µg/L	<1.0	NA	NA	<1.0 [<1.0]	<1.0 [<1.0]	<1.0	NA
1,2-Dichloropropane	0.39 {ca*}	µg/L	<1.0	NA	NA	<1.0 [<1.0]	<1.0 [<1.0]	<1.0	NA
2-Butanone	7,100 {nc}	µg/L	<4.0	NA	NA	<4.0 [<4.0]	<4.0 [<4.0]	<4.0	NA
2-Hexanone	- -	µg/L	<4.0	NA	NA	<4.0 [<4.0]	<4.0 [<4.0]	<4.0	NA
4-Methyl-2-pentanone	2,000 {nc}	µg/L	<4.0	NA	NA	<4.0 [<4.0]	<4.0 [<4.0]	<4.0	NA
Acetone	22,000 {nc}	µg/L	<4.0 J	NA	NA	<4.0 J [<4.0 J]	<4.0 J [<4.0 J]	<4.0 J	NA
Benzene	0.41 {ca}	µg/L	<1.0	NA	NA	<1.0 [<1.0]	<1.0 [<1.0]	<1.0	NA
Bromodichloromethane	1.1 {ca}	µg/L	<1.0	NA	NA	<1.0 [<1.0]	<1.0 [<1.0]	<1.0	NA
Bromoform	8.5 {ca*}	µg/L	<1.0	NA	NA	<1.0 [<1.0]	<1.0 [<1.0]	<1.0	NA
Bromomethane	8.7 {nc}	µg/L	<1.0 L	NA	NA	<1.0 L [<1.0 L]	<1.0 L [<1.0 L]	<1.0 L	NA
Carbon Disulfide	1,000 {nc}	µg/L	<1.0	NA	NA	0.17 B [0.30 B]	0.15 B [0.16 B]	<1.0	NA
Carbon Tetrachloride	0.2 {ca}	µg/L	<1.0	NA	NA	<1.0 [<1.0]	<1.0 [<1.0]	<1.0	NA
Chlorobenzene	91 {nc}	µg/L	<1.0	NA	NA	<1.0 [<1.0]	<1.0 [<1.0]	<1.0	NA
Chloroethane	21,000 {nc}	µg/L	<1.0	NA	NA	<1.0 [<1.0]	<1.0 [<1.0]	<1.0	NA
Chloroform	0.19 {ca}	µg/L	<1.0	NA	NA	<1.0 [<1.0]	0.36 J [0.37 J]	0.36 J	NA
Chloromethane	1.8 {ca}	µg/L	<1.0 L	NA	NA	<1.0 L [<1.0 L]	<1.0 L [<1.0 L]	<1.0 L	NA
cis-1,2-Dichloroethene	370 {nc}	µg/L	<1.0	NA	NA	<1.0 [<1.0]	<1.0 [<1.0]	<1.0	NA
cis-1,3-Dichloropropene	- -	µg/L	<1.0	NA	NA	<1.0 [<1.0]	<1.0 [<1.0]	<1.0	NA
Dibromochloromethane	0.8 {ca}	µg/L	<1.0	NA	NA	<1.0 [<1.0]	<1.0 [<1.0]	<1.0	NA
Ethylbenzene	1.5 {ca}	µg/L	<1.0	NA	NA	<1.0 [<1.0]	<1.0 [<1.0]	<1.0	NA
m,p-Xylene	200 {nc}	µg/L	<2.0	NA	NA	<2.0 [<2.0]	<2.0 [<2.0]	<2.0	NA
Methylene Chloride	4.8 {ca}	µg/L	<1.0	NA	NA	<1.0 [<1.0]	<1.0 [<1.0]	<1.0	NA
o-Xylene	1,400 {nc}	µg/L	<1.0	NA	NA	<1.0 [<1.0]	<1.0 [<1.0]	<1.0	NA
Styrene	1,600 {nc}	µg/L	<1.0	NA	NA	<1.0 [<1.0]	<1.0 [<1.0]	<1.0	NA
Tetrachloroethene	0.11 {ca}	µg/L	<1.0	NA	NA	<1.0 [<1.0]	<1.0 [<1.0]	<1.0	NA
Toluene	2,300 {nc}	µg/L	<1.0	NA	NA	<1.0 [<1.0]	<1.0 [<1.0]	<1.0	NA
trans-1,2-Dichloroethene	110 {nc}	µg/L	<1.0	NA	NA	<1.0 [<1.0]	<1.0 [<1.0]	<1.0	NA
trans-1,3-Dichloropropene	- -	µg/L	<1.0	NA	NA	<1.0 [<1.0]	<1.0 [<1.0]	<1.0	NA
Trichloroethene	1.7 {ca}	µg/L	<1.0	NA	NA	<1.0 [<1.0]	<1.0 [<1.0]	<1.0	NA
Vinyl Chloride	0.016 {ca}	µg/L	<1.0	NA	NA	<1.0 [<1.0]	<1.0 [<1.0]	<1.0	NA
Xylenes (total)	200 {nc}	µg/L	<2.0	NA	NA	<2.0 [<2.0]	<2.0 [<2.0]	<2.0	NA
Semivolatile Organics									
1,2,4-Trichlorobenzene	19 {ca*}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
1,2-Dichlorobenzene	370 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
1,3-Dichlorobenzene	- -	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
1,4-Dichlorobenzene	0.43 {ca}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
2,4,5-Trichlorophenol	3,700 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
2,4,6-Trichlorophenol	6.1 {ca**}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
2,4-Dichlorophenol	110 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
2,4-Dimethylphenol	730 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
2,4-Dinitrophenol	73 {nc}	µg/L	<25	<25	<25	<25 [<25]	<25 [<25]	<25	NA
2,4-Dinitrotoluene	73 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
2,6-Dinitrotoluene	37 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
2-Chloronaphthalene	2,900 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
2-Chlorophenol	180 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
2-Methylnaphthalene	150 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
2-Methylphenol	1,800 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
2-Nitroaniline	- -	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
2-Nitrophenol	- -	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
3,3'-Dichlorobenzidine	0.15 {ca**}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
3-Nitroaniline	- -	µg/L	<5.0 J	<5.0	<5.0	<5.0 J [<5.0 J]	<5.0 [<5.0]	<5.0	NA
4,6-Dinitro-2-methylphenol	- -	µg/L	<25	<25	<25	<25 [<25]	<25 [<25]	<25	NA
4-Bromophenyl-phenylether	- -	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
4-Chloro-3-Methylphenol	- -	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
4-Chloroaniline	150 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
4-Chlorophenyl-phenylether	- -	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
4-Methylphenol	180 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
4-Nitroaniline	- -	µg/L	<5.0 J	<5.0	<5.0	<5.0 J [<5.0 J]	<5.0 J [<5.0 J]	<5.0 J	NA
4-Nitrophenol	- -	µg/L	<25	<25	<25	<25 [<25]	<25 [<25]	<25	NA
Acenaphthene	2,200 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
Acenaphthylene	- -	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
Anthracene	11,000 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
Benzo(a)anthracene	0.029 {ca**}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
Benzo(a)pyrene	0.0029 {ca**}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
Benzo(b)fluoranthene	0.029 {ca**}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
Benzo(g,h,i)perylene	- -	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
Benzo(k)fluoranthene	0.29 {ca**}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
Benzoic Acid	150,000 {max}	µg/L	<25	4.5 J	6.0 J	5.7 J [4.8 J]	6.1 J [<25]	5.7 J	NA
Benzyl Alcohol	18,000 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
bis(2-Chloroethoxy)methane	110 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
bis(2-Chloroethyl)ether	0.012 {ca**}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
bis(2-Chloroisopropyl)ether	- -	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
bis(2-Ethylhexyl)phthalate	4.8 {ca}	µg/L	<5.0	4.8 B	5.8 B	<5.0 [<5.0]	3.5 J [8.0]	2.0 J	NA
Butylbenzylphthalate	35 {ca}	µg/L	<5.0	<5.0	<5.0	0.37 B [<5.0]	1.1 B [0.32 B]	0.68 B	NA
Carbazole	3.4 {ca**}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
Chrysene	2.9 {ca**}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
Dibenzo(a,h)anthracene	0.0029 {ca**}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
Dibenzofuran	37 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
Diethylphthalate	29,000 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	0.37 J [<5.0]	<5.0	NA
Dimethylphthalate	- -	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
Di-n-Butylphthalate	3,700 {nc}	µg/L	<5.0	<5.0	<5.0	1.0 B [<5.0]	0.86 B [0.94 B]	0.89 B	NA
Dinitrotoluene Mix	0.099 {ca}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
Di-n-Octylphthalate	3,700 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
Fluoranthene	1,500 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
Fluorene	1,500 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
Hexachlorobenzene	0.042 {ca}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
Hexachlorobutadiene	0.86 {ca*}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA

Notes found at end of table.

Table 8-8. Surface Water Analytical Results, Rail Yard, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Date Collected:	Tapwater Screening Values [a]	Units	RYSW02 06/27/02	RYSW03 07/15/02	RYSW04 07/15/02	RYSW05 06/27/02	RYSW12 06/25/02	RYSW13 06/25/02	RYSW15 07/11/02
Semivolatile Organics									
Hexachlorocyclopentadiene	220 {nc}	µg/L	<5.0 J	<5.0	<5.0	<5.0 J [<5.0 J]	<5.0 J [<5.0 J]	<5.0 J	NA
Hexachloroethane	4.8 {ca**}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
Indeno(1,2,3-cd)pyrene	0.029 {ca**}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
Isophorone	71 {ca}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
Naphthalene	6.2 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
Nitrobenzene	3.4 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
N-Nitroso-di-n-propylamine	0.0096 {ca**}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
N-Nitrosodiphenylamine	14 {ca**}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
Pentachlorophenol	0.56 {ca}	µg/L	<25	<25	<25	<25 [<25]	<25 [<25]	<25	NA
Phenanthrene	- -	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
Phenol	11,000 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
Pyrene	1,100 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
Pyridine	37 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0 [<5.0]	<5.0	NA
Inorganics									
Aluminum	37,000 {nc}	µg/L	<200	462	608	110 J [341]	130 J [150 J]	150 J	NA
Antimony	15 {nc}	µg/L	<5.00	0.360 B	0.580 B	0.390 B [<5.00]	<5.00 [<5.00]	<5.00	NA
Arsenic	0.045 {ca}	µg/L	<3.00	<3.00	<3.00	<3.00 [<3.00]	<3.00 [<3.00]	<3.00	NA
Barium	7,300 {nc}	µg/L	45.3	29.4	22.6	15.0 J [15.0 J]	78.9 [79.6]	78.7	NA
Beryllium	73 {nc}	µg/L	<2.00	<5.00	<5.00	<2.00 [<2.00]	<2.00 [<2.00]	<2.00	NA
Cadmium	18 {nc}	µg/L	<2.00	0.110 B	0.0600 B	<2.00 [<2.00]	<2.00 [<2.00]	<2.00	NA
Calcium	- -	µg/L	59,500	35,200	21,100	15,300 [15,500]	57,700 [57,500]	59,000	NA
Chromium	55,000 {nc}	µg/L	<10.0	<10.0	5.50 J	<10.0 [<10.0]	<10.0 [<10.0]	<10.0	NA
Cobalt	11 {nc}	µg/L	<50.0	<50.0	<50.0	<50.0 [<50.0]	<50.0 [<50.0]	<50.0	NA
Copper	1,500 {nc}	µg/L	<20.0	<20.0	<20.0	<20.0 [<20.0]	<20.0 [<20.0]	<20.0	NA
Iron	26,000 {nc}	µg/L	<50.0	513	553	127 [286]	237 [274]	210	NA
Lead	15 {nc}	µg/L	<2.00	1.20 B	1.10 B	<2.00 [<2.00]	0.990 B [1.10 B]	0.880 B	NA
Magnesium	- -	µg/L	26,400	25,600	25,800	26,400 [26,600]	16,900 [17,000]	17,100	NA
Manganese	880 {nc}	µg/L	1.70 J	97.8	81.7	24.2 [29.9]	21.1 [21.4]	19.5	NA
Mercury	0.63 {nc}	µg/L	<0.100	<0.100	<0.100	<0.100 [<0.100]	<0.100 [<0.100]	<0.100	NA
Nickel	730 {nc}	µg/L	<40.0	<40.0	<40.0	<40.0 [<40.0]	<40.0 [<40.0]	<40.0	NA
Potassium	- -	µg/L	1,700 J	2,700 J	3,360	3,120 [3,370]	3,420 [3,750]	3,590	NA
Selenium	180 {nc}	µg/L	0.480 B	<5.00	<5.00	<5.00 [<5.00]	<5.00 [<5.00]	<5.00	NA
Silver	180 {nc}	µg/L	<10.0	5.20 B	8.30 B	<10.0 [<10.0]	<10.0 [<10.0]	<10.0	NA
Sodium	- -	µg/L	950	908	895	1,000 [1,010]	36,000 [36,800]	36,200	NA
Thallium	2.4 {nc}	µg/L	<2.00	<2.00	<2.00	<2.00 [<2.00]	<2.00 [<2.00]	<2.00	NA
Vanadium	260 {nc}	µg/L	<50.0	<50.0	<50.0	<50.0 [<50.0]	<50.0 [<50.0]	<50.0	NA
Zinc	11,000 {nc}	µg/L	<20.0	<20.0	<20.0	<20.0 [<20.0]	<20.0 [7.60 J]	<20.0	NA
Perchlorate									
Perchlorate	26 {nc}	µg/L	<1	<1	<1	<1 [<1]	<1 [<1]	<1	<1
Miscellaneous									
Hardness	- -	µg/L	257,000	193,000	159,000	147,000 [148,000]	214,000 [214,000]	218,000	177,000

µg/L	Micrograms per liter.
[a]	USEPA Regional Screening Levels (USEPA 2008a). Adjusted tap-water screening levels used to assess surface water at the NRU.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
{max}	Concentration may exceed ceiling limit.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted tap water RSL.

Table 8-9
Surface Soil Risk Assessment Dataset
Surface Soil (0-1 foot Depth Interval)
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Volatile Organic Compounds												
2-Butanone	78-93-3	1	-	16	6	0.016	-	0.016	0.0053	-	0.0067	RYSS06
3-Octanone	106-68-3	3	-	3	100	0.009	-	0.15	–	-	–	RYSS06
Acetone	67-64-1	4	-	16	25	0.017	-	0.31	0.0053	-	0.0067	RYSS06
Ethanol	64-17-5	2	-	2	100	0.0062	-	0.087	–	-	–	RYSS06
Methylene Chloride	75-09-2	5	-	21	24	0.00061	-	3	0.0056	-	0.0067	SS-08a
Semi-Volatile Organic Compounds												
2,4-Dinitrotoluene	121-14-2	2	-	24	8	0.06	-	0.4	0.2	-	0.3	SS-08
2,6-Dinitrotoluene	606-20-2	1	-	24	4	0.32	-	0.32	0.2	-	0.3	SS-08
Benzoic Acid	65-85-0	2	-	21	10	0.15	-	0.17	0.99	-	2.6	RYSS14
bis(2-Ethylhexyl)phthalate	117-81-7	8	-	26	31	0.038	-	1.8	0.2	-	0.52	SS-07
Carbazole	86-74-8	2	-	24	8	0.1	-	0.12	0.2	-	0.52	RYSS07
Dibenzofuran	132-64-9	1	-	21	5	0.045	-	0.045	0.2	-	0.52	RYSS07
Diethylphthalate	84-66-2	1	-	21	5	0.09	-	0.09	0.2	-	0.52	RYSB7
Di-n-Butylphthalate	84-74-2	4	-	23	17	0.06	-	1.1	0.2	-	0.52	SS-08
Pentachlorophenol	87-86-5	2	-	24	8	0.11	-	830	0.97	-	2.6	TR-02C
Explosives												
4-Amino-2,6-Dinitrotoluene	19406-51-0	1	-	22	5	0.05	-	0.05	0.2	-	0.3	RYSS04
Pesticides												
4,4'-DDE	72-55-9	2	-	10	20	0.01	-	0.04	0.00083	-	0.00882	TR-02A
Alpha-BHC	319-84-6	4	-	6	67	0.00052	-	0.00077	0.0079	-	0.00882	RYSS10
Beta-BHC	319-85-7	2	-	6	33	0.00017	-	0.00025	0.00083	-	0.00882	RYSS10
Alpha-Chlordane	5103-71-9	2	-	10	20	0.02	-	0.03	0.00083	-	0.00882	SS-08
Dieldrin	60-57-1	1	-	9	11	0.27	-	0.27	0.00083	-	0.00882	TR-02C
Endrin Aldehyde	7421-93-4	1	-	8	12	0.04	-	0.04	0.00083	-	0.00882	SS-08
Polycyclic Aromatic Hydrocarbons												
2-Methylnaphthalene	91-57-6	12	-	23	52	0.00088	-	0.04	0.0021	-	0.52	SS-08
Acenaphthene	83-32-9	3	-	21	14	0.0011	-	0.0065	0.002	-	0.52	RYSS07
Acenaphthylene	208-96-8	4	-	24	17	0.00097	-	0.07	0.002	-	0.52	TR-02A
Anthracene	120-12-7	8	-	24	33	0.0015	-	0.1	0.002	-	0.52	TR-02A
Benzo(a)anthracene	56-55-3	15	-	26	58	0.0011	-	0.4	0.0022	-	0.52	TR-02A
Benzo(a)pyrene	50-32-8	15	-	26	58	0.0011	-	0.4	0.0022	-	0.52	TR-02A
Benzo(b)fluoranthene	205-99-2	15	-	26	58	0.002	-	1	0.0022	-	0.52	TR-02A
Benzo(g,h,i)perylene	191-24-2	13	-	21	62	0.0016	-	0.037	0.0022	-	0.52	RYSS05
Benzo(k)fluoranthene	207-08-9	14	-	26	54	0.00083	-	0.56	0.0022	-	0.52	TR-02A
Chrysene	218-01-9	15	-	26	58	0.0013	-	0.66	0.0022	-	0.52	TR-02A
Dibenzo(a,h)anthracene	53-70-3	7	-	24	29	0.0016	-	0.05	0.002	-	0.52	TR-02A
Fluoranthene	206-44-0	15	-	26	58	0.0015	-	0.39	0.0022	-	0.52	TR-02A
Fluorene	86-73-7	3	-	21	14	0.0011	-	0.0067	0.002	-	0.52	RYSS07
Indeno(1,2,3-cd)pyrene	193-39-5	14	-	24	58	0.0014	-	0.11	0.0022	-	0.52	TR-02A
Naphthalene	91-20-3	12	-	21	57	0.00097	-	0.0069	0.0021	-	0.52	RYSS04

Table 8-9
Surface Soil Risk Assessment Dataset
Surface Soil (0-1 foot Depth Interval)
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)		Detects Max (mg/kg)	Detection Limits Min (mg/kg)		Detection Limits Max (mg/kg)	Maximum Location
Phenanthrene	85-01-8	15	-	26	58	0.0013	-	0.1	0.0022	-	0.52	SS-08
Pyrene	129-00-0	15	-	26	58	0.001	-	0.86	0.0022	-	0.52	TR-02A
Polychlorinated Biphenyls												
Aroclor 1254	11097-69-1	7	-	26	27	0.02	-	1.7	0.03	-	0.04	SS-08
Inorganics												
Aluminum	7429-90-5	25	-	25	100	338	-	43600	–	-	–	RYSS15
Antimony	7440-36-0	11	-	22	50	0.21	-	0.58	0.51	-	0.78	RYSS12
Arsenic	7440-38-2	25	-	25	100	1.39	-	20.8	–	-	–	SS-08
Barium	7440-39-3	25	-	25	100	11.1	-	1770	–	-	–	SS-07
Beryllium	7440-41-7	23	-	25	92	0.21	-	2.46	0.1	-	0.1	RYSS10
Cadmium	7440-43-9	6	-	25	24	0.06	-	1.8	0.1	-	0.16	SS-08
Calcium	7440-70-2	25	-	25	100	611	-	196000	–	-	–	SS-07
Chromium	7440-47-3	24	-	25	96	3.1	-	59	–	-	–	RYSS04
Cobalt	7440-48-4	24	-	25	96	1.3	-	74.9	–	-	–	RYSB4
Copper	7440-50-8	24	-	25	96	2.3	-	60.2	–	-	–	SS-08
Iron	7439-89-6	25	-	25	100	2600	-	50100	–	-	–	RYSS04
Lead	7439-92-1	25	-	25	100	1.8	-	149	–	-	–	SS-08
Magnesium	7439-95-4	25	-	25	100	606	-	104000	–	-	–	SS-07
Manganese	7439-96-5	25	-	25	100	92.7	-	791	–	-	–	RYSS14
Mercury	7439-97-6	19	-	23	83	0.02	-	0.41	0.11	-	0.14	RYSB7
Nickel	7440-02-0	24	-	25	96	1.6	-	42.2	–	-	–	RYSS01
Potassium	7440-09-7	24	-	25	96	162	-	4570	–	-	–	RYSS02
Selenium	7782-49-2	3	-	22	14	0.43	-	1	0.58	-	1.35	RYSB1
Sodium	7440-23-5	22	-	22	100	5.1	-	331	–	-	–	RYSB1
Thallium	7440-28-0	20	-	25	80	0.09	-	0.89	0.21	-	0.31	RYSB7
Vanadium	7440-62-2	25	-	25	100	5	-	91.5	–	-	–	SS-08a
Zinc	7440-66-6	25	-	25	100	7.1	-	752	–	-	–	SS-08

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilogram.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table 8-10
Surface Soil Risk Assessment Dataset
Surface Soil (0-2 foot Depth Interval)
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Volatile Organic Compounds												
2-Butanone	78-93-3	1	-	16	6	0.016	-	0.016	0.0053	-	0.0067	RYSS06
3-Octanone	106-68-3	3	-	3	100	0.009	-	0.15	–	-	–	RYSS06
Acetone	67-64-1	4	-	16	25	0.017	-	0.31	0.0053	-	0.0067	RYSS06
Ethanol	64-17-5	2	-	2	100	0.0062	-	0.087	–	-	–	RYSS06
Methylene Chloride	75-09-2	5	-	21	24	0.00061	-	3	0.0056	-	0.0067	SS-08a
Semi-Volatile Organic Compounds												
2,4-Dinitrotoluene	121-14-2	2	-	25	8	0.06	-	0.4	0.2	-	0.3	SS-08
2,6-Dinitrotoluene	606-20-2	1	-	25	4	0.32	-	0.32	0.2	-	0.3	SS-08
Benzoic Acid	65-85-0	2	-	22	9	0.15	-	0.17	0.99	-	2.6	RYSS14
bis(2-Ethylhexyl)phthalate	117-81-7	8	-	27	30	0.038	-	1.8	0.2	-	0.52	SS-07
Carbazole	86-74-8	2	-	25	8	0.1	-	0.12	0.2	-	0.52	RYSS07
Dibenzofuran	132-64-9	1	-	22	5	0.045	-	0.045	0.2	-	0.52	RYSS07
Diethylphthalate	84-66-2	1	-	22	5	0.09	-	0.09	0.2	-	0.52	RYSB7
Di-n-Butylphthalate	84-74-2	5	-	24	21	0.06	-	1.1	0.2	-	0.52	SS-08
Pentachlorophenol	87-86-5	2	-	25	8	0.11	-	830	0.97	-	2.6	TR-02C
Explosives												
4-Amino-2,6-Dinitrotoluene	19406-51-0	1	-	23	4	0.05	-	0.05	0.2	-	0.3	RYSS04
Pesticides												
4,4'-DDE	72-55-9	2	-	10	20	0.01	-	0.04	0.00083	-	0.00882	TR-02A
Alpha-BHC	319-84-6	4	-	6	67	0.00052	-	0.00077	0.0079	-	0.00882	RYSS10
Beta-BHC	319-85-7	2	-	6	33	0.00017	-	0.00025	0.00083	-	0.00882	RYSS10
Alpha-Chlordane	5103-71-9	2	-	10	20	0.02	-	0.03	0.00083	-	0.00882	SS-08
Dieldrin	60-57-1	1	-	9	11	0.27	-	0.27	0.00083	-	0.00882	TR-02C
Endrin Aldehyde	7421-93-4	1	-	8	12	0.04	-	0.04	0.00083	-	0.00882	SS-08
Polycyclic Aromatic Hydrocarbons												
2-Methylnaphthalene	91-57-6	12	-	24	50	0.00088	-	0.04	0.0021	-	0.52	SS-08
Acenaphthene	83-32-9	3	-	22	14	0.0011	-	0.0065	0.002	-	0.52	RYSS07
Acenaphthylene	208-96-8	4	-	25	16	0.00097	-	0.07	0.002	-	0.52	TR-02A
Anthracene	120-12-7	8	-	25	32	0.0015	-	0.1	0.002	-	0.52	TR-02A
Benzo(a)anthracene	56-55-3	15	-	27	56	0.0011	-	0.4	0.0022	-	0.52	TR-02A
Benzo(a)pyrene	50-32-8	15	-	27	56	0.0011	-	0.4	0.0022	-	0.52	TR-02A
Benzo(b)fluoranthene	205-99-2	15	-	27	56	0.002	-	1	0.0022	-	0.52	TR-02A
Benzo(g,h,i)perylene	191-24-2	13	-	22	59	0.0016	-	0.037	0.0022	-	0.52	RYSS05
Benzo(k)fluoranthene	207-08-9	14	-	27	52	0.00083	-	0.56	0.0022	-	0.52	TR-02A
Chrysene	218-01-9	15	-	27	56	0.0013	-	0.66	0.0022	-	0.52	TR-02A
Dibenzo(a,h)anthracene	53-70-3	7	-	25	28	0.0016	-	0.05	0.002	-	0.52	TR-02A
Fluoranthene	206-44-0	15	-	27	56	0.0015	-	0.39	0.0022	-	0.52	TR-02A
Fluorene	86-73-7	3	-	22	14	0.0011	-	0.0067	0.002	-	0.52	RYSS07
Indeno(1,2,3-cd)pyrene	193-39-5	14	-	25	56	0.0014	-	0.11	0.0022	-	0.52	TR-02A
Naphthalene	91-20-3	12	-	22	55	0.00097	-	0.0069	0.0021	-	0.52	RYSS04

Table 8-10
Surface Soil Risk Assessment Dataset
Surface Soil (0-2 foot Depth Interval)
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)		Detects Max (mg/kg)	Detection Limits Min (mg/kg)		Detection Limits Max (mg/kg)	Maximum Location
Phenanthrene	85-01-8	15	-	27	56	0.0013	-	0.1	0.0022	-	0.52	SS-08
Pyrene	129-00-0	15	-	27	56	0.001	-	0.86	0.0022	-	0.52	TR-02A
Polychlorinated Biphenyls												
Aroclor 1254	11097-69-1	7	-	26	27	0.02	-	1.7	0.03	-	0.04	SS-08
Inorganics												
Aluminum	7429-90-5	26	-	26	100	338	-	43600	–	-	–	RYSS15
Antimony	7440-36-0	11	-	23	48	0.21	-	0.58	0.51	-	0.78	RYSS12
Arsenic	7440-38-2	26	-	26	100	1.39	-	20.8	–	-	–	SS-08
Barium	7440-39-3	26	-	26	100	11.1	-	1770	–	-	–	SS-07
Beryllium	7440-41-7	24	-	26	92	0.13	-	2.46	0.1	-	0.1	RYSS10
Cadmium	7440-43-9	6	-	26	23	0.06	-	1.8	0.1	-	0.16	SS-08
Calcium	7440-70-2	26	-	26	100	611	-	196000	–	-	–	SS-07
Chromium	7440-47-3	25	-	26	96	3.1	-	59	–	-	–	RYSS04
Cobalt	7440-48-4	25	-	26	96	1.3	-	74.9	–	-	–	RYSB4
Copper	7440-50-8	25	-	26	96	2.3	-	60.2	–	-	–	SS-08
Iron	7439-89-6	26	-	26	100	2600	-	50100	–	-	–	RYSS04
Lead	7439-92-1	26	-	26	100	1.8	-	149	–	-	–	SS-08
Magnesium	7439-95-4	26	-	26	100	266	-	104000	–	-	–	SS-07
Manganese	7439-96-5	26	-	26	100	36.6	-	791	–	-	–	RYSS14
Mercury	7439-97-6	19	-	24	79	0.02	-	0.41	0.11	-	0.14	RYSB7
Nickel	7440-02-0	25	-	26	96	1.6	-	42.2	–	-	–	RYSS01
Potassium	7440-09-7	25	-	26	96	162	-	4570	–	-	–	RYSS02
Selenium	7782-49-2	3	-	23	13	0.43	-	1	0.58	-	1.35	RYSB1
Sodium	7440-23-5	23	-	23	100	5.1	-	331	–	-	–	RYSB1
Thallium	7440-28-0	20	-	26	77	0.09	-	0.89	0.21	-	0.31	RYSB7
Vanadium	7440-62-2	26	-	26	100	5	-	91.5	–	-	–	SS-08a
Zinc	7440-66-6	26	-	26	100	6.1	-	752	–	-	–	SS-08

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilogram.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table 8-11
Soil Risk Assessment Dataset
Combined Surface and Subsurface Soil
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b]			FOD	Detects			Detection Limits			Maximum Location
		number of detects / number of samples			%	Min	-	Max	Min	-	Max	
						(mg/kg)		(mg/kg)	(mg/kg)		(mg/kg)	
Volatile Organic Compounds												
2-Butanone	78-93-3	1	-	19	5	0.016	-	0.016	0.0053	-	0.0086	RYSS06
3-Octanone	106-68-3	3	-	3	100	0.009	-	0.15	–	-	–	RYSS06
Acetone	67-64-1	4	-	19	21	0.017	-	0.31	0.0053	-	0.0086	RYSS06
Ethanol	64-17-5	2	-	2	100	0.0062	-	0.087	–	-	–	RYSS06
Methylene Chloride	75-09-2	5	-	24	21	0.00061	-	3	0.0056	-	0.0086	SS-08a
Semi-Volatile Organic Compounds												
2,4-Dinitrotoluene	121-14-2	2	-	34	6	0.06	-	0.4	0.2	-	0.3	SS-08
2,6-Dinitrotoluene	606-20-2	1	-	34	3	0.32	-	0.32	0.2	-	0.3	SS-08
Benzoic Acid	65-85-0	2	-	31	6	0.15	-	0.17	0.99	-	2.6	RYSS14
bis(2-Ethylhexyl)phthalate	117-81-7	9	-	36	25	0.038	-	1.8	0.2	-	0.52	SS-07
Carbazole	86-74-8	2	-	34	6	0.1	-	0.12	0.2	-	0.52	RYSS07
Dibenzofuran	132-64-9	1	-	31	3	0.045	-	0.045	0.2	-	0.52	RYSS07
Diethylphthalate	84-66-2	3	-	31	10	0.09	-	1.1	0.2	-	0.52	RYSB6
Di-n-Butylphthalate	84-74-2	6	-	33	18	0.06	-	1.1	0.2	-	0.52	SS-08
Pentachlorophenol	87-86-5	2	-	34	6	0.11	-	830	0.97	-	2.6	TR-02C
Explosives												
4-Amino-2,6-Dinitrotoluene	19406-51-0	2	-	32	6	0.04	-	0.05	0.2	-	0.3	RYSS04
Pesticides												
4,4'-DDE	72-55-9	2	-	10	20	0.01	-	0.04	0.00083	-	0.00882	TR-02A
Alpha-BHC	319-84-6	4	-	6	67	0.00052	-	0.00077	0.0079	-	0.00882	RYSS10
Beta-BHC	319-85-7	2	-	6	33	0.00017	-	0.00025	0.00083	-	0.00882	RYSS10
Alpha-Chlordane	5103-71-9	2	-	10	20	0.02	-	0.03	0.00083	-	0.00882	SS-08
Dieldrin	60-57-1	1	-	9	11	0.27	-	0.27	0.00083	-	0.00882	TR-02C
Endrin Aldehyde	7421-93-4	1	-	8	12	0.04	-	0.04	0.00083	-	0.00882	SS-08
Polycyclic Aromatic Hydrocarbons												
2-Methylnaphthalene	91-57-6	13	-	33	39	0.00088	-	0.04	0.0021	-	0.52	SS-08
Acenaphthene	83-32-9	3	-	31	10	0.0011	-	0.0065	0.002	-	0.52	RYSS07
Acenaphthylene	208-96-8	4	-	34	12	0.00097	-	0.07	0.002	-	0.52	TR-02A
Anthracene	120-12-7	8	-	34	24	0.0015	-	0.1	0.002	-	0.52	TR-02A
Benzo(a)anthracene	56-55-3	15	-	36	42	0.0011	-	0.4	0.0022	-	0.52	TR-02A
Benzo(a)pyrene	50-32-8	15	-	36	42	0.0011	-	0.4	0.0022	-	0.52	TR-02A
Benzo(b)fluoranthene	205-99-2	15	-	36	42	0.002	-	1	0.0022	-	0.52	TR-02A
Benzo(g,h,i)perylene	191-24-2	13	-	31	42	0.0016	-	0.037	0.0022	-	0.52	RYSS05
Benzo(k)fluoranthene	207-08-9	14	-	36	39	0.00083	-	0.56	0.0022	-	0.52	TR-02A
Chrysene	218-01-9	15	-	36	42	0.0013	-	0.66	0.0022	-	0.52	TR-02A
Dibenzo(a,h)anthracene	53-70-3	7	-	34	21	0.0016	-	0.05	0.002	-	0.52	TR-02A
Fluoranthene	206-44-0	15	-	36	42	0.0015	-	0.39	0.0022	-	0.52	TR-02A
Fluorene	86-73-7	3	-	31	10	0.0011	-	0.0067	0.002	-	0.52	RYSS07
Indeno(1,2,3-cd)pyrene	193-39-5	14	-	34	41	0.0014	-	0.11	0.0022	-	0.52	TR-02A
Naphthalene	91-20-3	13	-	31	42	0.00097	-	0.0069	0.0021	-	0.52	RYSS04

Table 8-11
Soil Risk Assessment Dataset
Combined Surface and Subsurface Soil
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b]				Detects			Detection Limits			Maximum Location
		number of detects / number of samples			FOD %	Min (mg/kg)	-	Max (mg/kg)	Min (mg/kg)	-	Max (mg/kg)	
Phenanthrene	85-01-8	15	-	36	42	0.0013	-	0.1	0.0022	-	0.52	SS-08
Pyrene	129-00-0	15	-	36	42	0.001	-	0.86	0.0022	-	0.52	TR-02A
Polychlorinated Biphenyls												
Aroclor 1254	11097-69-1	7	-	29	24	0.02	-	1.7	0.03	-	0.05	SS-08
Inorganics												
Aluminum	7429-90-5	35	-	35	100	338	-	43600	–	-	–	RYSS15
Antimony	7440-36-0	12	-	32	38	0.21	-	0.58	0.51	-	0.78	RYSS12
Arsenic	7440-38-2	35	-	35	100	1.39	-	20.8	–	-	–	SS-08
Barium	7440-39-3	35	-	35	100	11.1	-	1770	–	-	–	SS-07
Beryllium	7440-41-7	33	-	35	94	0.13	-	4.3	0.1	-	0.1	RYSB1
Cadmium	7440-43-9	6	-	35	17	0.06	-	1.8	0.1	-	0.16	SS-08
Calcium	7440-70-2	35	-	35	100	60	-	196000	–	-	–	SS-07
Chromium	7440-47-3	34	-	35	97	3.1	-	59	–	-	–	RYSS04
Cobalt	7440-48-4	34	-	35	97	1.3	-	74.9	–	-	–	RYSB4
Copper	7440-50-8	34	-	35	97	2.3	-	60.2	–	-	–	SS-08
Iron	7439-89-6	35	-	35	100	2600	-	50100	–	-	–	RYSS04
Lead	7439-92-1	35	-	35	100	1.8	-	149	–	-	–	SS-08
Magnesium	7439-95-4	35	-	35	100	190	-	104000	–	-	–	SS-07
Manganese	7439-96-5	35	-	35	100	36.6	-	791	–	-	–	RYSS14
Mercury	7439-97-6	23	-	33	70	0.02	-	0.46	0.07	-	0.14	RYSB1
Nickel	7440-02-0	34	-	35	97	1.6	-	42.2	–	-	–	RYSS01
Potassium	7440-09-7	34	-	35	97	162	-	4570	–	-	–	RYSS02
Selenium	7782-49-2	3	-	32	9	0.43	-	1	0.58	-	1.57	RYSB1
Sodium	7440-23-5	32	-	32	100	5.1	-	331	–	-	–	RYSB1
Thallium	7440-28-0	24	-	35	69	0.09	-	0.89	0.21	-	0.31	RYSB7
Vanadium	7440-62-2	35	-	35	100	5	-	91.5	–	-	–	SS-08a
Zinc	7440-66-6	35	-	35	100	6.1	-	752	–	-	–	SS-08

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilogram.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table 8-12
Sediment Risk Assessment Dataset
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Volatile Organic Compounds												
2-Butanone	78-93-3	2	-	14	14	0.01	-	0.1	0.0054	-	0.012	RYSD04
Acetone	67-64-1	5	-	14	36	0.003	-	0.53	0.0054	-	0.009	RYSD04
Carbon Disulfide	75-15-0	3	-	11	27	0.00062	-	0.0022	0.0054	-	0.009	RYSD04
Methylene Chloride	75-09-2	3	-	14	21	0.001	-	0.003	0.0054	-	0.016	SD-03,SD-05
Semi-Volatile Organic Compounds										-		
4-Methylphenol	106-44-5	1	-	11	9	0.036	-	0.036	0.18	-	0.52	RYSD05
Benzoic Acid	65-85-0	1	-	11	9	0.28	-	0.28	0.9	-	2.6	RYSD03
bis(2-Ethylhexyl)phthalate	117-81-7	10	-	14	71	0.047	-	0.33	0.3	-	0.52	RYSD09
Di-n-Butylphthalate	84-74-2	1	-	11	9	0.069	-	0.069	0.18	-	0.52	RYSD10
Explosives										-		
Nitroglycerine	55-63-0	2	-	11	18	0.26	-	0.57	0.32	-	0.93	RYSD03
Pentaerythritol Tetranitrate	78-11-5	2	-	11	18	0.13	-	0.23	0.36	-	0.93	RYSD09
Herbicides										-		
2,4,5-T	93-76-5	3	-	11	27	0.00567	-	0.0334	0.012	-	1.08	RYSD04
2,4,5-TP	93-72-1	2	-	11	18	0.00976	-	0.104	0.0118	-	1.08	RYSD04
2,4-D	94-75-7	1	-	11	9	0.209	-	0.209	0.024	-	2.17	RYSD08
Dalapon	75-99-0	1	-	11	9	0.107	-	0.107	0.118	-	10.8	RYSD07
Dicamba	1918-00-9	1	-	11	9	0.0497	-	0.0497	0.0235	-	2.17	RYSD04
Dichlorprop	120-36-5	1	-	11	9	0.353	-	0.353	0.0235	-	2.17	RYSD04
MCPP	93-65-2	1	-	11	9	3.53	-	3.53	12	-	1080	RYSD08
Pesticides										-		
4,4'-DDD	72-54-8	4	-	11	36	0.00068	-	0.00209	0.00072	-	0.00819	RYSD12
4,4'-DDE	72-55-9	7	-	11	64	0.00031	-	0.0084	0.00116	-	0.00819	RYSD12
4,4'-DDT	50-29-3	6	-	11	55	0.00055	-	0.004	0.00078	-	0.00819	RYSD10
Alpha-BHC	319-84-6	2	-	11	18	0.00052	-	0.00059	0.00072	-	0.00819	RYSD03
Delta-BHC	319-86-8	2	-	11	18	0.00099	-	0.0012	0.00078	-	0.00819	RYSD10
Gamma-BHC (Lindane)	58-89-9	1	-	11	9	0.00097	-	0.00097	0.00072	-	0.00819	RYSD06
Alpha-Chlordane	5103-71-9	4	-	11	36	0.00087	-	0.0101	0.00078	-	0.00819	RYSD09
Gamma-Chlordane	5566-34-7	4	-	11	36	0.00081	-	0.013	0.00078	-	0.00819	RYSD10
Dieldrin	60-57-1	4	-	11	36	0.00174	-	0.0041	0.00078	-	0.00819	RYSD10
Endosulfan II	33213-65-9	3	-	11	27	0.00025	-	0.00072	0.00078	-	0.00819	RYSD06
Endrin	72-20-8	1	-	11	9	0.0125	-	0.0125	0.00072	-	0.00819	RYSD10
Endrin Aldehyde	7421-93-4	1	-	14	7	0.04	-	0.04	0.00072	-	0.00819	SD-04
Endrin Ketone	53494-70-5	1	-	11	9	0.00203	-	0.00203	0.00072	-	0.00819	RYSD10
Heptachlor	76-44-8	2	-	11	18	0.00084	-	0.00213	0.00078	-	0.00819	RYSD10
Heptachlor Epoxide	1024-57-3	2	-	11	18	0.00399	-	0.00726	0.00078	-	0.00819	RYSD09

Table 8-12
Sediment Risk Assessment Dataset
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Max (mg/kg)	Detection Limits Min (mg/kg)	-	Max (mg/kg)	Maximum Location
Methoxychlor	72-43-5	1	-	11	9	0.0026	-	0.0026	0.00072	-	0.00819	RYSD03
Polycyclic Aromatic Hydrocarbons										-		
2-Methylnaphthalene	91-57-6	6	-	11	55	0.0014	-	0.04	0.2	-	0.3	RYSD04
Acenaphthene	83-32-9	3	-	11	27	0.0019	-	0.059	0.003	-	0.3	RYSD06
Acenaphthylene	208-96-8	4	-	11	36	0.0026	-	0.026	0.003	-	0.3	RYSD01,RYSD04
Anthracene	120-12-7	5	-	11	45	0.0034	-	0.081	0.003	-	0.3	RYSD06
Benzo(a)anthracene	56-55-3	9	-	11	82	0.0038	-	0.19	0.003	-	0.2	RYSD06
Benzo(a)pyrene	50-32-8	7	-	11	64	0.0058	-	0.17	0.003	-	0.3	RYSD06
Benzo(b)fluoranthene	205-99-2	7	-	11	64	0.011	-	0.25	0.003	-	0.3	RYSD06
Benzo(g,h,i)perylene	191-24-2	5	-	11	45	0.0038	-	0.1	0.003	-	0.3	RYSD06
Benzo(k)fluoranthene	207-08-9	7	-	11	64	0.0029	-	0.08	0.003	-	0.3	RYSD06
Chrysene	218-01-9	9	-	11	82	0.0053	-	0.17	0.003	-	0.2	RYSD06
Dibenzo(a,h)anthracene	53-70-3	3	-	11	27	0.0036	-	0.026	0.003	-	0.3	RYSD06
Fluoranthene	206-44-0	10	-	14	71	0.0079	-	0.44	0.003	-	0.2	RYSD06
Fluorene	86-73-7	4	-	11	36	0.0019	-	0.046	0.003	-	0.3	RYSD06
Indeno(1,2,3-cd)pyrene	193-39-5	5	-	11	45	0.004	-	0.12	0.003	-	0.3	RYSD06
Naphthalene	91-20-3	4	-	11	36	0.0049	-	0.043	0.003	-	0.3	RYSD04
Phenanthrene	85-01-8	8	-	11	73	0.0065	-	0.36	0.003	-	0.2	RYSD06
Pyrene	129-00-0	9	-	11	82	0.011	-	0.3	0.003	-	0.2	RYSD06
Inorganics										-		
Aluminum	7429-90-5	14	-	14	100	6660	-	27000	–	-	–	SD-05
Antimony	7440-36-0	8	-	11	73	0.34	-	1	0.79	-	0.89	RYSD03
Arsenic	7440-38-2	14	-	14	100	2.2	-	11.8	–	-	–	RYSD08,RYSD10
Barium	7440-39-3	14	-	14	100	30.4	-	113	–	-	–	SD-04
Beryllium	7440-41-7	14	-	14	100	0.42	-	1.67	–	-	–	RYSD08
Cadmium	7440-43-9	8	-	11	73	0.08	-	0.21	0.11	-	0.31	RYSD01
Calcium	7440-70-2	14	-	14	100	1850	-	176000	–	-	–	SD-03
Chromium	7440-47-3	14	-	14	100	13.6	-	80.9	–	-	–	RYSD03
Cobalt	7440-48-4	14	-	14	100	5.1	-	15	–	-	–	RYSD08
Copper	7440-50-8	14	-	14	100	4.95	-	47.6	–	-	–	SD-03
Iron	7439-89-6	14	-	14	100	8760	-	79600	–	-	–	RYSD08
Lead	7439-92-1	14	-	14	100	10.9	-	33	–	-	–	RYSD08
Magnesium	7439-95-4	14	-	14	100	1560	-	42500	–	-	–	RYSD09
Manganese	7439-96-5	14	-	14	100	90.9	-	1220	–	-	–	SD-04
Mercury	7439-97-6	9	-	11	82	0.03	-	0.08	0.07	-	0.15	RYSD07,RYSD08
Nickel	7440-02-0	14	-	14	100	6	-	24.5	–	-	–	RYSD08
Potassium	7440-09-7	14	-	14	100	400	-	2620	–	-	–	RYSD05

Table 8-12
Sediment Risk Assessment Dataset
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Selenium	7782-49-2	5	-	14	36	0.42	-	1.7	1.08	-	2.32	SD-05
Sodium	7440-23-5	12	-	14	86	13	-	110	–	-	–	SD-04
Thallium	7440-28-0	11	-	11	100	0.07	-	0.45	–	-	–	RYSD03
Vanadium	7440-62-2	14	-	14	100	16.6	-	110	–	-	–	RYSD08
Zinc	7440-66-6	14	-	14	100	16.2	-	110	–	-	–	RYSD07

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilogram.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table 8-13
Surface Water Risk Assessment Dataset
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects /	number of samples		FOD %	Detects Min (mg/L)	-	Max (mg/L)	Detection Limits Min (mg/L)	-	Max (mg/L)	Maximum Location
Volatile Organic Compounds												
Carbon Disulfide	75-15-0	2	-	4	50	0.00015	-	0.0003	0.001	-	0.001	RYSW05
Chloroform	67-66-3	2	-	4	50	0.00036	-	0.00037	0.001	-	0.001	RYSW12
Semi-Volatile Organic Compounds												
Benzoic Acid	65-85-0	5	-	6	83	0.0045	-	0.0061	0.025	-	0.025	RYSW12
bis(2-Ethylhexyl)phthalate	117-81-7	4	-	6	67	0.002	-	0.008	0.005	-	0.005	RYSW12
Butylbenzylphthalate	85-68-7	3	-	6	50	0.00032	-	0.0011	0.005	-	0.005	RYSW12
Diethylphthalate	84-66-2	1	-	6	17	0.00037	-	0.00037	0.005	-	0.005	RYSW12
Di-n-Butylphthalate	84-74-2	3	-	6	50	0.00086	-	0.001	0.005	-	0.005	RYSW05
Explosives												
m-Nitrotoluene	99-08-1	3	-	6	50	0.00038	-	0.00125	0.00052	-	0.00052	RYSW04
Nitrobenzene	98-95-3	3	-	6	50	0.00013	-	0.0002	0.00026	-	0.00026	RYSW04
Nitroglycerine	55-63-0	1	-	6	17	0.00061	-	0.00061	0.00097	-	0.00097	RYSW03
Herbicides												
2,4,5-TP	93-72-1	1	-	6	17	0.00005	-	0.00005	0.0001	-	0.0001	RYSW03
2,4-D	94-75-7	2	-	6	33	0.00409	-	0.00466	0.0005	-	0.0005	RYSW12
2,4-DB	94-82-6	1	-	6	17	0.00041	-	0.00041	0.002	-	0.002	RYSW12
MCPA	94-74-6	1	-	6	17	0.11	-	0.11	0.125	-	0.125	RYSW12
MCPP	93-65-2	1	-	6	17	0.0463	-	0.0463	0.125	-	0.125	RYSW12
Pesticides												
4,4'-DDT	50-29-3	1	-	6	17	0.00001	-	0.00001	0.00002	-	0.00002	RYSW13
Delta-BHC	319-86-8	1	-	6	17	0.00001	-	0.00001	0.00002	-	0.00002	RYSW03
Dieldrin	60-57-1	2	-	6	33	0.0000063	-	7.19E-06	0.00002	-	0.00002	RYSW12
Endosulfan Sulfate	1031-07-8	1	-	6	17	0.00002	-	0.00003	0.00002	-	0.00002	RYSW05
Endrin Aldehyde	7421-93-4	1	-	6	17	0.00001	-	0.00001	0.00002	-	0.00002	RYSW05
Endrin Ketone	53494-70-5	1	-	6	17	8.28E-06	-	8.28E-06	0.00002	-	0.00002	RYSW12
Polycyclic Aromatic Hydrocarbons												
2-Methylnaphthalene	91-57-6	1	-	6	17	0.00002	-	0.00003	0.00005	-	0.005	RYSW05
Naphthalene	91-20-3	4	-	6	67	0.00002	-	0.00003	0.005	-	0.005	RYSW03,RYSW04
Phenanthrene	85-01-8	1	-	6	17	0.00002	-	0.00002	0.00005	-	0.005	RYSW05
Inorganics												
Aluminum	7429-90-5	6	-	7	86	0.11	-	0.608	0.2	-	0.2	RYSW04
Antimony	7440-36-0	3	-	6	50	0.00036	-	0.00058	0.005	-	0.005	RYSW04
Barium	7440-39-3	6	-	6	100	0.015	-	0.0796	–	-	–	RYSW12
Cadmium	7440-43-9	2	-	6	33	0.00006	-	0.00011	0.002	-	0.002	RYSW03
Calcium	7440-70-2	7	-	7	100	15.3	-	59.5	–	-	–	RYSW02
Chromium	7440-47-3	1	-	6	17	0.0055	-	0.0055	0.01	-	0.01	RYSW04
Copper	7440-50-8	1	-	7	14	0.038	-	0.038	0.02	-	0.02	WW-04

Table 8-13
Surface Water Risk Assessment Dataset
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/L)	-	Max (mg/L)	Detection Limits Min (mg/L)	-	Max (mg/L)	Maximum Location
Iron	7439-89-6	6	-	7	86	0.127	-	4.47	0.05	-	0.05	WW-04
Lead	7439-92-1	5	-	7	71	0.00088	-	0.031	0.002	-	0.002	WW-04
Magnesium	7439-95-4	7	-	7	100	6.53	-	26.6	–	-	–	RYSW05
Manganese	7439-96-5	7	-	7	100	0.0017	-	0.102	–	-	–	WW-04
Potassium	7440-09-7	7	-	7	100	1.7	-	3.75	–	-	–	RYSW12
Selenium	7782-49-2	1	-	6	17	0.00048	-	0.00048	0.005	-	0.005	RYSW02
Silver	7440-22-4	2	-	6	33	0.0052	-	0.0083	0.01	-	0.01	RYSW04
Sodium	7440-23-5	7	-	7	100	0.895	-	36.8	–	-	–	RYSW12
Zinc	7440-66-6	2	-	7	29	0.0076	-	0.274	0.02	-	0.02	WW-04

Notes:
– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/L = Milligrams per liter.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table 8-14
Selection of Constituents of Potential Concern for Surface Soil (0-2 foot Depth Interval)
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a] (mg/kg)	Adjusted Soil Regional Screening Level (RSL) [b]: Industrial Scenario (mg/kg)		Residential Scenario (mg/kg)		Surrogate	Background Level [c] (mg/kg)	Does Maximum Exceed RSL?: Industrial (YES, no)	Residential (YES, no)	Is Constituent a Surface Soil COPC? [d] (YES, no)
Volatile Organic Compounds											
2-Butanone	78-93-3	1.60E-02	1.90E+04	nms	2.80E+03	ns		–	no	no	no
3-Octanone	106-68-3	1.50E-01	NA		NA			–	NA	NA	**YES**
Acetone	67-64-1	3.10E-01	6.10E+04	nms	6.10E+03	n		–	no	no	no
Ethanol	64-17-5	8.70E-02	NA		NA			–	NA	NA	**YES**
Methylene Chloride	75-09-2	3.00E+00	5.40E+01	c	1.10E+01	c		–	no	no	no
Semi-Volatile Organic Compounds											
2,4-Dinitrotoluene	121-14-2	4.00E-01	1.20E+02	n	1.20E+01	n		–	no	no	no
2,6-Dinitrotoluene	606-20-2	3.20E-01	6.20E+01	n	6.10E+00	n		–	no	no	no
Benzoic Acid	65-85-0	1.70E-01	2.50E+05	nm	2.40E+04	nm		–	no	no	no
bis(2-Ethylhexyl)phthalate	117-81-7	1.80E+00	1.20E+02	c*	3.50E+01	c*		–	no	no	no
Carbazole	86-74-8	1.20E-01	NA		NA			–	NA	NA	**YES**
Dibenzofuran	132-64-9	4.50E-02	1.00E+02	n	7.80E+00	n	Furan	–	no	no	no
Diethylphthalate	84-66-2	9.00E-02	4.90E+04	nm	4.90E+03	n		–	no	no	no
Di-n-Butylphthalate	84-74-2	1.10E+00	6.20E+03	n	6.10E+02	n		–	no	no	no
Pentachlorophenol	87-86-5	8.30E+02	9.00E+00	c	3.00E+00	c		–	**YES**	**YES**	**YES**
Explosives											
4-Amino-2,6-Dinitrotoluene	19406-51-0	5.00E-02	1.90E+02	n	1.50E+01	n		–	no	no	no
Pesticides											
4,4'-DDE	72-55-9	4.00E-02	5.10E+00	c	1.40E+00	c		–	no	no	no
Alpha-BHC	319-84-6	7.70E-04	2.70E-01	c	7.70E-02	c		–	no	no	no
Beta-BHC	319-85-7	2.50E-04	9.60E-01	c	2.70E-01	c		–	no	no	no
Alpha-Chlordane	5103-71-9	3.00E-02	6.50E+00	c*	1.60E+00	c*	Chlordane	–	no	no	no
Dieldrin	60-57-1	2.70E-01	1.10E-01	c	3.00E-02	c		–	**YES**	**YES**	**YES**
Endrin Aldehyde	7421-93-4	4.00E-02	1.80E+01	n	1.80E+00	n	Endrin	–	no	no	no
Polycyclic Aromatic Hydrocarbons											
2-Methylnaphthalene	91-57-6	4.00E-02	4.10E+02	ns	3.10E+01	n		–	no	no	no
Acenaphthene	83-32-9	6.50E-03	3.30E+03	n	3.40E+02	n		–	no	no	no
Acenaphthylene	208-96-8	7.00E-02	3.30E+03	n	3.40E+02	n	Acenaphthene	–	no	no	no
Anthracene	120-12-7	1.00E-01	1.70E+04	nm	1.70E+03	n		–	no	no	no
Benzo(a)anthracene	56-55-3	4.00E-01	2.10E+00	c	1.50E-01	c		–	no	**YES**	**YES**
Benzo(a)pyrene	50-32-8	4.00E-01	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Benzo(b)fluoranthene	205-99-2	1.00E+00	2.10E+00	c	1.50E-01	c		–	no	**YES**	**YES**
Benzo(g,h,i)perylene	191-24-2	3.70E-02	1.70E+03	n	1.70E+02	n	Pyrene	–	no	no	no
Benzo(k)fluoranthene	207-08-9	5.60E-01	2.10E+01	c	1.50E+00	c		–	no	no	no
Chrysene	218-01-9	6.60E-01	2.10E+02	c	1.50E+01	c		–	no	no	no
Dibenzo(a,h)anthracene	53-70-3	5.00E-02	2.10E-01	c	1.50E-02	c		–	no	**YES**	**YES**
Fluoranthene	206-44-0	3.90E-01	2.20E+03	n	2.30E+02	n		–	no	no	no
Fluorene	86-73-7	6.70E-03	2.20E+03	n	2.30E+02	n		–	no	no	no
Indeno(1,2,3-cd)pyrene	193-39-5	1.10E-01	2.10E+00	c	1.50E-01	c		–	no	no	no
Naphthalene	91-20-3	6.90E-03	2.00E+01	c*	3.90E+00	c*		–	no	no	no
Phenanthrene	85-01-8	1.00E-01	1.70E+04	nm	1.70E+03	n	Anthracene	–	no	no	no

Table 8-14
Selection of Constituents of Potential Concern for Surface Soil (0-2 foot Depth Interval)
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a] (mg/kg)	Adjusted Soil Regional Screening Level (RSL) [b] Industrial Scenario (mg/kg)		Residential Scenario (mg/kg)		Surrogate	Background Level [c] (mg/kg)	Does Maximum Exceed RSL? Industrial (YES, no)	Residential (YES, no)	Is Constituent a Surface Soil COPC? [d] (YES, no)
Pyrene	129-00-0	8.60E-01	1.70E+03	n	1.70E+02	n		–	no	no	no
Polychlorinated Biphenyls											
Aroclor 1254	11097-69-1	1.70E+00	7.40E-01	c*	1.10E-01	c**		–	**YES**	**YES**	**YES**
Inorganics											
Aluminum	7429-90-5	4.36E+04	9.90E+04	nm	7.70E+03	n		4.00E+04	no	**YES**	**YES**
Antimony	7440-36-0	5.80E-01	4.10E+01	n	3.10E+00	n		–	no	no	no
Arsenic	7440-38-2	2.08E+01	1.60E+00	c	3.90E-01	c*		1.58E+01	**YES**	**YES**	**YES**
Barium	7440-39-3	1.77E+03	1.90E+04	nm	1.50E+03	n		2.09E+02	no	**YES**	**YES**
Beryllium	7440-41-7	2.46E+00	2.00E+02	n	1.60E+01	n		1.02E+00	no	no	no
Cadmium	7440-43-9	1.80E+00	8.10E+01	n	7.00E+00	n		6.90E-01	no	no	no
Calcium	7440-70-2	1.96E+05	NA		NA			–	NA	NA	no
Chromium	7440-47-3	5.90E+01	1.40E+03	c	2.80E+02	c		6.53E+01	no	no	no
Cobalt	7440-48-4	7.49E+01	3.00E+01	n	2.30E+00	n		7.23E+01	**YES**	**YES**	**YES**
Copper	7440-50-8	6.02E+01	4.10E+03	n	3.10E+02	n		5.35E+01	no	no	no
Iron	7439-89-6	5.01E+04	7.20E+04	nm	5.50E+03	n		5.10E+04	no	**YES**	no
Lead	7439-92-1	1.49E+02	8.00E+02	«	4.00E+02	«		2.68E+01	no	no	no
Magnesium	7439-95-4	1.04E+05	NA		NA			–	NA	NA	no
Manganese	7439-96-5	7.91E+02	2.30E+03	n	1.80E+02	n		2.54E+03	no	**YES**	no
Mercury	7439-97-6	4.10E-01	3.10E+01	n	2.30E+00	n		1.30E-01	no	no	no
Nickel	7440-02-0	4.22E+01	2.00E+03	n	1.60E+02	n		6.28E+01	no	no	no
Potassium	7440-09-7	4.57E+03	NA		NA			–	NA	NA	no
Selenium	7782-49-2	1.00E+00	5.10E+02	n	3.90E+01	n		–	no	no	no
Sodium	7440-23-5	3.31E+02	NA		NA			–	NA	NA	no
Thallium	7440-28-0	8.90E-01	6.60E+00	n	5.10E-01	n		2.11E+00	no	**YES**	no
Vanadium	7440-62-2	9.15E+01	7.20E+02	n	5.50E+01	n		1.08E+02	no	**YES**	no
Zinc	7440-66-6	7.52E+02	3.10E+04	nm	2.30E+03	n		2.02E+02	no	no	no

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
mg/kg = Milligrams per kilogram.
NA = Not available or not applicable.
RSL = Regional Screening Level.
USEPA = United States Environmental Protection Agency.

[a] Maximum concentration in surface soil (0-2 foot depth interval).
[b] The screening levels used were from USEPA (2008a). Screening levels based on non-cancer effects were adjusted downward by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = concentration may exceed ceiling limit; s = Concentration may exceed saturation concentration (Csat).
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.
[c] Background levels for metals are facility-wide soil background point estimates taken from Facility-Wide Background Study Report (IT Corporation 2001).
[d] Constituents detected with maximum concentrations greater than adjusted residential screening levels were considered COPCs unless they were metals detected at concentrations lower than background, or are essential nutrients (i.e., calcium, magnesium, potassium, sodium), or were known laboratory contaminants (i.e. acetone).

Table 8-15
Selection of Constituents of Potential Concern for Combined Surface and Subsurface Soil
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b]					Background Level [c]	Does Maximum Exceed RSL?		Is Constituent a Surface/ Subsurface Soil COPC? [d]
			Industrial Scenario		Residential Scenario		Surrogate		Industrial	Residential	
		(mg/kg)	(mg/kg)		(mg/kg)			(mg/kg)	(YES, no)	(YES, no)	(YES, no)
Volatile Organic Compounds											
2-Butanone	78-93-3	1.60E-02	1.90E+04	nms	2.80E+03	ns		–	no	no	no
3-Octanone	106-68-3	1.50E-01	NA		NA			–	NA	NA	**YES**
Acetone	67-64-1	3.10E-01	6.10E+04	nms	6.10E+03	n		–	no	no	no
Ethanol	64-17-5	8.70E-02	NA		NA			–	NA	NA	**YES**
Methylene Chloride	75-09-2	3.00E+00	5.40E+01	c	1.10E+01	c		–	no	no	no
Semi-Volatile Organic Compounds											
2,4-Dinitrotoluene	121-14-2	4.00E-01	1.20E+02	n	1.20E+01	n		–	no	no	no
2,6-Dinitrotoluene	606-20-2	3.20E-01	6.20E+01	n	6.10E+00	n		–	no	no	no
Benzoic Acid	65-85-0	1.70E-01	2.50E+05	nm	2.40E+04	nm		–	no	no	no
bis(2-Ethylhexyl)phthalate	117-81-7	1.80E+00	1.20E+02	c*	3.50E+01	c*		–	no	no	no
Butylbenzylphthalate	85-68-7	–	9.10E+02	c	2.60E+02	c*		–	–	–	no
Carbazole	86-74-8	1.20E-01	NA		NA			–	NA	NA	**YES**
Dibenzofuran	132-64-9	4.50E-02	1.00E+02	n	7.80E+00	n	Furan	–	no	no	no
Diethylphthalate	84-66-2	1.10E+00	4.90E+04	nm	4.90E+03	n		–	no	no	no
Di-n-Butylphthalate	84-74-2	1.10E+00	6.20E+03	n	6.10E+02	n		–	no	no	no
Pentachlorophenol	87-86-5	8.30E+02	9.00E+00	c	3.00E+00	c		–	**YES**	**YES**	**YES**
Explosives											
4-Amino-2,6-Dinitrotoluene	19406-51-0	5.00E-02	1.90E+02	n	1.50E+01	n		–	no	no	no
Pesticides											
4,4'-DDE	72-55-9	4.00E-02	5.10E+00	c	1.40E+00	c		–	no	no	no
Alpha-BHC	319-84-6	7.70E-04	2.70E-01	c	7.70E-02	c		–	no	no	no
Beta-BHC	319-85-7	2.50E-04	9.60E-01	c	2.70E-01	c		–	no	no	no
Alpha-Chlordane	5103-71-9	3.00E-02	6.50E+00	c*	1.60E+00	c*	Chlordane	–	no	no	no
Dieldrin	60-57-1	2.70E-01	1.10E-01	c	3.00E-02	c		–	**YES**	**YES**	**YES**
Endrin Aldehyde	7421-93-4	4.00E-02	1.80E+01	n	1.80E+00	n	Endrin	–	no	no	no
Polycyclic Aromatic Hydrocarbons											
2-Methylnaphthalene	91-57-6	4.00E-02	4.10E+02	ns	3.10E+01	n		–	no	no	no
Acenaphthene	83-32-9	6.50E-03	3.30E+03	n	3.40E+02	n		–	no	no	no
Acenaphthylene	208-96-8	7.00E-02	3.30E+03	n	3.40E+02	n	Acenaphthene	–	no	no	no
Anthracene	120-12-7	1.00E-01	1.70E+04	nm	1.70E+03	n		–	no	no	no
Benzo(a)anthracene	56-55-3	4.00E-01	2.10E+00	c	1.50E-01	c		–	no	**YES**	**YES**
Benzo(a)pyrene	50-32-8	4.00E-01	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Benzo(b)fluoranthene	205-99-2	1.00E+00	2.10E+00	c	1.50E-01	c		–	no	**YES**	**YES**
Benzo(g,h,i)perylene	191-24-2	3.70E-02	1.70E+03	n	1.70E+02	n	Pyrene	–	no	no	no
Benzo(k)fluoranthene	207-08-9	5.60E-01	2.10E+01	c	1.50E+00	c		–	no	no	no
Chrysene	218-01-9	6.60E-01	2.10E+02	c	1.50E+01	c		–	no	no	no
Dibenzo(a,h)anthracene	53-70-3	5.00E-02	2.10E-01	c	1.50E-02	c		–	no	**YES**	**YES**
Fluoranthene	206-44-0	3.90E-01	2.20E+03	n	2.30E+02	n		–	no	no	no
Fluorene	86-73-7	6.70E-03	2.20E+03	n	2.30E+02	n		–	no	no	no
Indeno(1,2,3-cd)pyrene	193-39-5	1.10E-01	2.10E+00	c	1.50E-01	c		–	no	no	no
Naphthalene	91-20-3	6.90E-03	2.00E+01	c*	3.90E+00	c*		–	no	no	no
Phenanthrene	85-01-8	1.00E-01	1.70E+04	nm	1.70E+03	n	Anthracene	–	no	no	no
Pyrene	129-00-0	8.60E-01	1.70E+03	n	1.70E+02	n		–	no	no	no
Polychlorinated Biphenyls											
Aroclor 1254	11097-69-1	1.70E+00	7.40E-01	c*	1.10E-01	c**		–	**YES**	**YES**	**YES**
Inorganics											
Aluminum	7429-90-5	4.36E+04	9.90E+04	nm	7.70E+03	n		4.00E+04	no	**YES**	**YES**
Antimony	7440-36-0	5.80E-01	4.10E+01	n	3.10E+00	n		–	no	no	no
Arsenic	7440-38-2	2.08E+01	1.60E+00	c	3.90E-01	c*		1.58E+01	**YES**	**YES**	**YES**

Table 8-15
Selection of Constituents of Potential Concern for Combined Surface and Subsurface Soil
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a] (mg/kg)	Adjusted Soil Regional Screening Level (RSL) [b]: Industrial Scenario (mg/kg)		Residential Scenario (mg/kg)		Surrogate	Background Level [c] (mg/kg)	Does Maximum Exceed RSL?: Industrial (YES, no)	Residential (YES, no)	Is Constituent a Surface/ Subsurface Soil COPC? [d] (YES, no)
Barium	7440-39-3	1.77E+03	1.90E+04	nm	1.50E+03	n		2.09E+02	no	**YES**	**YES**
Beryllium	7440-41-7	4.30E+00	2.00E+02	n	1.60E+01	n		1.02E+00	no	no	no
Cadmium	7440-43-9	1.80E+00	8.10E+01	n	7.00E+00	n		6.90E-01	no	no	no
Calcium	7440-70-2	1.96E+05	NA		NA			–	NA	NA	no
Chromium	7440-47-3	5.90E+01	1.40E+03	c	2.80E+02	c		6.53E+01	no	no	no
Cobalt	7440-48-4	7.49E+01	3.00E+01	n	2.30E+00	n		7.23E+01	**YES**	**YES**	**YES**
Copper	7440-50-8	6.02E+01	4.10E+03	n	3.10E+02	n		5.35E+01	no	no	no
Iron	7439-89-6	5.01E+04	7.20E+04	nm	5.50E+03	n		5.10E+04	no	**YES**	no
Lead	7439-92-1	1.49E+02	8.00E+02	«	4.00E+02	«		2.68E+01	no	no	no
Magnesium	7439-95-4	1.04E+05	NA		NA			–	NA	NA	no
Manganese	7439-96-5	7.91E+02	2.30E+03	n	1.80E+02	n		2.54E+03	no	**YES**	no
Mercury	7439-97-6	4.60E-01	3.10E+01	n	2.30E+00	n		1.30E-01	no	no	no
Nickel	7440-02-0	4.22E+01	2.00E+03	n	1.60E+02	n		6.28E+01	no	no	no
Potassium	7440-09-7	4.57E+03	NA		NA			–	NA	NA	no
Selenium	7782-49-2	1.00E+00	5.10E+02	n	3.90E+01	n		–	no	no	no
Sodium	7440-23-5	3.31E+02	NA		NA			–	NA	NA	no
Thallium	7440-28-0	8.90E-01	6.60E+00	n	5.10E-01	n		2.11E+00	no	**YES**	no
Vanadium	7440-62-2	9.15E+01	7.20E+02	n	5.50E+01	n		1.08E+02	no	**YES**	no
Zinc	7440-66-6	7.52E+02	3.10E+04	nm	2.30E+03	n		2.02E+02	no	no	no

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
NA =
RSL =
USEPA =

[a] Maximum concentration in combined surface and subsurface soil.

[b] The screening levels used were from USEPA (2008a). Screening levels based on non-cancer effects were adjusted downward by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = Concentration may exceed ceiling limit; s = Concentration may exceed saturation concentration (Csat).
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.

[c] Background levels for metals are facility-wide soil background point estimates taken from Facility-Wide Background Study Report (IT Corporation 2001).

[d] Constituents detected with maximum concentrations greater than adjusted residential screening levels were considered COPCs unless they were metals detected at concentrations lower than background, or are essential nutrients (i.e., calcium, magnesium, potassium, sodium), or were known laboratory contaminants (i.e. acetone).

Table 8-16
Selection of Constituents of Potential Concern for Sediment
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a] (mg/kg)	Adjusted Soil Regional Screening Level (RSL) [b] Residential Scenario (mg/kg)		Surrogate	Is Constituent a Sediment COPC? [c] (YES, no)
Volatile Organic Compounds						
2-Butanone	78-93-3	1.00E-01	2.80E+03	ns		no
Acetone	67-64-1	5.30E-01	6.10E+03	n		no
Carbon Disulfide	75-15-0	2.20E-03	6.70E+01	ns		no
Methylene Chloride	75-09-2	3.00E-03	1.10E+01	c		no
Semi-Volatile Organic Compounds						
4-Methylphenol	106-44-5	3.60E-02	3.10E+01	n		no
Benzoic Acid	65-85-0	2.80E-01	2.40E+04	nm		no
bis(2-Ethylhexyl)phthalate	117-81-7	3.30E-01	3.50E+01	c*		no
Di-n-Butylphthalate	84-74-2	6.90E-02	6.10E+02	n		no
Explosives						
Nitroglycerine	55-63-0	5.70E-01	6.10E-01	n		no
Pentaerythritol Tetranitrate	78-11-5	2.30E-01	NA			**YES**
Herbicides						
2,4,5-T	93-76-5	3.34E-02	6.10E+01	n		no
2,4,5-TP	93-72-1	1.04E-01	4.90E+01	n		no
2,4-D	94-75-7	2.09E-01	6.90E+01	n		no
Dalapon	75-99-0	1.07E-01	1.80E+02	n		no
Dicamba	1918-00-9	4.97E-02	1.80E+02	n		no
Dichlorprop	120-36-5	3.53E-01	NA			**YES**
MCPP	93-65-2	3.53E+00	6.10E+00	n		no
Pesticides						
4,4'-DDD	72-54-8	2.09E-03	2.00E+00	c		no
4,4'-DDE	72-55-9	8.40E-03	1.40E+00	c		no
4,4'-DDT	50-29-3	4.00E-03	1.70E+00	c*		no
Alpha-BHC	319-84-6	5.90E-04	7.70E-02	c		no
Delta-BHC	319-86-8	1.20E-03	5.20E-01	c*	gamma-BHC	no
Gamma-BHC (Lindane)	58-89-9	9.70E-04	5.20E-01	c*		no
Alpha-Chlordane	5103-71-9	1.01E-02	1.60E+00	c*	Chlordane	no
Gamma-Chlordane	5566-34-7	1.30E-02	1.60E+00	c*	Chlordane	no
Dieldrin	60-57-1	4.10E-03	3.00E-02	c		no
Endosulfan II	33213-65-9	7.20E-04	3.70E+01	n	Endosulfan	no
Endrin	72-20-8	1.25E-02	1.80E+00	n		no
Endrin Aldehyde	7421-93-4	4.00E-02	1.80E+00	n	Endrin	no
Endrin Ketone	53494-70-5	2.03E-03	1.80E+00	n	Endrin	no
Heptachlor	76-44-8	2.13E-03	1.10E-01	c		no
Heptachlor Epoxide	1024-57-3	7.26E-03	5.30E-02	c*		no
Methoxychlor	72-43-5	2.60E-03	3.10E+01	n		no

Table 8-16
Selection of Constituents of Potential Concern for Sediment
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a] (mg/kg)	Adjusted Soil Regional Screening Level (RSL) [b] Residential Scenario (mg/kg)		Surrogate	Is Constituent a Sediment COPC? [c] (YES, no)
Polycyclic Aromatic Hydrocarbons						
2-Methylnaphthalene	91-57-6	4.00E-02	3.10E+01	n		no
Acenaphthene	83-32-9	5.90E-02	3.40E+02	n		no
Acenaphthylene	208-96-8	2.60E-02	3.40E+02	n	Acenaphthene	no
Anthracene	120-12-7	8.10E-02	1.70E+03	n		no
Benzo(a)anthracene	56-55-3	1.90E-01	1.50E-01	c		**YES**
Benzo(a)pyrene	50-32-8	1.70E-01	1.50E-02	c		**YES**
Benzo(b)fluoranthene	205-99-2	2.50E-01	1.50E-01	c		**YES**
Benzo(g,h,i)perylene	191-24-2	1.00E-01	1.70E+02	n	Pyrene	no
Benzo(k)fluoranthene	207-08-9	8.00E-02	1.50E+00	c		no
Chrysene	218-01-9	1.70E-01	1.50E+01	c		no
Dibenzo(a,h)anthracene	53-70-3	2.60E-02	1.50E-02	c		**YES**
Fluoranthene	206-44-0	4.40E-01	2.30E+02	n		no
Fluorene	86-73-7	4.60E-02	2.30E+02	n		no
Indeno(1,2,3-cd)pyrene	193-39-5	1.20E-01	1.50E-01	c		no
Naphthalene	91-20-3	4.30E-02	3.90E+00	c*		no
Phenanthrene	85-01-8	3.60E-01	1.70E+03	n	Anthracene	no
Pyrene	129-00-0	3.00E-01	1.70E+02	n		no
Inorganics						
Aluminum	7429-90-5	2.70E+04	7.70E+03	n		**YES**
Antimony	7440-36-0	1.00E+00	3.10E+00	n		no
Arsenic	7440-38-2	1.18E+01	3.90E-01	c*		**YES**
Barium	7440-39-3	1.13E+02	1.50E+03	n		no
Beryllium	7440-41-7	1.67E+00	1.60E+01	n		no
Cadmium	7440-43-9	2.10E-01	7.00E+00	n		no
Calcium	7440-70-2	1.76E+05	NA			no
Chromium	7440-47-3	8.09E+01	2.80E+02	c		no
Cobalt	7440-48-4	1.50E+01	2.30E+00	n		**YES**
Copper	7440-50-8	4.76E+01	3.10E+02	n		no
Iron	7439-89-6	7.96E+04	5.50E+03	n		**YES**
Lead	7439-92-1	3.30E+01	4.00E+02	«		no
Magnesium	7439-95-4	4.25E+04	NA			no
Manganese	7439-96-5	1.22E+03	1.80E+02	n		**YES**
Mercury	7439-97-6	8.00E-02	2.30E+00	n		no
Nickel	7440-02-0	2.45E+01	1.60E+02	n		no
Potassium	7440-09-7	2.62E+03	NA			no
Selenium	7782-49-2	1.70E+00	3.90E+01	n		no
Sodium	7440-23-5	1.10E+02	NA			no
Thallium	7440-28-0	4.50E-01	5.10E-01	n		no

Table 8-16
Selection of Constituents of Potential Concern for Sediment
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b]			Is Constituent a Sediment COPC? [c]
			Residential Scenario		Surrogate	
		(mg/kg)	(mg/kg)			(YES, no)
Vanadium	7440-62-2	1.10E+02	5.50E+01	n		**YES**
Zinc	7440-66-6	1.10E+02	2.30E+03	n		no

Notes:

CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
mg/kg = Milligrams per kilogram.
NA = Not available or not applicable.
RSL = Regional Screening Level.
USEPA = United States Environmental Protection Agency.

[a] Maximum concentration in sediment.

[b] The screening levels used were risk screening levels for the residential scenario from USEPA (2008a). Screening levels based on non-cancer effects were adjusted downward by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = Concentration may exceed ceiling limit;
s = Concentration may exceed saturation concentration (Csat).
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.

[c] Constituents detected with maximum concentrations greater than adjusted residential screening levels were considered COPCs unless they were metals detected at concentrations lower than background, or are essential nutrients (i.e., calcium, magnesium, potassium, sodium), or were known laboratory contaminants (i.e. acetone).

Table 8-17
Selection Constituents of Potential Concern for Surface Water
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Tap Water Regional Screening Level (RSL) [b]			Is Constituent a Surface Water COPC? [c]
		(mg/L)	(mg/L)		Surrogate	(YES, no)
Volatile Organic Compounds						
Carbon Disulfide	75-15-0	3.00E-04	1.00E-01	n		no
Chloroform	67-66-3	3.70E-04	1.90E-04	c		**YES**
Semi-Volatile Organic Compounds						
Benzoic Acid	65-85-0	6.10E-03	1.50E+01	n		no
bis(2-Ethylhexyl)phthalate	117-81-7	8.00E-03	4.80E-03	c		**YES**
Butylbenzylphthalate	85-68-7	1.10E-03	3.50E-02	c		no
Diethylphthalate	84-66-2	3.70E-04	2.90E+00	n		no
Di-n-Butylphthalate	84-74-2	1.00E-03	3.70E-01	n		no
Explosives						
m-Nitrotoluene	99-08-1	1.25E-03	7.30E-02	n		no
Nitrobenzene	98-95-3	2.00E-04	3.40E-04	n		no
Nitroglycerine	55-63-0	6.10E-04	3.70E-04	n		**YES**
Herbicides						
2,4,5-TP	93-72-1	5.00E-05	2.90E-02	n		no
2,4-D	94-75-7	4.66E-03	3.70E-02	n		no
2,4-DB	94-82-6	4.10E-04	2.90E-02	n		no
MCPA	94-74-6	1.10E-01	1.80E-03	n		**YES**
MCPP	93-65-2	4.63E-02	3.70E-03	n		**YES**
Pesticides						
4,4'-DDT	50-29-3	1.00E-05	2.00E-04	c*		no
Delta-BHC	319-86-8	1.00E-05	6.10E-05	c	gamma-BHC	no
Dieldrin	60-57-1	7.19E-06	4.20E-06	c		**YES**
Endosulfan Sulfate	1031-07-8	3.00E-05	2.20E-02	n	Endosulfan	no
Endrin Aldehyde	7421-93-4	1.00E-05	1.10E-03	n	Endrin	no
Endrin Ketone	53494-70-5	8.28E-06	1.10E-03	n	Endrin	no
Polycyclic Aromatic Hydrocarbons						
2-Methylnaphthalene	91-57-6	3.00E-05	1.50E-02	n		no
Naphthalene	91-20-3	3.00E-05	1.40E-04	c*		no
Phenanthrene	85-01-8	2.00E-05	1.10E+00	n	Anthracene	no
Inorganics						
Aluminum	7429-90-5	6.08E-01	3.70E+00	n		no
Antimony	7440-36-0	5.80E-04	1.50E-03	n		no
Barium	7440-39-3	7.96E-02	7.30E-01	n		no
Cadmium	7440-43-9	1.10E-04	1.80E-03	n		no
Calcium	7440-70-2	5.95E+01	NA			no
Chromium	7440-47-3	5.50E-03	5.50E+00	n		no
Copper	7440-50-8	3.80E-02	1.50E-01	n		no

Table 8-17
Selection Constituents of Potential Concern for Surface Water
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Tap Water Regional Screening Level (RSL) [b]			Is Constituent a Surface Water COPC? [c]
		(mg/L)	(mg/L)		Surrogate	(YES, no)
Iron	7439-89-6	4.47E+00	2.60E+00	n		**YES**
Lead	7439-92-1	3.10E-02	1.50E-02	**		**YES**
Magnesium	7439-95-4	2.66E+01	NA			no
Manganese	7439-96-5	1.02E-01	8.80E-02	n		**YES**
Potassium	7440-09-7	3.75E+00	NA			no
Selenium	7782-49-2	4.80E-04	1.80E-02	n		no
Silver	7440-22-4	8.30E-03	1.80E-02	n		no
Sodium	7440-23-5	3.68E+01	NA			no
Zinc	7440-66-6	2.74E-01	1.10E+00	n		no

Notes:

CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
mg/L = Milligrams per liter.
NA = Not available or not applicable.
RSL = Regional Screening Level.
USEPA = United States Environmental Protection Agency.

[a] Maximum concentration in surface water.

[b] The screening levels used were risk screening levels for tap water from USEPA (2008a). Screening levels based on non-cancer effects were adjusted downward by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = Concentration may exceed ceiling limit;
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.

[c] Constituents detected with maximum concentrations greater than screening levels were considered COPCs unless they were essential nutrients (i.e., calcium, magnesium, potassium, sodium), or were known laboratory contaminants (i.e. acetone).

Table 8-18
Exposure Point Concentrations
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a]				Exposure Point Concentrations [b]			
		Surface Soil	Combined Surface and Subsurface Soil	Sediment	Surface Water	Surface Soil (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Sediment (mg/kg)	Surface Water (mg/L)
Volatile Organic Compounds									
1,2,3-Trichloropropane	96-18-4	no	no	no	no	–	–	–	–
1,2,4-Trimethylbenzene	95-63-6	no	no	no	no	–	–	–	–
2-Butanone	78-93-3	no	no	no	no	–	–	–	–
3-Octanone	106-68-3	**YES**	**YES**	no	no	1.50E-01 m	1.50E-01 m	–	–
4-Methyl-2-pentanone	108-10-1	no	no	no	no	–	–	–	–
Acetone	67-64-1	no	no	no	no	–	–	–	–
Bromodichloromethane	75-27-4	no	no	no	no	–	–	–	–
Carbon Disulfide	75-15-0	no	no	no	no	–	–	–	–
Chloroform	67-66-3	no	no	no	**YES**	–	–	–	3.70E-04 m
cis-1,2-Dichloroethene	156-59-2	no	no	no	no	–	–	–	–
d-Limonene	5989-27-5	no	no	no	no	–	–	–	–
Ethanol	64-17-5	**YES**	**YES**	no	no	8.70E-02 m	8.70E-02 m	–	–
m,p-Xylene	136777612	no	no	no	no	–	–	–	–
Methylene Chloride	75-09-2	no	no	no	no	–	–	–	–
p-Isopropyltoluene	99-87-6	no	no	no	no	–	–	–	–
Tetrachloroethene	127-18-4	no	no	no	no	–	–	–	–
Toluene	108-88-3	no	no	no	no	–	–	–	–
Trichloroethene	79-01-6	no	no	no	no	–	–	–	–
Xylenes (total)	1330-20-7	no	no	no	no	–	–	–	–
Semi-Volatile Organic Compounds									
1,2,4-Trichlorobenzene	120-82-1	no	no	no	no	–	–	–	–
1,2-Dichlorobenzene	95-50-1	no	no	no	no	–	–	–	–
1,3-Dichlorobenzene	541-73-1	no	no	no	no	–	–	–	–
1,4-Dichlorobenzene	106-46-7	no	no	no	no	–	–	–	–
2,4-Dinitrotoluene	121-14-2	no	no	no	no	–	–	–	–
2,6-Dinitrotoluene	606-20-2	no	no	no	no	–	–	–	–
3,3'-Dichlorobenzidine	91-94-1	no	no	no	no	–	–	–	–
4-Methylphenol	106-44-5	no	no	no	no	–	–	–	–
Benzoic Acid	65-85-0	no	no	no	no	–	–	–	–
bis(2-Ethylhexyl)phthalate	117-81-7	no	no	no	**YES**	–	–	–	8.00E-03 m
Butylbenzylphthalate	85-68-7	no	no	no	no	–	–	–	–
Carbazole	86-74-8	**YES**	**YES**	no	no	1.20E-01 m	1.20E-01 m	–	–
Dibenzofuran	132-64-9	no	no	no	no	–	–	–	–
Diethylphthalate	84-66-2	no	no	no	no	–	–	–	–
Di-n-Butylphthalate	84-74-2	no	no	no	no	–	–	–	–
Di-n-Octylphthalate	117-84-0	no	no	no	no	–	–	–	–
N-Nitrosodiphenylamine	86-30-6	no	no	no	no	–	–	–	–
Pentachlorophenol	87-86-5	**YES**	**YES**	no	no	8.30E+02 m	8.30E+02 m	–	–
Phenol	108-95-2	no	no	no	no	–	–	–	–

Table 8-18
Exposure Point Concentrations
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a]				Exposure Point Concentrations [b]			
		Surface Soil	Combined Surface and Subsurface Soil	Sediment	Surface Water	Surface Soil (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Sediment (mg/kg)	Surface Water (mg/L)
Dioxin/Furan Compounds									
1,2,3,4,6,7,8-HpCDD	35822-46-9	no	no	no	no	–	–	–	–
1,2,3,4,6,7,8-HpCDF	67562-39-4	no	no	no	no	–	–	–	–
1,2,3,4,7,8,9-HpCDF	55673-89-7	no	no	no	no	–	–	–	–
1,2,3,4,7,8-HxCDD	39227-28-6	no	no	no	no	–	–	–	–
1,2,3,4,7,8-HxCDF	70648-26-9	no	no	no	no	–	–	–	–
1,2,3,6,7,8-HxCDD	57653-85-7	no	no	no	no	–	–	–	–
1,2,3,6,7,8-HxCDF	57117-44-9	no	no	no	no	–	–	–	–
1,2,3,7,8,9-HxCDD	19408-74-3	no	no	no	no	–	–	–	–
1,2,3,7,8,9-HxCDF	72918-21-9	no	no	no	no	–	–	–	–
1,2,3,7,8-PeCDD	40321-76-4	no	no	no	no	–	–	–	–
1,2,3,7,8-PeCDF	57117-41-6	no	no	no	no	–	–	–	–
2,3,4,6,7,8-HxCDF	60851-34-5	no	no	no	no	–	–	–	–
2,3,4,7,8-PeCDF	57117-31-4	no	no	no	no	–	–	–	–
2,3,7,8-TCDD	1746-01-6	no	no	no	no	–	–	–	–
2,3,7,8-TCDF	51207-31-9	no	no	no	no	–	–	–	–
OCDD	3268-87-9	no	no	no	no	–	–	–	–
OCDF	39001-02-0	no	no	no	no	–	–	–	–
Explosives									
1,3,5-Trinitrobenzene	99-35-4	no	no	no	no	–	–	–	–
1,3-Dinitrobenzene	99-65-0	no	no	no	no	–	–	–	–
2,4,6-Trinitrotoluene	118-96-7	no	no	no	no	–	–	–	–
4-Amino-2,6-Dinitrotoluene	19406-51-0	no	no	no	no	–	–	–	–
m-Nitrotoluene	99-08-1	no	no	no	no	–	–	–	–
Nitrobenzene	98-95-3	no	no	no	no	–	–	–	–
Nitroglycerine	55-63-0	no	no	no	**YES**	–	–	–	6.10E-04 m
Pentaerythritol Tetranitrate	78-11-5	no	no	**YES**	no	–	–	2.30E-01 m	–
Perchlorate	14797-73-0	no	no	no	no	–	–	–	–
Herbicides									
2,4,5-T	93-76-5	no	no	no	no	–	–	–	–
2,4,5-TP	93-72-1	no	no	no	no	–	–	–	–
2,4-D	94-75-7	no	no	no	no	–	–	–	–
2,4-DB	94-82-6	no	no	no	no	–	–	–	–
Dalapon	75-99-0	no	no	no	no	–	–	–	–
Dicamba	1918-00-9	no	no	no	no	–	–	–	–
Dichlorprop	120-36-5	no	no	**YES**	no	–	–	3.53E-01 m	–
MCPA	94-74-6	no	no	no	**YES**	–	–	–	1.10E-01 m
MCPP	93-65-2	no	no	no	**YES**	–	–	–	4.63E-02 m
Pesticides									
4,4'-DDD	72-54-8	no	no	no	no	–	–	–	–
4,4'-DDE	72-55-9	no	no	no	no	–	–	–	–
4,4'-DDT	50-29-3	no	no	no	no	–	–	–	–

Table 8-18
Exposure Point Concentrations
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a]				Exposure Point Concentrations [b]			
		Surface Soil	Combined Surface and Subsurface Soil	Sediment	Surface Water	Surface Soil (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Sediment (mg/kg)	Surface Water (mg/L)
Alpha-BHC	319-84-6	no	no	no	no	–	–	–	–
Beta-BHC	319-85-7	no	no	no	no	–	–	–	–
Delta-BHC	319-86-8	no	no	no	no	–	–	–	–
Gamma-BHC (Lindane)	58-89-9	no	no	no	no	–	–	–	–
Alpha-Chlordane	5103-71-9	no	no	no	no	–	–	–	–
Gamma-Chlordane	5566-34-7	no	no	no	no	–	–	–	–
Dieldrin	60-57-1	**YES**	**YES**	no	**YES**	2.70E-01 m	2.70E-01 m	–	7.19E-06 m
Endosulfan I	115-29-7	no	no	no	no	–	–	–	–
Endosulfan II	33213-65-9	no	no	no	no	–	–	–	–
Endosulfan Sulfate	1031-07-8	no	no	no	no	–	–	–	–
Endrin	72-20-8	no	no	no	no	–	–	–	–
Endrin Aldehyde	7421-93-4	no	no	no	no	–	–	–	–
Endrin Ketone	53494-70-5	no	no	no	no	–	–	–	–
Heptachlor	76-44-8	no	no	no	no	–	–	–	–
Heptachlor Epoxide	1024-57-3	no	no	no	no	–	–	–	–
Methoxychlor	72-43-5	no	no	no	no	–	–	–	–
Polycyclic Aromatic Hydrocarbons									
1-Methylnaphthalene	90-12-0	no	no	no	no	–	–	–	–
2-Methylnaphthalene	91-57-6	no	no	no	no	–	–	–	–
Acenaphthene	83-32-9	no	no	no	no	–	–	–	–
Acenaphthylene	208-96-8	no	no	no	no	–	–	–	–
Anthracene	120-12-7	no	no	no	no	–	–	–	–
Benzo(a)anthracene	56-55-3	**YES**	**YES**	**YES**	no	2.42E-01	1.56E-01	1.23E-01	–
Benzo(a)pyrene	50-32-8	**YES**	**YES**	**YES**	no	2.42E-01	1.56E-01	8.91E-02	–
Benzo(b)fluoranthene	205-99-2	**YES**	**YES**	**YES**	no	4.95E-01	2.41E-01	1.39E-01	–
Benzo(g,h,i)perylene	191-24-2	no	no	no	no	–	–	–	–
Benzo(k)fluoranthene	207-08-9	no	no	no	no	–	–	–	–
Chrysene	218-01-9	no	no	no	no	–	–	–	–
Dibenzo(a,h)anthracene	53-70-3	**YES**	**YES**	**YES**	no	1.10E-02	1.04E-02	2.60E-02 m	–
Fluoranthene	206-44-0	no	no	no	no	–	–	–	–
Fluorene	86-73-7	no	no	no	no	–	–	–	–
Indeno(1,2,3-cd)pyrene	193-39-5	no	no	no	no	–	–	–	–
Naphthalene	91-20-3	no	no	no	no	–	–	–	–
Phenanthrene	85-01-8	no	no	no	no	–	–	–	–
Pyrene	129-00-0	no	no	no	no	–	–	–	–
Polychlorinated Biphenyls									
Aroclor 1254	11097-69-1	**YES**	**YES**	no	no	3.85E-01	3.44E-01	–	–
Aroclor 1260	11096-82-5	no	no	no	no	–	–	–	–
Inorganics									

Table 8-18
Exposure Point Concentrations
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a]				Exposure Point Concentrations [b]			
		Surface Soil	Combined Surface and Subsurface Soil	Sediment	Surface Water	Surface Soil (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Sediment (mg/kg)	Surface Water (mg/L)
Aluminum	7429-90-5	**YES**	**YES**	**YES**	no	2.56E+04	2.23E+04	2.08E+04	–
Antimony	7440-36-0	no	no	no	no	–	–	–	–
Arsenic	7440-38-2	**YES**	**YES**	**YES**	no	8.97E+00	7.92E+00	7.79E+00	–
Barium	7440-39-3	**YES**	**YES**	no	no	4.18E+02	3.08E+02	–	–
Beryllium	7440-41-7	no	no	no	no	–	–	–	–
Cadmium	7440-43-9	no	no	no	no	–	–	–	–
Calcium	7440-70-2	no	no	no	no	–	–	–	–
Chromium	7440-47-3	no	no	no	no	–	–	–	–
Cobalt	7440-48-4	**YES**	**YES**	**YES**	no	2.81E+01	2.70E+01	1.15E+01	–
Copper	7440-50-8	no	no	no	no	–	–	–	–
Iron	7439-89-6	no	no	**YES**	**YES**	–	–	3.32E+04	4.47E+00 m
Lead	7439-92-1	no	no	no	**YES**	–	–	–	7.06E-03 avg
Magnesium	7439-95-4	no	no	no	no	–	–	–	–
Manganese	7439-96-5	no	no	**YES**	**YES**	–	–	5.36E+02	1.02E-01 m
Mercury	7439-97-6	no	no	no	no	–	–	–	–
Nickel	7440-02-0	no	no	no	no	–	–	–	–
Potassium	7440-09-7	no	no	no	no	–	–	–	–
Selenium	7782-49-2	no	no	no	no	–	–	–	–
Silver	7440-22-4	no	no	no	no	–	–	–	–
Sodium	7440-23-5	no	no	no	no	–	–	–	–
Thallium	7440-28-0	no	no	no	no	–	–	–	–
Vanadium	7440-62-2	no	no	**YES**	no	–	–	5.79E+01	–
Zinc	7440-66-6	no	no	no	no	–	–	–	–

Notes:
– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilogram.
mg/L = Milligrams per liter.

[a] Constituent of Potential Concern.
[b] The exposure point concentration (EPC) was the upper confidence level on the mean (UCL) or the maximum concentration where the UCL was incalculable.
EPCs marked with "m" are based on the maximum detected concentration.
Exposure to lead is evaluated by predicting resultant blood lead levels using the arithmetic average (avg).
The UCLs were calculated using ProUCL 4.0. The UCL used is the one recommended by ProUCL 4.0.

Table 8-19
Summary of Calculated Human Health Risks and Hazards
RAIL YARD
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

RECEPTOR Exposure Medium - Scenario	Total Excess Lifetime Cancer Risk	Total Non-Cancer Hazard
Site Worker		
Surface Soil - Direct Contact	1E-04	0.3
Sediment - Wading	8E-07	0.01
Surface Water - Wading	2E-07	0.1
TOTAL SITE RISKS (Site Worker):	1E-04	0.4
Hypothetical Future Construction Worker		
Combined Surface and Subsurface Soil - Direct Contact	5E-06	0.7
TOTAL SITE RISKS (Construction Worker):	5E-06	0.7
Hypothetical Future Adult Resident		
Combined Surface and Subsurface Soil - Direct Contact	1E-04	0.3
Sediment - Wading	1E-06	0.02
Surface Water - Wading	9E-07	0.2
TOTAL SITE RISKS (Adult Resident):	1E-04	0.6
Hypothetical Future Child Resident		
Combined Surface and Subsurface Soil - Direct Contact	2E-04	3
Sediment - Wading	1E-06	0.1
Surface Water - Wading	6E-08	0.1
TOTAL SITE RISKS (Child Resident):	2E-04	3
Hypothetical Aggregate Child Resident (Adult + Child)		
Combined Surface and Subsurface Soil - Direct Contact	3E-04	--
Sediment - Wading	3E-06	--
Surface Water - Wading	1E-06	--
TOTAL SITE RISKS (Aggregate Resident):	3E-04	--

Table 8-20
Screening Level -Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Background Concentration [a] (mg/kg)	Ecological Screening Level (ESLs) [b] (mg/kg)		Maximum HQ [c] (unitless)	Bioaccumulative Chemical?[d] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [e]	
			Value	*Source*			(YES/no)	Rationale
Volatile Organic Compounds								
2-Butanone	0.016	–	89.6	*R5*	0.0002	no	no	HQ • 1
3-Octanone	0.15	–	NA		NA	no	**YES**	**NSL**
Acetone	0.31	–	2.5	*R5*	0.1	no	no	HQ • 1
Ethanol	0.087	–	NA		NA	no	**YES**	**NSL**
Methylene Chloride	3	–	4.05	*R5*	0.7	no	no	HQ • 1
Semi-Volatile Organic Compounds								
2,4-Dinitrotoluene	0.4	–	1.28	*R5*	0.3	no	no	HQ • 1
2,6-Dinitrotoluene	0.32	–	0.0328	*R5*	10	no	**YES**	**HQ > 1**
Benzoic Acid	0.17	–	NA		NA	no	**YES**	**NSL**
bis(2-Ethylhexyl)phthalate	1.8	–	0.92594	*R5*	2	no	**YES**	**HQ > 1**
Carbazole	0.12	–	NA		NA	no	**YES**	**NSL**
Dibenzofuran	0.045	–	NA		NA	no	**YES**	**NSL**
Diethylphthalate	0.09	–	24.8	*R5*	0.004	no	no	HQ • 1
Di-n-Butylphthalate	1.1	–	0.15	*R5*	7	no	**YES**	**HQ > 1**
Pentachlorophenol	830	–	2.1	*EcoSSL*	400	YES	**YES**	**HQ > 1**
Explosives								
4-Amino-2,6-Dinitrotoluene	0.05	–	80	*T*	0.0006	no	no	HQ • 1
Pesticides								
4,4'-DDE	0.04	–	0.021	*EcoSSL*	2	YES	**YES**	**HQ > 1**
BHC, alpha-	0.00077	–	0.0994	*R5*	0.008	YES	**YES**	**Bioaccumulative**
BHC, beta-	0.00025	–	0.00398	*R5*	0.06	YES	**YES**	**Bioaccumulative**
Chlordane, alpha-	0.03	–	0.224	*R5*	0.1	YES	**YES**	**Bioaccumulative**
Dieldrin	0.27	–	0.0049	*EcoSSL*	60	YES	**YES**	**HQ > 1**
Endrin Aldehyde	0.04	–	0.0105	*R5*	4	no	**YES**	**HQ > 1**
Polycyclic Aromatic Hydrocarbons								
2-Methylnaphthalene	0.04	–	3.24	*R5*	0.01	no	no	HQ • 1
Acenaphthene	0.0065	–	682	*R5*	0.00001	YES	**YES**	**Bioaccumulative**
Acenaphthylene	0.07	–	682	*R5*	0.0001	YES	**YES**	**Bioaccumulative**
Anthracene	0.1	–	1,480	*R5*	0.00007	YES	**YES**	**Bioaccumulative**
Benzo(a)anthracene	0.4	–	5.21	*R5*	0.08	YES	**YES**	**Bioaccumulative**
Benzo(a)pyrene	0.4	–	1.52	*R5*	0.3	YES	**YES**	**Bioaccumulative**
Benzo(b)fluoranthene	1	–	59.8	*R5*	0.02	YES	**YES**	**Bioaccumulative**
Benzo(g,h,i)perylene	0.037	–	119	*R5*	0.0003	YES	**YES**	**Bioaccumulative**
Benzo(k)fluoranthene	0.56	–	148	*R5*	0.004	YES	**YES**	**Bioaccumulative**
Chrysene	0.66	–	4.73	*R5*	0.1	YES	**YES**	**Bioaccumulative**
Dibenzo(a,h)anthracene	0.05	–	18.4	*R5*	0.003	YES	**YES**	**Bioaccumulative**
Fluoranthene	0.39	–	122	*R5*	0.003	YES	**YES**	**Bioaccumulative**
Fluorene	0.0067	–	122	*R5*	0.00005	YES	**YES**	**Bioaccumulative**
Indeno(1,2,3-cd)pyrene	0.11	–	109	*R5*	0.001	YES	**YES**	**Bioaccumulative**
Naphthalene	0.0069	–	0.0994	*R5*	0.07	no	no	HQ • 1
Phenanthrene	0.1	–	45.7	*R5*	0.002	YES	**YES**	**Bioaccumulative**
Pyrene	0.86	–	78.5	*R5*	0.01	YES	**YES**	**Bioaccumulative**

Table 8-20
Screening Level -Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Background Concentration [a] (mg/kg)	Ecological Screening Level (ESLs) [b] (mg/kg)		Maximum HQ [c] (unitless)	Bioaccumulative Chemical?[d] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [e]	
			Value	*Source*			(YES/no)	Rationale
Polychlorinated Biphenyls								
Aroclor 1254	1.7	–	NA		NA	YES	**YES**	**Bioaccumulative**
Inorganics								
Aluminum	43,600	40,041	50	*ORNL*	900	no	**YES**	**HQ > 1**
Antimony	0.58	NA	0.27	*EcoSSL*	2	no	**YES**	**HQ > 1**
Arsenic	20.8	15.8	18	*EcoSSL*	1	YES	**YES**	**HQ > 1**
Barium	1,770	209	330	*EcoSSL*	5	no	**YES**	**HQ > 1**
Beryllium	2.46	1.02	21	*EcoSSL*	0.1	no	no	HQ • 1
Cadmium	1.8	0.69	0.36	*EcoSSL*	5	YES	**YES**	**HQ > 1**
Calcium	196,000	NA	NA		NA	no	no	NT
Chromium	59	65.3	26	*EcoSSL*	2	YES	no	max • BKGD
Cobalt	74.9	72.3	13	*EcoSSL*	6	no	**YES**	**HQ > 1**
Copper	60.2	53.5	28	*EcoSSL*	2	YES	**YES**	**HQ > 1**
Iron	50,100	50,962	NA		NA	no	no	max • BKGD
Lead	149	26.8	11	*EcoSSL*	10	YES	**YES**	**HQ > 1**
Magnesium	104,000	NA	NA		NA	no	no	NT
Manganese	791	2,543	220	*EcoSSL*	4	no	no	max • BKGD
Mercury	0.41	0.13	0.1	*R5*	4	no	**YES**	**HQ > 1**
Nickel	42.2	62.8	38	*EcoSSL*	1	YES	no	max • BKGD
Potassium	4,570	NA	NA		NA	no	no	NT
Selenium	1	NA	0.52	*EcoSSL*	2	YES	**YES**	**HQ > 1**
Sodium	331	NA	NA		NA	no	no	NT
Thallium	0.89	2.11	0.05692	*R5*	20	no	no	max • BKGD
Vanadium	91.5	108	7.8	*EcoSSL*	10	no	no	max • BKGD
Zinc	752	202	46	*EcoSSL*	20	YES	**YES**	**HQ > 1**

Notes:
– = Not available or applicable.
mg/kg = Milligrams per kilogram.
NA = Not available or applicable.

[a] Background levels for inorganics are facility-wide soil background point estimates taken from Facility-Wide Background Study Report (IT Corporation 2001).
[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[c] The maximum hazard quotient (HQ) is the ratio of the maximum constituent concentration to the surface soil screening level. HQs are rounded to one significant figure.
[d] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.
[e] Constituents with a hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for screening level assessment unless they were essential nutrients and thus considered non-toxic (NT), or were inorganics present at concentrations below background (max • BKGD).

Table 8-21
Screening Level - Constituents of Potential Ecological Concern in Sediment
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Ecological Screening Level (ESLs) [a] (mg/kg)		Maximum HQ [b] (unitless)	Bioaccumulative Chemical?[c] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [d]	
		Value	*Source*			(YES/no)	Rationale
Volatile Organic Compounds							
2-Butanone	0.1	0.0424	*R5*	2	no	**YES**	**HQ > 1**
Acetone	0.53	0.0099	*R5*	50	no	**YES**	**HQ > 1**
Carbon Disulfide	0.0022	0.000851	*R3*	3	no	**YES**	**HQ > 1**
Methylene Chloride	0.003	0.159	*R5*	0.02	no	no	HQ • 1
Semi-Volatile Organic Compounds							
4-Methylphenol	0.036	0.67	*R3*	0.05	no	no	HQ • 1
Benzoic Acid	0.28	0.65	*R3*	0.4	no	no	HQ • 1
bis(2-Ethylhexyl)phthalate	0.33	0.18	*R3*	2	no	**YES**	**HQ > 1**
Di-n-Butylphthalate	0.069	6.47	*R3*	0.01	no	no	HQ • 1
Explosives							
Nitroglycerine	0.57	NA		NA	no	**YES**	**NSL**
Pentaerythritol Tetranitrate	0.23	NA		NA	no	**YES**	**NSL**
Herbicides							
2,4,5-T	0.0334	12.3	*R3*	0.003	no	no	HQ • 1
2,4,5-TP	0.104	0.675	*R3*	0.2	no	no	HQ • 1
2,4-D	0.209	1.273	*R5*	0.2	no	no	HQ • 1
Dalapon	0.107	NA		NA	no	**YES**	**NSL**
Dicamba	0.0497	NA		NA	no	**YES**	**NSL**
Dichlorprop	0.353	NA		NA	no	**YES**	**NSL**
MCPP	3.53	NA		NA	no	**YES**	**NSL**
Pesticides							
4,4'-DDD	0.00209	0.00488	*R3*	0.4	YES	**YES**	**Bioaccumulative**
4,4'-DDE	0.0084	0.00316	*R3*	3	YES	**YES**	**HQ > 1**
4,4'-DDT	0.004	7	*ORNL*	0.0006	YES	**YES**	**Bioaccumulative**
BHC, alpha-	0.00059	0.006	*R3*	0.1	YES	**YES**	**Bioaccumulative**
BHC, delta-	0.0012	6.4	*R3*	0.0002	YES	**YES**	**Bioaccumulative**
BHC, gamma- (Lindane)	0.00097	0.00237	*R3*	0.4	YES	**YES**	**Bioaccumulative**
Chlordane, alpha-	0.0101	0.00324	*R3s*	3	YES	**YES**	**HQ > 1**
Chlordane, gamma-	0.013	0.00324	*R3s*	4	no	**YES**	**HQ > 1**
Dieldrin	0.0041	0.0019	*R3*	2	YES	**YES**	**HQ > 1**
Endosulfan II	0.00072	0.014	*R3*	0.05	YES	**YES**	**Bioaccumulative**
Endrin	0.0125	0.00222	*R3*	6	YES	**YES**	**HQ > 1**
Endrin Aldehyde	0.04	0.48	*R5*	0.08	no	no	HQ • 1
Endrin Ketone	0.00203	0.00222	*R3s*	0.9	no	no	HQ • 1
Heptachlor	0.00213	0.068	*R3*	0.03	YES	**YES**	**Bioaccumulative**
Heptachlor Epoxide	0.00726	0.00247	*R3*	3	YES	**YES**	**HQ > 1**
Methoxychlor	0.0026	0.0187	*R3*	0.1	YES	**YES**	**Bioaccumulative**
Polycyclic Aromatic Hydrocarbons							
2-Methylnaphthalene	0.04	0.0202	*R3*	2	no	**YES**	**HQ > 1**
Acenaphthene	0.059	0.0067	*R3*	9	YES	**YES**	**HQ > 1**
Acenaphthylene	0.026	0.0059	*R3*	4	YES	**YES**	**HQ > 1**
Anthracene	0.081	0.0572	*R3*	1	YES	**YES**	**Bioaccumulative**
Benzo(a)anthracene	0.19	0.108	*R3*	2	YES	**YES**	**HQ > 1**

Table 8-21
Screening Level - Constituents of Potential Ecological Concern in Sediment
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Ecological Screening Level (ESLs) [a] (mg/kg)		Maximum HQ [b] (unitless)	Bioaccumulative Chemical?[c] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [d]	
		Value	*Source*			(YES/no)	Rationale
Benzo(a)pyrene	0.17	0.15	*R3*	1	YES	**YES**	**Bioaccumulative**
Benzo(b)fluoranthene	0.25	10.4	*R5*	0.02	YES	**YES**	**Bioaccumulative**
Benzo(g,h,i)perylene	0.1	0.17	*R3*	0.6	YES	**YES**	**Bioaccumulative**
Benzo(k)fluoranthene	0.08	0.24	*R3*	0.3	YES	**YES**	**Bioaccumulative**
Chrysene	0.17	0.166	*R3*	1	YES	**YES**	**Bioaccumulative**
Dibenzo(a,h)anthracene	0.026	0.033	*R3*	0.8	YES	**YES**	**Bioaccumulative**
Fluoranthene	0.44	0.423	*R3*	1	YES	**YES**	**Bioaccumulative**
Fluorene	0.046	0.0774	*R3*	0.6	YES	**YES**	**Bioaccumulative**
Indeno(1,2,3-cd)pyrene	0.12	0.017	*R3*	7	YES	**YES**	**HQ > 1**
Naphthalene	0.043	0.176	*R3*	0.2	no	no	HQ • 1
Phenanthrene	0.36	0.204	*R3*	2	YES	**YES**	**HQ > 1**
Pyrene	0.3	0.195	*R3*	2	YES	**YES**	**HQ > 1**
Inorganics							
Aluminum	27,000	58,000	*ARCS_PEC*	0.5	no	no	HQ • 1
Antimony	1	2	*R3*	0.5	no	no	HQ • 1
Arsenic	11.8	9.8	*R3*	1	YES	**YES**	**Bioaccumulative**
Barium	113	NA		NA	no	**YES**	**NSL**
Beryllium	1.67	NA		NA	no	**YES**	**NSL**
Cadmium	0.21	0.99	*R3*	0.2	YES	**YES**	**Bioaccumulative**
Calcium	176,000	NA		NA	no	no	NT
Chromium	80.9	43.4	*R3*	2	YES	**YES**	**HQ > 1**
Cobalt	15	50	*R3*	0.3	no	no	HQ • 1
Copper	47.6	31.6	*R3*	2	YES	**YES**	**HQ > 1**
Iron	79,600	20,000	*R3*	4	no	**YES**	**HQ > 1**
Lead	33	35.8	*R3*	0.9	YES	**YES**	**Bioaccumulative**
Magnesium	42,500	NA		NA	no	no	NT
Manganese	1,220	460	*R3*	3	no	**YES**	**HQ > 1**
Mercury	0.08	0.18	*R3*	0.4	no	no	HQ • 1
Nickel	24.5	22.7	*R3*	1	YES	**YES**	**Bioaccumulative**
Potassium	2,620	NA		NA	no	no	NT
Selenium	1.7	2	*R3*	0.9	YES	**YES**	**Bioaccumulative**
Sodium	110	NA		NA	no	no	NT
Thallium	0.45	NA		NA	no	**YES**	**NSL**
Vanadium	110	NA		NA	no	**YES**	**NSL**
Zinc	110	121	*R3*	0.9	YES	**YES**	**Bioaccumulative**

Notes:
– = Not available or applicable.
mg/kg = Milligrams per kilogram.
NA = Not available or applicable.

[a] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[b] The maximum hazard quotient (HQ) is the ratio of the maximum constituent concentration to the sediment screening level. HQs are rounded to one significant figure.
[c] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.
[d] Constituents with a hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for screening level assessment unless they were essential nutrients and thus considered non-toxic (NT).

Table 8-22
Screening Level - Constituents of Potential Ecological Concern in Surface Water
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/L)	Ecological Screening Level (ESLs) [a] (mg/L) Value	*Source*	Maximum HQ [b] (unitless)	Bioaccumulative Chemical?[c] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rationale
Volatile Organic Compounds							
Carbon Disulfide	0.0003	0.00092	*R3*	0.3	no	no	HQ • 1
Chloroform	0.00037	0.0018	*R3*	0.2	no	no	HQ • 1
Semi-Volatile Organic Compounds							
Benzoic Acid	0.0061	0.042	*R3*	0.1	no	no	HQ • 1
bis(2-Ethylhexyl)phthalate	0.008	0.016	*R3*	0.5	no	no	HQ • 1
Butylbenzylphthalate	0.0011	0.019	*R3*	0.06	no	no	HQ • 1
Diethylphthalate	0.00037	0.21	*R3*	0.002	no	no	HQ • 1
Di-n-Butylphthalate	0.001	0.019	*R3*	0.05	no	no	HQ • 1
Explosives							
m-Nitrotoluene	0.00125	0.75	*R3*	0.002	no	no	HQ • 1
Nitrobenzene	0.0002	0.22	*R5*	0.0009	no	no	HQ • 1
Nitroglycerine	0.00061	0.138	*R3*	0.004	no	no	HQ • 1
Herbicides							
2,4,5-TP	0.00005	0.03	*R3*	0.002	no	no	HQ • 1
2,4-D	0.00466	0.22	*R5*	0.02	no	no	HQ • 1
2,4-DB	0.00041	NA		NA	no	**YES**	**NSL**
MCPA	0.11	NA		NA	no	**YES**	**NSL**
MCPP	0.0463	NA		NA	no	**YES**	**NSL**
Pesticides							
4,4'-DDT	0.00001	0.0000005	*R3*	20	YES	**YES**	**HQ > 1**
BHC, delta-	0.00001	0.141	*R3*	0.00007	YES	**YES**	**Bioaccumulative**
Dieldrin	0.00000719	0.000056	*R3*	0.1	YES	**YES**	**Bioaccumulative**
Endosulfan Sulfate	0.00003	0.00222	*R5*	0.01	no	no	HQ • 1
Endrin Aldehyde	0.00001	0.00015	*R5*	0.07	no	no	HQ • 1
Endrin Ketone	0.00000828	0.000036	*R3s*	0.2	no	no	HQ • 1
Polycyclic Aromatic Hydrocarbons							
2-Methylnaphthalene	0.00003	0.0047	*R3*	0.006	no	no	HQ • 1
Naphthalene	0.00003	0.0011	*R3*	0.03	no	no	HQ • 1
Phenanthrene	0.00002	0.0004	*R3*	0.05	YES	**YES**	**Bioaccumulative**

Table 8-22
Screening Level - Constituents of Potential Ecological Concern in Surface Water
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/L)	Ecological Screening Level (ESLs) [a] (mg/L)		Maximum HQ [b] (unitless)	Bioaccumulative Chemical?[c] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [d]	
		Value	*Source*			(YES/no)	Rationale
Inorganics							
Aluminum	0.608	0.087	*R3*	7	no	**YES**	**HQ > 1**
Antimony	0.00058	0.03	*R3*	0.02	no	no	HQ • 1
Barium	0.0796	0.004	*R3*	20	no	**YES**	**HQ > 1**
Cadmium	0.00011	0.00025	*R3*	0.4	YES	**YES**	**Bioaccumulative**
Calcium	59.5	116	*R3*	NA	no	no	NT
Chromium	0.0055	0.085	*R3*	0.06	YES	**YES**	**Bioaccumulative**
Copper	0.038	0.009	*R3*	4	YES	**YES**	**HQ > 1**
Iron	4.47	0.3	*R3*	10	no	**YES**	**HQ > 1**
Lead	0.031	0.0025	*R3*	10	YES	**YES**	**HQ > 1**
Magnesium	26.6	82	*R3*	NA	no	no	NT
Manganese	0.102	0.12	*R3*	0.9	no	no	HQ • 1
Potassium	3.75	NA		NA	no	no	NT
Selenium	0.00048	0.001	*R3*	0.5	YES	**YES**	**Bioaccumulative**
Silver	0.0083	0.0032	*R3*	3	YES	**YES**	**HQ > 1**
Sodium	36.8	680	*R3*	NA	no	no	NT
Zinc	0.274	0.12	*R3*	2	YES	**YES**	**HQ > 1**

Notes:
– = Not available or applicable.
mg/L = Milligrams per liter.
NA = Not available or applicable.

[a] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.

[b] The maximum hazard quotient (HQ) is the ratio of the maximum constituent concentration to the surface water screening level. HQs are rounded to one significant figure

[c] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.

[d] Constituents with a hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for screening level assessment unless they were essential nutrients and thus considered non-toxic (NT).

Table 8-23
Baseline Level - Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)		Ecological Screening Level (ESLs) [b] (mg/kg)		Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d]		Bioaccumulative ? [e] (YES/no)
			Value	*Source*		(YES/no)	Rationale	
Volatile Organic Compounds								
3-Octanone	0.15	m	NA		NA	**YES**	**NSL**	no
Ethanol	0.087	m	NA		NA	**YES**	**NSL**	no
Semi-Volatile Organic Compounds								
2,6-Dinitrotoluene	0.32	m	0.0328	*R5*	10	**YES**	**HQ > 1**	no
Benzoic Acid	0.17	m	NA		NA	**YES**	**NSL**	no
bis(2-Ethylhexyl)phthalate	0.312		0.92594	*R5*	0.3	no	**HQ • 1**	no
Carbazole	0.12	m	NA		NA	**YES**	**NSL**	no
Dibenzofuran	0.045	m	NA		NA	**YES**	**NSL**	no
Di-n-Butylphthalate	0.213		0.15	*R5*	1	no	**HQ • 1**	no
Pentachlorophenol	830	m	2.1	*EcoSSL*	400	**YES**	**HQ > 1**	**YES**
Pesticides								
4,4'-DDE	0.04	m	0.021	*EcoSSL*	2	**YES**	**HQ > 1**	**YES**
BHC, alpha-	0.00077	m	0.0994	*R5*	0.008	**YES**	**Bioaccumulative**	**YES**
BHC, beta-	0.00025	m	0.00398	*R5*	0.06	**YES**	**Bioaccumulative**	**YES**
Chlordane, alpha-	0.03	m	0.224	*R5*	0.1	**YES**	**Bioaccumulative**	**YES**
Dieldrin	0.27	m	0.0049	*EcoSSL*	60	**YES**	**HQ > 1**	**YES**
Endrin Aldehyde	0.04	m	0.0105	*R5*	4	**YES**	**HQ > 1**	**YES**
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	0.0065	m	682	*R5*	0.00001	**YES**	**Bioaccumulative**	**YES**
Acenaphthylene	0.07	m	682	*R5*	0.0001	**YES**	**Bioaccumulative**	**YES**
Anthracene	0.0216		1,480	*R5*	0.00001	**YES**	**Bioaccumulative**	**YES**
Benzo(a)anthracene	0.242		5.21	*R5*	0.05	**YES**	**Bioaccumulative**	**YES**
Benzo(a)pyrene	0.242		1.52	*R5*	0.2	**YES**	**Bioaccumulative**	**YES**
Benzo(b)fluoranthene	0.476		59.8	*R5*	0.008	**YES**	**Bioaccumulative**	**YES**
Benzo(g,h,i)perylene	0.0231		119	*R5*	0.0002	**YES**	**Bioaccumulative**	**YES**
Benzo(k)fluoranthene	0.27		148	*R5*	0.002	**YES**	**Bioaccumulative**	**YES**
Chrysene	0.318		4.73	*R5*	0.07	**YES**	**Bioaccumulative**	**YES**
Dibenzo(a,h)anthracene	0.011		18.4	*R5*	0.0006	**YES**	**Bioaccumulative**	**YES**
Fluoranthene	0.102		122	*R5*	0.0008	**YES**	**Bioaccumulative**	**YES**
Fluorene	0.0067	m	122	*R5*	0.00005	**YES**	**Bioaccumulative**	**YES**
Indeno(1,2,3-cd)pyrene	0.0277		109	*R5*	0.0003	**YES**	**Bioaccumulative**	**YES**
Phenanthrene	0.0596		45.7	*R5*	0.001	**YES**	**Bioaccumulative**	**YES**
Pyrene	0.412		78.5	*R5*	0.005	**YES**	**Bioaccumulative**	**YES**
Polychlorinated Biphenyls								
Aroclor 1254	0.385		NA		NA	**YES**	**NSL**	**YES**

Table 8-23
Baseline Level - Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)	Ecological Screening Level (ESLs) [b] (mg/kg) Value	*Source*	Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rationale	Bioaccumulative ? [e] (YES/no)
Inorganics							
Aluminum	24,984	50	*ORNL*	500	**YES**	**HQ > 1**	no
Antimony	0.368	0.27	*EcoSSL*	1	no	**HQ • 1**	no
Barium	403	330	*EcoSSL*	1	no	**HQ • 1**	no
Cadmium	0.319	0.36	*EcoSSL*	0.9	**YES**	**Bioaccumulative**	**YES**
Cobalt	27.35	13	*EcoSSL*	2	**YES**	**HQ > 1**	no
Copper	25.89	28	*EcoSSL*	0.9	**YES**	**Bioaccumulative**	**YES**
Iron	34,847	NA		NA	no		no
Lead	51.33	11	*EcoSSL*	5	**YES**	**HQ > 1**	**YES**
Mercury	0.135	0.1	*R5*	1	no	**HQ • 1**	no
Selenium	1 m	0.52	*EcoSSL*	2	**YES**	**HQ > 1**	**YES**
Zinc	186.4	46	*EcoSSL*	4	**YES**	**HQ > 1**	**YES**

Notes:
– = Not available or applicable.
mg/kg = Milligrams per kilogram.
NA = Not available or applicable.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[c] The refined hazard quotient (HQ) is the ratio of the EPC to the surface soil screening level. HQs are rounded to one significant figure.
[d] Constituents with a refined hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for baseline risk assessment.
[e] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.

Table 8-24
Baseline Level - Constituents of Potential Ecological Concern in Sediment
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)		Ecological Screening Level (ESLs) [b] (mg/kg) Value	*Source*	Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rationale	Bioaccumulative ? [e] (YES/no)
Volatile Organic Compounds								
2-Butanone	0.1	m	0.0424	*R5*	2	**YES**	**HQ > 1**	no
Acetone	0.13		0.0099	*R5*	10	**YES**	**HQ > 1**	no
Carbon Disulfide	0.0022	m	0.000851	*R3*	3	**YES**	**HQ > 1**	no
Semi-Volatile Organic Compounds								
bis(2-Ethylhexyl)phthalate	0.219		0.18	*R3*	1	no	**HQ • 1**	no
Explosives								
Nitroglycerine	0.57	m	NA		NA	**YES**	**NSL**	no
Pentaerythritol Tetranitrate	0.23	m	NA		NA	**YES**	**NSL**	no
Herbicides								
Dalapon	0.107	m	NA		NA	**YES**	**NSL**	no
Dicamba	0.0497	m	NA		NA	**YES**	**NSL**	no
Dichlorprop	0.353	m	NA		NA	**YES**	**NSL**	no
MCPP	3.53	m	NA		NA	**YES**	**NSL**	no
Pesticides								
4,4'-DDD	0.00209	m	0.00488	*R3*	0.4	**YES**	**Bioaccumulative**	**YES**
4,4'-DDE	0.00368		0.00316	*R3*	1	**YES**	**Bioaccumulative**	**YES**
4,4'-DDT	0.00274		7	*ORNL*	0.0004	**YES**	**Bioaccumulative**	**YES**
BHC, alpha-	0.00059	m	0.006	*R3*	0.1	**YES**	**Bioaccumulative**	**YES**
BHC, delta-	0.0012	m	6.4	*R3*	0.0002	**YES**	**Bioaccumulative**	**YES**
BHC, gamma- (Lindane)	0.00097	m	0.00237	*R3*	0.4	**YES**	**Bioaccumulative**	**YES**
Chlordane, alpha-	0.0101	m	0.00324	*R3s*	3	**YES**	**HQ > 1**	**YES**
Chlordane, gamma-	0.013	m	0.00324	*R3s*	4	**YES**	**HQ > 1**	**YES**
Dieldrin	0.0041	m	0.0019	*R3*	2	**YES**	**HQ > 1**	**YES**
Endosulfan II	0.00072	m	0.014	*R3*	0.05	**YES**	**Bioaccumulative**	**YES**
Endrin	0.0125	m	0.00222	*R3*	6	**YES**	**HQ > 1**	**YES**
Heptachlor	0.00213	m	0.068	*R3*	0.03	**YES**	**Bioaccumulative**	**YES**
Heptachlor Epoxide	0.00726	m	0.00247	*R3*	3	**YES**	**HQ > 1**	**YES**
Methoxychlor	0.0026	m	0.0187	*R3*	0.1	**YES**	**Bioaccumulative**	**YES**
Polycyclic Aromatic Hydrocarbons								
2-Methylnaphthalene	0.0217		0.0202	*R3*	1	no	**HQ • 1**	no
Acenaphthene	0.059	m	0.0067	*R3*	9	**YES**	**HQ > 1**	**YES**
Acenaphthylene	0.026	m	0.0059	*R3*	4	**YES**	**HQ > 1**	**YES**
Anthracene	0.0447		0.0572	*R3*	0.8	**YES**	**Bioaccumulative**	**YES**
Benzo(a)anthracene	0.123		0.108	*R3*	1	**YES**	**Bioaccumulative**	**YES**
Benzo(a)pyrene	0.0891		0.15	*R3*	0.6	**YES**	**Bioaccumulative**	**YES**
Benzo(b)fluoranthene	0.139		10.4	*R5*	0.01	**YES**	**Bioaccumulative**	**YES**
Benzo(g,h,i)perylene	0.073		0.17	*R3*	0.4	**YES**	**Bioaccumulative**	**YES**
Benzo(k)fluoranthene	0.0443		0.24	*R3*	0.2	**YES**	**Bioaccumulative**	**YES**
Chrysene	0.0808		0.166	*R3*	0.5	**YES**	**Bioaccumulative**	**YES**
Dibenzo(a,h)anthracene	0.026	m	0.033	*R3*	0.8	**YES**	**Bioaccumulative**	**YES**

Table 8-24
Baseline Level - Constituents of Potential Ecological Concern in Sediment
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)		Ecological Screening Level (ESLs) [b] (mg/kg) Value	*Source*	Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rationale	Bioaccumulative ? [e] (YES/no)
Fluoranthene	0.238		0.423	*R3*	0.6	**YES**	**Bioaccumulative**	**YES**
Fluorene	0.046	m	0.0774	*R3*	0.6	**YES**	**Bioaccumulative**	**YES**
Indeno(1,2,3-cd)pyrene	0.0824		0.017	*R3*	5	**YES**	**HQ > 1**	**YES**
Phenanthrene	0.253		0.204	*R3*	1	**YES**	**Bioaccumulative**	**YES**
Pyrene	0.125		0.195	*R3*	0.6	**YES**	**Bioaccumulative**	**YES**
Inorganics								
Arsenic	7.788		9.8	*R3*	0.8	**YES**	**Bioaccumulative**	**YES**
Barium	77.57		NA		NA	**YES**	**NSL**	no
Beryllium	1.09		NA		NA	**YES**	**NSL**	no
Cadmium	0.154		0.99	*R3*	0.2	**YES**	**Bioaccumulative**	**YES**
Chromium	45.48		43.4	*R3*	1	no	**HQ • 1**	no
Copper	24.06		31.6	*R3*	0.8	**YES**	**Bioaccumulative**	**YES**
Iron	33,199		20,000	*R3*	2	**YES**	**HQ > 1**	no
Lead	22	avg	35.8	*R3*	0.6	**YES**	**Bioaccumulative**	**YES**
Manganese	535.9		460	*R3*	1	no	**HQ • 1**	no
Nickel	17.19		22.7	*R3*	0.8	**YES**	**Bioaccumulative**	**YES**
Selenium	1.13		2	*R3*	0.6	**YES**	**Bioaccumulative**	**YES**
Thallium	0.296		NA		NA	**YES**	**NSL**	no
Vanadium	57.92		NA		NA	**YES**	**NSL**	no
Zinc	73.56		121	*R3*	0.6	**YES**	**Bioaccumulative**	**YES**

Notes:
– = Not available or applicable.
mg/kg = Milligrams per kilogram.
NA = Not available or applicable.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[c] The refined hazard quotient (HQ) is the ratio of the EPC to the sediment screening level. HQs are rounded to one significant figure.
[d] Constituents with a refined hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for baseline risk assessment.
[e] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.

Table 8-25
Baseline Level - Constituents of Potential Ecological Concern in Surface Water
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/L)		Ecological Screening Level (ESLs) [b] (mg/L) Value	*Source*	Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rationale	Bioaccumulative ? [e] (YES/no)
Herbicides								
2,4-DB	0.00041	m	NA		NA	**YES**	**NSL**	no
MCPA	0.11	m	NA		NA	**YES**	**NSL**	no
MCPP	0.0463	m	NA		NA	**YES**	**NSL**	no
Pesticides								
4,4'-DDT	0.00001	m	0.0000005	*R3*	20	**YES**	**HQ > 1**	**YES**
BHC, delta-	0.00001	m	0.141	*R3*	0.00007	**YES**	**Bioaccumulative**	**YES**
Dieldrin	0.00000719	m	0.000056	*R3*	0.1	**YES**	**Bioaccumulative**	**YES**
Polycyclic Aromatic Hydrocarbons								
Phenanthrene	0.00002	m	0.0004	*R3*	0.05	**YES**	**Bioaccumulative**	**YES**
Inorganics								
Aluminum	0.608	m	0.087	*R3*	7	**YES**	**HQ > 1**	no
Barium	0.0796	m	0.004	*R3*	20	**YES**	**HQ > 1**	no
Cadmium	0.00011	m	0.00025	*R3*	0.4	**YES**	**Bioaccumulative**	**YES**
Chromium	0.0055	m	0.085	*R3*	0.06	no	**HQ • 1**	no
Copper	0.038	m	0.009	*R3*	4	**YES**	**HQ > 1**	**YES**
Iron	4.47	m	0.3	*R3*	10	**YES**	**HQ > 1**	no
Lead	0.031	m	0.0025	*R3*	10	**YES**	**HQ > 1**	**YES**
Selenium	0.00048	m	0.001	*R3*	0.5	**YES**	**Bioaccumulative**	**YES**
Silver	0.0083	m	0.0032	*R3*	3	**YES**	**HQ > 1**	**YES**
Zinc	0.274	m	0.12	*R3*	2	**YES**	**HQ > 1**	**YES**

Notes:
– = Not available or applicable.
mg/L = Milligrams per liter.
NA = Not available or applicable.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[c] The refined hazard quotient (HQ) is the ratio of the EPC to the surface water screening level. HQs are rounded to one significant figure.
[d] Constituents with a refined hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for baseline risk assessment.
[e] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.

Table 8-26

Summary of Ecological Risk Characterization Results - Terrestrial Habitat

RAIL YARD

New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Soil Frequency of Detection # detects / n samples	Soil Frequency of Detection %	EPC (mg/kg)		Baseline Level Assessment Hazard Quotient [a]	Baseline Level Assessment Ecological Screening Level [b] Source	Baseline Level Assessment Ecological Screening Level [b] Basis	Bioaccum-ulative ? (YES/no)	Results of Refined Food Chain Models [c] Short-tailed Shrew LOAEL HQ	Short-tailed Shrew NOAEL HQ	American Robin LOAEL HQ	American Robin NOAEL HQ
Volatile Organic Compounds												
3-Octanone	3 / 3	100%	0.15	m	NA			no	–	–	–	–
Ethanol	2 / 2	100%	0.087	m	NA			no	–	–	–	–
Semi-Volatile Organic Compounds												
2,6-Dinitrotoluene	1 / 34	3%	0.32	m	**10**	R5		no	–	–	–	–
Benzoic Acid	2 / 31	6%	0.17	m	NA			no	–	–	–	–
Carbazole	2 / 34	6%	0.12	m	NA			no	–	–	–	–
Dibenzofuran	1 / 31	3%	0.045	m	NA			no	–	–	–	–
Pentachlorophenol	2 / 34	6%	830	m	**400**	EcoSSL	avi	YES	**10**	**100**	0.1	1
Pesticides												
4,4'-DDE	2 / 10	20%	0.04	m	**2**	EcoSSL	mam	YES	0.001	0.005	0.1	1
BHC, alpha-	4 / 6	67%	0.0008	m	0.008	R5		YES	0.00002	0.00004	0.00003	0.0001
BHC, beta-	2 / 6	33%	0.0003	m	0.06	R5		YES	0.00001	0.00005	0.000008	0.00003
Chlordane, alpha-	2 / 10	20%	0.03	m	0.1	R5		YES	0.0001	0.001	0.0001	0.001
Dieldrin	1 / 9	11%	0.27	m	**60**	EcoSSL	mam	YES	0.1	1	0.02	0.2
Endrin Aldehyde	1 / 8	13%	0.04	m	**4**	R5		YES	0.007	0.07	0.001	0.01
Polycyclic Aromatic Hydrocarbons												
Acenaphthene	3 / 31	10%	0.0065	m	0.00001	R5		YES	0.00002	0.0002	0.000002	0.00002
Acenaphthylene	4 / 34	12%	0.07	m	0.0001	R5		YES	0.00004	0.000004	0.00003	0.0003
Anthracene	8 / 34	24%	0.0216		0.00001	R5		YES	0.00000004	0.0000004	0.000003	0.00003
Benzo(a)anthracene	15 / 36	42%	0.242		0.05	R5		YES	0.0008	0.008	0.00003	0.0003
Benzo(a)pyrene	15 / 36	42%	0.242		0.2	R5		YES	0.0004	0.004	0.00004	0.0004
Benzo(b)fluoranthene	15 / 36	42%	0.476		0.008	R5		YES	0.0003	0.007	0.00007	0.0007
Benzo(g,h,i)perylene	13 / 31	42%	0.0231		0.0002	R5		YES	0.0007	0.007	0.000003	0.00003
Benzo(k)fluoranthene	14 / 36	39%	0.27		0.002	R5		YES	0.0002	0.004	0.00004	0.0004
Chrysene	15 / 36	42%	0.318		0.07	R5		YES	0.00002	0.0002	0.00005	0.0005
Dibenzo(a,h)anthracene	7 / 34	21%	0.011		0.0006	R5		YES	0.02	0.2	0.000002	0.00002
Fluoranthene	15 / 36	42%	0.102		0.0008	R5		YES	0.00008	0.0008	0.00003	0.0003
Fluorene	3 / 31	10%	0.0067	m	0.00005	R5		YES	0.000001	0.000004	0.000002	0.00002
Indeno(1,2,3-cd)pyrene	14 / 34	41%	0.0277		0.0003	R5		YES	0.003	0.03	0.000004	0.00004
Phenanthrene	15 / 36	42%	0.0596		0.001	R5		YES	0.00003	0.0003	0.000009	0.00009
Pyrene	15 / 36	42%	0.412		0.005	R5		YES	0.0003	0.003	0.00006	0.0006
Polychlorinated Biphenyls												
Aroclor 1254	7 / 29	24%	0.385		NA			YES	0.09	0.9	0.02	0.2

Table 8-26

Summary of Ecological Risk Characterization Results - Terrestrial Habitat

RAIL YARD

New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Soil Frequency of Detection # detects / n samples			Soil Frequency of Detection %	Soil EPC (mg/kg)		Baseline Level Assessment Hazard Quotient [a]	Baseline Level Assessment Ecological Screening Level [b] Source	Baseline Level Assessment Ecological Screening Level [b] Basis	Bioaccumulative ? (YES/no)	Results of Refined Food Chain Models [c] Short-tailed Shrew LOAEL HQ	Short-tailed Shrew NOAEL HQ	American Robin LOAEL HQ	American Robin NOAEL HQ
Inorganics														
Aluminum	35	/	35	100%	24,984		**500**	ORNL		no	–	–	–	–
Cadmium	6	/	35	17%	0.319		0.9	EcoSSL	mam	YES	0.03	0.3	0.003	0.03
Cobalt	34	/	35	97%	27.35		**2**	EcoSSL	veg	no	–	–	–	–
Copper	34	/	35	97%	25.89		0.9	EcoSSL	avi	YES	0.01	0.02	0.01	0.01
Iron	35	/	35	100%	34,847		NA			no	–	–	–	–
Lead	35	/	35	100%	51.33		**5**	EcoSSL	avi	YES	0.005	0.05	0.02	0.2
Selenium	3	/	32	9%	1	m	**2**	EcoSSL	veg	YES	0.08	0.1	0.03	0.06
Zinc	35	/	35	100%	186.4		**4**	EcoSSL	avi	YES	0.2	**2**	0.08	0.7

Notes:

– =	Not applicable.
COPEC =	Constituent of Potential Ecological Concern.
EPC =	Exposure point concentrations - the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
LOAEL HQ =	Lowest observed adverse effect level hazard quotient.
mg/kg =	Milligrams per kilogram.
NA =	Not available.
NOAEL HQ =	No observed adverse effect level hazard quotient.
[a]	Hazard quotients (HQs) greater than one are presented in bold font. HQs are rounded to one significant figure (unitless).
[b]	See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate. R5: Region 5 Ecological Screening Levels (USEPA 2003e; R5). EcoSSL: USEPA Ecological Soil Screening Levels (USEPA 2005b, EcoSSL). Where readily available (i.e., EcoSSLs), the basis of the ESL is presented.
[c]	Foodchain modeling was conducted for bioaccumulative COPECs.

Table 8-27
Summary of Ecological Risk Characterization Results - Aquatic Habitat
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

	Sediment			Surface Water			Baseline Level Assessment			Results of Refined Food Chain Models [b]			
							Sediment	Surface Water					
	Frequency of Detection		EPC	Frequency of Detection		EPC	Hazard Quotient	Hazard Quotient	Bioaccum-ulative ?	Mink		Great Blue Heron	
Constituent	# detects / n samples	%	(mg/kg)	# detects / n samples	%	(mg/L)	[a]	[a]	(YES/no)	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ
Volatile Organic Compounds													
2-Butanone	2 / 14	14%	0.1 m	0 / 4	0%	–	**2**	NA	no	–	–	–	–
Acetone	5 / 14	36%	0.13	0 / 4	0%	–	**10**	NA	no	–	–	–	–
Carbon Disulfide	3 / 11	27%	0.0022 m	2 / 4	50%	–	**3**	NA	no	–	–	–	–
Explosives													
Nitroglycerine	2 / 11	18%	0.57 m	1 / 6	17%	–	NA	NA	no	–	–	–	–
Pentaerythritol Tetranitrate	2 / 11	18%	0.23 m	0 / 6	0%	–	NA	NA	no	–	–	–	–
Herbicides													
2,4-DB	0 / 11	0%	–	1 / 6	17%	0.00041 m	–	NA	no	–	–	–	–
Dalapon	1 / 11	9%	0.107 m	0 / 6	0%	–	NA	NA	no	–	–	–	–
Dicamba	1 / 11	9%	0.0497 m	0 / 6	0%	–	NA	NA	no	–	–	–	–
Dichlorprop	1 / 11	9%	0.353 m	0 / 6	0%	–	NA	NA	no	–	–	–	–
MCPA	0 / 11	0%	–	1 / 6	17%	0.11 m	–	NA	no	–	–	–	–
MCPP	1 / 11	9%	3.53 m	1 / 6	17%	0.0463 m	NA	NA	no	–	–	–	–
Pesticides													
4,4'-DDD	4 / 11	36%	0.00209 m	0 / 6	0%	–	0.4	NA	YES	0.00006	0.0003	0.007	0.07
4,4'-DDE	7 / 11	64%	0.00368	0 / 6	0%	–	1	NA	YES	0.0009	0.005	0.1	1
4,4'-DDT	6 / 11	55%	0.00274	1 / 6	17%	0.00001 m	0.0004	**20**	YES	0.00006	0.0003	0.007	0.07
BHC, alpha-	2 / 11	18%	0.00059 m	0 / 6	0%	–	0.1	NA	YES	–	–	–	–
BHC, delta-	2 / 11	18%	0.0012 m	1 / 6	17%	0.00001 m	0.0002	0.00007	YES	–	–	–	–
BHC, gamma- (Lindane)	1 / 11	9%	0.00097 m	0 / 6	0%	–	0.4	NA	YES	–	–	–	–
Chlordane, alpha-	4 / 11	36%	0.0101 m	0 / 6	0%	–	**3**	NA	YES	0.00005	0.0005	0.00004	0.0004
Chlordane, gamma-	4 / 11	36%	0.013 m	0 / 6	0%	–	**4**	NA	YES	0.00005	0.0005	0.00005	0.0005
Dieldrin	4 / 11	36%	0.0041 m	2 / 6	33%	0.00000719 m	**2**	0.1	YES	0.006	0.06	0.001	0.01
Endosulfan II	3 / 11	27%	0.00072 m	0 / 6	0%	–	0.05	NA	YES	–	–	–	–
Endrin	1 / 11	9%	0.0125 m	0 / 6	0%	–	**6**	NA	YES	–	–	–	–
Heptachlor	2 / 11	18%	0.00213 m	0 / 6	0%	–	0.03	NA	YES	0.0002	0.002	–	–
Heptachlor Epoxide	2 / 11	18%	0.00726 m	0 / 6	0%	–	**3**	NA	YES	0.0003	0.003	–	–
Methoxychlor	1 / 11	9%	0.0026 m	0 / 6	0%	–	0.1	NA	YES	–	–	–	–
Polycyclic Aromatic Hydrocarbons													
Acenaphthene	3 / 11	27%	0.059 m	0 / 6	0%	–	**9**	NA	YES	0.000001	0.00001	0.0000001	0.000001
Acenaphthylene	4 / 11	36%	0.026 m	0 / 6	0%	–	**4**	NA	YES	0.0000001	0.00000001	0.00000004	0.0000004
Anthracene	5 / 11	45%	0.0447	0 / 6	0%	–	0.8	NA	YES	0.000000003	0.00000003	0.00000008	0.0000008
Benzo(a)anthracene	9 / 11	82%	0.123	0 / 6	0%	–	1	NA	YES	0.00003	0.0003	0.0000005	0.000005
Benzo(a)pyrene	7 / 11	64%	0.0891	0 / 6	0%	–	0.6	NA	YES	0.000009	0.00009	0.0000004	0.000004
Benzo(b)fluoranthene	7 / 11	64%	0.139	0 / 6	0%	–	0.01	NA	YES	0.000004	0.0001	0.0000006	0.000006
Benzo(g,h,i)perylene	5 / 11	45%	0.073	0 / 6	0%	–	0.4	NA	YES	0.00007	0.0007	0.0000003	0.000003
Benzo(k)fluoranthene	7 / 11	64%	0.0443	0 / 6	0%	–	0.2	NA	YES	0.000001	0.00004	0.0000002	0.000002
Chrysene	9 / 11	82%	0.0808	0 / 6	0%	–	0.5	NA	YES	0.0000005	0.000005	0.0000003	0.000003
Dibenzo(a,h)anthracene	3 / 11	27%	0.026 m	0 / 6	0%	–	0.8	NA	YES	0.002	0.02	0.0000001	0.000001
Fluoranthene	10 / 14	71%	0.238	0 / 6	0%	–	0.6	NA	YES	0.000003	0.00003	0.000001	0.00001
Fluorene	4 / 11	36%	0.046 m	0 / 6	0%	–	0.6	NA	YES	0.00000007	0.0000002	0.00000008	0.0000008
Indeno(1,2,3-cd)pyrene	5 / 11	45%	0.0824	0 / 6	0%	–	**5**	NA	YES	0.00009	0.0009	0.0000003	0.000003
Phenanthrene	8 / 11	73%	0.253	1 / 6	17%	0.00002 m	1	0.05	YES	0.000005	0.00005	0.0000004	0.000004
Pyrene	9 / 11	82%	0.125	0 / 6	0%	–	0.6	NA	YES	0.000007	0.00007	0.0000005	0.000005

Table 8-27
Summary of Ecological Risk Characterization Results - Aquatic Habitat
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

	Sediment				Surface Water				Baseline Level Assessment			Results of Refined Food Chain Models [b]			
	Frequency of Detection		EPC		Frequency of Detection		EPC		Sediment Hazard Quotient	Surface Water Hazard Quotient	Bioaccum-ulative ?	Mink		Great Blue Heron	
Constituent	**# detects / n samples**	**%**	**(mg/kg)**		**# detects / n samples**	**%**	**(mg/L)**		**[a]**	**[a]**	**(YES/no)**	**LOAEL HQ**	**NOAEL HQ**	**LOAEL HQ**	**NOAEL HQ**
Inorganics															
Aluminum	14 / 14	100%	–		6 / 7	86%	0.608	m	–	**7**	no	–	–	–	–
Arsenic	14 / 14	100%	7.788		0 / 6	0%	–		0.8	NA	YES	0.09	0.9	0.03	0.08
Barium	14 / 14	100%	77.57		6 / 6	100%	0.0796	m	NA	**20**	no	–	–	–	–
Beryllium	14 / 14	100%	1.09		0 / 6	0%	–		NA	NA	no	–	–	–	–
Cadmium	8 / 11	73%	0.154		2 / 6	33%	0.00011	m	0.2	0.4	YES	0.008	0.08	0.0006	0.006
Copper	14 / 14	100%	24.06		1 / 7	14%	0.038	m	0.8	**4**	YES	0.06	0.07	0.02	0.02
Iron	14 / 14	100%	33,199		6 / 7	86%	4.47	m	**2**	**10**	no	–	–	–	–
Lead	14 / 14	100%	25.33	avg	5 / 7	71%	0.031	m	0.6	**10**	YES	0.02	0.2	0.03	0.3
Nickel	14 / 14	100%	17.19		0 / 6	0%	–		0.8	NA	YES	0.02	0.03	0.008	0.01
Selenium	5 / 14	36%	1.13		1 / 6	17%	0.00048	m	0.6	0.5	YES	0.2	0.4	0.06	0.1
Silver	0 / 11	0%	–		2 / 6	33%	0.0083	m	–	**3**	YES	–	–	–	–
Thallium	11 / 11	100%	0.296		0 / 6	0%	–		NA	NA	no	–	–	–	–
Vanadium	14 / 14	100%	57.92		0 / 6	0%	–		NA	NA	no	–	–	–	–
Zinc	14 / 14	100%	73.56		2 / 7	29%	0.274	m	0.6	**2**	YES	0.2	**2**	0.03	0.3

Notes:
– = Not applicable.
EPC = Exposure point concentrations - the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration.
EPCs marked with "m" are the maximum concentration.
LOAEL HQ = Lowest observed adverse effect level hazard quotient.
mg/kg = Milligrams per kilogram.
mg/L = Milligrams per liter.
NOAEL HQ = No observed adverse effect level hazard quotient.

[a] Hazard quotients (HQs) greater than one are presented in bold font. HQs are rounded to one significant figure (unitless).
[b] Foodchain modeling was conducted for bioaccumulative COPECs.

Table 9-1. Soil Analytical Results, Western Burning Ground, 1997 Gannett Fleming Independent Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	SS-04 0 - 0.5 06/03/97	SS-04a 0 - 0.5 06/03/97	SS-05 0 - 0.5 06/03/97
Dioxin/Furan							
1,2,3,4,6,7,8-HpCDD	0.00039 {ca**}	0.0016 {ca**}	- -	mg/kg	0.000021925	0.00001374	0.00001422
1,2,3,4,6,7,8-HpCDF	0.00032 {ca**}	0.0011 {ca**}	- -	mg/kg	0.000002541 B	0.000001492 B	0.000002285 B
1,2,3,4,7,8-HxCDF	0.000032 {ca**}	0.00011 {ca**}	- -	mg/kg	ND	ND	0.000000756 J
1,2,3,6,7,8-HxCDD	0.000039 {ca**}	0.00016 {ca**}	- -	mg/kg	0.000001062 J	0.000000503	ND
1,2,3,7,8,9-HxCDD	0.000039 {ca**}	0.00016 {ca**}	- -	mg/kg	0.000000567 J	ND	ND
OCDD	0.013 {ca**}	0.053 {ca**}	- -	mg/kg	0.00083547	0.00051434	0.00067782
OCDF	0.011 {ca**}	0.038 {ca**}	- -	mg/kg	0.00000397 B	0.000002011 B	0.000003306 B
Total HpCDDs	- -	- -	- -	mg/kg	0.000018718	0.00001187	0.000013721
Total HpCDFs	- -	- -	- -	mg/kg	0.000004247 I	0.000002527 I	0.000004698 I
Total HxCDDs	- -	- -	- -	mg/kg	0.000004853 J	0.000003464	0.000003753
Total HxCDFs	- -	- -	- -	mg/kg	0.000007154 J	0.000004695 I	0.000015869 I
Total PeCDFs	- -	- -	- -	mg/kg	0.000001176	0.000002388 I	0.000003891 I
Total TCDFs	- -	- -	- -	mg/kg	ND	0.000001169 I	0.000001248 I
PCBs							
Aroclor-1254	0.22 {ca**}	0.74 {ca*}	- -	mg/kg	0.084	0.047	ND
Volatile Organics							
Acetone	6,100 {nc}	61,000 {nc}	- -	mg/kg	ND	ND	0.0040 B
Carbon Disulfide	67 {nc}	300 {nc}	- -	mg/kg	0.00080 J	ND	ND
Methylene Chloride	11 {ca}	54 {ca}	- -	mg/kg	0.0030 B	0.0030 B	0.0020 B
Semivolatile Organics							
bis(2-Ethylhexyl)phthalate	35 {ca*}	120 {ca*}	- -	mg/kg	0.10 J	0.090 J	0.070 J
Di-n-Butylphthalate	610 {nc}	6,200 {nc}	- -	mg/kg	0.040 J	ND	ND
Inorganics							
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	18,700	20,300	13,600
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	9.70	6.10	7.20
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	22.4 J	23.8 J	35.6 J
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	0.700	0.600	0.600
Calcium	- -	- -	- -	mg/kg	980	702	1,080
Chromium	280 {ca}	1,460 {ca}	65.3	mg/kg	39.1	37.1	34.4
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	12.3	13.6	5.10
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	**57.6**	25.6	26.4
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	47,800	39,100	35,700
Lead	400 {++}	800 {++}	26.8	mg/kg	**42.9**	**27.5**	**310**
Magnesium	- -	- -	- -	mg/kg	763	657	524
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	255	347	188
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	15.0	18.9	10.2
Potassium	- -	- -	- -	mg/kg	684	674	458
Vanadium	55{nc}	720 {nc}	108	mg/kg	73.7	67.6	66.3
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	162	85.7	**205**

mg/kg	Milligrams per kilogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
ND	Not Detected.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 9-2. Sediment Analytical Results, Western Burning Ground, 1997 Gannett Fleming Independent Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	SD-01 0 - 0.5 06/04/97	SD-02 0 - 0.5 06/04/97
Organochlorine Pesticides						
4,4'-DDE	1.4 {ca**}	5.1 {ca**}	- -	mg/kg	ND	R
PCBs						
Total PCBs	0.24 {ca**}	0.86 {ca**}	- -	mg/kg	ND	ND
Volatile Organics						
2-Butanone	2,800 {nc}	19,000 {nc}	- -	mg/kg	0.015	0.019
Acetone	6,100 {nc}	61,000 {nc}	- -	mg/kg	0.056 B	0.078 B
Methylene Chloride	11 {ca}	54 {ca}	- -	mg/kg	0.0020 B	0.0020 B
Toluene	500 {nc}	4600 {nc}	- -	mg/kg	0.10	0.010 J
Semivolatile Organics						
4-Methylphenol	31 {nc}	310 {nc}	- -	mg/kg	0.50 J	0.20 J
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.090 J	0.10 J
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	0.090 J	ND
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.090 J	0.10 J
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	0.090 J	0.10 J
bis(2-Ethylhexyl)phthalate	35 {ca*}	120 {ca*}	- -	mg/kg	0.060 J	0.18 J
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	0.090 J	0.13 J
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	0.30 J	0.20 J
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.12 J	0.15 J
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	0.20 J	0.15 J
Inorganics						
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	7,760	8,140
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	5.10	4.80
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	55.4	68.0 J
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	**1.10**	0.700
Calcium	- -	- -	- -	mg/kg	9,190	6,110
Chromium	280 {ca}	1,460 {ca}	65.3	mg/kg	29.9	20.6
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	5.20	6.50
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	28.3	**85.1**
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	18,500	14,200
Lead	400 {++}	800 {++}	26.8	mg/kg	23.5	**36.6**
Magnesium	- -	- -	- -	mg/kg	3,260	1,480
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	112	245
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	10.6	8.80
Potassium	- -	- -	- -	mg/kg	435	479
Sodium	- -	- -	- -	mg/kg	118	100
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	0.200	0.200
Vanadium	55{nc}	720 {nc}	108	mg/kg	30.7	27.2
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	69.5	61.2

mg/kg	Milligrams per kilogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
ND	Not Detected.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 9-3. Surface Water Analytical Results, Western Burning Ground, 1997 Gannett Fleming Independent Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Date Collected:	Tapwater Screening Values [a]	Units	SW-01 06/05/97	SW-02 06/04/97
Inorganics				
Calcium	- -	µg/L	73,600	77,200
Iron	26,000 {nc}	µg/L	ND	297
Lead	15 {nc}	µg/L	ND	2.00
Magnesium	- -	µg/L	12,600	13,800
Manganese	880 {nc}	µg/L	ND	26.0
Potassium	- -	µg/L	2,700	2,610
Sodium	- -	µg/L	6,540	22,400
Vanadium	260 {nc}	µg/L	79.0	75.0

µg/L	Micrograms per liter.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
	Adjusted tap-water screening levels used to assess surface water at the NRU.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
NA	Not Analyzed.
ND	Not Detected.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted tap water RSL.

Table 9-4. Soil Analytical Results, Western Burning Ground, 1998 ICF KE Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values- Residential [a]	Adjusted Soil Screening Values- Industrial [a]	Facility-Wide Background Values [b]	Units	WBGSB1 0 - 2 08/05/98	WBGSB1 2 - 4 08/05/98	WBGSB2 0 - 2 08/05/98	WBGSB2 6 - 8 08/05/98	WBGSB2 9 - 11 08/05/98	WBGSB3 0 - 1 08/05/98	WBGSB4 0 - 1.5 08/05/98	WBGSB5 0 - 2 08/05/98
Explosives												
1,3,5-Trinitrobenzene	220 {nc}	2,700 {nc}	- -	mg/kg	<0.2	<0.2	<0.2	<0.3 [<0.2]	<0.3	<0.2	<0.2	<0.2
1,3-Dinitrobenzene	0.61 {nc}	6.2 {nc}	- -	mg/kg	<0.2	<0.2	<0.2	<0.3 [<0.2]	<0.3	<0.2	<0.2	<0.2
2,4,6-Trinitrotoluene	3.6 {ca**}	42 {ca**}	- -	mg/kg	<0.2	<0.2	<0.2	<0.3 [<0.2]	<0.3	<0.2	<0.2	<0.2
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.2	<0.2	<0.2	<0.3 [<0.2]	<0.3	<0.2	<0.2	<0.2
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	<0.2	<0.2	<0.2	<0.3 [<0.2]	<0.3	<0.2	<0.2	<0.2
2-Amino-4,6-Dinitrotoluene	15 {nc}	190 {nc}	- -	mg/kg	<0.2	<0.2	<0.2	<0.3 [<0.2]	<0.3	<0.2	<0.2	<0.2
4-Amino-2,6-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.2	<0.2	<0.2	<0.3 [<0.2]	<0.3	<0.2	<0.2	<0.2
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	<0.2	<0.2	<0.2	<0.3 [<0.2]	<0.3	<0.2	<0.2	<0.2
HMX	310 {nc}	3,100 {nc}	- -	mg/kg	<2.4	<2.4	<2.4	<2.5 [<2.4]	<2.5	<2.4	<2.4	<2.3
m-Nitrotoluene	- -	- -	- -	mg/kg	<0.2	<0.2	<0.2	<0.3 [<0.2]	<0.3	<0.2	<0.2	<0.2
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	<0.2	<0.2	<0.2	<0.3 [<0.2]	<0.3	<0.2	<0.2	<0.2
Nitroglycerine	0.61 {nc}	6.2 {nc}	- -	mg/kg	<1.2	<1.2	<1.2	<1.3 [<1.2]	<1.3	<1.2	<1.2	<1.1
o-Nitrotoluene	78 {nc}	1,300 {sat}	- -	mg/kg	<0.2	<0.2	<0.2	<0.3 [<0.2]	<0.3	<0.2	<0.2	<0.2
Pentaerythritol Tetranitrate	- -	- -	- -	mg/kg	<1.2	<1.2	<1.2	<1.3 [<1.2]	<1.3	<1.2	<1.2	<1.1
p-Nitrotoluene	30 {ca**}	110 {ca*}	- -	mg/kg	<0.2	<0.2	<0.2	<0.3 [<0.2]	<0.3	<0.2	<0.2	<0.2
RDX	4.4 {ca*}	16 {ca}	- -	mg/kg	<0.2	<0.2	<0.2	<0.3 [<0.2]	<0.3	<0.2	<0.2	<0.2
Tetryl	24 {nc}	250 {nc}	- -	mg/kg	<0.2	<0.2	<0.2	<0.3 [<0.2]	<0.3	<0.2	<0.2	<0.2
Volatile Organics												
1,1,1,2-Tetrachloroethane	2 {ca}	9.8 {ca}	- -	mg/kg	<0.0010	<0.0010	<0.0010	<0.0020 [<0.0020]	<0.0020	<0.0010 J	<0.0010 J	<0.0020
1,1,1-Trichloroethane	680 {sat}	680 {sat}	- -	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010 J [<0.0010]	<0.0010 J	<0.0010	<0.0010	<0.0010
1,1,2,2-Tetrachloroethane	0.59 {ca**}	2.9 {ca**}	- -	mg/kg	<0.0020	<0.0020	<0.0020	<0.0020 J [<0.0020]	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020
1,1,2-Trichloroethane	1.1 {ca}	5.5 {ca}	- -	mg/kg	<0.0020	<0.0020	<0.0020	<0.0020 J [<0.0020]	<0.0020 J	<0.0020	<0.0020	<0.0020
1,1-Dichloroethane	3.4 {ca}	17 {ca}	- -	mg/kg	<0.0020	<0.0020	<0.0020	<0.0020 J [<0.0020]	<0.0020 J	<0.0010	<0.0020	<0.0020
1,1-Dichloroethene	25 {nc}	110 {nc}	- -	mg/kg	<0.0020	<0.0020	<0.0020	<0.0030 J [<0.0030]	<0.0030 J	<0.0020	<0.0020	<0.0020
1,1-Dichloropropene	- -	- -	- -	mg/kg	<0.0010	<0.0010	<0.0010	<0.0020 J [<0.0020]	<0.0020 J	<0.0010	<0.0010	<0.0010
1,2,3-Trichlorobenzene	- -	- -	- -	mg/kg	<0.0020	<0.0020	<0.0020	<0.0020 J [<0.0020]	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020
1,2,3-Trichloropropane	0.091 {ca}	0.41 {ca}	- -	mg/kg	<0.0030	<0.0030	<0.0030	<0.0040 J [<0.0040]	<0.0040 J	<0.0030 J	<0.0030 J	<0.0030
1,2,4-Trichlorobenzene	180 {ca**}	220 {sat}	- -	mg/kg	<0.0010	<0.0010	<0.0010	<0.0020 J [<0.0020]	<0.0020 J	<0.0010 J	<0.0010 J	<0.0020
1,2,4-Trimethylbenzene	6.7 {nc}	28 {nc}	- -	mg/kg	<0.0020	<0.0020	<0.0020	<0.0020 J [<0.0020]	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020
1,2-Dibromo-3-chloropropane	0.0056 {ca}	0.073 {ca}	- -	mg/kg	<0.0060	<0.0060	<0.0060	<0.0070 J [<0.0070]	<0.0070 J	<0.0060 J	<0.0060 J	<0.0060
1,2-Dibromoethane	0.034 {ca}	0.17 {ca}	- -	mg/kg	<0.0020	<0.0020	<0.0020	<0.0020 [<0.0020]	<0.0020	<0.0020 J	<0.0020 J	<0.0020
1,2-Dichlorobenzene	220 {sat}	220 {sat}	- -	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010 J [<0.0010]	<0.0010 J	<0.0010 J	<0.0010 J	<0.0010
1,2-Dichloroethane	0.45 {ca}	2.2 {ca}	- -	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010 J [<0.0010]	<0.0010 J	<0.0010	<0.0010	<0.0010
1,2-Dichloropropane	0.93 {ca*}	4.7 {ca*}	- -	mg/kg	<0.0040	<0.0040	<0.0040	<0.0050 J [<0.0050]	<0.0050 J	<0.0040	<0.0040	<0.0040
1,3,5-Trimethylbenzene	- -	- -	- -	mg/kg	<0.0020	<0.0020	<0.0020	<0.0020 J [<0.0020]	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	<0.0010	<0.0010	<0.0010	<0.0020 J [<0.0020]	<0.0020 J	<0.0010 J	<0.0010 J	<0.0020
1,3-Dichloropropane	160 {nc}	1,600 {sat}	- -	mg/kg	<0.0010	<0.0010	<0.0010	<0.0020 [<0.0020]	<0.0020	<0.0010 J	<0.0010 J	<0.0020
1,4-Dichlorobenzene	2.6 {ca}	13 {ca}	- -	mg/kg	<0.0010	<0.0010	<0.0010	<0.0020 J [<0.0020]	<0.0020 J	<0.0010 J	<0.0010 J	<0.0020
2,2-Dichloropropane	- -	- -	- -	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010 J [<0.0010]	<0.0010 J	<0.0010	<0.0010	<0.0010
2-Butanone	2,800 {nc}	19,000 {nc}	- -	mg/kg	<0.0060	<0.0060	R	<0.0070 J [<0.0070 J]	<0.0070 J	R	R	<0.0060 J
2-Chloroethyl Vinyl Ether	- -	- -	- -	mg/kg	<0.0060	<0.0060	<0.0060	<0.0070 J [<0.0070]	<0.0070 J	<0.0060	<0.0060	<0.0060
2-Chlorotoluene	1,000 {sat}	1,000 {sat}	- -	mg/kg	<0.0010	<0.0010	<0.0010	<0.0020 J [<0.0020]	<0.0020 J	<0.0010 J	<0.0010 J	<0.0010
2-Hexanone	- -	- -	- -	mg/kg	<0.0060	<0.0060	<0.0060	<0.0070 J [<0.0070 J]	<0.0070 J	<0.0060 J	R	<0.0060 J
4-Chlorotoluene	290 {sat}	290 {sat}	- -	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010 J [<0.0010]	<0.0010 J	<0.0010 J	<0.0010 J	<0.0010
4-Methyl-2-pentanone	530 {nc}	5,200 {sat}	- -	mg/kg	<0.0060	<0.0060	<0.0060	<0.0070 [<0.0070]	<0.0070	<0.0060 J	<0.0060 J	<0.0060
Acetone	6,100 {nc}	61,000 {nc}	- -	mg/kg	<0.0060	<0.0060	<0.0060	<0.0070 J [<0.0070]	<0.0070 J	<0.0060	<0.0060	<0.0060
Acrolein	0.016 {nc}	0.068 {nc}	- -	mg/kg	<0.0060	<0.0060	<0.0060	<0.0070 J [<0.0070]	<0.0070 J	<0.0060	<0.0060	<0.0060
Acrylonitrile	0.24 {ca*}	1.2 {ca*}	- -	mg/kg	<0.0060	<0.0060	<0.0060	<0.0070 J [<0.0070]	<0.0070 J	<0.0060	<0.0060	<0.0060
Benzene	1.1 {ca*}	5.6 {ca*}	- -	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010 J [<0.0010]	<0.0010 J	<0.0010	<0.0010	<0.0010
Bromobenzene	- -	- -	- -	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010 J [<0.0010]	<0.0010 J	<0.0010 J	<0.0010 J	<0.0010
Bromochloromethane	- -	- -	- -	mg/kg	<0.0020	<0.0020	<0.0020	<0.0020 J [<0.0020]	<0.0020 J	<0.0020	<0.0020	<0.0020
Bromodichloromethane	10 {ca}	46 {ca}	- -	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010 J [<0.0010]	<0.0010 J	<0.0010	<0.0010	<0.0010
Bromoform	61 {ca*}	220 {ca*}	- -	mg/kg	<0.00060	<0.00060	<0.00060	<0.00070 [<0.00070]	<0.00070	<0.00060 J	<0.00060 J	<0.00060
Bromomethane	0.79 {nc}	3.5 {nc}	- -	mg/kg	<0.0040	<0.0040	<0.0040	<0.0050 J [<0.0050]	<0.0060 J	<0.0040	<0.0040	<0.0050
Carbon Disulfide	67 {nc}	300 {nc}	- -	mg/kg	<0.0060	<0.0060	<0.0060	<0.0070 J [<0.0070]	<0.0070 J	<0.0060	<0.0060	<0.0060
Carbon Tetrachloride	0.25 {ca}	1.3 {ca}	- -	mg/kg	<0.0050	<0.0050	<0.0050	<0.0060 J [<0.0060]	<0.0060 J	<0.0040	<0.0050	<0.0050
Chlorobenzene	31 {nc}	860 {sat}	- -	mg/kg	<0.0010	<0.0010	<0.0010	<0.0020 [<0.0020]	<0.0020	<0.0010 J	<0.0010 J	<0.0010
Chloroethane	2,200 {sat}	2,200 {sat}	- -	mg/kg	<0.0060	<0.0060	<0.0060	<0.0070 J [<0.0070]	<0.0070 J	<0.0060	<0.0060	<0.0060
Chloroform	0.3 {ca}	1.5 {ca}	- -	mg/kg	<0.0010	<0.0010	<0.0010	<0.0020 J [<0.0020]	<0.0020 J	<0.0010	<0.0010	<0.0010
Chloromethane	1.7 {ca*}	8.4 {ca*}	- -	mg/kg	<0.0040	<0.0040	<0.0040	<0.0050 J [<0.0050]	<0.0050 J	<0.0040	<0.0040	<0.0040
cis-1,2-Dichloroethene	78 {nc}	1,300 {sat}	- -	mg/kg	<0.0020	<0.0020	<0.0020	<0.0020 J [<0.0020]	<0.0020 J	<0.0020	<0.0020	<0.0020
cis-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010 J [<0.0010]	<0.0010 J	<0.0010	<0.0010	<0.0010
Dibromochloromethane	5.8 {ca}	21 {ca}	- -	mg/kg	<0.00080	<0.00080	<0.00080	<0.0010 [<0.0010]	<0.0010	<0.00080 J	<0.00080 J	<0.00090
Dibromomethane	78 {nc}	3,000 {sat}	- -	mg/kg	<0.0020	<0.0020	<0.0020	<0.0020 J [<0.0020]	<0.0020 J	<0.0020	<0.0020	<0.0020
Dichlorodifluoromethane	19 {nc}	78 {nc}	- -	mg/kg	<0.0020	<0.0020	<0.0020	<0.0020 J [<0.0020]	<0.0020 J	<0.0020	<0.0020	<0.0020
Ethylbenzene	5.7 {ca}	29 {ca}	- -	mg/kg	<0.0010	<0.0010	<0.0010	<0.0020 [<0.0020]	<0.0020	<0.0010 J	<0.0010 J	<0.0010
Hexachlorobutadiene	6.2 {ca**}	22 {ca*}	- -	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010 J [<0.0010]	<0.0010 J	<0.0010 J	<0.0010 J	<0.0010
Isopropylbenzene	310 {sat}	310 {sat}	- -	mg/kg	<0.0020	<0.0020	<0.0020	<0.0020 J [<0.0020]	<0.0020 J	<0.0010 J	<0.0020 J	<0.0020
m,p-Xylene	60 {nc}	260 {nc}	- -	mg/kg	<0.0030	<0.0030	<0.0030	<0.0030 [<0.0030]	<0.0030	<0.0030 J	<0.0030 J	<0.0030
Methylene Chloride	11 {ca}	54 {ca}	- -	mg/kg	<0.0010	<0.0010	0.0030	<0.0010 J [<0.0010]	<0.0010 J	<0.0010	0.0030	<0.0010
n-Butylbenzene	- -	- -	- -	mg/kg	<0.0020	<0.0020	<0.0020	<0.0020 J [<0.0020]	<0.0020 J	<0.0020 J	<0.0020 J	<0.0020
n-Propylbenzene	- -	- -	- -	mg/kg	<0.0020	<0.0020	<0.0020	<0.0020 J [<0.0020]	<0.0020 J	<0.0010 J	<0.0020 J	<0.0020
o-Xylene	300 {sat}	300 {sat}	- -	mg/kg	<0.0010	<0.0010	<0.0010	<0.0020 [<0.0020]	<0.0020	<0.0010 J	<0.0010 J	<0.0020
p-Isopropyltoluene	- -	- -	- -	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010 J [<0.0010]	<0.0010 J	<0.0010 J	<0.0010 J	<0.0010
sec-Butylbenzene	- -	- -	- -	mg/kg	<0.0010	<0.0010	<0.0010	<0.0020 J [<0.0020]	<0.0020 J	<0.0010 J	<0.0010 J	<0.0020
Styrene	1,000 {sat}	1,000 {sat}	- -	mg/kg	<0.00020	<0.00020	<0.00020	<0.00030 [<0.00030]	<0.00030	<0.00020 J	<0.00020 J	<0.00020
tert-Butylbenzene	- -	- -	- -	mg/kg	<0.0010	<0.0010	<0.0010	<0.0020 J [<0.0020]	<0.0020 J	<0.0010 J	<0.0010 J	<0.0020
Tetrachloroethene	0.57 {ca}	2.7 {ca}	- -	mg/kg	<0.0010	<0.0010	<0.0010	<0.0020 [<0.0020]	<0.0020	<0.0010 J	<0.0010 J	<0.0010
Toluene	500 {nc}	4600 {nc}	- -	mg/kg	<0.0010	<0.0020	<0.0010	<0.0020 J [<0.0020]	<0.0020 J	<0.0010	<0.0010	<0.0020
trans-1,2-Dichloroethene	11 {nc}	50 {nc}	- -	mg/kg	<0.0050	<0.0050	<0.0050	<0.0060 J [<0.0060]	<0.0060 J	<0.0050	<0.0050	<0.0050
trans-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010 J [<0.0010]	<0.0010 J	<0.0010	<0.0010	<0.0010
Trichloroethene	2.8 {ca}	14 {ca}	- -	mg/kg	<0.0030	<0.0030	<0.0030	<0.0040 J [<0.0040]	<0.0040 J	<0.0030	<0.0030	<0.0030
Trichlorofluoromethane	80 {nc}	1,300 {sat}	- -	mg/kg	<0.0010	<0.0010	<0.0010	<0.0020 J [<0.0020]	<0.0020 J	<0.0010	<0.0010	<0.0010
Vinyl Acetate	99 {nc}	2,800 {sat}	- -	mg/kg	<0.0060	<0.0060	<0.0060	<0.0070 J [<0.0070]	<0.0070 J	<0.0060	<0.0060	<0.0060
Vinyl Chloride	0.06 {ca}	1.7 {ca}	- -	mg/kg	<0.0020	<0.0020	<0.0020	<0.0030 J [<0.0030]	<0.0030 J	<0.0020	<0.0020	<0.0020
Xylenes (total)	60 {nc}	260 {nc}	- -	mg/kg	<0.0030	<0.0030	<0.0030	<0.0030 [<0.0030]	<0.0030	<0.0030	<0.0030	<0.0030

Notes found at end of table.

Table 9-4. Soil Analytical Results, Western Burning Ground, 1998 ICF KE Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values- Residential [a]	Adjusted Soil Screening Values- Industrial [a]	Facility-Wide Background Values [b]	Units	WBGSB1 0 - 2 08/05/98	WBGSB1 2 - 4 08/05/98	WBGSB2 0 - 2 08/05/98	WBGSB2 6 - 8 08/05/98	WBGSB2 9 - 11 08/05/98	WBGSB3 0 - 1 08/05/98	WBGSB4 0 - 1.5 08/05/98	WBGSB5 0 - 2 08/05/98
Semivolatile Organics												
1,2,4-Trichlorobenzene	8.7 {ca**}	40 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	220 {sat}	220 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Diphenylhydrazine	0.61 {ca**}	2.2 {ca**}	- -	mg/kg	<0.38	NA	<0.38	<0.46 [<0.46]	<0.48	<0.37	<0.38	<0.40
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	2.6 {ca}	13 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	610 {nc}	6,200 {nc}	- -	mg/kg	<0.92	<0.94	<0.92	<1.1 [<1.1]	<1.2	<0.89	<0.93	<0.98
2,4,6-Trichlorophenol	44 {ca**}	160 {ca**}	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	<0.37	<0.38	<0.40
2,4-Dichlorophenol	18 {nc}	180 {nc}	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	<0.37	<0.38	<0.40
2,4-Dimethylphenol	120 {nc}	1,200 {nc}	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	<0.37	<0.38	<0.40
2,4-Dinitrophenol	12 {nc}	120 {nc}	- -	mg/kg	<1.9	<1.9	<1.9	<2.3 [<2.3]	<2.4	<1.8	<1.9	<2.0
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	210 {sat}	210 {sat}	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	<0.37	<0.38	<0.40
2-Chlorophenol	39 {nc}	510 {nc}	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	<0.37	<0.38	<0.40
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	<0.37	<0.38	<0.40
2-Methylphenol	310 {nc}	3,100 {nc}	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	<0.37	<0.38	<0.40
2-Nitroaniline	- -	- -	- -	mg/kg	<1.9	<1.9	<1.9	<2.3 [<2.3]	<2.4	<1.8	<1.9	<2.0
2-Nitrophenol	- -	- -	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	<0.37	<0.38	<0.40
3,3'-Dichlorobenzidine	1.1 {ca**}	3.8 {ca**}	- -	mg/kg	<0.75	<0.76	<0.75	<0.92 [<0.92]	<0.94	<0.72	<0.76 J	<0.79
3-Nitroaniline	- -	- -	- -	mg/kg	<1.9	<1.9	<1.9	<2.3 [<2.3]	<2.4	<1.8	<1.9	<2.0
4,6-Dinitro-2-methylphenol	- -	- -	- -	mg/kg	<1.9	<1.9	<1.9	<2.3 [<2.3]	<2.4	<1.8	<1.9	<2.0
4-Bromophenyl-phenylether	- -	- -	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	<0.37	<0.38	<0.40
4-Chloro-3-Methylphenol	- -	- -	- -	mg/kg	<0.75	<0.76	<0.75	<0.92 [<0.92]	<0.94	<0.72	<0.76	<0.79
4-Chloroaniline	24 {nc}	250 {nc}	- -	mg/kg	<0.75	<0.76	<0.75	<0.92 [<0.92]	<0.94	<0.72	<0.76	<0.79
4-Chlorophenyl-phenylether	- -	- -	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	<0.37	<0.38	<0.40
4-Methylphenol	31 {nc}	310 {nc}	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	<0.37	<0.38	<0.40
4-Nitroaniline	- -	- -	- -	mg/kg	<1.9	<1.9	<1.9	<2.3 [<2.3]	<2.4	<1.8	<1.9	<2.0
4-Nitrophenol	- -	- -	- -	mg/kg	<1.9	<1.9	<1.9	<2.3 [<2.3]	<2.4	<1.8	<1.9	<2.0
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	<0.37	<0.38	<0.40
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	<0.37	<0.38	<0.40
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	<0.37	0.040 J	<0.40
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	0.16 J	0.15 J	<0.40
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.38 J	<0.39	<0.38	<0.46 [<0.46]	<0.48	0.40 J	0.33 J	<0.40
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.38 J	<0.39	<0.38	<0.46 [<0.46]	<0.48	0.62 J	0.48 J	<0.40
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	<0.38 J	<0.39	<0.38	<0.46 [<0.46]	<0.48	0.17 J	0.13 J	<0.40
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	<0.38 J	<0.39	<0.38	<0.46 [<0.46]	<0.48	0.51 J	0.40 J	<0.40
Benzoic Acid	240,000 {max}	2,500,000 {max}	- -	mg/kg	<1.9	<1.9	<1.9	<2.3 [<2.3]	<2.4	<1.8	<1.9	<2.0
Benzyl Alcohol	3,100 {nc}	310,000 {max}	- -	mg/kg	<0.75	<0.76	<0.75	<0.92 [<0.92]	<0.94	<0.72	<0.76	<0.79
bis(2-Chloroethoxy)methane	18 {nc}	180 {nc}	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	<0.37	<0.38	<0.40
bis(2-Chloroethyl)ether	0.19 {ca**}	0.9 {ca**}	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	<0.37	<0.38	<0.40
bis(2-Chloroisopropyl)ether	- -	- -	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	<0.37	<0.38	<0.40
bis(2-Ethylhexyl)phthalate	35 {ca*}	120 {ca*}	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	0.040 J	<0.38 J	<0.40
Butylbenzylphthalate	260 {ca*}	910 {ca*}	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	<0.37	<0.38 J	<0.40
Carbazole	24 {ca**}	86 {ca**}	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	<0.37	0.040 J	<0.40
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	0.24 J	0.22 J	<0.40
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.38 J	<0.39	<0.38	<0.46 [<0.46]	<0.48	R	R	<0.40
Dibenzofuran	- -	- -	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	<0.37	<0.38	<0.40
Diethylphthalate	4,900 {nc}	490,000 {max}	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	<0.37	<0.38	<0.40
Dimethylphthalate	- -	- -	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	<0.37	<0.38	<0.40
Di-n-Butylphthalate	610 {nc}	6,200 {nc}	- -	mg/kg	<0.38	<0.39	<0.38	0.080 J [<0.46]	<0.48	<0.37	<0.38	<0.40
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-Octylphthalate	- -	- -	- -	mg/kg	<0.38 J	<0.39	<0.38	<0.46 [<0.46]	<0.48	R	R	<0.40
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	0.33 J	0.33 J	<0.40
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	<0.37	<0.38	<0.40
Hexachlorobenzene	0.3 {ca}	1.1 {ca}	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	<0.37	<0.38	<0.40
Hexachlorobutadiene	6.2 {ca**}	22 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	37 {nc}	370 {nc}	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	<0.37	<0.38	<0.40
Hexachloroethane	35 {ca**}	120 {ca**}	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	<0.37	<0.38	<0.40
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.38 J	<0.39	<0.38	<0.46 [<0.46]	<0.48	0.15 J	0.13 J	<0.40
Isophorone	510 {ca*}	1,800 {ca*}	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	<0.37	<0.38	<0.40
Naphthalene	3.9 {ca}	20 {ca}	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	<0.37	<0.38	<0.40
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	0.069 {ca**}	0.25 {ca**}	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	<0.37	<0.38	<0.40
N-Nitrosodiphenylamine	99 {ca**}	350 {ca**}	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	0.060 J	<0.38	<0.40
Pentachlorophenol	3 {ca}	9 {ca}	- -	mg/kg	<1.9	<1.9	<1.9	<2.3 [<2.3]	<2.4	<1.8	<1.9	<2.0
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	0.12 J	0.19 J	<0.40
Phenol	1,800 {nc}	180,000 {max}	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	<0.37	<0.38	<0.40
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	<0.38	<0.39	<0.38	<0.46 [<0.46]	<0.48	0.40	0.43 J	<0.40

Notes found at end of table.

Table 9-4. Soil Analytical Results, Western Burning Ground, 1998 ICF KE Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values- Residential [a]	Adjusted Soil Screening Values- Industrial [a]	Facility-Wide Background Values [b]	Units	WBGSB1 0 - 2 08/05/98	WBGSB1 2 - 4 08/05/98	WBGSB2 0 - 2 08/05/98	WBGSB2 6 - 8 08/05/98	WBGSB2 9 - 11 08/05/98	WBGSB3 0 - 1 08/05/98	WBGSB4 0 - 1.5 08/05/98	WBGSB5 0 - 2 08/05/98
Inorganics												
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	12,500	14,200	10,100	12,700 [23,500]	27,000	14,500	13,200	15,300
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	<0.560	<0.570	<0.560	<0.690 [<0.680]	<0.710	5.30 K	<0.580	<0.580
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	9.40 K	7.80 K	**17.0 K**	3.70 K [5.10 K]	5.30 K	**35.8**	**37.9**	9.80 K
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	**210 K**	26.9 K	**457 K**	22.3 B [43.1 K]	45.9 K	**610 K**	**584 K**	49.6 K
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	0.320 J	0.700	0.480 J	**2.70 [3.00]**	**1.40**	0.290 J	0.420 J	0.540 J
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	0.450 J	<0.110	**1.90**	<0.140 [<0.140]	0.300 J	**2.70**	0.400 J	<0.120
Calcium	- -	- -	- -	mg/kg	33,900	2,570 B	97,300	4,710 B [7,060 B]	37,300	47,600	10,600 B	9,430 B
Chromium	280 {ca}	1,460 {ca}	65.3	mg/kg	**195**	41.5	**233**	28.0 [47.4]	64.1	**249**	34.9	38.2
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	7.20 K	7.80 K	8.70 K	7.90 K [12.1 K]	16.4 K	10.9 K	8.30 K	8.60 K
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	**556**	18.0 B	**203**	14.9 B [18.2 B]	13.9 B	**1,340**	**194**	53.4
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	34,500	27,300	26,300	19,900 [30,800]	28,700	42,900	28,000	39,300
Lead	400 {++}	800 {++}	26.8	mg/kg	**2,070**	**179**	**2,450**	9.50 [18.7]	13.3	**3,990**	**2,480**	**44.5**
Magnesium	- -	- -	- -	mg/kg	18,900	2,490 B	21,000	17,900 [41,100]	58,900	23,200	4,910	3,560
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	177	44.9	312	255 [222]	247	548	161	139
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	<0.110	<0.120	<0.120	<0.140 [<0.140]	<0.140	<0.110	<0.120	<0.120
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	11.6 K	12.0 K	18.6 K	17.7 K [29.0 K]	20.0 K	28.4 K	17.7 K	11.7 K
Potassium	- -	- -	- -	mg/kg	1,100 K	1,040 K	1,950 K	2,860 K [7,170 K]	10,600 K	1,620 K	836 K	1,030 K
Selenium	39 {nc}	510 {nc}	- -	mg/kg	<0.560	<0.570	<0.560	<0.690 [<0.680]	<0.710	<0.560	<0.580	<0.580
Silver	39 {nc}	510 {nc}	- -	mg/kg	<0.230 L	<0.230 L	0.240 B	<0.280 L [<0.270 L]	<0.280 L	0.500 B	<0.230 L	<0.230 L
Sodium	- -	- -	- -	mg/kg	111 B	49.1 B	217 B	65.8 B [66.8 B]	120 B	384 B	123 B	78.7 B
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	<0.230 L	<0.230 L	0.410 B	<0.280 L [<0.270 L]	0.670 B	0.860 B	<0.230 L	<0.230 L
Vanadium	55{nc}	720 {nc}	108	mg/kg	45.9 K	56.2 K	33.5 K	38.3 K [63.4 K]	67.7 K	53.9 K	54.0 K	70.3 K
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	**1,100**	57.6 B	**2,520**	47.4 B [75.5 B]	57.3 B	**3,250**	**1,280**	126 B

mg/kg	Milligrams per kilogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 9-5. Soil Analytical Results, Western Burning Ground, 1999 ICF KE Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID:	Adjusted Soil Screening	Adjusted Soil Screening	Facility-Wide		WBGSB6	WBGSB7	WBGSB8	WBGSB9	WBGSB10	WBGSB11	WBGBC1	WBGBC1	WBGSB12	WBGSB13	WBGSB13	WBGSB14	WBGSB14	WBGSB15	WBGSB15
Sample Depth(Feet):	Values-Residential [a]	Values-Industrial [a]	Background Values [b]		0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	5 - 7	0 - 4	0 - 2	2 - 4	0 - 2	2 - 4	0 - 2	2 - 4
Date Collected:				Units	05/26/99	05/26/99	05/26/99	05/26/99	05/26/99	05/26/99	08/18/99	08/18/99	08/18/99	10/06/99	10/06/99	10/06/99	10/06/99	10/06/99	10/06/99
Explosives																			
1,3,5-Trinitrobenzene	220 {nc}	2,700 {nc}	- -	mg/kg	<0.25 J	<0.25 J	<0.26 J [<0.26 J]	<0.25 J	<0.24 J	<0.23 J	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dinitrobenzene	0.61 {nc}	6.2 {nc}	- -	mg/kg	<0.25	<0.25	<0.26 [<0.26]	<0.25	<0.24	<0.23	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trinitrotoluene	3.6 {ca**}	42 {ca**}	- -	mg/kg	<0.25	<0.25	<0.26 [<0.26]	<0.25	<0.24	<0.23	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.25	<0.25	<0.26 [<0.26]	<0.25	<0.24	<0.23	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	<0.25	<0.25	<0.26 [<0.26]	<0.25	<0.24	<0.23	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Amino-4,6-Dinitrotoluene	15 {nc}	190 {nc}	- -	mg/kg	<0.25 J	<0.25 J	<0.26 J [<0.26 J]	<0.25 J	<0.24 J	<0.23 J	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Amino-2,6-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.25 J	<0.25 J	<0.26 J [<0.26 J]	<0.25 J	<0.24 J	<0.23 J	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	<0.25	<0.25	<0.26 [<0.26]	<0.25	<0.24	<0.23	NA	NA	NA	NA	NA	NA	NA	NA	NA
HMX	310 {nc}	3,100 {nc}	- -	mg/kg	<0.25	<0.25	<0.26 [<0.26]	<0.25	<0.24	<0.23	NA	NA	NA	NA	NA	NA	NA	NA	NA
m-Nitrotoluene	- -	- -	- -	mg/kg	<0.25	<0.25	<0.26 [<0.26]	<0.25	<0.24	<0.23	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	<0.25	<0.25	<0.26 [<0.26]	<0.25	<0.24	<0.23	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitroglycerine	0.61 {nc}	6.2 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
o-Nitrotoluene	78 {nc}	1,300 {sat}	- -	mg/kg	<0.25	<0.25	<0.26 [<0.26]	<0.25	<0.24	<0.23	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentaerythritol Tetranitrate	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Nitrotoluene	30 {ca**}	110 {ca*}	- -	mg/kg	<0.25	<0.25	<0.26 [<0.26]	<0.25	<0.24	<0.23	NA	NA	NA	NA	NA	NA	NA	NA	NA
RDX	4.4 {ca*}	16 {ca}	- -	mg/kg	<0.25	<0.25	<0.26 [<0.26]	<0.25	<0.24	<0.23	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetryl	24 {nc}	250 {nc}	- -	mg/kg	<0.25	<0.25	<0.26 [<0.26]	<0.25	<0.24	<0.23	NA	NA	NA	NA	NA	NA	NA	NA	NA
PAHs																			
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.030 J	<0.030 J	<0.030 [<0.030 J]	0.32 J	<0.030 J	<0.030 J	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.030	<0.030	<0.030 [<0.030]	<0.030	<0.030	<0.020	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	<0.020	<0.020	<0.020 [<0.020]	<0.020	<0.020	<0.010	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.020	<0.020	<0.020 [<0.020]	<0.020	<0.020	<0.020	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.020	<0.020	<0.020 [<0.020]	<0.020	<0.020	<0.020	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.030	<0.030	<0.030 [<0.030]	0.020 J	<0.030	<0.020	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	<0.030	<0.030	<0.030 [<0.030]	<0.030	<0.030	<0.020	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	<0.030	<0.020	<0.030 [<0.030]	<0.030	<0.020	<0.020	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	<0.020	<0.020	<0.020 [0.020 J]	<0.020	<0.020	<0.020	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.020	<0.020	<0.030 [<0.030]	<0.020	<0.020	<0.020	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.020	<0.020	<0.020 [<0.020]	<0.020	<0.020	<0.020	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.030	<0.030	<0.030 [<0.030]	<0.030	<0.030	<0.020	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.010	<0.010	<0.010 [<0.020]	<0.010	<0.010	<0.010	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	3.9 {nc}	20 {nc}	- -	mg/kg	<0.040	<0.040	<0.040 [<0.040]	<0.040	<0.030	<0.030	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	<0.020	<0.020	<0.020 [<0.020]	<0.020	<0.020	<0.020	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	<0.020	<0.020	<0.020 [<0.020]	0.040 J	<0.020	<0.020	NA	NA	NA	NA	NA	NA	NA	NA	NA
Volatile Organics																			
1,1,1,2-Tetrachloroethane	2 {ca}	9.8 {ca}	- -	mg/kg	<0.0015	<0.0015	<0.0015 [<0.0016]	<0.0015	<0.0014	<0.0014	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	680 {sat}	680 {sat}	- -	mg/kg	<0.0011	<0.0011	<0.0012 [<0.0012]	<0.0011	<0.0011	<0.0010	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	0.59 {ca**}	2.9 {ca**}	- -	mg/kg	<0.0020	<0.0020	<0.0021 [<0.0021]	<0.0020	<0.0019	<0.0018	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	1.1 {ca}	5.5 {ca}	- -	mg/kg	<0.0017	<0.0017	<0.0017 [<0.0018]	<0.0017	<0.0016	<0.0015	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	3.4 {ca}	17 {ca}	- -	mg/kg	<0.0016	<0.0016	<0.0017 [<0.0017]	<0.0016	<0.0016	<0.0015	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	25 {nc}	110 {nc}	- -	mg/kg	<0.0024	<0.0024	<0.0025 [<0.0025]	<0.0024	<0.0023	<0.0022	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloropropene	- -	- -	- -	mg/kg	<0.0014	<0.0014	<0.0015 [<0.0015]	<0.0014	<0.0014	<0.0013	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3-Trichlorobenzene	- -	- -	- -	mg/kg	<0.0018	<0.0017	<0.0018 [<0.0018]	<0.0018	<0.0017	<0.0016	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	0.091 {ca}	0.41 {ca}	- -	mg/kg	<0.0031	<0.0031	<0.0032 [<0.0032]	<0.0031	<0.0030	<0.0028	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	180 {ca**}	220 {sat}	- -	mg/kg	<0.0015	<0.0015	<0.0015 [<0.0016]	<0.0015	<0.0014	<0.0014	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trimethylbenzene	6.7 {nc}	28 {nc}	- -	mg/kg	<0.0020	<0.0020	<0.0021 [<0.0021]	<0.0020	<0.0019	<0.0018	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dibromo-3-chloropropane	0.0056 {ca}	0.073 {ca}	- -	mg/kg	<0.0063	<0.0062	<0.0064 [<0.0065]	<0.0063	<0.0060	<0.0057	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dibromoethane	0.034 {ca}	0.17 {ca}	- -	mg/kg	<0.0020	<0.0020	<0.0021 [<0.0021]	<0.0020	<0.0019	<0.0018	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	220 {sat}	220 {sat}	- -	mg/kg	<0.0013	<0.0012	<0.0013 [<0.0013]	<0.0013	<0.0012	<0.0011	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	0.45 {ca}	2.2 {ca}	- -	mg/kg	<0.0013	<0.0012	<0.0013 [<0.0013]	<0.0013	<0.0012	<0.0011	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	0.93 {ca*}	4.7 {ca*}	- -	mg/kg	<0.0043	<0.0042	<0.0044 [<0.0044]	<0.0043	<0.0041	<0.0039	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3,5-Trimethylbenzene	- -	- -	- -	mg/kg	<0.0020	<0.0020	<0.0021 [<0.0021]	<0.0020	<0.0019	<0.0018	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	<0.0015	<0.0015	<0.0015 [<0.0016]	<0.0015	<0.0014	<0.0014	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dichloropropane	160 {nc}	1,600 {sat}	- -	mg/kg	<0.0015	<0.0015	<0.0015 [<0.0016]	<0.0015	<0.0014	<0.0014	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	2.6 {ca}	13 {ca}	- -	mg/kg	<0.0015	<0.0015	<0.0015 [<0.0016]	<0.0015	<0.0014	<0.0014	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,2-Dichloropropane	- -	- -	- -	mg/kg	<0.0013	<0.0012	<0.0013 [<0.0013]	<0.0013	<0.0012	<0.0011	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone	2,800 {nc}	19,000 {nc}	- -	mg/kg	R	R	R [R]	R	R	R	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Chloroethyl Vinyl Ether	- -	- -	- -	mg/kg	<0.0063	<0.0062	<0.0064 [<0.0065]	<0.0063	<0.0060	<0.0057	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Chlorotoluene	1,000 {sat}	1,000 {sat}	- -	mg/kg	<0.0014	<0.0014	<0.0014 [<0.0014]	<0.0014	<0.0013	<0.0013	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Hexanone	- -	- -	- -	mg/kg	<0.0063	<0.0062	<0.0064 [<0.0065]	<0.0063	<0.0060	<0.0057	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chlorotoluene	290 {sat}	290 {sat}	- -	mg/kg	<0.0013	<0.0012	<0.0013 [<0.0013]	<0.0013	<0.0012	<0.0011	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methyl-2-pentanone	530 {nc}	5,200 {sat}	- -	mg/kg	<0.0063	<0.0062	<0.0064 [<0.0065]	<0.0063	<0.0060	<0.0057	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone	6,100 {nc}	61,000 {nc}	- -	mg/kg	<0.0063 J	<0.0062 J	<0.0064 J [<0.0065 J]	<0.0063 J	0.070 J	<0.0057 J	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acrolein	0.016 {nc}	0.068 {nc}	- -	mg/kg	R	R	R [R]	R	R	R	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acrylonitrile	0.24 {ca*}	1.2 {ca*}	- -	mg/kg	R	R	R [R]	R	R	R	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	1.1 {ca*}	5.6 {ca*}	- -	mg/kg	<0.0013	<0.0012	<0.0013 [<0.0013]	<0.0013	<0.0012	<0.0011	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromobenzene	- -	- -	- -	mg/kg	<0.0013	<0.0012	<0.0013 [<0.0013]	<0.0013	<0.0012	<0.0011	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromochloromethane	- -	- -	- -	mg/kg	<0.0021	<0.0021	<0.0022 [<0.0022]	<0.0021	<0.0021	<0.0019	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromodichloromethane	10 {ca}	46 {ca}	- -	mg/kg	<0.0013	<0.0012	<0.0013 [<0.0013]	<0.0013	<0.0012	<0.0011	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromoform	61 {ca*}	220 {ca*}	- -	mg/kg	<0.00060	<0.00060	<0.00060 [<0.00060]	<0.00060	<0.00060	<0.00060	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromomethane	0.79 {nc}	3.5 {nc}	- -	mg/kg	<0.0047	<0.0047	<0.0048 [<0.0049]	<0.0047	<0.0046	<0.0043	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	67 {nc}	300 {nc}	- -	mg/kg	<0.0063	<0.0062	<0.0064 [<0.0065]	<0.0063	<0.0060	<0.0057	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Tetrachloride	0.25 {ca}	1.3 {ca}	- -	mg/kg	<0.0050 J	<0.0049 J	<0.0051 J [<0.0052 J]	<0.0050 J	<0.0048 J	<0.0045 J	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	31 {nc}	860 {sat}	- -	mg/kg	<0.0014	<0.0014	<0.0014 [<0.0014]	<0.0014	<0.0013	<0.0013	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroethane	2,200 {sat}	2,200 {sat}	- -	mg/kg	<0.0063	<0.0062	<0.0064 [<0.0065]	<0.0063	<0.0060	<0.0057	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	0.3 {ca}	1.5 {ca}	- -	mg/kg	<0.0015	<0.0015	<0.0015 [<0.0015]	<0.0015	<0.0014	<0.0013	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes found at end of table.

Table 9-5. Soil Analytical Results, Western Burning Ground, 1999 ICF KE Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	WBGSB6 0 - 2 05/26/99	WBGSB7 0 - 2 05/26/99	WBGSB8 0 - 2 05/26/99	WBGSB9 0 - 2 05/26/99	WBGSB10 0 - 2 05/26/99	WBGSB11 0 - 2 05/26/99	WBGBC1 0 - 2 08/18/99	WBGBC1 5 - 7 08/18/99	WBGSB12 0 - 4 08/18/99	WBGSB13 0 - 2 10/06/99	WBGSB13 2 - 4 10/06/99	WBGSB14 0 - 2 10/06/99	WBGSB14 2 - 4 10/06/99	WBGSB15 0 - 2 10/06/99	WBGSB15 2 - 4 10/06/99
Volatile Organics																			
Chloromethane	1.7 {ca*}	8.4 {ca*}	- -	mg/kg	<0.0042	<0.0041	<0.0043 [<0.0043]	<0.0042	<0.0040	<0.0038	NA	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,2-Dichloroethene	78 {nc}	1,300 {sat}	- -	mg/kg	<0.0022	<0.0021	<0.0022 [<0.0022]	<0.0022	<0.0021	<0.0020	NA	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.0013	<0.0012	<0.0013 [<0.0013]	<0.0013	<0.0012	<0.0011	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibromochloromethane	5.8 {ca}	21 {ca}	- -	mg/kg	<0.00090	<0.00090	<0.00090 [<0.00090]	<0.00090	<0.00080	<0.00080	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibromomethane	78 {nc}	3,000 {sat}	- -	mg/kg	<0.0018	<0.0018	<0.0018 [<0.0019]	<0.0018	<0.0017	<0.0016	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dichlorodifluoromethane	19 {nc}	78 {nc}	- -	mg/kg	<0.0021	<0.0020	<0.0021 [<0.0021]	<0.0021	<0.0020	<0.0019	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	5.7 {ca}	29 {ca}	- -	mg/kg	<0.0014	<0.0014	<0.0014 [<0.0014]	<0.0014	<0.0013	<0.0013	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	6.2 {ca**}	22 {ca*}	- -	mg/kg	<0.0013	<0.0012	<0.0013 [<0.0013]	<0.0013	<0.0012	<0.0011	NA	NA	NA	NA	NA	NA	NA	NA	NA
Isopropylbenzene	310 {sat}	310 {sat}	- -	mg/kg	<0.0016	<0.0016	<0.0017 [<0.0017]	<0.0016	<0.0016	<0.0015	NA	NA	NA	NA	NA	NA	NA	NA	NA
m,p-Xylene	60 {nc}	260 {nc}	- -	mg/kg	<0.0029	<0.0028	<0.0029 [<0.0030]	<0.0029	<0.0028	<0.0026	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	11 {ca}	54 {ca}	- -	mg/kg	<0.0013	<0.0012	<0.0013 [<0.0013]	<0.0013	<0.0012	<0.0011	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Butylbenzene	- -	- -	- -	mg/kg	<0.0021	<0.0021	<0.0022 [<0.0022]	<0.0021	<0.0020	<0.0019	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Propylbenzene	- -	- -	- -	mg/kg	<0.0016	<0.0016	<0.0017 [<0.0017]	<0.0016	<0.0016	<0.0015	NA	NA	NA	NA	NA	NA	NA	NA	NA
o-Xylene	300 {sat}	300 {sat}	- -	mg/kg	<0.0015	<0.0015	<0.0015 [<0.0016]	<0.0015	<0.0014	<0.0014	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Isopropyltoluene	- -	- -	- -	mg/kg	<0.0011	<0.0011	0.0048 [<0.0012]	<0.0011	<0.0011	<0.0010	NA	NA	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene	- -	- -	- -	mg/kg	<0.0015	<0.0015	<0.0015 [<0.0016]	<0.0015	<0.0014	<0.0014	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	1,000 {sat}	1,000 {sat}	- -	mg/kg	<0.00030	<0.00020	<0.00030 [<0.00030]	<0.00030	<0.00020	<0.00020	NA	NA	NA	NA	NA	NA	NA	NA	NA
tert-Butylbenzene	- -	- -	- -	mg/kg	<0.0015	<0.0015	<0.0015 [<0.0016]	<0.0015	<0.0014	<0.0014	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	0.57 {ca}	2.7 {ca}	- -	mg/kg	<0.0014	<0.0014	<0.0014 [<0.0014]	<0.0014	<0.0013	<0.0013	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	500 {nc}	4600 {nc}	- -	mg/kg	<0.0016	<0.0015	<0.0016 [<0.0016]	<0.0016	<0.0015	<0.0014	NA	NA	NA	NA	NA	NA	NA	NA	NA
trans-1,2-Dichloroethene	11 {nc}	50 {nc}	- -	mg/kg	<0.0053	<0.0052	<0.0054 [<0.0055]	<0.0053	<0.0051	<0.0048	NA	NA	NA	NA	NA	NA	NA	NA	NA
trans-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.0013	<0.0012	<0.0013 [<0.0013]	<0.0013	<0.0012	<0.0011	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	2.8 {ca}	14 {ca}	- -	mg/kg	<0.0032	<0.0032	<0.0033 [<0.0034]	<0.0032	<0.0031	<0.0029	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	80 {nc}	1,300 {sat}	- -	mg/kg	<0.0014	<0.0014	<0.0015 [<0.0015]	<0.0014	<0.0014	<0.0013	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Acetate	99 {nc}	2,800 {sat}	- -	mg/kg	<0.0063 J	<0.0062 J	<0.0064 J [<0.0065 J]	<0.0063 J	<0.0060 J	<0.0057 J	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	0.06 {ca}	1.7 {ca}	- -	mg/kg	<0.0023	<0.0023	<0.0024 [<0.0024]	<0.0023	<0.0023	<0.0021	NA	NA	NA	NA	NA	NA	NA	NA	NA
Xylenes (total)	60 {nc}	260 {nc}	- -	mg/kg	<0.0029	<0.0028	<0.0029 [<0.0030]	<0.0029	<0.0028	<0.0026	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organics																			
1,2,4-Trichlorobenzene	8.7 {ca**}	40 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
1,2-Dichlorobenzene	220 {sat}	220 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
1,2-Diphenylhydrazine	0.61 {ca**}	2.2 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
1,4-Dichlorobenzene	2.6 {ca}	13 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
2,4,5-Trichlorophenol	610 {nc}	6,200 {nc}	- -	mg/kg	<1.0	<0.98	<1.0 [<1.0]	<1.0	<0.97	<0.92	<0.96	<0.97	<0.98	<1.0 [<1.0]	<0.92 [<1.0]	NA	NA	<1.0	<1.0
2,4,6-Trichlorophenol	44 {ca**}	160 {ca**}	- -	mg/kg	<0.38	<0.37	<0.39 [<0.39]	<0.38	<0.36	<0.34	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
2,4-Dichlorophenol	18 {nc}	180 {nc}	- -	mg/kg	<0.38	<0.37	<0.39 [<0.39]	<0.38	<0.36	<0.34	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
2,4-Dimethylphenol	120 {nc}	1,200 {nc}	- -	mg/kg	<0.38	<0.37	<0.39 [<0.39]	<0.38	<0.36	<0.34	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
2,4-Dinitrophenol	12 {nc}	120 {nc}	- -	mg/kg	<2.5	<2.5	<2.6 [<2.6]	<2.5	<2.4	<2.3	<2.4	<2.4	<2.5	<2.6 [<2.5]	<2.3 [<2.5]	NA	NA	<2.5	<2.5
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
2-Chloronaphthalene	210 {sat}	210 {sat}	- -	mg/kg	<0.38	<0.37	<0.39 [<0.39]	<0.38	<0.36	<0.34	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
2-Chlorophenol	39 {nc}	510 {nc}	- -	mg/kg	<0.38	<0.37	<0.39 [<0.39]	<0.38	<0.36	<0.34	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	<0.38	<0.37	<0.39 [<0.39]	<0.38	<0.36	<0.34	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
2-Methylphenol	310 {nc}	3,100 {nc}	- -	mg/kg	<0.38	<0.37	<0.39 [<0.39]	<0.38	<0.36	<0.34	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
2-Nitroaniline	- -	- -	- -	mg/kg	<2.5	<2.5	<2.6 [<2.6]	<2.5	<2.4	<2.3	<2.4	<2.4	<2.5	<2.6 [<2.5]	<2.3 [<2.5]	NA	NA	<2.5	<2.5
2-Nitrophenol	- -	- -	- -	mg/kg	<0.38	<0.37	<0.39 [<0.39]	<0.38	<0.36	<0.34	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
3,3'-Dichlorobenzidine	1.1 {ca**}	3.8 {ca**}	- -	mg/kg	<0.75	<0.74	<0.77 [<0.77]	<0.75	<0.73	<0.69	<0.72	<0.73	<0.74	<0.76 [<0.75]	<0.69 [<0.75]	NA	NA	<0.75	<0.75
3-Nitroaniline	- -	- -	- -	mg/kg	<2.5	<2.5	<2.6 [<2.6]	<2.5	<2.4	<2.3	<2.4	<2.4	<2.5	<2.6 [<2.5]	<2.3 [<2.5]	NA	NA	<2.5	<2.5
4,6-Dinitro-2-methylphenol	- -	- -	- -	mg/kg	<2.5	<2.5	<2.6 [<2.6]	<2.5	<2.4	<2.3	<2.4	<2.4	<2.5	<2.6 [<2.5]	<2.3 [<2.5]	NA	NA	<2.5	<2.5
4-Bromophenyl-phenylether	- -	- -	- -	mg/kg	<0.38	<0.37	<0.39 [<0.39]	<0.38	<0.36	<0.34	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
4-Chloro-3-Methylphenol	- -	- -	- -	mg/kg	<0.75	<0.74	<0.77 [<0.77]	<0.75	<0.73	<0.69	<0.72	<0.73	<0.74	<0.76 [<0.75]	<0.69 [<0.75]	NA	NA	<0.75	<0.75
4-Chloroaniline	24 {nc}	250 {nc}	- -	mg/kg	<0.75	<0.74	<0.77 [<0.77]	<0.75	<0.73	<0.69	<0.72	<0.73	<0.74	<0.76 [<0.75]	<0.69 [<0.75]	NA	NA	<0.75	<0.75
4-Chlorophenyl-phenylether	- -	- -	- -	mg/kg	<0.38	<0.37	<0.39 [<0.39]	<0.38	<0.36	<0.34	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
4-Methylphenol	31 {nc}	310 {nc}	- -	mg/kg	<0.38	<0.37	<0.39 [<0.39]	<0.38	<0.36	<0.34	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
4-Nitroaniline	- -	- -	- -	mg/kg	<2.5	<2.5	<2.6 [<2.6]	<2.5	<2.4	<2.3	<2.4 J	<2.4 J	<2.5 J	<2.6 [<2.5]	<2.3 [<2.5]	NA	NA	<2.5	<2.5
4-Nitrophenol	- -	- -	- -	mg/kg	<2.5	<2.5	<2.6 [<2.6]	<2.5	<2.4	<2.3	<2.4	<2.4	<2.5	<2.6 [<2.5]	<2.3 [<2.5]	NA	NA	<2.5	<2.5
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.36	<0.36	<0.37	<0.38 J [<0.37 J]	<0.34 J [<0.37 J]	NA	NA	<0.37 J	<0.37 J
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.36	<0.36	<0.37	<0.38 J [<0.37 J]	<0.34 J [<0.37 J]	NA	NA	<0.37 J	<0.37 J
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
Benzoic Acid	240,000 {max}	2,500,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzyl Alcohol	3,100 {nc}	310,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Chloroethoxy)methane	18 {nc}	180 {nc}	- -	mg/kg	<0.38	<0.37	<0.39 [<0.39]	<0.38	<0.36	<0.34	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
bis(2-Chloroethyl)ether	0.19 {ca**}	0.9 {ca**}	- -	mg/kg	<0.38	<0.37	<0.39 [<0.39]	<0.38	<0.36	<0.34	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
bis(2-Chloroisopropyl)ether	- -	- -	- -	mg/kg	<0.38	<0.37	<0.39 [<0.39]	<0.38	<0.36	<0.34	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
bis(2-Ethylhexyl)phthalate	35 {ca*}	120 {ca*}	- -	mg/kg	<0.38	<0.37	<0.39 [<0.39]	<0.38	<0.36	<0.34	0.040	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
Butylbenzylphthalate	260 {ca*}	910 {ca*}	- -	mg/kg	<0.38	<0.37	<0.39 [<0.39]	<0.38	<0.36	<0.34	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
Carbazole	24 {ca**}	86 {ca**}	- -	mg/kg	<0.38	<0.37	<0.39 [<0.39]	<0.38	<0.36	<0.34	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.36	<0.36	<0.37	<0.38 J [<0.37 J]	<0.34 J [<0.37 J]	NA	NA	<0.37 J	<0.37 J
Dibenzofuran	- -	- -	- -	mg/kg	<0.38	<0.37	<0.39 [<0.39]	<0.38	<0.36	<0.34	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
Diethylphthalate	4,900 {nc}	490,000 {max}	- -	mg/kg	<0.38	<0.37	<0.39 [<0.39]	<0.38	<0.36	<0.34	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
Dimethylphthalate	- -	- -	- -	mg/kg	<0.38	<0.37	<0.39 [<0.39]	<0.38	<0.36	<0.34	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
Di-n-Butylphthalate	610 {nc}	6,200 {nc}	- -	mg/kg	<0.38	0.050 B	<0.39 [0.050 B]	0.070 B	0.070 B	0.13 B	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
Di-n-Octylphthalate	- -	- -	- -	mg/kg	<0.38	<0.37	<0.39 [<0.39]	<0.38	<0.36	<0.34	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37

Notes found at end of table.

Table 9-5. Soil Analytical Results, Western Burning Ground, 1999 ICF KE Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	WBGSB6 0 - 2 05/26/99	WBGSB7 0 - 2 05/26/99	WBGSB8 0 - 2 05/26/99	WBGSB9 0 - 2 05/26/99	WBGSB10 0 - 2 05/26/99	WBGSB11 0 - 2 05/26/99	WBGBC1 0 - 2 08/18/99	WBGBC1 5 - 7 08/18/99	WBGSB12 0 - 4 08/18/99	WBGSB13 0 - 2 10/06/99	WBGSB13 2 - 4 10/06/99	WBGSB14 0 - 2 10/06/99	WBGSB14 2 - 4 10/06/99	WBGSB15 0 - 2 10/06/99	WBGSB15 2 - 4 10/06/99
Semivolatile Organics																			
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
Hexachlorobenzene	0.3 {ca}	1.1 {ca}	- -	mg/kg	<0.38	<0.37	<0.39 [<0.39]	<0.38	<0.36	<0.34	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
Hexachlorobutadiene	6.2 {ca**}	22 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
Hexachlorocyclopentadiene	37 {nc}	370 {nc}	- -	mg/kg	<0.38	<0.37	<0.39 [<0.39]	<0.38	<0.36	<0.34	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
Hexachloroethane	35 {ca**}	120 {ca**}	- -	mg/kg	<0.38	<0.37	<0.39 [<0.39]	<0.38	<0.36	<0.34	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.36	<0.36	<0.37	<0.38 J [<0.37 J]	<0.34 J [<0.37 J]	NA	NA	<0.37 J	<0.37 J
Isophorone	510 {ca*}	1,800 {ca*}	- -	mg/kg	<0.38	<0.37	<0.39 [<0.39]	<0.38	<0.36	<0.34	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
Naphthalene	3.9 {ca}	20 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
N-Nitroso-di-n-propylamine	0.069 {ca**}	0.25 {ca**}	- -	mg/kg	<0.38	<0.37	<0.39 [<0.39]	<0.38	<0.36	<0.34	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
N-Nitrosodiphenylamine	99 {ca**}	350 {ca**}	- -	mg/kg	<0.38	<0.37	<0.39 [<0.39]	<0.38	<0.36	<0.34	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
Pentachlorophenol	3 {ca}	9 {ca}	- -	mg/kg	<2.5	<2.5	<2.6 [<2.6]	<2.5	<2.4	<2.3	<2.4	<2.4	<2.5	<2.6 [<2.5]	<2.3 [<2.5]	NA	NA	<2.5	<2.5
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
Phenol	1,800 {nc}	180,000 {max}	- -	mg/kg	<0.38	<0.37	<0.39 [<0.39]	<0.38	<0.36	<0.34	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.36	<0.36	<0.37	<0.38 [<0.37]	<0.34 [<0.37]	NA	NA	<0.37	<0.37
Inorganics																			
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	17,100	14,700	15,800 [18,800]	15,500	14,800	8,570	27,900	**46,500**	18,300	10,600 [10,300]	11,700 [14,100]	16,000	11,400	10,400	14,600
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	<0.630	<0.610	1.90 B [<0.650]	<0.620	<0.580	<0.560	1.70 B	2.20 B	1.70 B	<0.490 [<0.500]	<0.500 [<0.500]	<0.590	<0.620	<0.490	<0.500
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	11.6	10.0	**17.1 [15.8]**	14.9	8.50	6.00 B	11.2 K	11.4 K	9.80 K	6.80 B [8.70 L]	8.00 L [8.40 L]	11.3 L	8.40 L	7.40 B	9.20 L
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	11.5 L	20.6 L	35.9 L [19.4 L]	72.2 L	30.0 L	22.9 L	33.1	105	23.8 J	14.7 J [19.8 J]	27.8 [24.3]	17.2 J	24.4 J	17.0 J	17.6 J
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	0.610 K	0.520 K	0.650 K [0.490 K]	0.780 K	0.570 K	0.230 K	0.830 B	**2.50**	0.550 B	0.590 B [0.620 B]	**1.30 B [1.00 B]**	0.680 B	0.690 B	0.670 B	**1.10 B**
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	0.440	0.300	**0.740 [0.790]**	0.540	0.330	<0.110	<0.120	0.310 J	<0.120	<0.100 [<0.100]	<0.100 [<0.100]	<0.120	<0.120	<0.100	<0.100
Calcium	- -	- -	- -	mg/kg	533	856	1,300 [1,050]	1,780	1,630	660	3,730	4,630	1,300	714 [1,040]	1,230 [1,480]	826	1,450	643	1,250
Chromium	280 {ca}	1,460 {ca}	65.3	mg/kg	37.7	28.1	46.6 [49.7]	45.7	30.6	22.2	39.4	65.3	35.7	23.9 [28.2]	37.3 [29.6]	32.3	30.6	24.1	43.1
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	7.10	8.20	7.20 [4.80]	11.9	6.00	5.80	17.0	17.3	8.30	6.20 [22.6]	23.0 [14.4]	17.9	7.70	7.50	10.6
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	35.7 K	21.6	40.0 K [29.0 K]	33.8 K	21.1	10.4	28.1	43.0	20.0	17.7 [20.4]	18.2 [25.5]	24.6	21.8	18.4	27.2
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	37,600	31,800	**39,300 [54,000]**	39,100	35,000	20,400	46,000	43,700	36,400	29,000 [32,800]	27,800 [39,800]	40,300	31,600	30,300	42,700
Lead	400 {++}	800 {++}	26.8	mg/kg	21.0 J	15.1 J	**79.4 J [17.7 J]**	**43.6 J**	11.6	11.6	**33.2**	18.6	19.0	19.3 [25.3]	**25.5 [29.0]**	**33.3**	21.3	18.0	25.6
Magnesium	- -	- -	- -	mg/kg	337	416	688 [735]	1,100	601	319	3,990	31,300	866	434 J [474 J]	2,510 [897]	699	912	526	372 J
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	70.7 K	87.0 K	82.8 K [60.2 K]	122 K	71.3 K	131 K	268	256	111	79.9 [162]	241 [183]	192	83.2	92.5	71.5
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	<0.130	<0.120	<0.130 [<0.120]	**0.210 K**	**0.210 K**	<0.110	**0.190**	<0.120	**0.200**	<0.100 [<0.100]	<0.100 [<0.100]	<0.110	<0.120	<0.100	**0.140 K**
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	17.9 K	11.5 K	15.1 K [11.3 K]	16.2 K	10.7 K	5.30	18.4	36.0	12.8	9.00 [8.60]	13.6 [15.7]	13.8	10.7	9.60	19.5
Potassium	- -	- -	- -	mg/kg	488	545	704 [625]	684	583	444	1,240	5,960	969	488 J [528]	861 [619]	858	788	512	634
Selenium	39 {nc}	510 {nc}	- -	mg/kg	<0.500 L	<0.490 L	<0.510 L [<0.520 L]	<0.500 L	<0.580 L	1.20	<0.590	<0.590	<0.610	<0.490 L [<0.500 L]	<0.500 L [<0.500 L]	<0.590 L	<0.620 L	<0.490 L	<0.500 L
Silver	39 {nc}	510 {nc}	- -	mg/kg	0.350 B	0.280 B	0.360 B [0.470 B]	0.410 B	0.280 B	0.130 B	<0.120	<0.120	<0.120	1.50 [1.90]	1.60 [2.30]	<0.120	<0.120	1.80	2.00
Sodium	- -	- -	- -	mg/kg	120 B	123 B	159 B [124 B]	148 B	112 B	119 B	116 B	153 B	90.0 B	119 B [113 B]	102 B [103 B]	176 B	163 B	91.8 B	95.7 B
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	<0.880	<0.850	<0.890 [<0.910]	<0.870	<0.810	<0.780	<0.820 J	<0.830 J	<0.850 J	<0.690 [<0.700]	<0.700 [<0.690]	<0.830	<0.880	<0.680	<0.690
Vanadium	55{nc}	720 {nc}	108	mg/kg	82.8 K	61.7 K	86.2 K [90.7 K]	82.3 K	63.8 K	39.0 K	74.9	75.8	65.9	49.7 [58.5]	52.5 [68.9]	78.5	62.2	55.7	76.2
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	59.5 K	30.9 K	**381 K [118]**	96.5 K	25.7 K	15.2 K	**414**	59.5	32.8	25.7 K [32.4 K]	28.4 K [29.6 K]	30.3	33.0	23.7 K	31.8 K
Miscellaneous																			
pH	- -	- -	- -	pH Units	6.15	NA	NA	6.6	NA	5.95	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Organic Carbon	- -	- -	- -	mg/kg	1,736	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Inorganics-TCLP	**TCLP Screening Value**																		
Arsenic	5,000	- -	- -	µg/L	NA	NA	NA	<6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	10,000	- -	- -	µg/L	NA	NA	NA	341	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	1,000	- -	- -	µg/L	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	5,000	- -	- -	µg/L	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	5,000	- -	- -	µg/L	NA	NA	NA	<2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	200	- -	- -	µg/L	NA	NA	NA	<0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	1,000	- -	- -	µg/L	NA	NA	NA	<4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	5,000	- -	- -	µg/L	NA	NA	NA	1.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes found at end of table.

Table 9-5. Soil Analytical Results, Western Burning Ground, 1999 ICF KE Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	WBGSB16 0 - 2 10/06/99	WBGSB16 2 - 4 10/06/99	WBGSB17 0 - 2 10/06/99	WBGSB17 2 - 4 10/06/99	WBGSB18 0 - 2 10/06/99	WBGSB18 2 - 4 10/06/99	WBGSB19 0 - 2 10/06/99	WBGSB19 2 - 4 10/06/99	WBGSB20 0 - 2 10/06/99	WBGSB20 2 - 4 10/06/99	WBGSB21 0 - 2 10/06/99	WBGSB21 2 - 4 10/06/99
Explosives																
1,3,5-Trinitrobenzene	220 {nc}	2,700 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dinitrobenzene	0.61 {nc}	6.2 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trinitrotoluene	3.6 {ca**}	42 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Amino-4,6-Dinitrotoluene	15 {nc}	190 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Amino-2,6-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HMX	310 {nc}	3,100 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
m-Nitrotoluene	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitroglycerine	0.61 {nc}	6.2 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
o-Nitrotoluene	78 {nc}	1,300 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentaerythritol Tetranitrate	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Nitrotoluene	30 {ca**}	110 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
RDX	4.4 {ca*}	16 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetryl	24 {nc}	250 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PAHs																
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	3.9 {nc}	20 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Volatile Organics																
1,1,1,2-Tetrachloroethane	2 {ca}	9.8 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	680 {sat}	680 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	0.59 {ca**}	2.9 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	1.1 {ca}	5.5 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	3.4 {ca}	17 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	25 {nc}	110 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloropropene	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3-Trichlorobenzene	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	0.091 {ca}	0.41 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	180 {ca**}	220 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trimethylbenzene	6.7 {nc}	28 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dibromo-3-chloropropane	0.0056 {ca}	0.073 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dibromoethane	0.034 {ca}	0.17 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	220 {sat}	220 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	0.45 {ca}	2.2 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	0.93 {ca*}	4.7 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3,5-Trimethylbenzene	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dichloropropane	160 {nc}	1,600 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	2.6 {ca}	13 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,2-Dichloropropane	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone	2,800 {nc}	19,000 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Chloroethyl Vinyl Ether	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Chlorotoluene	1,000 {sat}	1,000 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Hexanone	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chlorotoluene	290 {sat}	290 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methyl-2-pentanone	530 {nc}	5,200 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone	6,100 {nc}	61,000 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acrolein	0.016 {nc}	0.068 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acrylonitrile	0.24 {ca*}	1.2 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	1.1 {ca*}	5.6 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromobenzene	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromochloromethane	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromodichloromethane	10 {ca}	46 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromoform	61 {ca*}	220 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromomethane	0.79 {nc}	3.5 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	67 {nc}	300 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Tetrachloride	0.25 {ca}	1.3 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	31 {nc}	860 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroethane	2,200 {sat}	2,200 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	0.3 {ca}	1.5 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes found at end of table.

Table 9-5. Soil Analytical Results, Western Burning Ground, 1999 ICF KE Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	WBGSB16 0 - 2 10/06/99	WBGSB16 2 - 4 10/06/99	WBGSB17 0 - 2 10/06/99	WBGSB17 2 - 4 10/06/99	WBGSB18 0 - 2 10/06/99	WBGSB18 2 - 4 10/06/99	WBGSB19 0 - 2 10/06/99	WBGSB19 2 - 4 10/06/99	WBGSB20 0 - 2 10/06/99	WBGSB20 2 - 4 10/06/99	WBGSB21 0 - 2 10/06/99	WBGSB21 2 - 4 10/06/99
Volatile Organics																
Chloromethane	1.7 {ca*}	8.4 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,2-Dichloroethene	78 {nc}	1,300 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,3-Dichloropropene	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibromochloromethane	5.8 {ca}	21 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibromomethane	78 {nc}	3,000 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dichlorodifluoromethane	19 {nc}	78 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	5.7 {ca}	29 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	6.2 {ca**}	22 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Isopropylbenzene	310 {sat}	310 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
m,p-Xylene	60 {nc}	260 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	11 {ca}	54 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Butylbenzene	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Propylbenzene	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
o-Xylene	300 {sat}	300 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Isopropyltoluene	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	1,000 {sat}	1,000 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tert-Butylbenzene	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	0.57 {ca}	2.7 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	500 {nc}	4600 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
trans-1,2-Dichloroethene	11 {nc}	50 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
trans-1,3-Dichloropropene	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	2.8 {ca}	14 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	80 {nc}	1,300 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Acetate	99 {nc}	2,800 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	0.06 {ca}	1.7 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Xylenes (total)	60 {nc}	260 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organics																
1,2,4-Trichlorobenzene	8.7 {ca**}	40 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
1,2-Dichlorobenzene	220 {sat}	220 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
1,2-Diphenylhydrazine	0.61 {ca**}	2.2 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
1,4-Dichlorobenzene	2.6 {ca}	13 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
2,4,5-Trichlorophenol	610 {nc}	6,200 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<1.0 [<0.94]	<0.94 [<1.0]	NA	NA	<0.98	<0.10
2,4,6-Trichlorophenol	44 {ca**}	160 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.050
2,4-Dichlorophenol	18 {nc}	180 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.090
2,4-Dimethylphenol	120 {nc}	1,200 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
2,4-Dinitrophenol	12 {nc}	120 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<2.5 [<2.4]	<2.4 [<2.5]	NA	NA	<2.5	<0.19
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
2-Chloronaphthalene	210 {sat}	210 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
2-Chlorophenol	39 {nc}	510 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.050
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
2-Methylphenol	310 {nc}	3,100 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.070
2-Nitroaniline	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	<2.5 [<2.4]	<2.4 [<2.5]	NA	NA	<2.5	<0.14
2-Nitrophenol	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.12
3,3'-Dichlorobenzidine	1.1 {ca**}	3.8 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.75 [<0.70]	<0.70 [<0.75]	NA	NA	<0.74	<0.16
3-Nitroaniline	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	<2.5 [<2.4]	<2.4 [<2.5]	NA	NA	<2.5	<0.15
4,6-Dinitro-2-methylphenol	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	<2.5 [<2.4]	<2.4 [<2.5]	NA	NA	<2.5	<0.24
4-Bromophenyl-phenylether	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
4-Chloro-3-Methylphenol	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.75 [<0.70]	<0.70 [<0.75]	NA	NA	<0.74	<0.070
4-Chloroaniline	24 {nc}	250 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.75 [<0.70]	<0.70 [<0.75]	NA	NA	<0.74	<0.070
4-Chlorophenyl-phenylether	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
4-Methylphenol	31 {nc}	310 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.070
4-Nitroaniline	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	<2.5 [<2.4]	<2.4 [<2.5]	NA	NA	<2.5	<0.20
4-Nitrophenol	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	<2.5 [<2.4]	<2.4 [<2.5]	NA	NA	<2.5	<0.030
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 J [<0.35 J]	<0.35 J [<0.38 J]	NA	NA	<0.37 J	<0.12 J
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 J [<0.35 J]	<0.35 J [<0.38 J]	NA	NA	<0.37 J	<0.030 J
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.11
Benzoic Acid	240,000 {max}	2,500,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzyl Alcohol	3,100 {nc}	310,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Chloroethoxy)methane	18 {nc}	180 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
bis(2-Chloroethyl)ether	0.19 {ca**}	0.9 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
bis(2-Chloroisopropyl)ether	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
bis(2-Ethylhexyl)phthalate	35 {ca*}	120 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.070
Butylbenzylphthalate	260 {ca*}	910 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
Carbazole	24 {ca**}	86 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.050
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 J [<0.35 J]	<0.35 J [<0.38 J]	NA	NA	<0.37 J	<0.050 J
Dibenzofuran	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.060
Diethylphthalate	4,900 {nc}	490,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
Dimethylphthalate	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
Di-n-Butylphthalate	610 {nc}	6,200 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
Di-n-Octylphthalate	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030

Notes found at end of table.

Table 9-5. Soil Analytical Results, Western Burning Ground, 1999 ICF KE Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	WBGSB16 0 - 2 10/06/99	WBGSB16 2 - 4 10/06/99	WBGSB17 0 - 2 10/06/99	WBGSB17 2 - 4 10/06/99	WBGSB18 0 - 2 10/06/99	WBGSB18 2 - 4 10/06/99	WBGSB19 0 - 2 10/06/99	WBGSB19 2 - 4 10/06/99	WBGSB20 0 - 2 10/06/99	WBGSB20 2 - 4 10/06/99	WBGSB21 0 - 2 10/06/99	WBGSB21 2 - 4 10/06/99
Semivolatile Organics																
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
Hexachlorobenzene	0.3 {ca}	1.1 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
Hexachlorobutadiene	6.2 {ca**}	22 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
Hexachlorocyclopentadiene	37 {nc}	370 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
Hexachloroethane	35 {ca**}	120 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 J [<0.35 J]	<0.35 J [<0.38 J]	NA	NA	<0.37 J	<0.030 J
Isophorone	510 {ca*}	1,800 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
Naphthalene	3.9 {ca}	20 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
N-Nitroso-di-n-propylamine	0.069 {ca**}	0.25 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
N-Nitrosodiphenylamine	99 {ca**}	350 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
Pentachlorophenol	3 {ca}	9 {ca}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<2.5 [<2.4]	<2.4 [<2.5]	NA	NA	<2.5	<0.12
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
Phenol	1,800 {nc}	180,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.37 [<0.35]	<0.35 [<0.38]	NA	NA	<0.37	<0.030
Inorganics																
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	13,700 [13,200]	15,900	15,400	15,700	15,700	12,900	14,500 [10,700]	8,650 [8,290]	20,900	15,700	11,100	14,600
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	<0.610 [<0.610]	<0.630	<0.640	<0.640	<0.590	<0.590	<0.500 [<0.500]	<0.500 [<0.490]	<0.590	<0.610	<0.490	0.610 J
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	12.5 L [12.0 L]	12.5 L	11.9 L	13.0 L	10.2 L	8.10 L	5.40 B [5.10 B]	6.40 B [5.60 B]	9.90 L	14.3 L	8.50 L	11.6 L
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	26.3 [22.9 J]	20.7 J	19.6 J	17.1 J	18.5 J	16.4 J	20.0 [22.7]	23.0 [19.0 J]	17.5 J	23.9 J	25.5	22.0 J
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	0.960 B [0.680 B]	0.930 B	0.770 B	0.810 B	0.560 B	0.350 B	1.00 B [0.720 B]	0.530 B [0.430 B]	**1.10 B**	0.660 B	0.710 B	0.750 B
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	<0.120 [<0.120]	<0.130	<0.130	<0.130	<0.120	<0.120	<0.100 [<0.100]	<0.100 [<0.100]	<0.0100	<0.120	<0.100	<0.120
Calcium	- -	- -	- -	mg/kg	1,300 [1,190]	1,420	1,130	1,430	836	843	760 [920]	828 [776]	1,680	2,940	1,220	1,360
Chromium	280 {ca}	1,460 {ca}	65.3	mg/kg	37.5 [34.1]	41.1	39.4	40.4	38.8	38.7	35.3 [28.8]	22.6 [20.5]	45.7	41.3	28.8	34.8
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	31.4 [14.8]	10.1	11.0	7.30	6.30	5.40 J	7.10 [7.60]	8.10 [7.90]	17.7	8.90	8.60	10.0
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	29.8 [24.5]	23.9	27.4	31.4	22.9	19.9	21.3 [15.5]	11.9 [13.1]	32.3	27.5	19.3	26.5
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	46,700 [40,300]	42,500	44,300	48,800	39,700	39,800	39,200 [27,300]	23,400 [22,800]	43,400	47,100	32,300	40,600
Lead	400 {++}	800 {++}	26.8	mg/kg	**44.4 [29.9]**	25.3	**26.9**	**26.9**	19.6	12.6	15.1 [14.8]	18.0 [14.5]	**28.9**	23.6	24.0	24.0
Magnesium	- -	- -	- -	mg/kg	693 [588 J]	12,000	698	708	609	713	627 [967]	481 J [518]	2,480	808	784	605
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	241 [160]	125	119	119	74.6	47.4	45.7 [197]	129 [103]	119	148	158	127
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	<0.120 [<0.120]	<0.120	<0.130	<0.120	<0.120	<0.120	<0.100 [<0.100]	<0.100 [<0.100]	**0.160 K**	**0.180 K**	<0.100	<0.120
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	14.4 [12.1]	14.1	13.8	16.0	12.6	7.60	12.2 [8.90]	6.70 [5.30]	20.0	14.4	9.40	13.8
Potassium	- -	- -	- -	mg/kg	690 [621]	1,030	728	981	534 J	708	670 [523]	652 [646]	1,420	973	442 J	629
Selenium	39 {nc}	510 {nc}	- -	mg/kg	<0.610 L [<0.610 L]	<0.630 L	<0.640 L	<0.640 L	<0.590 L	<0.590 L	<0.500 L [<0.500 L]	<0.500 L [<0.490 L]	<0.590 L	<0.610 L	<0.490 L	<0.590 L
Silver	39 {nc}	510 {nc}	- -	mg/kg	<0.120 [<0.120]	<0.130	<0.130	<0.130	<0.120	<0.120	2.20 [1.50]	1.40 [1.30]	<0.120	<0.120	1.70	<0.120
Sodium	- -	- -	- -	mg/kg	149 B [144 B]	163 B	142 B	151 B	134 B	126 B	104 B [107 B]	92.7 B [97.2 B]	131 B	154 B	95.2 B	124 B
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	<0.850 [<0.850]	<0.880	<0.890	<0.890	<0.830	<0.820	<0.690 [<0.700]	<0.700 [<0.690]	<0.820	<0.850	<0.680	<0.820
Vanadium	55{nc}	720 {nc}	108	mg/kg	81.6 [75.0]	74.9	83.5	88.9	80.6	71.0	70.2 [51.0]	42.1 [41.9]	84.6	92.3	57.3	77.5
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	54.7 [43.9]	39.7	40.1	53.3	29.2	16.9	28.1 K [17.7 K]	17.6 K [16.2 K]	38.2	38.3	33.7 K	40.0
Miscellaneous																
pH	- -	- -	- -	pH Units	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Organic Carbon	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Inorganics-TCLP	**TCLP Screening Value**															
Arsenic	5,000	- -	- -	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	10,000	- -	- -	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	1,000	- -	- -	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	5,000	- -	- -	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	5,000	- -	- -	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	200	- -	- -	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	1,000	- -	- -	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	5,000	- -	- -	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

mg/kg	Milligrams per kilogram.
µg/L	Micrograms per liter.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 9-6. Excavated Soil Sampling Results From Test Pitting Activites, Western Burning Ground, 1999 ICF KE Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID:			WBGDW1	WBGDW2	WBGDW3	WBGDW4	WBGDW5	WBGDW6	WBGDW7	WBGDW15	WBGDW16
Sample Depth(Feet):	TCLP		0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2			
Date Collected:	Standard	Units	05/26/99	05/26/99	05/26/99	05/26/99	05/26/99	05/26/99	06/21/99	06/28/99	07/13/99
Inorganics-TCLP											
Arsenic	5,000	µg/L	<6	<6	<6	<6	<6	<6	<6	<6	7.7
Barium	10,000	µg/L	48.5	905	42.1	120	24.2	24	116	628	126
Cadmium	1,000	µg/L	<1	3.9	<1	<1	<1	1.3	<1	1.3	<1
Chromium	5,000	µg/L	<1	3.2	<1	<1	<1	<1	337	103	5.6
Lead	5,000	µg/L	<2	11.4	2.2	<2	5.3	<2	<2	272	9.1
Mercury	200	µg/L	<0.2	<0.2	0.75	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Selenium	1,000	µg/L	<4	5	<4	4.5	<4	<4	<4	<4	<4
Silver	5,000	µg/L	<1	<1	1.1	<1	<1	<1	<1	<1	<1

Location ID:	WBGDW17	WBGDW18	WBGDW19	WBGDW20	WBGDW21	WBGDW22	WBGDW23	WBGDW23	WBGDW24	WBGDW25	WBGDW26
Sample Depth(Feet):											
Date Collected:	07/14/99	07/15/99	07/15/99	07/15/99	07/15/99	07/22/99	07/22/99	07/29/99	07/23/99	07/23/99	10/06/99
Inorganics-TCLP											
Arsenic	6	<6	<6	<6	<6	<6	<6	<6	<6	<6	<6
Barium	485	346	272	497	847	221	553	326	588	423	108
Cadmium	<1	5.6	2.9	2.3	8.2	2.4	3.4	1.6	2.1	4.5	<1
Chromium	113	13	<1	144	19.5	<1	6.9	66	<1	17.2	<1
Lead	88.9	468	284	424	558	157	3,530	721	172	221	8.6
Mercury	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Selenium	<5	12.9	10.6	11.1	10.2	<5	6.2	<5	<5	<5	<5
Silver	1.3	1.2	<1	<1	<1	1	<1	<1	1	<1	<1

µg/L	Micrograms per liter.
J	Constituent concentration quanitified as estimated.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above TCLP Screening Value.

Table 9-7. Test Pit Confirmation Soil Samples, Western Burning Ground, 1999 ICF KE Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	WBGTP1A 2.5 - 3 06/22/99	WBGTP1B 3 - 3.5 06/23/99	WBGTP1B 3.5 - 4 07/23/99	WBGTP1S 1 - 1.5 06/22/99	WBGTP1SB 1 - 1.5 06/23/99	WBGTP2A 2.5 - 3 06/22/99	WBGTP2B 3 - 3.5 06/22/99	WBGTP2S 1 - 1.5 06/22/99	WBGTP3A 2.5 - 3 06/23/99	WBGTP3S 1 - 1.5 06/23/99	WBGTP4A 2.5 - 3 06/24/99	WBGTP4B 2 - 2.5 06/24/99	WBGTP4S 0.5 - 1 06/24/99	WBGTP5A 2.5 - 3 06/24/99	WBGTP5B 2.5 - 3 06/24/99	WBGTP6A 2.5 - 3 06/23/99	WBGTP7A 2.5 - 3 07/13/99	WBGTP7B 2.5 - 3 07/14/99	WBGTP7S 1 - 1.5 07/14/99	WBGTP8A 3 - 3.5 07/13/99	WBGTP8B 3 - 3.5 07/13/99	WBGTP9A 2.5 - 3 06/24/99	WBGTP9S 1 - 1.5 06/24/99	WBGTP10A 2.5 - 3 07/15/99
Dioxin/Furan																												
1,2,3,4,6,7,8-HpCDD	0.00039 {ca**}	0.0016 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	0.000243	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.000133	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8-HpCDF	0.00032 {ca**}	0.0011 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	0.00000042	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0000256	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8,9-HpCDF	0.00032 {ca**}	0.0011 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.0000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00000151	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-HxCDD	0.000039 {ca**}	0.00016 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	0.00000723	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00000168	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-HxCDF	0.000032 {ca**}	0.00011 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.00000006	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00000181	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-HxCDD	0.000039 {ca**}	0.00016 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	0.000023	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00000389	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-HxCDF	0.000032 {ca**}	0.00011 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.00000006	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00000218	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-HxCDD	0.000039 {ca**}	0.00016 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	0.0000181	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00000325	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-HxCDF	0.000032 {ca**}	0.00011 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.00000007	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00000052	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-PeCDD	0.0000039 {ca**}	0.000016 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	0.00000685	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00000141	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-PeCDF	0.00011 {ca**}	0.00038 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.00000005	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00000144	NA	NA	NA	NA	NA	NA	NA
2,3,4,6,7,8-HxCDF	0.000032 {ca**}	0.00011 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.00000006	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00000342	NA	NA	NA	NA	NA	NA	NA
2,3,4,7,8-PeCDF	0.000011 {ca**}	0.000038 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.00000005	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00000155	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-TCDD	0.0000045 {ca*}	0.000018 {ca*}	- -	mg/kg	NA	NA	NA	NA	NA	NA	0.00000047	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00000417	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-TCDF	0.000032 {ca**}	0.00011 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	<0.00000007	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00000225	NA	NA	NA	NA	NA	NA	NA
OCDD	0.013 {ca**}	0.053 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	0.00721	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00648 J	NA	NA	NA	NA	NA	NA	NA
OCDF	0.011 {ca**}	0.038 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	0.00000127	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0000472	NA	NA	NA	NA	NA	NA	NA
Total HpCDDs	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	0.000523	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.000278	NA	NA	NA	NA	NA	NA	NA
Total HpCDFs	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	0.00000042	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0000647	NA	NA	NA	NA	NA	NA	NA
Total HxCDDs	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	0.0002	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.000045	NA	NA	NA	NA	NA	NA	NA
Total HxCDFs	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	0.00000087	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0000473	NA	NA	NA	NA	NA	NA	NA
Total PeCDDs	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	0.0000355	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0000107	NA	NA	NA	NA	NA	NA	NA
Total PeCDFs	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	0.00000085	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0000542	NA	NA	NA	NA	NA	NA	NA
Total TCDDs	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	0.0000032	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00000978	NA	NA	NA	NA	NA	NA	NA
Total TCDFs	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	0.00000015	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0000562	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organics																												
1,2,4-Trichlorobenzene	8.7 {ca**}	40 {ca**}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.010	<0.010	<0.010	<0.010	<0.010	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.010	<0.010	<0.34
1,2-Dichlorobenzene	220 {sat}	220 {sat}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.020	<0.020	<0.020	<0.020	<0.020	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.020	<0.020	<0.34
1,2-Diphenylhydrazine	0.61 {ca**}	2.2 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.0062	<0.0061	<0.0060	<0.0060	<0.0061	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.0061	<0.0058	<0.34
1,4-Dichlorobenzene	2.6 {ca}	13 {ca}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.010	<0.010	<0.010	<0.010	<0.010	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.010	<0.010	<0.34
2,4,5-Trichlorophenol	610 {nc}	6,200 {nc}	- -	mg/kg	<1.0	<1.0	NA	<1.0	<0.91	<0.99	<0.94	<0.98	<0.95	<0.96	<0.11	<0.11	<0.11	<0.10	<0.11	<1.1	<1.0	<1.0	<1.1 [<1.0]	<0.98	<0.96	<0.11	<0.10	<0.92
2,4,6-Trichlorophenol	44 {ca**}	160 {ca**}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.050	<0.050	<0.050	<0.050	<0.050	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.050	<0.050	<0.34
2,4-Dichlorophenol	18 {nc}	180 {nc}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.10	<0.10	<0.10	<0.10	<0.10	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.10	<0.090	<0.34
2,4-Dimethylphenol	120 {nc}	1,200 {nc}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.030	<0.030	<0.030	<0.030	<0.030	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.030	<0.030	<0.34
2,4-Dinitrophenol	12 {nc}	120 {nc}	- -	mg/kg	<2.1	<2.1	NA	<2.2	<1.9	<2.1	<2.0	<2.1	<2.0	<2.0	<0.20	<0.19	<0.19	<0.19	<0.19	<2.3	<2.5	<2.5	<2.6 [<2.6]	<2.5	<2.4	<0.19	<0.19	<2.3
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.010	<0.010	<0.010	<0.010	<0.010	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.010	<0.010	<0.34
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.010	<0.010	<0.010	<0.010	<0.010	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.010	<0.010	<0.34
2-Chloronaphthalene	210 {sat}	210 {sat}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.0070	<0.0069	<0.0068	<0.0068	<0.0069	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.0069	<0.0066	<0.34
2-Chlorophenol	39 {nc}	510 {nc}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.050	<0.050	<0.050	<0.050	<0.050	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.050	<0.050	<0.34
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.070	<0.060	<0.060	<0.060	<0.060	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.070	<0.060	<0.34
2-Methylphenol	310 {nc}	3,100 {nc}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.080	<0.070	<0.070	<0.070	<0.070	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.070	<0.070	<0.34
2-Nitroaniline	- -	- -	- -	mg/kg	<2.1	<2.1	NA	<2.2	<1.9	<2.1	<2.0	<2.1	<2.0	<2.0	<0.15	<0.14	<0.14	<0.14	<0.15	<2.3	<2.5	<2.5	<2.6 [<2.6]	<2.5	<2.4	<0.15	<0.14	<2.3
2-Nitrophenol	- -	- -	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.13	<0.13	<0.13	<0.13	<0.13	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.13	<0.12	<0.34
3,3'-Dichlorobenzidine	1.1 {ca**}	3.8 {ca**}	- -	mg/kg	<0.81	<0.81	NA	<0.82	<0.74	<0.80	<0.76	<0.79	<0.77	<0.78	<0.17	<0.16	<0.16	<0.16	<0.16	<0.88	<0.75	<0.75	<0.78 [<0.77]	<0.74	<0.72	<0.16	<0.16	<0.69
3-Nitroaniline	- -	- -	- -	mg/kg	<2.1	<2.1	NA	<2.2	<1.9	<2.1	<2.0	<2.1	<2.0	<2.0	<0.16	<0.16	<0.15	<0.15	<0.16	<2.3	<2.5	<2.5	<2.6 [<2.6]	<2.5	<2.4	<0.16	<0.15	<2.3
4,6-Dinitro-2-methylphenol	- -	- -	- -	mg/kg	<2.1	<2.1	NA	<2.2	<1.9	<2.1	<2.0	<2.1	<2.0	<2.0	<0.26	<0.25	<0.25	<0.25	<0.25	<2.3	<2.5	<2.5	<2.6 [<2.6]	<2.5	<2.4	<0.26	<0.24	<2.3
4-Bromophenyl-phenylether	- -	- -	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.020	<0.020	<0.020	<0.020	<0.020	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.020	<0.020	<0.34
4-Chloro-3-Methylphenol	- -	- -	- -	mg/kg	<0.81	<0.81	NA	<0.82	<0.74	<0.80	<0.76	<0.79	<0.77	<0.78	<0.080	<0.080	<0.080	<0.080	<0.080	<0.88	<0.75	<0.75	<0.78 [<0.77]	<0.74	<0.72	<0.080	<0.070	<0.69
4-Chloroaniline	24 {nc}	250 {nc}	- -	mg/kg	<0.81	<0.81	NA	<0.82	<0.74	<0.80	<0.76	<0.79	<0.77	<0.78	<0.080	<0.080	<0.080	<0.080	<0.080	<0.88	<0.75	<0.75	<0.78 [<0.77]	<0.74	<0.72	<0.080	<0.070	<0.69
4-Chlorophenyl-phenylether	- -	- -	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.010	<0.010	<0.010	<0.010	<0.010	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.010	<0.010	<0.34
4-Methylphenol	31 {nc}	310 {nc}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.080	<0.080	<0.080	<0.080	<0.080	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.080	<0.070	<0.34
4-Nitroaniline	- -	- -	- -	mg/kg	<2.1	<2.1	NA	<2.2	<1.9	<2.1	<2.0	<2.1	<2.0	<2.0	<0.22	<0.21	<0.21	<0.21	<0.21	<2.3	<2.5	<2.5	<2.6 [<2.6]	<2.5	<2.4	<0.22	<0.21	<2.3
4-Nitrophenol	- -	- -	- -	mg/kg	<2.1	<2.1	NA	<2.2	<1.9	<2.1	<2.0	<2.1	<2.0	<2.0	<0.040	<0.040	<0.040	<0.030	<0.040	<2.3	<2.5	<2.5	<2.6 [<2.6]	<2.5	<2.4	<0.040	<0.030	<2.3
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.0075	<0.0073	<0.0072	<0.0071	<0.0073	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.0073	<0.0070	<0.34
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.0091	<0.0089	<0.0089	<0.0087	<0.0089	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.0090	<0.0086	<0.34
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.020	<0.020	<0.020	<0.020	<0.020	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.020	<0.020	<0.34
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.010	<0.010	<0.010	<0.010	<0.010	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.010	<0.010	<0.34
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	0.040	<0.40	<0.010	<0.010	<0.010	<0.010	<0.010	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	0.050	<0.010	<0.34
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	0.060 J	<0.40	<0.13	<0.12	<0.12	<0.12	<0.12	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	0.040	<0.12	<0.34
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	0.39	<0.39	0.38 J	0.42 J	<0.40	<0.010 J	<0.010 J	<0.010	<0.0099 J	<0.010 J	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	0.42 J	<0.0097 J	<0.34
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	0.080 J	<0.40	<0.12	<0.12	<0.12	<0.12	<0.12	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	0.050 J	<0.11	<0.34
Benzoic Acid	240,000 {max}	2,500,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzyl Alcohol	3,100 {nc}	310,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Chloroethoxy)methane	18 {nc}	180 {nc}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.020	<0.020	<0.020	<0.020	<0.020	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.020	<0.020	<0.34
bis(2-Chloroethyl)ether	0.19 {ca**}	0.9 {ca**}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.010 J	<0.010 J	<0.010	<0.010 J	<0.010 J	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.010 J	<0.010 J	<0.34
bis(2-Chloroisopropyl)ether	- -	- -	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.010 J	<0.010 J	<0.010	<0.010 J	<0.010 J	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.010 J	<0.010 J	<0.34
bis(2-Ethylhexyl)phthalate	35 {ca*}	120 {ca*}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.070	<0.070	<0.070	<0.070	<0.070	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.070	0.050	<0.34
Butylbenzylphthalate	260 {ca*}	910 {ca*}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.010	<0.010	<0.010	<0.010	<0.010	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.010	<0.010	<0.34
Carbazole	24 {ca**}	86 {ca**}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.060 J	<0.060 J	<0.050	<0.050 J	<0.060 J	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.060 J	<0.050 J	<0.34
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	0.040	<0.40	<0.020	<0.020	<0.020	<0.020	<0.020	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	0.080 J	<0.020	<0.34
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.060 J	<0.060 J	<0.060	<0.050 J	<0.060 J	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	0.20 J	<0.050 J	<0.34
Dibenzofuran	- -	- -	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.060	<0.060	<0.060	<0.060	<0.060	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.060	<0.060	<0.34
Diethylphthalate	4,900 {nc}	490,000 {max}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.010	<0.010	<0.010	<0.0099	<0.010	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.010	<0.0097	<0.34
Dimethylphthalate	- -	- -	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.010	<0.010	<0.010	<0.010	<0.010	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.010	<0.010	<0.34
Di-n-Butylphthalate	610 {nc}	6,200 {nc}	- -	mg/kg	0.36 B	<0.41	NA	<0.42	0.21 B	0.42 B	0.24 B	<0.40	<0.39	0.20 B	<0.030	<0.030	<0.030	<0.030	<0.030	0.17 B	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.030	0.090 B	<0.34
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.010	<0.010	<0.010	<0.010	<0.010	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.010	<0.010	<0.34
Di-n-Octylphthalate	- -	- -	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.020	<0.020	<0.020	<0.010	<0.020	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.020	<0.010	<0.34
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.010	<0.010	<0.010	<0.010	<0.010	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	0.12	<0.010	<0.34
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.0079	<0.0077	<0.0076	<0.0075	<0.0077	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.0077	<0.0074	<0.34
Hexachlorobenzene	0.3 {ca}	1.1 {ca}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.010	<0.010	<0.010	<0.010	<0.010	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.010	<0.010	<0.34
Hexachlorobutadiene	6.2 {ca**}	22 {ca*}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.010	<0.010	<0.010	<0.010	<0.010	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.010	<0.010	<0.34
Hexachlorocyclopentadiene	37 {nc}	370 {nc}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.010	<0.010	<0.010	<0.010	<0.010	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.010	<0.010	<0.34
Hexachloroethane	35 {ca**}	120 {ca**}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.020	<0.020	<0.020	<0.020	<0.020	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.020	<0.020	<0.34
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.030 J	<0.030 J	<0.030	<0.030 J	<0.030 J	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.030 J	<0.030 J	<0.34
Isophorone	510 {ca*}	1,800 {ca*}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.010	<0.010	<0.010	<0.010	<0.010	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.010	<0.010	<0.34
Naphthalene	3.9 {ca}	20 {ca}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.0075	<0.0073	<0.0072	<0.0071	<0.0073	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.0073	<0.0070	<0.34
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.0079	<0.0077	<0.0076	<0.0075	<0.0077	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.0077	<0.0074	<0.34
N-Nitroso-di-n-propylamine	0.069 {ca**}	0.25 {ca**}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.010 J	<0.010 J	<0.010	<0.010 J	<0.010 J	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.010 J	<0.010 J	<0.34
N-Nitrosodiphenylamine	99 {ca**}	350 {ca**}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.010	<0.010	<0.010	<0.010	<0.010	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.010	<0.010	<0.34
Pentachlorophenol	3 {ca}	9 {ca}	- -	mg/kg	<2.1	<2.1	NA	<2.2	<1.9	<2.1	<2.0	<2.1	<2.0	<2.0	<0.13	<0.13	<0.13	<0.13	<0.13	<2.3	<2.5	<2.5	<2.6 [<2.6]	<2.5	<2.4	<0.13	<0.12	<2.3
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.010	<0.010	<0.010	<0.010	<0.010	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	0.050	<0.010	<0.34
Phenol	1,800 {nc}	180,000 {max}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.010	<0.010	<0.010	<0.010	<0.010	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.010	<0.010	<0.34
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	<0.41	<0.41	NA	<0.42	<0.38	<0.41	<0.39	<0.40	<0.39	<0.40	<0.010	<0.010	<0.010	<0.010	<0.010	<0.45	<0.38	<0.37	<0.39 [<0.39]	<0.37	<0.36	<0.010	<0.010	<0.34

Notes found at end of table.

Table 9-7. Test Pit Confirmation Soil Samples, Western Burning Ground, 1999 ICF KE Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: / Sample Depth(Feet): / Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	WBGTP1A 2.5 - 3 06/22/99	WBGTP1B 3 - 3.5 06/23/99	WBGTP1B 3.5 - 4 07/23/99	WBGTP1S 1 - 1.5 06/22/99	WBGTP1SB 1 - 1.5 06/23/99	WBGTP2A 2.5 - 3 06/22/99	WBGTP2B 3 - 3.5 06/22/99	WBGTP2S 1 - 1.5 06/22/99
Inorganics												
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	11,700	9,950	10,300	10,000	8,270	8,450	6,910	11,600
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	<0.620	<0.630	1.30 B	<0.630	<0.570	<0.620	<0.580	<0.610
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	6.50 B	6.00 B	5.40 B	4.20 B	4.40 B	3.80 B	1.70 B	7.30
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	24.4	38.6	56.0	21.5 J	25.4	17.0 J	13.7 J	52.5
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	0.770 B	0.850 B	0.910 B	0.360 B	0.290 B	0.490 B	0.240 B	0.670 B
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	<0.120	<0.130	<0.120	<0.130	<0.110	<0.120	<0.120	0.200 K
Calcium	- -	- -	- -	mg/kg	1,420	1,840	7,020	990	912	2,030	1,860	3,640
Chromium	280 {ca}	1,460 {ca}	65.3	mg/kg	38.6 K	47.9 K	**69.6**	25.0 K	22.0 K	24.9 K	23.3 K	41.3 K
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	11.8 K	7.80	7.10 K	8.50	6.20	7.90	2.30 J	9.50 K
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	23.5	22.5	26.1 K	12.2	11.8	16.7	10.0	**66.0 K**
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	36,400	30,200	30,100	25,000	21,100	25,200	16,400	30,900
Lead	400 {++}	800 {++}	26.8	mg/kg	**34.0**	**231**	**808**	14.8	17.9	25.4	**54.8**	**173**
Magnesium	- -	- -	- -	mg/kg	836	2,340	4,020	462 J	458 J	771	521 J	2,170
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	123 K	109 K	144	117 K	123 K	125 K	38.5 K	149 K
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	<0.120	<0.130	<0.120	**0.210**	<0.110	**0.200**	<0.110	0.130
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	11.1 J	10.3 J	10.0 K	4.40 J	4.20 J	7.10 J	2.60 J	10.8 J
Potassium	- -	- -	- -	mg/kg	766	1,010	1,020 J	438 J	335 J	678	382 J	741
Selenium	39 {nc}	510 {nc}	- -	mg/kg	<0.500	0.610 K	<0.610 L	<0.500	<0.450	0.580 J	<0.470	<0.490
Silver	39 {nc}	510 {nc}	- -	mg/kg	<0.120	<0.130	0.240 B	<0.130	<0.110	<0.120	<0.120	<0.120
Sodium	- -	- -	- -	mg/kg	194 B	61.6 B	23.7 B	122 B	45.2 B	133 B	109 B	130 B
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	<0.870	<0.880	<0.850	<0.880	<0.790	<0.870	<0.810	<0.860
Vanadium	55{nc}	720 {nc}	108	mg/kg	69.3 K	52.3 K	57.4 K	47.7 K	35.7 K	49.4 K	44.7 K	55.7 K
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	29.0 K	86.6 K	**311 J**	22.1 K	26.5 K	25.1 K	18.5 K	**214 K**
Miscellaneous												
pH	- -	- -	- -	pH Units	6.85	6.7	NA	6.9	6.8	6.75	6.95	6.85

Location ID: / Sample Depth(Feet): / Date Collected:	WBGTP3A 2.5 - 3 06/23/99	WBGTP3S 1 - 1.5 06/23/99	WBGTP4A 2.5 - 3 06/24/99	WBGTP4B 2 - 2.5 06/24/99	WBGTP4S 0.5 - 1 06/24/99	WBGTP5A 2.5 - 3 06/24/99	WBGTP5B 2.5 - 3 06/24/99	WBGTP6A 2.5 - 3 06/23/99	WBGTP7A 2.5 - 3 07/13/99	WBGTP7B 2.5 - 3 07/14/99	WBGTP7S 1 - 1.5 07/14/99	WBGTP8A 3 - 3.5 07/13/99	WBGTP8B 3 - 3.5 07/13/99	WBGTP9A 2.5 - 3 06/24/99	WBGTP9S 1 - 1.5 06/24/99	WBGTP10A 2.5 - 3 07/15/99
Inorganics																
Aluminum	16,700	11,200	14,700	15,000	14,300	14,300	15,200	9,480	11,800	9,090	15,300 [14,900]	13,300	10,400	10,400	12,300	10,800
Antimony	<0.590	<0.590	<0.630	<0.610	<0.610	<0.600	<0.620	<0.680	<0.630	<0.620	<0.640 [<0.650]	<0.620	<0.600	<0.610	<0.590	<0.570
Arsenic	9.80	5.40 B	9.70 K	9.20 K	9.40 K	7.20 B	8.30 K	3.70 B	4.50 B	2.80 B	7.80 B [7.10 B]	4.30 B	3.40 B	9.70 K	9.50 K	7.30 B
Barium	51.8	22.9 J	25.7	26.8	15.2	24.4	29.5	18.9 J	24.3 J	22.5 J	14.0 J [14.5 J]	22.4 J	21.6 J	184	28.9	33.2
Beryllium	**1.20 B**	0.520 B	0.440 B	0.290 B	0.300 B	0.160 B	0.260 B	<0.140	0.290 B	<0.120	0.230 B [0.320 B]	0.300 B	0.370 B	0.140 B	0.290 B	0.490 B
Cadmium	0.280 K	<0.120	<0.130	<0.120	<0.120	<0.120	<0.120	<0.140	<0.130	<0.120	<0.130 [<0.130]	<0.120	<0.120	**0.750**	<0.120	<0.110
Calcium	7,190	2,650	1,640	2,890	657	1,060	2,610	1,170	1,440	1,320	755 [748]	1,270	1,710	29,200	2,010	2,090
Chromium	45.2 K	35.8 K	41.1	36.4	34.6	30.7	34.1	29.0 K	33.0	17.7 K	38.8 [34.5]	30.3	23.8	34.5	34.0	28.9
Cobalt	16.1 K	9.00	13.3	8.40	6.60	6.90	8.30	1.90 J	6.30 K	2.70 K	4.30 K [4.20 K]	3.20 K	6.20 K	6.10 J	8.80	7.70 K
Copper	34.1 K	20.3	25.2 K	23.1 K	24.6 K	16.7 K	23.0 K	12.6	16.2 K	9.20	20.5 K [20.0 K]	15.2	19.1 K	**122 K**	45.1 K	20.3 K
Iron	36,300	32,300	38,900	34,700	39,500	29,900	32,200	22,800	25,900	16,700	36,700 [34,900]	24,800	26,400	25,800	39,500	30,600
Lead	**137**	19.5	**39.6**	**36.8**	19.9	14.1	**32.6**	9.30	**81.4**	17.4	11.5 [13.1]	9.40	15.6	**265**	**33.3**	26.0
Magnesium	4,150	890	1,170	1,350	510	689	1,290	549 J	943	765	522 J [449 J]	1,050	1,120	4,640	511	856
Manganese	160 K	81.9 K	132	92.0	74.0	83.1	85.1	21.3 K	60.7	48.1	46.3 [44.2]	39.5	98.3	152	157	99.1
Mercury	<0.120	<0.120	<0.130	<0.120	<0.120	<0.120	<0.120	**0.210**	<0.130	<0.120	<0.130 [<0.120]	<0.120	<0.120	<0.120	<0.110	<0.120
Nickel	15.9 J	11.7 J	12.2	9.90	10.2	8.00	10.3	2.50 J	5.10	2.80 J	6.10 [6.00]	5.90	5.80	10.1	10.0 B	7.50
Potassium	1,750	418 J	835 J	1,090 J	573 J	1,120 J	1,110 J	1,250	807 J	1,070 J	1,300 J [1,190 J]	942 J	796 J	866 J	452 J	1,370 J
Selenium	<0.470	0.520 K	<0.500	<0.490	<0.490	<0.480	<0.490	0.720 K	<0.510	<0.620	<0.640 [<0.650]	<0.500	<0.480	<0.490	<0.470	<0.570
Silver	<0.120	<0.120	<0.130	<0.120	<0.120	<0.120	<0.120	<0.140	0.140 B	<0.120	0.240 B [0.200 B]	0.220 B	0.120 B	0.140	<0.120	0.210 B
Sodium	81.6 B	46.5 B	75.5 B	99.1 B	68.0 B	111 B	106 B	59.0 B	166 B	249 B	236 B [233 B]	198 B	169 B	116 B	58.0 B	183 B
Thallium	<0.830	1.20 J	<0.880	<0.860	<0.850	<0.830	<0.860	<0.950	<0.890	<0.870	<0.900 [<0.910]	<0.870	<0.840	<0.860	<0.820	<0.790
Vanadium	57.4 K	50.1 K	69.7	63.7	71.0	56.3	60.5	42.3 K	51.8 K	36.5 K	91.1 K [82.9 K]	56.1 K	43.0 K	48.2	62.3	58.4 K
Zinc	**309 K**	178 K	40.7	57.0	132	26.2	58.4	25.3 K	63.6	17.2 K	25.6 K [26.7 K]	95.4	72.8	**685 L**	**689**	45.5
Miscellaneous																
pH	6.65	6.75	6.45	6.15	7.15	6.25	6.3	6.25	6.3	6.6	6.65 [6.6]	6.35	6.3	7.05	7.25	7.5

Notes found at end of table.

Table 9-7. Test Pit Confirmation Soil Samples, Western Burning Ground, 1999 ICF KE Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	WBGTP10B 2.5 - 3 07/15/99	WBGTP10S 0.5 - 1 07/15/99	WBGTP11A 2.5 - 3 07/15/99	WBGTP11B 2.5 - 3 07/15/99	WBGTP12A 2.5 - 3 07/15/99	WBGTP12S 0.5 - 1 07/15/99	WBGTP13A 1.5 - 2 07/22/99	WBGTP13B 1 - 1.5 07/22/99	WBGTP13S 1.5 - 2 07/22/99	WBGTP14A 2 - 2.5 07/22/99	WBGTP14B 1.5 - 2 07/22/99	WBGTP15A 1.5 - 2 07/15/99	WBGTP16A 0.5 - 1 07/22/99	WBGTP16A 0.5 - 1 09/14/99	WBGTP17A 0.5 - 1 07/22/99	WBGTP18A 1 - 1.5 07/22/99	WBGTP18S 1 - 1.5 07/22/99	WBGTP19A 2.5 - 3 07/29/99	WBGTP19S 2.5 - 3 07/29/99
Dioxin/Furan																							
1,2,3,4,6,7,8-HpCDD	0.00039 {ca**}	0.0016 {ca**}	- -	mg/kg	0.0000452	NA	NA	NA	0.000128	0.000145	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0000548	NA	0.000039 B	NA
1,2,3,4,6,7,8-HpCDF	0.00032 {ca**}	0.0011 {ca**}	- -	mg/kg	0.00000137	NA	NA	NA	0.0000226	0.0000132	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00000044	NA	0.00000036 B	NA
1,2,3,4,7,8,9-HpCDF	0.00032 {ca**}	0.0011 {ca**}	- -	mg/kg	<0.0000002	NA	NA	NA	0.00000105	0.00000098	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00000011	NA	0.00000011 B	NA
1,2,3,4,7,8-HxCDD	0.000039 {ca**}	0.00016 {ca**}	- -	mg/kg	0.00000088	NA	NA	NA	0.00000236	0.00000209 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00000092	NA	0.00000051	NA
1,2,3,4,7,8-HxCDF	0.000032 {ca**}	0.00011 {ca**}	- -	mg/kg	0.00000041	NA	NA	NA	0.00000179	0.00000145 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00000013	NA	0.00000013 B	NA
1,2,3,6,7,8-HxCDD	0.000039 {ca**}	0.00016 {ca**}	- -	mg/kg	0.00000131	NA	NA	NA	0.0000063	0.00000503	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00000176	NA	0.00000096	NA
1,2,3,6,7,8-HxCDF	0.000032 {ca**}	0.00011 {ca**}	- -	mg/kg	0.00000029	NA	NA	NA	0.00000158	0.00000115	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00000009	NA	0.00000011 B	NA
1,2,3,7,8,9-HxCDD	0.000039 {ca**}	0.00016 {ca**}	- -	mg/kg	0.0000017	NA	NA	NA	0.00000623	0.00000412	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00000409	NA	0.00000092	NA
1,2,3,7,8,9-HxCDF	0.000032 {ca**}	0.00011 {ca**}	- -	mg/kg	<0.00000014	NA	NA	NA	0.00000054	<0.0000005	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00000008	NA	<0.00000005	NA
1,2,3,7,8-PeCDD	0.0000039 {ca**}	0.000016 {ca**}	- -	mg/kg	0.00000057	NA	NA	NA	0.00000183	0.00000168	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00000081	NA	0.0000005 B	NA
1,2,3,7,8-PeCDF	0.00011 {ca**}	0.00038 {ca**}	- -	mg/kg	0.00000038	NA	NA	NA	0.00000121	0.00000124	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00000011	NA	0.00000009 B	NA
2,3,4,6,7,8-HxCDF	0.000032 {ca**}	0.00011 {ca**}	- -	mg/kg	0.00000021	NA	NA	NA	0.00000185	0.0000015	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0000001	NA	0.00000011 B	NA
2,3,4,7,8-PeCDF	0.000011 {ca**}	0.000038 {ca**}	- -	mg/kg	0.00000049	NA	NA	NA	0.00000185	0.00000172	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00000014	NA	0.00000015 B	NA
2,3,7,8-TCDD	0.0000045 {ca*}	0.000018 {ca*}	- -	mg/kg	0.00000024	NA	NA	NA	0.00000054	0.00000053	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00000032	NA	0.00000045 B	NA
2,3,7,8-TCDF	0.000032 {ca**}	0.00011 {ca**}	- -	mg/kg	0.00000044	NA	NA	NA	0.00000166	0.00000184	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00000012	NA	0.00000008	NA
OCDD	0.013 {ca**}	0.053 {ca**}	- -	mg/kg	0.00543 J	NA	NA	NA	0.0055 J	0.0083 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0032	NA	0.00436 J	NA
OCDF	0.011 {ca**}	0.038 {ca**}	- -	mg/kg	0.00000186 B	NA	NA	NA	0.0000254	0.0000181	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00000125	NA	0.00000054 B	NA
Total HpCDDs	- -	- -	- -	mg/kg	0.000109	NA	NA	NA	0.00026	0.000296	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.000141	NA	0.0000755 B	NA
Total HpCDFs	- -	- -	- -	mg/kg	0.00000344	NA	NA	NA	0.0000471	0.0000285	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00000044	NA	0.00000047 B	NA
Total HxCDDs	- -	- -	- -	mg/kg	0.0000166	NA	NA	NA	0.000059	0.0000409	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0000234	NA	0.0000045	NA
Total HxCDFs	- -	- -	- -	mg/kg	0.00000125 B	NA	NA	NA	0.0000235	0.0000131	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00000117	NA	0.00000072 B	NA
Total PeCDDs	- -	- -	- -	mg/kg	0.00000318	NA	NA	NA	0.0000174	0.0000161	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00000562	NA	0.00000158 B	NA
Total PeCDFs	- -	- -	- -	mg/kg	0.00000165	NA	NA	NA	0.0000214	0.0000183	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00000068	NA	0.00000102	NA
Total TCDDs	- -	- -	- -	mg/kg	0.00000024	NA	NA	NA	0.00000669	0.0000049	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0000011	NA	0.00000058 B	NA
Total TCDFs	- -	- -	- -	mg/kg	0.00000037	NA	NA	NA	0.0000258	0.0000291	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00000053	NA	0.00000048	NA
Semivolatile Organics																							
1,2,4-Trichlorobenzene	8.7 {ca**}	40 {ca**}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
1,2-Dichlorobenzene	220 {sat}	220 {sat}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
1,2-Diphenylhydrazine	0.61 {ca**}	2.2 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
1,4-Dichlorobenzene	2.6 {ca}	13 {ca}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
2,4,5-Trichlorophenol	610 {nc}	6,200 {nc}	- -	mg/kg	<0.90	<0.97	<0.90	<0.94	<0.89	<0.97	<0.96	<1.0	<0.93	<1.0	<1.3	<0.95	<1.0	NA	<1.0	<1.2	<1.0	<1.0	<1.0
2,4,6-Trichlorophenol	44 {ca**}	160 {ca**}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
2,4-Dichlorophenol	18 {nc}	180 {nc}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
2,4-Dimethylphenol	120 {nc}	1,200 {nc}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
2,4-Dinitrophenol	12 {nc}	120 {nc}	- -	mg/kg	<2.3	<2.4	<2.3	<2.4	<2.3	<2.4	<2.4 J	<2.5 J	<2.3 J	<2.6 J	<3.3 J	<2.4	<2.5 J	NA	<2.5 J	<2.9	<2.5 J	<2.6	<2.6
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
2-Chloronaphthalene	210 {sat}	210 {sat}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
2-Chlorophenol	39 {nc}	510 {nc}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
2-Methylphenol	310 {nc}	3,100 {nc}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
2-Nitroaniline	- -	- -	- -	mg/kg	<2.3	<2.4	<2.3	<2.4	<2.3	<2.4	<2.4	<2.5	<2.3	<2.6	<3.3	<2.4	<2.5	NA	<2.5	<2.9	<2.5	<2.6	<2.6
2-Nitrophenol	- -	- -	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
3,3'-Dichlorobenzidine	1.1 {ca**}	3.8 {ca**}	- -	mg/kg	<0.68	<0.73	<0.68	<0.70	<0.67	<0.73	<0.72	<0.75	<0.69	<0.77	<0.98	<0.71	<0.75	NA	<0.75	<0.87	<0.75	<0.76	<0.76
3-Nitroaniline	- -	- -	- -	mg/kg	<2.3	<2.4	<2.3	<2.4	<2.3	<2.4	<2.4	<2.5	<2.3	<2.6	<3.3	<2.4	<2.5	NA	<2.5	<2.9	<2.5	<2.6 J	<2.6 J
4,6-Dinitro-2-methylphenol	- -	- -	- -	mg/kg	<2.3	<2.4	<2.3	<2.4	<2.3	<2.4	<2.4 J	<2.5 J	<2.3 J	<2.6 J	<3.3 J	<2.4	<2.5 J	NA	<2.5 J	<2.9 J	<2.5 J	<2.6	<2.6
4-Bromophenyl-phenylether	- -	- -	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
4-Chloro-3-Methylphenol	- -	- -	- -	mg/kg	<0.68	<0.73	<0.68	<0.70	<0.67	<0.73	<0.72	<0.75	<0.69	<0.77	<0.98	<0.71	<0.75	NA	<0.75	<0.87	<0.75	<0.76	<0.76
4-Chloroaniline	24 {nc}	250 {nc}	- -	mg/kg	<0.68	<0.73	<0.68	<0.70	<0.67	<0.73	<0.72	<0.75	<0.69	<0.77	<0.98	<0.71	<0.75	NA	<0.75	<0.87	<0.75	<0.76 J	<0.76 J
4-Chlorophenyl-phenylether	- -	- -	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
4-Methylphenol	31 {nc}	310 {nc}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
4-Nitroaniline	- -	- -	- -	mg/kg	<2.3	<2.4	<2.3	<2.4	<2.3	<2.4	<2.4	<2.5	<2.3	<2.6	<3.3	<2.4	<2.5	NA	<2.5	<2.9	<2.5	<2.6	<2.6
4-Nitrophenol	- -	- -	- -	mg/kg	<2.3	<2.4	<2.3	<2.4	<2.3	<2.4	<2.4	<2.5	<2.3	<2.6	<3.3	<2.4	<2.5	NA	<2.5	<2.9	<2.5	<2.6	<2.6
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36 J	<0.37 J	<0.34 J	<0.39 J	<0.49 J	<0.35	<0.38 J	NA	<0.37 J	<0.43 J	<0.37 J	<0.38	<0.38
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	0.030	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
Benzoic Acid	240,000 {max}	2,500,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzyl Alcohol	3,100 {nc}	310,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Chloroethoxy)methane	18 {nc}	180 {nc}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
bis(2-Chloroethyl)ether	0.19 {ca**}	0.9 {ca**}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
bis(2-Chloroisopropyl)ether	- -	- -	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
bis(2-Ethylhexyl)phthalate	35 {ca*}	120 {ca*}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
Butylbenzylphthalate	260 {ca*}	910 {ca*}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
Carbazole	24 {ca**}	86 {ca**}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
Dibenzofuran	- -	- -	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
Diethylphthalate	4,900 {nc}	490,000 {max}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
Dimethylphthalate	- -	- -	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
Di-n-Butylphthalate	610 {nc}	6,200 {nc}	- -	mg/kg	<0.34	0.040 B	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
Di-n-Octylphthalate	- -	- -	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	0.040 B	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
Hexachlorobenzene	0.3 {ca}	1.1 {ca}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
Hexachlorobutadiene	6.2 {ca**}	22 {ca*}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
Hexachlorocyclopentadiene	37 {nc}	370 {nc}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36 J	<0.37 J	<0.34 J	<0.39 J	<0.49 J	<0.35	<0.38 J	NA	<0.37 J	<0.43 J	<0.37 J	<0.38	<0.38
Hexachloroethane	35 {ca**}	120 {ca**}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36 J	<0.37 J	<0.34 J	<0.39 J	<0.49 J	<0.35	<0.38 J	NA	<0.37 J	<0.43 J	<0.37 J	<0.38	<0.38
Isophorone	510 {ca*}	1,800 {ca*}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
Naphthalene	3.9 {ca}	20 {ca}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36 J	<0.37 J	<0.34 J	<0.39 J	<0.49 J	<0.35	<0.38 J	NA	<0.37 J	<0.43 J	<0.37 J	<0.38	<0.38
N-Nitroso-di-n-propylamine	0.069 {ca**}	0.25 {ca**}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
N-Nitrosodiphenylamine	99 {ca**}	350 {ca**}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
Pentachlorophenol	3 {ca}	9 {ca}	- -	mg/kg	<2.3	<2.4	<2.3	<2.4	<2.3	<2.4	<2.4	<2.5	<2.3	<2.6	<3.3	<2.4	<2.5	NA	<2.5	<2.9	<2.5	<2.6	<2.6
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
Phenol	1,800 {nc}	180,000 {max}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	<0.34	<0.36	<0.34	<0.35	<0.33	<0.36	<0.36	<0.37	<0.34	<0.39	<0.49	<0.35	<0.38	NA	<0.37	<0.43	<0.37	<0.38	<0.38

Notes found at end of table.

Table 9-7. Test Pit Confirmation Soil Samples, Western Burning Ground, 1999 ICF KE Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	WBGTP10B 2.5 - 3 07/15/99	WBGTP10S 0.5 - 1 07/15/99	WBGTP11A 2.5 - 3 07/15/99	WBGTP11B 2.5 - 3 07/15/99	WBGTP12A 2.5 - 3 07/15/99	WBGTP12S 0.5 - 1 07/15/99	WBGTP13A 1.5 - 2 07/22/99	WBGTP13B 1 - 1.5 07/22/99	WBGTP13S 1.5 - 2 07/22/99	WBGTP14A 2 - 2.5 07/22/99	WBGTP14B 1.5 - 2 07/22/99	WBGTP15A 1.5 - 2 07/15/99	WBGTP16A 0.5 - 1 07/22/99	WBGTP16A 0.5 - 1 09/14/99	WBGTP17A 0.5 - 1 07/22/99	WBGTP18A 1 - 1.5 07/22/99	WBGTP18S 1 - 1.5 07/22/99	WBGTP19A 2.5 - 3 07/29/99	WBGTP19S 2.5 - 3 07/29/99
Inorganics																							
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	7,520	13,300	5,760	13,800	9,390	11,300	9,150	11,000	18,700	11,400	25,400	8,690	12,100	9,020	15,200	23,800	12,300	13,500	12,400
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	<0.570	<0.610	<0.550	<0.580	<0.560	<0.610	0.710 B	1.20 B	1.30 B	<0.650	1.50 B	<0.590	1.00 B	1.20 B	1.10 B	1.40 B	0.700 B	<0.620	<0.640
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	2.60 B	13.0	2.70 B	8.20	7.50 B	8.70	3.80 B	4.90 B	5.30 B	5.10 B	10.7 K	4.00 B	5.50	8.10 K	6.50 B	4.70 B	7.00 B	9.60	8.80
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	14.7 J	15.3 J	20.0 J	95.9	132	108	21.7 J	24.3	73.1	19.7 J	47.5	26.7	12.2 J	69.4	14.5 J	69.2	38.0	31.3	36.5
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	<0.110	0.550 B	0.120 B	0.710 B	0.340 B	0.490 B	0.310 B	0.790 B	**2.50 J**	0.690 B	**1.70 J**	0.240 B	0.590 B	**3.40**	0.960 B	**3.90 J**	0.880 B	0.810 B	0.860 B
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	<0.110	<0.120	<0.110	0.220 K	0.360 K	0.190 K	<0.120	<0.120	<0.110	<0.130	<0.160	<0.120	<0.130	<0.110	<0.130	<0.140	<0.120	<0.120	<0.130
Calcium	- -	- -	- -	mg/kg	1,430	796	1,040	15,700	29,000	2,610	2,870	2,330	7,740	2,660	9,800	1,750	1,400	4,670	2,200	3,600	1,460	1,500	1,750
Chromium	280 {ca}	1,460 {ca}	65.3	mg/kg	13.5 K	36.6	12.5 K	35.1	23.4	37.3	46.2	42.4	45.8	31.7	**67.0**	22.4	47.4	22.0	45.0	**72.8**	32.1	30.3	33.5
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	1.40 K	10.0 K	2.30 K	6.80 K	5.60 K	8.90 K	3.20 K	21.1 K	20.1 K	7.80 K	10.5 K	2.20 K	7.00 K	18.7	10.2 K	28.4 K	10.3 K	10.1	14.1
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	8.20 K	26.1 K	7.10 K	**63.6**	**55.8**	**108**	19.3 K	24.0 K	26.3 K	27.0 K	36.0 K	10.1 K	21.1 K	31.6	30.7 K	35.7 K	28.4 K	23.6	26.1
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	14,300	44,100	13,400	27,300	19,700	33,600	32,100	39,200	34,200	37,700	**52,400**	17,100	36,200	32,700	47,700	**52,900**	34,700	34,800	34,800
Lead	400 {++}	800 {++}	26.8	mg/kg	8.90	23.2	7.90	**89.7**	**161**	**116**	**135**	**113**	**140**	**42.4**	**41.0**	12.1 K	**681**	**34.2**	21.9	**27.4**	**40.2**	15.7	**27.5**
Magnesium	- -	- -	- -	mg/kg	475 J	381 J	408 J	6,330	7,470	1,340	1,090	1,050	10,500	939	14,000	1,900	608 J	2,810	509 J	5,450	1,330	1,020	920
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	27.2 K	208	42.4 K	113	115	152	72.8	152	297	94.7	157	59.0	57.3	911	65.9	146	170	105	150
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	<0.110	<0.120	<0.110	<0.110	<0.110	<0.120	<0.120	<0.120	<0.120	<0.130	<0.160	<0.120	<0.130	**0.240**	<0.110	<0.140	<0.120	<0.120	<0.130
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	1.30 J	11.3	1.80 J	11.6	7.30	10.6	4.00 K	9.40 K	27.6 K	9.10 K	21.1 K	2.30 J	7.70 K	37.0	15.2 K	37.3 K	9.70 K	11.4	12.5
Potassium	- -	- -	- -	mg/kg	465 J	830 J	930 J	1,560 J	1,050 J	544 J	441 J	639 J	1,860 J	1,030 J	3,340 J	599 J	581 J	501 J	431 J	988 J	562 J	655	618 J
Selenium	39 {nc}	510 {nc}	- -	mg/kg	<0.570	<0.610	<0.550	<0.580	<0.560	<0.610	<0.590 L	<0.600 L	<0.560 L	<0.650 L	<0.800 L	<0.590	<0.630 L	<0.560 L	<0.630 L	<0.700 L	<0.620 L	<0.620	<0.640
Silver	39 {nc}	510 {nc}	- -	mg/kg	0.160 B	0.290 B	<0.110	0.180 B	0.160 B	0.260 B	0.260 B	0.720 B	<0.110	0.170 B	0.170 B	0.150 B	0.130	<0.110 L	0.240 B	<0.140	0.130 B	<0.120	<0.130
Sodium	- -	- -	- -	mg/kg	158 B	148 B	150 B	201 B	212 B	165 B	148 B	139 B	162 B	<1.00	23.2 B	162 B	144 B	119 B	150 B	193 B	138 B	246 B	236
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	0.820 J	<0.850	<0.770	<0.810	<0.780	<0.850	<0.830	<0.850	<0.790	<0.910	<1.10	<0.830	<0.890	<0.780 L	<0.880	<0.980	<0.880	<0.860	<0.900
Vanadium	55{nc}	720 {nc}	108	mg/kg	29.6 K	77.1 K	28.0 K	48.4 K	38.4 K	63.1 K	56.2 K	68.3 K	63.6 K	65.9 K	96.4 K	37.3 K	67.9 K	51.6	87.9 K	99.4 K	59.8 K	55.5	56.4
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	22.7 K	113	16.0 K	172	**305**	**613**	90.2 J	48.5 J	42.3 J	93.4 J	85.6 J	23.3 K	80.6 J	173	46.9 J	44.3 J	60.5 J	19.1	36.3
Miscellaneous																							
pH	- -	- -	- -	pH Units	7.75	7.45	7.55	7	7.4	7.6	7	7.15	7.05	6.95	6.9	7.25	6.95	NA	6.8	6.8	7.2	5.1	5.85

mg/kg	Milligrams per kilogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 9-8. Sediment Analytical Results, Western Burning Ground, 1998 and 1999 ICF KE Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	WBGSD1 0 - 0.5 07/16/98	WBGSD2 0 - 0.5 07/16/98	WBGSD3 0 - 0.5 07/16/98	WBGSD4 0 - 0.5 05/27/99	WBGSD5 0 - 0.5 05/27/99	WBGSD5 0 - 0.5 06/16/99	WBGSD6 0 - 0.5 05/27/99
Explosives											
1,3,5-Trinitrobenzene	220 {nc}	2,700 {nc}	- -	mg/kg	<0.25	<0.25	<0.25	NA	NA	NA	NA
1,3-Dinitrobenzene	0.61 {nc}	6.2 {nc}	- -	mg/kg	<0.25	<0.25	<0.25	NA	NA	NA	NA
2,4,6-Trinitrotoluene	3.6 {ca**}	42 {ca**}	- -	mg/kg	<0.25	<0.25	<0.25	NA	NA	NA	NA
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.25	<0.25	<0.25	NA	NA	NA	NA
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	<0.25	<0.25	<0.25	NA	NA	NA	NA
2-Amino-4,6-Dinitrotoluene	15 {nc}	190 {nc}	- -	mg/kg	<0.25	<0.25	<0.25	NA	NA	NA	NA
4-Amino-2,6-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.25	<0.25	<0.25	NA	NA	NA	NA
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	<0.25	<0.25	<0.25	NA	NA	NA	NA
HMX	310 {nc}	3,100 {nc}	- -	mg/kg	<0.25	<0.25	<0.25	NA	NA	NA	NA
m-Nitrotoluene	- -	- -	- -	mg/kg	<0.25	<0.25	<0.25	NA	NA	NA	NA
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	<0.25	<0.25	<0.25	NA	NA	NA	NA
Nitroglycerine	0.61 {nc}	6.2 {nc}	- -	mg/kg	<1.2	<1.2	<1.2	NA	NA	NA	NA
o-Nitrotoluene	78 {nc}	1,300 {sat}	- -	mg/kg	<0.25	<0.25	<0.25	NA	NA	NA	NA
Pentaerythritol Tetranitrate	- -	- -	- -	mg/kg	<1.2	<1.2	<1.2	NA	NA	NA	NA
p-Nitrotoluene	30 {ca**}	110 {ca*}	- -	mg/kg	<0.25	<0.25	<0.25	NA	NA	NA	NA
RDX	4.4 {ca*}	16 {ca}	- -	mg/kg	<0.25	<0.25	<0.25	NA	NA	NA	NA
Tetryl	24 {nc}	250 {nc}	- -	mg/kg	<0.25	<0.25	<0.25	NA	NA	NA	NA
Volatile Organics											
1,1,1,2-Tetrachloroethane	2 {ca}	9.8 {ca}	- -	mg/kg	<0.0020	<0.0030	<0.0030	NA	NA	NA	NA
1,1,1-Trichloroethane	680 {sat}	680 {sat}	- -	mg/kg	<0.0010	<0.0020	<0.0030	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	0.59 {ca**}	2.9 {ca**}	- -	mg/kg	<0.0020	<0.0040 J	<0.0050	NA	NA	NA	NA
1,1,2-Trichloroethane	1.1 {ca}	5.5 {ca}	- -	mg/kg	<0.0020	<0.0040	<0.0040	NA	NA	NA	NA
1,1-Dichloroethane	3.4 {ca}	17 {ca}	- -	mg/kg	<0.0020	<0.0040	<0.0040	NA	NA	NA	NA
1,1-Dichloroethene	25 {nc}	110 {nc}	- -	mg/kg	<0.0030	<0.0050	<0.0060	NA	NA	NA	NA
1,1-Dichloropropene	- -	- -	- -	mg/kg	<0.0020	<0.0030	<0.0030	NA	NA	NA	NA
1,2,3-Trichlorobenzene	- -	- -	- -	mg/kg	<0.0020	<0.0040	<0.0040	NA	NA	NA	NA
1,2,3-Trichloropropane	0.091 {ca}	0.41 {ca}	- -	mg/kg	<0.0030	<0.0070 J	<0.0070	NA	NA	NA	NA
1,2,4-Trichlorobenzene	180 {ca**}	220 {sat}	- -	mg/kg	<0.0020	<0.0030 J	<0.0030	NA	NA	NA	NA
1,2,4-Trimethylbenzene	6.7 {nc}	28 {nc}	- -	mg/kg	<0.0020	<0.0040 J	<0.0050	NA	NA	NA	NA
1,2-Dibromo-3-chloropropane	0.0056 {ca}	0.073 {ca}	- -	mg/kg	<0.0070	<0.010 J	<0.010	NA	NA	NA	NA
1,2-Dibromoethane	0.034 {ca}	0.17 {ca}	- -	mg/kg	<0.0020	<0.0040	<0.0050	NA	NA	NA	NA
1,2-Dichlorobenzene	220 {sat}	220 {sat}	- -	mg/kg	<0.0010	<0.0030 J	<0.0030	NA	NA	NA	NA
1,2-Dichloroethane	0.45 {ca}	2.2 {ca}	- -	mg/kg	<0.0010	<0.0030	<0.0030	NA	NA	NA	NA
1,2-Dichloropropane	0.93 {ca*}	4.7 {ca*}	- -	mg/kg	<0.0050	<0.0090	<0.010	NA	NA	NA	NA
1,3,5-Trimethylbenzene	- -	- -	- -	mg/kg	<0.0020	<0.0040 J	<0.0050	NA	NA	NA	NA
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	<0.0020	<0.0030 J	<0.0030	NA	NA	NA	NA
1,3-Dichloropropane	160 {nc}	1,600 {sat}	- -	mg/kg	<0.0020	<0.0030	<0.0030	NA	NA	NA	NA
1,4-Dichlorobenzene	2.6 {ca}	13 {ca}	- -	mg/kg	<0.0020	<0.0030 J	<0.0030	NA	NA	NA	NA
2,2-Dichloropropane	- -	- -	- -	mg/kg	<0.0010	<0.0030	<0.0030	NA	NA	NA	NA
2-Butanone	2,800 {nc}	19,000 {nc}	- -	mg/kg	<0.0070	<0.010	<0.010	NA	NA	NA	NA
2-Chloroethyl Vinyl Ether	- -	- -	- -	mg/kg	<0.0070	<0.010	<0.010	NA	NA	NA	NA
2-Chlorotoluene	1,000 {sat}	1,000 {sat}	- -	mg/kg	<0.0020	<0.0030 J	<0.0030	NA	NA	NA	NA
2-Hexanone	- -	- -	- -	mg/kg	<0.0070	<0.010	<0.010	NA	NA	NA	NA
4-Chlorotoluene	290 {sat}	290 {sat}	- -	mg/kg	<0.0010	<0.0030 J	<0.0030	NA	NA	NA	NA
4-Methyl-2-pentanone	530 {nc}	5,200 {sat}	- -	mg/kg	<0.0070	<0.010	<0.010	NA	NA	NA	NA
Acetone	6,100 {nc}	61,000 {nc}	- -	mg/kg	0.0030 J	<0.010	0.020 J	NA	NA	NA	NA
Acrolein	0.016 {nc}	0.068 {nc}	- -	mg/kg	<0.0070	<0.010	<0.010	NA	NA	NA	NA
Acrylonitrile	0.24 {ca*}	1.2 {ca*}	- -	mg/kg	<0.0070	<0.010	<0.010	NA	NA	NA	NA
Benzene	1.1 {ca*}	5.6 {ca*}	- -	mg/kg	<0.0010	<0.0030	<0.0030	NA	NA	NA	NA
Bromobenzene	- -	- -	- -	mg/kg	<0.0010	<0.0030 J	<0.0030	NA	NA	NA	NA
Bromochloromethane	- -	- -	- -	mg/kg	<0.0020	<0.0050	<0.0050	NA	NA	NA	NA
Bromodichloromethane	10 {ca}	46 {ca}	- -	mg/kg	<0.0010	<0.0030	<0.0030	NA	NA	NA	NA
Bromoform	61 {ca*}	220 {ca*}	- -	mg/kg	<0.00070	<0.0010	<0.0010	NA	NA	NA	NA
Bromomethane	0.79 {nc}	3.5 {nc}	- -	mg/kg	<0.0050	<0.010	<0.010	NA	NA	NA	NA
Carbon Disulfide	67 {nc}	300 {nc}	- -	mg/kg	<0.0070	<0.010	<0.010	NA	NA	NA	NA
Carbon Tetrachloride	0.25 {ca}	1.3 {ca}	- -	mg/kg	<0.0050	<0.010	<0.010	NA	NA	NA	NA
Chlorobenzene	31 {nc}	860 {sat}	- -	mg/kg	<0.0020	<0.0030	<0.0030	NA	NA	NA	NA
Chloroethane	2,200 {sat}	2,200 {sat}	- -	mg/kg	<0.0070	<0.010	<0.010	NA	NA	NA	NA
Chloroform	0.3 {ca}	1.5 {ca}	- -	mg/kg	<0.0020	<0.0030	<0.0030	NA	NA	NA	NA
Chloromethane	1.7 {ca*}	8.4 {ca*}	- -	mg/kg	<0.0040	<0.0090	<0.010	NA	NA	NA	NA
cis-1,2-Dichloroethene	78 {nc}	1,300 {sat}	- -	mg/kg	<0.0020	<0.0050	<0.0050	NA	NA	NA	NA
cis-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.0010	<0.0030	<0.0030	NA	NA	NA	NA
Dibromochloromethane	5.8 {ca}	21 {ca}	- -	mg/kg	<0.00090	<0.0020	<0.0020	NA	NA	NA	NA
Dibromomethane	78 {nc}	3,000 {sat}	- -	mg/kg	<0.0020	<0.0040	<0.0040	NA	NA	NA	NA
Dichlorodifluoromethane	19 {nc}	78 {nc}	- -	mg/kg	<0.0020	<0.0050	<0.0050	NA	NA	NA	NA
Ethylbenzene	5.7 {ca}	29 {ca}	- -	mg/kg	<0.0020	<0.0030	<0.0030	NA	NA	NA	NA
Hexachlorobutadiene	6.2 {ca**}	22 {ca*}	- -	mg/kg	<0.0010	<0.0030 J	<0.0030	NA	NA	NA	NA
Isopropylbenzene	310 {sat}	310 {sat}	- -	mg/kg	<0.0020	<0.0040 J	<0.0040	NA	NA	NA	NA
m,p-Xylene	60 {nc}	260 {nc}	- -	mg/kg	<0.0030	<0.0060	<0.0070	NA	NA	NA	NA
Methylene Chloride	11 {ca}	54 {ca}	- -	mg/kg	<0.0010	<0.0030	<0.0030	NA	NA	NA	NA
n-Butylbenzene	- -	- -	- -	mg/kg	<0.0020	<0.0050 J	<0.0050	NA	NA	NA	NA
n-Propylbenzene	- -	- -	- -	mg/kg	<0.0020	<0.0040 J	<0.0040	NA	NA	NA	NA
o-Xylene	300 {sat}	300 {sat}	- -	mg/kg	<0.0020	<0.0030	<0.0030	NA	NA	NA	NA
p-Isopropyltoluene	- -	- -	- -	mg/kg	<0.0010	<0.0020 J	<0.0030	NA	NA	NA	NA
sec-Butylbenzene	- -	- -	- -	mg/kg	<0.0020	<0.0030 J	<0.0030	NA	NA	NA	NA
Styrene	1,000 {sat}	1,000 {sat}	- -	mg/kg	<0.00030	<0.00060	<0.0010	NA	NA	NA	NA
tert-Butylbenzene	- -	- -	- -	mg/kg	<0.0020	<0.0030 J	<0.0030	NA	NA	NA	NA
Tetrachloroethene	0.57 {ca}	2.7 {ca}	- -	mg/kg	<0.0020	<0.0030	<0.0030	NA	NA	NA	NA
Toluene	500 {nc}	4600 {nc}	- -	mg/kg	0.0040	0.040	0.010	NA	NA	NA	NA
trans-1,2-Dichloroethene	11 {nc}	50 {nc}	- -	mg/kg	<0.0060	<0.010	<0.010	NA	NA	NA	NA
trans-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.0010	<0.0030	<0.0030	NA	NA	NA	NA
Trichloroethene	2.8 {ca}	14 {ca}	- -	mg/kg	<0.0040	<0.0070	<0.0070	NA	NA	NA	NA
Trichlorofluoromethane	80 {nc}	1,300 {sat}	- -	mg/kg	<0.0020	<0.0030	<0.0030	NA	NA	NA	NA
Vinyl Acetate	99 {nc}	2,800 {sat}	- -	mg/kg	<0.0070	<0.010	<0.010	NA	NA	NA	NA
Vinyl Chloride	0.06 {ca}	1.7 {ca}	- -	mg/kg	<0.0020	<0.0050	<0.0050	NA	NA	NA	NA
Xylenes (total)	60 {nc}	260 {nc}	- -	mg/kg	<0.0030	<0.0060	<0.0070	NA	NA	NA	NA

Notes found at end of table.

Table 9-8. Sediment Analytical Results, Western Burning Ground, 1998 and 1999 ICF KE Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	WBGSD1 0 - 0.5 07/16/98	WBGSD2 0 - 0.5 07/16/98	WBGSD3 0 - 0.5 07/16/98	WBGSD4 0 - 0.5 05/27/99	WBGSD5 0 - 0.5 05/27/99	WBGSD5 0 - 0.5 06/16/99	WBGSD6 0 - 0.5 05/27/99
Semivolatile Organics											
1,2,4-Trichlorobenzene	8.7 {ca**}	40 {ca**}	- -	mg/kg	NA	NA	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
1,2-Dichlorobenzene	220 {sat}	220 {sat}	- -	mg/kg	NA	NA	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
1,2-Diphenylhydrazine	0.61 {ca**}	2.2 {ca**}	- -	mg/kg	<0.42	<0.92	<0.94	NA	NA	NA	NA
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	NA	NA	NA	<0.69	<1.1	NA	<0.93 [<0.85]
1,4-Dichlorobenzene	2.6 {ca}	13 {ca}	- -	mg/kg	NA	NA	NA	<0.69	<1.1	NA	<0.93 [<0.85]
2,4,5-Trichlorophenol	610 {nc}	6,200 {nc}	- -	mg/kg	<1.0	<2.2	<2.3	<1.9	<3.0	NA	<2.5 [<2.3]
2,4,6-Trichlorophenol	44 {ca**}	160 {ca**}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
2,4-Dichlorophenol	18 {nc}	180 {nc}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
2,4-Dimethylphenol	120 {nc}	1,200 {nc}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
2,4-Dinitrophenol	12 {nc}	120 {nc}	- -	mg/kg	<2.1	<4.6	<4.7	<4.7	<7.4	NA	<6.3 [<5.7]
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	NA	NA	NA	<0.69	<1.1	NA	<0.93 [<0.85]
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	NA	NA	NA	<0.69	<1.1	NA	<0.93 [<0.85]
2-Chloronaphthalene	210 {sat}	210 {sat}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
2-Chlorophenol	39 {nc}	510 {nc}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
2-Methylphenol	310 {nc}	3,100 {nc}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
2-Nitroaniline	- -	- -	- -	mg/kg	<2.1	<4.6	<4.7	<4.7	<7.4	NA	<6.3 [<5.7]
2-Nitrophenol	- -	- -	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
3,3'-Dichlorobenzidine	1.1 {ca**}	3.8 {ca**}	- -	mg/kg	<0.82	<1.8	<1.9	<1.4	<2.2	NA	<1.9 [<1.7]
3-Nitroaniline	- -	- -	- -	mg/kg	<2.1	<4.6	<4.7	<4.7	<7.4	NA	<6.3 [<5.7]
4,6-Dinitro-2-methylphenol	- -	- -	- -	mg/kg	<2.1	<4.6	<4.7	<4.7	<7.4	NA	<6.3 [<5.7]
4-Bromophenyl-phenylether	- -	- -	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
4-Chloro-3-Methylphenol	- -	- -	- -	mg/kg	<0.82	<1.8	<1.9	<1.4	<2.2	NA	<1.9 [<1.7]
4-Chloroaniline	24 {nc}	250 {nc}	- -	mg/kg	<0.82	<1.8	<1.9	<1.4	<2.2	NA	<1.9 [<1.7]
4-Chlorophenyl-phenylether	- -	- -	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
4-Methylphenol	31 {nc}	310 {nc}	- -	mg/kg	<0.42	2.2	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
4-Nitroaniline	- -	- -	- -	mg/kg	<2.1	<4.6	<4.7	<4.7	<7.4	NA	<6.3 [<5.7]
4-Nitrophenol	- -	- -	- -	mg/kg	<2.1	<4.6	<4.7	<4.7	<7.4	NA	<6.3 [<5.7]
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
Benzoic Acid	240,000 {max}	2,500,000 {max}	- -	mg/kg	<2.1	<4.6	<4.7	NA	NA	NA	NA
Benzyl Alcohol	3,100 {nc}	310,000 {max}	- -	mg/kg	<0.82	<1.8	<1.9	NA	NA	NA	NA
bis(2-Chloroethoxy)methane	18 {nc}	180 {nc}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
bis(2-Chloroethyl)ether	0.19 {ca**}	0.9 {ca**}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
bis(2-Chloroisopropyl)ether	- -	- -	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
bis(2-Ethylhexyl)phthalate	35 {ca*}	120 {ca*}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	0.15	NA	<0.93 [<0.85]
Butylbenzylphthalate	260 {ca*}	910 {ca*}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
Carbazole	24 {ca**}	86 {ca**}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
Dibenzofuran	- -	- -	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
Diethylphthalate	4,900 {nc}	490,000 {max}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
Dimethylphthalate	- -	- -	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
Di-n-Butylphthalate	610 {nc}	6,200 {nc}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	NA	NA	NA	<0.69	<1.1	NA	<0.93 [<0.85]
Di-n-Octylphthalate	- -	- -	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
Hexachlorobenzene	0.3 {ca}	1.1 {ca}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
Hexachlorobutadiene	6.2 {ca**}	22 {ca*}	- -	mg/kg	NA	NA	NA	<0.69	<1.1	NA	<0.93 [<0.85]
Hexachlorocyclopentadiene	37 {nc}	370 {nc}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
Hexachloroethane	35 {ca**}	120 {ca**}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
Isophorone	510 {ca*}	1,800 {ca*}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
Naphthalene	3.9 {ca}	20 {ca}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85] [<0.85]
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	NA	NA	NA	<0.69	<1.1	NA	<0.93 [<0.85]
N-Nitroso-di-n-propylamine	0.069 {ca**}	0.25 {ca**}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
N-Nitrosodiphenylamine	99 {ca**}	350 {ca**}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
Pentachlorophenol	3 {ca}	9 {ca}	- -	mg/kg	<2.1	<4.6	<4.7	<4.7	<7.4	NA	<6.3 [<5.7]
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
Phenol	1,800 {nc}	180,000 {max}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	<0.42	<0.92	<0.94	<0.69	<1.1	NA	<0.93 [<0.85]
Inorganics											
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	23,100	23,900	6,720	6,730	5,790	13,800	6,010 [6,670]
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	<0.650	<1.30	<1.40	1.20 B	<1.80	<1.60	1.70 B [<1.40]
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	10.3	10.0	2.90	3.30 B	5.30 B	3.90 B	4.20 B [4.90 B]
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	96.7 K	65.2 K	47.3 K	46.2 L	72.1 L	67.0 J	50.1 L [50.6 J]
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	**1.20 B**	0.800 B	0.930 B	0.710 K	0.450 K	<0.330 L	0.540 K [0.520]
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	<0.130	<0.270	<0.280	<0.230	<0.360	<0.330	<0.310 [<0.280]
Calcium	- -	- -	- -	mg/kg	2,450 B	30,400	11,800 B	15,700	70,800	56,300	22,300 [23,000]
Chromium	280 {ca}	1,460 {ca}	65.3	mg/kg	40.0	46.8	26.0	21.9	39.3	**96.9**	25.0 [24.9]
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	25.1 K	13.5 K	3.20 K	10.2	5.50	8.30 J	7.30 [8.00]
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	15.4 B	18.8 B	15.0 B	18.6 K	24.4	19.8 K	28.7 K [37.2 K]
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	36,800	33,900	8,530	15,300	12,700	20,100	15,500 [16,100]
Lead	400 {++}	800 {++}	26.8	mg/kg	**28.1**	26.8	18.7	20.8 J	**347 J**	**899**	**29.5 J [31.0 J]**
Magnesium	- -	- -	- -	mg/kg	2,140 B	4,010	1,800 B	1,780	3,170	4,350	1,720 [1,830]
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	721	165	25.9	121 K	155 K	144	238 K [238 K]
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	<0.140	<0.270	<0.290	<0.230	<0.370	<0.320	<0.300 [<0.270]
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	17.9 K	17.9 K	7.70 K	8.70 K	5.00 K	11.2 J	7.00 K [7.60 K]
Potassium	- -	- -	- -	mg/kg	1,350 J	2,210 J	376 B	448	568	1,110 J	440 [498]
Selenium	39 {nc}	510 {nc}	- -	mg/kg	<0.650 L	<1.30 L	<1.40 L	<0.930 L	<1.40 L	<1.30	1.30 L [1.30 J]
Silver	39 {nc}	510 {nc}	- -	mg/kg	0.790 B	1.60 B	0.950 B	<0.230	<0.360	<0.330	<0.310 [<0.280]
Sodium	- -	- -	- -	mg/kg	194 B	389 B	398 B	292 B	577 B	422 B	516 B [456 B]
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	1.70 B	<0.540 L	<0.560 L	<1.60	<2.50	<2.30	<2.20 [<2.00]
Vanadium	55{nc}	720 {nc}	108	mg/kg	66.2 K	67.3 K	20.1 K	33.0 K	23.6 K	34.8	31.4 K [32.1 K]
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	38.0 B	41.8 B	65.9 B	30.5 K	104 K	**209**	42.0 K [44.3 K]
Miscellaneous											
Total Organic Carbon	- -	- -	- -	mg/kg	NA	NA	NA	21,842	39,276	NA	37,330 [35,146]

mg/kg	Milligrams per kilogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 9-9. Surface Water Analytical Results, Western Burning Ground, 1998 and 1999 ICF KE Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Date Collected:	Tapwater Screening Values [a]	Units	WBGSW1 07/16/98	WBGSW2 07/16/98	WBGSW3 07/16/98	WBGSW4 05/27/99	WBGSW5 05/27/99	WBGSW6 05/27/99
Explosives								
1,3,5-Trinitrobenzene	1,100 {nc}	µg/L	<0.5	<0.5 L	<0.5	NA	NA	NA
1,3-Dinitrobenzene	3.7 {nc}	µg/L	<0.5	<0.5 L	<0.5	NA	NA	NA
2,4,6-Trinitrotoluene	2.2 {ca**}	µg/L	<0.5	<0.5 L	<0.5	NA	NA	NA
2,4-Dinitrotoluene	73 {nc}	µg/L	<0.5	<0.5 L	<0.5	NA	NA	NA
2,6-Dinitrotoluene	37 {nc}	µg/L	<0.5	<0.5 L	<0.5	NA	NA	NA
2-Amino-4,6-Dinitrotoluene	73 {nc}	µg/L	<0.5	<0.5 L	<0.5	NA	NA	NA
4-Amino-2,6-Dinitrotoluene	73 {nc}	µg/L	<0.5	<0.5 L	<0.5	NA	NA	NA
Dinitrotoluene Mix	0.099 {ca}	µg/L	<0.5	<0.5	<0.5	NA	NA	NA
HMX	1,800 {nc}	µg/L	<0.5	<0.5 L	<0.5	NA	NA	NA
m-Nitrotoluene	- -	µg/L	<0.5	<0.5 L	<0.5	NA	NA	NA
Nitrobenzene	3.4 {nc}	µg/L	<0.5	<0.5 L	<0.5	NA	NA	NA
Nitroglycerine	3.7 {nc}	µg/L	<2.5	<2.5 L	<2.5	NA	NA	NA
o-Nitrotoluene	370 {nc}	µg/L	<0.5	<0.5 L	<0.5	NA	NA	NA
Pentaerythritol Tetranitrate	- -	µg/L	<2.5	<2.5 L	<2.5	NA	NA	NA
Perchlorate	26 {nc}	µg/L	NA	NA	NA	NA	NA	NA
p-Nitrotoluene	4.2 {ca*}	µg/L	<0.5	<0.5 L	<0.5	NA	NA	NA
RDX	0.61 {ca}	µg/L	<0.5	<0.5 L	<0.5	NA	NA	NA
Tetryl	150 {nc}	µg/L	<0.5	<0.5 L	<0.5	NA	NA	NA
PAHs								
2-Methylnaphthalene	150 {nc}	µg/L	NA	NA	NA	NA	NA	NA
Acenaphthene	2,200 {nc}	µg/L	NA	NA	<0.10	NA	NA	NA
Acenaphthylene	- -	µg/L	NA	NA	<1.0	NA	NA	NA
Anthracene	11,000 {nc}	µg/L	NA	NA	<0.050	NA	NA	NA
Benzo(a)anthracene	0.029 {ca**}	µg/L	NA	NA	<0.050	NA	NA	NA
Benzo(a)pyrene	0.0029 {ca**}	µg/L	NA	NA	<0.050	NA	NA	NA
Benzo(b)fluoranthene	0.029 {ca**}	µg/L	NA	NA	<0.10	NA	NA	NA
Benzo(g,h,i)perylene	- -	µg/L	NA	NA	<0.10	NA	NA	NA
Benzo(k)fluoranthene	0.29 {ca**}	µg/L	NA	NA	<0.050	NA	NA	NA
Chrysene	2.9 {ca**}	µg/L	NA	NA	<0.050	NA	NA	NA
Dibenzo(a,h)anthracene	0.0029 {ca**}	µg/L	NA	NA	<0.10	NA	NA	NA
Fluoranthene	1,500 {nc}	µg/L	NA	NA	<0.10 J	NA	NA	NA
Fluorene	1,500 {nc}	µg/L	NA	NA	<0.10	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.029 {ca**}	µg/L	NA	NA	<0.050	NA	NA	NA
Naphthalene	6.2 {nc}	µg/L	NA	NA	<0.10	NA	NA	NA
Phenanthrene	- -	µg/L	NA	NA	<0.050	NA	NA	NA
Pyrene	1,100 {nc}	µg/L	NA	NA	<0.050	NA	NA	NA
Volatile Organics								
1,1,1,2-Tetrachloroethane	0.52 {ca}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
1,1,1-Trichloroethane	9,100 {nc}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
1,1,2,2-Tetrachloroethane	0.067 {ca**}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
1,1,2-Trichloroethane	0.24 {ca}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
1,1-Dichloroethane	2.4 {ca}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
1,1-Dichloroethene	340 {nc}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
1,1-Dichloropropene	- -	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
1,2,3-Trichlorobenzene	- -	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
1,2,3-Trichloropropane	0.0096 {ca}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
1,2,4-Trichlorobenzene	19 {ca*}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
1,2,4-Trimethylbenzene	15 {nc}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
1,2-Dibromo-3-chloropropane	0.00032 {ca}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
1,2-Dibromoethane	0.0065 {ca}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
1,2-Dichlorobenzene	370 {nc}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
1,2-Dichloroethane	0.15 {ca}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
1,2-Dichloropropane	0.39 {ca*}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
1,3,5-Trimethylbenzene	- -	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
1,3-Dichlorobenzene	- -	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
1,3-Dichloropropane	730 {nc}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
1,4-Dichlorobenzene	0.43 {ca}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
2,2-Dichloropropane	- -	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
2-Butanone	7,100 {nc}	µg/L	<5.0	4.0 J	<5.0	NA	NA	NA
2-Chloroethyl Vinyl Ether	- -	µg/L	<5.0	<5.0	<5.0	NA	NA	NA
2-Chlorotoluene	730 {nc}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
2-Hexanone	- -	µg/L	<5.0	<5.0	<5.0	NA	NA	NA
4-Chlorotoluene	2,600 {nc}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
4-Methyl-2-pentanone	2,000 {nc}	µg/L	<5.0	<5.0	<5.0	NA	NA	NA
Acetone	22,000 {nc}	µg/L	<5.0	<5.0	<5.0	NA	NA	NA
Acrolein	0.042 {nc}	µg/L	<5.0	<5.0	<5.0	NA	NA	NA
Acrylonitrile	0.045 {ca*}	µg/L	<5.0	<5.0	<5.0	NA	NA	NA
Benzene	0.41 {ca}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
Bromobenzene	- -	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
Bromochloromethane	- -	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
Bromodichloromethane	1.1 {ca}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
Bromoform	8.5 {ca*}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
Bromomethane	8.7 {nc}	µg/L	<2.0	<2.0	<2.0	NA	NA	NA
Carbon Disulfide	1,000 {nc}	µg/L	<5.0	<5.0	<5.0	NA	NA	NA
Carbon Tetrachloride	0.2 {ca}	µg/L	<2.0	<2.0	<2.0	NA	NA	NA
Chlorobenzene	91 {nc}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
Chloroethane	21,000 {nc}	µg/L	<2.0	<2.0	<2.0	NA	NA	NA
Chloroform	0.19 {ca}	µg/L	<1.0	3.0	<1.0	NA	NA	NA
Chloromethane	1.8 {ca}	µg/L	<2.0	<2.0	<2.0	NA	NA	NA
cis-1,2-Dichloroethene	370 {nc}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
cis-1,3-Dichloropropene	- -	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
Dibromochloromethane	0.8 {ca}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
Dibromomethane	370 {nc}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
Dichlorodifluoromethane	390 {nc}	µg/L	<2.0	<2.0	<2.0	NA	NA	NA
Ethylbenzene	1.5 {ca}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
Hexachlorobutadiene	0.86 {ca*}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
Isopropylbenzene	680 {nc}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
m,p-Xylene	- -	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
Methylene Chloride	4.8 {ca}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
n-Butylbenzene	- -	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
n-Propylbenzene	- -	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
o-Xylene	1,400 {nc}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
p-Isopropyltoluene	- -	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
sec-Butylbenzene	- -	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
Styrene	1,600 {nc}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
tert-Butylbenzene	- -	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
Tetrachloroethene	0.11 {ca}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
Toluene	2,300 {nc}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
trans-1,2-Dichloroethene	110 {nc}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
trans-1,3-Dichloropropene	- -	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
Trichloroethene	1.7 {ca}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
Trichlorofluoromethane	1,300 {nc}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
Vinyl Acetate	410 {nc}	µg/L	<5.0	<5.0	<5.0	NA	NA	NA
Vinyl Chloride	0.016 {ca}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA
Xylenes (total)	200 {nc}	µg/L	<1.0	<1.0	<1.0	NA	NA	NA

Notes found at end of table.

Table 9-9. Surface Water Analytical Results, Western Burning Ground, 1998 and 1999 ICF KE Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Date Collected:	Tapwater Screening Values [a]	Units	WBGSW1 07/16/98	WBGSW2 07/16/98	WBGSW3 07/16/98	WBGSW4 05/27/99	WBGSW5 05/27/99	WBGSW6 05/27/99
Semivolatile Organics								
1,2,4-Trichlorobenzene	19 {ca*}	µg/L	<10	<10	<10	<10	<10	<10
1,2-Dichlorobenzene	370 {nc}	µg/L	<10	<10	<10	<10	<10	<10
1,2-Diphenylhydrazine	0.084 {ca**}	µg/L	<10	<10	<10	NA	NA	NA
1,3-Dichlorobenzene	- -	µg/L	NA	NA	NA	<10	<10	<10
1,4-Dichlorobenzene	0.43 {ca}	µg/L	NA	NA	NA	<10	<10	<10
2,4,5-Trichlorophenol	3,700 {nc}	µg/L	<50	<50	<50	<10	<10	<10
2,4,6-Trichlorophenol	6.1 {ca**}	µg/L	<10	<10	<10	<10	<10	<10
2,4-Dichlorophenol	110 {nc}	µg/L	<10	<10	<10	<10	<10	<10
2,4-Dimethylphenol	730 {nc}	µg/L	<10	<10	<10	<10	<10	<10
2,4-Dinitrophenol	73 {nc}	µg/L	<50	<50	<50	<10	<10	<10
2,4-Dinitrotoluene	73 {nc}	µg/L	NA	NA	NA	<10	<10	<10
2,6-Dinitrotoluene	37 {nc}	µg/L	NA	NA	NA	<10	<10	<10
2-Chloronaphthalene	2,900 {nc}	µg/L	<10	<10	<10	<10	<10	<10
2-Chlorophenol	180 {nc}	µg/L	<10	<10	<10	<10	<10	<10
2-Methylnaphthalene	150 {nc}	µg/L	<10	<10	<10	<10	<10	<10
2-Methylphenol	1,800 {nc}	µg/L	<10	<10	<10	<10	<10	<10
2-Nitroaniline	- -	µg/L	<50	<50	<50	<10	<10	<10
2-Nitrophenol	- -	µg/L	<10	<10	<10	<10	<10	<10
3,3'-Dichlorobenzidine	0.15 {ca**}	µg/L	<20	<20	<20	<10	<10	<10
3-Nitroaniline	- -	µg/L	<50	<50	<50	<10	<10	<10
4,6-Dinitro-2-methylphenol	- -	µg/L	<50	<50	<50	<10	<10	<10
4-Bromophenyl-phenylether	- -	µg/L	<10	<10	<10	<10	<10	<10
4-Chloro-3-Methylphenol	- -	µg/L	<20	<20	<20	<10	<10	<10
4-Chloroaniline	150 {nc}	µg/L	<20	<20	<20	<10	<10	<10
4-Chlorophenyl-phenylether	- -	µg/L	<10	<10	<10	<10	<10	<10
4-Methylphenol	180 {nc}	µg/L	<10	<10	<10	<10	<10	<10
4-Nitroaniline	- -	µg/L	<50	<50	<50	<10	<10	<10
4-Nitrophenol	- -	µg/L	<50	<50	<50	<10	<10	<10
Acenaphthene	2,200 {nc}	µg/L	<10	<10	NA	<10	<10	<10
Acenaphthylene	- -	µg/L	<10	<10	NA	<10	<10	<10
Anthracene	11,000 {nc}	µg/L	<10	<10	NA	<10	<10	<10
Benzo(a)anthracene	0.029 {ca**}	µg/L	<10	<10	NA	<10	<10	<10
Benzo(a)pyrene	0.0029 {ca**}	µg/L	<10	<10	NA	<10	<10	<10
Benzo(b)fluoranthene	0.029 {ca**}	µg/L	<10	<10	NA	<10	<10	<10
Benzo(g,h,i)perylene	- -	µg/L	<10	<10	NA	<10	<10	<10
Benzo(k)fluoranthene	0.29 {ca**}	µg/L	<10	<10	NA	<10	<10	<10
Benzoic Acid	150,000 {max}	µg/L	<50	<50	<50	NA	NA	NA
Benzyl Alcohol	18,000 {nc}	µg/L	<20	<20	<20	NA	NA	NA
bis(2-Chloroethoxy)methane	110 {nc}	µg/L	<10	<10	<10	<10 J	<10	<10 J
bis(2-Chloroethyl)ether	0.012 {ca**}	µg/L	<10	<10	<10	<10	<10	<10
bis(2-Chloroisopropyl)ether	- -	µg/L	<10	<10	<10	<10	<10	<10
bis(2-Ethylhexyl)phthalate	4.8 {ca}	µg/L	<10	<10	<10	<10	<10	<10
Butylbenzylphthalate	7,300 {nc}	µg/L	<10	<10	<10	<10	<10	<10
Carbazole	3.4 {ca**}	µg/L	<10	<10	<10	<10	<10	<10
Chrysene	2.9 {ca**}	µg/L	<10	<10	NA	<10	<10	<10
Dibenzo(a,h)anthracene	0.0029 {ca**}	µg/L	<10	<10	NA	<10	<10	<10
Dibenzofuran	- -	µg/L	<10	<10	<10	<10	<10	<10
Diethylphthalate	29,000 {nc}	µg/L	1.0 J	<10	<10	<10	<10	<10
Dimethylphthalate	- -	µg/L	<10	<10	<10	<10	<10	<10
Di-n-Butylphthalate	3,700 {nc}	µg/L	<10	<10	<10	<10	0.13 B	<10
Dinitrotoluene Mix	0.099 {ca}	µg/L	NA	NA	NA	<10	<10	<10
Di-n-Octylphthalate	- -	µg/L	<10	<10	<10	<10	<10	<10
Fluoranthene	1,500 {nc}	µg/L	<10	<10	NA	<10	<10	<10
Fluorene	1,500 {nc}	µg/L	<10	<10	NA	<10	<10	<10
Hexachlorobenzene	0.042 {ca}	µg/L	<10	<10	<10	<10	<10	<10
Hexachlorobutadiene	0.86 {ca*}	µg/L	NA	NA	NA	<10	<10	<10
Hexachlorocyclopentadiene	220 {nc}	µg/L	<10	<10	<10	<10	<10	<10
Hexachloroethane	4.8 {ca**}	µg/L	<10	<10	<10	<10	<10	<10
Indeno(1,2,3-cd)pyrene	0.029 {ca**}	µg/L	<10	<10	NA	<10	<10	<10
Isophorone	71 {ca}	µg/L	<10	<10	<10	<10	<10	<10
Naphthalene	6.2 {nc}	µg/L	<10	<10	NA	<10	<10	<10
Nitrobenzene	3.4 {nc}	µg/L	NA	NA	NA	<10	<10	<10
N-Nitroso-di-n-propylamine	0.0096 {ca**}	µg/L	<10	<10	<10	<10	<10	<10
N-Nitrosodiphenylamine	14 {ca**}	µg/L	<10	<10	<10	<10	<10	<10
Pentachlorophenol	0.56 {ca}	µg/L	<50	<50	<50	<10	<10	<10
Phenanthrene	- -	µg/L	<10	<10	NA	<10	<10	<10
Phenol	11,000 {nc}	µg/L	<10	<10	<10	<10 J	<10	<10 J
Pyrene	1,100 {nc}	µg/L	<10	<10	NA	<10	<10	<10
Inorganics								
Aluminum	37,000 {nc}	µg/L	66.6 B	63.0 B	39.2 B	232 B	67.9 B	91.8 B
Antimony	15 {nc}	µg/L	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
Arsenic	0.045 {ca}	µg/L	<7.00	<7.00	<7.00	<6.00	8.60 B	10.4 K
Barium	7,300 {nc}	µg/L	79.2 B	73.4 B	54.0 B	56.4 J	63.1 L	63.9 J
Beryllium	73 {nc}	µg/L	<1.00	<1.00	<1.00	1.10 B	<1.00	<1.00
Cadmium	18 {nc}	µg/L	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Calcium	- -	µg/L	61,900 B	56,700 B	66,500 B	70,300	73,400	71,100
Chromium	55,000 {nc}	µg/L	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Cobalt	11 {nc}	µg/L	<2.00 L	<2.00 L	<2.00 L	<1.00	<1.00	<1.00
Copper	1,500 {nc}	µg/L	19.6 B	15.0 B	23.5 B	20.2 K	4.10 B	2.20 K
Iron	26,000 {nc}	µg/L	307 B	434 B	41.6 B	261 J	88.0 B	180
Lead	15 {nc}	µg/L	<2.00	<2.00	<2.00	<2.00 L	4.00 B	<2.00 L
Magnesium	- -	µg/L	15,300 B	14,200 B	12,100 B	12,900	14,900	15,000
Manganese	880 {nc}	µg/L	10.2 B	18.5 B	2.00 B	24.0	14.1 K	11.4 J
Mercury	0.63 {nc}	µg/L	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200
Nickel	730 {nc}	µg/L	1.40 K	1.50 K	<1.00	<1.00	<1.00	<1.00
Potassium	- -	µg/L	2,100 B	2,010 B	1,900 B	2,090 J	2,090	2,090 J
Selenium	180 {nc}	µg/L	<5.00	<5.00	<5.00	<4.00	<4.00 L	<4.00
Silver	180 {nc}	µg/L	<2.00 J	<2.00 J	<2.00 J	1.20 K	<1.00	1.00 K
Sodium	- -	µg/L	29,700	27,800	21,100	25,700	35,000	37,100
Thallium	2.4 {nc}	µg/L	5.40 B	<2.00 L	2.30 B	<7.00 L	<7.00	<7.00 L
Vanadium	260 {nc}	µg/L	<2.00	<2.00	<2.00	1.20 K	1.20 B	1.10 K
Zinc	11,000 {nc}	µg/L	21.3 B	21.1 B	23.7 B	21.3 K	18.4 B	19.3 K
Perchlorate								
Perchlorate	26 {nc}	µg/L	NA	NA	NA	<3	<3	<3
Miscellaneous								
Total Organic Carbon	- -	µg/L	NA	NA	NA	<100,000	<100,000	<100,000

µg/L	Micrograms per liter.
[a]	USEPA Regional Screening Levels (USEPA 2008a). Adjusted tap-water screening levels used to assess surface water at the NRU.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{max}	Concentration may exceed ceiling limit.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted tap water RSL.

Table 9-10. Soil Analytical Results, Western Burning Ground, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	WBGSB22 0 - 0.5 06/18/02	WBGSB22 2 - 4 06/19/02	WBGSB22 6 - 8 06/19/02	WBGSB23 0 - 0.5 06/18/02	WBGSB23 2 - 4 06/19/02	WBGSB23 6 - 8 06/19/02	WBGSB24 0 - 0.5 06/18/02	WBGSB24 2 - 4 06/19/02	WBGSB24 6 - 8 06/19/02	WBGSB25 0 - 0.5 06/18/02	WBGSB25 2 - 4 06/19/02	WBGSB25 6 - 8 06/19/02	WBGTR01 0 - 0.5 06/18/02
Dioxin/Furan																	
1,2,3,4,6,7,8-HpCDD	0.00039 {ca**}	0.0016 {ca**}	- -	mg/kg	0.0000203	0.0002122 J	0.00001232	0.00002764	0.00001744 J	0.00000181	0.00002537	0.00002548	0.00000304	0.0001572	0.00000383	0.00000124	NA
1,2,3,4,6,7,8-HpCDF	0.00032 {ca**}	0.0011 {ca**}	- -	mg/kg	0.000001	0.00003587 J	0.00000137	0.0000013	0.00000016 J	0.00000016	0.00000463	<0.00000013	<0.00000009	0.00003102	<0.00000016	<0.00000011	NA
1,2,3,4,7,8,9-HpCDF	0.00032 {ca**}	0.0011 {ca**}	- -	mg/kg	<0.00000005	0.00000405 J	0.00000016 J	<0.00000007	<0.00000004	<0.00000003	0.00000023	<0.00000016	<0.00000011	0.00000205	<0.00000021	<0.00000015	NA
1,2,3,4,7,8-HxCDD	0.000039 {ca**}	0.00016 {ca**}	- -	mg/kg	0.00000028	0.00000663 J	0.00000026	0.00000055	<0.00000007	<0.00000007	0.00000029	<0.00000021	<0.00000021	0.00000333	<0.00000027	<0.00000022	NA
1,2,3,4,7,8-HxCDF	0.000032 {ca**}	0.00011 {ca**}	- -	mg/kg	0.00000019	0.0000183 J	0.0000006	0.00000032	<0.00000003	<0.00000003	0.00000062	<0.0000001	<0.00000007	0.00000564	<0.00000012	<0.00000009	NA
1,2,3,6,7,8-HxCDD	0.000039 {ca**}	0.00016 {ca**}	- -	mg/kg	0.00000037 J	0.00001314 J	0.00000045	0.00000079	<0.00000005	<0.00000006	0.00000076	<0.00000016	<0.00000017	0.00000661	<0.00000021	<0.00000017	NA
1,2,3,6,7,8-HxCDF	0.000032 {ca**}	0.00011 {ca**}	- -	mg/kg	0.00000018 J	0.00000849 J	0.00000027	0.00000039 J	<0.00000003	<0.00000003	0.00000047 J	<0.0000001	<0.00000007	0.00000508 J	<0.00000012	<0.00000009	NA
1,2,3,7,8,9-HxCDD	0.000039 {ca**}	0.00016 {ca**}	- -	mg/kg	0.00000104	0.00002096 J	0.00000881	0.00000162	0.00000032 J	0.00000031	0.00000105	<0.00000016	<0.00000016	0.00000834	<0.00000021	<0.00000017	NA
1,2,3,7,8,9-HxCDF	0.000032 {ca**}	0.00011 {ca**}	- -	mg/kg	<0.00000007	0.00000182 J	<0.00000005	<0.00000009	<0.00000005	<0.00000004	<0.00000003	<0.00000011	<0.00000008	0.00000045	<0.00000014	<0.0000001	NA
1,2,3,7,8-PeCDD	0.0000039 {ca**}	0.000016 {ca**}	- -	mg/kg	<0.0000001	0.00000413 J	0.00000025 J	<0.00000011	<0.00000006	<0.00000007	0.0000002	<0.00000015	<0.00000011	0.00000173	<0.00000017	<0.00000013	NA
1,2,3,7,8-PeCDF	0.00011 {ca**}	0.00038 {ca**}	- -	mg/kg	<0.00000007	0.00000416 J	0.00000019	<0.00000008	<0.00000004	<0.00000004	0.0000001	<0.0000001	<0.00000007	0.00000107	<0.0000001	<0.00000008	NA
2,3,4,6,7,8-HxCDF	0.000032 {ca**}	0.00011 {ca**}	- -	mg/kg	<0.00000006	0.00000528 J	0.00000026	0.00000014	<0.00000004	<0.00000004	0.00000017 J	<0.00000011	<0.00000008	0.00000238	<0.00000014	<0.0000001	NA
2,3,4,7,8-PeCDF	0.000011 {ca**}	0.000038 {ca**}	- -	mg/kg	<0.00000008	0.00000641 J	0.00000024	<0.00000009	<0.00000005	<0.00000004	0.00000013	<0.00000011	<0.00000007	0.00000149	<0.00000011	<0.00000008	NA
2,3,7,8-TCDD	0.0000045 {ca*}	0.000018 {ca*}	- -	mg/kg	<0.00000006	0.00000404 J	<0.00000007	0.00000151	<0.00000005	<0.00000005	0.00000032 J	<0.00000015	<0.00000013	0.00000077 J	<0.00000017	<0.00000013	NA
2,3,7,8-TCDF	0.000032 {ca**}	0.00011 {ca**}	- -	mg/kg	<0.00000006 J	0.00001035 J	0.00000035 J	<0.00000007 J	<0.00000003	<0.00000003	<0.00000021 J	<0.00000013	<0.00000011	0.0000017 J	<0.00000014	<0.00000009	NA
OCDD	0.013 {ca**}	0.053 {ca**}	- -	mg/kg	0.003301 J	0.003034 J	0.001028 J	0.002912 J	0.006013 J	0.0001833 J	0.003963 J	0.005689 J	0.0003054 J	0.002972 J	0.0002626 J	0.00005723 J	NA
OCDF	0.011 {ca**}	0.038 {ca**}	- -	mg/kg	0.00000202 B	0.00005688 J	0.00000242 B	0.0000027 B	0.00000155 B	0.0000014 B	0.00001049 J	0.00000223 J	0.00000093 J	0.00005862 J	<0.00000039 J	0.00000253 J	NA
Total HpCDDs	- -	- -	- -	mg/kg	0.00004377	0.0004875 J	0.00003006	0.00005739	0.00003269 J	0.00000382	0.00005008	0.00004247	0.00000662	0.0003078	0.00000941	0.00000347	NA
Total HpCDFs	- -	- -	- -	mg/kg	0.00000221	0.0000816 J	0.00000247	0.00000266	0.00000052 J	0.00000066	0.00001178	<0.00000013	<0.00000009	0.00007396	<0.00000016	0.0000009	NA
Total HxCDDs	- -	- -	- -	mg/kg	0.00000519	0.0001282 J	0.000014	0.0000097	0.00000054 J	0.00000031	0.00000502	0.00000173	<0.00000016	0.00007337	<0.00000021	<0.00000017	NA
Total HxCDFs	- -	- -	- -	mg/kg	0.00000079	0.00007702 J	0.00000113	0.00000112	<0.00000003	<0.00000003	0.00000378	<0.0000001	<0.00000007	0.0000445	<0.00000012	<0.00000009	NA
Total PeCDDs	- -	- -	- -	mg/kg	<0.0000001	0.00001327 J	<0.00000008	<0.00000011	<0.00000006	<0.00000007	0.0000002	<0.00000015	<0.00000011	0.00000554	<0.00000017	<0.00000013	NA
Total PeCDFs	- -	- -	- -	mg/kg	0.00000035	0.00006234 J	0.00000074	0.00000066	<0.00000004	<0.00000004	0.00000112	<0.0000001	<0.00000007	0.0000181	<0.0000001	<0.00000008	NA
Total TCDDs	- -	- -	- -	mg/kg	<0.00000006	0.00002637 J	<0.00000007	0.00000244	<0.00000005	<0.00000005	0.00000094	<0.00000015	<0.00000013	0.00000671	<0.00000017	<0.00000013	NA
Total TCDFs	- -	- -	- -	mg/kg	0.00000041	0.0001252 J	0.00000428	0.00000176	<0.00000003	<0.00000003	0.00000192	<0.00000013	<0.00000011	0.00002448	<0.00000014	<0.00000009	NA
Explosives																	
1,3,5-Trinitrobenzene	220 {nc}	2,700 {nc}	- -	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
1,3-Dinitrobenzene	0.61 {nc}	6.2 {nc}	- -	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
2,4,6-Trinitrotoluene	3.6 {ca**}	42 {ca**}	- -	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	NA
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	NA
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	NA
2-Amino-4,6-Dinitrotoluene	15 {nc}	190 {nc}	- -	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	NA
4-Amino-2,6-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	NA
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	NA
HMX	310 {nc}	3,100 {nc}	- -	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	NA
m-Nitrotoluene	- -	- -	- -	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	NA
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	NA
Nitroglycerine	0.61 {nc}	6.2 {nc}	- -	mg/kg	<0.3	<0.35	<0.37	<0.3	<0.41	<0.38	<0.3	<0.38	<0.35	<0.3	<0.35	<0.39	NA
o-Nitrotoluene	78 {nc}	1,300 {sat}	- -	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	NA
Pentaerythritol Tetranitrate	- -	- -	- -	mg/kg	<0.3	<0.35	<0.37	<0.3	<0.41	<0.38	0.11 J	<0.38	<0.35	<0.3	<0.35	<0.39	NA
p-Nitrotoluene	30 {ca**}	110 {ca*}	- -	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	NA
RDX	4.4 {ca*}	16 {ca}	- -	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	NA
Tetryl	24 {nc}	250 {nc}	- -	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	NA
Herbicides																	
2,4,5-T	61 {nc}	620 {nc}	- -	mg/kg	<0.0101	NA	NA	<0.0101	NA	NA	<0.0102	NA	NA	<0.101	NA	NA	NA
2,4,5-TP	49 {nc}	490 {nc}	- -	mg/kg	<0.0101	NA	NA	<0.0101	NA	NA	<0.0102	NA	NA	0.0078 J	NA	NA	NA
2,4-D	69 {nc}	770 {nc}	- -	mg/kg	<0.0201	NA	NA	<0.0202	NA	NA	0.0107 J	NA	NA	0.0302 J	NA	NA	NA
2,4-DB	49 {nc}	490 {nc}	- -	mg/kg	<0.101	NA	NA	<0.101	NA	NA	<0.102	NA	NA	<1.01	NA	NA	NA
Dalapon	180 {nc}	1,800 {nc}	- -	mg/kg	0.0392 J	NA	NA	0.0223 J	NA	NA	0.163	NA	NA	<1.01	NA	NA	NA
Dicamba	180 {nc}	1,800 {nc}	- -	mg/kg	<0.0201	NA	NA	<0.0202	NA	NA	<0.0204	NA	NA	<0.203	NA	NA	NA
Dichlorprop	- -	- -	- -	mg/kg	<0.0201	NA	NA	<0.0202	NA	NA	<0.0204	NA	NA	<0.203	NA	NA	NA
Dinoseb	6.1 {nc}	62 {nc}	- -	mg/kg	<0.0201	NA	NA	<0.0202	NA	NA	<0.0204	NA	NA	<0.203	NA	NA	NA
MCPA	3.1 {nc}	31 {nc}	- -	mg/kg	<10.1	NA	NA	<10.1	NA	NA	<10.2	NA	NA	<101	NA	NA	NA
MCPP	6.1 {nc}	62 {nc}	- -	mg/kg	<10.1	NA	NA	2.56 J	NA	NA	<10.2	NA	NA	<101	NA	NA	NA
Organochlorine Pesticides																	
4,4'-DDD	2 {ca**}	7.2 {ca**}	- -	mg/kg	<0.0067	NA	NA	<0.00672	NA	NA	<0.00681	NA	NA	0.0019 J	NA	NA	NA
4,4'-DDE	1.4 {ca**}	5.1 {ca**}	- -	mg/kg	<0.0067 J	NA	NA	<0.00672 J	NA	NA	<0.00681 J	NA	NA	<0.00676 J	NA	NA	NA
4,4'-DDT	1.7 {ca*}	7 {ca*}	- -	mg/kg	<0.0067 J	NA	NA	<0.00672 J	NA	NA	<0.00681 J	NA	NA	<0.00676 J	NA	NA	NA
Aldrin	0.029 {ca*}	0.1 {ca}	- -	mg/kg	<0.0067	NA	NA	<0.00672	NA	NA	<0.00681	NA	NA	<0.00676	NA	NA	NA
Alpha-BHC	0.077 {ca**}	0.27 {ca**}	- -	mg/kg	<0.0067	NA	NA	<0.00672	NA	NA	<0.00681	NA	NA	<0.00676	NA	NA	NA
Alpha-Chlordane	1.6 {ca**}	6.5 {ca**}	- -	mg/kg	<0.0067	NA	NA	<0.00672	NA	NA	<0.00681	NA	NA	<0.00676	NA	NA	NA
Beta-BHC	0.27 {ca**}	0.96 {ca**}	- -	mg/kg	<0.0067 J	NA	NA	<0.00672 J	NA	NA	<0.00681 J	NA	NA	<0.00676 J	NA	NA	NA
Delta-BHC	0.52 {ca**}	2.1 {ca**}	- -	mg/kg	<0.0067	NA	NA	<0.00672	NA	NA	<0.00681	NA	NA	<0.00676	NA	NA	NA
Dieldrin	0.03 {ca}	0.11 {ca}	- -	mg/kg	<0.0067 J	NA	NA	<0.00672 J	NA	NA	0.00472 J	NA	NA	<0.00676 J	NA	NA	NA
Endosulfan I	- -	- -	- -	mg/kg	<0.0067 J	NA	NA	<0.00672 J	NA	NA	<0.00681 J	NA	NA	<0.00676 J	NA	NA	NA
Endosulfan II	37 {nc}	370 {nc}	- -	mg/kg	<0.0067	NA	NA	<0.00672	NA	NA	<0.00681	NA	NA	<0.00676	NA	NA	NA
Endosulfan Sulfate	- -	- -	- -	mg/kg	<0.0067 J	NA	NA	<0.00672 J	NA	NA	<0.00681 J	NA	NA	<0.00676 J	NA	NA	NA
Endrin	1.8 {nc}	18 {nc}	- -	mg/kg	<0.0067 J	NA	NA	<0.00672 J	NA	NA	<0.00681 J	NA	NA	<0.00676 J	NA	NA	NA
Endrin Aldehyde	1.8 {nc}	18 {nc}	- -	mg/kg	<0.0067 J	NA	NA	<0.00672 J	NA	NA	<0.00681 J	NA	NA	<0.00676 J	NA	NA	NA
Endrin Ketone	- -	- -	- -	mg/kg	<0.0067	NA	NA	<0.00672	NA	NA	<0.00681	NA	NA	<0.00676	NA	NA	NA
Gamma-BHC (Lindane)	0.52 {ca*}	2.1 {ca}	- -	mg/kg	<0.0067	NA	NA	<0.00672	NA	NA	<0.00681	NA	NA	<0.00676	NA	NA	NA
Gamma-Chlordane	1.6 {ca**}	6.5 {ca**}	- -	mg/kg	<0.0067	NA	NA	<0.00672	NA	NA	<0.00681	NA	NA	<0.00676	NA	NA	NA
Heptachlor	0.11 {ca}	0.38 {ca}	- -	mg/kg	<0.0067 J	NA	NA	<0.00672 J	NA	NA	<0.00681 J	NA	NA	<0.00676 J	NA	NA	NA
Heptachlor Epoxide	0.053 {ca*}	0.19 {ca*}	- -	mg/kg	<0.0067 J	NA	NA	<0.00672 J	NA	NA	<0.00681 J	NA	NA	<0.00676 J	NA	NA	NA
Methoxychlor	31 {nc}	310 {nc}	- -	mg/kg	<0.0067 J	NA	NA	<0.00672 J	NA	NA	<0.00681 J	NA	NA	<0.00676 J	NA	NA	NA
Toxaphene	0.44 {ca**}	1.6 {ca**}	- -	mg/kg	<0.335	NA	NA	<0.336	NA	NA	<0.34	NA	NA	<0.338	NA	NA	NA

Notes found at end of table.

Table 9-10. Soil Analytical Results, Western Burning Ground, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	WBGSB22 0 - 0.5 06/18/02	WBGSB22 2 - 4 06/19/02	WBGSB22 6 - 8 06/19/02	WBGSB23 0 - 0.5 06/18/02	WBGSB23 2 - 4 06/19/02	WBGSB23 6 - 8 06/19/02	WBGSB24 0 - 0.5 06/18/02	WBGSB24 2 - 4 06/19/02	WBGSB24 6 - 8 06/19/02	WBGSB25 0 - 0.5 06/18/02	WBGSB25 2 - 4 06/19/02	WBGSB25 6 - 8 06/19/02	WBGTR01 0 - 0.5 06/18/02
PAHs																	
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	0.0016 B	0.0093	0.0010 B	0.0028 B	0.0063	0.0062	0.0029 B	0.0052	<0.0020	0.023	<0.0020	<0.0022	NA
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.0017	0.0030 B	<0.0021	<0.0017	0.0032 B	0.0037 B	0.036	0.0019 B	<0.0020	0.025	<0.0020	<0.0022	NA
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.0017	0.0016 J	<0.0021	<0.0017	0.0027	0.0038	<0.0017	0.0019 J	<0.0020	0.0039	<0.0020	<0.0022	NA
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.00037 J	0.021	<0.0021	<0.0017	<0.0023	0.0011 J	0.089	0.0011 J	<0.0020	0.10	<0.0020	<0.0022	NA
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.0019	0.21	0.0026	0.0037	<0.0023	<0.0022	0.58	0.0071	<0.0020	0.97	<0.0020	<0.0022	NA
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	0.0017	0.33	0.0029	0.0064	<0.0023	<0.0022	0.54	0.0060	<0.0020	1.1	<0.0020	<0.0022	NA
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.0034	0.53	0.0053	0.013	<0.0023	<0.0022	0.97	0.013	<0.0020	1.8	<0.0020	<0.0022	NA
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	0.0017	0.23	0.0023	0.0082	<0.0023	<0.0022	0.56	0.0038	<0.0020	0.96	<0.0020	<0.0022	NA
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	0.0010 J	0.15	0.0016 J	0.0036	<0.0023	<0.0022	0.26	0.0033	<0.0020	0.53	<0.0020	<0.0022	NA
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	0.0018	0.21	0.0024	0.0053	<0.0023	<0.0022	0.59	0.0074	<0.0020	0.99	<0.0020	<0.0022	NA
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.0017	0.062 J	<0.0021	0.0026	<0.0023	<0.0022	0.13	0.0013 J	<0.0020	0.22	<0.0020	<0.0022	NA
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	0.0031	0.23	0.0037	0.0069	0.00096 J	<0.0022	0.97	0.0096	<0.0020	1.6	<0.0020	<0.0022	NA
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.0017	0.0046	<0.0021	0.00094 J	0.0020 J	0.0024	0.028	0.0014 J	<0.0020	0.027	<0.0020	<0.0022	NA
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.0018	0.28	0.0027	0.0094	<0.0023	<0.0022	0.60	0.0047	<0.0020	1.1	<0.0020	<0.0022	NA
Naphthalene	3.9 {nc}	20 {nc}	- -	mg/kg	0.00087 B	0.0089	0.0013 B	0.0016 B	0.0079 B	0.0068 B	0.0027 B	0.0069 B	<0.0020	0.018	<0.0020	<0.0022	NA
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.0020	0.099	<0.0021	0.0045	0.0016 J	0.0020 J	0.62	0.0039	<0.0020	0.69	<0.0020	<0.0022	NA
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	0.0028	0.26 J	0.0043 J	0.0070	0.0012 J	<0.0022 J	1.1	0.010 J	<0.0020 J	1.6	<0.0020 J	<0.0022 J	NA
PCBs																	
Aroclor-1016	0.39 {nc}	21 {ca**}	- -	mg/kg	<0.030	<0.030	<0.040	<0.030	<0.040	<0.040	<0.030	<0.040	<0.030	<0.030	<0.030	<0.040	<0.030
Aroclor-1221	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.060	<0.070	<0.080	<0.060	<0.090	<0.080	<0.060	<0.080	<0.070	<0.060	<0.070	<0.080	<0.070
Aroclor-1232	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.030	<0.030	<0.040	<0.030	<0.040	<0.040	<0.030	<0.040	<0.030	<0.030	<0.030	<0.040	<0.030
Aroclor-1242	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.030	<0.030	<0.040	<0.030	<0.040	<0.040	<0.030	<0.040	<0.030	<0.030	<0.030	<0.040	<0.030
Aroclor-1248	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.030	<0.030	<0.040	<0.030	<0.040	<0.040	<0.030	<0.040	<0.030	<0.030	<0.030	<0.040	<0.030
Aroclor-1254	0.22 {ca**}	0.74 {ca*}	- -	mg/kg	<0.030	0.87	<0.040	<0.030	<0.040	<0.040	<0.030	<0.040	<0.030	<0.030	<0.030	<0.040	<0.030
Aroclor-1260	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.030	<0.030	<0.040	<0.030	<0.040	<0.040	<0.030	<0.040	<0.030	<0.030	<0.030	<0.040	<0.030
Volatile Organics																	
1,1,1-Trichloroethane	680 {sat}	680 {sat}	- -	mg/kg	<0.0045	<0.0053	<0.0063	<0.0055	<0.0069	<0.0064	<0.0051	<0.0063	<0.0053	<0.0046	<0.0053	<0.0072	NA
1,1,2,2-Tetrachloroethane	0.59 {ca**}	2.9 {ca**}	- -	mg/kg	<0.0045	<0.0053	<0.0063	<0.0055	<0.0069	<0.0064	<0.0051	<0.0063	<0.0053	<0.0046	<0.0053	<0.0072	NA
1,1,2-Trichloroethane	1.1 {ca}	5.5 {ca}	- -	mg/kg	<0.0045	<0.0053	<0.0063	<0.0055	<0.0069	<0.0064	<0.0051	<0.0063	<0.0053	<0.0046	<0.0053	<0.0072	NA
1,1-Dichloroethane	3.4 {ca}	17 {ca}	- -	mg/kg	<0.0045	<0.0053	<0.0063	<0.0055	<0.0069	<0.0064	<0.0051	<0.0063	<0.0053	<0.0046	<0.0053	<0.0072	NA
1,1-Dichloroethene	25 {nc}	110 {nc}	- -	mg/kg	<0.0045	<0.0053	<0.0063	<0.0055	<0.0069	<0.0064	<0.0051	<0.0063	<0.0053	<0.0046	<0.0053	<0.0072	NA
1,2-Dichloroethane	0.45 {ca}	2.2 {ca}	- -	mg/kg	<0.0045	<0.0053	<0.0063	<0.0055	<0.0069	<0.0064	<0.0051	<0.0063	<0.0053	<0.0046	<0.0053	<0.0072	NA
1,2-Dichloropropane	0.93 {ca*}	4.7 {ca*}	- -	mg/kg	<0.0045	<0.0053	<0.0063	<0.0055	<0.0069	<0.0064	<0.0051	<0.0063	<0.0053	<0.0046	<0.0053	<0.0072	NA
2-Butanone	2,800 {nc}	19,000 {nc}	- -	mg/kg	<0.0045	<0.0053	<0.0063	<0.0055	<0.0069	<0.0064	<0.0051	<0.0063	<0.0053	<0.0046	<0.0053	<0.0072	NA
2-Hexanone	- -	- -	- -	mg/kg	<0.0045	<0.0053	<0.0063	<0.0055	<0.0069	<0.0064	<0.0051	<0.0063	<0.0053	<0.0046	<0.0053	<0.0072	NA
4-Methyl-2-pentanone	530 {nc}	5,200 {sat}	- -	mg/kg	<0.0045	<0.0053	<0.0063	<0.0055	<0.0069	<0.0064	<0.0051	<0.0063	<0.0053	<0.0046	<0.0053	<0.0072	NA
Acetone	6,100 {nc}	61,000 {nc}	- -	mg/kg	0.043 B	<0.0053	<0.0063	<0.0055	<0.0069	<0.0064	<0.0051	<0.0063	<0.0053	<0.0046	<0.0053	<0.0072	NA
Benzene	1.1 {ca*}	5.6 {ca*}	- -	mg/kg	<0.0045	<0.0053	<0.0063	<0.0055	<0.0069	<0.0064	<0.0051	<0.0063	<0.0053	<0.0046	<0.0053	<0.0072	NA
Bromodichloromethane	10 {ca}	46 {ca}	- -	mg/kg	<0.0045	<0.0053	<0.0063	<0.0055	<0.0069	<0.0064	<0.0051	<0.0063	<0.0053	<0.0046	<0.0053	<0.0072	NA
Bromoform	61 {ca*}	220 {ca*}	- -	mg/kg	<0.0045	<0.0053 L	<0.0063 L	<0.0055	<0.0069 L	<0.0064 L	<0.0051	<0.0063 L	<0.0053 L	<0.0046	<0.0053 L	<0.0072 L	NA
Bromomethane	0.79 {nc}	3.5 {nc}	- -	mg/kg	<0.0045	<0.0053	<0.0063	<0.0055	<0.0069	<0.0064	<0.0051	<0.0063	<0.0053	<0.0046	<0.0053	<0.0072	NA
Carbon Disulfide	67 {nc}	300 {nc}	- -	mg/kg	<0.0045	<0.0053	<0.0063	<0.0055	<0.0069	0.00046 B	<0.0051	<0.0063	<0.0053	<0.0046	0.00039 B	<0.0072	NA
Carbon Tetrachloride	0.25 {ca}	1.3 {ca}	- -	mg/kg	<0.0045	<0.0053	<0.0063	<0.0055	<0.0069	<0.0064	<0.0051	<0.0063	<0.0053	<0.0046	<0.0053	<0.0072	NA
Chlorobenzene	31 {nc}	860 {sat}	- -	mg/kg	<0.0045	<0.0053	<0.0063	<0.0055	<0.0069	<0.0064	<0.0051	<0.0063	<0.0053	<0.0046	<0.0053	<0.0072	NA
Chloroethane	2,200 {sat}	2,200 {sat}	- -	mg/kg	<0.0045	<0.0053	<0.0063	<0.0055	<0.0069	<0.0064	<0.0051	<0.0063	<0.0053	<0.0046	<0.0053	<0.0072	NA
Chloroform	0.3 {ca}	1.5 {ca}	- -	mg/kg	<0.0045	<0.0053	<0.0063	<0.0055	<0.0069	<0.0064	<0.0051	<0.0063	<0.0053	<0.0046	<0.0053	<0.0072	NA
Chloromethane	1.7 {ca*}	8.4 {ca*}	- -	mg/kg	<0.0045	<0.0053	<0.0063	<0.0055	<0.0069	<0.0064	<0.0051	<0.0063	<0.0053	<0.0046	<0.0053	<0.0072	NA
cis-1,2-Dichloroethene	78 {nc}	1,300 {sat}	- -	mg/kg	<0.0045	<0.0053	<0.0063	<0.0055	<0.0069	<0.0064	<0.0051	<0.0063	<0.0053	<0.0046	<0.0053	<0.0072	NA
cis-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.0045	<0.0053	<0.0063	<0.0055	<0.0069	<0.0064	<0.0051	<0.0063	<0.0053	<0.0046	<0.0053	<0.0072	NA
Dibromochloromethane	5.8 {ca}	21 {ca}	- -	mg/kg	<0.0045	<0.0053	<0.0063	<0.0055	<0.0069	<0.0064	<0.0051	<0.0063	<0.0053	<0.0046	<0.0053	<0.0072	NA
Ethylbenzene	5.7 {ca}	29 {ca}	- -	mg/kg	<0.0045	<0.0053	<0.0063	<0.0055	<0.0069	<0.0064	<0.0051	<0.0063	<0.0053	<0.0046	<0.0053	<0.0072	NA
m,p-Xylene	60 {nc}	260 {nc}	- -	mg/kg	<0.0090	<0.011	<0.013	<0.011	<0.014	<0.013	<0.010	<0.013	<0.011	<0.0091	<0.011	<0.014	NA
Methylene Chloride	11 {ca}	54 {ca}	- -	mg/kg	<0.0045	<0.0053	<0.0063	<0.0055	<0.0069	<0.0064	<0.0051	<0.0063	<0.0053	<0.0046	<0.0053	<0.0072	NA
o-Xylene	300 {sat}	300 {sat}	- -	mg/kg	<0.0045	<0.0053	<0.0063	<0.0055	<0.0069	<0.0064	<0.0051	<0.0063	<0.0053	<0.0046	<0.0053	<0.0072	NA
Styrene	1,000 {sat}	1,000 {sat}	- -	mg/kg	<0.0045	<0.0053	<0.0063	<0.0055	<0.0069	<0.0064	<0.0051	<0.0063	<0.0053	<0.0046	<0.0053	<0.0072	NA
Tetrachloroethene	0.57 {ca}	2.7 {ca}	- -	mg/kg	<0.0045	<0.0053	<0.0063	<0.0055	<0.0069	<0.0064	<0.0051	<0.0063	<0.0053	<0.0046	<0.0053	<0.0072	NA
Toluene	500 {nc}	4600 {nc}	- -	mg/kg	0.00032 B	<0.0053	<0.0063	0.0011 B	<0.0069	<0.0064	<0.0051	<0.0063	<0.0053	<0.0046	<0.0053	<0.0072	NA
trans-1,2-Dichloroethene	11 {nc}	50 {nc}	- -	mg/kg	<0.0045	<0.0053	<0.0063	<0.0055	<0.0069	<0.0064	<0.0051	<0.0063	<0.0053	<0.0046	<0.0053	<0.0072	NA
trans-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.0045	<0.0053	<0.0063	<0.0055	<0.0069	<0.0064	<0.0051	<0.0063	<0.0053	<0.0046	<0.0053	<0.0072	NA
Trichloroethene	2.8 {ca}	14 {ca}	- -	mg/kg	<0.0045	<0.0053	<0.0063	<0.0055	<0.0069	<0.0064	<0.0051	<0.0063	<0.0053	<0.0046	<0.0053	<0.0072	NA
Vinyl Chloride	0.06 {ca}	1.7 {ca}	- -	mg/kg	<0.0045	<0.0053	<0.0063	<0.0055	<0.0069	<0.0064	<0.0051	<0.0063	<0.0053	<0.0046	<0.0053	<0.0072	NA
Xylenes (total)	60 {nc}	260 {nc}	- -	mg/kg	<0.0090	<0.011	<0.013	<0.011	<0.014	<0.013	<0.010	<0.013	<0.011	<0.0091	<0.011	<0.014	NA
Semivolatile Organics																	
1,2,4-Trichlorobenzene	8.7 {ca**}	40 {ca**}	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
1,2-Dichlorobenzene	220 {sat}	220 {sat}	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
1,4-Dichlorobenzene	2.6 {ca}	13 {ca}	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
2,4,5-Trichlorophenol	610 {nc}	6,200 {nc}	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
2,4,6-Trichlorophenol	44 {ca**}	160 {ca**}	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
2,4-Dichlorophenol	18 {nc}	180 {nc}	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
2,4-Dimethylphenol	120 {nc}	1,200 {nc}	- -	mg/kg	<0.17 L	<0.20	<0.21	<0.17 L	<0.23	<0.22	<0.17 L	<0.22	<0.20	<0.17 L	<0.20	<0.22	NA
2,4-Dinitrophenol	12 {nc}	120 {nc}	- -	mg/kg	<0.84 L	<0.97	<1.0	<0.84 L	<1.1	<1.1	<0.85 L	<1.1	<0.98	<0.85 L	<0.98	<1.1	NA
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
2-Chloronaphthalene	210 {sat}	210 {sat}	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
2-Chlorophenol	39 {nc}	510 {nc}	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	<0.17	0.011 J	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	0.016 J	<0.20	<0.22	NA
2-Methylphenol	310 {nc}	3,100 {nc}	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
2-Nitroaniline	- -	- -	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
2-Nitrophenol	- -	- -	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA

Notes found at end of table.

Table 9-10. Soil Analytical Results, Western Burning Ground, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	WBGSB22 0 - 0.5 06/18/02	WBGSB22 2 - 4 06/19/02	WBGSB22 6 - 8 06/19/02	WBGSB23 0 - 0.5 06/18/02	WBGSB23 2 - 4 06/19/02	WBGSB23 6 - 8 06/19/02	WBGSB24 0 - 0.5 06/18/02	WBGSB24 2 - 4 06/19/02	WBGSB24 6 - 8 06/19/02	WBGSB25 0 - 0.5 06/18/02	WBGSB25 2 - 4 06/19/02	WBGSB25 6 - 8 06/19/02	WBGTR01 0 - 0.5 06/18/02
Semivolatile Organics																	
3,3'-Dichlorobenzidine	1.1 {ca**}	3.8 {ca**}	- -	mg/kg	<0.17 J	<0.20	<0.21	<0.17 J	<0.23	<0.22	<0.17 J	<0.22	<0.20	<0.17 J	<0.20	<0.22	NA
3-Nitroaniline	- -	- -	- -	mg/kg	<0.17	<0.20 J	<0.21 J	<0.17	<0.23 J	<0.22 J	<0.17	<0.22 J	<0.20 J	<0.17	<0.20 J	<0.22 J	NA
4,6-Dinitro-2-methylphenol	- -	- -	- -	mg/kg	<0.84 L	<0.97	<1.0	<0.84 L	<1.1	<1.1	<0.85 L	<1.1	<0.98	<0.85 L	<0.98	<1.1	NA
4-Bromophenyl-phenylether	- -	- -	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
4-Chloro-3-Methylphenol	- -	- -	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
4-Chloroaniline	24 {nc}	250 {nc}	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
4-Chlorophenyl-phenylether	- -	- -	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
4-Methylphenol	31 {nc}	310 {nc}	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
4-Nitroaniline	- -	- -	- -	mg/kg	<0.17	<0.20 J	<0.21 J	<0.17	<0.23 J	<0.22 J	<0.17	<0.22 J	<0.20 J	<0.17	<0.20 J	<0.22 J	NA
4-Nitrophenol	- -	- -	- -	mg/kg	<0.84	<0.97	<1.0	<0.84	<1.1	<1.1	<0.85	<1.1	<0.98	<0.85	<0.98	<1.1	NA
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	0.023 J	<0.22	<0.20	0.015 J	<0.20	<0.22	NA
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	<0.17	0.031 J	<0.21	<0.17	<0.23	<0.22	0.061 J	<0.22	<0.20	0.051 J	<0.20	<0.22	NA
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.17	0.28	<0.21	0.0085 J	<0.23	<0.22	0.38	<0.22	<0.20	0.32	<0.20	<0.22	NA
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.17	0.55	<0.21	<0.17	<0.23	<0.22	0.37	<0.22	<0.20	0.40	<0.20	<0.22	NA
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.17	0.76	<0.21	<0.17	<0.23	<0.22	0.73	<0.22	<0.20	0.65	<0.20	<0.22	NA
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	<0.17	0.62	<0.21	<0.17	<0.23	<0.22	0.31	<0.22	<0.20	0.28	<0.20	<0.22	NA
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	<0.17	0.23	<0.21	<0.17	<0.23	<0.22	0.19	<0.22	<0.20	0.15 J	<0.20	<0.22	NA
Benzoic Acid	240,000 {max}	2,500,000 {max}	- -	mg/kg	<0.84	<0.97	<1.0	<0.84	<1.1	<1.1	<0.85	<1.1	<0.98	<0.85	<0.98	<1.1	NA
Benzyl Alcohol	3,100 {nc}	310,000 {max}	- -	mg/kg	<0.17	<0.20 J	<0.21 J	<0.17	<0.23 J	<0.22 J	<0.17	<0.22 J	<0.20 J	<0.17	<0.20 J	<0.22 J	NA
bis(2-Chloroethoxy)methane	18 {nc}	180 {nc}	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
bis(2-Chloroethyl)ether	0.19 {ca**}	0.9 {ca**}	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
bis(2-Chloroisopropyl)ether	- -	- -	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
bis(2-Ethylhexyl)phthalate	35 {ca*}	120 {ca*}	- -	mg/kg	0.16 B	0.83 B	<0.21	0.21 B	<0.23	<0.22	0.16 B	<0.22	<0.20	0.67 B	<0.20	<0.22	NA
Butylbenzylphthalate	260 {ca*}	910 {ca*}	- -	mg/kg	<0.17	0.16 B	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
Carbazole	24 {ca**}	86 {ca**}	- -	mg/kg	<0.17	0.023 J	<0.21 J	<0.17	<0.23 J	<0.22 J	0.10 J	<0.22 J	<0.20 J	0.038 J	<0.20 J	<0.22 J	NA
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	<0.17	0.36	<0.21	<0.17	<0.23	<0.22	0.47	<0.22	<0.20	0.32	<0.20	<0.22	NA
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.17	0.17 J	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	0.076 J	<0.20	<0.22	NA
Dibenzofuran	- -	- -	- -	mg/kg	<0.17	0.010 J	<0.21	<0.17	<0.23	<0.22	0.011 J	<0.22	<0.20	0.014 J	<0.20	<0.22	NA
Diethylphthalate	4,900 {nc}	490,000 {max}	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
Dimethylphthalate	- -	- -	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
Di-n-Butylphthalate	610 {nc}	6,200 {nc}	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
Di-n-Octylphthalate	- -	- -	- -	mg/kg	<0.17	<0.20	<0.21	0.016 J	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.17	0.39	<0.21	0.0089 J	<0.23	<0.22	0.89	<0.22	<0.20	0.44	<0.20	<0.22	NA
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	0.016 J	<0.22	<0.20	0.014 J	<0.20	<0.22	NA
Hexachlorobenzene	0.3 {ca}	1.1 {ca}	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
Hexachlorobutadiene	6.2 {ca**}	22 {ca*}	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
Hexachlorocyclopentadiene	37 {nc}	370 {nc}	- -	mg/kg	<0.17 L	<0.20	<0.21	<0.17 L	<0.23	<0.22	<0.17 L	<0.22	<0.20	<0.17 L	<0.20	<0.22	NA
Hexachloroethane	35 {ca**}	120 {ca**}	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	<0.17	0.70 J	<0.21	<0.17	<0.23	<0.22	0.32	<0.22	<0.20	0.32	<0.20	<0.22	NA
Isophorone	510 {ca*}	1,800 {ca*}	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
Naphthalene	3.9 {ca}	20 {ca}	- -	mg/kg	<0.17	0.015 J	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
N-Nitroso-di-n-propylamine	0.069 {ca**}	0.25 {ca**}	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
N-Nitrosodiphenylamine	99 {ca**}	350 {ca**}	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
Pentachlorophenol	3 {ca}	9 {ca}	- -	mg/kg	<0.84	<0.97	<1.0	<0.84	<1.1	<1.1	<0.85	<1.1	<0.98	<0.85	<0.98	<1.1	NA
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	<0.17	0.17 J	<0.21	<0.17	<0.23	<0.22	0.43	<0.22	<0.20	0.25	<0.20	<0.22	NA
Phenol	1,800 {nc}	180,000 {max}	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	<0.17	0.39	<0.21	0.0068 J	<0.23	<0.22	0.67	<0.22	<0.20	0.38 J	<0.20	<0.22	NA
Pyridine	7.8 {nc}	100 {nc}	- -	mg/kg	<0.17	<0.20	<0.21	<0.17	<0.23	<0.22	<0.17	<0.22	<0.20	<0.17	<0.20	<0.22	NA
Inorganics																	
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	18,200	20,900	33,200	23,900	24,100	**41,600**	22,100	19,300	9,600	17,500	15,300	31,600	NA
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	<0.500 L	4.26 L	0.280 B	<0.500 L	0.270 B	0.390 B	0.290 B	<0.630 L	0.530 L	0.850 L	<0.590 L	<0.650 L	NA
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	7.53 L	**29.0 L**	7.54 L	6.55 L	8.64 L	9.92 L	7.73 L	6.73 L	6.41 L	6.38 L	5.03 L	10.0 L	NA
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	26.9	**295**	147	37.8	34.1	136	54.3	42.9	29.8	99.0	84.0	62.2	NA
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	0.440 B	0.560 B	**2.35 J**	0.750 L	**1.09 J**	**1.55 J**	0.640 L	0.780 J	0.730 J	0.600 L	<0.590	**3.25 J**	NA
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	<0.100	**2.95**	<0.120	<0.100	<0.130	<0.120	0.0900 J	<0.120	<0.110	0.300	<0.110	<0.130	NA
Calcium	- -	- -	- -	mg/kg	947	31,500	4,310	1,020	1,410	3,610	2,130	1,060	538	4,900	885	1,880	NA
Chromium	280 {ca}	1,460 {ca}	65.3	mg/kg	30.3	**256 L**	56.6 L	33.3	41.6 L	61.5 L	41.3	25.9 L	21.9 L	**69.6**	20.8 L	62.3 L	NA
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	8.86 J	10.8	17.7	9.60 J	13.0	13.1	6.59 J	14.2	19.8	11.7 J	14.7	8.28	NA
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	16.4	**174**	32.5	19.3	23.9	22.2	32.1	31.7	4.37	52.8	9.52	23.4	NA
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	26,300	**61,800 J**	36,100 J	28,700	36,900 J	41,000 J	31,300	31,700 J	16,600 J	24,000	20,700 J	27,800 J	NA
Lead	400 {++}	800 {++}	26.8	mg/kg	25.3 J	**965**	**86.5**	**26.9 J**	21.5	18.1	**79.1**	23.3	**33.1**	**259**	19.3	**30.5**	NA
Magnesium	- -	- -	- -	mg/kg	1,700	18,300	33,000	1,540	2,150	17,600	1,500	1,150	1,300	4,300	1,050	13,400	NA
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	122	633	374	72.2	235	275	122	134	344	323	309	71.1	NA
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	0.0600	0.0500 J	0.0800	0.0400 J	0.0700	0.0300 J	0.0600	0.0600	<0.0500	0.0400 J	0.0700	0.100	NA
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	15.3	35.4	35.6	17.4	21.0	36.9	18.4	17.5	5.94	18.9	10.2	33.3	NA
Potassium	- -	- -	- -	mg/kg	759	1,790	2,050	1,260	1,150	2,300	813	1,240	592	1,070	565	2,780	NA
Selenium	39 {nc}	510 {nc}	- -	mg/kg	0.750 L	<1.17 L	<1.26 L	0.740 L	0.860 B	<1.27 L	0.590 L	<1.27 L	<1.18 L	0.500 L	<1.18 L	<1.32 L	NA
Silver	39 {nc}	510 {nc}	- -	mg/kg	<1.01	<1.17	<1.26	<1.01	<1.37	<1.27	<1.02	<1.27	<1.18	<1.01	<1.18	<1.32	NA
Sodium	- -	- -	- -	mg/kg	10.5 B	113	23.0 B	25.2 B	58.1	59.5	14.4 B	18.0 B	9.70 B	28.3	14.0 B	18.0 B	NA
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	0.200 J	0.150 J	0.410 J	0.190 J	0.410 J	0.300 J	0.190 J	0.190 J	0.120 J	0.170 J	0.170 J	0.220 J	NA
Vanadium	55{nc}	720 {nc}	108	mg/kg	48.6	48.1 L	57.2 L	54.9	68.5 L	73.9 L	57.5	41.0 L	35.6 L	42.9	33.6 L	56.5 L	NA
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	36.3	**1,510 J**	50.0 J	34.5	37.6 J	42.6 J	130	17.5 J	11.8 J	**449**	24.0 J	35.1 J	NA
Miscellaneous																	
pH	- -	- -	- -	pH Units	NA	NA	NA	5.31 J	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Organic Carbon	- -	- -	- -	mg/kg	NA	NA	NA	25,600	NA	NA	NA	NA	NA	NA	NA	NA	NA

mg/kg	Milligrams per kilogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 9-11. Sediment Analytical Results, Western Burning Ground, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values- Residential [a]	Adjusted Soil Screening Values- Industrial [a]	Facility-Wide Background Values [b]	Units	WBGSW/SD07 0 - 0.5 06/26/02	WBGSW/SD08 0 - 0.5 06/25/02	WBGSW/SD09 0 - 0.5 06/25/02	WBGSW/SD10 0 - 0.5 06/26/02	WBGSD11 0 - 0.5 06/27/02	WBGSD12 0 - 0.5 06/26/02	WBGSW/SD13 0 - 0.5 06/26/02	WBGSW/SD14 0 - 0.5 06/25/02	WBGSW/SD15 0 - 0.5 06/27/02
Dioxin/Furan													
1,2,3,4,6,7,8-HpCDD	0.00039 {ca**}	0.0016 {ca**}	- -	mg/kg	0.00001793	0.00000211 J	0.00002099	0.00002501	0.00007199	0.00003719	NA	NA	NA
1,2,3,4,6,7,8-HpCDF	0.00032 {ca**}	0.0011 {ca**}	- -	mg/kg	0.00000094	<0.00000017	0.00000285	0.0000053	0.0000063	0.00000177	NA	NA	NA
1,2,3,4,7,8,9-HpCDF	0.00032 {ca**}	0.0011 {ca**}	- -	mg/kg	<0.00000025	<0.00000023	0.00000026	0.00000054 J	<0.00000033	<0.00000024	NA	NA	NA
1,2,3,4,7,8-HxCDD	0.000039 {ca**}	0.00016 {ca**}	- -	mg/kg	<0.00000034	<0.00000032	<0.0000003	<0.00000026	0.00000103	0.00000071	NA	NA	NA
1,2,3,4,7,8-HxCDF	0.000032 {ca**}	0.00011 {ca**}	- -	mg/kg	<0.0000002	<0.00000014	0.00000092 J	0.00000168	<0.0000002	<0.00000019	NA	NA	NA
1,2,3,6,7,8-HxCDD	0.000039 {ca**}	0.00016 {ca**}	- -	mg/kg	<0.00000027	<0.00000026	<0.00000024	0.00000148	0.00000204 J	0.00000099 J	NA	NA	NA
1,2,3,6,7,8-HxCDF	0.000032 {ca**}	0.00011 {ca**}	- -	mg/kg	<0.00000019	<0.00000014	<0.00000014	0.00000173 J	<0.00000019	<0.00000019	NA	NA	NA
1,2,3,7,8,9-HxCDD	0.000039 {ca**}	0.00016 {ca**}	- -	mg/kg	<0.00000026	<0.00000026	0.00000093	0.00000155	0.00000239	0.00000144 J	NA	NA	NA
1,2,3,7,8,9-HxCDF	0.000032 {ca**}	0.00011 {ca**}	- -	mg/kg	<0.00000023	<0.00000019	<0.00000019	<0.00000025	<0.00000023	<0.00000022	NA	NA	NA
1,2,3,7,8-PeCDD	0.0000039 {ca**}	0.000016 {ca**}	- -	mg/kg	<0.00000037	<0.00000022	<0.00000025	<0.00000029	<0.00000024	<0.00000023	NA	NA	NA
1,2,3,7,8-PeCDF	0.00011 {ca**}	0.00038 {ca**}	- -	mg/kg	<0.00000021	<0.00000012	<0.00000012	<0.0000002	<0.0000002	<0.00000019	NA	NA	NA
2,3,4,6,7,8-HxCDF	0.000032 {ca**}	0.00011 {ca**}	- -	mg/kg	<0.00000023	<0.00000018	<0.00000018	0.00000094 J	<0.00000023	<0.00000022	NA	NA	NA
2,3,4,7,8-PeCDF	0.000011 {ca**}	0.000038 {ca**}	- -	mg/kg	<0.00000022	<0.00000014	<0.00000013	0.00000141	<0.00000021	<0.00000019	NA	NA	NA
2,3,7,8-TCDD	0.0000045 {ca*}	0.000018 {ca*}	- -	mg/kg	<0.00000032	<0.00000024	<0.00000022	<0.00000017	<0.00000028	<0.00000027	NA	NA	NA
2,3,7,8-TCDF	0.000032 {ca**}	0.00011 {ca**}	- -	mg/kg	<0.00000035	<0.00000014	<0.00000015	0.00000283 J	<0.0000003	<0.00000028	NA	NA	NA
OCDD	0.013 {ca**}	0.053 {ca**}	- -	mg/kg	0.0007224	0.0001412	0.001106	0.001119	0.003422	0.001753	NA	NA	NA
OCDF	0.011 {ca**}	0.038 {ca**}	- -	mg/kg	0.00000244 J	<0.0000003 J	0.00000662 J	0.00001139	0.00001515	0.00000398	NA	NA	NA
Total HpCDDs	- -	- -	- -	mg/kg	0.00004226	0.00000315	0.00004811	0.00005053	0.0001538	0.00008485	NA	NA	NA
Total HpCDFs	- -	- -	- -	mg/kg	0.00000265	<0.00000017	0.00000781	0.00001135	0.00001837	0.00000177	NA	NA	NA
Total HxCDDs	- -	- -	- -	mg/kg	0.00000236	<0.00000026	0.00000397	0.00001213	0.00001657	0.00000876	NA	NA	NA
Total HxCDFs	- -	- -	- -	mg/kg	0.00000187	<0.00000014	0.00000258	0.00000654	0.00000514	0.00000154	NA	NA	NA
Total PeCDDs	- -	- -	- -	mg/kg	<0.00000037	<0.00000022	<0.00000025	<0.00000029	0.00000055	<0.00000023	NA	NA	NA
Total PeCDFs	- -	- -	- -	mg/kg	<0.00000021	<0.00000012	<0.00000012	0.00000779	0.00000965	0.00000088	NA	NA	NA
Total TCDDs	- -	- -	- -	mg/kg	<0.00000032	<0.00000024	<0.00000022	0.00000233	<0.00000028	<0.00000027	NA	NA	NA
Total TCDFs	- -	- -	- -	mg/kg	<0.00000035	<0.00000014	<0.00000015	0.00003442	<0.0000003	<0.00000028	NA	NA	NA
Explosives													
1,3,5-Trinitrobenzene	220 {nc}	2,700 {nc}	- -	mg/kg	NA	<0.1	<0.2	<0.2	<0.2	0.41	NA	NA	NA
1,3-Dinitrobenzene	0.61 {nc}	6.2 {nc}	- -	mg/kg	NA	<0.1	<0.2	<0.2	<0.2	<0.2	NA	NA	NA
2,4,6-Trinitrotoluene	3.6 {ca**}	42 {ca**}	- -	mg/kg	NA	<0.2	<0.4	<0.4	<0.4	<0.4	NA	NA	NA
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	NA	<0.2	<0.4	<0.4	<0.4	<0.4	NA	NA	NA
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	NA	<0.2	<0.4	<0.4	<0.4	<0.4	NA	NA	NA
2-Amino-4,6-Dinitrotoluene	15 {nc}	190 {nc}	- -	mg/kg	NA	<0.2	<0.4	<0.4	<0.4	<0.4	NA	NA	NA
4-Amino-2,6-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	NA	<0.2	<0.4	<0.4	<0.4	<0.4	NA	NA	NA
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	NA	<0.2	<0.4	<0.4	<0.4	<0.4	NA	NA	NA
HMX	310 {nc}	3,100 {nc}	- -	mg/kg	NA	<0.2	<0.4	<0.4	<0.4	<0.4	NA	NA	NA
m-Nitrotoluene	- -	- -	- -	mg/kg	NA	<0.4	<0.8	<0.8	<0.8	<0.8	NA	NA	NA
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	NA	<0.2	<0.4	<0.4	<0.4	<0.4	NA	NA	NA
Nitroglycerine	0.61 {nc}	6.2 {nc}	- -	mg/kg	NA	<0.46	<1.03	<1.07	<1.41	0.96 J	NA	NA	NA
o-Nitrotoluene	78 {nc}	1,300 {sat}	- -	mg/kg	NA	<0.4	<0.8	<0.8	<0.8	<0.8	NA	NA	NA
Pentaerythritol Tetranitrate	- -	- -	- -	mg/kg	NA	<0.46	<1.03	<1.07	<1.41	<1.28	NA	NA	NA
p-Nitrotoluene	30 {ca**}	110 {ca*}	- -	mg/kg	NA	<0.4	<0.8	<0.8	<0.8	<0.8	NA	NA	NA
RDX	4.4 {ca*}	16 {ca}	- -	mg/kg	NA	<0.2	<0.4	<0.4	<0.4	<0.4	NA	NA	NA
Tetryl	24 {nc}	250 {nc}	- -	mg/kg	NA	<0.2	<0.4	<0.4	<0.4	<0.4	NA	NA	NA
Herbicides													
2,4,5-T	61 {nc}	620 {nc}	- -	mg/kg	NA	<0.0153	NA	<0.0178	NA	NA	<0.0379	0.00757 J	<0.214
2,4,5-TP	49 {nc}	490 {nc}	- -	mg/kg	NA	<0.0153	NA	<0.0178	NA	NA	<0.0379	<0.024	<0.214
2,4-D	69 {nc}	770 {nc}	- -	mg/kg	NA	0.385	NA	<0.0356	NA	NA	<0.0758	6.83	<0.427
2,4-DB	49 {nc}	490 {nc}	- -	mg/kg	NA	<0.153 L	NA	<0.178 L	NA	NA	<0.379 L	<0.24 L	<2.14 L
Dalapon	180 {nc}	1,800 {nc}	- -	mg/kg	NA	<0.153	NA	<0.178	NA	NA	<0.379	<0.24	<2.14
Dicamba	180 {nc}	1,800 {nc}	- -	mg/kg	NA	0.0322 B	NA	<0.0356	NA	NA	<0.0758	<0.0481	<0.427
Dichlorprop	- -	- -	- -	mg/kg	NA	<0.0307	NA	<0.0356	NA	NA	<0.0758	<0.0481	<0.427
Dinoseb	6.1 {nc}	62 {nc}	- -	mg/kg	NA	<0.0307 L	NA	<0.0356 L	NA	NA	<0.0758 L	<0.0481 L	<0.427 L
MCPA	3.1 {nc}	31 {nc}	- -	mg/kg	NA	<15.3	NA	<17.8	NA	NA	<37.9	<24	<214
MCPP	6.1 {nc}	62 {nc}	- -	mg/kg	NA	3.56 B	NA	<17.8	NA	NA	<37.9	<24	<214
Organochlorine Pesticides													
4,4'-DDD	2 {ca**}	7.2 {ca**}	- -	mg/kg	NA	0.00033 J	NA	0.00099 J	NA	NA	0.00152 J	0.00063 J	<0.00143
4,4'-DDE	1.4 {ca**}	5.1 {ca**}	- -	mg/kg	NA	0.00308	NA	0.0027 B	NA	NA	0.00203 B	<0.0016	0.00152 B
4,4'-DDT	1.7 {ca*}	7 {ca*}	- -	mg/kg	NA	<0.00102	NA	0.0119	NA	NA	<0.00253	0.00356	0.00142 B
Aldrin	0.029 {ca*}	0.1 {ca}	- -	mg/kg	NA	<0.00102	NA	<0.00119	NA	NA	<0.00253	<0.0016	<0.00143
Alpha-BHC	0.077 {ca**}	0.27 {ca**}	- -	mg/kg	NA	<0.00102	NA	<0.00119	NA	NA	<0.00253	<0.0016	<0.00143
Alpha-Chlordane	1.6 {ca**}	6.5 {ca**}	- -	mg/kg	NA	0.00021 J	NA	<0.00119	NA	NA	<0.00253	<0.0016	0.00071 J
Beta-BHC	0.27 {ca**}	0.96 {ca**}	- -	mg/kg	NA	<0.00102	NA	<0.00119	NA	NA	<0.00253	<0.0016	<0.00143
Delta-BHC	0.52 {ca**}	2.1 {ca**}	- -	mg/kg	NA	0.00095 B	NA	<0.00119	NA	NA	<0.00253	<0.0016	<0.00143
Dieldrin	0.03 {ca}	0.11 {ca}	- -	mg/kg	NA	<0.00102	NA	0.00347	NA	NA	<0.00253	<0.0016	<0.00143
Endosulfan I	- -	- -	- -	mg/kg	NA	<0.00102	NA	<0.00119	NA	NA	<0.00253	<0.0016	<0.00143
Endosulfan II	37 {nc}	370 {nc}	- -	mg/kg	NA	<0.00102	NA	0.00161	NA	NA	<0.00253	0.00094 J	<0.00143
Endosulfan Sulfate	- -	- -	- -	mg/kg	NA	<0.00102	NA	<0.00119	NA	NA	<0.00253	<0.0016	<0.00143
Endrin	1.8 {nc}	18 {nc}	- -	mg/kg	NA	<0.00102	NA	<0.00119	NA	NA	<0.00253	<0.0016	<0.00143
Endrin Aldehyde	1.8 {nc}	18 {nc}	- -	mg/kg	NA	<0.00102	NA	0.00169	NA	NA	<0.00253	<0.0016	<0.00143
Endrin Ketone	- -	- -	- -	mg/kg	NA	<0.00102	NA	0.00224	NA	NA	<0.00253	0.00288	<0.00143
Gamma-BHC (Lindane)	0.52 {ca*}	2.1 {ca}	- -	mg/kg	NA	<0.00102	NA	<0.00119	NA	NA	<0.00253	<0.0016	<0.00143
Gamma-Chlordane	1.6 {ca**}	6.5 {ca**}	- -	mg/kg	NA	<0.00102	NA	<0.00119	NA	NA	<0.00253	<0.0016	0.00088 J
Heptachlor	0.11 {ca}	0.38 {ca}	- -	mg/kg	NA	<0.00102	NA	<0.00119	NA	NA	<0.00253	<0.0016	<0.00143
Heptachlor Epoxide	0.053 {ca*}	0.19 {ca*}	- -	mg/kg	NA	<0.00102	NA	<0.00119	NA	NA	<0.00253	<0.0016	<0.00143
Methoxychlor	31 {nc}	310 {nc}	- -	mg/kg	NA	<0.00102	NA	<0.00119	NA	NA	<0.00253	0.00637	<0.00143
Toxaphene	0.44 {ca**}	1.6 {ca**}	- -	mg/kg	NA	<0.0511	NA	<0.0593	NA	NA	<0.126	<0.08	<0.0712
PAHs													
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	0.0022 B	<0.0040	0.062	<0.0030	<0.0040	NA	NA	NA	NA
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.0043	<0.0040	0.31	<0.0030	<0.0040	NA	NA	NA	NA
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.0043	<0.0040	0.021	<0.0030	<0.0040	NA	NA	NA	NA
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.0048	<0.0040	0.83	<0.0030	<0.0040	NA	NA	NA	NA
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.0090	<0.0040	4.0	<0.0030	<0.0040	NA	NA	NA	NA
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	0.0057	<0.0040	3.7	<0.0030	<0.0040	NA	NA	NA	NA
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.0081	<0.0040	4.6	<0.0030	<0.0040	NA	NA	NA	NA
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	0.0050 J	<0.0040	2.1	<0.0030	<0.0040	NA	NA	NA	NA
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	0.0033 J	<0.0040	1.4	<0.0030	<0.0040	NA	NA	NA	NA
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	0.0077	<0.0040	4.1	<0.0030	<0.0040	NA	NA	NA	NA
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.0043	<0.0040	0.56	<0.0030	<0.0040	NA	NA	NA	NA
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	0.019	<0.0040	4.9	<0.0030	0.0026 J	NA	NA	NA	NA
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	0.0027 J	<0.0040	0.25 J	<0.0030	<0.0040	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.0038 J	<0.0040	1.6	<0.0030	<0.0040	NA	NA	NA	NA
Naphthalene	3.9 {nc}	20 {nc}	- -	mg/kg	0.0017 B	<0.0040	0.085	<0.0030	<0.0040	NA	NA	NA	NA
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.014	<0.0040	2.8	<0.0030	<0.0040	NA	NA	NA	NA
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	0.015	<0.0040	5.0	<0.0030	0.0017 J	NA	NA	NA	NA

Notes found at end of table.

Table 9-11. Sediment Analytical Results, Western Burning Ground, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	WBGSW/SD07 0 - 0.5 06/26/02	WBGSW/SD08 0 - 0.5 06/25/02	WBGSW/SD09 0 - 0.5 06/25/02	WBGSW/SD10 0 - 0.5 06/26/02	WBGSD11 0 - 0.5 06/27/02	WBGSD12 0 - 0.5 06/26/02	WBGSW/SD13 0 - 0.5 06/26/02	WBGSW/SD14 0 - 0.5 06/25/02	WBGSW/SD15 0 - 0.5 06/27/02
PCBs													
Aroclor-1016	0.39 {nc}	21 {ca**}	- -	mg/kg	<0.080	<0.050	<0.050	<0.050	<0.070	<0.070	<0.12	<0.080	<0.070
Aroclor-1221	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.16	<0.10	<0.11	<0.11	<0.15	<0.14	<0.25	<0.16	<0.14
Aroclor-1232	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.080	<0.050	<0.050	<0.050	<0.070	<0.070	<0.12	<0.080	<0.070
Aroclor-1242	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.080	<0.050	<0.050	<0.050	<0.070	<0.070	<0.12	<0.080	<0.070
Aroclor-1248	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.080	<0.050	<0.050	<0.050	<0.070	<0.070	<0.12	<0.080	<0.070
Aroclor-1254	0.22 {ca**}	0.74 {ca*}	- -	mg/kg	<0.080	<0.050	<0.050	<0.050	<0.070	<0.070	<0.12	<0.080	<0.070
Aroclor-1260	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.080	<0.050	<0.050	<0.050	<0.070	<0.070	<0.12	<0.080	<0.070
Volatile Organics													
1,1,1-Trichloroethane	680 {sat}	680 {sat}	- -	mg/kg	<0.013	<0.0077	<0.0086	<0.0089	<0.012	<0.011	<0.019	<0.012	<0.011
1,1,2,2-Tetrachloroethane	0.59 {ca**}	2.9 {ca**}	- -	mg/kg	<0.013	<0.0077	<0.0086	<0.0089	<0.012	<0.011	<0.019	<0.012	<0.011
1,1,2-Trichloroethane	1.1 {ca}	5.5 {ca}	- -	mg/kg	<0.013	<0.0077	<0.0086	<0.0089	<0.012	<0.011	<0.019	<0.012	<0.011
1,1-Dichloroethane	3.4 {ca}	17 {ca}	- -	mg/kg	<0.013	<0.0077	<0.0086	<0.0089	<0.012	<0.011	<0.019	<0.012	<0.011
1,1-Dichloroethene	25 {nc}	110 {nc}	- -	mg/kg	<0.013	<0.0077	<0.0086	<0.0089	<0.012	<0.011	<0.019	<0.012	<0.011
1,2-Dichloroethane	0.45 {ca}	2.2 {ca}	- -	mg/kg	<0.013	<0.0077	<0.0086	<0.0089	<0.012	<0.011	<0.019	<0.012	<0.011
1,2-Dichloropropane	0.93 {ca*}	4.7 {ca*}	- -	mg/kg	<0.013	<0.0077	<0.0086	<0.0089	<0.012	<0.011	<0.019	<0.012	<0.011
2-Butanone	2,800 {nc}	19,000 {nc}	- -	mg/kg	0.17	<0.0077	<0.0086	<0.0089	0.090	0.18	<0.019	<0.012	<0.011
2-Hexanone	- -	- -	- -	mg/kg	<0.013	<0.0077	<0.0086	<0.0089	<0.012	<0.011	<0.019	<0.012	<0.011
4-Methyl-2-pentanone	530 {nc}	5,200 {sat}	- -	mg/kg	<0.013	<0.0077	<0.0086	<0.0089	<0.012	<0.011	<0.019	<0.012	<0.011
Acetone	6,100 {nc}	61,000 {nc}	- -	mg/kg	0.23 B	<0.0077 J	<0.0086 J	0.048 B	0.14 B	0.20 B	0.10 B	0.037 B	0.077 B
Benzene	1.1 {ca*}	5.6 {ca*}	- -	mg/kg	<0.013	<0.0077	<0.0086	<0.0089	<0.012	<0.011	<0.019	<0.012	<0.011
Bromodichloromethane	10 {ca}	46 {ca}	- -	mg/kg	<0.013	<0.0077	<0.0086	<0.0089	<0.012	<0.011	<0.019	<0.012	<0.011
Bromoform	61 {ca*}	220 {ca*}	- -	mg/kg	<0.013	<0.0077	<0.0086	<0.0089	<0.012	<0.011	<0.019	<0.012	<0.011
Bromomethane	0.79 {nc}	3.5 {nc}	- -	mg/kg	<0.013	<0.0077	<0.0086	<0.0089	<0.012	<0.011	<0.019	<0.012	<0.011
Carbon Disulfide	67 {nc}	300 {nc}	- -	mg/kg	<0.013	<0.0077	<0.0086	0.0012 B	0.0013 B	<0.011	0.0014 B	0.0015 B	0.0013 B
Carbon Tetrachloride	0.25 {ca}	1.3 {ca}	- -	mg/kg	<0.013	<0.0077	<0.0086	<0.0089	<0.012	<0.011	<0.019	<0.012	<0.011
Chlorobenzene	31 {nc}	860 {sat}	- -	mg/kg	<0.013	<0.0077	<0.0086	<0.0089	<0.012	<0.011	<0.019	<0.012	<0.011
Chloroethane	2,200 {sat}	2,200 {sat}	- -	mg/kg	<0.013	<0.0077	<0.0086	<0.0089	<0.012	<0.011	<0.019	<0.012	<0.011
Chloroform	0.3 {ca}	1.5 {ca}	- -	mg/kg	<0.013	<0.0077	<0.0086	<0.0089	<0.012	<0.011	<0.019	<0.012	<0.011
Chloromethane	1.7 {ca*}	8.4 {ca*}	- -	mg/kg	<0.013 L	<0.0077 L	<0.0086 L	<0.0089 L	<0.012 L	<0.011 L	<0.019 L	<0.012 L	<0.011 L
cis-1,2-Dichloroethene	78 {nc}	1,300 {sat}	- -	mg/kg	<0.013	<0.0077	<0.0086	<0.0089	<0.012	<0.011	<0.019	<0.012	<0.011
cis-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.013	<0.0077	<0.0086	<0.0089	<0.012	<0.011	<0.019	<0.012	<0.011
Dibromochloromethane	5.8 {ca}	21 {ca}	- -	mg/kg	<0.013	<0.0077	<0.0086	<0.0089	<0.012	<0.011	<0.019	<0.012	<0.011
Ethylbenzene	5.7 {ca}	29 {ca}	- -	mg/kg	<0.013	<0.0077	<0.0086	<0.0089	<0.012	<0.011	<0.019	<0.012	<0.011
m,p-Xylene	60 {nc}	260 {nc}	- -	mg/kg	<0.025	<0.015	<0.017	<0.018	<0.024	<0.021	<0.038	<0.024	<0.021
Methylene Chloride	11 {ca}	54 {ca}	- -	mg/kg	<0.013	<0.0077	<0.0086	<0.0089	<0.012	<0.011	<0.019	<0.012	<0.011
o-Xylene	300 {sat}	300 {sat}	- -	mg/kg	<0.013	<0.0077	<0.0086	<0.0089	<0.012	<0.011	<0.019	<0.012	<0.011
Styrene	1,000 {sat}	1,000 {sat}	- -	mg/kg	<0.013	<0.0077	<0.0086	<0.0089	<0.012	<0.011	<0.019	<0.012	<0.011
Tetrachloroethene	0.57 {ca}	2.7 {ca}	- -	mg/kg	<0.013	<0.0077	<0.0086	<0.0089	<0.012	<0.011	<0.019	<0.012	<0.011
Toluene	500 {nc}	4600 {nc}	- -	mg/kg	<0.013	<0.0077	<0.0086	0.0078 J	0.61 J	<0.011	<0.019	<0.012	0.00092 B
trans-1,2-Dichloroethene	11 {nc}	50 {nc}	- -	mg/kg	<0.013	<0.0077	<0.0086	<0.0089	<0.012	<0.011	<0.019	<0.012	<0.011
trans-1,3-Dichloropropene	- -	- -	- -	mg/kg	<0.013	<0.0077	<0.0086	<0.0089	<0.012	<0.011	<0.019	<0.012	<0.011
Trichloroethene	2.8 {ca}	14 {ca}	- -	mg/kg	<0.013	<0.0077	<0.0086	<0.0089	<0.012	<0.011	<0.019	<0.012	<0.011
Vinyl Chloride	0.06 {ca}	1.7 {ca}	- -	mg/kg	<0.013	<0.0077	<0.0086	<0.0089	<0.012	<0.011	<0.019	<0.012	<0.011
Xylenes (total)	60 {nc}	260 {nc}	- -	mg/kg	<0.025	<0.015	<0.017	<0.018	<0.024	<0.021	<0.038	<0.024	<0.021
Semivolatile Organics													
1,2,4-Trichlorobenzene	8.7 {ca**}	40 {ca**}	- -	mg/kg	<0.43	<0.26	0.012 J	<0.30	<0.40	<0.36	<0.64	0.023 J	<0.36
1,2-Dichlorobenzene	220 {sat}	220 {sat}	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
1,3-Dichlorobenzene	- -	- -	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
1,4-Dichlorobenzene	2.6 {ca}	13 {ca}	- -	mg/kg	<0.43	<0.26	0.012 J	<0.30	<0.40	<0.36	<0.64	0.049 J	<0.36
2,4,5-Trichlorophenol	610 {nc}	6,200 {nc}	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
2,4,6-Trichlorophenol	44 {ca**}	160 {ca**}	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
2,4-Dichlorophenol	18 {nc}	180 {nc}	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
2,4-Dimethylphenol	120 {nc}	1,200 {nc}	- -	mg/kg	<0.43	<0.26 L	<0.29 L	<0.30	<0.40	<0.36	<0.64	<0.41 L	<0.36
2,4-Dinitrophenol	12 {nc}	120 {nc}	- -	mg/kg	<2.1	<0.26	<0.29	<1.5	<2.0	<1.8	<3.1	<0.41	<1.8
2,4-Dinitrotoluene	12 {nc}	120 {nc}	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
2,6-Dinitrotoluene	6.1 {nc}	62 {nc}	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
2-Chloronaphthalene	210 {sat}	210 {sat}	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
2-Chlorophenol	39 {nc}	510 {nc}	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	0.056 J	<0.26	0.012 J	<0.30	<0.40	<0.36	<0.64	0.065 J	<0.36
2-Methylphenol	310 {nc}	3,100 {nc}	- -	mg/kg	<0.43	<0.26 L	<0.29 L	<0.30	<0.40	<0.36	<0.64	<0.41 L	<0.36
2-Nitroaniline	- -	- -	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
2-Nitrophenol	- -	- -	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
3,3'-Dichlorobenzidine	1.1 {ca**}	3.8 {ca**}	- -	mg/kg	<0.43	<0.26 L	<0.29 L	<0.30	<0.40	<0.36	<0.64	<0.41 L	<0.36
3-Nitroaniline	- -	- -	- -	mg/kg	<0.43 J	<0.26 J	<0.29 J	<0.30 J	<0.40 J	<0.36 J	<0.64 J	<0.41 J	<0.36 J
4,6-Dinitro-2-methylphenol	- -	- -	- -	mg/kg	<2.1	<1.3	<1.4	<1.5	<2.0	<1.8	<3.1	<2.0	<1.8
4-Bromophenyl-phenylether	- -	- -	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
4-Chloro-3-Methylphenol	- -	- -	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
4-Chloroaniline	24 {nc}	250 {nc}	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
4-Chlorophenyl-phenylether	- -	- -	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
4-Methylphenol	31 {nc}	310 {nc}	- -	mg/kg	<0.43	<0.26 L	<0.29 L	<0.30	<0.40	<0.36	<0.64	0.13 L	<0.36
4-Nitroaniline	- -	- -	- -	mg/kg	<0.43 J	<0.26 J	<0.29 J	<0.30 J	<0.40 J	<0.36 J	<0.64 J	<0.41 J	<0.36 J
4-Nitrophenol	- -	- -	- -	mg/kg	<2.1	<1.3	<1.4	<1.5	<2.0	<1.8	<3.1	<2.0	<1.8
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	0.16 J	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	0.052 J	<0.36
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.28 J	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	0.14 J	<0.36
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.39 J	<0.26	<0.29	<0.30	<0.40	0.053 J	<0.64	0.56	0.025 J
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	0.34 J	<0.26	<0.29	<0.30	<0.40	0.054 J	<0.64	0.44	<0.36
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.42 J	<0.26	<0.29	<0.30	<0.40	0.090 J	<0.64	0.55	<0.36
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	0.20 J	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	0.26 J	<0.36
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	0.15 J	<0.26	<0.29	<0.30	<0.40	0.022 J	<0.64	0.15 J	<0.36
Benzoic Acid	240,000 {max}	2,500,000 {max}	- -	mg/kg	<2.1	<1.3	<1.4	<1.5	<2.0	<1.8	<3.1	<2.0	<1.8
Benzyl Alcohol	3,100 {nc}	310,000 {max}	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
bis(2-Chloroethoxy)methane	18 {nc}	180 {nc}	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
bis(2-Chloroethyl)ether	0.19 {ca**}	0.9 {ca**}	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
bis(2-Chloroisopropyl)ether	- -	- -	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
bis(2-Ethylhexyl)phthalate	35 {ca*}	120 {ca*}	- -	mg/kg	<0.43	<0.26	0.072 B	0.27 B	0.18 B	0.14 B	<0.64	0.33 B	0.15 B
Butylbenzylphthalate	260 {ca*}	910 {ca*}	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
Carbazole	24 {ca**}	86 {ca**}	- -	mg/kg	0.21 J	<0.26 J	<0.29 J	<0.30 J	<0.40 J	<0.36 J	<0.64 J	0.14 J	<0.36 J
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	0.39 J	<0.26	<0.29	<0.30	<0.40	0.065 J	<0.64	0.56	0.023 J
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	0.098 J	<0.36
Dibenzofuran	- -	- -	- -	mg/kg	0.10 J	<1.3	<1.4	<0.30	<0.40	<0.36	<0.64	0.039 J	<0.36
Diethylphthalate	4,900 {nc}	490,000 {max}	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
Dimethylphthalate	- -	- -	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
Di-n-Butylphthalate	610 {nc}	6,200 {nc}	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
Dinitrotoluene Mix	0.71 {ca}	2.5 {ca}	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
Di-n-Octylphthalate	- -	- -	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	1.1	<0.26	<0.29	<0.30	<0.40	0.13 J	<0.64	0.63	0.050 J
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	0.18 J	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	0.071 J	<0.36
Hexachlorobenzene	0.3 {ca}	1.1 {ca}	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
Hexachlorobutadiene	6.2 {ca**}	22 {ca*}	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
Hexachlorocyclopentadiene	37 {nc}	370 {nc}	- -	mg/kg	<0.43 J	<0.26 J	<0.29 J	<0.30 J	<0.40 J	<0.36 J	<0.64 J	<0.41 J	<0.36 J

Notes found at end of table.

Table 9-11. Sediment Analytical Results, Western Burning Ground, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	WBGSW/SD07 0 - 0.5 06/26/02	WBGSW/SD08 0 - 0.5 06/25/02	WBGSW/SD09 0 - 0.5 06/25/02	WBGSW/SD10 0 - 0.5 06/26/02	WBGSD11 0 - 0.5 06/27/02	WBGSD12 0 - 0.5 06/26/02	WBGSW/SD13 0 - 0.5 06/26/02	WBGSW/SD14 0 - 0.5 06/25/02	WBGSW/SD15 0 - 0.5 06/27/02
Semivolatile Organics													
Hexachloroethane	35 {ca**}	120 {ca**}	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.24 J	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	0.25 J	<0.36
Isophorone	510 {ca*}	1,800 {ca*}	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
Naphthalene	3.9 {ca}	20 {ca}	- -	mg/kg	0.27 J	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	0.058 J	<0.36
Nitrobenzene	3.1 {nc}	28 {nc}	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
N-Nitroso-di-n-propylamine	0.069 {ca**}	0.25 {ca**}	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
N-Nitrosodiphenylamine	99 {ca**}	350 {ca**}	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
Pentachlorophenol	3 {ca}	9 {ca}	- -	mg/kg	<2.1	<1.3	<1.4	<1.5	<2.0	<1.8	<3.1	<2.0	<1.8
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	1.1	<0.26	<0.29	<0.30	<0.40	0.066 J	<0.64	0.52	0.026 J
Phenol	1,800 {nc}	180,000 {max}	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	0.086 B	<0.36
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	0.90	<0.26	<0.29	<0.30	<0.40	0.11 J	<0.64	0.73	0.030 J
Pyridine	7.8 {nc}	100 {nc}	- -	mg/kg	<0.43	<0.26	<0.29	<0.30	<0.40	<0.36	<0.64	<0.41	<0.36
Inorganics													
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	7,110 J	29,200	12,700	18,700 J	14,600 J	19,300 J	5,400 J	14,300	22,000 J
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	<1.25 L	<0.760 L	<0.850 L	3.10 L	<1.18 L	0.740 B	<1.89 L	0.570 B	<1.07 L
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	1.44 J	4.28 J	**16.6 J**	5.51 J	1.74 J	2.32 J	**30.4 J**	3.38 J	3.08 J
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	32.3	129	32.8	179	73.3	58.1	94.7	113	70.8
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	**1.20 J**	**1.67 B**	0.850 B	**2.27**	0.760 J	0.740 J	0.560 J	0.890 B	0.950 J
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	0.190 J	<0.150	<0.170	**2.70**	0.140 B	<0.210	<0.370	0.150 B	<0.210
Calcium	- -	- -	- -	mg/kg	5,530	1,820 J	28,400 J	27,300	38,500	13,300	14,200	61,100 J	38,400
Chromium	280 {ca}	1,460 {ca}	65.3	mg/kg	**116**	41.2 J	39.0 J	**15,400**	22.4	26.9	5.17 B	21.1 J	28.4
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	7.10 J	16.1	8.79	**84.1**	6.50 J	8.30 J	9.60 J	7.60 J	9.30 J
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	6.36 J	17.4	8.48	**188 J**	12.8 J	11.9 J	13.7 J	11.1	17.2 J
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	19,700	31,200	32,700	44,100	15,600	15,200	**293,000**	14,200	19,300
Lead	400 {++}	800 {++}	26.8	mg/kg	22.5	16.3	**44.6**	**109,000**	**29.4**	**28.5**	5.61 B	18.7	**29.0**
Magnesium	- -	- -	- -	mg/kg	1,870	4,810	5,510	4,170	3,580	1,680	863	2,500	10,200
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	43.6 B	479	339	295	126	264	2,310	1,540	206
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	<0.120	0.0600 J	0.0300 J	0.0600 J	0.0500 J	0.0500 J	<0.180	0.0900 J	0.0500 J
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	9.70 J	26.8	9.27	26.7	11.1	12.3	4.40 J	10.7	17.8
Potassium	- -	- -	- -	mg/kg	290 J	2,160	777	831	734	854	320 J	786	1,270
Selenium	39 {nc}	510 {nc}	- -	mg/kg	<2.50 L	<1.53 L	<1.71 L	<1.78 L	1.30 J	0.810 J	<3.79 L	<2.40 L	<2.14 L
Silver	39 {nc}	510 {nc}	- -	mg/kg	<2.50 L	<1.53	<1.71	8.42 L	<2.35 L	<2.14 L	<3.79 L	<2.40	<2.14 L
Sodium	- -	- -	- -	mg/kg	85.8	89.0 J	72.0 J	138	133	86.6	164	126 J	176
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	0.130 J	0.220 B	0.100 B	0.260 J	0.170 J	0.210 J	0.740 J	0.200 B	0.200 J
Vanadium	55{nc}	720 {nc}	108	mg/kg	40.6	59.3	52.2	106 J	29.6	32.4	14.0 J	22.4	41.0
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	44.4 J	31.6 J	22.0 J	**17,300**	59.2 J	50.3 J	17.1 J	52.5 J	65.5 J
Miscellaneous													
Total Organic Carbon	- -	- -	- -	mg/kg	53,700 K	NA	NA	28,600 K	24,200 K	NA	NA	NA	NA

mg/kg	Milligrams per kilogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 9-12. Surface Water Analytical Results, Western Burning Ground, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Date Collected:	Tapwater Screening Values [a]	Units	WBGSW/SD07 06/26/02	WBGSW/SD08 06/25/02	WBGSW/SD09 06/25/02	WBGSW/SD10 06/26/02	WBGSW/SD13 06/26/02	WBGSW/SD14 06/25/02	WBGSW/SD15 06/27/02
Dioxin/Furan									
1,2,3,4,6,7,8-HpCDD	- -	µg/L	<0.00000308	<0.00000253	<0.00001026	<0.00000196	NA	NA	NA
1,2,3,4,6,7,8-HpCDF	- -	µg/L	<0.0000016	<0.00000136	<0.00000396	<0.00000126	NA	NA	NA
1,2,3,4,7,8,9-HpCDF	- -	µg/L	<0.00000207	<0.00000176	<0.00000512	<0.00000164	NA	NA	NA
1,2,3,4,7,8-HxCDD	- -	µg/L	<0.00000215	<0.00000257	<0.00000715	<0.00000177	NA	NA	NA
1,2,3,4,7,8-HxCDF	- -	µg/L	<0.00000132	<0.00000121	<0.00000316	<0.00000114	NA	NA	NA
1,2,3,6,7,8-HxCDD	- -	µg/L	<0.00000168	<0.00000201	<0.0000056	<0.00000138	NA	NA	NA
1,2,3,6,7,8-HxCDF	- -	µg/L	<0.00000128	<0.00000118	<0.00000307	<0.00000111	NA	NA	NA
1,2,3,7,8,9-HxCDD	- -	µg/L	<0.00000163	<0.00000195	<0.00000542	<0.00000134	NA	NA	NA
1,2,3,7,8,9-HxCDF	- -	µg/L	<0.00000151	<0.00000139	<0.00000362	<0.00000131	NA	NA	NA
1,2,3,7,8-PeCDD	- -	µg/L	<0.00000149	<0.00000179	<0.00000458	<0.00000114	NA	NA	NA
1,2,3,7,8-PeCDF	0.000015 {ca**}	µg/L	<0.00000094	<0.00000103	<0.00000274	<0.0000008	NA	NA	NA
2,3,4,6,7,8-HxCDF	- -	µg/L	<0.0000015	<0.00000138	<0.0000036	<0.0000013	NA	NA	NA
2,3,4,7,8-PeCDF	0.0000015 {ca**}	µg/L	<0.00000098	<0.00000108	<0.00000286	<0.00000084	NA	NA	NA
2,3,7,8-TCDD	0.00000052 {ca*}	µg/L	<0.00000166	<0.00000156	<0.00000431	<0.00000137	NA	NA	NA
2,3,7,8-TCDF	0.0000045 {ca**}	µg/L	<0.00000138	<0.00000135	<0.00000287	<0.00000104	NA	NA	NA
OCDD	0.0015 {ca**}	µg/L	0.00001406 B	0.00003293 B	0.00003504 B	0.00002524 B	NA	NA	NA
OCDF	0.0015 {ca**}	µg/L	<0.00000544	<0.00000466	<0.00001257	<0.00000323	NA	NA	NA
Total HpCDDs	0.000045 {ca**}	µg/L	<0.00000308	<0.00000253	<0.00001026	<0.00000196	NA	NA	NA
Total HpCDFs	0.000045 {ca**}	µg/L	<0.0000016	<0.00000136	<0.00000396	<0.00000126	NA	NA	NA
Total HxCDDs	0.0000045 {ca**}	µg/L	<0.00000163	<0.00000195	<0.00000542	<0.00000134	NA	NA	NA
Total HxCDFs	0.0000045 {ca**}	µg/L	<0.00000128	<0.00000118	<0.00000307	<0.00000111	NA	NA	NA
Total PeCDDs	0.00000045 {ca**}	µg/L	<0.00000149	<0.00000179	<0.00000458	<0.00000114	NA	NA	NA
Total PeCDFs	- -	µg/L	<0.00000094	<0.00000103	<0.00000274	<0.0000008	NA	NA	NA
Total TCDDs	- -	µg/L	<0.00000166	<0.00000156	<0.00000431	<0.00000137	NA	NA	NA
Total TCDFs	- -	µg/L	<0.00000138	<0.00000135	<0.00000287	<0.00000104	NA	NA	NA
Explosives									
1,3,5-Trinitrobenzene	1,100 {nc}	µg/L	<0.13	<0.13	<0.13	<0.13	NA	NA	NA
1,3-Dinitrobenzene	3.7 {nc}	µg/L	<0.13	<0.13	<0.13	<0.13	NA	NA	NA
2,4,6-Trinitrotoluene	2.2 {ca**}	µg/L	<0.26	<0.26	<0.26	<0.26	NA	NA	NA
2,4-Dinitrotoluene	73 {nc}	µg/L	<0.13	<0.13	<0.13	<0.13	NA	NA	NA
2,6-Dinitrotoluene	37 {nc}	µg/L	<0.26	<0.26	<0.26	<0.26	NA	NA	NA
2-Amino-4,6-Dinitrotoluene	73 {nc}	µg/L	<0.26	<0.26	<0.26	<0.26	NA	NA	NA
4-Amino-2,6-Dinitrotoluene	73 {nc}	µg/L	<0.26	<0.26	<0.26	<0.26	NA	NA	NA
Dinitrotoluene Mix	0.099 {ca}	µg/L	<0.26	<0.26	<0.26	<0.26	NA	NA	NA
HMX	1,800 {nc}	µg/L	<0.26	<0.26	<0.26	<0.26	NA	NA	NA
m-Nitrotoluene	- -	µg/L	<0.52	0.36 J	0.38 J	<0.52	NA	NA	NA
Nitrobenzene	3.4 {nc}	µg/L	<0.26	<0.26	<0.26	<0.26	NA	NA	NA
Nitroglycerine	3.7 {nc}	µg/L	<0.97 L	<0.97 L	<0.97 L	<0.97 L	NA	NA	NA
o-Nitrotoluene	370 {nc}	µg/L	<0.52	<0.52	<0.52	<0.52	NA	NA	NA
Pentaerythritol Tetranitrate	- -	µg/L	<0.97 L	<0.97 L	<0.97 L	<0.97 L	NA	NA	NA
p-Nitrotoluene	4.2 {ca*}	µg/L	<0.52	<0.52	<0.52	<0.52	NA	NA	NA
RDX	0.61 {ca}	µg/L	<0.26	<0.26	<0.26	<0.26	NA	NA	NA
Tetryl	150 {nc}	µg/L	<0.26	<0.26	<0.26	<0.26	NA	NA	NA
Herbicides									
2,4,5-T	370 {nc}	µg/L	NA	<0.1	NA	<0.1	<0.1	<0.1	<0.1
2,4,5-TP	290 {nc}	µg/L	NA	<0.1	NA	<0.1	<0.1	<0.1	<0.1
2,4-D	370 {nc}	µg/L	NA	3.68	NA	<0.5	<0.5	3.56	<0.5
2,4-DB	290 {nc}	µg/L	NA	<2	NA	<2	<2	<2	<2
Dalapon	1,100 {nc}	µg/L	NA	<2	NA	<2	<2	<2	<2
Dicamba	1,100 {nc}	µg/L	NA	<0.5	NA	<0.5 L	<0.5 L	<0.5	<0.5 L
Dichlorprop	- -	µg/L	NA	<0.5	NA	<0.5	<0.5	<0.5	<0.5
Dinoseb	37 {nc}	µg/L	NA	<0.5	NA	<0.5	<0.5	<0.5	<0.5
MCPA	18 {nc}	µg/L	NA	<125	NA	<125	<125	<125	<125
MCPP	37 {nc}	µg/L	NA	54.1 J	NA	<125	<125	<125	<125
Organochlorine Pesticides									
4,4'-DDD	0.28 {ca**}	µg/L	NA	<0.02	NA	<0.02	<0.02	<0.02	<0.02
4,4'-DDE	0.2 {ca**}	µg/L	NA	<0.02	NA	<0.02	<0.02	<0.02	<0.02
4,4'-DDT	0.2 {ca*}	µg/L	NA	<0.02	NA	<0.02	<0.02	<0.02	<0.02
Aldrin	0.004 {ca}	µg/L	NA	<0.02	NA	<0.02	<0.02	<0.02	<0.02
Alpha-BHC	0.011 {ca**}	µg/L	NA	<0.02	NA	<0.02	<0.02	<0.02	<0.02
Alpha-Chlordane	- -	µg/L	NA	<0.02	NA	<0.02	<0.02	<0.02	<0.02
Beta-BHC	0.037 {ca**}	µg/L	NA	<0.02	NA	<0.02	<0.02	<0.02	<0.02
Delta-BHC	- -	µg/L	NA	<0.02	NA	<0.02	<0.02	<0.02	<0.02
Dieldrin	0.0042 {ca}	µg/L	NA	0.00521 J	NA	<0.02	0.00358 J	0.00901 J	<0.02
Endosulfan I	- -	µg/L	NA	<0.02	NA	<0.02	<0.02	<0.02	<0.02
Endosulfan II	- -	µg/L	NA	<0.02	NA	<0.02	<0.02	<0.02	<0.02
Endosulfan Sulfate	- -	µg/L	NA	<0.02	NA	<0.02	<0.02	<0.02	<0.02
Endrin	11 {nc}	µg/L	NA	<0.02	NA	<0.02	<0.02	<0.02	<0.02
Endrin Aldehyde	- -	µg/L	NA	<0.02	NA	<0.02	<0.02	<0.02	<0.02
Endrin Ketone	- -	µg/L	NA	<0.02	NA	<0.02	<0.02	<0.02	<0.02
Gamma-BHC (Lindane)	0.061 {ca}	µg/L	NA	<0.02	NA	<0.02	<0.02	<0.02	<0.02
Gamma-Chlordane	- -	µg/L	NA	<0.02	NA	<0.02	<0.02	<0.02	<0.02
Heptachlor	0.015 {ca}	µg/L	NA	<0.02	NA	<0.02	<0.02	<0.02	<0.02
Heptachlor Epoxide	0.0074 {ca*}	µg/L	NA	<0.02	NA	<0.02	<0.02	<0.02	<0.02
Methoxychlor	180 {nc}	µg/L	NA	<0.02	NA	<0.02	<0.02	<0.02	<0.02
Toxaphene	0.061 {ca**}	µg/L	NA	<1	NA	<1	<1	<1	<1
PAHs									
2-Methylnaphthalene	150 {nc}	µg/L	0.030 J	<0.050	<0.050	0.030 J	NA	NA	NA
Acenaphthene	2,200 {nc}	µg/L	0.020 J	<0.050	<0.050	<0.050	NA	NA	NA
Acenaphthylene	- -	µg/L	<0.050	<0.050	<0.050	<0.050	NA	NA	NA
Anthracene	11,000 {nc}	µg/L	0.020 J	<0.050	<0.050	<0.050	NA	NA	NA
Benzo(a)anthracene	0.029 {ca**}	µg/L	<0.050	<0.050	<0.050	<0.050	NA	NA	NA
Benzo(a)pyrene	0.0029 {ca**}	µg/L	<0.050	<0.050	<0.050	<0.050	NA	NA	NA
Benzo(b)fluoranthene	0.029 {ca**}	µg/L	<0.050	<0.050	<0.050	<0.050	NA	NA	NA
Benzo(g,h,i)perylene	- -	µg/L	<0.050 J	<0.050 J	<0.050 J	<0.050 J	NA	NA	NA
Benzo(k)fluoranthene	0.29 {ca**}	µg/L	<0.050	<0.050	<0.050	<0.050	NA	NA	NA
Chrysene	2.9 {ca**}	µg/L	<0.050	<0.050	<0.050	<0.050	NA	NA	NA
Dibenzo(a,h)anthracene	0.0029 {ca**}	µg/L	<0.050 J	<0.050 J	<0.050 J	<0.050 J	NA	NA	NA
Fluoranthene	1,500 {nc}	µg/L	<0.050	<0.050	<0.050	<0.050	NA	NA	NA
Fluorene	1,500 {nc}	µg/L	0.030 J	<0.050	<0.050	<0.050	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.029 {ca**}	µg/L	<0.050 J	<0.050 J	<0.050 J	<0.050 J	NA	NA	NA
Naphthalene	6.2 {nc}	µg/L	0.020 B	<0.050	<0.050	0.040 B	NA	NA	NA
Phenanthrene	- -	µg/L	0.030 J	<0.050	<0.050	<0.050	NA	NA	NA
Pyrene	1,100 {nc}	µg/L	<0.050	<0.050	<0.050	<0.050	NA	NA	NA

Notes found at end of table.

Table 9-12. Surface Water Analytical Results, Western Burning Ground, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Date Collected:	Tapwater Screening Values [a]	Units	WBGSW/SD07 06/26/02	WBGSW/SD08 06/25/02	WBGSW/SD09 06/25/02	WBGSW/SD10 06/26/02	WBGSW/SD13 06/26/02	WBGSW/SD14 06/25/02	WBGSW/SD15 06/27/02
PCBs									
Aroclor-1016	0.96 {ca**}	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10 L	<0.10	<0.10
Aroclor-1221	0.0068 {ca**}	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20 L	<0.20	<0.20
Aroclor-1232	0.0068 {ca**}	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10 L	<0.10	<0.10
Aroclor-1242	0.034 {ca**}	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10 L	<0.10	<0.10
Aroclor-1248	0.034 {ca**}	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10 L	<0.10	<0.10
Aroclor-1254	0.034 {ca*}	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10 L	<0.10	<0.10
Aroclor-1260	0.034 {ca**}	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10 L	<0.10	<0.10
Volatile Organics									
1,1,1-Trichloroethane	9,100 {nc}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2,2-Tetrachloroethane	0.067 {ca**}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2-Trichloroethane	0.24 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane	2.4 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethene	340 {nc}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichloroethane	0.15 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichloropropane	0.39 {ca*}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-Butanone	7,100 {nc}	µg/L	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
2-Hexanone	- -	µg/L	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
4-Methyl-2-pentanone	2,000 {nc}	µg/L	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
Acetone	22,000 {nc}	µg/L	2.8 J	<4.0 J	<4.0 J	<4.0 J	<4.0 J	<4.0 J	<4.0 J
Benzene	0.41 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromodichloromethane	1.1 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromoform	8.5 {ca*}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromomethane	8.7 {nc}	µg/L	<1.0 L	<1.0 L	<1.0 L	<1.0 L	<1.0 L	<1.0 L	<1.0 L
Carbon Disulfide	1,000 {nc}	µg/L	0.23 B	0.13 B	0.12 B	0.25 B	0.21 B	0.18 B	0.070 B
Carbon Tetrachloride	0.2 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chlorobenzene	91 {nc}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chloroethane	21,000 {nc}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chloroform	0.19 {ca}	µg/L	0.13 J	0.60 J	0.47 J	1.1	<1.0	<1.0	<1.0
Chloromethane	1.8 {ca}	µg/L	<1.0 L	<1.0 L	<1.0 L	<1.0 L	<1.0 L	<1.0 L	<1.0 L
cis-1,2-Dichloroethene	370 {nc}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	0.12 J	<1.0
cis-1,3-Dichloropropene	- -	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dibromochloromethane	0.8 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Ethylbenzene	1.5 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
m,p-Xylene	- -	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Methylene Chloride	4.8 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
o-Xylene	1,400 {nc}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Styrene	1,600 {nc}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Tetrachloroethene	0.11 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	0.16 J	<1.0
Toluene	2,300 {nc}	µg/L	<1.0	<1.0	<1.0	0.21 J	<1.0	<1.0	<1.0
trans-1,2-Dichloroethene	110 {nc}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,3-Dichloropropene	- -	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Trichloroethene	1.7 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	0.11 J	<1.0
Vinyl Chloride	0.016 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Xylenes (total)	200 {nc}	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Semivolatile Organics									
1,2,4-Trichlorobenzene	19 {ca*}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,2-Dichlorobenzene	370 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0	0.21 J	<5.0	<5.0
1,3-Dichlorobenzene	- -	µg/L	<5.0	<5.0	<5.0	<5.0	0.21 J	<5.0	<5.0
1,4-Dichlorobenzene	0.43 {ca}	µg/L	<5.0	<5.0	<5.0	<5.0	0.28 J	<5.0	<5.0
2,4,5-Trichlorophenol	3,700 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2,4,6-Trichlorophenol	6.1 {ca**}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2,4-Dichlorophenol	110 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2,4-Dimethylphenol	730 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2,4-Dinitrophenol	73 {nc}	µg/L	<25	<25	<25	<25	<25	<25	<25
2,4-Dinitrotoluene	73 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2,6-Dinitrotoluene	37 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2-Chloronaphthalene	2,900 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2-Chlorophenol	180 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2-Methylnaphthalene	150 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2-Methylphenol	1,800 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2-Nitroaniline	- -	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2-Nitrophenol	- -	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
3,3'-Dichlorobenzidine	0.15 {ca**}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
3-Nitroaniline	- -	µg/L	<5.0 J	<5.0	<5.0	<5.0 J	<5.0 J	<5.0	<5.0 J
4,6-Dinitro-2-methylphenol	- -	µg/L	<25	<25	<25	<25	<25	<25	<25
4-Bromophenyl-phenylether	- -	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4-Chloro-3-Methylphenol	- -	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4-Chloroaniline	150 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4-Chlorophenyl-phenylether	- -	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4-Methylphenol	180 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4-Nitroaniline	- -	µg/L	<5.0 J	<5.0 J	<5.0 J	<5.0 J	<5.0 J	<5.0 J	<5.0 J
4-Nitrophenol	- -	µg/L	<25	<25	<25	<25	<25	<25	<25
Acenaphthene	2,200 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Acenaphthylene	- -	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Anthracene	11,000 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Benzo(a)anthracene	0.029 {ca**}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Benzo(a)pyrene	0.0029 {ca**}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Benzo(b)fluoranthene	0.029 {ca**}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Benzo(g,h,i)perylene	- -	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Benzo(k)fluoranthene	0.29 {ca**}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Benzoic Acid	150,000 {max}	µg/L	<25	5.2 J	<25	5.2 J	<25	6.7 J	<25
Benzyl Alcohol	18,000 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
bis(2-Chloroethoxy)methane	110 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
bis(2-Chloroethyl)ether	0.012 {ca**}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
bis(2-Chloroisopropyl)ether	- -	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
bis(2-Ethylhexyl)phthalate	4.8 {ca}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	2.6 J	<5.0
Butylbenzylphthalate	7,300 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	0.63 B	<5.0
Carbazole	3.4 {ca**}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Chrysene	2.9 {ca**}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Dibenzo(a,h)anthracene	0.0029 {ca**}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Dibenzofuran	- -	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Diethylphthalate	29,000 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Dimethylphthalate	- -	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Di-n-Butylphthalate	3,700 {nc}	µg/L	<5.0	0.60 B	0.91 B	<5.0	<5.0	0.67 B	<5.0
Dinitrotoluene Mix	0.099 {ca}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Di-n-Octylphthalate	- -	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Fluoranthene	1,500 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Notes found at end of table.

Table 9-12. Surface Water Analytical Results, Western Burning Ground, 2002 Shaw Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Date Collected:	Tapwater Screening Values [a]	Units	WBGSW/SD07 06/26/02	WBGSW/SD08 06/25/02	WBGSW/SD09 06/25/02	WBGSW/SD10 06/26/02	WBGSW/SD13 06/26/02	WBGSW/SD14 06/25/02	WBGSW/SD15 06/27/02
Semivolatile Organics									
Fluorene	1,500 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Hexachlorobenzene	0.042 {ca}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Hexachlorobutadiene	0.86 {ca*}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Hexachlorocyclopentadiene	220 {nc}	µg/L	<5.0 J	<5.0 J	<5.0 J	<5.0 J	<5.0 J	<5.0 J	<5.0 J
Hexachloroethane	4.8 {ca**}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Indeno(1,2,3-cd)pyrene	0.029 {ca**}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Isophorone	71 {ca}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Naphthalene	6.2 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Nitrobenzene	3.4 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
N-Nitroso-di-n-propylamine	0.0096 {ca**}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
N-Nitrosodiphenylamine	14 {ca**}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Pentachlorophenol	0.56 {ca}	µg/L	<25	<25	<25	<25	<25	<25	<25
Phenanthrene	- -	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Phenol	11,000 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Pyrene	1,100 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Pyridine	37 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Inorganics									
Aluminum	37,000 {nc}	µg/L	284	200 J	150 J	304	811	120 J	428
Antimony	15 {nc}	µg/L	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
Arsenic	0.045 {ca}	µg/L	<3.00	<3.00	<3.00	<3.00	<3.00	<3.00	<3.00
Barium	7,300 {nc}	µg/L	70.7	80.3	80.8	84.9	148	101	110
Beryllium	73 {nc}	µg/L	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00
Cadmium	18 {nc}	µg/L	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00
Calcium	- -	µg/L	73,800	59,300	59,000	61,500	90,700	70,700	86,100
Chromium	- -	µg/L	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
Cobalt	- -	µg/L	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0
Copper	1,500 {nc}	µg/L	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0
Iron	26,000 {nc}	µg/L	204	303	281	428	50,900	131	310
Lead	- -	µg/L	0.370 B	1.20 B	1.30 B	28.9	0.170 B	<2.00	0.210 B
Magnesium	- -	µg/L	13,900	17,200	17,000	17,100	21,000	15,800	20,200
Manganese	880 {nc}	µg/L	5.30 J	10.3	21.7	23.6	1,470	47.4	7.40 J
Mercury	0.63 {nc}	µg/L	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Nickel	730 {nc}	µg/L	<40.0	<40.0	<40.0	<40.0	<40.0	<40.0	<40.0
Potassium	- -	µg/L	3,710	3,790	3,540	3,820	4,080	2,500 J	3,300
Selenium	180 {nc}	µg/L	<5.00	<5.00	<5.00	<5.00	<5.00	0.440 B	<5.00
Silver	180 {nc}	µg/L	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
Sodium	- -	µg/L	22,200	36,600	36,200	35,900	37,600	29,000	63,900
Thallium	2.4 {nc}	µg/L	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00
Vanadium	180 {nc}	µg/L	<50.0	<50.0	<50.0	<50.0	<50.0	16.0 J	<50.0
Zinc	11,000 {nc}	µg/L	18.0 J	<20.0	<20.0	20.6	<20.0	<20.0	<20.0
Perchlorate									
Perchlorate	26 {nc}	µg/L	<1	<1	<1	<1	<1	1.71	<1
Miscellaneous									
Hardness	- -	µg/L	242,000	219,000	217,000	224,000	313,000	242,000	298,000

µg/L	Micrograms per liter.
[a]	USEPA Regional Screening Levels (USEPA 2008a). Adjusted tap-water screening levels used to assess surface water at the NRU.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{max}	Concentration may exceed ceiling limit.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted tap water RSL.

Table 9-13. XRF Field Screening Results, Western Burning Ground, 2004 Shaw Additional Characterization Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Sample Location	XRF Lead Concentration (mg/kg)	Cooresponding Laboratory Sample ID
Unlined Drainage Ditch		
SB1A	**104**	-
SB1B	< 70	-
SB2A	**411**	-
SB2B	< 63	-
SB3A	< 82	-
SB4A	**165**	-
SB4B	< 52	-
SB5A	< 70	-
SB5B	**922**	-
SB6A	< 66	-
SB6B	< 55	WBGSB49B
SB7A	< 78	-
SB7B	< 68	-
SB8A	< 60	-
SB8B	**647**	-
SB8C	< 62	WBGSB46C
SB9A	< 64	-
SB9B	< 57	WBGSB52B
SB10A	< 59	WBGSB45A
SB10B	< 75	WBGSB45B
SB11A	< 66	-
SB11B	**1,010**	-
SB11C	< 80	WBGSB47C
SB12A	< 61	WBGSB43A
SB12B	< 65	WBGSB43B
SB13A	< 70	-
SB13B	< 58	WBGSB51B
SB14A	< 63	-
SB14B	**538**	-
SB14C	< 83	WBGSB48C
SB15A	< 61	-
SB15B	< 87	-
SB16A	< 54	-
SB16B	< 63	WBGSB50B
SB17A	< 67	-
SB17B	< 54	-
SB18A	< 58	-
SB18B	< 56	-
SB19A	< 61	-
SB19B	< 60	-
SB20A	< 63	-
SB20B	< 65	-
SB21A	< 59	-
SB21B	< 71	-
SB22A	< 65	-
SB22B	< 65	-
SB23A	< 66	-
SB23B	< 100	-
SB24A	< 62	WBGSB44A
SB24B	< 61	WBGSB44B
SB25A	< 73	-
SB28A	**120**	-
SB29A	< 60	-
SB32A	**65.8**	-
SB33A	**206**	-
SB33B	< 61	-
SB34A	**477**	-
SB35A	< 55	-

Sample Location	XRF Lead Concentration (mg/kg)	Cooresponding Laboratory Sample ID
Unlined Drainage Ditch		
WBGSB26A	< 55	WBGSB26A
--	--	WBGSB27A
WBGSB28A	**120**	WBGSB28A
DD1	< 52	WBGSB40A
DD2	< 49	
DD3	< 49	WBGSB39A
Slope to Pond		
SL1	**98**	WBGSB34A
SL3	**69.9**	WBGSB35A
SL5	< 61	
SL7	< 57	WBGSB36A
SL9	< 65	
SL10	< 56	WBGSB37A
SL11	< 63	WBGSB41A
SL12	< 53	WBGSB38A
SL13	< 41	
SL14	< 55	WBGSB42A
SL15	**52**	WBGSB29A
SL16	< 54	WBGSB30A
Swale to Pond		
SW1	< 49	WBGSB33A
SW3	**72.5**	
SW5	**76.5**	
SW7	< 54	WBGSB32A
SW9	< 62	
SW11	< 57	
SW13	< 62	WBGSB31A
Pond Sediment		
SD1	**18,300**	
SD2	**4,970**	
SD3	**213**	
SD4	**524**	
SD5	**332**	
SD6	**242**	
SD7	**657**	
SD8	**2,100**	
SD9	**117**	WBGSD17
SD10	**61.2**	WBGSD18
SD11	< 28	WBGSD19
SD12	< 71	WBGSD20
SD13	< 53	WBGSD21
SD14	< 48	WBGSD22
--	--	WBGSD16
Pond Perimeter		
PD1	< 39	-
PD2	< 50	-
PD3	< 55	-

mg/kg	Milligrams per kilogram.
538	Highlighted value indicates constituent concentration is above residential adjusted soil RSL (USEPA 2008a).
1,010	Highlighted value indicates constituent concentration is above industrial adjusted soil RSL (USEPA 2008a).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Note: Inorganics facility-wide background value taken from *Facility-Wide Background Study Report* , IT Corporation, 2001.

Table 9-14. Soil Analytical Results, Western Burning Ground, 2004 Shaw Additional Characterization Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	WBGSB26 0 - 0.5 07/16/04	WBGSB27 0 - 0.5 07/16/04	WBGSB28 0 - 0.5 07/16/04	WBGSB29 0 - 0.5 07/19/04	WBGSB30 0 - 0.5 07/19/04	WBGSB31 0 - 0.5 07/19/04	WBGSB32 0 - 0.5 07/19/04	WBGSB33 0 - 0.5 07/19/04	WBGSB34 0 - 0.5 07/19/04	WBGSB35 0 - 0.5 07/20/04	WBGSB36 0 - 0.5 07/20/04	WBGSB37 0 - 0.5 07/20/04	WBGSB38 0 - 0.5 07/19/04	WBGSB39 0 - 0.5 07/19/04	WBGSB40 0 - 0.5 07/19/04	WBGSB41 0 - 0.5 07/19/04
PAHs																				
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	<0.0091	<0.0094	<0.0085 [0.016]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.0091	<0.0094	<0.0085 [<0.0087]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.0091	<0.0094	<0.0085 [<0.0087]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.015	0.052	<0.0085 [<0.0087]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.089	0.42	0.021 J [0.036 J]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	0.091	0.51	0.029 J [0.050 J]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.17	0.64	0.046 J [0.081 J]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	0.074	0.27	0.027 [0.037]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	0.044	0.17	0.017 [0.025]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	0.11	0.33	0.026 [0.043]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.0091	0.080	<0.0085 [<0.0087]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	0.23	0.61	0.048 [0.067]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.0091	<0.0094	<0.0085 [<0.0087]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.069	0.27	0.025 [0.035]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	3.9 {nc}	20 {nc}	- -	mg/kg	<0.0091	<0.0094	<0.0085 [0.0092]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.087	0.20	0.016 [0.023]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	0.14 J	0.39	0.028 J [0.041]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCBs																				
Aroclor-1016	0.39 {nc}	21 {ca**}	- -	mg/kg	<0.045	<0.047	<0.042 [<0.044]	<0.043	<0.044	<0.041	<0.044	<0.050	<0.040	<0.044	<0.045	<0.042	<0.041	<0.044	<0.040	<0.040
Aroclor-1221	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.045	<0.047	<0.042 [<0.044]	<0.043	<0.044	<0.041	<0.044	<0.050	<0.040	<0.044	<0.045	<0.042	<0.041	<0.044	<0.040	<0.040
Aroclor-1232	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.045	<0.047	<0.042 [<0.044]	<0.043	<0.044	<0.041	<0.044	<0.050	<0.040	<0.044	<0.045	<0.042	<0.041	<0.044	<0.040	<0.040
Aroclor-1242	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.045	<0.047	<0.042 [<0.044]	<0.043	<0.044	<0.041	<0.044	<0.050	<0.040	<0.044	<0.045	<0.042	<0.041	<0.044	<0.040	<0.040
Aroclor-1248	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.045	<0.047	<0.042 [<0.044]	<0.043	<0.044	<0.041	<0.044	<0.050	<0.040	<0.044	<0.045	<0.042	<0.041	<0.044	<0.040	<0.040
Aroclor-1254	0.22 {ca**}	0.74 {ca*}	- -	mg/kg	<0.045	<0.047	<0.042 [<0.044]	<0.043	<0.044	<0.041	<0.044	<0.050	<0.040	<0.044	<0.045	<0.042	<0.041	<0.044	<0.040	<0.040
Aroclor-1260	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.045	<0.047	<0.042 [<0.044]	<0.043	<0.044	<0.041	<0.044	<0.050	<0.040	<0.044	<0.045	<0.042	<0.041	<0.044	<0.040	<0.040
Inorganics																				
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	15,700	19,000	21,800 [22,400]	40,000	34,300	24,200	28,500	20,100	30,400	33,700	39,000	26,300	24,400	16,500	15,700	27,000
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	<0.360 L	1.60 B	0.610 B [0.570 B]	0.830 B	0.610 B	0.850 B	0.470 B	0.760 B	0.520 B	<0.300	0.800 B	0.530 J	0.420 J	<0.330	0.490 J	0.360 J
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	8.30	9.50	9.40 [9.90]	10.8	13.3	9.40	9.80	7.90	10.8	8.60	15.8	10.2	9.00	6.10	5.60	7.20
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	45.5	128	81.7 [86.5]	72.9	55.8	34.1	74.1	53.8	54.9	83.5	56.4	34.4	43.5	72.5	39.2	51.6
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	0.830 J	0.920 J	**1.30 J [1.40 J]**	**2.80**	**2.90**	0.630	**1.40**	**1.30**	**1.60**	**2.30**	**3.10**	**1.40**	**1.10**	0.870	0.740	**1.60**
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	<0.0380	0.380 J	0.0840 J [0.0880 J]	0.420 J	0.370 J	0.200 J	0.400 J	0.300 J	0.390 J	0.0820 B	0.590 J	<0.0310	<0.0320	0.0780 B	<0.0330	<0.0290
Calcium	- -	- -	- -	mg/kg	1,650	8,840	3,980 [4,000]	5,740 J	4,330 J	1,230 J	4,030 J	5,320 J	3,390 J	7,550	7,950 J	3,130	2,920	2,400	1,150	1,600
Chromium	280 {ca}	1,460 {ca}	65.3	mg/kg	26.7	44.8	45.2 [45.5]	59.5	54.8	35.6	43.4	32.7	49.6	51.8 J	58.5	39.7 J	37.4 J	24.2 J	25.0 J	46.8 J
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	14.5	10.2	9.80 [11.2]	21.1	30.6	10.8	13.6	11.1	16.5	16.6	30.6	17.4	13.6	7.50	16.0	13.3
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	15.6	47.1	28.6 [29.8]	31.2	28.3	17.5	21.0	20.5	22.6	24.0	31.4	25.2	19.3	16.2	11.7	19.3
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	24,900	24,600	28,300 [29,200]	37,800	37,000	30,900	31,100	21,600	33,300	30,000	41,400	32,000	29,200	17,600	18,300	32,400
Lead	400 {++}	800 {++}	26.8	mg/kg	**32.5**	**279**	**114 [112]**	**33.5**	**41.0**	19.6	**31.8**	**43.1**	**85.6**	**54.9**	**45.8**	**29.1**	**27.8**	**38.0**	**28.7**	19.3
Magnesium	- -	- -	- -	mg/kg	1,220 K	3,390	3,140 [3,230]	9,210	4,710	752	6,230	3,010	4,230	12,200	6,750	2,750	2,800	1,530	1,780	4,850
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	637	428	251 [294]	280	283	180	364	224	212	233	282	154	166	292	449	193
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	0.0610	0.0700	0.0670 [0.0600]	0.120	0.130	0.0800	0.0970	0.0850	0.0920	0.110	0.130	0.100	0.0760 B	0.0360 B	0.0410 B	0.0530 B
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	14.9	17.3	20.7 [21.4]	35.2	33.6	12.1	22.6	16.6	24.3	29.6	36.8	21.1	19.2	12.3	12.9	24.1
Potassium	- -	- -	- -	mg/kg	702	1,120	1,200 [1,250]	2,910	2,050	792	1,620	1,200	1,690	2,530	2,820	1,600	1,470	612	764	1,270
Selenium	39 {nc}	510 {nc}	- -	mg/kg	1.10 B	0.750 B	0.860 B [0.720 B]	0.830 B	1.00 B	0.740 B	<0.660	<0.740	0.730 B	<0.580	0.850 B	0.780 B	<0.590	<0.640	<0.600	0.740 B
Silver	39 {nc}	510 {nc}	- -	mg/kg	<0.140	<0.140	<0.130 [<0.140]	<0.240	<0.280	<0.120	<0.130	<0.150	<0.120	<0.120	<0.280	<0.120	<0.120	<0.130	<0.120	<0.110
Sodium	- -	- -	- -	mg/kg	62.1 B	136 B	84.5 B [77.9 B]	72.0 B	72.5 B	75.8 B	80.7 B	101 B	70.6 B	51.2 J	82.7 B	54.2 J	46.0 B	58.4 B	75.8 B	43.0 B
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	<0.420	<0.430	<0.380 [<0.410]	<0.370	<0.420	<0.360	<0.400	<0.450	<0.350	<0.360	<0.420	<0.350	<0.360	<0.390	<0.360	<0.320
Vanadium	55{nc}	720 {nc}	108	mg/kg	46.1	48.0	53.9 [56.5]	80.9	74.2	63.5	63.0	46.1	66.5	62.1	84.7	63.4	58.4	37.5	43.0	65.6
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	43.6	**459**	202 [200]	55.9	51.6	28.7	51.9	56.3	48.7	45.5	52.0	41.0	37.2	67.5	34.1	32.1
Miscellaneous																				
Percent Solids	- -	- -	- -	%	73	71	79 [77]	78	76	81	76	67	83	75	74	79	82	76	83	84

Notes found at end of table.

Table 9-14. Soil Analytical Results, Western Burning Ground, 2004 Shaw Additional Characterization Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: / Sample Depth(Feet): / Date Collected:	Adjusted Soil Screening Values- Residential [a]	Adjusted Soil Screening Values- Industrial [a]	Facility-Wide Background Values [b]	Units	WBGSB42 0 - 0.5 07/19/04	WBGSB43 0 - 0.5 07/19/04	WBGSB43 4 - 5 07/19/04	WBGSB44 0 - 0.5 07/19/04	WBGSB44 1 - 2 07/19/04	WBGSB45 0 - 0.5 07/19/04	WBGSB45 4 - 5 07/19/04	WBGSB46 4 - 5 07/19/04	WBGSB47 5 - 6 07/19/04	WBGSB48 4 - 5 07/19/04	WBGSB49 1 - 2 07/19/04	WBGSB50 3 - 4 07/19/04	WBGSB51 3 - 4 07/19/04	WBGSB52 3 - 4 07/19/04	WBGSB53 0 - 0.5 09/14/04
PAHs																			
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	3.9 {nc}	20 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCBs																			
Aroclor-1016	0.39 {nc}	21 {ca**}	- -	mg/kg	<0.043	<0.041 [<0.041]	<0.043	<0.040	<0.037	<0.040	<0.042	<0.044	<0.043	<0.043	<0.043 [<0.040]	<0.042	<0.041	<0.041	NA
Aroclor-1221	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.043	<0.041 [<0.041]	<0.043	<0.040	<0.037	<0.040	<0.042	<0.044	<0.043	<0.043	<0.043 [<0.040]	<0.042	<0.041	<0.041	NA
Aroclor-1232	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.043	<0.041 [<0.041]	<0.043	<0.040	<0.037	<0.040	<0.042	<0.044	<0.043	<0.043	<0.043 [<0.040]	<0.042	<0.041	<0.041	NA
Aroclor-1242	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.043	<0.041 [<0.041]	<0.043	<0.040	<0.037	<0.040	<0.042	<0.044	<0.043	<0.043	<0.043 [<0.040]	<0.042	<0.041	<0.041	NA
Aroclor-1248	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.043	<0.041 [<0.041]	<0.043	<0.040	<0.037	<0.040	<0.042	<0.044	<0.043	<0.043	<0.043 [<0.040]	<0.042	<0.041	<0.041	NA
Aroclor-1254	0.22 {ca**}	0.74 {ca*}	- -	mg/kg	<0.043	<0.041 [<0.041]	<0.043	<0.040	<0.037	<0.040	<0.042	<0.044	<0.043	<0.043	<0.043 [<0.040]	<0.042	<0.041	<0.041	NA
Aroclor-1260	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.043	<0.041 [<0.041]	<0.043	<0.040	<0.037	<0.040	<0.042	<0.044	<0.043	<0.043	<0.043 [<0.040]	<0.042	<0.041	<0.041	NA
Inorganics																			
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	29,800	17,500 [16,500]	31,700	23,600	13,200	19,600	31,900	31,000	**53,700**	31,600	23,800 [24,000]	38,200	29,200	26,700	24,200 [22,000]
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	<0.320	0.530 L [0.580 B]	<0.340	0.320 J	0.330 B	0.560 J	0.600 B	<0.340	0.950 B	1.10 B	0.390 B [0.650 B]	<0.600	0.520 B	0.410 B	0.520 B [<0.310 L]
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	12.9	4.50 [4.70]	12.6	9.80	5.30	8.70	12.7	5.90	10.1	10.3	9.90 [9.20]	12.8	8.00	8.70	10.3 [9.80]
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	43.0	90.0 [93.9]	20.6	31.0	35.1	33.6	39.6	58.6	181	95.6	27.0 [29.8]	28.7	62.0	88.1	32.8 [31.7]
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	**1.90**	**1.30 [1.20]**	**1.10**	0.890	0.550	0.810	**1.40**	**2.70**	**3.30**	**1.40**	0.880 [0.980]	0.890	**1.40**	**1.80**	0.990 [0.980]
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	<0.0340	0.0660 B [0.220 J]	<0.0370	<0.0330	<0.0290	<0.0310	<0.0350	<0.0360	0.0900 B	0.0740 B	<0.0300 [0.200 J]	<0.0640	0.240 B	0.300 J	0.140 J [0.0690 J]
Calcium	- -	- -	- -	mg/kg	3,840	3,860 [3,760 J]	1,060	1,220	1,460	1,020	1,310	1,800	5,180	7,160	733 [691 J]	1,490	5,150	14,700	2,280 [2,250]
Chromium	280 {ca}	1,460 {ca}	65.3	mg/kg	46.1 J	**102 J [33.3 J]**	49.4 J	43.9 J	21.5 J	33.2 J	44.8 J	**75.3 J**	**80.6 J**	57.3 J	35.6 J [34.6]	52.2	40.3	62.8	38.4 [36.9]
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	25.0	11.0 [11.4]	20.2	13.4	7.20	11.5	16.5	23.2	12.9	12.5	7.20 [9.10]	18.0	17.9	9.30	10.3 [10.8]
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	24.6	12.9 [12.7]	25.8	23.1	9.50	16.6	24.6	40.9	35.5	**258**	18.1 [18.2]	26.2	19.0	18.7	19.6 [19.2]
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	37,100	19,300 [17,900]	47,400	40,600	19,500	28,200	44,800	**52,100**	47,700	38,800	35,000 [33,200]	**51,500**	31,100	23,700	33,500 [32,700]
Lead	400 {++}	800 {++}	26.8	mg/kg	**35.5**	19.4 [19.7]	**27.2**	**59.6**	19.5	**29.1**	24.3	17.4	19.8	**163**	18.6 [21.8]	18.9	17.0	20.7	**33.3 [32.0]**
Magnesium	- -	- -	- -	mg/kg	3,490	5,340 [5,130]	1,190	1,260	583	865	1,350	3,270	38,500	7,490	758 [807]	1,010	3,880	16,500	1,720 K [1,800 K]
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	238	416 [430]	146	158	171	184	203	489	294	230	127 [176]	262	145	220	136 [136]
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	0.110 B	0.0320 B [0.0300 J]	0.110 B	0.0640 B	0.0410 B	0.0590 B	0.0860 B	0.0500 B	0.0330 B	0.0300 B	0.110 B [0.0570 J]	0.0450	0.0580	0.0650	0.0650 [0.0690]
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	27.1	20.4 [14.6]	22.7	16.4	8.00	13.3	26.8	38.2	47.5	26.7	16.1 [16.9]	21.1	23.0	23.7	16.6 [15.7]
Potassium	- -	- -	- -	mg/kg	1,600	929 K [925 K]	1,060	1,030	602	745	1,160	1,020	2,230	1,380	990 [1,020]	1,130	1,480	1,290	1,170 K [1,150 K]
Selenium	39 {nc}	510 {nc}	- -	mg/kg	<0.610	<0.560 [<0.600]	1.40 J	<0.590	<0.520	0.740 B	1.10 J	<0.670	<0.650	0.610 J	0.840 J [0.950 J]	<1.20	0.740 J	<0.600	0.830 J [1.10 J]
Silver	39 {nc}	510 {nc}	- -	mg/kg	<0.250	<0.110 [<0.120]	<0.140	<0.240	<0.110	<0.120	<0.130	<1.40 L	<0.130	<0.120	<0.110 [<0.120]	<0.120 L	<0.130 L	<0.120 L	<0.120 [<0.120]
Sodium	- -	- -	- -	mg/kg	47.9 B	58.1 B [81.8 B]	48.6 B	58.9 B	55.6 B	57.2 B	51.4 B	<33.8	77.6 B	99.8 B	53.9 B [88.4 B]	88.4 B	81.6 B	84.4 B	66.5 B [65.6 B]
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	<0.370	<0.340 [<0.370]	<0.410	<0.360	<0.320	<0.350	<0.390	<0.410	<0.400	<0.360	<0.340 [<0.350]	<0.710	<0.380	<0.360	<0.370 [<0.360]
Vanadium	55{nc}	720 {nc}	108	mg/kg	73.1	46.9 [39.3]	88.5	67.5	38.7	56.5	83.4	96.0	99.8	73.3	68.5 [64.5]	98.6	63.4	56.8	65.6 [64.0]
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	41.8	41.9 [44.0]	43.8	68.6	61.6	42.7	38.2	32.0	67.1	**315**	31.3 [30.6]	37.2	32.4	39.6	35.9 [33.2]
Miscellaneous																			
Percent Solids	- -	- -	- -	%	77	82 [82]	78	83	89	84	80	76	77	79	78 [84]	79	82	82	83 [84]

mg/kg	Milligrams per kilogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 9-15. Sediment Analytical Results, Western Burning Ground, 2004 Shaw Additional Characterization Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	WBGSD16 0 - 0.5 07/16/04	WBGSD17 0 - 0.5 07/22/04	WBGSD18 0 - 0.5 07/22/04	WBGSD19 0 - 0.5 07/22/04	WBGSD20 0 - 0.5 07/22/04	WBGSD21 0 - 0.5 07/22/04	WBGSD22 0 - 0.5 07/22/04	WBGSD23 0 - 0.5 09/14/04	WBGSD24 0 - 0.5 09/14/04	WBGSD25 0 - 0.5 09/14/04
PAHs														
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	<0.016 [<0.016]	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.016 [0.029]	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	<0.016 [<0.016]	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.078 [0.048]	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.078 J [0.16 J]	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	0.087 J [0.17 J]	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.17 [0.27]	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	0.054 J [0.095 J]	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	0.053 J [0.12 J]	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	0.099 J [0.17 J]	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	<0.016 [<0.016]	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	0.18 J [0.39 J]	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	<0.016 [0.026]	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	0.060 [0.096]	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	3.9 {ca}	20 {ca}	- -	mg/kg	<0.016 [<0.016]	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	0.074 J [0.22 J]	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	0.12 J [0.27 J]	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCBs														
Aroclor-1016	0.39 {nc}	21 {ca**}	- -	mg/kg	<0.079 [<0.082]	<0.083 L	<0.079	<0.081	<0.082 J	<0.083	<0.064	NA	NA	NA
Aroclor-1221	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.079 [<0.082]	<0.083 L	<0.079	<0.081	<0.082 J	<0.083	<0.064	NA	NA	NA
Aroclor-1232	0.17 {ca**}	0.62 {ca**}	- -	mg/kg	<0.079 [<0.082]	<0.083 L	<0.079	<0.081	<0.082 J	<0.083	<0.064	NA	NA	NA
Aroclor-1242	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.079 [<0.082]	<0.083 L	<0.079	<0.081	<0.082 J	<0.083	<0.064	NA	NA	NA
Aroclor-1248	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.079 [<0.082]	<0.083 L	<0.079	<0.081	<0.082 J	<0.083	<0.064	NA	NA	NA
Aroclor-1254	0.22 {ca**}	0.74 {ca*}	- -	mg/kg	<0.079 [<0.082]	<0.083 L	<0.079	<0.081	<0.082 J	<0.083	<0.064	NA	NA	NA
Aroclor-1260	0.22 {ca**}	0.74 {ca**}	- -	mg/kg	<0.079 [<0.082]	<0.083 L	<0.079	<0.081	<0.082 J	<0.083	<0.064	NA	NA	NA
Inorganics														
Aluminum	7,700 {nc}	990,000 {max}	40,041	mg/kg	19,300 [18,400]	30,900	23,800	25,400	20,100	18,800	14,400	28,500	20,000	19,300
Antimony	3.1 {nc}	41 {nc}	- -	mg/kg	<0.430 [<0.480]	<0.470	<0.490 L	0.750 B	0.690 B	<0.460	0.610 B	0.510 B	<0.470	<0.430
Arsenic	0.39 {ca*}	1.6 {ca}	15.8	mg/kg	9.60 [11.0]	8.50	5.50	6.10	4.50	4.20	9.60	9.90	5.40	5.40
Barium	1,500 {nc}	190,000 {max}	209	mg/kg	63.3 [59.5]	108	105	112	119	113	60.7	60.6	109	95.3
Beryllium	16 {nc}	200 {nc}	1.02	mg/kg	**1.10 J [1.20 J]**	**1.70**	**1.10**	**1.20**	0.900	0.840	0.920	**1.90**	**1.10**	**1.10**
Cadmium	7 {nc}	81 {nc}	0.69	mg/kg	<0.0450 [0.0900 J]	0.470 B	0.460 B	0.490 B	0.440 B	0.410 B	0.470 J	0.120 J	0.250 J	0.270 J
Calcium	- -	- -	- -	mg/kg	14,500 [24,000]	69,900	76,500	65,700	120,000	101,000	25,700	29,200	75,100	63,600
Chromium	280 {ca}	1,460 {ca}	65.3	mg/kg	42.7 [44.4]	**80.6**	45.6	37.8	33.0	43.1	**66.8**	54.7	34.2	31.4
Cobalt	2.3 {nc}	30 {nc}	72.3	mg/kg	17.2 [15.7]	13.8	7.80	8.10	6.40	6.50	8.10	17.4	7.90	7.30
Copper	310 {nc}	4,100 {nc}	53.5	mg/kg	19.3 [21.0]	24.5	19.1	19.2	15.6	15.1	12.0	21.6	17.9	17.9
Iron	5,500 {nc}	720,000 {max}	50,962	mg/kg	31,500 [35,700]	27,000	19,900	22,100	16,400	16,400	28,600	27,700	19,400	19,300
Lead	400 {++}	800 {++}	26.8	mg/kg	**45.5 [40.6]**	**523**	**207**	**95.0**	**134**	**276**	**112**	**152**	**79.8**	**37.6**
Magnesium	- -	- -	- -	mg/kg	4,200 J [9,140 J]	6,610	4,690	5,010	4,170	3,700	1,840	6,820	4,970	4,390
Manganese	180 {nc}	2,300 {nc}	2,543	mg/kg	1,700 [1,370]	241	156	157	191	158	163	91.1	143	129
Mercury	3.1 {sat}	3.1 {sat}	0.13	mg/kg	0.0410 J [0.0540]	0.0670	0.0520	0.0400	0.0330 J	0.0410 J	0.0360	0.0760	0.0550	0.0490 J
Nickel	160 {nc}	2,000 {nc}	62.8	mg/kg	17.0 [16.7]	22.7	16.4	16.5	13.2	12.2	10.9	24.0	14.6	14.2
Potassium	- -	- -	- -	mg/kg	1,140 [920]	1,860	1,210 K	1,250	1,060	975	698	2,120	1,290	973
Selenium	39 {nc}	510 {nc}	- -	mg/kg	<1.70 [<0.930]	<0.910	<0.940	<0.960	<1.00	<0.890	1.20 J	<0.820	<0.910	<0.840
Silver	39 {nc}	510 {nc}	- -	mg/kg	<0.340 [<0.190]	<0.190 L	<0.190 L	<0.200 L	<0.210 L	<0.180 L	<0.140 L	<0.170	<0.180	<0.170
Sodium	- -	- -	- -	mg/kg	123 B [179 B]	237 B	233 B	251 B	243 B	235 B	144 B	182 B	232 B	197 B
Thallium	0.51 {nc}	6.6 {nc}	2.11	mg/kg	<1.00 [<0.560]	<0.560	<0.570	<0.590	<0.620	<0.540	<0.430	<0.500	<0.550	<0.510
Vanadium	55{nc}	720 {nc}	108	mg/kg	52.8 [61.5]	55.5	41.5	43.3	35.5	33.8	57.4	56.2	38.1	37.2
Zinc	2,300 {nc}	310,000 {max}	202	mg/kg	63.1 [65.4]	165	118	96.3	93.7	121	59.3	59.9	82.2	71.3
Miscellaneous														
Percent Solids	- -	- -	- -	%	42 [41]	40	42	41	41	40	52	43	40	42

mg/kg	Milligrams per kilogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 9-16. Fish Tissue Analytical Results, Western Burning Ground, 2004 Shaw Additional Characterization Sampling, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Fish Type: Sample Type: Date Collected:	Units	WBGTS01 Bluegill Whole Body 07/21/04	WBGTS02 Bluegill Whole Body 07/21/04	WBGTS03 Bluegill Whole Body 07/21/04	WBGTS04 Bluegill Whole Body 07/21/04	WBGTS05 Bluegill Whole Body 07/21/04	WBGTS06 Bluegill Whole Body 07/21/04	WBGTS07 Bluegill Whole Body 07/21/04	WBGTS08 White Sucker Whole Body 07/21/04	WBGTS15 Bluegill Fillet 07/21/04	WBGTS16 Bluegill Fillet 07/21/04	WBGTS17 Bluegill Fillet 07/21/04	WBGTS18 Bluegill Fillet 07/21/04	WBGTS19 Bluegill Fillet 07/21/04	WBGTS20 Bluegill Fillet 07/21/04	WBGTS21 Bluegill Fillet 07/21/04	WBGTS22 Common Carp Fillet 07/21/04
PCBs																	
Aroclor-1016	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050 J	<0.050	<0.050	<0.050
Aroclor-1221	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050 J	<0.050	<0.050	<0.050
Aroclor-1232	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050 J	<0.050	<0.050	<0.050
Aroclor-1242	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050 J	<0.050	<0.050	<0.050
Aroclor-1248	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050 J	<0.050	<0.050	<0.050
Aroclor-1254	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050 J	<0.050	<0.050	<0.050
Aroclor-1260	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050 J	<0.050	<0.050	<0.050
Inorganics																	
Aluminum	mg/kg	19.7	24.9	11.3	<7.60	34.7	<7.50	50.7	14.9	<7.80	<7.50	<7.40	<7.40	<7.40	<7.40	<7.40	<7.40
Antimony	mg/kg	<0.700	<0.740	<0.750	<0.760	<0.730	<0.750	<0.740	<0.740	<0.780	<0.750	<0.740	<0.740	<0.740	<0.740	<0.740	<0.740
Arsenic	mg/kg	<0.700	<0.740	<0.750	<0.760	<0.730	<0.750	<0.740	<0.740	<0.780	<0.750	<0.740	<0.740	<0.740	<0.740	<0.740	<0.740
Barium	mg/kg	1.80	2.10	1.00	0.880	0.840	2.00	2.40	0.750	<0.190	0.240	0.250	1.00	0.290	0.380	0.340	<0.180
Beryllium	mg/kg	<0.0700	<0.0740	<0.0750	<0.0760	<0.0730	<0.0750	<0.0740	<0.0740	<0.0780	<0.0750	<0.0740	<0.0740	<0.0740	<0.0740	<0.0740	<0.0740
Cadmium	mg/kg	<0.210	<0.220	<0.220	<0.230	<0.220	<0.220	<0.220	<0.220	<0.230	<0.220	<0.220	<0.220	<0.220	<0.220	<0.220	<0.220
Calcium	mg/kg	8,940	14,300	9,360	9,970	7,390	10,700	6,280	5,490	688	2,180	1,790	8,720	1,650	2,840	1,130	604 L
Chromium	mg/kg	0.260	0.440	0.350	0.650	0.470	0.300	0.630	0.420	<0.190	<0.190	<0.190	0.240	<0.180	<0.190	<0.190	<0.180
Cobalt	mg/kg	<0.170	<0.190	<0.190	<0.190	<0.180	<0.190	<0.190	<0.190	<0.190	<0.190	<0.190	<0.180	<0.180	<0.190	<0.190	<0.180
Copper	mg/kg	0.560	0.470	<0.370	0.440	<0.360	0.450	0.470	0.800	<0.390	0.560	<0.370	<0.370	<0.370	<0.370	<0.370	0.520
Iron	mg/kg	44.8	60.4	38.9	30.1	70.6	24.0	74.2	31.2	<5.80	<5.60	<5.60	<5.50	<5.50	<5.60	<5.60	11.9
Lead	mg/kg	<0.350	<0.370	<0.370	<0.380	<0.360	<0.370	<0.370	<0.370	<0.390	<0.370	<0.370	<0.370	<0.370	<0.370	<0.370	<0.370
Magnesium	mg/kg	286	402	356	275	313	294	262	270	262	236	232	300	232	234	209	206
Manganese	mg/kg	2.30	3.50	1.70	1.40	1.00	2.70	2.00	0.800	<0.190	0.230	<0.190	0.760	<0.180	0.240	0.530	<0.180
Mercury	mg/kg	0.0370	0.0400	0.0710	0.0780	0.0470	0.0280	0.0280	0.0240	0.0560	0.0870	0.0300	0.0690	<0.0190	0.0500	0.0360	0.0870
Nickel	mg/kg	<0.350	<0.370	<0.370	<0.380	<0.360	<0.370	<0.370	<0.370	<0.390	<0.370	<0.370	<0.370	<0.370	<0.370	<0.370	<0.370
Potassium	mg/kg	2,600 J	2,590 J	2,650 J	2,720 J	2,750 J	2,640 J	2,670 J	2,870 J	3,170 J	2,840 J	2,990 J	2,600 J	2,900 J	2,770 J	2,850 J	2,790 J
Selenium	mg/kg	<0.700	<0.740	<0.750	<0.760	<0.730	<0.750	<0.740	<0.740	<0.780	<0.750	<0.740	<0.740	<0.740	<0.740	<0.740	<0.740
Silver	mg/kg	<0.100	<0.110	<0.110	<0.110	<0.110	<0.110	<0.110	<0.110	<0.120	<0.110	<0.110	<0.110	<0.110	<0.110	<0.110	<0.110
Sodium	mg/kg	1,140 J	1,060 J	1,190 J	1,100 J	962 J	962 J	1,010 J	717 J	693 J	902 J	858 J	1,070 J	869 J	764 J	792 J	418 J
Thallium	mg/kg	<1.00	<1.10	<1.10	<1.10	<1.10	<1.10	<1.10	<1.10	<1.20	<1.10	<1.10	<1.10	<1.10	<1.10	<1.10	<1.10
Vanadium	mg/kg	<0.350	<0.370	<0.370	<0.380	<0.360	<0.370	<0.370	<0.370	<0.390	<0.370	<0.370	<0.370	<0.370	<0.370	<0.370	<0.370
Zinc	mg/kg	15.3	25.1	20.0	17.2	16.8	13.7	12.5	10.7	9.10	11.5	9.30	13.5	9.00	11.2	8.60	6.90
Miscellaneous																	
Percent Lipids	%	0.71	0.72	0.87	0.7	0.82	3.6	3.2	6.1	0.05	0.07	0.67	0.04	0.48	0.11	0.36	6.4

mg/kg Milligrams per kilogram.

Table 9-17. Sediment Analytical Results, Western Burning Ground, 2008 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Sample Depth(Feet): Date Collected:	Adjusted Soil Screening Values-Residential [a]	Adjusted Soil Screening Values-Industrial [a]	Facility-Wide Background Values [b]	Units	WBG-SE001 0 - 1 07/30/08	WBG-SE002 0 - 1 07/30/08	WBG-SE003 0 - 1 07/30/08	WBG-SE004 0 - 1 07/30/08	WBG-SE005 0 - 0.5 07/31/08	WBG-SE006 0 - 0.5 07/31/08
Semivolatile Organics										
1-Methylnaphthalene	22 {ca*}	99 {ca*}	- -	mg/kg	NA	NA	NA	NA	<0.0074	0.0026 J
2-Methylnaphthalene	31 {nc}	440 {sat}	- -	mg/kg	NA	NA	NA	NA	<0.0074	0.0028 J
Acenaphthene	340 {nc}	3,300 {nc}	- -	mg/kg	NA	NA	NA	NA	<0.0074	0.014
Acenaphthylene	340 {nc}	3,300 {nc}	- -	mg/kg	NA	NA	NA	NA	<0.0074	<0.0046
Anthracene	1,700 {nc}	170,000 {max}	- -	mg/kg	NA	NA	NA	NA	<0.0074	0.025
Benzo(a)anthracene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	0.0055 J	0.042
Benzo(a)pyrene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	NA	NA	NA	NA	<0.0074	0.038
Benzo(b)fluoranthene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	0.0096	0.047
Benzo(g,h,i)perylene	170 {nc}	1,700 {nc}	- -	mg/kg	NA	NA	NA	NA	<0.0074	0.020
Benzo(k)fluoranthene	1.5 {ca**}	21 {ca**}	- -	mg/kg	NA	NA	NA	NA	0.0053 J	0.029
Chrysene	15 {ca**}	210 {ca**}	- -	mg/kg	NA	NA	NA	NA	0.0087 J	0.042 J
Dibenzo(a,h)anthracene	0.015 {ca**}	0.21 {ca**}	- -	mg/kg	NA	NA	NA	NA	<0.0074	0.0061
Fluoranthene	230 {nc}	2,200 {nc}	- -	mg/kg	NA	NA	NA	NA	0.015 J	0.11 J
Fluorene	230 {nc}	2,200 {nc}	- -	mg/kg	NA	NA	NA	NA	<0.0074	0.014
Indeno(1,2,3-cd)pyrene	0.15 {ca**}	2.1 {ca**}	- -	mg/kg	NA	NA	NA	NA	<0.0074 J	0.024 J
Naphthalene	3.9 {ca}	20 {ca}	- -	mg/kg	NA	NA	NA	NA	<0.0074	<0.0046
Phenanthrene	1,700 {nc}	170,000 {max}	- -	mg/kg	NA	NA	NA	NA	0.0067 J	0.087
Pyrene	170 {nc}	1,700 {nc}	- -	mg/kg	NA	NA	NA	NA	0.018	0.094
Inorganics										
Lead	400 {++}	800 {++}	26.8	mg/kg	**1,550**	**500**	**1,070**	**255 [212]**	NA	NA

mg/kg	Milligrams per kilogram.
[a]	USEPA Regional Screening Levels (USEPA 2008a).
[b]	Inorganics facility-wide background value taken from Facility-Wide Background Study Report, IT Corporation, 2001.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{++}	The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
{max}	Concentration may exceed ceiling limit.
{sat}	Screening level may exceed saturation concentration.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted soil RSL (Residential).
10.6 J	Highlighted value indicates constituent concentration is above adjusted soil RSL (Industrial).
16	Bolded inorganics constituent concentration indicates concentration is above facility-wide background value.

Table 9-18. Surface Water Analytical Results, Western Burning Ground, 2008 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Date Collected:	Tapwater Screening Values [a]	Units	WBG-SW002 07/30/08	WBG-SW003 07/30/08	WBG-SW004 07/30/08	WBG-SW005 07/31/08	WBG-SW006 07/31/08
Semivolatile Organics							
1-Methylnaphthalene	2.3 {ca}	µg/L	NA	NA	NA	0.026 J	<0.047
2-Methylnaphthalene	150 {nc}	µg/L	NA	NA	NA	0.033 J	<0.047
Acenaphthene	2,200 {nc}	µg/L	NA	NA	NA	0.040 J	<0.047
Acenaphthylene	- -	µg/L	NA	NA	NA	<0.050	<0.047
Anthracene	11,000 {nc}	µg/L	NA	NA	NA	0.030 J	<0.047
Benzo(a)anthracene	0.029 {ca**}	µg/L	NA	NA	NA	<0.050	<0.047
Benzo(a)pyrene	0.0029 {ca**}	µg/L	NA	NA	NA	<0.050	<0.047
Benzo(b)fluoranthene	0.029 {ca**}	µg/L	NA	NA	NA	<0.050	<0.047
Benzo(g,h,i)perylene	- -	µg/L	NA	NA	NA	<0.050	<0.047
Benzo(k)fluoranthene	0.29 {ca**}	µg/L	NA	NA	NA	<0.050	<0.047
Chrysene	2.9 {ca**}	µg/L	NA	NA	NA	<0.050	<0.047
Dibenzo(a,h)anthracene	0.0029 {ca**}	µg/L	NA	NA	NA	<0.050	<0.047
Fluoranthene	1,500 {nc}	µg/L	NA	NA	NA	<0.050	<0.047
Fluorene	1,500 {nc}	µg/L	NA	NA	NA	0.034 J	<0.047
Indeno(1,2,3-cd)pyrene	0.029 {ca**}	µg/L	NA	NA	NA	<0.050 J	<0.047 J
Naphthalene	6.2 {nc}	µg/L	NA	NA	NA	<0.050	<0.047
Phenanthrene	- -	µg/L	NA	NA	NA	0.050	0.018 J
Pyrene	1,100 {nc}	µg/L	NA	NA	NA	<0.050	<0.047
Inorganics							
Lead	15 {nc}	µg/L	20.5	47.5	106	NA	NA

µg/L	Micrograms per liter.
[a]	USEPA Regional Screening Levels (USEPA 2008a). Adjusted tap-water screening levels used to assess surface water at the NRU.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample
24,400	Highlighted value indicates constituent concentration is above adjusted tap water RSL.

Table 9-19
Soil Risk Assessment Dataset
Surface Soil (0-1 foot Depth Interval)
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Volatile Organic Compounds												
Acetone	67-64-1	3	-	18	17	0.004	-	0.07	0.0046	-	0.0064	WBGSB10
Carbon Disulfide	75-15-0	1	-	18	6	0.0008	-	0.0008	0.0045	-	0.0064	SS-04
d-Limonene	5989-27-5	1	-	1	100	0.17	-	0.17	–	-	–	WBGSB23
Methylene Chloride	75-09-2	5	-	18	28	0.002	-	0.003	0.001	-	0.0055	SS-04,SS-04a,WBGSB2,WBGSB4
p-Isopropyltoluene	99-87-6	1	-	11	9	0.0048	-	0.0048	0.001	-	0.0011	WBGSB8
Toluene	108-88-3	2	-	15	13	0.00032	-	0.0011	0.001	-	0.0051	WBGSB23
Semi-Volatile Organic Compounds												
bis(2-Ethylhexyl)phthalate	117-81-7	9	-	29	31	0.04	-	0.67	0.07	-	0.4	WBGSB25
Carbazole	86-74-8	3	-	26	12	0.038	-	0.1	0.05	-	0.4	WBGSB24
Dibenzofuran	132-64-9	2	-	26	8	0.011	-	0.014	0.06	-	0.4	WBGSB25
Di-n-Butylphthalate	84-74-2	7	-	29	24	0.04	-	0.13	0.03	-	0.4	WBGSB11
Di-n-Octylphthalate	117-84-0	1	-	24	4	0.016	-	0.016	0.02	-	0.4	WBGSB23
N-Nitrosodiphenylamine	86-30-6	1	-	26	4	0.06	-	0.06	0.01	-	0.4	WBGSB3
Dioxin/Furan Compounds												
1,2,3,4,6,7,8-HpCDD	35822-46-9	8	-	8	100	1.374E-05	-	0.000157	–	-	–	WBGSB25
1,2,3,4,6,7,8-HpCDF	67562-39-4	8	-	8	100	0.000001	-	3.1E-05	–	-	–	WBGSB25
1,2,3,4,7,8,9-HpCDF	55673-89-7	3	-	5	60	2.3E-07	-	2.05E-06	0.00000005	-	0.00000007	WBGSB25
1,2,3,4,7,8-HxCDD	39227-28-6	5	-	5	100	2.8E-07	-	3.33E-06	–	-	–	WBGSB25
1,2,3,4,7,8-HxCDF	70648-26-9	6	-	8	75	1.9E-07	-	5.64E-06	–	-	–	WBGSB25
1,2,3,6,7,8-HxCDD	57653-85-7	7	-	8	88	3.7E-07	-	6.61E-06	–	-	–	WBGSB25
1,2,3,6,7,8-HxCDF	57117-44-9	5	-	5	100	1.8E-07	-	5.08E-06	–	-	–	WBGSB25
1,2,3,7,8,9-HxCDD	19408-74-3	6	-	8	75	5.67E-07	-	8.34E-06	–	-	–	WBGSB25
1,2,3,7,8,9-HxCDF	72918-21-9	1	-	5	20	4.5E-07	-	4.5E-07	0.00000003	-	0.0000005	WBGSB25
1,2,3,7,8-PeCDD	40321-76-4	3	-	5	60	0.0000002	-	1.73E-06	0.0000001	-	0.00000011	WBGSB25
1,2,3,7,8-PeCDF	57117-41-6	3	-	5	60	0.0000001	-	1.24E-06	0.00000007	-	0.00000008	WBGTP12S
2,3,4,6,7,8-HxCDF	60851-34-5	4	-	5	80	1.4E-07	-	2.38E-06	0.00000006	-	0.00000006	WBGSB25
2,3,4,7,8-PeCDF	57117-31-4	3	-	5	60	1.3E-07	-	1.72E-06	0.00000008	-	0.00000009	WBGTP12S
2,3,7,8-TCDD	1746-01-6	4	-	5	80	3.2E-07	-	1.51E-06	0.00000006	-	0.00000006	WBGSB23
2,3,7,8-TCDF	51207-31-9	2	-	5	40	0.0000017	-	1.84E-06	0.00000006	-	0.00000021	WBGTP12S
OCDD	3268-87-9	8	-	8	100	0.0005143	-	0.0083	–	-	–	WBGTP12S
OCDF	39001-02-0	8	-	8	100	2.011E-06	-	5.86E-05	–	-	–	WBGSB25
Explosives												
Pentaerythritol Tetranitrate	78-11-5	1	-	9	11	0.11	-	0.11	0.3	-	1.2	WBGSB24

Table 9-19
Soil Risk Assessment Dataset
Surface Soil (0-1 foot Depth Interval)
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Herbicides												
2,4,5-TP	93-72-1	1	-	4	25	0.0078	-	0.0078	0.0101	-	0.0102	WBGSB25
2,4-D	94-75-7	2	-	4	50	0.0107	-	0.0302	0.0201	-	0.0202	WBGSB25
Dalapon	75-99-0	3	-	4	75	0.0223	-	0.163	1.01	-	1.01	WBGSB24
MCPP	93-65-2	1	-	4	25	2.56	-	2.56	10.1	-	101	WBGSB23
Pesticides												
4,4'-DDD	72-54-8	1	-	4	25	0.0019	-	0.0019	0.0067	-	0.00681	WBGSB25
Dieldrin	60-57-1	1	-	4	25	0.00472	-	0.00472	0.0067	-	0.00676	WBGSB24
Polycyclic Aromatic Hydrocarbons												
2-Methylnaphthalene	91-57-6	5	-	29	17	0.0016	-	0.023	0.0091	-	0.4	WBGSB25
Acenaphthene	83-32-9	3	-	29	10	0.025	-	0.32	0.0017	-	0.4	WBGSB9
Acenaphthylene	208-96-8	1	-	29	3	0.0039	-	0.0039	0.0017	-	0.4	WBGSB25
Anthracene	120-12-7	6	-	29	21	0.00037	-	0.1	0.0017	-	0.4	WBGSB25
Benzo(a)anthracene	56-55-3	9	-	29	31	0.0019	-	0.97	0.01	-	0.4	WBGSB25
Benzo(a)pyrene	50-32-8	9	-	29	31	0.0017	-	1.1	0.01	-	0.4	WBGSB25
Benzo(b)fluoranthene	205-99-2	10	-	29	34	0.0034	-	1.8	0.02	-	0.4	WBGSB25
Benzo(g,h,i)perylene	191-24-2	9	-	29	31	0.0017	-	0.96	0.01	-	0.4	WBGSB25
Benzo(k)fluoranthene	207-08-9	9	-	29	31	0.001	-	0.53	0.02	-	0.4	WBGSB25
Chrysene	218-01-9	10	-	29	34	0.0018	-	0.99	0.02	-	0.4	WBGSB25
Dibenzo(a,h)anthracene	53-70-3	4	-	27	15	0.0026	-	0.22	0.0017	-	0.4	WBGSB25
Fluoranthene	206-44-0	9	-	29	31	0.0031	-	1.6	0.01	-	0.4	WBGSB25
Fluorene	86-73-7	3	-	29	10	0.00094	-	0.028	0.0017	-	0.4	WBGSB24
Indeno(1,2,3-cd)pyrene	193-39-5	9	-	29	31	0.0018	-	1.1	0.01	-	0.4	WBGSB25
Naphthalene	91-20-3	5	-	29	17	0.00087	-	0.018	0.0072	-	0.4	WBGSB25
Phenanthrene	85-01-8	9	-	29	31	0.002	-	0.69	0.01	-	0.4	WBGSB25
Pyrene	129-00-0	10	-	29	34	0.0028	-	1.6	0.01	-	0.4	WBGSB25
Polychlorinated Biphenyls												
Aroclor 1254	11097-69-1	2	-	28	7	0.047	-	0.084	0.03	-	0.05	SS-04
Inorganics												
Aluminum	7429-90-5	56	-	56	100	8570	-	40000	–	-	–	WBGSB29
Antimony	7440-36-0	26	-	53	49	0.29	-	5.3	0.3	-	0.64	WBGSB3
Arsenic	7440-38-2	56	-	56	100	4.5	-	37.9	–	-	–	WBGSB4
Barium	7440-39-3	56	-	56	100	11.5	-	610	–	-	–	WBGSB3
Beryllium	7440-41-7	56	-	56	100	0.23	-	3.4	–	-	–	WBGTP16A
Cadmium	7440-43-9	25	-	53	47	0.066	-	2.7	0.01	-	0.13	WBGSB3
Calcium	7440-70-2	56	-	56	100	533	-	97300	–	-	–	WBGSB2
Chromium	7440-47-3	56	-	56	100	22	-	249	–	-	–	WBGSB3
Cobalt	7440-48-4	56	-	56	100	4.8	-	31.4	–	-	–	WBGSB16
Copper	7440-50-8	56	-	56	100	10.4	-	1340	–	-	–	WBGSB3
Iron	7439-89-6	56	-	56	100	17600	-	54000	–	-	–	WBGSB8

Table 9-19
Soil Risk Assessment Dataset
Surface Soil (0-1 foot Depth Interval)
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)		Detects Max (mg/kg)	Detection Limits Min (mg/kg)		Detection Limits Max (mg/kg)	Maximum Location
Lead	7439-92-1	56	-	56	100	11.6	-	3990	–	-	–	WBGSB3
Magnesium	7439-95-4	56	-	56	100	319	-	23200	–	-	–	WBGSB3
Manganese	7439-96-5	56	-	56	100	45.7	-	911	–	-	–	WBGTP16A
Mercury	7439-97-6	31	-	53	58	0.03	-	0.24	0.1	-	0.13	WBGTP16A
Nickel	7440-02-0	56	-	56	100	5.3	-	37	–	-	–	WBGTP16A
Potassium	7440-09-7	56	-	56	100	431	-	2910	–	-	–	WBGSB29
Selenium	7782-49-2	17	-	53	32	0.5	-	1.2	0.49	-	0.74	WBGSB11
Silver	7440-22-4	16	-	53	30	0.13	-	2.2	0.11	-	1.02	WBGSB19
Sodium	7440-23-5	53	-	53	100	10.5	-	384	–	-	–	WBGSB3
Thallium	7440-28-0	6	-	53	11	0.17	-	0.86	0.23	-	0.89	WBGSB3
Vanadium	7440-62-2	56	-	56	100	33.5	-	90.7	–	-	–	WBGSB8
Zinc	7440-66-6	56	-	56	100	15.2	-	3250	–	-	–	WBGSB3

Notes:

– =	Not detected/ not analyzed/ not applicable.	PAH =	Polycyclic Aromatic Hydrocarbon.
CASN =	Chemical abstracts registry number.	USEPA =	United States Environmental Protection Agency.
mg/kg =	Milligrams per kilogram.	VOC =	Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.

[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table 9-20
Soil Risk Assessment Dataset
Surface Soil (0-2 foot Depth Interval)
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects /	number of samples	FOD %	Detects Min (mg/kg)	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	Detection Limits Max (mg/kg)	Maximum Location
Volatile Organic Compounds									
Acetone	67-64-1	3	18	17	0.004	0.07	0.0046	0.0064	WBGSB10
Carbon Disulfide	75-15-0	1	18	6	0.0008	0.0008	0.0045	0.0064	SS-04
d-Limonene	5989-27-5	1	1	100	0.17	0.17	–	–	WBGSB23
Methylene Chloride	75-09-2	5	18	28	0.002	0.003	0.001	0.0055	S-04a,WBGSB2,
p-Isopropyltoluene	99-87-6	1	11	9	0.0048	0.0048	0.001	0.0011	WBGSB8
Toluene	108-88-3	2	15	13	0.00032	0.0011	0.001	0.0051	WBGSB23
Semi-Volatile Organic Compounds									
bis(2-Ethylhexyl)phthalate	117-81-7	10	42	24	0.04	0.67	0.07	0.49	WBGSB25
Carbazole	86-74-8	3	39	8	0.038	0.1	0.05	0.49	WBGSB24
Dibenzofuran	132-64-9	2	39	5	0.011	0.014	0.06	0.49	WBGSB25
Di-n-Butylphthalate	84-74-2	10	42	24	0.04	0.21	0.03	0.49	WBGTP1SB
Di-n-Octylphthalate	117-84-0	1	37	3	0.016	0.016	0.01	0.49	WBGSB23
N-Nitrosodiphenylamine	86-30-6	1	39	3	0.06	0.06	0.01	0.49	WBGSB3
Dioxin/Furan Compounds									
1,2,3,4,6,7,8-HpCDD	35822-46-9	9	9	100	1.374E-05	0.000157	–	–	WBGSB25
1,2,3,4,6,7,8-HpCDF	67562-39-4	9	9	100	4.4E-07	3.1E-05	–	–	WBGSB25
1,2,3,4,7,8,9-HpCDF	55673-89-7	3	6	50	2.3E-07	2.05E-06	0.00000005	0.00000011	WBGSB25
1,2,3,4,7,8-HxCDD	39227-28-6	6	6	100	2.8E-07	3.33E-06	–	–	WBGSB25
1,2,3,4,7,8-HxCDF	70648-26-9	7	9	78	1.3E-07	5.64E-06	–	–	WBGSB25
1,2,3,6,7,8-HxCDD	57653-85-7	8	9	89	3.7E-07	6.61E-06	–	–	WBGSB25
1,2,3,6,7,8-HxCDF	57117-44-9	6	6	100	9E-08	5.08E-06	–	–	WBGSB25
1,2,3,7,8,9-HxCDD	19408-74-3	7	9	78	5.67E-07	8.34E-06	–	–	WBGSB25
1,2,3,7,8,9-HxCDF	72918-21-9	1	6	17	4.5E-07	4.5E-07	0.00000003	0.0000005	WBGSB25
1,2,3,7,8-PeCDD	40321-76-4	4	6	67	0.0000002	1.73E-06	0.0000001	0.00000011	WBGSB25
1,2,3,7,8-PeCDF	57117-41-6	4	6	67	0.0000001	1.24E-06	0.00000007	0.00000008	WBGTP12S
2,3,4,6,7,8-HxCDF	60851-34-5	5	6	83	0.0000001	2.38E-06	0.00000006	0.00000006	WBGSB25
2,3,4,7,8-PeCDF	57117-31-4	4	6	67	1.3E-07	1.72E-06	0.00000008	0.00000009	WBGTP12S
2,3,7,8-TCDD	1746-01-6	5	6	83	3.2E-07	1.51E-06	0.00000006	0.00000006	WBGSB23
2,3,7,8-TCDF	51207-31-9	3	6	50	1.2E-07	1.84E-06	0.00000006	0.00000021	WBGTP12S
OCDD	3268-87-9	9	9	100	0.0005143	0.0083	–	–	WBGTP12S
OCDF	39001-02-0	9	9	100	1.25E-06	5.86E-05	–	–	WBGSB25
Explosives									
Pentaerythritol Tetranitrate	78-11-5	1	9	11	0.11	0.11	0.3	1.2	WBGSB24
Herbicides									
2,4,5-TP	93-72-1	1	4	25	0.0078	0.0078	0.0101	0.0102	WBGSB25
2,4-D	94-75-7	2	4	50	0.0107	0.0302	0.0201	0.0202	WBGSB25
Dalapon	75-99-0	3	4	75	0.0223	0.163	1.01	1.01	WBGSB24

Table 9-20
Soil Risk Assessment Dataset
Surface Soil (0-2 foot Depth Interval)
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
MCPP	93-65-2	1	-	4	25	2.56	-	2.56	10.1	-	101	WBGSB23
Pesticides												
4,4'-DDD	72-54-8	1	-	4	25	0.0019	-	0.0019	0.0067	-	0.00681	WBGSB25
Dieldrin	60-57-1	1	-	4	25	0.00472	-	0.00472	0.0067	-	0.00676	WBGSB24
Polycyclic Aromatic Hydrocarbons												
2-Methylnaphthalene	91-57-6	5	-	42	12	0.0016	-	0.023	0.0091	-	0.49	WBGSB25
Acenaphthene	83-32-9	3	-	42	7	0.025	-	0.32	0.0017	-	0.49	WBGSB9
Acenaphthylene	208-96-8	1	-	42	2	0.0039	-	0.0039	0.0017	-	0.49	WBGSB25
Anthracene	120-12-7	6	-	42	14	0.00037	-	0.1	0.0017	-	0.49	WBGSB25
Benzo(a)anthracene	56-55-3	9	-	42	21	0.0019	-	0.97	0.01	-	0.49	WBGSB25
Benzo(a)pyrene	50-32-8	9	-	42	21	0.0017	-	1.1	0.01	-	0.49	WBGSB25
Benzo(b)fluoranthene	205-99-2	10	-	42	24	0.0034	-	1.8	0.02	-	0.49	WBGSB25
Benzo(g,h,i)perylene	191-24-2	10	-	42	24	0.0017	-	0.96	0.0097	-	0.49	WBGSB25
Benzo(k)fluoranthene	207-08-9	9	-	42	21	0.001	-	0.53	0.02	-	0.49	WBGSB25
Chrysene	218-01-9	10	-	42	24	0.0018	-	0.99	0.02	-	0.49	WBGSB25
Dibenzo(a,h)anthracene	53-70-3	4	-	40	10	0.0026	-	0.22	0.0017	-	0.49	WBGSB25
Fluoranthene	206-44-0	9	-	42	21	0.0031	-	1.6	0.01	-	0.49	WBGSB25
Fluorene	86-73-7	3	-	42	7	0.00094	-	0.028	0.0017	-	0.49	WBGSB24
Indeno(1,2,3-cd)pyrene	193-39-5	9	-	42	21	0.0018	-	1.1	0.01	-	0.49	WBGSB25
Naphthalene	91-20-3	5	-	42	12	0.00087	-	0.018	0.007	-	0.49	WBGSB25
Phenanthrene	85-01-8	9	-	42	21	0.002	-	0.69	0.01	-	0.49	WBGSB25
Pyrene	129-00-0	10	-	42	24	0.0028	-	1.6	0.01	-	0.49	WBGSB25
Polychlorinated Biphenyls												
Aroclor 1254	11097-69-1	2	-	30	7	0.047	-	0.084	0.03	-	0.05	SS-04
Inorganics												
Aluminum	7429-90-5	71	-	71	100	8270	-	40000	–	-	–	WBGSB29
Antimony	7440-36-0	34	-	68	50	0.29	-	5.3	0.3	-	0.64	WBGSB3
Arsenic	7440-38-2	71	-	71	100	3.8	-	37.9	–	-	–	WBGSB4
Barium	7440-39-3	71	-	71	100	11.5	-	610	–	-	–	WBGSB3
Beryllium	7440-41-7	71	-	71	100	0.23	-	3.9	–	-	–	WBGTP18A
Cadmium	7440-43-9	27	-	68	40	0.066	-	2.7	0.01	-	0.16	WBGSB3
Calcium	7440-70-2	71	-	71	100	533	-	97300	–	-	–	WBGSB2
Chromium	7440-47-3	71	-	71	100	21.5	-	249	–	-	–	WBGSB3
Cobalt	7440-48-4	71	-	71	100	2.2	-	31.4	–	-	–	WBGSB16
Copper	7440-50-8	71	-	71	100	9.5	-	1340	–	-	–	WBGSB3
Iron	7439-89-6	71	-	71	100	17100	-	54000	–	-	–	WBGSB8
Lead	7439-92-1	71	-	71	100	11.5	-	3990	–	-	–	WBGSB3
Magnesium	7439-95-4	71	-	71	100	319	-	23200	–	-	–	WBGSB3
Manganese	7439-96-5	71	-	71	100	44.2	-	911	–	-	–	WBGTP16A
Mercury	7439-97-6	35	-	68	51	0.03	-	0.24	0.1	-	0.16	WBGTP16A

Table 9-20
Soil Risk Assessment Dataset
Surface Soil (0-2 foot Depth Interval)
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b]				Detects			Detection Limits			Maximum Location
		number of detects / number of samples			FOD %	Min (mg/kg)	-	Max (mg/kg)	Min (mg/kg)	-	Max (mg/kg)	
Nickel	7440-02-0	71	-	71	100	2.3	-	37.3	–	-	–	WBGTP18A
Potassium	7440-09-7	71	-	71	100	335	-	3340	–	-	–	WBGTP14B
Selenium	7782-49-2	19	-	68	28	0.5	-	1.2	0.45	-	0.8	WBGSB11
Silver	7440-22-4	22	-	68	32	0.13	-	2.2	0.11	-	1.02	WBGSB19
Sodium	7440-23-5	68	-	68	100	10.5	-	384	–	-	–	WBGSB3
Thallium	7440-28-0	7	-	68	10	0.17	-	1.2	0.23	-	1.1	WBGTP3S
Vanadium	7440-62-2	71	-	71	100	33.5	-	99.4	–	-	–	WBGTP18A
Zinc	7440-66-6	71	-	71	100	15.2	-	3250	–	-	–	WBGSB3

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilogram.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.

[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table 9-21
Soil Risk Assessment Dataset
Combined Surface and Subsurface Soil
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Volatile Organic Compounds												
Acetone	67-64-1	3	-	29	10	0.004	-	0.07	0.0046	-	0.0072	WBGSB10
Carbon Disulfide	75-15-0	3	-	29	10	0.00039	-	0.0008	0.0045	-	0.0072	SS-04
d-Limonene	5989-27-5	1	-	1	100	0.17	-	0.17	–	-	–	WBGSB23
Methylene Chloride	75-09-2	5	-	29	17	0.002	-	0.003	0.001	-	0.0072	SS-04,SS-04a,WBGSB2,WBGSB4
p-Isopropyltoluene	99-87-6	1	-	14	7	0.0048	-	0.0048	0.001	-	0.0011	WBGSB8
Toluene	108-88-3	2	-	26	8	0.00032	-	0.0011	0.001	-	0.0072	WBGSB23
Semi-Volatile Organic Compounds												
bis(2-Ethylhexyl)phthalate	117-81-7	11	-	81	14	0.04	-	0.83	0.07	-	0.49	WBGSB22
Butylbenzylphthalate	85-68-7	1	-	78	1	0.16	-	0.16	0.01	-	0.49	WBGSB22
Carbazole	86-74-8	4	-	78	5	0.023	-	0.1	0.05	-	0.49	WBGSB24
Dibenzofuran	132-64-9	3	-	78	4	0.01	-	0.014	0.06	-	0.49	WBGSB25
Di-n-Butylphthalate	84-74-2	15	-	81	19	0.04	-	0.42	0.03	-	0.49	WBGTP2A
Di-n-Octylphthalate	117-84-0	1	-	76	1	0.016	-	0.016	0.01	-	0.49	WBGSB23
N-Nitrosodiphenylamine	86-30-6	1	-	78	1	0.06	-	0.06	0.01	-	0.49	WBGSB3
Dioxin/Furan Compounds												
1,2,3,4,6,7,8-HpCDD	35822-46-9	22	-	22	100	0.00000124	-	0.000243	–	-	–	WBGTP2B
1,2,3,4,6,7,8-HpCDF	67562-39-4	18	-	22	82	0.00000016	-	3.587E-05	9E-08	-	1.6E-07	WBGSB22
1,2,3,4,7,8,9-HpCDF	55673-89-7	8	-	19	42	0.00000011	-	4.05E-06	3E-08	-	2.1E-07	WBGSB22
1,2,3,4,7,8-HxCDD	39227-28-6	13	-	19	68	0.00000026	-	7.23E-06	7E-08	-	2.7E-07	WBGTP2B
1,2,3,4,7,8-HxCDF	70648-26-9	13	-	22	59	0.00000013	-	0.0000183	3E-08	-	1.2E-07	WBGSB22
1,2,3,6,7,8-HxCDD	57653-85-7	15	-	22	68	0.00000037	-	0.000023	5E-08	-	2.1E-07	WBGTP2B
1,2,3,6,7,8-HxCDF	57117-44-9	12	-	19	63	0.00000009	-	8.49E-06	3E-08	-	1.2E-07	WBGSB22
1,2,3,7,8,9-HxCDD	19408-74-3	16	-	22	73	0.00000031	-	2.096E-05	1.6E-07	-	2.1E-07	WBGSB22
1,2,3,7,8,9-HxCDF	72918-21-9	4	-	19	21	0.00000045	-	1.82E-06	3E-08	-	0.0000005	WBGSB22
1,2,3,7,8-PeCDD	40321-76-4	11	-	19	58	0.0000002	-	6.85E-06	6E-08	-	1.7E-07	WBGTP2B
1,2,3,7,8-PeCDF	57117-41-6	10	-	19	53	0.00000009	-	4.16E-06	4E-08	-	0.0000001	WBGSB22
2,3,4,6,7,8-HxCDF	60851-34-5	11	-	19	58	0.0000001	-	5.28E-06	4E-08	-	1.4E-07	WBGSB22
2,3,4,7,8-PeCDF	57117-31-4	10	-	19	53	0.00000013	-	6.41E-06	4E-08	-	1.1E-07	WBGSB22
2,3,7,8-TCDD	1746-01-6	11	-	19	58	0.00000024	-	4.17E-06	5E-08	-	1.7E-07	WBGTP7A
2,3,7,8-TCDF	51207-31-9	9	-	19	47	0.00000008	-	1.035E-05	3E-08	-	2.1E-07	WBGSB22
OCDD	3268-87-9	22	-	22	100	0.00005723	-	0.0083	–	-	–	WBGTP12S
OCDF	39001-02-0	21	-	22	95	0.00000054	-	5.862E-05	3.9E-07	-	3.9E-07	WBGSB25
Explosives												
Pentaerythritol Tetranitrate	78-11-5	1	-	20	5	0.11	-	0.11	0.3	-	1.3	WBGSB24
Herbicides												
2,4,5-TP	93-72-1	1	-	4	25	0.0078	-	0.0078	0.0101	-	0.0102	WBGSB25
2,4-D	94-75-7	2	-	4	50	0.0107	-	0.0302	0.0201	-	0.0202	WBGSB25

Table 9-21
Soil Risk Assessment Dataset
Combined Surface and Subsurface Soil
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Dalapon	75-99-0	3	-	4	75	0.0223	-	0.163	1.01	-	1.01	WBGSB24
MCPP	93-65-2	1	-	4	25	2.56	-	2.56	10.1	-	101	WBGSB23
Pesticides												
4,4'-DDD	72-54-8	1	-	4	25	0.0019	-	0.0019	0.0067	-	0.00681	WBGSB25
Dieldrin	60-57-1	1	-	4	25	0.00472	-	0.00472	0.0067	-	0.00676	WBGSB24
Polycyclic Aromatic Hydrocarbons												
2-Methylnaphthalene	91-57-6	10	-	81	12	0.001	-	0.023	0.002	-	0.49	WBGSB25
Acenaphthene	83-32-9	7	-	81	9	0.0019	-	0.32	0.0017	-	0.49	WBGSB9
Acenaphthylene	208-96-8	5	-	81	6	0.0016	-	0.0039	0.0017	-	0.49	WBGSB25
Anthracene	120-12-7	9	-	81	11	0.00037	-	0.1	0.0017	-	0.49	WBGSB25
Benzo(a)anthracene	56-55-3	12	-	81	15	0.0019	-	0.97	0.002	-	0.49	WBGSB25
Benzo(a)pyrene	50-32-8	14	-	81	17	0.0017	-	1.1	0.002	-	0.49	WBGSB25
Benzo(b)fluoranthene	205-99-2	15	-	81	19	0.0034	-	1.8	0.002	-	0.49	WBGSB25
Benzo(g,h,i)perylene	191-24-2	16	-	81	20	0.0017	-	0.96	0.002	-	0.49	WBGSB25
Benzo(k)fluoranthene	207-08-9	15	-	81	19	0.001	-	0.53	0.002	-	0.49	WBGSB25
Chrysene	218-01-9	15	-	81	19	0.0018	-	0.99	0.002	-	0.49	WBGSB25
Dibenzo(a,h)anthracene	53-70-3	7	-	79	9	0.0013	-	0.22	0.0017	-	0.49	WBGSB25
Fluoranthene	206-44-0	15	-	81	19	0.00096	-	1.6	0.002	-	0.49	WBGSB25
Fluorene	86-73-7	7	-	81	9	0.00094	-	0.028	0.0017	-	0.49	WBGSB24
Indeno(1,2,3-cd)pyrene	193-39-5	12	-	81	15	0.0018	-	1.1	0.002	-	0.49	WBGSB25
Naphthalene	91-20-3	10	-	81	12	0.00087	-	0.018	0.002	-	0.49	WBGSB25
Phenanthrene	85-01-8	14	-	81	17	0.0016	-	0.69	0.002	-	0.49	WBGSB25
Pyrene	129-00-0	14	-	81	17	0.0012	-	1.6	0.002	-	0.49	WBGSB25
Polychlorinated Biphenyls												
Aroclor 1254	11097-69-1	3	-	46	7	0.047	-	0.87	0.03	-	0.05	WBGSB22
Inorganics												
Aluminum	7429-90-5	124	-	124	100	5760	-	53700	–	-	–	WBGSB47
Antimony	7440-36-0	47	-	121	39	0.27	-	5.3	0.3	-	0.71	WBGSB3
Arsenic	7440-38-2	124	-	124	100	1.7	-	37.9	–	-	–	WBGSB4
Barium	7440-39-3	124	-	124	100	11.5	-	610	–	-	–	WBGSB3
Beryllium	7440-41-7	120	-	124	97	0.12	-	3.9	0.11	-	0.59	WBGTP18A
Cadmium	7440-43-9	38	-	121	31	0.066	-	2.95	0.01	-	0.16	WBGSB22
Calcium	7440-70-2	124	-	124	100	533	-	97300	–	-	–	WBGSB2
Chromium	7440-47-3	124	-	124	100	12.5	-	256	–	-	–	WBGSB22
Cobalt	7440-48-4	124	-	124	100	1.4	-	31.4	–	-	–	WBGSB16
Copper	7440-50-8	124	-	124	100	4.37	-	1340	–	-	–	WBGSB3
Iron	7439-89-6	124	-	124	100	13400	-	61800	–	-	–	WBGSB22
Lead	7439-92-1	124	-	124	100	7.9	-	3990	–	-	–	WBGSB3
Magnesium	7439-95-4	124	-	124	100	319	-	58900	–	-	–	WBGSB2

Table 9-21
Soil Risk Assessment Dataset
Combined Surface and Subsurface Soil
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Max (mg/kg)	Detection Limits Min (mg/kg)	-	Max (mg/kg)	Maximum Location
Manganese	7439-96-5	124	-	124	100	21.3	-	911	–	-	–	WBGTP16A
Mercury	7439-97-6	54	-	121	45	0.03	-	0.24	0.05	-	0.16	WBGTP16A
Nickel	7440-02-0	124	-	124	100	1.3	-	47.5	–	-	–	WBGSB47
Potassium	7440-09-7	124	-	124	100	335	-	10600	–	-	–	WBGSB2
Selenium	7782-49-2	27	-	121	22	0.5	-	1.4	0.45	-	1.32	WBGSB43
Silver	7440-22-4	35	-	121	29	0.12	-	2.3	0.11	-	1.4	WBGSB13
Sodium	7440-23-5	119	-	121	98	9.7	-	384	1	-	33.8	WBGSB3
Thallium	7440-28-0	17	-	121	14	0.12	-	1.2	0.23	-	1.1	WBGTP3S
Vanadium	7440-62-2	124	-	124	100	28	-	99.8	–	-	–	WBGSB47
Zinc	7440-66-6	124	-	124	100	11.8	-	3250	–	-	–	WBGSB3

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilogram.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table 9-22
Sediment Risk Assessment Dataset
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples	FOD %	Detects Min (mg/kg)	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	Detection Limits Max (mg/kg)	Maximum Location
Volatile Organic Compounds								
2-Butanone	78-93-3	5 - 14	36	0.015	0.18	0.007	0.019	WBGSD12
Acetone	67-64-1	11 - 14	79	0.003	0.23	0.0077	0.01	WBGSW/SD07
Carbon Disulfide	75-15-0	5 - 12	42	0.0012	0.0015	0.007	0.013	WBGSW/SD14
Methylene Chloride	75-09-2	2 - 14	14	0.002	0.002	0.001	0.019	SD-01,SD-02
Toluene	108-88-3	8 - 14	57	0.00092	0.61	0.0077	0.019	WBGSD11
Semi-Volatile Organic Compounds								
1,2,4-Trichlorobenzene	120-82-1	2 - 15	13	0.012	0.023	0.002	1.1	WBGSW/SD14
1,4-Dichlorobenzene	106-46-7	2 - 15	13	0.012	0.049	0.002	1.1	WBGSW/SD14
4-Methylphenol	106-44-5	4 - 17	24	0.13	2.2	0.26	1.1	WBGSD2
bis(2-Ethylhexyl)phthalate	117-81-7	9 - 17	53	0.06	0.33	0.26	0.94	WBGSW/SD14
Carbazole	86-74-8	2 - 15	13	0.14	0.21	0.26	1.1	WBGSW/SD07
Dibenzofuran	132-64-9	2 - 15	13	0.039	0.1	0.3	1.4	WBGSW/SD07
Phenol	108-95-2	1 - 15	7	0.086	0.086	0.26	1.1	WBGSW/SD14
Dioxin/Furan Compounds								
1,2,3,4,6,7,8-HpCDD	35822-46-9	6 - 6	100	2.11E-06	7.199E-05	–	–	WBGSD11
1,2,3,4,6,7,8-HpCDF	67562-39-4	5 - 6	83	9.4E-07	0.0000063	0.00000017	0.00000017	WBGSD11
1,2,3,4,7,8,9-HpCDF	55673-89-7	2 - 6	33	2.6E-07	5.4E-07	0.00000023	0.00000033	WBGSW/SD10
1,2,3,4,7,8-HxCDD	39227-28-6	2 - 6	33	7.1E-07	1.03E-06	0.00000026	0.00000034	WBGSD11
1,2,3,4,7,8-HxCDF	70648-26-9	2 - 6	33	9.2E-07	1.68E-06	0.00000014	0.0000002	WBGSW/SD10
1,2,3,6,7,8-HxCDD	57653-85-7	3 - 6	50	9.9E-07	2.04E-06	0.00000024	0.00000027	WBGSD11
1,2,3,6,7,8-HxCDF	57117-44-9	1 - 6	17	1.73E-06	1.73E-06	0.00000014	0.00000019	WBGSW/SD10
1,2,3,7,8,9-HxCDD	19408-74-3	4 - 6	67	9.3E-07	2.39E-06	0.00000026	0.00000026	WBGSD11
2,3,4,6,7,8-HxCDF	60851-34-5	1 - 6	17	9.4E-07	9.4E-07	0.00000018	0.00000023	WBGSW/SD10
2,3,4,7,8-PeCDF	57117-31-4	1 - 6	17	1.41E-06	1.41E-06	0.00000013	0.00000022	WBGSW/SD10
2,3,7,8-TCDF	51207-31-9	1 - 6	17	2.83E-06	2.83E-06	0.00000014	0.00000035	WBGSW/SD10
OCDD	3268-87-9	6 - 6	100	0.0001412	0.003422	–	–	WBGSD11
OCDF	39001-02-0	5 - 6	83	2.44E-06	1.515E-05	0.0000003	0.0000003	WBGSD11
Explosives								
1,3,5-Trinitrobenzene	99-35-4	1 - 8	12	0.41	0.41	0.1	0.25	WBGSD12
Nitroglycerine	55-63-0	1 - 8	12	0.96	0.96	0.46	1.41	WBGSD12
Herbicides								
2,4,5-T	93-76-5	1 - 5	20	0.00757	0.00757	0.0153	0.214	WBGSW/SD14
2,4-D	94-75-7	2 - 5	40	0.385	6.83	0.0356	0.427	WBGSW/SD14
Dicamba	1918-00-9	1 - 5	20	0.0322	0.0322	0.0356	0.427	WBGSW/SD08
MCPP	93-65-2	1 - 5	20	3.56	3.56	17.8	214	WBGSW/SD08
Pesticides								
4,4'-DDD	72-54-8	4 - 5	80	0.00033	0.00152	0.00143	0.00143	WBGSW/SD13
4,4'-DDE	72-55-9	4 - 6	67	0.00152	0.00308	0.0016	0.0016	WBGSW/SD08
4,4'-DDT	50-29-3	3 - 5	60	0.00142	0.0119	0.00102	0.00253	WBGSW/SD10

Table 9-22
Sediment Risk Assessment Dataset
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b]				Detects			Detection Limits			Maximum Location
		number of detects / number of samples			FOD %	Min	-	Max	Min	-	Max	
						(mg/kg)		(mg/kg)	(mg/kg)		(mg/kg)	
Delta-BHC	319-86-8	1	-	5	20	0.00095	-	0.00095	0.00119	-	0.00253	WBGSW/SD08
Alpha-Chlordane	5103-71-9	2	-	5	40	0.00021	-	0.00071	0.00119	-	0.00253	WBGSW/SD15
Gamma-Chlordane	5566-34-7	1	-	5	20	0.00088	-	0.00088	0.00102	-	0.00253	WBGSW/SD15
Dieldrin	60-57-1	1	-	5	20	0.00347	-	0.00347	0.00102	-	0.00253	WBGSW/SD10
Endosulfan II	33213-65-9	2	-	5	40	0.00094	-	0.00161	0.00102	-	0.00253	WBGSW/SD10
Endrin Aldehyde	7421-93-4	1	-	5	20	0.00169	-	0.00169	0.00102	-	0.00253	WBGSW/SD10
Endrin Ketone	53494-70-5	2	-	5	40	0.00224	-	0.00288	0.00102	-	0.00253	WBGSW/SD14
Methoxychlor	72-43-5	1	-	5	20	0.00637	-	0.00637	0.00102	-	0.00253	WBGSW/SD14
Polycyclic Aromatic Hydrocarbons										-		
1-Methylnaphthalene	90-12-0	1	-	2	50	0.0026	-	0.0026	0.0074	-	0.0074	WBG-SE006
2-Methylnaphthalene	91-57-6	4	-	18	22	0.0022	-	0.065	0.003	-	1.1	WBGSW/SD14
Acenaphthene	83-32-9	4	-	18	22	0.014	-	0.31	0.003	-	1.1	WBGSW/SD09
Acenaphthylene	208-96-8	1	-	18	6	0.021	-	0.021	0.003	-	1.1	WBGSW/SD09
Anthracene	120-12-7	5	-	18	28	0.0048	-	0.83	0.003	-	1.1	WBGSW/SD09
Benzo(a)anthracene	56-55-3	10	-	20	50	0.0055	-	4	0.003	-	1.1	WBGSW/SD09
Benzo(a)pyrene	50-32-8	7	-	20	35	0.0057	-	3.7	0.003	-	1.1	WBGSW/SD09
Benzo(b)fluoranthene	205-99-2	9	-	20	45	0.0081	-	4.6	0.003	-	1.1	WBGSW/SD09
Benzo(g,h,i)perylene	191-24-2	5	-	18	28	0.005	-	2.1	0.003	-	1.1	WBGSW/SD09
Benzo(k)fluoranthene	207-08-9	9	-	20	45	0.0033	-	1.4	0.003	-	1.1	WBGSW/SD09
Chrysene	218-01-9	10	-	20	50	0.0077	-	4.1	0.003	-	1.1	WBGSW/SD09
Dibenzo(a,h)anthracene	53-70-3	3	-	18	17	0.0061	-	0.56	0.003	-	1.1	WBGSW/SD09
Fluoranthene	206-44-0	11	-	20	55	0.0026	-	4.9	0.003	-	1.1	WBGSW/SD09
Fluorene	86-73-7	5	-	18	28	0.0027	-	0.25	0.003	-	1.1	WBGSW/SD09
Indeno(1,2,3-cd)pyrene	193-39-5	5	-	18	28	0.0038	-	1.6	0.003	-	1.1	WBGSW/SD09
Naphthalene	91-20-3	3	-	18	17	0.0017	-	0.085	0.003	-	1.1	WBGSW/SD09
Phenanthrene	85-01-8	10	-	20	50	0.0067	-	2.8	0.003	-	1.1	WBGSW/SD09
Pyrene	129-00-0	11	-	20	55	0.0017	-	5	0.003	-	1.1	WBGSW/SD09
Inorganics										-		
Aluminum	7429-90-5	28	-	28	100	5400	-	30900	–	-	–	WBGSD17
Antimony	7440-36-0	9	-	26	35	0.51	-	3.1	0.43	-	1.89	WBGSW/SD10
Arsenic	7440-38-2	28	-	28	100	1.44	-	30.4	–	-	–	WBGSW/SD13
Barium	7440-39-3	28	-	28	100	32.3	-	179	–	-	–	WBGSW/SD10
Beryllium	7440-41-7	27	-	28	96	0.45	-	2.27	0.33	-	0.33	WBGSW/SD10
Cadmium	7440-43-9	14	-	26	54	0.09	-	2.7	0.13	-	0.37	WBGSW/SD10
Calcium	7440-70-2	28	-	28	100	1820	-	120000	–	-	–	WBGSD20
Chromium	7440-47-3	28	-	28	100	5.17	-	15400	–	-	–	WBGSW/SD10
Cobalt	7440-48-4	28	-	28	100	3.2	-	84.1	–	-	–	WBGSW/SD10
Copper	7440-50-8	28	-	28	100	6.36	-	188	–	-	–	WBGSW/SD10
Iron	7439-89-6	28	-	28	100	8530	-	293000	–	-	–	WBGSW/SD13
Lead	7439-92-1	32	-	32	100	5.61	-	109000	–	-	–	WBGSW/SD10

Table 9-22
Sediment Risk Assessment Dataset
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Magnesium	7439-95-4	28	-	28	100	863	-	10200	–	-	–	WBGSW/SD15
Manganese	7439-96-5	28	-	28	100	25.9	-	2310	–	-	–	WBGSW/SD13
Mercury	7439-97-6	17	-	26	65	0.03	-	0.09	0.12	-	0.37	WBGSW/SD14
Nickel	7440-02-0	28	-	28	100	4.4	-	26.8	–	-	–	WBGSW/SD08
Potassium	7440-09-7	28	-	28	100	290	-	2210	–	-	–	WBGSD2
Selenium	7782-49-2	4	-	26	15	0.81	-	1.3	0.65	-	3.79	WBGSD6,WBGSD11
Silver	7440-22-4	4	-	26	15	0.79	-	8.42	0.14	-	3.79	WBGSW/SD10
Sodium	7440-23-5	28	-	28	100	72	-	577	–	-	–	WBGSD5
Thallium	7440-28-0	12	-	28	43	0.1	-	1.7	0.43	-	2.5	WBGSD1
Vanadium	7440-62-2	28	-	28	100	14	-	106	–	-	–	WBGSW/SD10
Zinc	7440-66-6	28	-	28	100	17.1	-	17300	–	-	–	WBGSW/SD10

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilogram.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.

[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table 9-23
Surface Water Risk Assessment Dataset
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/L)		Detects Max (mg/L)	Detection Limits Min (mg/L)		Detection Limits Max (mg/L)	Maximum Location
Volatile Organic Compounds												
2-Butanone	78-93-3	1	-	10	10	0.004	-	0.004	0.004	-	0.005	WBGDW2
Acetone	67-64-1	1	-	10	10	0.0028	-	0.0028	0.004	-	0.005	WBGSW/SD07
Carbon Disulfide	75-15-0	7	-	10	70	0.00007	-	0.00025	0.005	-	0.005	WBGSW/SD10
Chloroform	67-66-3	5	-	10	50	0.00013	-	0.003	0.001	-	0.001	WBGDW2
cis-1,2-Dichloroethene	156-59-2	1	-	10	10	0.00012	-	0.00012	0.001	-	0.001	WBGSW/SD14
Tetrachloroethene	127-18-4	1	-	10	10	0.00016	-	0.00016	0.001	-	0.001	WBGSW/SD14
Toluene	108-88-3	1	-	10	10	0.00021	-	0.00021	0.001	-	0.001	WBGSW/SD10
Trichloroethene	79-01-6	1	-	10	10	0.00011	-	0.00011	0.001	-	0.001	WBGSW/SD14
Semi-Volatile Organic Compounds												
1,2-Dichlorobenzene	95-50-1	1	-	13	8	0.00021	-	0.00021	0.001	-	0.01	WBGSW/SD13
1,3-Dichlorobenzene	541-73-1	1	-	13	8	0.00021	-	0.00021	0.001	-	0.01	WBGSW/SD13
1,4-Dichlorobenzene	106-46-7	1	-	13	8	0.00028	-	0.00028	0.001	-	0.01	WBGSW/SD13
Benzoic Acid	65-85-0	3	-	10	30	0.0052	-	0.0067	0.025	-	0.05	WBGSW/SD14
bis(2-Ethylhexyl)phthalate	117-81-7	1	-	13	8	0.0026	-	0.0026	0.005	-	0.01	WBGSW/SD14
Butylbenzylphthalate	85-68-7	1	-	13	8	0.00063	-	0.00063	0.005	-	0.01	WBGSW/SD14
Diethylphthalate	84-66-2	1	-	13	8	0.001	-	0.001	0.005	-	0.01	WBGDW1
Di-n-Butylphthalate	84-74-2	4	-	13	31	0.00013	-	0.00091	0.005	-	0.01	WBGSW/SD09
Dioxin/Furan Compounds												
OCDD	3268-87-9	4	-	4	100	1.406E-08	-	3.5E-08	–	-	–	WBGSW/SD09
Explosives												
m-Nitrotoluene	99-08-1	2	-	7	29	0.00036	-	0.00038	0.0005	-	0.00052	WBGSW/SD09
Herbicides												
2,4-D	94-75-7	2	-	5	40	0.00356	-	0.00368	0.0005	-	0.0005	WBGSW/SD08
MCPP	93-65-2	1	-	5	20	0.0541	-	0.0541	0.125	-	0.125	WBGSW/SD08
Pesticides												
Dieldrin	60-57-1	3	-	5	60	3.58E-06	-	9.01E-06	0.00002	-	0.00002	WBGSW/SD14
Polycyclic Aromatic Hydrocarbons												
1-Methylnaphthalene	90-12-0	1	-	2	50	0.000026	-	0.000026	0.000047	-	0.000047	WBG-SW005
2-Methylnaphthalene	91-57-6	3	-	15	20	0.00003	-	0.000033	0.000047	-	0.01	WBG-SW005
Acenaphthene	83-32-9	2	-	15	13	0.00002	-	0.00004	0.000047	-	0.01	WBG-SW005
Anthracene	120-12-7	2	-	15	13	0.00002	-	0.00003	0.000047	-	0.01	WBG-SW005
Fluorene	86-73-7	2	-	15	13	0.00003	-	0.000034	0.000047	-	0.01	WBG-SW005
Naphthalene	91-20-3	2	-	15	13	0.00002	-	0.00004	0.000047	-	0.01	WBGSW/SD10
Phenanthrene	85-01-8	3	-	15	20	0.000018	-	0.00005	0.00005	-	0.01	WBG-SW005
Inorganics												
Aluminum	7429-90-5	13	-	13	100	0.0392	-	0.811	–	-	–	WBGSW/SD13
Arsenic	7440-38-2	2	-	13	15	0.0086	-	0.0104	0.003	-	0.007	WBGDW6

Table 9-23
Surface Water Risk Assessment Dataset
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/L)	-	Detects Max (mg/L)	Detection Limits Min (mg/L)	-	Detection Limits Max (mg/L)	Maximum Location
Barium	7440-39-3	13	-	13	100	0.054	-	0.148	–	-	–	WBGSW/SD13
Beryllium	7440-41-7	1	-	13	8	0.0011	-	0.0011	0.001	-	0.002	WBGDW4
Calcium	7440-70-2	15	-	15	100	56.7	-	90.7	–	-	–	WBGSW/SD13
Copper	7440-50-8	6	-	13	46	0.0011	-	0.0235	0.02	-	0.02	WBGDW3
Iron	7439-89-6	14	-	15	93	0.0416	-	50.9	–	-	–	WBGSW/SD13
Lead	7439-92-1	11	-	18	61	0.00017	-	0.106	0.002	-	0.002	WBG-SW004
Magnesium	7439-95-4	15	-	15	100	12.1	-	21	–	-	–	WBGSW/SD13
Manganese	7439-96-5	14	-	15	93	0.002	-	1.47	–	-	–	WBGSW/SD13
Nickel	7440-02-0	2	-	13	15	0.0014	-	0.0015	0.001	-	0.04	WBGDW2
Potassium	7440-09-7	15	-	15	100	1.9	-	4.08	–	-	–	WBGSW/SD13
Selenium	7782-49-2	1	-	13	8	0.00044	-	0.00044	0.004	-	0.005	WBGSW/SD14
Silver	7440-22-4	2	-	13	15	0.001	-	0.0012	0.001	-	0.01	WBGDW4
Sodium	7440-23-5	15	-	15	100	6.54	-	63.9	–	-	–	WBGSW/SD15
Thallium	7440-28-0	2	-	13	15	0.0023	-	0.0054	0.002	-	0.007	WBGDW1
Vanadium	7440-62-2	6	-	15	40	0.0011	-	0.079	0.002	-	0.05	SW-01
Zinc	7440-66-6	8	-	13	62	0.018	-	0.0237	0.02	-	0.02	WBGDW3

Notes:
– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/L = Milligrams per liter.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table 9-24
Fish Fillet Risk Assessment Dataset
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b]				Detects			Detection Limits		
		number of detects / number of samples			FOD %	Min	-	Max	Min	-	Max
						(mg/kg)		(mg/kg)	(mg/kg)		(mg/kg)
Inorganics										-	
Barium	7440-39-3	6	-	8	75	0.24	-	1	0.18	-	0.19
Calcium	7440-70-2	8	-	8	100	604	-	8720	–	-	–
Chromium	7440-47-3	1	-	8	12	0.24	-	0.24	0.18	-	0.19
Copper	7440-50-8	2	-	8	25	0.52	-	0.56	0.37	-	0.39
Iron	7439-89-6	1	-	8	12	11.9	-	11.9	5.5	-	5.8
Magnesium	7439-95-4	8	-	8	100	206	-	300	–	-	–
Manganese	7439-96-5	4	-	8	50	0.23	-	0.76	0.18	-	0.19
Mercury	7439-97-6	7	-	8	88	0.03	-	0.087	0.019	-	0.019
Potassium	7440-09-7	8	-	8	100	2600	-	3170	–	-	–
Sodium	7440-23-5	8	-	8	100	418	-	1070	–	-	–
Zinc	7440-66-6	8	-	8	100	6.9	-	13.5	–	-	–

Notes:
– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilograms.
ND = Non-detects.

[a] All constituents analyzed for are shown.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table 9-25
Fish Whole Body Risk Assessment Dataset
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b]				Detects			Detection Limits		
		number of detects / number of samples			FOD %	Min (mg/kg)	-	Max (mg/kg)	Min (mg/kg)	-	Max (mg/kg)
Inorganics										-	
Aluminum	7429-90-5	6	-	8	75	11.3	-	50.7	7.5	-	7.6
Barium	7440-39-3	8	-	8	100	0.75	-	2.4	–	-	–
Calcium	7440-70-2	8	-	8	100	5490	-	14300	–	-	–
Chromium	7440-47-3	8	-	8	100	0.26	-	0.65	–	-	–
Copper	7440-50-8	6	-	8	75	0.44	-	0.8	0.36	-	0.37
Iron	7439-89-6	8	-	8	100	24	-	74.2	–	-	–
Magnesium	7439-95-4	8	-	8	100	262	-	402	–	-	–
Manganese	7439-96-5	8	-	8	100	0.8	-	3.5	–	-	–
Mercury	7439-97-6	8	-	8	100	0.024	-	0.078	–	-	–
Potassium	7440-09-7	8	-	8	100	2590	-	2870	–	-	–
Sodium	7440-23-5	8	-	8	100	717	-	1190	–	-	–
Zinc	7440-66-6	8	-	8	100	10.7	-	25.1	–	-	–

Notes:
– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilograms.
ND = Non-detects.

[a] All constituents analyzed for are shown.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table 9-26
Selection of Constituents of Potential Concern for Surface Soil (0-2 foot Depth Interval)
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b]					Background Level [c]	Does Maximum Exceed RSL?		Is Constituent a Surface Soil COPC? [d]
			Industrial Scenario		Residential Scenario		Surrogate		Industrial	Residential	
		(mg/kg)	(mg/kg)		(mg/kg)			(mg/kg)	(YES, no)	(YES, no)	(YES, no)
Volatile Organic Compounds											
Acetone	67-64-1	7.00E-02	6.10E+04	nms	6.10E+03	n		–	no	no	no
Carbon Disulfide	75-15-0	8.00E-04	3.00E+02	ns	6.70E+01	ns		–	no	no	no
d-Limonene	5989-27-5	1.70E-01	NA		NA			–	NA	NA	**YES**
Methylene Chloride	75-09-2	3.00E-03	5.40E+01	c	1.10E+01	c		–	no	no	no
p-Isopropyltoluene	99-87-6	4.80E-03	1.10E+03	ns	2.20E+02	ns	Isopropylbenzene	–	no	no	no
Toluene	108-88-3	1.10E-03	4.60E+03	ns	5.00E+02	ns		–	no	no	no
Semi-Volatile Organic Compounds											
bis(2-Ethylhexyl)phthalate	117-81-7	6.70E-01	1.20E+02	c*	3.50E+01	c*		–	no	no	no
Carbazole	86-74-8	1.00E-01	NA		NA			–	NA	NA	**YES**
Dibenzofuran	132-64-9	1.40E-02	1.00E+02	n	7.80E+00	n	Furan	–	no	no	no
Di-n-Butylphthalate	84-74-2	2.10E-01	6.20E+03	n	6.10E+02	n		–	no	no	no
Di-n-Octylphthalate	117-84-0	1.60E-02	6.20E+03	n	6.10E+02	n	di-n-Butylphthalate	–	no	no	no
N-Nitrosodiphenylamine	86-30-6	6.00E-02	3.50E+02	c	9.90E+01	c		–	no	no	no
Dioxin/Furan Compounds											
1,2,3,4,6,7,8-HpCDD	35822-46-9	1.57E-04	1.80E-03	c	4.50E-04	c	Total HpCDD	–	no	no	no
1,2,3,4,6,7,8-HpCDF	67562-39-4	3.10E-05	1.30E-03	c	3.70E-04	c	Total HpCDF	–	no	no	no
1,2,3,4,7,8,9-HpCDF	55673-89-7	2.05E-06	1.30E-03	c	3.70E-04	c	Total HpCDF	–	no	no	no
1,2,3,4,7,8-HxCDD	39227-28-6	3.33E-06	1.80E-04	c	4.50E-05	c	Total HxCDD	–	no	no	no
1,2,3,4,7,8-HxCDF	70648-26-9	5.64E-06	1.30E-04	c	3.70E-05	c	Total HxCDF	–	no	no	no
1,2,3,6,7,8-HxCDD	57653-85-7	6.61E-06	1.80E-04	c	4.50E-05	c	Total HxCDD	–	no	no	no
1,2,3,6,7,8-HxCDF	57117-44-9	5.08E-06	1.30E-04	c	3.70E-05	c	Total HxCDF	–	no	no	no
1,2,3,7,8,9-HxCDD	19408-74-3	8.34E-06	1.80E-04	c	4.50E-05	c	Total HxCDD	–	no	no	no
1,2,3,7,8,9-HxCDF	72918-21-9	4.50E-07	1.30E-04	c	3.70E-05	c	Total HxCDF	–	no	no	no
1,2,3,7,8-PeCDD	40321-76-4	1.73E-06	1.80E-05	c	4.50E-06	c	Total PeCDD	–	no	no	no
1,2,3,7,8-PeCDF	57117-41-6	1.24E-06	4.40E-04	c	1.20E-04	c		–	no	no	no
2,3,4,6,7,8-HxCDF	60851-34-5	2.38E-06	1.30E-04	c	3.70E-05	c	Total HxCDF	–	no	no	no
2,3,4,7,8-PeCDF	57117-31-4	1.72E-06	4.40E-05	c	1.20E-05	c		–	no	no	no
2,3,7,8-TCDD	1746-01-6	1.51E-06	1.80E-05	c*	4.50E-06	c*		–	no	no	no
2,3,7,8-TCDF	51207-31-9	1.84E-06	1.30E-04	c	3.70E-05	c		–	no	no	no
OCDD	3268-87-9	8.30E-03	6.10E-02	c	1.50E-02	c		–	no	no	no
OCDF	39001-02-0	5.86E-05	4.40E-02	c	1.20E-02	c		–	no	no	no
Explosives											
Pentaerythritol Tetranitrate	78-11-5	1.10E-01	NA		NA			–	NA	NA	**YES**
Herbicides											
2,4,5-TP	93-72-1	7.80E-03	4.90E+02	n	4.90E+01	n		–	no	no	no
2,4-D	94-75-7	3.02E-02	7.70E+02	n	6.90E+01	n		–	no	no	no
Dalapon	75-99-0	1.63E-01	1.80E+03	n	1.80E+02	n		–	no	no	no
MCPP	93-65-2	2.56E+00	6.20E+01	n	6.10E+00	n		–	no	no	no
Pesticides											
4,4'-DDD	72-54-8	1.90E-03	7.20E+00	c	2.00E+00	c		–	no	no	no
Dieldrin	60-57-1	4.72E-03	1.10E-01	c	3.00E-02	c		–	no	no	no

Table 9-26
Selection of Constituents of Potential Concern for Surface Soil (0-2 foot Depth Interval)
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b] Industrial Scenario		Adjusted Soil Regional Screening Level (RSL) [b] Residential Scenario		Surrogate	Background Level [c]	Does Maximum Exceed RSL? Industrial	Does Maximum Exceed RSL? Residential	Is Constituent a Surface Soil COPC? [d]
		(mg/kg)	(mg/kg)		(mg/kg)			(mg/kg)	(YES, no)	(YES, no)	(YES, no)
Polycyclic Aromatic Hydrocarbons											
2-Methylnaphthalene	91-57-6	2.30E-02	4.10E+02	ns	3.10E+01	n		–	no	no	no
Acenaphthene	83-32-9	3.20E-01	3.30E+03	n	3.40E+02	n		–	no	no	no
Acenaphthylene	208-96-8	3.90E-03	3.30E+03	n	3.40E+02	n	Acenaphthene	–	no	no	no
Anthracene	120-12-7	1.00E-01	1.70E+04	nm	1.70E+03	n		–	no	no	no
Benzo(a)anthracene	56-55-3	9.70E-01	2.10E+00	c	1.50E-01	c		–	no	**YES**	**YES**
Benzo(a)pyrene	50-32-8	1.10E+00	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Benzo(b)fluoranthene	205-99-2	1.80E+00	2.10E+00	c	1.50E-01	c		–	no	**YES**	**YES**
Benzo(g,h,i)perylene	191-24-2	9.60E-01	1.70E+03	n	1.70E+02	n	Pyrene	–	no	no	no
Benzo(k)fluoranthene	207-08-9	5.30E-01	2.10E+01	c	1.50E+00	c		–	no	no	no
Chrysene	218-01-9	9.90E-01	2.10E+02	c	1.50E+01	c		–	no	no	no
Dibenzo(a,h)anthracene	53-70-3	2.20E-01	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Fluoranthene	206-44-0	1.60E+00	2.20E+03	n	2.30E+02	n		–	no	no	no
Fluorene	86-73-7	2.80E-02	2.20E+03	n	2.30E+02	n		–	no	no	no
Indeno(1,2,3-cd)pyrene	193-39-5	1.10E+00	2.10E+00	c	1.50E-01	c		–	no	**YES**	**YES**
Naphthalene	91-20-3	1.80E-02	2.00E+01	c*	3.90E+00	c*		–	no	no	no
Phenanthrene	85-01-8	6.90E-01	1.70E+04	nm	1.70E+03	n	Anthracene	–	no	no	no
Pyrene	129-00-0	1.60E+00	1.70E+03	n	1.70E+02	n		–	no	no	no
Polychlorinated Biphenyls											
Aroclor 1254	11097-69-1	8.40E-02	7.40E-01	c*	1.10E-01	n		–	no	no	no
Inorganics											
Aluminum	7429-90-5	4.00E+04	9.90E+04	nm	7.70E+03	n		4.00E+04	no	**YES**	no
Antimony	7440-36-0	5.30E+00	4.10E+01	n	3.10E+00	n		–	no	**YES**	**YES**
Arsenic	7440-38-2	3.79E+01	1.60E+00	c	3.90E-01	c*		1.58E+01	**YES**	**YES**	**YES**
Barium	7440-39-3	6.10E+02	1.90E+04	nm	1.50E+03	n		2.09E+02	no	no	no
Beryllium	7440-41-7	3.90E+00	2.00E+02	n	1.60E+01	n		1.02E+00	no	no	no
Cadmium	7440-43-9	2.70E+00	8.10E+01	n	7.00E+00	n		6.90E-01	no	no	no
Calcium	7440-70-2	9.73E+04	NA		NA			–	NA	NA	no
Chromium	7440-47-3	2.49E+02	1.40E+03	c	2.80E+02	c		6.53E+01	no	no	no
Cobalt	7440-48-4	3.14E+01	3.00E+01	n	2.30E+00	n		7.23E+01	**YES**	**YES**	no
Copper	7440-50-8	1.34E+03	4.10E+03	n	3.10E+02	n		5.35E+01	no	**YES**	**YES**
Iron	7439-89-6	5.40E+04	7.20E+04	nm	5.50E+03	n		5.10E+04	no	**YES**	**YES**
Lead	7439-92-1	3.99E+03	8.00E+02	«	4.00E+02	«		2.68E+01	**YES**	**YES**	**YES**
Magnesium	7439-95-4	2.32E+04	NA		NA			–	NA	NA	no
Manganese	7439-96-5	9.11E+02	2.30E+03	n	1.80E+02	n		2.54E+03	no	**YES**	no
Mercury	7439-97-6	2.40E-01	2.80E+00	ns	6.70E-01	ns		1.30E-01	no	no	no
Nickel	7440-02-0	3.73E+01	2.00E+03	n	1.60E+02	n		6.28E+01	no	no	no
Potassium	7440-09-7	3.34E+03	NA		NA			–	NA	NA	no
Selenium	7782-49-2	1.20E+00	5.10E+02	n	3.90E+01	n		–	no	no	no
Silver	7440-22-4	2.20E+00	5.10E+02	n	3.90E+01	n		–	no	no	no
Sodium	7440-23-5	3.84E+02	NA		NA			–	NA	NA	no
Thallium	7440-28-0	1.20E+00	6.60E+00	n	5.10E-01	n		2.11E+00	no	**YES**	no

Table 9-26
Selection of Constituents of Potential Concern for Surface Soil (0-2 foot Depth Interval)
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a] (mg/kg)	Adjusted Soil Regional Screening Level (RSL) [b] Industrial Scenario (mg/kg)		Residential Scenario (mg/kg)		Surrogate	Background Level [c] (mg/kg)	Does Maximum Exceed RSL? Industrial (YES, no)	Residential (YES, no)	Is Constituent a Surface Soil COPC? [d] (YES, no)
Vanadium	7440-62-2	9.94E+01	7.20E+02	n	5.50E+01	n		1.08E+02	no	**YES**	no
Zinc	7440-66-6	3.25E+03	3.10E+04	nm	2.30E+03	n		2.02E+02	no	**YES**	**YES**

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
mg/kg = Milligrams per kilogram.
NA = Not available or not applicable.
RSL = Regional Screening Level.
USEPA = United States Environmental Protection Agency.

[a] Maximum concentration in surface soil (0-2 foot depth interval).
[b] The screening levels used were from USEPA (2008a). Screening levels based on non-cancer effects were adjusted downward by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = concentration may exceed ceiling limit; s = Concentration may exceed saturation concentration (Csat).
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.
[c] Background levels for metals are facility-wide soil background point estimates taken from Facility-Wide Background Study Report (IT Corporation, 2001).
[d] Constituents detected with maximum concentrations greater than adjusted residential screening levels were considered COPCs unless they were metals detected at concentrations lower than background, or are essential nutrients (i.e., calcium, magnesium, potassium, sodium), or were known laboratory contaminants (i.e. acetone).

Table 9-27
Selection of Constituents of Potential Concern for Combined Surface and Subsurface Soil
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b]					Background Level [c]	Does Maximum Exceed RSL?		Is Constituent a Surface/ Subsurface Soil COPC? [d]
			Industrial Scenario		Residential Scenario		Surrogate		Industrial	Residential	
		(mg/kg)	(mg/kg)		(mg/kg)			(mg/kg)	(YES, no)	(YES, no)	(YES, no)
Volatile Organic Compounds											
Acetone	67-64-1	7.00E-02	6.10E+04	nms	6.10E+03	n		–	no	no	no
Carbon Disulfide	75-15-0	8.00E-04	3.00E+02	ns	6.70E+01	ns		–	no	no	no
d-Limonene	5989-27-5	1.70E-01	NA		NA			–	NA	NA	**YES**
Methylene Chloride	75-09-2	3.00E-03	5.40E+01	c	1.10E+01	c		–	no	no	no
p-Isopropyltoluene	99-87-6	4.80E-03	1.10E+03	ns	2.20E+02	ns	Isopropylbenzene	–	no	no	no
Toluene	108-88-3	1.10E-03	4.60E+03	ns	5.00E+02	ns		–	no	no	no
Semi-Volatile Organic Compounds											
bis(2-Ethylhexyl)phthalate	117-81-7	8.30E-01	1.20E+02	c*	3.50E+01	c*		–	no	no	no
Butylbenzylphthalate	85-68-7	1.60E-01	9.10E+02	c	2.60E+02	c*		–	no	no	no
Carbazole	86-74-8	1.00E-01	NA		NA			–	NA	NA	**YES**
Dibenzofuran	132-64-9	1.40E-02	1.00E+02	n	7.80E+00	n	Furan	–	no	no	no
Di-n-Butylphthalate	84-74-2	4.20E-01	6.20E+03	n	6.10E+02	n		–	no	no	no
Di-n-Octylphthalate	117-84-0	1.60E-02	6.20E+03	n	6.10E+02	n	di-n-Butylphthalate	–	no	no	no
N-Nitrosodiphenylamine	86-30-6	6.00E-02	3.50E+02	c	9.90E+01	c		–	no	no	no
Dioxin/Furan Compounds											
1,2,3,4,6,7,8-HpCDD	35822-46-9	2.43E-04	1.80E-03	c	4.50E-04	c	Total HpCDD	–	no	no	no
1,2,3,4,6,7,8-HpCDF	67562-39-4	3.59E-05	1.30E-03	c	3.70E-04	c	Total HpCDF	–	no	no	no
1,2,3,4,7,8,9-HpCDF	55673-89-7	4.05E-06	1.30E-03	c	3.70E-04	c	Total HpCDF	–	no	no	no
1,2,3,4,7,8-HxCDD	39227-28-6	7.23E-06	1.80E-04	c	4.50E-05	c	Total HxCDD	–	no	no	no
1,2,3,4,7,8-HxCDF	70648-26-9	1.83E-05	1.30E-04	c	3.70E-05	c	Total HxCDF	–	no	no	no
1,2,3,6,7,8-HxCDD	57653-85-7	2.30E-05	1.80E-04	c	4.50E-05	c	Total HxCDD	–	no	no	no
1,2,3,6,7,8-HxCDF	57117-44-9	8.49E-06	1.30E-04	c	3.70E-05	c	Total HxCDF	–	no	no	no
1,2,3,7,8,9-HxCDD	19408-74-3	2.10E-05	1.80E-04	c	4.50E-05	c	Total HxCDD	–	no	no	no
1,2,3,7,8,9-HxCDF	72918-21-9	1.82E-06	1.30E-04	c	3.70E-05	c	Total HxCDF	–	no	no	no
1,2,3,7,8-PeCDD	40321-76-4	6.85E-06	1.80E-05	c	4.50E-06	c	Total PeCDD	–	no	**YES**	**YES**
1,2,3,7,8-PeCDF	57117-41-6	4.16E-06	4.40E-04	c	1.20E-04	c		–	no	no	no
2,3,4,6,7,8-HxCDF	60851-34-5	5.28E-06	1.30E-04	c	3.70E-05	c	Total HxCDF	–	no	no	no
2,3,4,7,8-PeCDF	57117-31-4	6.41E-06	4.40E-05	c	1.20E-05	c		–	no	no	no
2,3,7,8-TCDD	1746-01-6	4.17E-06	1.80E-05	c*	4.50E-06	c*		–	no	no	no
2,3,7,8-TCDF	51207-31-9	1.04E-05	1.30E-04	c	3.70E-05	c		–	no	no	no
OCDD	3268-87-9	8.30E-03	6.10E-02	c	1.50E-02	c		–	no	no	no
OCDF	39001-02-0	5.86E-05	4.40E-02	c	1.20E-02	c		–	no	no	no
Explosives											
Pentaerythritol Tetranitrate	78-11-5	1.10E-01	NA		NA			–	NA	NA	**YES**
Herbicides											
2,4,5-TP	93-72-1	7.80E-03	4.90E+02	n	4.90E+01	n		–	no	no	no
2,4-D	94-75-7	3.02E-02	7.70E+02	n	6.90E+01	n		–	no	no	no
Dalapon	75-99-0	1.63E-01	1.80E+03	n	1.80E+02	n		–	no	no	no
MCPP	93-65-2	2.56E+00	6.20E+01	n	6.10E+00	n		–	no	no	no
Pesticides											
4,4'-DDD	72-54-8	1.90E-03	7.20E+00	c	2.00E+00	c		–	no	no	no
Dieldrin	60-57-1	4.72E-03	1.10E-01	c	3.00E-02	c		–	no	no	no
Polycyclic Aromatic Hydrocarbons											
2-Methylnaphthalene	91-57-6	2.30E-02	4.10E+02	ns	3.10E+01	n		–	no	no	no
Acenaphthene	83-32-9	3.20E-01	3.30E+03	n	3.40E+02	n		–	no	no	no
Acenaphthylene	208-96-8	3.90E-03	3.30E+03	n	3.40E+02	n	Acenaphthene	–	no	no	no
Anthracene	120-12-7	1.00E-01	1.70E+04	nm	1.70E+03	n		–	no	no	no
Benzo(a)anthracene	56-55-3	9.70E-01	2.10E+00	c	1.50E-01	c		–	no	**YES**	**YES**
Benzo(a)pyrene	50-32-8	1.10E+00	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Benzo(b)fluoranthene	205-99-2	1.80E+00	2.10E+00	c	1.50E-01	c		–	no	**YES**	**YES**
Benzo(g,h,i)perylene	191-24-2	9.60E-01	1.70E+03	n	1.70E+02	n	Pyrene	–	no	no	no

Table 9-27
Selection of Constituents of Potential Concern for Combined Surface and Subsurface Soil
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b]					Background Level [c]	Does Maximum Exceed RSL?		Is Constituent a Surface/ Subsurface Soil COPC? [d]
			Industrial Scenario		Residential Scenario		Surrogate		Industrial	Residential	
		(mg/kg)	(mg/kg)		(mg/kg)			(mg/kg)	(YES, no)	(YES, no)	(YES, no)
Benzo(k)fluoranthene	207-08-9	5.30E-01	2.10E+01	c	1.50E+00	c		–	no	no	no
Chrysene	218-01-9	9.90E-01	2.10E+02	c	1.50E+01	c		–	no	no	no
Dibenzo(a,h)anthracene	53-70-3	2.20E-01	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Fluoranthene	206-44-0	1.60E+00	2.20E+03	n	2.30E+02	n		–	no	no	no
Fluorene	86-73-7	2.80E-02	2.20E+03	n	2.30E+02	n		–	no	no	no
Indeno(1,2,3-cd)pyrene	193-39-5	1.10E+00	2.10E+00	c	1.50E-01	c		–	no	**YES**	**YES**
Naphthalene	91-20-3	1.80E-02	2.00E+01	c*	3.90E+00	c*		–	no	no	no
Phenanthrene	85-01-8	6.90E-01	1.70E+04	nm	1.70E+03	n	Anthracene	–	no	no	no
Pyrene	129-00-0	1.60E+00	1.70E+03	n	1.70E+02	n		–	no	no	no
Polychlorinated Biphenyls											
Aroclor 1254	11097-69-1	8.70E-01	7.40E-01	c*	1.10E-01	n		–	**YES**	**YES**	**YES**
Inorganics											
Aluminum	7429-90-5	5.37E+04	9.90E+04	nm	7.70E+03	n		4.00E+04	no	**YES**	**YES**
Antimony	7440-36-0	5.30E+00	4.10E+01	n	3.10E+00	n		–	no	**YES**	**YES**
Arsenic	7440-38-2	3.79E+01	1.60E+00	c	3.90E-01	c*		1.58E+01	**YES**	**YES**	**YES**
Barium	7440-39-3	6.10E+02	1.90E+04	nm	1.50E+03	n		2.09E+02	no	no	no
Beryllium	7440-41-7	3.90E+00	2.00E+02	n	1.60E+01	n		1.02E+00	no	no	no
Cadmium	7440-43-9	2.95E+00	8.10E+01	n	7.00E+00	n		6.90E-01	no	no	no
Calcium	7440-70-2	9.73E+04	NA		NA			–	NA	NA	no
Chromium	7440-47-3	2.56E+02	1.40E+03	c	2.80E+02	c		6.53E+01	no	no	no
Cobalt	7440-48-4	3.14E+01	3.00E+01	n	2.30E+00	n		7.23E+01	**YES**	**YES**	no
Copper	7440-50-8	1.34E+03	4.10E+03	n	3.10E+02	n		5.35E+01	no	**YES**	**YES**
Iron	7439-89-6	6.18E+04	7.20E+04	nm	5.50E+03	n		5.10E+04	no	**YES**	**YES**
Lead	7439-92-1	3.99E+03	8.00E+02	«	4.00E+02	«		2.68E+01	**YES**	**YES**	**YES**
Magnesium	7439-95-4	5.89E+04	NA		NA			–	NA	NA	no
Manganese	7439-96-5	9.11E+02	2.30E+03	n	1.80E+02	n		2.54E+03	no	**YES**	no
Mercury	7439-97-6	2.40E-01	2.80E+00	ns	6.70E-01	ns		1.30E-01	no	no	no
Nickel	7440-02-0	4.75E+01	2.00E+03	n	1.60E+02	n		6.28E+01	no	no	no
Potassium	7440-09-7	1.06E+04	NA		NA			–	NA	NA	no
Selenium	7782-49-2	1.40E+00	5.10E+02	n	3.90E+01	n		–	no	no	no
Silver	7440-22-4	2.30E+00	5.10E+02	n	3.90E+01	n		–	no	no	no
Sodium	7440-23-5	3.84E+02	NA		NA			–	NA	NA	no
Thallium	7440-28-0	1.20E+00	6.60E+00	n	5.10E-01	n		2.11E+00	no	**YES**	no
Vanadium	7440-62-2	9.98E+01	7.20E+02	n	5.50E+01	n		1.08E+02	no	**YES**	no
Zinc	7440-66-6	3.25E+03	3.10E+04	nm	2.30E+03	n		2.02E+02	no	**YES**	**YES**

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
mg/kg = Milligrams per kilogram.
NA = Not available or not applicable.
RSL = Regional Screening Level.
USEPA = United States Environmental Protection Agency.

[a] Maximum concentration in combined surface and subsurface soil.

[b] The screening levels used were from USEPA (2008a). Screening levels based on non-cancer effects were adjusted downward by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = Concentration may exceed ceiling limit; s = Concentration may exceed saturation concentration (Csat).
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.

[c] Background levels for metals are facility-wide soil background point estimates taken from Facility-Wide Background Study Report (IT Corporation, 2001).

[d] Constituents detected with maximum concentrations greater than adjusted residential screening levels were considered COPCs unless they were metals detected at concentrations lower than background, or are essential nutrients (i.e., calcium, magnesium, potassium, sodium), or were known laboratory contaminants (i.e. acetone).

Table 9-28
Selection of Constituents of Potential Concern for Sediment
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a] (mg/kg)	Adjusted Soil Regional Screening Level (RSL) [b] Residential Scenario (mg/kg)		Surrogate	Is Constituent a Sediment COPC? [c] (YES, no)
Volatile Organic Compounds						
2-Butanone	78-93-3	1.80E-01	2.80E+03	ns		no
Acetone	67-64-1	2.30E-01	6.10E+03	n		no
Carbon Disulfide	75-15-0	1.50E-03	6.70E+01	ns		no
Methylene Chloride	75-09-2	2.00E-03	1.10E+01	c		no
Toluene	108-88-3	6.10E-01	5.00E+02	ns		no
Semi-Volatile Organic Compounds						
1,2,4-Trichlorobenzene	120-82-1	2.30E-02	8.70E+00	n		no
1,4-Dichlorobenzene	106-46-7	4.90E-02	2.60E+00	c		no
4-Methylphenol	106-44-5	2.20E+00	3.10E+01	n		no
bis(2-Ethylhexyl)phthalate	117-81-7	3.30E-01	3.50E+01	c*		no
Carbazole	86-74-8	2.10E-01	NA			**YES**
Dibenzofuran	132-64-9	1.00E-01	7.80E+00	n	Furan	no
Phenol	108-95-2	8.60E-02	1.80E+03	n		no
Dioxin/Furan Compounds						
1,2,3,4,6,7,8-HpCDD	35822-46-9	7.20E-05	4.50E-04	c	Total HpCDD	no
1,2,3,4,6,7,8-HpCDF	67562-39-4	6.30E-06	3.70E-04	c	Total HpCDF	no
1,2,3,4,7,8,9-HpCDF	55673-89-7	5.40E-07	3.70E-04	c	Total HpCDF	no
1,2,3,4,7,8-HxCDD	39227-28-6	1.03E-06	4.50E-05	c	Total HxCDD	no
1,2,3,4,7,8-HxCDF	70648-26-9	1.68E-06	3.70E-05	c	Total HxCDF	no
1,2,3,6,7,8-HxCDD	57653-85-7	2.04E-06	4.50E-05	c	Total HxCDD	no
1,2,3,6,7,8-HxCDF	57117-44-9	1.73E-06	3.70E-05	c	Total HxCDF	no
1,2,3,7,8,9-HxCDD	19408-74-3	2.39E-06	4.50E-05	c	Total HxCDD	no
2,3,4,6,7,8-HxCDF	60851-34-5	9.40E-07	3.70E-05	c	Total HxCDF	no
2,3,4,7,8-PeCDF	57117-31-4	1.41E-06	1.20E-05	c		no
2,3,7,8-TCDF	51207-31-9	2.83E-06	3.70E-05	c		no
OCDD	3268-87-9	3.42E-03	1.50E-02	c		no
OCDF	39001-02-0	1.52E-05	1.20E-02	c		no
Explosives						
1,3,5-Trinitrobenzene	99-35-4	4.10E-01	2.20E+02	n		no
Nitroglycerine	55-63-0	9.60E-01	6.10E-01	n		**YES**
Herbicides						
2,4,5-T	93-76-5	7.57E-03	6.10E+01	n		no
2,4-D	94-75-7	6.83E+00	6.90E+01	n		no
Dicamba	1918-00-9	3.22E-02	1.80E+02	n		no
MCPP	93-65-2	3.56E+00	6.10E+00	n		no
Pesticides						
4,4'-DDD	72-54-8	1.52E-03	2.00E+00	c		no
4,4'-DDE	72-55-9	3.08E-03	1.40E+00	c		no
4,4'-DDT	50-29-3	1.19E-02	1.70E+00	c*		no
Delta-BHC	319-86-8	9.50E-04	5.20E-01	c*	gamma-BHC	no
Alpha-Chlordane	5103-71-9	7.10E-04	1.60E+00	c*	Chlordane	no
Gamma-Chlordane	5566-34-7	8.80E-04	1.60E+00	c*	Chlordane	no
Dieldrin	60-57-1	3.47E-03	3.00E-02	c		no
Endosulfan II	33213-65-9	1.61E-03	3.70E+01	n	Endosulfan	no
Endrin Aldehyde	7421-93-4	1.69E-03	1.80E+00	n	Endrin	no
Endrin Ketone	53494-70-5	2.88E-03	1.80E+00	n	Endrin	no
Methoxychlor	72-43-5	6.37E-03	3.10E+01	n		no
Polycyclic Aromatic Hydrocarbons						
1-Methylnaphthalene	90-12-0	2.60E-03	2.20E+01	c		no
2-Methylnaphthalene	91-57-6	6.50E-02	3.10E+01	n		no
Acenaphthene	83-32-9	3.10E-01	3.40E+02	n		no
Acenaphthylene	208-96-8	2.10E-02	3.40E+02	n	Acenaphthene	no
Anthracene	120-12-7	8.30E-01	1.70E+03	n		no
Benzo(a)anthracene	56-55-3	4.00E+00	1.50E-01	c		**YES**
Benzo(a)pyrene	50-32-8	3.70E+00	1.50E-02	c		**YES**
Benzo(b)fluoranthene	205-99-2	4.60E+00	1.50E-01	c		**YES**

Table 9-28
Selection of Constituents of Potential Concern for Sediment
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a] (mg/kg)	Adjusted Soil Regional Screening Level (RSL) [b] Residential Scenario (mg/kg)		Surrogate	Is Constituent a Sediment COPC? [c] (YES, no)
Benzo(g,h,i)perylene	191-24-2	2.10E+00	1.70E+02	n	Pyrene	no
Benzo(k)fluoranthene	207-08-9	1.40E+00	1.50E+00	c		no
Chrysene	218-01-9	4.10E+00	1.50E+01	c		no
Dibenzo(a,h)anthracene	53-70-3	5.60E-01	1.50E-02	c		**YES**
Fluoranthene	206-44-0	4.90E+00	2.30E+02	n		no
Fluorene	86-73-7	2.50E-01	2.30E+02	n		no
Indeno(1,2,3-cd)pyrene	193-39-5	1.60E+00	1.50E-01	c		**YES**
Naphthalene	91-20-3	8.50E-02	3.90E+00	c*		no
Phenanthrene	85-01-8	2.80E+00	1.70E+03	n	Anthracene	no
Pyrene	129-00-0	5.00E+00	1.70E+02	n		no
Inorganics						
Aluminum	7429-90-5	3.09E+04	7.70E+03	n		**YES**
Antimony	7440-36-0	3.10E+00	3.10E+00	n		no
Arsenic	7440-38-2	3.04E+01	3.90E-01	c*		**YES**
Barium	7440-39-3	1.79E+02	1.50E+03	n		no
Beryllium	7440-41-7	2.27E+00	1.60E+01	n		no
Cadmium	7440-43-9	2.70E+00	7.00E+00	n		no
Calcium	7440-70-2	1.20E+05	NA			no
Chromium	7440-47-3	1.54E+04	2.80E+02	c		**YES**
Cobalt	7440-48-4	8.41E+01	2.30E+00	n		**YES**
Copper	7440-50-8	1.88E+02	3.10E+02	n		no
Iron	7439-89-6	2.93E+05	5.50E+03	n		**YES**
Lead	7439-92-1	1.09E+05	4.00E+02	«		**YES**
Magnesium	7439-95-4	1.02E+04	NA			no
Manganese	7439-96-5	2.31E+03	1.80E+02	n		**YES**
Mercury	7439-97-6	9.00E-02	6.70E-01	ns		no
Nickel	7440-02-0	2.68E+01	1.60E+02	n		no
Potassium	7440-09-7	2.21E+03	NA			no
Selenium	7782-49-2	1.30E+00	3.90E+01	n		no
Silver	7440-22-4	8.42E+00	3.90E+01	n		no
Sodium	7440-23-5	5.77E+02	NA			no
Thallium	7440-28-0	1.70E+00	5.10E-01	n		**YES**
Vanadium	7440-62-2	1.06E+02	5.50E+01	n		**YES**
Zinc	7440-66-6	1.73E+04	2.30E+03	n		**YES**

Notes:

CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
mg/kg = Milligrams per kilogram.
NA = Not available or not applicable.
RSL = Regional Screening Level.
USEPA = United States Environmental Protection Agency.

[a] Maximum concentration in sediment.

[b] The screening levels used were risk screening levels for the residential scenario from USEPA (2008a). Screening levels based on non-cancer effects were adjusted downward by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = Concentration may exceed ceiling limit; s = Concentration may exceed saturation concentration (Csat).
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.

[c] Constituents detected with maximum concentrations greater than adjusted residential screening levels were considered COPCs unless they were metals detected at concentrations lower than background, or are essential nutrients (i.e., calcium, magnesium, potassium, sodium), or were known laboratory contaminants (i.e. acetone).

Table 9-29
Selection Constituents of Potential Concern for Surface Water
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Tap Water Regional Screening Level (RSL) [b]			Is Constituent a Surface Water COPC? [c]
		(mg/L)	(mg/L)		Surrogate	(YES, no)
Volatile Organic Compounds						
2-Butanone	78-93-3	4.00E-03	7.10E-01	n		no
Acetone	67-64-1	2.80E-03	2.20E+00	n		no
Carbon Disulfide	75-15-0	2.50E-04	1.00E-01	n		no
Chloroform	67-66-3	3.00E-03	1.90E-04	c		**YES**
cis-1,2-Dichloroethene	156-59-2	1.20E-04	3.70E-02	n		no
Tetrachloroethene	127-18-4	1.60E-04	1.10E-04	c		**YES**
Toluene	108-88-3	2.10E-04	2.30E-01	n		no
Trichloroethene	79-01-6	1.10E-04	1.70E-03	c		no
Semi-Volatile Organic Compounds						
1,2-Dichlorobenzene	95-50-1	2.10E-04	3.70E-02	n		no
1,3-Dichlorobenzene	541-73-1	2.10E-04	3.70E-02	n	1,2-Dichlorobenzene	no
1,4-Dichlorobenzene	106-46-7	2.80E-04	4.30E-04	c		no
Benzoic Acid	65-85-0	6.70E-03	1.50E+01	n		no
bis(2-Ethylhexyl)phthalate	117-81-7	2.60E-03	4.80E-03	c		no
Butylbenzylphthalate	85-68-7	6.30E-04	3.50E-02	c		no
Diethylphthalate	84-66-2	1.00E-03	2.90E+00	n		no
Di-n-Butylphthalate	84-74-2	9.10E-04	3.70E-01	n		no
Dioxin/Furan Compounds						
OCDD	3268-87-9	3.50E-08	1.70E-06	c		no
Explosives						
m-Nitrotoluene	99-08-1	3.80E-04	7.30E-02	n		no
Herbicides						
2,4-D	94-75-7	3.68E-03	3.70E-02	n		no
MCPP	93-65-2	5.41E-02	3.70E-03	n		**YES**
Pesticides						
Dieldrin	60-57-1	9.01E-06	4.20E-06	c		**YES**
Polycyclic Aromatic Hydrocarbons						
1-Methylnaphthalene	90-12-0	2.60E-05	2.30E-03	c		no
2-Methylnaphthalene	91-57-6	3.30E-05	1.50E-02	n		no
Acenaphthene	83-32-9	4.00E-05	2.20E-01	n		no
Anthracene	120-12-7	3.00E-05	1.10E+00	n		no
Fluorene	86-73-7	3.40E-05	1.50E-01	n		no
Naphthalene	91-20-3	4.00E-05	1.40E-04	c*		no
Phenanthrene	85-01-8	5.00E-05	1.10E+00	n	Anthracene	no

Table 9-29
Selection Constituents of Potential Concern for Surface Water
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Tap Water Regional Screening Level (RSL) [b]			Is Constituent a Surface Water COPC? [c]
		(mg/L)	(mg/L)		Surrogate	(YES, no)
Inorganics						
Aluminum	7429-90-5	8.11E-01	3.70E+00	n		no
Arsenic	7440-38-2	1.04E-02	4.50E-05	c		**YES**
Barium	7440-39-3	1.48E-01	7.30E-01	n		no
Beryllium	7440-41-7	1.10E-03	7.30E-03	n		no
Calcium	7440-70-2	9.07E+01	NA			no
Copper	7440-50-8	2.35E-02	1.50E-01	n		no
Iron	7439-89-6	5.09E+01	2.60E+00	n		**YES**
Lead	7439-92-1	1.06E-01	1.50E-03	«		**YES**
Magnesium	7439-95-4	2.10E+01	NA			no
Manganese	7439-96-5	1.47E+00	8.80E-02	n		**YES**
Nickel	7440-02-0	1.50E-03	7.30E-02	n		no
Potassium	7440-09-7	4.08E+00	NA			no
Selenium	7782-49-2	4.40E-04	1.80E-02	n		no
Silver	7440-22-4	1.20E-03	1.80E-02	n		no
Sodium	7440-23-5	6.39E+01	NA			no
Thallium	7440-28-0	5.40E-03	2.40E-04	n		**YES**
Vanadium	7440-62-2	7.90E-02	2.60E-02	n		**YES**
Zinc	7440-66-6	2.37E-02	1.10E+00	n		no

Notes:

CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
mg/L = Milligrams per liter.
NA = Not available or not applicable.
RSL = Regional Screening Level.
USEPA = United States Environmental Protection Agency.

[a] Maximum concentration in surface water.

[b] The screening levels used were risk screening levels for tap water from USEPA (2008a). Screening levels based on non-cancer effects were adjusted downward by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = Concentration may exceed ceiling limit;
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.

[c] Constituents detected with maximum concentrations greater than screening levels were considered COPCs unless they were essential nutrients (i.e., calcium, magnesium, potassium, sodium), or were known laboratory contaminants (i.e. acetone).

Table 9-30
Selection Constituents of Potential Concern for Fish Consumption
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a] (mg/kg)	Is Constituent a Fish Fillet COPC? [c] (YES, no)
Inorganics			
Barium	7440-39-3	1.00E+00	**YES**
Calcium	7440-70-2	8.72E+03	no
Chromium	7440-47-3	2.40E-01	**YES**
Copper	7440-50-8	5.60E-01	**YES**
Iron	7439-89-6	1.19E+01	**YES**
Magnesium	7439-95-4	3.00E+02	no
Manganese	7439-96-5	7.60E-01	**YES**
Mercury	7439-97-6	8.70E-02	**YES**
Potassium	7440-09-7	3.17E+03	no
Sodium	7440-23-5	1.07E+03	no
Zinc	7440-66-6	1.35E+01	**YES**

Notes:
CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
mg/kg = Milligrams per kilogram.
NA = Not available or not applicable.

[a] Maximum concentration in fish fillet.
[c] Constituents detected were considered COPCs unless they were essential nutrients (i.e., calcium, magnesium, potassium, sodium), or were known laboratory contaminants (i.e. acetone).

Table 9-31
Exposure Point Concentrations
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a] Surface Soil	COPC? [a] Combined Surface and Subsurface Soil	COPC? [a] Combined Surface Soil and Sediment	COPC? [a] Combined Surface and Subsurface Soil and Sediment	COPC? [a] Sediment	COPC? [a] Surface Water	Exposure Point Concentrations [b] Surface Soil (mg/kg)	Exposure Point Concentrations [b] Combined Surface and Subsurface Soil (mg/kg)	Exposure Point Concentrations [b] Combined Surface Soil and Sediment (mg/kg)	Exposure Point Concentrations [b] Combined Surface and Subsurface Soil and Sediment (mg/kg)	Exposure Point Concentrations [b] Sediment (mg/kg)	Exposure Point Concentrations [b] Surface Water (mg/L)
Volatile Organic Compounds													
1,2,3-Trichloropropane	96-18-4	no	no	no	no	no	no	–	–	–	–	–	–
1,2,4-Trimethylbenzene	95-63-6	no	no	no	no	no	no	–	–	–	–	–	–
2-Butanone	78-93-3	no	no	no	no	no	no	–	–	–	–	–	–
3-Octanone	106-68-3	no	no	no	no	no	no	–	–	–	–	–	–
4-Methyl-2-pentanone	108-10-1	no	no	no	no	no	no	–	–	–	–	–	–
Acetone	67-64-1	no	no	no	no	no	no	–	–	–	–	–	–
Bromodichloromethane	75-27-4	no	no	no	no	no	no	–	–	–	–	–	–
Carbon Disulfide	75-15-0	no	no	no	no	no	no	–	–	–	–	–	–
Chloroform	67-66-3	no	no	no	no	no	**YES**	–	–	–	–	–	1.29E-03
cis-1,2-Dichloroethene	156-59-2	no	no	no	no	no	no	–	–	–	–	–	–
d-Limonene	5989-27-5	**YES**	**YES**	**YES**	**YES**	no	no	1.70E-01 m	1.70E-01 m	1.70E-01 m	1.70E-01 m	–	–
Ethanol	64-17-5	no	no	no	no	no	no	–	–	–	–	–	–
m,p-Xylene	136777612	no	no	no	no	no	no	–	–	–	–	–	–
Methylene Chloride	75-09-2	no	no	no	no	no	no	–	–	–	–	–	–
p-Isopropyltoluene	99-87-6	no	no	no	no	no	no	–	–	–	–	–	–
Tetrachloroethene	127-18-4	no	no	no	no	no	**YES**	–	–	–	–	–	1.60E-04 m
Toluene	108-88-3	no	no	no	no	no	no	–	–	–	–	–	–
Trichloroethene	79-01-6	no	no	no	no	no	no	–	–	–	–	–	–
Xylenes (total)	1330-20-7	no	no	no	no	no	no	–	–	–	–	–	–
Semi-Volatile Organic Compounds													
1,2,4-Trichlorobenzene	120-82-1	no	no	no	no	no	no	–	–	–	–	–	–
1,2-Dichlorobenzene	95-50-1	no	no	no	no	no	no	–	–	–	–	–	–
1,3-Dichlorobenzene	541-73-1	no	no	no	no	no	no	–	–	–	–	–	–
1,4-Dichlorobenzene	106-46-7	no	no	no	no	no	no	–	–	–	–	–	–
2,4-Dinitrotoluene	121-14-2	no	no	no	no	no	no	–	–	–	–	–	–
2,6-Dinitrotoluene	606-20-2	no	no	no	no	no	no	–	–	–	–	–	–
3,3'-Dichlorobenzidine	91-94-1	no	no	no	no	no	no	–	–	–	–	–	–
4-Methylphenol	106-44-5	no	no	no	no	no	no	–	–	–	–	–	–
Benzoic Acid	65-85-0	no	no	no	no	no	no	–	–	–	–	–	–
bis(2-Ethylhexyl)phthalate	117-81-7	no	no	no	no	no	no	–	–	–	–	–	–
Butylbenzylphthalate	85-68-7	no	no	no	no	no	no	–	–	–	–	–	–
Carbazole	86-74-8	**YES**	**YES**	**YES**	**YES**	**YES**	no	1.00E-01 m	1.00E-01 m	1.21E-01	7.81E-02	2.10E-01 m	–
Dibenzofuran	132-64-9	no	no	no	no	no	no	–	–	–	–	–	–
Diethylphthalate	84-66-2	no	no	no	no	no	no	–	–	–	–	–	–
Di-n-Butylphthalate	84-74-2	no	no	no	no	no	no	–	–	–	–	–	–
Di-n-Octylphthalate	117-84-0	no	no	no	no	no	no	–	–	–	–	–	–
N-Nitrosodiphenylamine	86-30-6	no	no	no	no	no	no	–	–	–	–	–	–
Pentachlorophenol	87-86-5	no	no	no	no	no	no	–	–	–	–	–	–
Phenol	108-95-2	no	no	no	no	no	no	–	–	–	–	–	–

Table 9-31
Exposure Point Concentrations
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a]						Exposure Point Concentrations [b]					
		Surface Soil	Combined Surface and Subsurface Soil	Combined Surface Soil and Sediment	Combined Surface and Subsurface Soil and Sediment	Sediment	Surface Water	Surface Soil (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Combined Surface Soil and Sediment (mg/kg)	Combined Surface and Subsurface Soil and Sediment (mg/kg)	Sediment (mg/kg)	Surface Water (mg/L)
Dioxin/Furan Compounds													
1,2,3,4,6,7,8-HpCDD	35822-46-9	no	no	no	no	no	no	–	–	–	–	–	–
1,2,3,4,6,7,8-HpCDF	67562-39-4	no	no	no	no	no	no	–	–	–	–	–	–
1,2,3,4,7,8,9-HpCDF	55673-89-7	no	no	no	no	no	no	–	–	–	–	–	–
1,2,3,4,7,8-HxCDD	39227-28-6	no	no	no	no	no	no	–	–	–	–	–	–
1,2,3,4,7,8-HxCDF	70648-26-9	no	no	no	no	no	no	–	–	–	–	–	–
1,2,3,6,7,8-HxCDD	57653-85-7	no	no	no	no	no	no	–	–	–	–	–	–
1,2,3,6,7,8-HxCDF	57117-44-9	no	no	no	no	no	no	–	–	–	–	–	–
1,2,3,7,8,9-HxCDD	19408-74-3	no	no	no	no	no	no	–	–	–	–	–	–
1,2,3,7,8,9-HxCDF	72918-21-9	no	no	no	no	no	no	–	–	–	–	–	–
1,2,3,7,8-PeCDD	40321-76-4	no	**YES**	no	**YES**	no	no	–	1.98E-06	–	1.45E-06	–	–
1,2,3,7,8-PeCDF	57117-41-6	no	no	no	no	no	no	–	–	–	–	–	–
2,3,4,6,7,8-HxCDF	60851-34-5	no	no	no	no	no	no	–	–	–	–	–	–
2,3,4,7,8-PeCDF	57117-31-4	no	no	no	no	no	no	–	–	–	–	–	–
2,3,7,8-TCDD	1746-01-6	no	no	no	no	no	no	–	–	–	–	–	–
2,3,7,8-TCDF	51207-31-9	no	no	no	no	no	no	–	–	–	–	–	–
OCDD	3268-87-9	no	no	no	no	no	no	–	–	–	–	–	–
OCDF	39001-02-0	no	no	no	no	no	no	–	–	–	–	–	–
Explosives										–	–		
1,3,5-Trinitrobenzene	99-35-4	no	no	no	no	no	no	–	–	–	–	–	–
1,3-Dinitrobenzene	99-65-0	no	no	no	no	no	no	–	–	–	–	–	–
2,4,6-Trinitrotoluene	118-96-7	no	no	no	no	no	no	–	–	–	–	–	–
4-Amino-2,6-Dinitrotoluene	19406-51-0	no	no	no	no	no	no	–	–	–	–	–	–
m-Nitrotoluene	99-08-1	no	no	no	no	no	no	–	–	–	–	–	–
Nitrobenzene	98-95-3	no	no	no	no	no	no	–	–	–	–	–	–
Nitroglycerine	55-63-0	no	no	**YES**	**YES**	**YES**	no	–	–	9.60E-01 m	9.60E-01 m	9.60E-01 m	–
Pentaerythritol Tetranitrate	78-11-5	**YES**	**YES**	**YES**	**YES**	no	no	1.10E-01 m	1.10E-01 m	1.10E-01 m	1.10E-01 m	–	–
Perchlorate	14797-73-0	no	no	no	no	no	no	–	–	–	–	–	–
Herbicides													
2,4,5-T	93-76-5	no	no	no	no	no	no	–	–	–	–	–	–
2,4,5-TP	93-72-1	no	no	no	no	no	no	–	–	–	–	–	–
2,4-D	94-75-7	no	no	no	no	no	no	–	–	–	–	–	–
2,4-DB	94-82-6	no	no	no	no	no	no	–	–	–	–	–	–
Dalapon	75-99-0	no	no	no	no	no	no	–	–	–	–	–	–
Dicamba	1918-00-9	no	no	no	no	no	no	–	–	–	–	–	–
Dichlorprop	120-36-5	no	no	no	no	no	no	–	–	–	–	–	–
MCPA	94-74-6	no	no	no	no	no	no	–	–	–	–	–	–
MCPP	93-65-2	no	no	no	no	no	**YES**	–	–	–	–	–	5.41E-02 m

Table 9-31
Exposure Point Concentrations
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a] Surface Soil	Combined Surface and Subsurface Soil	Combined Surface Soil and Sediment	Combined Surface and Subsurface Soil and Sediment	Sediment	Surface Water	Exposure Point Concentrations [b] Surface Soil (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Combined Surface Soil and Sediment (mg/kg)	Combined Surface and Subsurface Soil and Sediment (mg/kg)	Sediment (mg/kg)	Surface Water (mg/L)
Pesticides													
4,4'-DDD	72-54-8	no	no	no	no	no	no	–	–	–	–	–	–
4,4'-DDE	72-55-9	no	no	no	no	no	no	–	–	–	–	–	–
4,4'-DDT	50-29-3	no	no	no	no	no	no	–	–	–	–	–	–
Alpha-BHC	319-84-6	no	no	no	no	no	no	–	–	–	–	–	–
Beta-BHC	319-85-7	no	no	no	no	no	no	–	–	–	–	–	–
Delta-BHC	319-86-8	no	no	no	no	no	no	–	–	–	–	–	–
Gamma-BHC (Lindane)	58-89-9	no	no	no	no	no	no	–	–	–	–	–	–
Alpha-Chlordane	5103-71-9	no	no	no	no	no	no	–	–	–	–	–	–
Gamma-Chlordane	5566-34-7	no	no	no	no	no	no	–	–	–	–	–	–
Dieldrin	60-57-1	no	no	no	no	no	**YES**	–	–	–	–	–	9.01E-06 m
Endosulfan I	115-29-7	no	no	no	no	no	no	–	–	–	–	–	–
Endosulfan II	33213-65-9	no	no	no	no	no	no	–	–	–	–	–	–
Endosulfan Sulfate	1031-07-8	no	no	no	no	no	no	–	–	–	–	–	–
Endrin	72-20-8	no	no	no	no	no	no	–	–	–	–	–	–
Endrin Aldehyde	7421-93-4	no	no	no	no	no	no	–	–	–	–	–	–
Endrin Ketone	53494-70-5	no	no	no	no	no	no	–	–	–	–	–	–
Heptachlor	76-44-8	no	no	no	no	no	no	–	–	–	–	–	–
Heptachlor Epoxide	1024-57-3	no	no	no	no	no	no	–	–	–	–	–	–
Methoxychlor	72-43-5	no	no	no	no	no	no	–	–	–	–	–	–
Polycyclic Aromatic Hydrocarbons													
1-Methylnaphthalene	90-12-0	no	no	no	no	no	no	–	–	–	–	–	–
2-Methylnaphthalene	91-57-6	no	no	no	no	no	no	–	–	–	–	–	–
Acenaphthene	83-32-9	no	no	no	no	no	no	–	–	–	–	–	–
Acenaphthylene	208-96-8	no	no	no	no	no	no	–	–	–	–	–	–
Anthracene	120-12-7	no	no	no	no	no	no	–	–	–	–	–	–
Benzo(a)anthracene	56-55-3	**YES**	**YES**	**YES**	**YES**	**YES**	no	1.72E-01	7.92E-02	2.57E-01	1.65E-01	2.32E+00	–
Benzo(a)pyrene	50-32-8	**YES**	**YES**	**YES**	**YES**	**YES**	no	2.11E-01	1.01E-01	2.59E-01	1.69E-01	6.20E-01	–
Benzo(b)fluoranthene	205-99-2	**YES**	**YES**	**YES**	**YES**	**YES**	no	3.12E-01	1.32E-01	3.36E-01	2.19E-01	7.35E-01	–
Benzo(g,h,i)perylene	191-24-2	no	no	no	no	no	no	–	–	–	–	–	–
Benzo(k)fluoranthene	207-08-9	no	no	no	no	no	no	–	–	–	–	–	–
Chrysene	218-01-9	no	no	no	no	no	no	–	–	–	–	–	–
Dibenzo(a,h)anthracene	53-70-3	**YES**	**YES**	**YES**	**YES**	**YES**	no	2.20E-01 m	4.44E-02	6.29E-02	4.71E-02	5.60E-01 m	–
Fluoranthene	206-44-0	no	no	no	no	no	no	–	–	–	–	–	–
Fluorene	86-73-7	no	no	no	no	no	no	–	–	–	–	–	–
Indeno(1,2,3-cd)pyrene	193-39-5	**YES**	**YES**	**YES**	**YES**	**YES**	no	1.85E-01	8.96E-02	1.62E-01	1.09E-01	3.06E-01	–
Naphthalene	91-20-3	no	no	no	no	no	no	–	–	–	–	–	–
Phenanthrene	85-01-8	no	no	no	no	no	no	–	–	–	–	–	–
Pyrene	129-00-0	no	no	no	no	no	no	–	–	–	–	–	–
Polychlorinated Biphenyls													
Aroclor 1254	11097-69-1	no	**YES**	no	**YES**	no	no	–	8.70E-01 m	–	8.70E-01 m	–	–
Aroclor 1260	11096-82-5	no	no	no	no	no	no	–	–	–	–	–	–

Table 9-31
Exposure Point Concentrations
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

		COPC? [a]						Exposure Point Concentrations [b]					
Constituent of Potential Concern (COPC)	**CASN**	**Surface Soil**	**Combined Surface and Subsurface Soil**	**Combined Surface Soil and Sediment**	**Combined Surface and Subsurface Soil and Sediment**	**Sediment**	**Surface Water**	**Surface Soil (mg/kg)**	**Combined Surface and Subsurface Soil (mg/kg)**	**Combined Surface Soil and Sediment (mg/kg)**	**Combined Surface and Subsurface Soil and Sediment (mg/kg)**	**Sediment (mg/kg)**	**Surface Water (mg/L)**
Inorganics													
Aluminum	7429-90-5	no	**YES**	**YES**	**YES**	**YES**	no	–	1.96E+04	1.89E+04	1.92E+04	1.92E+04	–
Antimony	7440-36-0	**YES**	**YES**	**YES**	**YES**	no	no	8.61E-01	7.21E-01	8.00E-01	7.13E-01	–	–
Arsenic	7440-38-2	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	1.18E+01	9.75E+00	1.12E+01	1.04E+01	8.69E+00	1.04E-02 m
Barium	7440-39-3	no	no	no	no	no	no	–	–	–	–	–	–
Beryllium	7440-41-7	no	no	no	no	no	no	–	–	–	–	–	–
Cadmium	7440-43-9	no	no	no	no	no	no	–	–	–	–	–	–
Calcium	7440-70-2	no	no	no	no	no	no	–	–	–	–	–	–
Chromium	7440-47-3	no	no	**YES**	**YES**	**YES**	no	–	–	8.77E+02	5.86E+02	6.05E+03	–
Cobalt	7440-48-4	no	no	**YES**	**YES**	**YES**	no	–	–	1.29E+01	1.43E+01	2.45E+01	–
Copper	7440-50-8	**YES**	**YES**	**YES**	**YES**	no	no	1.77E+02	9.84E+01	1.12E+02	8.54E+01	–	–
Iron	7439-89-6	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	3.60E+04	3.51E+04	3.83E+04	3.65E+04	7.47E+04	3.99E+01
Lead	7439-92-1	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	2.13E+02 avg	1.55E+02 avg	7.87E+03	5.23E+03	3.61E+03 avg	1.93E-02 avg
Magnesium	7439-95-4	no	no	no	no	no	no	–	–	–	–	–	–
Manganese	7439-96-5	no	no	**YES**	**YES**	**YES**	**YES**	–	–	3.88E+02	3.12E+02	8.31E+02	1.15E+00
Mercury	7439-97-6	no	no	no	no	no	no	–	–	–	–	–	–
Nickel	7440-02-0	no	no	no	no	no	no	–	–	–	–	–	–
Potassium	7440-09-7	no	no	no	no	no	no	–	–	–	–	–	–
Selenium	7782-49-2	no	no	no	no	no	no	–	–	–	–	–	–
Silver	7440-22-4	no	no	no	no	no	no	–	–	–	–	–	–
Sodium	7440-23-5	no	no	no	no	no	no	–	–	–	–	–	–
Thallium	7440-28-0	no	no	**YES**	**YES**	**YES**	**YES**	–	–	2.82E-01	2.77E-01	3.89E-01	5.40E-03 m
Vanadium	7440-62-2	no	no	**YES**	**YES**	**YES**	**YES**	–	–	6.02E+01	6.08E+01	4.90E+01	2.60E-02
Zinc	7440-66-6	**YES**	**YES**	**YES**	**YES**	**YES**	no	7.17E+02	4.01E+02	1.46E+03	9.92E+02	6.81E+03	–

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilogram.
mg/L = Milligrams per liter.

[a] Constituent of Potential Concern.
[b] The exposure point concentration (EPC) was the upper confidence level on the mean (UCL) or the maximum concentration where the UCL was incalculable.
EPCs marked with "m" are based on the maximum detected concentration.
Exposure to lead is evaluated by predicting resultant blood lead levels using the arithmetic average (avg).
The UCLs were calculated using ProUCL 4.0. The UCL used is the one recommended by ProUCL 4.0.

Table 9-32
Summary of Calculated Human Health Risks and Hazards
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

RECEPTOR / Exposure Medium - Scenario	Total Excess Lifetime Cancer Risk	Total Non-Cancer Hazard
Site Worker		
Surface Soil - Direct Contact	1E-05	0.1
Sediment - Wading	2E-06	0.1
Surface Water - Wading	3E-06	0.2
TOTAL SITE RISKS (Site Worker):	1E-05	0.4
Hypothetical Future Construction Worker		
Combined Surface and Subsurface Soil - Direct Contact	5E-07	0.5
TOTAL SITE RISKS (Construction Worker):	5E-07	0.5
Hypothetical Future Adult Resident		
Combined Surface and Subsurface Soil - Direct Contact	1E-05	0.2
Sediment - Wading	6E-06	0.2
Surface Water - Wading	6E-07	0.04
Fish Consumption	NA	0.3
TOTAL SITE RISKS (Adult Resident):	2E-05	0.8
Hypothetical Future Child Resident		
Combined Surface and Subsurface Soil - Direct Contact	3E-05	2
Sediment - Wading	5E-06	2
Surface Water - Wading	6E-07	0.1
Fish Consumption	NA	1
TOTAL SITE RISKS (Child Resident):	3E-05	6
Hypothetical Future Aggregate Resident (Adult + Child)		
Combined Surface and Subsurface Soil - Direct Contact	4E-05	--
Sediment - Wading	1E-05	--
Surface Water - Wading	1E-06	--
Fish Consumption	NA	--
TOTAL SITE RISKS (Aggregate Resident):	5E-05	--

Table 9-33
Summary of Calculated Human Health Risks and Hazards for Combined Soil and Sediment
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

RECEPTOR Exposure Medium - Scenario	Total Excess Lifetime Cancer Risk	Total Non-Cancer Hazard
Site Worker		
Surface Soil and Sediment - Direct Contact	1E-05	0.5
TOTAL SITE RISKS (Site Worker):	1E-05	0.5
Hypothetical Future Construction Worker		
Combined Surface and Subsurface Soil and Sediment - Direct Conta	6E-07	0.8
TOTAL SITE RISKS (Construction Worker):	6E-07	0.8
Hypothetical Future Adult Resident		
Combined Surface and Subsurface Soil and Sediment - Direct Conta	1E-05	0.7
TOTAL SITE RISKS (Adult Resident):	1E-05	0.7
Hypothetical Future Child Resident		
Combined Surface and Subsurface Soil and Sediment - Direct Conta	3E-05	6
TOTAL SITE RISKS (Child Resident):	3E-05	6
Hypothetical Future Aggregate Resident (Adult + Child)		
Combined Surface and Subsurface Soil and Sediment - Direct Conta	5E-05	--
TOTAL SITE RISKS (Aggregate Resident):	5E-05	--

Table 9-33a
Summary of Calculated Blood Lead Level Estimates
WESTERN BURNING GROUND
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Exposure Medium/Receptor	Model Used [a]	Receptor Blood Lead Level[b]		Fetus Blood Level [b]
		Adult	Child	
		50th Percentile/ Geometric Mean (µg/dL)	range in seven years (µg/dL)	95th Percentile (µg/dL)
WESTERN BURNING GROUND				
Surface Soil (0-1 feet below ground surface)				
Hypothetical Current Commercial/Industrial Worker Receptor	USEPA ALM	2.0	–	7.1
Surface and Subsurface Soil				
Hypothetical Construction Worker Receptor	USEPA ALM	2.0	–	7.0
Hypothetical Future Child Resident Receptor	IEUBK	–	2.9 - 5.5	–
Hypothetical Future Adult Resident Receptor	USEPA ALM	2.1	–	7.3
Sediment				
Hypothetical Future Child Resident Receptor	IEUBK	–	NC	–
Hypothetical Future Adult Resident Receptor	USEPA ALM	2.8	–	10

Notes:
– = Not applicable.
NC = Not calculable.
µg/dL = Microgram(s) per deciliter.

[a] USEPA ALM: USEPA Adult Lead Methodology Spreadsheet.
USEPA Technical Review Workgroup for Lead, Adult Lead Committee (USEPA 2003b).
USEPA IEUBK: USEPA Integrated Exposure Uptake Biogenetic Model for Lead in Children (USEPA 2005).
[b] Compare to a target blood lead level of 10 µg/dL.

Table 9-34
Screening Level -Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Background Concentration [a] (mg/kg)	Ecological Screening Level (ESLs) [b] (mg/kg) Value	*Source*	Maximum HQ [c] (unitless)	Bioaccumulative Chemical? [d] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [e] (YES/no)	Rational
Volatile Organic Compounds								
Acetone	0.07	–	2.5	*R5*	0.03	no	no	HQ • 1
Carbon Disulfide	0.0008	–	0.09412	*R5*	0.008	no	no	HQ • 1
d-Limonene	0.17	–	NA		NA	no	**YES**	**NSL**
Methylene Chloride	0.003	–	4.05	*R5*	0.0007	no	no	HQ • 1
p-Isopropyltoluene	0.0048	–	NA		NA	no	**YES**	**NSL**
Toluene	0.0011	–	5.45	*R5*	0.0002	no	no	HQ • 1
Semi-Volatile Organic Compounds								
bis(2-Ethylhexyl)phthalate	0.67	–	0.92594	*R5*	0.7	no	no	HQ • 1
Carbazole	0.1	–	NA		NA	no	**YES**	**NSL**
Dibenzofuran	0.014	–	NA		NA	no	**YES**	**NSL**
Di-n-Butylphthalate	0.13	–	0.15	*R5*	0.9	no	no	HQ • 1
Di-n-Octylphthalate	0.016	–	709	*R5*	0.00002	no	no	HQ • 1
N-Nitrosodiphenylamine	0.06	–	0.545	*R5*	0.1	no	no	HQ • 1
Dioxin/Furan Compounds								
Dioxin Toxicity Equivalents [f]	9.90E-06	–	0.000000199	*R5s*	50	no	**YES**	**HQ > 1**
Explosives								
Pentaerythritol Tetranitrate	0.11	–	NA		NA	no	**YES**	**NSL**
Herbicides								
2,4,5-TP	0.0078	–	0.109	*R5*	0.07	no	no	HQ • 1
2,4-D	0.0302	–	0.272	*R5*	0.1	no	no	HQ • 1
Dalapon	0.163	–	NA		NA	no	**YES**	**NSL**
MCPP	2.56	–	NA		NA	no	**YES**	**NSL**
Pesticides								
4,4'-DDD	0.0019	–	0.021	*EcoSSL*	0.09	YES	**YES**	**Bioaccumulative**
Dieldrin	0.00472	–	0.0049	*EcoSSL*	1	YES	**YES**	**Bioaccumulative**
Polycyclic Aromatic Hydrocarbons								
2-Methylnaphthalene	0.023	–	3.24	*R5*	0.007	no	no	HQ • 1
Acenaphthene	0.32	–	682	*R5*	0.0005	YES	**YES**	**Bioaccumulative**
Acenaphthylene	0.0039	–	682	*R5*	0.000006	YES	**YES**	**Bioaccumulative**
Anthracene	0.1	–	1,480	*R5*	0.00007	YES	**YES**	**Bioaccumulative**
Benzo(a)anthracene	0.97	–	5.21	*R5*	0.2	YES	**YES**	**Bioaccumulative**
Benzo(a)pyrene	1.1	–	1.52	*R5*	0.7	YES	**YES**	**Bioaccumulative**
Benzo(b)fluoranthene	1.8	–	59.8	*R5*	0.03	YES	**YES**	**Bioaccumulative**
Benzo(g,h,i)perylene	0.96	–	119	*R5*	0.008	YES	**YES**	**Bioaccumulative**
Benzo(k)fluoranthene	0.53	–	148	*R5*	0.004	YES	**YES**	**Bioaccumulative**
Chrysene	0.99	–	4.73	*R5*	0.2	YES	**YES**	**Bioaccumulative**
Dibenzo(a,h)anthracene	0.22	–	18.4	*R5*	0.01	YES	**YES**	**Bioaccumulative**
Fluoranthene	1.6	–	122	*R5*	0.01	YES	**YES**	**Bioaccumulative**
Fluorene	0.028	–	122	*R5*	0.0002	YES	**YES**	**Bioaccumulative**
Indeno(1,2,3-cd)pyrene	1.1	–	109	*R5*	0.01	YES	**YES**	**Bioaccumulative**
Naphthalene	0.018	–	0.0994	*R5*	0.2	no	no	HQ • 1

Table 9-34
Screening Level -Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Background Concentration [a] (mg/kg)	Ecological Screening Level (ESLs) [b] (mg/kg) Value	*Source*	Maximum HQ [c] (unitless)	Bioaccumulative Chemical? [d] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [e] (YES/no)	Rational
Phenanthrene	0.69	–	45.7	*R5*	0.02	YES	**YES**	**Bioaccumulative**
Pyrene	1.6	–	78.5	*R5*	0.02	YES	**YES**	**Bioaccumulative**
Polychlorinated Biphenyls								
Aroclor 1254	0.084	–	NA		NA	YES	**YES**	**Bioaccumulative**
Inorganics								
Aluminum	40,000	40,041	50	*ORNL*	800	no	no	max • BKGD
Antimony	5.3	NA	0.27	*EcoSSL*	20	no	**YES**	**HQ > 1**
Arsenic	37.9	15.8	18	*EcoSSL*	2	YES	**YES**	**HQ > 1**
Barium	610	209	330	*EcoSSL*	2	no	**YES**	**HQ > 1**
Beryllium	3.4	1.02	21	*EcoSSL*	0.2	no	no	HQ • 1
Cadmium	2.7	0.69	0.36	*EcoSSL*	8	YES	**YES**	**HQ > 1**
Calcium	97,300	NA	NA		NA	no	no	NT
Chromium	249	65.3	26	*EcoSSL*	10	YES	**YES**	**HQ > 1**
Cobalt	31.4	72.3	13	*EcoSSL*	2	no	no	max • BKGD
Copper	1,340	53.5	28	*EcoSSL*	50	YES	**YES**	**HQ > 1**
Iron	54,000	50,962	NA		NA	no	**YES**	**NSL**
Lead	3,990	26.8	11	*EcoSSL*	400	YES	**YES**	**HQ > 1**
Magnesium	23,200	NA	NA		NA	no	no	NT
Manganese	911	2,543	220	*EcoSSL*	4	no	no	max • BKGD
Mercury	0.24	0.13	0.1	*R5*	2	no	**YES**	**HQ > 1**
Nickel	37	62.8	38	*EcoSSL*	1	YES	no	max • BKGD
Potassium	2,910	NA	NA		NA	no	no	NT
Selenium	1.2	NA	0.52	*EcoSSL*	2	YES	**YES**	**HQ > 1**
Silver	2.2	NA	4.2	*EcoSSL*	0.5	YES	**YES**	**Bioaccumulative**
Sodium	384	NA	NA		NA	no	no	NT
Thallium	0.86	2.11	0.05692	*R5*	20	no	no	max • BKGD
Vanadium	90.7	108	7.8	*EcoSSL*	10	no	no	max • BKGD
Zinc	3,250	202	46	*EcoSSL*	70	YES	**YES**	**HQ > 1**

Notes:

– = Not available or applicable.
mg/kg = Milligrams per kilogram.
NA = Not available or applicable.

[a] Background levels for inorganics are facility-wide soil background point estimates taken from Facility-Wide Background Study Report (IT Corporation 2001).
[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[c] The maximum hazard quotient (HQ) is the ratio of the maximum constituent concentration to the surface soil screening level. HQs are rounded to one significant figure.
[d] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.
[e] (COPECs) for screening level assessment unless they were essential nutrients and thus considered non-toxic (NT), or were inorganics present at concentrations below background (max • BKGD).
[f] Sum of individual dioxin/furan compounds multiplied by their individual TEFs.

Table 9-35
Screening Level - Constituents of Potential Ecological Concern in Sediment
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Ecological Screening Level (ESLs) [a] (mg/kg) Value	*Source*	Maximum HQ [b] (unitless)	Bioaccumulative Chemical? [c] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rational
Volatile Organic Compounds							
2-Butanone	0.18	0.0424	*R5*	4	no	**YES**	**HQ > 1**
Acetone	0.23	0.0099	*R5*	20	no	**YES**	**HQ > 1**
Carbon Disulfide	0.0015	0.000851	*R3*	2	no	**YES**	**HQ > 1**
Methylene Chloride	0.002	0.159	*R5*	0.01	no	no	HQ • 1
Toluene	0.61	1.22	*R5*	0.5	no	no	HQ • 1
Semi-Volatile Organic Compounds							
1,2,4-Trichlorobenzene	0.023	2.1	*R3*	0.01	YES	**YES**	**Bioaccumulative**
1,4-Dichlorobenzene	0.049	0.599	*R3*	0.08	YES	**YES**	**Bioaccumulative**
4-Methylphenol	2.2	0.67	*R3*	3	no	**YES**	**HQ > 1**
bis(2-Ethylhexyl)phthalate	0.33	0.18	*R3*	2	no	**YES**	**HQ > 1**
Carbazole	0.21	NA		NA	no	**YES**	**NSL**
Dibenzofuran	0.1	0.415	*R3*	0.2	no	no	HQ • 1
Phenol	0.086	0.42	*R3*	0.2	no	no	HQ • 1
Dioxin/Furan Compounds							
Dioxin Toxicity Equivalents [e]	2.82E-06	0.00000085	*R3s*	3	YES	**YES**	**HQ > 1**
Explosives							
1,3,5-Trinitrobenzene	0.41	NA		NA	no	**YES**	**NSL**
Nitroglycerine	0.96	NA		NA	no	**YES**	**NSL**
Herbicides							
2,4,5-T	0.00757	12.3	*R3*	0.0006	no	no	HQ • 1
2,4-D	6.83	1.273	*R5*	5	no	**YES**	**HQ > 1**
Dicamba	0.0322	NA		NA	no	**YES**	**NSL**
MCPP	3.56	NA		NA	no	**YES**	**NSL**
Pesticides							
4,4'-DDD	0.00152	0.00488	*R3*	0.3	YES	**YES**	**Bioaccumulative**
4,4'-DDE	0.00308	0.00316	*R3*	1	YES	**YES**	**Bioaccumulative**
4,4'-DDT	0.0119	7	*ORNL*	0.002	YES	**YES**	**Bioaccumulative**
BHC, delta-	0.00095	6.4	*R3*	0.0001	YES	**YES**	**Bioaccumulative**
Chlordane, alpha-	0.00071	0.00324	*R3s*	0.2	YES	**YES**	**Bioaccumulative**
Chlordane, gamma-	0.00088	0.00324	*R3s*	0.3	no	no	HQ • 1
Dieldrin	0.00347	0.0019	*R3*	2	YES	**YES**	**HQ > 1**
Endosulfan II	0.00161	0.014	*R3*	0.1	YES	**YES**	**Bioaccumulative**
Endrin Aldehyde	0.00169	0.48	*R5*	0.004	no	no	HQ • 1
Endrin Ketone	0.00288	0.00222	*R3s*	1	no	no	HQ • 1
Methoxychlor	0.00637	0.0187	*R3*	0.3	YES	**YES**	**Bioaccumulative**
Polycyclic Aromatic Hydrocarbons							
1-Methylnaphthalene	0.0026	0.0202	*R3s*	0.1	no	no	HQ • 1
2-Methylnaphthalene	0.065	0.0202	*R3*	3	no	**YES**	**HQ > 1**
Acenaphthene	0.31	0.0067	*R3*	50	YES	**YES**	**HQ > 1**
Acenaphthylene	0.021	0.0059	*R3*	4	YES	**YES**	**HQ > 1**
Anthracene	0.83	0.0572	*R3*	10	YES	**YES**	**HQ > 1**
Benzo(a)anthracene	4	0.108	*R3*	40	YES	**YES**	**HQ > 1**
Benzo(a)pyrene	3.7	0.15	*R3*	20	YES	**YES**	**HQ > 1**
Benzo(b)fluoranthene	4.6	10.4	*R5*	0.4	YES	**YES**	**Bioaccumulative**
Benzo(g,h,i)perylene	2.1	0.17	*R3*	10	YES	**YES**	**HQ > 1**
Benzo(k)fluoranthene	1.4	0.24	*R3*	6	YES	**YES**	**HQ > 1**

Table 9-35
Screening Level - Constituents of Potential Ecological Concern in Sediment
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Ecological Screening Level (ESLs) [a] (mg/kg)		Maximum HQ [b] (unitless)	Bioaccumulative Chemical? [c] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [d]	
		Value	*Source*			(YES/no)	Rational
Chrysene	4.1	0.166	*R3*	20	YES	**YES**	**HQ > 1**
Dibenzo(a,h)anthracene	0.56	0.033	*R3*	20	YES	**YES**	**HQ > 1**
Fluoranthene	4.9	0.423	*R3*	10	YES	**YES**	**HQ > 1**
Fluorene	0.25	0.0774	*R3*	3	YES	**YES**	**HQ > 1**
Indeno(1,2,3-cd)pyrene	1.6	0.017	*R3*	90	YES	**YES**	**HQ > 1**
Naphthalene	0.085	0.176	*R3*	0.5	no	no	HQ • 1
Phenanthrene	2.8	0.204	*R3*	10	YES	**YES**	**HQ > 1**
Pyrene	5	0.195	*R3*	30	YES	**YES**	**HQ > 1**
Inorganics							
Aluminum	30,900	58,000	*ARCS_PEC*	0.5	no	no	HQ • 1
Antimony	3.1	2	*R3*	2	no	**YES**	**HQ > 1**
Arsenic	30.4	9.8	*R3*	3	YES	**YES**	**HQ > 1**
Barium	179	NA		NA	no	**YES**	**NSL**
Beryllium	2.27	NA		NA	no	**YES**	**NSL**
Cadmium	2.7	0.99	*R3*	3	YES	**YES**	**HQ > 1**
Calcium	120,000	NA		NA	no	no	NT
Chromium	15,400	43.4	*R3*	400	YES	**YES**	**HQ > 1**
Cobalt	84.1	50	*R3*	2	no	**YES**	**HQ > 1**
Copper	188	31.6	*R3*	6	YES	**YES**	**HQ > 1**
Iron	293,000	20,000	*R3*	10	no	**YES**	**HQ > 1**
Lead	109,000	35.8	*R3*	3000	YES	**YES**	**HQ > 1**
Magnesium	10,200	NA		NA	no	no	NT
Manganese	2,310	460	*R3*	5	no	**YES**	**HQ > 1**
Mercury	0.09	0.18	*R3*	0.5	no	no	HQ • 1
Nickel	26.8	22.7	*R3*	1	YES	**YES**	**Bioaccumulative**
Potassium	2,210	NA		NA	no	no	NT
Selenium	1.3	2	*R3*	0.7	YES	**YES**	**Bioaccumulative**
Silver	8.42	1	*R3*	8	YES	**YES**	**HQ > 1**
Sodium	577	NA		NA	no	no	NT
Thallium	1.7	NA		NA	no	**YES**	**NSL**
Vanadium	106	NA		NA	no	**YES**	**NSL**
Zinc	17,300	121	*R3*	100	YES	**YES**	**HQ > 1**

Notes:
– = Not available or applicable.
mg/kg = Milligrams per kilogram.
NA = Not available or applicable.

[a] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[b] The maximum hazard quotient (HQ) is the ratio of the maximum constituent concentration to the sediment screening level. HQs are rounded to one significant figure.
[c] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.
[d] Constituents with a hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for screening level assessment unless they were essential nutrients and thus considered non-toxic (NT).
[e] Sum of individual dioxin/furan compounds multiplied by their individual TEFs.

Table 9-36
Screening Level - Constituents of Potential Ecological Concern in Surface Water
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/L)	Ecological Screening Level (ESLs) [a] (mg/L) Value	*Source*	Maximum HQ [b] (unitless)	Bioaccumulative Chemical? [c] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rational
Volatile Organic Compounds							
2-Butanone	0.004	14	*R3*	0.0003	no	no	HQ • 1
Acetone	0.0028	1.5	*R3*	0.002	no	no	HQ • 1
Carbon Disulfide	0.00025	0.00092	*R3*	0.3	no	no	HQ • 1
Chloroform	0.003	0.0018	*R3*	2	no	**YES**	**HQ > 1**
cis-1,2-Dichloroethene	0.00012	0.97	*R3s*	0.0001	no	no	HQ • 1
Tetrachloroethene	0.00016	0.111	*R3*	0.001	no	no	HQ • 1
Toluene	0.00021	0.002	*R3*	0.1	no	no	HQ • 1
Trichloroethene	0.00011	0.021	*R3*	0.005	no	no	HQ • 1
Semi-Volatile Organic Compounds							
1,2-Dichlorobenzene	0.00021	0.0007	*R3*	0.3	YES	**YES**	**Bioaccumulative**
1,3-Dichlorobenzene	0.00021	0.15	*R3*	0.001	YES	**YES**	**Bioaccumulative**
1,4-Dichlorobenzene	0.00028	0.026	*R3*	0.01	YES	**YES**	**Bioaccumulative**
Benzoic Acid	0.0067	0.042	*R3*	0.2	no	no	HQ • 1
bis(2-Ethylhexyl)phthalate	0.0026	0.016	*R3*	0.2	no	no	HQ • 1
Butylbenzylphthalate	0.00063	0.019	*R3*	0.03	no	no	HQ • 1
Diethylphthalate	0.001	0.21	*R3*	0.005	no	no	HQ • 1
Di-n-Butylphthalate	0.00091	0.019	*R3*	0.05	no	no	HQ • 1
Dioxin/Furan Compounds							
Dioxin Toxicity Equivalents [e]	3.50E-12	3.1E-12	*R3s*	1	YES	**YES**	**Bioaccumulative**
Explosives							
m-Nitrotoluene	0.00038	0.75	*R3*	0.0005	no	no	HQ • 1
Herbicides							
2,4-D	0.00368	0.22	*R5*	0.02	no	no	HQ • 1
MCPP	0.0541	NA		NA	no	**YES**	**NSL**
Pesticides							
Dieldrin	0.00000901	0.000056	*R3*	0.2	YES	**YES**	**Bioaccumulative**
Polycyclic Aromatic Hydrocarbons							
1-Methylnaphthalene	0.000026	0.0021	*R3*	0.01	no	no	HQ • 1
2-Methylnaphthalene	0.000033	0.0047	*R3*	0.007	no	no	HQ • 1
Acenaphthene	0.00004	0.0058	*R3*	0.007	YES	**YES**	**Bioaccumulative**
Anthracene	0.00003	0.000012	*R3*	3	YES	**YES**	**HQ > 1**
Fluorene	0.000034	0.003	*R3*	0.01	YES	**YES**	**Bioaccumulative**
Naphthalene	0.00004	0.0011	*R3*	0.04	no	no	HQ • 1
Phenanthrene	0.00005	0.0004	*R3*	0.1	YES	**YES**	**Bioaccumulative**
Inorganics							
Aluminum	0.811	0.087	*R3*	9	no	**YES**	**HQ > 1**
Arsenic	0.0104	0.005	*R3*	2	YES	**YES**	**HQ > 1**
Barium	0.148	0.004	*R3*	40	no	**YES**	**HQ > 1**
Beryllium	0.0011	0.00066	*R3*	2	no	**YES**	**HQ > 1**
Calcium	90.7	116	*R3*	NA	no	no	NT
Copper	0.0235	0.009	*R3*	3	YES	**YES**	**HQ > 1**
Iron	50.9	0.3	*R3*	200	no	**YES**	**HQ > 1**
Lead	0.106	0.0025	*R3*	40	YES	**YES**	**HQ > 1**

Table 9-36
Screening Level - Constituents of Potential Ecological Concern in Surface Water
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/L)	Ecological Screening Level (ESLs) [a] (mg/L)		Maximum HQ [b] (unitless)	Bioaccumulative Chemical? [c] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [d]	
		Value	*Source*			(YES/no)	Rational
Magnesium	21	82	*R3*	NA	no	no	NT
Manganese	1.47	0.12	*R3*	10	no	**YES**	**HQ > 1**
Nickel	0.0015	0.052	*R3*	0.03	YES	**YES**	**Bioaccumulative**
Potassium	4.08	NA		NA	no	no	NT
Selenium	0.00044	0.001	*R3*	0.4	YES	**YES**	**Bioaccumulative**
Silver	0.0012	0.0032	*R3*	0.4	YES	**YES**	**Bioaccumulative**
Sodium	63.9	680	*R3*	NA	no	no	NT
Thallium	0.0054	0.0008	*R3*	7	no	**YES**	**HQ > 1**
Vanadium	0.079	0.02	*R3*	4	no	**YES**	**HQ > 1**
Zinc	0.0237	0.12	*R3*	0.2	YES	**YES**	**Bioaccumulative**

Notes:
– = Not available or applicable.
mg/L = Milligrams per liter.
NA = Not available or applicable.

[a] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[b] The maximum hazard quotient (HQ) is the ratio of the maximum constituent concentration to the surface soil screening level. HQs are rounded to one significant figure.
[c] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.
[d] Constituent with a hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential
[e] Sum of individual dioxin/furan compounds multiplied by their individual TEFs.

Table 9-37
Baseline Level - Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)		TEF [b]	Ecological Screening Level (ESLs) [b] (mg/kg) Value	*Source*	Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rational	Bioaccumulative ? [e] (YES/no)
Volatile Organic Compounds									
d-Limonene	0.17	m	–	NA		NA	**YES**	**NSL**	no
p-Isopropyltoluene	0.0048	m	–	NA		NA	**YES**	**NSL**	no
Semi-Volatile Organic Compounds									
Carbazole	0.1	m	–	NA		NA	**YES**	**NSL**	no
Dibenzofuran	0.014	m	–	NA		NA	**YES**	**NSL**	no
Dioxin/Furan Compounds									
Dioxin Toxicity Equivalents	9.90E-06	m		0.000000199	*R5s*	50	**YES**	**HQ > 1**	**YES**
Explosives									
Pentaerythritol Tetranitrate	0.11	m	–	NA		NA	**YES**	**NSL**	no
Herbicides									
Dalapon	0.163	m	–	NA		NA	**YES**	**NSL**	no
MCPP	2.56	m	–	NA		NA	**YES**	**NSL**	no
Pesticides									
4,4'-DDD	0.0019	m	–	0.021	*EcoSSL*	0.09	**YES**	**Bioaccumulative**	**YES**
Dieldrin	0.00472	m	–	0.0049	*EcoSSL*	1	**YES**	**Bioaccumulative**	**YES**
Polycyclic Aromatic Hydrocarbons									
Acenaphthene	0.32	m	–	682	*R5*	0.0005	**YES**	**Bioaccumulative**	**YES**
Acenaphthylene	0.0039	m	–	682	*R5*	0.000006	**YES**	**Bioaccumulative**	**YES**
Anthracene	0.035		–	1,480	*R5*	0.00002	**YES**	**Bioaccumulative**	**YES**
Benzo(a)anthracene	0.132		–	5.21	*R5*	0.03	**YES**	**Bioaccumulative**	**YES**
Benzo(a)pyrene	0.164		–	1.52	*R5*	0.1	**YES**	**Bioaccumulative**	**YES**
Benzo(b)fluoranthene	0.228		–	59.8	*R5*	0.004	**YES**	**Bioaccumulative**	**YES**
Benzo(g,h,i)perylene	0.148		–	119	*R5*	0.001	**YES**	**Bioaccumulative**	**YES**
Benzo(k)fluoranthene	0.123		–	148	*R5*	0.0008	**YES**	**Bioaccumulative**	**YES**
Chrysene	0.164		–	4.73	*R5*	0.03	**YES**	**Bioaccumulative**	**YES**
Dibenzo(a,h)anthracene	0.22	m	–	18.4	*R5*	0.01	**YES**	**Bioaccumulative**	**YES**
Fluoranthene	0.236		–	122	*R5*	0.002	**YES**	**Bioaccumulative**	**YES**
Fluorene	0.028	m	–	122	*R5*	0.0002	**YES**	**Bioaccumulative**	**YES**
Indeno(1,2,3-cd)pyrene	0.145		–	109	*R5*	0.001	**YES**	**Bioaccumulative**	**YES**
Phenanthrene	0.119		–	45.7	*R5*	0.003	**YES**	**Bioaccumulative**	**YES**
Pyrene	0.2		–	78.5	*R5*	0.003	**YES**	**Bioaccumulative**	**YES**
Polychlorinated Biphenyls									
Aroclor 1254	0.084	m	–	NA		NA	**YES**	**NSL**	**YES**

Table 9-37
Baseline Level - Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)	TEF [b]	Ecological Screening Level (ESLs) [b] (mg/kg)		Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d]		Bioaccumulative ? [e] (YES/no)
			Value	*Source*		(YES/no)	Rational	
Inorganics								
Antimony	0.836	–	0.27	*EcoSSL*	3	**YES**	**HQ > 1**	no
Arsenic	10.72	–	18	*EcoSSL*	0.6	**YES**	**Bioaccumulative**	**YES**
Barium	68.87	–	330	*EcoSSL*	0.2	no	HQ • 1	no
Cadmium	0.322	–	0.36	*EcoSSL*	0.9	**YES**	**Bioaccumulative**	**YES**
Chromium	55.92	–	26	*EcoSSL*	2	**YES**	**HQ > 1**	no
Copper	145.5	–	28	*EcoSSL*	5	**YES**	**HQ > 1**	**YES**
Iron	35,755	–	NA		NA	**YES**	**NSL**	no
Lead	698	–	11	*EcoSSL*	60	**YES**	**HQ > 1**	**YES**
Mercury	0.0954	–	0.1	*R5*	1	no	HQ • 1	no
Selenium	0.625	–	0.52	*EcoSSL*	1	**YES**	**Bioaccumulative**	**YES**
Silver	0.37	–	4.2	*EcoSSL*	0.09	**YES**	**Bioaccumulative**	**YES**
Zinc	593.9	–	46	*EcoSSL*	10	**YES**	**HQ > 1**	**YES**

Notes:
– = Not available or applicable.
mg/kg = Milligrams per kilogram.
NA = Not available or applicable.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[c] The refined hazard quotient (HQ) is the ratio of the EPC to the surface soil screening level. HQs are rounded to one significant figure.
[d] Constituents with a refined hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for baseline risk assessment.
[e] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.

Table 9-38
Baseline Level - Constituents of Potential Ecological Concern in Sediment
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)		Ecological Screening Level (ESLs) [b] (mg/kg) Value	*Source*	Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rational	Bioaccumulative ? [e] (YES/no)
Volatile Organic Compounds								
2-Butanone	0.0737		0.0424	*R5*	2	**YES**	**HQ > 1**	no
Acetone	0.107		0.0099	*R5*	10	**YES**	**HQ > 1**	no
Carbon Disulfide	0.00143		0.000851	*R3*	2	**YES**	**HQ > 1**	no
Semi-Volatile Organic Compounds								
1,2,4-Trichlorobenzene	0.023	m	2.1	*R3*	0.01	**YES**	**Bioaccumulative**	**YES**
1,4-Dichlorobenzene	0.049	m	0.599	*R3*	0.08	**YES**	**Bioaccumulative**	**YES**
4-Methylphenol	2.2	m	0.67	*R3*	3	**YES**	**HQ > 1**	no
bis(2-Ethylhexyl)phthalate	0.214		0.18	*R3*	1	no	HQ • 1	no
Carbazole	0.21	m	NA		NA	**YES**	**NSL**	no
Dioxin/Furan Compounds								
Dioxin Toxicity Equivalents	2.8E-06	m	0.00000085	*R3s*	3	**YES**	**HQ > 1**	**YES**
Explosives								
1,3,5-Trinitrobenzene	0.41	m	NA		NA	**YES**	**NSL**	no
Nitroglycerine	0.96	m	NA		NA	**YES**	**NSL**	no
Herbicides								
2,4-D	6.83	m	1.273	*R5*	5	**YES**	**HQ > 1**	no
Dicamba	0.0322	m	NA		NA	**YES**	**NSL**	no
MCPP	3.56	m	NA		NA	**YES**	**NSL**	no
Pesticides								
4,4'-DDD	0.00152	m	0.00488	*R3*	0.3	**YES**	**Bioaccumulative**	**YES**
4,4'-DDE	0.00308	m	0.00316	*R3*	1	**YES**	**Bioaccumulative**	**YES**
4,4'-DDT	0.0119	m	7	*ORNL*	0.002	**YES**	**Bioaccumulative**	**YES**
BHC, delta-	0.00095	m	6.4	*R3*	0.0001	**YES**	**Bioaccumulative**	**YES**
Chlordane, alpha-	0.00071	m	0.00324	*R3s*	0.2	**YES**	**Bioaccumulative**	**YES**
Dieldrin	0.00347	m	0.0019	*R3*	2	**YES**	**HQ > 1**	**YES**
Endosulfan II	0.00161	m	0.014	*R3*	0.1	**YES**	**Bioaccumulative**	**YES**
Methoxychlor	0.00637	m	0.0187	*R3*	0.3	**YES**	**Bioaccumulative**	**YES**
Polycyclic Aromatic Hydrocarbons								
2-Methylnaphthalene	0.065	m	0.0202	*R3*	3	**YES**	**HQ > 1**	no
Acenaphthene	0.31	m	0.0067	*R3*	50	**YES**	**HQ > 1**	**YES**
Acenaphthylene	0.021	m	0.0059	*R3*	4	**YES**	**HQ > 1**	**YES**
Anthracene	0.201		0.0572	*R3*	4	**YES**	**HQ > 1**	**YES**
Benzo(a)anthracene	2.322		0.108	*R3*	20	**YES**	**HQ > 1**	**YES**
Benzo(a)pyrene	0.62		0.15	*R3*	4	**YES**	**HQ > 1**	**YES**
Benzo(b)fluoranthene	0.735		10.4	*R5*	0.07	**YES**	**Bioaccumulative**	**YES**
Benzo(g,h,i)perylene	0.386		0.17	*R3*	2	**YES**	**HQ > 1**	**YES**
Benzo(k)fluoranthene	0.24		0.24	*R3*	1	**YES**	**Bioaccumulative**	**YES**
Chrysene	2.38		0.166	*R3*	10	**YES**	**HQ > 1**	**YES**
Dibenzo(a,h)anthracene	0.56	m	0.033	*R3*	20	**YES**	**HQ > 1**	**YES**
Fluoranthene	0.891		0.423	*R3*	2	**YES**	**HQ > 1**	**YES**

Table 9-38
Baseline Level - Constituents of Potential Ecological Concern in Sediment
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	**Exposure Point Concentration [a] (mg/kg)**	**Ecological Screening Level (ESLs) [b] (mg/kg) Value**	***Source***	**Refined HQ [c] (unitless)**	**Baseline Level Constituent of Potential Ecological Concern? [d] (YES/no)**	**Rational**	**Bioaccumulative ? [e] (YES/no)**
Fluorene	0.0913	0.0774	*R3*	1	**YES**	**Bioaccumulative**	**YES**
Indeno(1,2,3-cd)pyrene	0.306	0.017	*R3*	20	**YES**	**HQ > 1**	**YES**
Phenanthrene	0.484	0.204	*R3*	2	**YES**	**HQ > 1**	**YES**
Pyrene	0.854	0.195	*R3*	4	**YES**	**HQ > 1**	**YES**
Inorganics							
Antimony	0.966	2	*R3*	0.5	no	HQ • 1	no
Arsenic	8.685	9.8	*R3*	0.9	**YES**	**Bioaccumulative**	**YES**
Barium	92.82	NA		NA	**YES**	**NSL**	no
Beryllium	1.164	NA		NA	**YES**	**NSL**	no
Cadmium	0.507	0.99	*R3*	0.5	**YES**	**Bioaccumulative**	**YES**
Chromium	6,048	43.4	*R3*	100	**YES**	**HQ > 1**	no
Cobalt	24.48	50	*R3*	0.5	no	HQ • 1	no
Copper	54.79	31.6	*R3*	2	**YES**	**HQ > 1**	**YES**
Iron	74,658	20,000	*R3*	4	**YES**	**HQ > 1**	no
Lead	37,445	35.8	*R3*	1,000	**YES**	**HQ > 1**	**YES**
Manganese	831.3	460	*R3*	2	**YES**	**HQ > 1**	no
Nickel	15.71	22.7	*R3*	0.7	**YES**	**Bioaccumulative**	**YES**
Selenium	1.3 m	2	*R3*	0.7	**YES**	**Bioaccumulative**	**YES**
Silver	8.42 m	1	*R3*	8	**YES**	**HQ > 1**	**YES**
Thallium	0.389	NA		NA	**YES**	**NSL**	no
Vanadium	49.04	NA		NA	**YES**	**NSL**	no
Zinc	6,810	121	*R3*	60	**YES**	**HQ > 1**	**YES**

Notes:
– = Not available or applicable.
mg/kg = Milligrams per kilogram.
NA = Not available or applicable.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[c] The refined hazard quotient (HQ) is the ratio of the EPC to the sediment screening level. HQs are rounded to one significant figure.
[d] Constituents with a refined hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for baseline risk assessment.
[e] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.

Table 9-39
Baseline Level - Constituents of Potential Ecological Concern in Surface Water
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/L)		Ecological Screening Level (ESLs) [b] (mg/L) Value	*Source*	Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rational	Bioaccumulative ? [e] (YES/no)
Volatile Organic Compounds								
Chloroform	0.00129		0.0018	*R3*	0.7	no	HQ • 1	no
Semi-Volatile Organic Compounds								
1,2-Dichlorobenzene	0.00021	m	0.0007	*R3*	0.3	**YES**	**Bioaccumulative**	**YES**
1,3-Dichlorobenzene	0.00021	m	0.15	*R3*	0.001	**YES**	**Bioaccumulative**	**YES**
1,4-Dichlorobenzene	0.00028	m	0.026	*R3*	0.01	**YES**	**Bioaccumulative**	**YES**
Dioxin/Furan Compounds								
Dioxin Toxicity Equivalents	3.504E-12	m	3.1E-12	*R3s*	1	**YES**	**Bioaccumulative**	**YES**
Herbicides								
MCPP	0.0541	m	NA		NA	**YES**	**NSL**	no
Pesticides								
Dieldrin	0.00000901	m	0.000056	*R3*	0.2	**YES**	**Bioaccumulative**	**YES**
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	0.00004	m	0.0058	*R3*	0.007	**YES**	**Bioaccumulative**	**YES**
Anthracene	0.00003	m	0.000012	*R3*	3	**YES**	**HQ > 1**	**YES**
Fluorene	0.000034	m	0.003	*R3*	0.01	**YES**	**Bioaccumulative**	**YES**
Phenanthrene	0.00005	m	0.0004	*R3*	0.1	**YES**	**Bioaccumulative**	**YES**
Inorganics								
Aluminum	0.351		0.087	*R3*	4	**YES**	**HQ > 1**	no
Arsenic	0.0104	m	0.005	*R3*	2	**YES**	**HQ > 1**	**YES**
Barium	0.0952		0.004	*R3*	20	**YES**	**HQ > 1**	no
Beryllium	0.0011	m	0.00066	*R3*	2	**YES**	**HQ > 1**	no
Copper	0.0185		0.009	*R3*	2	**YES**	**HQ > 1**	**YES**
Iron	39.87		0.3	*R3*	100	**YES**	**HQ > 1**	no
Lead	0.0248		0.0025	*R3*	10	**YES**	**HQ > 1**	**YES**
Manganese	1.154		0.12	*R3*	10	**YES**	**HQ > 1**	no
Nickel	0.0015	m	0.052	*R3*	0.03	**YES**	**Bioaccumulative**	**YES**
Selenium	0.00044	m	0.001	*R3*	0.4	**YES**	**Bioaccumulative**	**YES**
Silver	0.0012	m	0.0032	*R3*	0.4	**YES**	**Bioaccumulative**	**YES**
Thallium	0.0054	m	0.0008	*R3*	7	**YES**	**HQ > 1**	no
Vanadium	0.026		0.02	*R3*	1	no	HQ • 1	no
Zinc	0.0208		0.12	*R3*	0.2	**YES**	**Bioaccumulative**	**YES**

Notes:

– =	Not available or applicable.
mg/L =	Milligrams per liter.
NA =	Not available or applicable.
[a]	Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
[b]	See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[c]	The refined hazard quotient (HQ) is the ratio of the EPC to the surface water screening level. HQs are rounded to one significant figure.
[d]	Constituents with a refined hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for baseline risk assessment.
[e]	Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.

Table 9-40

Summary of Ecological Risk Characterization Results - Terrestrial Habitat

WESTERN BURNING GROUND

New River Unit, Radford Army Ammunition Plant, Radford, Virginia

	Soil						Baseline Level Assessment				Results of Refined Food Chain Models [c]			
	Frequency of Detection				EPC		Hazard Quotient	Ecological Screening Level [b]		Bioaccum-ulative ?	Short-tailed Shrew		American Robin	
Constituent	# detects / n samples			%	(mg/kg)		[a]	Source	Basis	(YES/no)	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ
Volatile Organic Compounds														
d-Limonene	1	-	1	100%	0.17	m	NA			no	–	–	–	–
p-Isopropyltoluene	1	-	11	9%	0.0048	m	NA			no	–	–	–	–
Semi-Volatile Organic Compounds														
Carbazole	3	-	26	12%	0.1	m	NA			no	–	–	–	–
Dibenzofuran	2	-	26	8%	0.014	m	NA			no	–	–	–	–
Dioxin/Furan Compounds														
Dioxin Toxicity Equivalents	8	-	8	100%	9.9E-06	m	**50**	R5s		YES	0.005	0.05	0.0009	0.009
Explosives														
Pentaerythritol Tetranitrate	1	-	9	11%	0.11	m	NA			no	–	–	–	–
Herbicides														
Dalapon	3	-	4	75%	0.163	m	NA			no	–	–	–	–
MCPP	1	-	4	25%	2.56	m	NA			no	–	–	–	–
Pesticides														
4,4'-DDD	1	-	4	25%	0.0019	m	0.09	EcoSSL	mam	YES	0.00005	0.0003	0.006	0.06
Dieldrin	1	-	4	25%	0.00472	m	1	EcoSSL	mam	YES	0.002	0.02	0.0004	0.004
Polycyclic Aromatic Hydrocarbons														
Acenaphthene	3	-	29	10%	0.32	m	0.0005	R5		YES	0.001	0.01	0.0001	0.001
Acenaphthylene	1	-	29	3%	0.0039	m	0.000006	R5		YES	0.000002	0.0000002	0.000001	0.00001
Anthracene	6	-	29	21%	0.035		0.00002	R5		YES	6E-08	0.0000006	0.000005	0.00005
Benzo(a)anthracene	9	-	29	31%	0.132		0.03	R5		YES	0.0004	0.004	0.00002	0.0002
Benzo(a)pyrene	9	-	29	31%	0.164		0.1	R5		YES	0.0003	0.003	0.00003	0.0003
Benzo(b)fluoranthene	10	-	29	34%	0.228		0.004	R5		YES	0.0001	0.003	0.00003	0.0003
Benzo(g,h,i)perylene	9	-	29	31%	0.148		0.001	R5		YES	0.005	0.05	0.00002	0.0002
Benzo(k)fluoranthene	9	-	29	31%	0.123		0.0008	R5		YES	0.00007	0.002	0.00002	0.0002
Chrysene	10	-	29	34%	0.164		0.03	R5		YES	0.00001	0.0001	0.00002	0.0002
Dibenzo(a,h)anthracene	4	-	27	15%	0.22	m	0.01	R5		YES	0.4	**4**	0.00003	0.0003
Fluoranthene	9	-	29	31%	0.236		0.002	R5		YES	0.0002	0.002	0.00008	0.0008
Fluorene	3	-	29	10%	0.028	m	0.0002	R5		YES	0.000006	0.00002	0.000009	0.00009
Indeno(1,2,3-cd)pyrene	9	-	29	31%	0.145		0.001	R5		YES	0.01	0.1	0.00002	0.0002
Phenanthrene	9	-	29	31%	0.119		0.003	R5		YES	0.00005	0.0005	0.00002	0.0002
Pyrene	10	-	29	34%	0.2		0.003	R5		YES	0.0001	0.001	0.00003	0.0003
Polychlorinated Biphenyls														
Aroclor 1254	2	-	28	7%	0.084	m	NA			YES	0.02	0.2	0.003	0.03

Table 9-40

Summary of Ecological Risk Characterization Results - Terrestrial Habitat

WESTERN BURNING GROUND

New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Soil Frequency of Detection # detects / n samples			Soil Frequency of Detection %	EPC (mg/kg)	Baseline Level Assessment Hazard Quotient [a]	Baseline Level Assessment Ecological Screening Level [b] Source	Baseline Level Assessment Ecological Screening Level [b] Basis	Bioaccum-ulative ? (YES/no)	Results of Refined Food Chain Models [c] Short-tailed Shrew LOAEL HQ	Short-tailed Shrew NOAEL HQ	American Robin LOAEL HQ	American Robin NOAEL HQ
Inorganics													
Antimony	26	-	53	49%	0.836	**3**	EcoSSL	mam	no	–	–	–	–
Arsenic	56	-	56	100%	10.72	0.6	EcoSSL	veg	YES	0.05	0.5	0.02	0.06
Cadmium	25	-	53	47%	0.322	0.9	EcoSSL	mam	YES	0.03	0.3	0.003	0.03
Chromium	56	-	56	100%	55.92	**2**	EcoSSL	avi	no	–	–	–	–
Copper	56	-	56	100%	145.5	**5**	EcoSSL	avi	YES	0.07	0.08	0.04	0.05
Iron	56	-	56	100%	35,755	NA			no	–	–	–	–
Lead	56	-	56	100%	698	**60**	EcoSSL	avi	YES	0.06	0.6	0.3	**3**
Selenium	17	-	53	32%	0.625	1	EcoSSL	veg	YES	0.05	0.09	0.02	0.03
Silver	16	-	53	30%	0.37	0.09	EcoSSL	avi	YES	0.00006	0.0006	0.01	0.02
Zinc	56	-	56	100%	593.9	**10**	EcoSSL	avi	YES	0.8	**8**	0.1	1

Notes:

– = Not applicable.

COPEC = Constituent of Potential Ecological Concern.

EPC = Exposure point concentrations - the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration.
EPCs marked with "m" are the maximum concentration.

LOAEL HQ = Lowest observed adverse effect level hazard quotient.

mg/kg = Milligrams per kilogram.

NA = Not available.

NOAEL HQ = No observed adverse effect level hazard quotient.

[a] Hazard quotients (HQs) greater than one are presented in bold font. HQs are rounded to one significant figure (unitless).

[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
R5: Region 5 Ecological Screening Levels (USEPA 2003e; R5).
EcoSSL: USEPA Ecological Soil Screening Levels (USEPA 2005b, EcoSSL).
Where readily available (i.e., EcoSSLs), the basis of the ESL is presented.

[c] Foodchain modeling was conducted for bioaccumulative COPECs.

Table 9-41

Summary of Ecological Risk Characterization Results - Aquatic Habitat

WESTERN BURNING GROUND

New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Sediment: Frequency of Detection # detects / n samples	Sediment: %	Sediment: EPC (mg/kg)	Surface Water: Frequency of Detection # detects / n samples	Surface Water: %	Surface Water: EPC (mg/L)	Baseline Level Assessment: Sediment Hazard Quotient [a]	Baseline Level Assessment: Surface Water Hazard Quotient [a]	Bioaccum-ulative ? (YES/no)	Results of Refined Food Chain Models [b]: Mink LOAEL HQ	Mink NOAEL HQ	Great Blue Heron LOAEL HQ	Great Blue Heron NOAEL HQ
Volatile Organic Compounds													
2-Butanone	5 - 14	36%	0.0737	1 - 10	10%	0.004 m	**2**	0.0003	no	–	–	–	–
Acetone	11 - 14	79%	0.107	1 - 10	10%	0.0028 m	**10**	0.002	no	–	–	–	–
Carbon Disulfide	5 - 12	42%	0.00143	7 - 10	70%	0.0002	**2**	0.2	no	–	–	–	–
Semi-Volatile Organic Compounds				-									
1,2,4-Trichlorobenzene	2 - 15	13%	0.023 m	0 - 13	0%	–	0.01	NA	YES	–	–	–	–
1,2-Dichlorobenzene	0 - 15	0%	–	1 - 13	8%	0.0002 m	NA	0.3	YES	–	–	–	–
1,3-Dichlorobenzene	0 - 15	0%	–	1 - 13	8%	0.0002 m	NA	0.001	YES	–	–	–	–
1,4-Dichlorobenzene	2 - 15	13%	0.049 m	1 - 13	8%	0.0003 m	0.08	0.01	YES	–	–	–	–
4-Methylphenol	4 - 17	24%	2.2 m	0 - 13	0%	–	**3**	NA	no	–	–	–	–
Carbazole	2 - 15	13%	0.21 m	0 - 13	0%	–	NA	NA	no	–	–	–	–
Dioxin/Furan Compounds				-									
Dioxin Toxicity Equivalents	6 - 6	100%	2.8E-06 m	4 - 4	100%	4E-12 m	**3**	1	YES	0.0000003	0.000003	0.00000001	0.0000001
Explosives				-									
1,3,5-Trinitrobenzene	1 - 8	13%	0.41 m	0 - 7	0%	–	NA	NA	no	–	–	–	–
Nitroglycerine	1 - 8	13%	0.96 m	0 - 7	0%	–	NA	NA	no	–	–	–	–
Herbicides				-									
2,4-D	2 - 5	40%	6.83 m	2 - 5	40%	0.0037 m	**5**	0.02	no	–	–	–	–
Dicamba	1 - 5	20%	0.0322 m	0 - 5	0%	–	NA	NA	no	–	–	–	–
MCPP	1 - 5	20%	3.56 m	1 - 5	20%	0.0541 m	NA	NA	no	–	–	–	–
Pesticides				-									
4,4'-DDD	4 - 5	80%	0.00152 m	0 - 5	0%	–	0.3	NA	YES	0.00003	0.0002	0.004	0.04
4,4'-DDE	4 - 6	67%	0.00308 m	0 - 5	0%	–	1	NA	YES	0.0009	0.005	0.1	1
4,4'-DDT	3 - 5	60%	0.0119 m	0 - 5	0%	–	0.002	NA	YES	0.0003	0.001	0.03	0.3
BHC, delta-	1 - 5	20%	0.00095 m	0 - 5	0%	–	0.0001	NA	YES	–	–	–	–
Chlordane, alpha-	2 - 5	40%	0.00071 m	0 - 5	0%	–	0.2	NA	YES	0.000003	0.00003	0.000003	0.00003
Dieldrin	1 - 5	20%	0.00347 m	3 - 5	60%	9E-06 m	**2**	0.2	YES	0.005	0.05	0.001	0.01
Endosulfan II	2 - 5	40%	0.00161 m	0 - 5	0%	–	0.1	NA	YES	–	–	–	–
Methoxychlor	1 - 5	20%	0.00637 m	0 - 5	0%	–	0.3	NA	YES	–	–	–	–
Polycyclic Aromatic Hydrocarbons				-									
2-Methylnaphthalene	4 - 18	22%	0.065 m	3 - 15	20%	3E-05 m	**3**	0.007	no	–	–	–	–
Acenaphthene	4 - 18	22%	0.31 m	2 - 15	13%	4E-05 m	**50**	0.007	YES	0.000008	0.00008	0.0000005	0.000005
Acenaphthylene	1 - 18	6%	0.021 m	0 - 15	0%	–	**4**	NA	YES	0.00000009	0.000000009	0.00000004	0.0000004
Anthracene	5 - 18	28%	0.201	2 - 15	13%	3E-05 m	**4**	**3**	YES	0.00000002	0.0000002	0.0000003	0.000003
Benzo(a)anthracene	10 - 20	50%	2.322	0 - 15	0%	–	**20**	NA	YES	0.0006	0.006	0.00001	0.0001
Benzo(a)pyrene	7 - 20	35%	0.62	0 - 15	0%	–	**4**	NA	YES	0.00007	0.0007	0.000003	0.00003
Benzo(b)fluoranthene	9 - 20	45%	0.735	0 - 15	0%	–	0.07	NA	YES	0.00002	0.0005	0.000003	0.00003
Benzo(g,h,i)perylene	5 - 18	28%	0.386	0 - 15	0%	–	**2**	NA	YES	0.0005	0.005	0.000002	0.00002
Benzo(k)fluoranthene	9 - 20	45%	0.24	0 - 15	0%	–	1	NA	YES	0.000007	0.0002	0.000001	0.00001
Chrysene	10 - 20	50%	2.38	0 - 15	0%	–	**10**	NA	YES	0.00001	0.0001	0.00001	0.0001
Dibenzo(a,h)anthracene	3 - 18	17%	0.56 m	0 - 15	0%	–	**20**	NA	YES	0.04	0.4	0.000002	0.00002
Fluoranthene	11 - 20	55%	0.891	0 - 15	0%	–	**2**	NA	YES	0.00001	0.0001	0.000004	0.00004
Fluorene	5 - 18	28%	0.0913	2 - 15	13%	3E-05 m	1	0.01	YES	0.0000002	0.0000005	0.0000002	0.000002
Indeno(1,2,3-cd)pyrene	5 - 18	28%	0.306	0 - 15	0%	–	**20**	NA	YES	0.0002	0.002	0.000001	0.00001
Phenanthrene	10 - 20	50%	0.484	3 - 15	20%	5E-05 m	**2**	0.1	YES	0.000008	0.00008	0.0000008	0.000008
Pyrene	11 - 20	55%	0.854	0 - 15	0%	–	**4**	NA	YES	0.00006	0.0006	0.000004	0.00004

Table 9-41

Summary of Ecological Risk Characterization Results - Aquatic Habitat

WESTERN BURNING GROUND

New River Unit, Radford Army Ammunition Plant, Radford, Virginia

	Sediment			Surface Water			Baseline Level Assessment			Results of Refined Food Chain Models [b]			
	Frequency of Detection		EPC	Frequency of Detection		EPC	Sediment Hazard Quotient	Surface Water Hazard Quotient	Bioaccum-ulative ?	Mink		Great Blue Heron	
Constituent	**# detects / n samples**	**%**	**(mg/kg)**	**# detects / n samples**	**%**	**(mg/L)**	**[a]**	**[a]**	**(YES/no)**	**LOAEL HQ**	**NOAEL HQ**	**LOAEL HQ**	**NOAEL HQ**
Inorganics				-									
Aluminum	28 - 28	100%	19,156	13 - 13	100%	0.351	0.3	**4**	no	–	–	–	–
Barium	28 - 28	100%	92.82	13 - 13	100%	0.0952	NA	**20**	no	–	–	–	–
Beryllium	27 - 28	96%	1.164	1 - 13	8%	0.0011 m	NA	**2**	no	–	–	–	–
Cadmium	14 - 26	54%	0.507	0 - 13	0%	–	0.5	NA	YES	–	–	–	–
Chromium	28 - 28	100%	6,048	0 - 13	0%	–	**100**	NA	no	–	–	–	–
Copper	28 - 28	100%	54.79	6 - 13	46%	0.0185	**2**	**2**	YES	0.003	0.004	0.0006	0.0009
Iron	28 - 28	100%	74,658	14 - 15	93%	39.87	**4**	**100**	no	–	–	–	–
Lead	32 - 32	100%	37,445	11 - 18	61%	0.0248	**1,000**	**10**	YES	0.00005	0.0005	0.00001	0.0001
Manganese	28 - 28	100%	831.3	14 - 15	93%	1.154	**2**	**10**	no	–	–	–	–
Nickel	28 - 28	100%	15.71	2 - 13	15%	0.0015 m	0.7	0.03	YES	0.000003	0.000006	0.0000003	0.0000004
Selenium	4 - 26	15%	1.3 m	1 - 13	8%	0.0004 m	0.7	0.4	YES	0.0002	0.0003	0.000008	0.00002
Silver	4 - 26	15%	8.42 m	2 - 13	15%	0.0012 m	**8**	0.4	YES	0.0000008	0.000008	0.00002	0.00004
Thallium	12 - 28	43%	0.389	2 - 13	15%	0.0054 m	NA	**7**	no	–	–	–	–
Vanadium	28 - 28	100%	49.04	6 - 15	40%	0.026	NA	1	no	–	–	–	–
Zinc	28 - 28	100%	6,810	8 - 13	62%	0.0208	**60**	0.2	YES	0.04	0.4	0.008	0.07

Notes:

– = Not applicable.

EPC = Exposure point concentrations - the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration.
EPCs marked with "m" are the maximum concentration.

FOD Frequency of Detection.

LOAEL HQ = Lowest observed adverse effect level hazard quotient.

mg/kg = Milligrams per kilogram.

mg/L = Milligrams per liter.

NOAEL HQ = No observed adverse effect level hazard quotient.

[a] Hazard quotients (HQs) greater than one are presented in bold font. HQs are rounded to one significant figure (unitless).

[b] Foodchain modeling was conducted for bioaccumulative COPECs.

Table 10-1. Groundwater Analytical Results, Facility-Wide Groundwater Sampling Event, 2007 Shaw Groundwater Sampling Event, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: / Date Collected:	Tapwater Screening Values [a]	Units	BLAMW01 06/20/07	BLAMW02 06/21/07	IAAMW01 06/21/07	IAAMW02 06/20/07	IAAMW03 06/20/07	IAAMW04 06/21/07	NBG-MW-01 06/19/07	NBG-MW-02 06/19/07	WBGMW01 06/18/07	WBGMW02 06/18/07	WBGMW03 06/19/07
Dioxin/Furan													
1,2,3,4,6,7,8-HpCDD	0.000052 {ca*}	µg/L	<0.00000576	0.00000312 J	NA	<0.00000563	<0.00000598	<0.00000575	0.00000367 J [<0.00000577]	0.00000373 J	0.0000479 B	<0.00000539	<0.00000546
1,2,3,4,6,7,8-HpCDF	0.000052 {ca*}	µg/L	0.0000121 B	0.00000245 B	NA	0.00000426 B	<0.00000598	0.00000138 B	0.00000609 B [0.00000693 B]	0.00000457 B	0.0000308 B	0.0000128 B	0.0000083 B
1,2,3,4,7,8,9-HpCDF	0.000052 {ca*}	µg/L	<0.00000576	<0.00000577	NA	<0.00000563	<0.00000598	<0.00000575	0.00000412 J [<0.00000577]	<0.00000583	<0.00000846	<0.00000615	<0.00000546
1,2,3,4,7,8-HxCDD	0.0000052 {ca*}	µg/L	<0.00000576	<0.00000577	NA	<0.00000563	<0.00000598	<0.00000575	0.00000575 B [<0.00000577]	0.00000284 B	<0.00000846	<0.00000539	<0.00000546
1,2,3,4,7,8-HxCDF	0.0000052 {ca*}	µg/L	0.00000272 B	0.00000367 B	NA	0.00000173 B	<0.00000598	0.00000221 B	0.0000071 B [0.00000376 B]	0.00000434 B	0.00000802 B	0.00000641 B	<0.00000546
1,2,3,6,7,8-HxCDD	0.0000052 {ca*}	µg/L	<0.00000576	<0.00000577	NA	<0.00000563	<0.00000598	<0.00000575	0.00000513 B [<0.00000577]	0.00000324 B	<0.00000846	<0.00000539	<0.00000546
1,2,3,6,7,8-HxCDF	0.0000052 {ca*}	µg/L	0.00000177 B	0.0000024 B	NA	0.0000011 B	<0.00000598	0.00000129 B	0.00000625 B [0.00000286 B]	0.00000347 B	0.00000369 B	<0.00000539	<0.00000546
1,2,3,7,8,9-HxCDD	0.0000052 {ca*}	µg/L	<0.00000576	<0.00000577 J	NA	<0.00000563	<0.00000598	<0.00000575	0.00000554 B [<0.00000577]	0.00000333 B	<0.00000846	<0.00000539	<0.00000546
1,2,3,7,8,9-HxCDF	0.0000052 {ca*}	µg/L	<0.00000576	<0.00000577	NA	<0.00000563	<0.00000598	<0.00000575	0.00000623 B [0.00000236 B]	0.0000034 B	<0.00000846	<0.00000539	<0.00000546
1,2,3,7,8-PeCDD	0.00000052 {ca*}	µg/L	<0.00000576	0.00000471 B	NA	<0.00000563	<0.00000598	0.00000294 B	0.00000777 B [0.00000367 B]	0.00000455 B	<0.00000846	<0.00000539	<0.00000546
1,2,3,7,8-PeCDF	0.000017 {ca**}	µg/L	<0.00000576	0.000019 B	NA	0.000000901 B	0.00000268 B	0.0000122 B	0.00000946 B [0.00000383 B]	0.00000513 B	<0.00000846	<0.00000539	<0.00000546
2,3,4,6,7,8-HxCDF	0.0000052 {ca*}	µg/L	<0.00000576	0.00000199 B	NA	<0.00000563	<0.00000598	0.000000989 B	0.00000419 B [0.00000215 B]	0.00000261 B	<0.00000846	<0.00000539	<0.00000546
2,3,4,7,8-PeCDF	0.0000017{ca**}	µg/L	0.000000968 B	0.0000158 B	NA	0.00000115 B	0.00000211 B	0.00000975 B	0.00000738 B [0.0000036 B]	0.00000431 B	<0.00000846	0.00000205 B	<0.00000546
2,3,7,8-TCDD	0.00000052 {ca*}	µg/L	<0.00000576	0.00000425 J	NA	<0.00000113	<0.00000309	0.00000315 J	0.00000318 J [<0.00000292]	<0.00000201	<0.00000396	<0.00000512	<0.00000356
2,3,7,8-TCDF	0.0000052 {ca*}	µg/L	<0.00000576	0.0000121 J	NA	0.000000743 B	<0.00000251	0.00000913 B	0.0000038 B [<0.00000231]	0.00000156 B	<0.00000296	<0.00000356	<0.00000245
OCDD	0.0017 {ca**}	µg/L	0.00000816 J	0.000065 J	NA	0.00000628 J	0.0000144 J	0.0000229 J	0.0000102 J [0.0000094 J]	0.0000226 J	0.000395 B	0.00000688 B	<0.0000109
OCDF	0.0017 {ca**}	µg/L	0.0000236 B	<0.0000115	NA	0.00000505 B	<0.000012	<0.0000115	0.00000763 B [0.0000121 B]	0.00000758 B	0.0000926 B	0.0000395 B	0.0000101 B
Total HpCDDs	0.000045 {ca**}	µg/L	<0.00000576	0.00000686 J	NA	<0.00000563	<0.00000598	<0.00000575	0.00000367 J [<0.00000577]	0.00000373 J	0.0000847 B	<0.00000539	<0.00000546
Total HpCDFs	0.000045 {ca**}	µg/L	0.0000147 B	0.00000245 B	NA	0.00000426 B	<0.00000598	0.00000138 B	0.0000102 B [0.00000693 B]	0.00000457 B	0.0000376 B	0.0000128 B	0.0000083 B
Total HxCDDs	0.0000045 {ca**}	µg/L	<0.00000576	<0.00000577	NA	<0.00000563	<0.00000598	<0.00000575	0.0000164 B [<0.00000577]	0.00000942 B	0.0000145 B	<0.00000539	<0.00000546
Total HxCDFs	0.0000045 {ca**}	µg/L	0.00000592 B	0.00000806 B	NA	0.00000399 B	<0.00000598	0.00000448 B	0.0000238 B [0.0000111 B]	0.0000138 B	0.0000175 B	0.0000121 B	<0.00000546
Total PeCDDs	0.00000045 {ca**}	µg/L	<0.00000576	0.00000471 B	NA	<0.00000563	<0.00000598	0.00000294 B	0.00000777 B [0.00000367 B]	0.00000455 B	<0.00000846	<0.00000539	<0.00000546
Total PeCDFs	- -	µg/L	0.00000258 B	0.0000348 B	NA	0.00000264 B	0.00000478 B	0.0000227 B	0.0000205 B [0.00000744 B]	0.00000944 B	0.00000305 B	0.0000103 B	<0.00000546
Total TCDDs	- -	µg/L	<0.00000188	0.00000425 J	NA	<0.00000563	<0.00000309	0.00000315 J	0.00000318 J [<0.00000292]	<0.00000201	<0.00000396	<0.00000512	<0.00000356
Total TCDFs	- -	µg/L	<0.00000156	0.0000121 B	NA	0.000000743 B	<0.00000251	0.00000913 B	0.0000038 B [<0.00000231]	0.00000156 B	<0.00000296	<0.00000356	<0.00000245
Explosives													
1,3,5-Trinitrobenzene	1,100 {nc}	µg/L	<0.22	<0.24	NA	<0.23	<0.22	<0.23	<0.23 [<0.22]	<0.22	<0.38	<0.2	<0.2
1,3-Dinitrobenzene	3.7 {nc}	µg/L	<0.22	<0.24	NA	<0.23	<0.22	<0.23	<0.23 [<0.22]	<0.22	<0.38	<0.2	<0.2
2,4,6-Trinitrotoluene	2.2 {ca**}	µg/L	<0.22	<0.24	NA	<0.23	<0.22	<0.23	<0.23 [<0.22]	<0.22	<0.38	<0.2	<0.2
2,4-Dinitrotoluene	73 {nc}	µg/L	<0.22	<0.24	NA	<0.23	<0.22	<0.23	<0.23 [<0.22]	<0.22	<0.38	<0.2	<0.2
2,6-Dinitrotoluene	37 {nc}	µg/L	<0.22	<0.24	NA	<0.23	<0.22	<0.23	<0.23 [<0.22]	<0.22	<0.38	<0.2	<0.2
2-Amino-4,6-Dinitrotoluene	73 {nc}	µg/L	<0.22	<0.24	NA	<0.23	<0.22	<0.23	<0.23 [<0.22]	<0.22	<0.38	<0.2	<0.2
4-Amino-2,6-Dinitrotoluene	73 {nc}	µg/L	<0.22	<0.24	NA	<0.23	<0.22	<0.23	<0.23 [<0.22]	<0.22	<0.38	<0.2	<0.2
Dinitrotoluene Mix	0.099 {ca}	µg/L	<0.22	<0.24	NA	<0.23	<0.22	<0.23	<0.23 [<0.22]	<0.22	<0.38	<0.2	<0.2
HMX	1,800 {nc}	µg/L	<0.22	<0.24	NA	<0.23	<0.22	<0.23	<0.23 [<0.22]	<0.22	<0.38	<0.2	<0.2
m-Nitrotoluene	- -	µg/L	<0.22	<0.24	NA	<0.23	<0.22	<0.23	<0.23 [<0.22]	<0.22	<0.38	<0.2	<0.2
Nitrobenzene	3.4 {nc}	µg/L	<0.22	<0.24	NA	<0.23	<0.22	<0.23	<0.23 [<0.22]	<0.22	<0.38	<0.2	<0.2
Nitroglycerine	3.7 {nc}	µg/L	<2.2	<2.4	NA	<2.3	<2.2	<2.3	<2.3 [<2.2]	<2.2	<3.8	<2	<2
o-Nitrotoluene	370 {nc}	µg/L	<0.22	<0.24	NA	<0.23	<0.22	<0.23	<0.23 [<0.22]	<0.22	<0.38	<0.2	<0.2
Pentaerythritol Tetranitrate	- -	µg/L	<2.2	<2.4	NA	<2.3	<2.2	<2.3	<2.3 [<2.2]	<2.2	<3.8	<2	<2
Perchlorate	26 {nc}	µg/L	<0.2 J	<0.2 J	0.191 B	0.156 B	<0.2 J	0.195 B	<0.2 J [0.16 B]	0.176 B	<0.2 J	0.0911 B	0.19 B
p-Nitrotoluene	4.2 {ca*}	µg/L	<0.22	<0.24	NA	<0.23	<0.22	<0.23	<0.23 [<0.22]	<0.22	<0.38	<0.2	<0.2
RDX	0.61 {ca}	µg/L	<0.22	<0.24	NA	<0.23	<0.22	<0.23	<0.23 [<0.22]	<0.22	<0.38	<0.2	<0.2
Tetryl	150 {nc}	µg/L	<0.22	<0.24	NA	<0.23	<0.22	<0.23	<0.23 [<0.22]	<0.22	<0.38	<0.2	<0.2
Herbicides													
2,4,5-T	370 {nc}	µg/L	<0.22	<0.24	NA	<0.22	<0.24	<0.2	<0.21 [<0.24]	<0.24	NA	<0.2	<0.24
2,4,5-TP	290 {nc}	µg/L	<0.22	<0.24	NA	<0.22	<0.24 J	<0.2	<0.21 [<0.24]	<0.24	NA	<0.2	<0.24
2,4-D	370 {nc}	µg/L	<1.7	<1.8	NA	<1.7	<1.8	<1.5	<1.6 [<1.8]	<1.8	NA	<1.5	<1.8
Organochlorine Pesticides													
4,4'-DDD	0.28 {ca**}	µg/L	<0.11	<0.11	NA	<0.1	<0.1	<0.11	<0.1 [<0.11 L]	<0.11	NA	<0.096	<0.1
4,4'-DDE	0.2 {ca**}	µg/L	<0.11	<0.11	NA	<0.1	<0.1	<0.11	<0.1 [<0.11 L]	<0.11	NA	<0.096	<0.1
4,4'-DDT	0.2 {ca*}	µg/L	<0.11	<0.11	NA	<0.1	<0.1	<0.11	<0.1 [<0.11 L]	<0.11	NA	<0.096	<0.1
Aldrin	0.004 {ca}	µg/L	<0.053	<0.053	NA	<0.051	<0.05	<0.053	<0.05 [<0.053 L]	<0.053	NA	<0.048	<0.051
Alpha-BHC	0.011 {ca**}	µg/L	<0.053	<0.053	NA	<0.051	<0.05	<0.053	<0.05 [<0.053 L]	<0.053	NA	<0.048	<0.051
Alpha-Chlordane	- -	µg/L	<0.053	<0.053	NA	<0.051	<0.05	<0.053	<0.05 [<0.053 L]	<0.053	NA	<0.048	<0.051
Beta-BHC	0.037 {ca**}	µg/L	<0.053	<0.053	NA	<0.051	<0.05	<0.053	<0.05 [<0.053 L]	<0.053	NA	<0.048	<0.051
Delta-BHC	0.061 {ca}	µg/L	<0.053	<0.053	NA	<0.051	<0.05	<0.053	<0.05 [<0.053 L]	<0.053	NA	<0.048	<0.051
Dieldrin	0.0042 {ca}	µg/L	<0.053	<0.053	NA	<0.051	<0.05	<0.053	<0.05 [<0.053 L]	<0.053	NA	<0.048	<0.051
Endosulfan I	220 {nc}	µg/L	<0.053	<0.053	NA	<0.051	<0.05	<0.053	<0.05 [<0.053 L]	<0.053	NA	<0.048	<0.051
Endosulfan II	220 {nc}	µg/L	<0.11	<0.11	NA	<0.1	<0.1	<0.11	<0.1 [<0.11 L]	<0.11	NA	<0.096	<0.1
Endosulfan Sulfate	220 {nc}	µg/L	<0.11	<0.11	NA	<0.1	<0.1	<0.11	<0.1 [<0.11 L]	<0.11	NA	<0.096	<0.1
Endrin	11 {nc}	µg/L	<0.11	<0.11	NA	<0.1	<0.1	<0.11	<0.1 [<0.11 L]	<0.11	NA	<0.096	<0.1
Endrin Aldehyde	11 {nc}	µg/L	<0.11 L	<0.11 L	NA	<0.1 L	<0.1 L	<0.11 L	<0.1 L [<0.11 L]	<0.11 L	NA	<0.096 L	<0.1 L
Endrin Ketone	11 {nc}	µg/L	<0.11	<0.11	NA	<0.1	<0.1	<0.11	<0.1 [<0.11 L]	<0.11	NA	<0.096	<0.1
Gamma-BHC (Lindane)	0.061 {ca}	µg/L	<0.053	<0.053	NA	<0.051	<0.05	<0.053	<0.05 [<0.053 L]	<0.053	NA	<0.048	<0.051
Gamma-Chlordane	0.19 {ca}	µg/L	<0.053	<0.053	NA	<0.051	<0.05	<0.053	<0.05 [<0.053 L]	<0.053	NA	<0.048	<0.051
Heptachlor	0.015 {ca}	µg/L	<0.053	<0.053	NA	<0.051	<0.05	<0.053	<0.05 [<0.053 L]	<0.053	NA	<0.048	<0.051
Heptachlor Epoxide	0.0074 {ca*}	µg/L	<0.053	<0.053	NA	<0.051	<0.05	<0.053	<0.05 [<0.053 L]	<0.053	NA	<0.048	<0.051
Methoxychlor	180 {nc}	µg/L	<0.11	<0.11	NA	<0.1	<0.1	<0.11	<0.1 [<0.11 L]	<0.11	NA	<0.096	<0.1
Toxaphene	0.061 {ca**}	µg/L	<2.6	<2.7	NA	<2.6	<2.5	<2.7	<2.5 [<2.6 L]	<2.6	NA	<2.4	<2.6
PAHs													
1-Methylnaphthalene	2.3 {ca}	µg/L	<1.0	<1.0	NA	<1.0	<1.0	<1.0	<1.2 [<1.2]	<1.3	<1.0	<1.2	<1.0
2-Methylnaphthalene	150 {nc}	µg/L	<1.0	<1.0	NA	<1.0	<1.0	<1.0	<1.2 [<1.2]	<1.3	<1.0	<1.2	<1.0
Acenaphthene	2,200 {nc}	µg/L	<1.0	<1.0	NA	<1.0	<1.0	<1.0	<1.2 [<1.2]	<1.3	<1.0	<1.2	<1.0
Acenaphthylene	- -	µg/L	<1.0	<1.0	NA	<1.0	<1.0	<1.0	<1.2 [<1.2]	<1.3	<1.0	<1.2	<1.0
Anthracene	11,000 {nc}	µg/L	<1.0	<1.0	NA	<1.0	<1.0	<1.0	<1.2 [<1.2]	<1.3	<1.0	<1.2	<1.0
Benzo(a)anthracene	0.029 {ca**}	µg/L	<0.20	<0.20	NA	<0.21	<0.21	<0.20	<0.24 [<0.24]	<0.25	<0.20	<0.24	<0.20
Benzo(a)pyrene	0.0029 {ca**}	µg/L	<0.20	<0.20	NA	<0.21	<0.21	<0.20	<0.24 [<0.24]	<0.25	<0.20	<0.24	<0.20
Benzo(b)fluoranthene	0.029 {ca**}	µg/L	<0.20	<0.20	NA	<0.21	<0.21	<0.20	<0.24 [<0.24]	<0.25	<0.20	<0.24	<0.20
Benzo(g,h,i)perylene	- -	µg/L	<0.20	<0.20	NA	<0.21	<0.21	<0.20	<0.24 [<0.24]	<0.25	<0.20	<0.24	<0.20
Benzo(k)fluoranthene	0.29 {ca**}	µg/L	<0.20	<0.20	NA	<0.21	<0.21	<0.20	<0.24 [<0.24]	<0.25	<0.20	<0.24	<0.20
Chrysene	2.9 {ca**}	µg/L	<0.20	<0.20	NA	<0.21	<0.21	<0.20	<0.24 [<0.24]	<0.25	<0.20	<0.24	<0.20
Dibenzo(a,h)anthracene	0.0029 {ca**}	µg/L	<0.20	<0.20	NA	<0.21	<0.21	<0.20	<0.24 [<0.24]	<0.25	<0.20	<0.24	<0.20
Fluoranthene	1,500 {nc}	µg/L	<1.0	<1.0	NA	<1.0	<1.0	<1.0	<1.2 [<1.2]	<1.3	<1.0	<1.2	<1.0
Fluorene	1,500 {nc}	µg/L	<1.0	<1.0	NA	<1.0	<1.0	<1.0	<1.2 [<1.2]	<1.3	<1.0	<1.2	<1.0
Indeno(1,2,3-cd)pyrene	0.029 {ca**}	µg/L	<0.20	<0.20	NA	<0.21	<0.21	<0.20	<0.24 [<0.24]	<0.25	<0.20	<0.24	<0.20
Naphthalene	6.2 {nc}	µg/L	<1.0	<1.0	NA	<1.0	<1.0	<1.0	<1.2 [<1.2]	<1.3	<1.0	<1.2	<1.0
Phenanthrene	- -	µg/L	<1.0	<1.0	NA	<1.0	<1.0	<1.0	<1.2 [<1.2]	<1.3	<1.0	<1.2	<1.0
Pyrene	1,100 {nc}	µg/L	<1.0	<1.0	NA	<1.0	<1.0	<1.0	<1.2 [<1.2]	<1.3	<1.0	<1.2	<1.0
PCBs													
Aroclor-1016	0.96 {ca**}	µg/L	<0.53	<0.53	NA	<0.51	<0.50	<0.53	<0.50 [<0.53 L]	<0.53	NA	<0.48	<0.51
Aroclor-1221	0.0068 {ca**}	µg/L	<0.53	<0.53	NA	<0.51	<0.50	<0.53	<0.50 [<0.53 L]	<0.53	NA	<0.48	<0.51
Aroclor-1232	0.0068 {ca**}	µg/L	<0.53	<0.53	NA	<0.51	<0.50	<0.53	<0.50 [<0.53 L]	<0.53	NA	<0.48	<0.51
Aroclor-1242	0.034 {ca**}	µg/L	<0.53	<0.53	NA	<0.51	<0.50	<0.53	<0.50 [<0.53 L]	<0.53	NA	<0.48	<0.51
Aroclor-1248	0.034 {ca**}	µg/L	<0.53	<0.53	NA	<0.51	<0.50	<0.53	<0.50 [<0.53 L]	<0.53	NA	<0.48	<0.51
Aroclor-1254	0.034 {ca*}	µg/L	<0.53	<0.53	NA	<0.51	<0.50	<0.53	<0.50 [<0.53 L]	<0.53	NA	<0.48	<0.51
Aroclor-1260	0.034 {ca**}	µg/L	<0.53	<0.53	NA	<0.51	<0.50	<0.53	<0.50 [<0.53 L]	<0.53	NA	<0.48	<0.51

Notes found at end of table.

Volatile Organics													
1,1,1-Trichloroethane	9,100 {nc}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0

Table 10-1. Groundwater Analytical Results, Facility-Wide Groundwater Sampling Event, 2007 Shaw Groundwater Sampling Event, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Date Collected:	Tapwater Screening Values [a]	Units	BLAMW01 06/20/07	BLAMW02 06/21/07	IAAMW01 06/21/07	IAAMW02 06/20/07	IAAMW03 06/20/07	IAAMW04 06/21/07	NBG-MW-01 06/19/07	NBG-MW-02 06/19/07	WBGMW01 06/18/07	WBGMW02 06/18/07	WBGMW03 06/19/07
1,1,2,2-Tetrachloroethane	0.067 {ca**}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0
1,1,2-Trichloroethane	0.24 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane	2.4 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethene	340 {nc}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0
1,2-Dichloroethane	0.15 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0
1,2-Dichloropropane	0.39 {ca*}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0
2-Butanone	7,100 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0	<5.0	<5.0	<5.0
2-Hexanone	- -	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0	<5.0	<5.0	<5.0
4-Methyl-2-pentanone	2,000 {nc}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0	<5.0	<5.0	<5.0
Acetone	22,000 {nc}	µg/L	<25	5.4 B	<25	<25	<25	<25	<25 [<25]	<25	<25	5.6 B	<25
Benzene	0.41 {ca}	µg/L	<1.0	<1.0 L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0
Bromodichloromethane	1.1 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0
Bromoform	8.5 {ca*}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0
Bromomethane	8.7 {nc}	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0 [<2.0]	<2.0	R	<2.0	<2.0
Carbon Disulfide	1,000 {nc}	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0 [<2.0]	<2.0	<2.0	<2.0	<2.0
Carbon Tetrachloride	0.2 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0
Chlorobenzene	91 {nc}	µg/L	<1.0	<1.0 L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0
Chloroethane	21,000 {nc}	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0 [<2.0]	<2.0	R	<2.0	<2.0
Chloroform	0.19 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	1.2 J	<1.0	<1.0
Chloromethane	1.8 {ca}	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0 [<2.0]	<2.0	R	<2.0	<2.0
cis-1,2-Dichloroethene	370 {nc}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0
cis-1,3-Dichloropropene	- -	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0
Dibromochloromethane	0.8 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0
Ethylbenzene	1.5 {ca}	µg/L	<1.0	<1.0 L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0
m,p-Xylene	- -	µg/L	<2.0	<2.0 L	<2.0	<2.0	<2.0	<2.0	<2.0 [<2.0]	<2.0	<2.0	<2.0	<2.0
Methylene Chloride	4.8 {ca}	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0	<5.0	<5.0	<5.0
o-Xylene	1,400 {nc}	µg/L	<1.0	<1.0 L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0
Styrene	1,600 {nc}	µg/L	<1.0	<1.0 L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0
Tetrachloroethene	0.11 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0
Toluene	2,300 {nc}	µg/L	0.70 B	<1.0 L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0
trans-1,2-Dichloroethene	110 {nc}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0
trans-1,3-Dichloropropene	- -	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0
Trichloroethene	1.7 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0
Vinyl Chloride	0.016 {ca}	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	R	<1.0	<1.0
Xylenes (total)	200 {nc}	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0 [<2.0]	<2.0	<2.0	<2.0	<2.0
Semivolatile Organics													
1,2,4-Trichlorobenzene	19 {ca*}	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
1,2-Dichlorobenzene	370 {nc}	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
1,3-Dichlorobenzene	- -	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
1,4-Dichlorobenzene	0.43 {ca}	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
2,4,5-Trichlorophenol	3,700 {nc}	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
2,4,6-Trichlorophenol	6.1 {ca**}	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
2,4-Dichlorophenol	110 {nc}	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
2,4-Dimethylphenol	730 {nc}	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
2,4-Dinitrophenol	73 {nc}	µg/L	<26	<25	NA	<26	<26	<26	<30 [<30]	<31	<25	<29	<25
2,4-Dinitrotoluene	73 {nc}	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
2,6-Dinitrotoluene	37 {nc}	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
2-Chloronaphthalene	2,900 {nc}	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
2-Chlorophenol	180 {nc}	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
2-Methylphenol	1,800 {nc}	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
2-Nitroaniline	- -	µg/L	<10	<10	NA	<10	<10	<10	<12 [<12]	<13	<10	<12	<10
2-Nitrophenol	- -	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
3,3'-Dichlorobenzidine	0.15 {ca**}	µg/L	<10	<10	NA	<10	<10	<10	<12 [<12]	<13	<10	<12	<10
3-Nitroaniline	- -	µg/L	<10	<10	NA	<10	<10	<10	<12 [<12]	<13	<10	<12	<10
4,6-Dinitro-2-methylphenol	- -	µg/L	<10	<10	NA	<10	<10	<10	<12 [<12]	<13	<10	<12	<10
4-Bromophenyl-phenylether	- -	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
4-Chloro-3-Methylphenol	- -	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
4-Chloroaniline	150 {nc}	µg/L	<10	<10	NA	<10	<10	<10	<12 [<12]	<13	<10	<12	<10
4-Chlorophenyl-phenylether	- -	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
4-Methylphenol	180 {nc}	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
4-Nitroaniline	- -	µg/L	<10	<10	NA	<10	<10	<10	<12 [<12]	<13	<10	<12	<10
4-Nitrophenol	- -	µg/L	<26	<25	NA	<26	<26	<26	<30 [<30]	<31	<25	<29	<25
Benzoic Acid	150,000 {max}	µg/L	<26	<25	NA	<26	<26	<26	<30 [<30]	<31	<25	<29	<25
Benzyl Alcohol	18,000 {nc}	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
bis(2-Chloroethoxy)methane	110 {nc}	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
bis(2-Chloroethyl)ether	0.012 {ca**}	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
bis(2-Chloroisopropyl)ether	- -	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
bis(2-Ethylhexyl)phthalate	4.8 {ca}	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
Butylbenzylphthalate	7,300 {nc}	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
Carbazole	3.4 {ca**}	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
Dibenzofuran	- -	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
Diethylphthalate	29,000 {nc}	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
Dimethylphthalate	- -	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
Di-n-Butylphthalate	3,700 {nc}	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
Dinitrotoluene Mix	0.099 {ca}	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
Di-n-Octylphthalate	- -	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
Hexachlorobenzene	0.042 {ca}	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
Hexachlorobutadiene	0.86 {ca*}	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
Hexachlorocyclopentadiene	220 {nc}	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
Hexachloroethane	4.8 {ca**}	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
Isophorone	71 {ca}	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
Nitrobenzene	3.4 {nc}	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
N-Nitroso-di-n-propylamine	0.0096 {ca**}	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
N-Nitrosodiphenylamine	14 {ca**}	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0
Pentachlorophenol	0.56 {ca}	µg/L	<26	<25	NA	<26	<26	<26	<30 [<30]	<31	<25	<29	<25
Phenol	11,000 {nc}	µg/L	<5.1	<5.0	NA	<5.2	<5.2	<5.1	<6.0 [<6.1]	<6.3	<5.0	<5.9	<5.0

Notes found at end of table.

Table 10-1. Groundwater Analytical Results, Facility-Wide Groundwater Sampling Event, 2007 Shaw Groundwater Sampling Event, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: Date Collected:	Tapwater Screening Values [a]	Units	BLAMW01 06/20/07	BLAMW02 06/21/07	IAAMW01 06/21/07	IAAMW02 06/20/07	IAAMW03 06/20/07	IAAMW04 06/21/07	NBG-MW-01 06/19/07	NBG-MW-02 06/19/07	WBGMW01 06/18/07	WBGMW02 06/18/07	WBGMW03 06/19/07
Inorganics													
Aluminum	37,000 {nc}	µg/L	424	4,970	34,900	<18.0	875	2,850	448 [409]	1,790	17,800	91.0 B	<18.0
Antimony	15 {nc}	µg/L	<3.40 L	<3.40 L	<3.40 L	<3.40 L	<3.40 L	<3.40 L	<3.40 L [<3.40 L]	<3.40 L	<3.40 L	<3.40 L	<3.40 L
Arsenic	0.045 {ca}	µg/L	<2.80	<2.80	20.9	<2.80	<2.80	<2.80	6.30 B [<2.80]	<2.80	8.20 B	<2.80	<2.80
Barium	7,300 {nc}	µg/L	151 J	242	105 J	240	49.7 J	41.3 J	99.5 J [95.3 J]	93.9 J	130 J	81.9 J	147 J
Beryllium	73 {nc}	µg/L	<1.00	<1.00	17.7	<1.00	1.20 K	<1.00	<1.00 [<1.00]	1.10 K	1.90 K	<1.00	<1.00
Cadmium	18 {nc}	µg/L	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00 [<1.00]	<1.00	<1.00	<1.00	<1.00
Calcium	- -	µg/L	63,000	260,000	47,900	79,600 J	75,900	63,800	78,200 J [78,400 J]	75,600 J	345,000 J	95,900 J	106,000 J
Chromium	55,000 {nc}	µg/L	56.9 J	170	101	4.00 J	35.2 J	17.1	17.1 [15.4]	20.5	48.0	7.00 J	3.80 J
Cobalt	11 {nc}	µg/L	4.70 J	10.5 J	30.2 J	<1.00	2.40 J	1.50 J	5.60 J [5.10 J]	1.90 J	9.30 J	<1.00	2.40 J
Copper	1,500 {nc}	µg/L	3.10 K	19.3 B	42.0	<1.00	<1.00	1.30 B	<1.00 [<1.00]	<1.00	17.2 B	<1.00	<1.00
Iron	26,000 {nc}	µg/L	683	7,280	83,300	<15.0	1,490	4,270	470 [419]	2,470	19,200	<15.0	<15.0
Lead	15 {nc}	µg/L	3.50 B	7.10 B	80.9	2.90 B	2.50 B	3.50 B	2.90 B [<1.70]	1.80 B	34.3	1.80 B	2.20 B
Magnesium	- -	µg/L	17,200	61,100	13,900	18,700	9,670	30,100	11,600 [11,500]	16,400	104,000	36,800	32,700
Manganese	880 {nc}	µg/L	29.4	151	1,790	27.3	30.1	169	32.7 [31.5]	42.4	256	15.5	6.70 B
Mercury	0.63 {nc}	µg/L	<0.100	<0.100	<0.200	<0.100	<0.100	<0.100	<0.100 [<0.100]	<0.100	0.540 J	<0.100	<0.100
Nickel	730 {nc}	µg/L	35.8 J	115	92.8	3.60 J	11.8 J	11.8 J	11.8 J [10.1 J]	14.2 J	22.0 J	5.00 J	5.80 J
Potassium	- -	µg/L	4,000 B	9,330 J	7,790 B	3,370 B	3,450 B	3,820 B	4,350 B [4,350 B]	4,460 B	12,000 J	4,440 B	4,050 B
Selenium	180 {nc}	µg/L	<2.80	<2.80	22.2 B	<2.80	<2.80	<2.80	<2.80 [<2.80]	<2.80	<2.80	<2.80	<2.80
Silver	180 {nc}	µg/L	<0.900	<0.900	<0.900	<0.900	<0.900	<0.900	<0.900 [<0.900]	<0.900	<0.900	<0.900	<0.900
Sodium	- -	µg/L	3,130 B	5,730 B	2,850 B	6,910 B	8,850 B	6,860 B	2,830 B [2,820 B]	2,870 B	25,600 J	6,940 B	6,230 B
Thallium	2.4 {nc}	µg/L	<2.90	<2.90	<2.90	<2.90	<2.90	<2.90	<2.90 [<2.90]	<2.90	<2.90	<2.90	<2.90
Vanadium	260 {nc}	µg/L	1.80 J	15.3 J	112	<1.10	3.10 J	8.60 J	1.50 J [1.40 J]	5.60 J	40.3 J	1.10 J	<1.10
Zinc	11,000 {nc}	µg/L	17.4 B	23.9 B	226	5.10 B	7.20 B	7.90 B	9.00 B [7.50 B]	13.8 B	112 J	10.5 B	17.1 B
Miscellaneous													
Total Organic Carbon	- -	µg/L	<1,000	80,700	NA	1,100	<1,000	<1,000	<1,000 [<1,000]	<1,000	2,200	2,300	1,400
Total Organic Halides	- -	µg/L	<50	<50	NA	<50	<50	<50	<50 [<50]	<50	<50	<50	<50

µg/L	Micrograms per liter.
[a]	USEPA Regional Screening Levels (USEPA 2008a). Adjusted tap-water screening levels used to assess groundwater at the NRU.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
{max}	Concentration may exceed ceiling limit.
B (Inorganics)	Constituent concentration quanitified as estimated.
B (Organics)	Constituent was detected in the associated method blank.
J	Constituent concentration quanitified as estimated.
K	Estimated concentration bias high.
L	Estimated concentration bias low.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted tap water RSL.

Table 10-2. Groundwater and Spring Water Analytical Results, Facility-Wide Groundwater Sampling Event, 2008 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: / Date Collected:	Tapwater Screening Values [a]	Units	BLAMW01 10/03/08	BLAMW02 10/03/08	IAAMW01 09/24/08	IAAMW01 09/25/08	IAAMW02 09/24/08	IAAMW03 09/24/08	IAAMW04 09/24/08	NBG-MW-01 09/25/08	NBG-MW-02 09/25/08	WBGMW01 09/25/08	WBGMW02 09/25/08	WBGMW03 09/25/08	NSPRING003 09/24/08	NSPRING004 09/24/08	RY_SPRING002 09/24/08	WBG_SPRING001 09/24/08
Field Parameters																		
Temperature	-	°C	17.89	14.70	-	-	15.04	14.65	13.97	14.56	16.55	14.24	13.78	13.83	13.07	15.23	15.20	15.15
pH	-	-	6.93	7.35	-	-	7.61	7.49	7.62	7.52	7.86	8.73	7.74	7.63	7.90	8.06	7.91	7.95
Dissolved Oxygen	-	mg/L	0.34	4.18	-	-	0.83	6.85	5.68	6.51	451	0.57	0.32	0.18	-	-	-	-
Conductivity	-	µmhos/cm	333	516	-	-	5.02	558	509	482	407	850	680	675	465	442	423	450
Turbidity	-	NTU	35.1	325	>1,000	-	4.37	60.2	137	99.6	>1,000	77.1	2.14	4.36	3.60	2.01	22.9	3.51
Oxidation/Reduction Potential	-	mV	-186.8	45.1	-	-	-256.1	43.9	38.9	79.2	20.7	-	-227.3	-185.8	-	-	-	-
PAHs																		
1-Methylnaphthalene	2.3 {ca}	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.092	<0.092	<0.092	<0.092
2-Methylnaphthalene	150 {nc}	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.092	<0.092	<0.092	<0.092
Acenaphthene	2,200 {nc}	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.092	<0.092	<0.092	<0.092
Acenaphthylene	- -	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.092	<0.092	<0.092	<0.092
Anthracene	11,000 {nc}	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.092	<0.092	<0.092	<0.092
Benzo(a)anthracene	0.029 {ca**}	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.092	<0.092	<0.092	<0.092
Benzo(a)pyrene	0.0029 {ca**}	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.092	<0.092	<0.092	<0.092
Benzo(b)fluoranthene	0.029 {ca**}	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.092	<0.092	<0.092	<0.092
Benzo(g,h,i)perylene	- -	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.092	<0.092	<0.092	<0.092
Benzo(k)fluoranthene	0.29 {ca**}	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.092	<0.092	<0.092	<0.092
Chrysene	2.9 {ca**}	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.092	<0.092	<0.092	<0.092
Dibenzo(a,h)anthracene	0.0029 {ca**}	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.092	<0.092	<0.092	<0.092
Fluoranthene	1,500 {nc}	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.092	<0.092	<0.092	<0.092
Fluorene	1,500 {nc}	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.092	<0.092	<0.092	<0.092
Indeno(1,2,3-cd)pyrene	0.029 {ca**}	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.092	<0.092	<0.092	<0.092
Naphthalene	6.2 {nc}	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.092	<0.092	0.044	0.032
Phenanthrene	- -	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.092	<0.092	0.038	<0.092
Pyrene	1,100 {nc}	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.092	<0.092	<0.092	<0.092
Inorganics																		
Aluminum	37,000 {nc}	µg/L	194 J [192 J]	7,210	28,800	NA	<200	1,330	2,670	3,050	38,700	1,950	<200	<200	<200	<200	496	<200
Antimony	15 {nc}	µg/L	<15.0 [<15.0]	<15.0	<15.0	NA	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0
Arsenic	0.045 {ca}	µg/L	<5.00 [<5.00]	<5.00	24.1	NA	<5.00	<5.00	<5.00	<5.00	20.6	<5.00	<5.00	5.50	<5.00	<5.00	<5.00	<5.00
Barium	7,300 {nc}	µg/L	144 [145]	206	57.1	NA	222	70.0	34.6 J	62.4	145	102	100	243	49.8	66.1	48.7	57.2
Beryllium	73 {nc}	µg/L	<5.00 [<5.00]	<5.00	8.60	NA	<5.00	<5.00	<5.00	<5.00	5.10	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
Cadmium	18 {nc}	µg/L	<5.00 [<5.00]	<5.00	10.6	NA	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
Calcium	- -	µg/L	45,800 [46,300]	197,000	48,500 J	NA	74,200 J	96,100 J	60,700	120,000 J	147,000 J	92,400 J	81,200 J	87,900	65,900 J	59,000 J	63,400 J	70,200 J
Chromium	55,000 {nc}	µg/L	10.0 [9.40 J]	247	62.7	NA	<10.0	6.60 J	15.8	11.0	72.6	2.50 J	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
Cobalt	11 {nc}	µg/L	<15.0 [<15.0]	12.6 J	19.3	NA	<15.0	<15.0	<15.0	<15.0	12.6 J	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0
Copper	1,500 {nc}	µg/L	8.50 J [8.30 J]	16.5 J	35.2	NA	<25.0	5.30 J	7.50 J	6.20 J	39.9	<25.0	<25.0	<25.0	<25.0	<25.0	<25.0	<25.0
Iron	26,000 {nc}	µg/L	375 [363]	8,220	51,000	NA	456	1,390	2,670	3,280	44,400	1,020	2,860	6,100	<100	<100	635	<100
Lead	15 {nc}	µg/L	<3.00 [<3.00]	4.40	48.7	NA	<3.00	2.50 J	<3.00	4.30	23.4	1.60 J	<3.00	<3.00	<3.00	<3.00	<3.00	<3.00
Magnesium	- -	µg/L	15,100 [15,300]	50,500	10,300	NA	22,300	10,600	30,500	19,800	35,700	45,400	41,400	35,200	11,900	19,000	27,600	11,800
Manganese	880 {nc}	µg/L	14.2 J [14.3 J]	134	784	NA	34.0	42.9	89.7	104	361	21.4	89.1	69.6	<15.0	<15.0	28.1	<15.0
Mercury	0.63 {nc}	µg/L	<0.200 [<0.200]	<0.200	0.180 J	NA	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200
Nickel	730 {nc}	µg/L	8.40 J [7.90 J]	197	46.7	NA	<10.0	6.60 J	12.7	8.50 J	65.9	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
Potassium	- -	µg/L	2,620 J [2,640 J]	5,640	4,860 J	NA	2,270 J	2,090 J	1,910 J	3,470 J	9,470	5,770	3,010 J	2,890 J	1,670 J	1,820 J	1,970 J	2,200 J
Selenium	180 {nc}	µg/L	<5.00 [<5.00]	<5.00	<5.00	NA	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
Silver	180 {nc}	µg/L	<10.0 [<10.0]	2.10 J	<10.0	NA	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
Sodium	- -	µg/L	1,570 J [1,670 J]	2,270 J	1,710 J	NA	16,800	6,710	1,360 J	1,170 J	1,090 J	18,500	4,470 J	5,910	1,430 J	<5,000	1,420 J	8,750 J
Thallium	2.4 {nc}	µg/L	<10.0 [<10.0]	<10.0	<10.0	NA	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
Vanadium	260 {nc}	µg/L	<50.0 [<50.0]	17.1 J	71.3	NA	<50.0	<50.0	5.60 J	7.40 J	80.2	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0
Zinc	11,000 {nc}	µg/L	39.6 [39.8]	22.0	177	NA	12.2	11.1	9.40	15.5	106	9.80	6.50	8.10	9.00 J	7.00 J	15.4 J	9.30 J
Inorganics-Filtered																		
Aluminum	37,000 {nc}	µg/L	NA	<200	NA	<200	NA	<200	<200	<200	<200	<200	NA	NA	NA	NA	NA	NA
Antimony	15 {nc}	µg/L	NA	<15.0	NA	<15.0	NA	<15.0	<15.0	<15.0	<15.0	<15.0	NA	NA	NA	NA	NA	NA
Arsenic	0.045 {ca}	µg/L	NA	<5.00	NA	<5.00	NA	<5.00	<5.00	<5.00	<5.00	<5.00	NA	NA	NA	NA	NA	NA
Barium	7,300 {nc}	µg/L	NA	70.0	NA	<40.0	NA	66.5	27.2 J	51.1	71.4	89.7	NA	NA	NA	NA	NA	NA
Beryllium	73 {nc}	µg/L	NA	<5.00	NA	<5.00	NA	<5.00	<5.00	<5.00	<5.00	<5.00	NA	NA	NA	NA	NA	NA
Cadmium	18 {nc}	µg/L	NA	<5.00	NA	<5.00	NA	<5.00	<5.00	<5.00	<5.00	<5.00	NA	NA	NA	NA	NA	NA
Calcium	- -	µg/L	NA	63,400	NA	46,800 J	NA	103,000 J	65,000 J	87,500 J	67,600 J	85,900 J	NA	NA	NA	NA	NA	NA
Chromium	55,000 {nc}	µg/L	NA	<10.0	NA	<10.0	NA	<10.0	<10.0	<10.0	<10.0	<10.0	NA	NA	NA	NA	NA	NA
Cobalt	11 {nc}	µg/L	NA	<15.0	NA	<15.0	NA	<15.0	<15.0	<15.0	<15.0	<15.0	NA	NA	NA	NA	NA	NA
Copper	1,500 {nc}	µg/L	NA	<25.0	NA	<25.0	NA	<25.0	<25.0	<25.0	<25.0	<25.0	NA	NA	NA	NA	NA	NA
Iron	26,000 {nc}	µg/L	NA	<100	NA	<100	NA	<100	<100	<100	<100	<100	NA	NA	NA	NA	NA	NA
Lead	15 {nc}	µg/L	NA	<3.00	NA	<3.00	NA	<3.00	<3.00	<3.00	<3.00	<3.00	NA	NA	NA	NA	NA	NA
Magnesium	- -	µg/L	NA	26,000	NA	4,880 J	NA	10,700	31,700	11,800	12,800	43,100	NA	NA	NA	NA	NA	NA
Manganese	880 {nc}	µg/L	NA	28.5	NA	<15.0	NA	24.2	22.2	13.2 J	22.2	9.50 J	NA	NA	NA	NA	NA	NA
Mercury	0.63 {nc}	µg/L	NA	<0.200	NA	<0.200	NA	<0.200	<0.200	<0.200	<0.200	<0.200	NA	NA	NA	NA	NA	NA
Nickel	730 {nc}	µg/L	NA	33.8	NA	<10.0	NA	<10.0	<10.0	<10.0	<10.0	<10.0	NA	NA	NA	NA	NA	NA
Potassium	- -	µg/L	NA	2,310 J	NA	<5,000	NA	1,830 J	1,550 J	2,840 J	2,180 J	5,220	NA	NA	NA	NA	NA	NA
Selenium	180 {nc}	µg/L	NA	<5.00	NA	<5.00	NA	<5.00	<5.00	<5.00	<5.00	<5.00	NA	NA	NA	NA	NA	NA
Silver	180 {nc}	µg/L	NA	<10.0	NA	<10.0	NA	<10.0	<10.0	<10.0	<10.0	<10.0	NA	NA	NA	NA	NA	NA
Sodium	- -	µg/L	NA	2,320 J	NA	1,420 J	NA	6,990	1,530 J	1,340 J	1,180 J	18,100	NA	NA	NA	NA	NA	NA
Thallium	2.4 {nc}	µg/L	NA	<10.0	NA	<10.0	NA	<10.0	<10.0	<10.0	<10.0	<10.0	NA	NA	NA	NA	NA	NA
Vanadium	260 {nc}	µg/L	NA	<50.0	NA	<50.0	NA	<50.0	<50.0	<50.0	<50.0	<50.0	NA	NA	NA	NA	NA	NA
Zinc	11,000 {nc}	µg/L	NA	6.70	NA	<8.20 J	NA	<6.50 J	<6.10 J	7.10	<6.00 J	<20.0	NA	NA	NA	NA	NA	NA

µg/L	Micrograms per liter.
°C	Degrees Celsius.
mg/L	Milligrams per liter.
µmhos/cm	Micromhos per centimeter.
NTU	Nephelometric Turbidity Unit.
mV	Millivolts.
[a]	USEPA Regional Screening Levels (USEPA 2008a). Adjusted tap-water screening levels used to assess groundwater at the NRU.
{ca}	Carcinogen.
{nc}	Noncarcinogen.
*	Noncarcinogen screening level is less than one hundred times the carcinogen screening level.
**	Noncarcinogen screening level is less than ten times the carcinogen screening level.
J	Constituent concentration quanitified as estimated.
NA	Not Analyzed.
[3.3]	Bracketed concentration indicates laboratory analytical result for duplicate sample.
24,400	Highlighted value indicates constituent concentration is above adjusted tap water RSL.

Table 10-3. Groundwater and Spring Water Analytical Results, Facility-Wide Groundwater Sampling Event, 2010 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID:	Tapwater Screening Values [1]	Units	BLAMW01	BLAMW02	IAAMW01	IAAMW02	IAAMW03	IAAMW04	NBG-MW-01	NBG-MW-02	WBGMW01	WBGMW02	WBGMW03	WBG-SPRING01	RY-SPRING02	SPRING03	SPRING04
Date Collected:			04/06/10	04/07/10	04/06/10	04/06/10	04/06/10	04/06/10	04/07/10	04/07/10	04/07/10	04/07/10	04/07/10	04/06/10	04/06/10	04/07/10	04/07/10
Field Parameters																	
Temperature	--	°C	15.80	24.34	14.46	16.73	16.71	21.12	17.20	19.34	13.06	18.35	15.73	15.76	15.79	11.27	11.59
pH	--	--	7.43	7.71	7.04	7.47	10.63	7.54	8.22	7.21	7.21	7.25	10.17	8.18	11.73	11.03	9.20
Dissolved Oxygen	--	mg/L	7.45	5.14	7.32	0.99	8.41	6.78	9.34	6.21	2.20	2.72	3.44	6.52	7.12	--	--
Conductivity	--	µmhos/cm	351	0.391	268	.672	0.400	.437	460	0.353	0.613	0.555	7.53	512	493	459	443
Turbidity	--	NTU	41.5	5.42	6.45	8.99	12.1	9.48	2.75	6.23	>RL	28.9	51.2	9.21	6.11	5.48	4.98
Oxidation/Reduction Potential	--	mV	88.7	9.8	147.3	-189.6	-152.0	-28.6	-394.9	73.0	-34.5	-83.5	-431.2	57.2	-245	-306	-270.2
Dioxin/Furan																	
1,2,3,4,6,7,8-HpCDD	- -	ng/L	NA	NA	NA	NA	NA	NA	<0.0502	<0.0517	<0.0505	<0.0512	<0.05	NA	NA	NA	NA
1,2,3,4,6,7,8-HpCDF	- -	ng/L	NA	NA	NA	NA	NA	NA	<0.0502	<0.0517	<0.0505	<0.0512	<0.05	NA	NA	NA	NA
1,2,3,4,7,8,9-HpCDF	- -	ng/L	NA	NA	NA	NA	NA	NA	<0.0502	<0.0517	<0.0505	<0.0512	<0.05	NA	NA	NA	NA
1,2,3,4,7,8-HxCDD	- -	ng/L	NA	NA	NA	NA	NA	NA	<0.0502	<0.0517	<0.0505	<0.0512	<0.05	NA	NA	NA	NA
1,2,3,4,7,8-HxCDF	- -	ng/L	NA	NA	NA	NA	NA	NA	<0.0502	<0.0517	<0.0505	<0.0512	<0.05	NA	NA	NA	NA
1,2,3,6,7,8-HxCDD	- -	ng/L	NA	NA	NA	NA	NA	NA	<0.0502	<0.0517	<0.0505	<0.0512	<0.05	NA	NA	NA	NA
1,2,3,6,7,8-HxCDF	- -	ng/L	NA	NA	NA	NA	NA	NA	<0.0502	<0.0517	<0.0505	<0.0512	<0.05	NA	NA	NA	NA
1,2,3,7,8,9-HxCDD	- -	ng/L	NA	NA	NA	NA	NA	NA	<0.0502	<0.0517	<0.0505	<0.0512	<0.05	NA	NA	NA	NA
1,2,3,7,8,9-HxCDF	- -	ng/L	NA	NA	NA	NA	NA	NA	<0.0502	<0.0517	<0.0505	<0.0512	<0.05	NA	NA	NA	NA
1,2,3,7,8-PeCDD	- -	ng/L	NA	NA	NA	NA	NA	NA	<0.0502	<0.0517	<0.0505	<0.0512	<0.05	NA	NA	NA	NA
1,2,3,7,8-PeCDF	0.015 {ca**}	ng/L	NA	NA	NA	NA	NA	NA	<0.0502	<0.0517	<0.0505	<0.0512	<0.05	NA	NA	NA	NA
2,3,4,6,7,8-HxCDF	- -	ng/L	NA	NA	NA	NA	NA	NA	<0.0502	<0.0517	<0.0505	<0.0512	<0.05	NA	NA	NA	NA
2,3,4,7,8-PeCDF	0.0015 {ca**}	ng/L	NA	NA	NA	NA	NA	NA	<0.0502	<0.0517	<0.0505	<0.0512	<0.05	NA	NA	NA	NA
2,3,7,8-TCDD	0.00052 {ca*}	ng/L	NA	NA	NA	NA	NA	NA	<0.01	<0.0103	<0.0101	<0.0102	<0.01	NA	NA	NA	NA
2,3,7,8-TCDF	0.0045 {ca**}	ng/L	NA	NA	NA	NA	NA	NA	<0.01	<0.0103	<0.0101	<0.0102	<0.01	NA	NA	NA	NA
OCDD	1.5 {ca**}	ng/L	NA	NA	NA	NA	NA	NA	<0.1	<0.103	**0.249**	<0.102	<0.1	NA	NA	NA	NA
OCDF	1.5 {ca**}	ng/L	NA	NA	NA	NA	NA	NA	<0.1	<0.103	<0.101	<0.102	<0.1	NA	NA	NA	NA
Total HpCDDs	0.045 {ca**}	ng/L	NA	NA	NA	NA	NA	NA	<0.0502	<0.0517	<0.0505	<0.0512	<0.05	NA	NA	NA	NA
Total HpCDFs	0.045 {ca**}	ng/L	NA	NA	NA	NA	NA	NA	<0.0502	<0.0517	<0.0505	<0.0512	<0.05	NA	NA	NA	NA
Total HxCDDs	0.0045 {ca**}	ng/L	NA	NA	NA	NA	NA	NA	<0.0502	<0.0517	<0.0505	<0.0512	<0.05	NA	NA	NA	NA
Total HxCDFs	0.0045 {ca**}	ng/L	NA	NA	NA	NA	NA	NA	<0.0502	<0.0517	<0.0505	<0.0512	<0.05	NA	NA	NA	NA
Total PeCDDs	0.00045 {ca**}	ng/L	NA	NA	NA	NA	NA	NA	<0.0502	<0.0517	<0.0505	<0.0512	<0.05	NA	NA	NA	NA
Total PeCDFs	- -	ng/L	NA	NA	NA	NA	NA	NA	<0.0502	<0.0517	<0.0505	<0.0512	<0.05	NA	NA	NA	NA
Total TCDDs	- -	ng/L	NA	NA	NA	NA	NA	NA	<0.01	<0.0103	<0.0101	<0.0102	<0.01	NA	NA	NA	NA
Total TCDFs	- -	ng/L	NA	NA	NA	NA	NA	NA	<0.01	<0.0103	<0.0101	<0.0102	<0.01	NA	NA	NA	NA
Explosives																	
1,3,5-Trinitrobenzene	1,100 {nc}	ug/L	<0.222	<0.222	<0.222	<0.226	<0.222 [<0.222]	<0.224	<0.222	<0.222	<0.222	<0.226	<0.222	<0.222	<0.224	<0.231	<0.222
1,3-Dinitrobenzene	3.7 {nc}	ug/L	<0.222	<0.222	<0.222	<0.226	<0.222 [<0.222]	<0.224	<0.222	<0.222	<0.222	<0.226	<0.222	<0.222	<0.224	<0.231	<0.222
2,4,6-Trinitrotoluene	2.2 {ca**}	ug/L	<0.222	<0.222	<0.222	<0.226	<0.222 [<0.222]	<0.224	<0.222	<0.222	<0.222	<0.226	<0.222	<0.222	<0.224	<0.231	<0.222
2,4-Dinitrotoluene	0.22 {nc}	ug/L	<0.222	<0.222	<0.222	<0.226	<0.222 [<0.222]	<0.224	<0.222	<0.222	<0.222	<0.226	<0.222	<0.222	<0.224	<0.231	<0.222
2,6-Dinitrotoluene	37 {nc}	ug/L	<0.222	<0.222	<0.222	<0.226	<0.222 [<0.222]	<0.224	<0.222	**0.393 J**	<0.222	<0.226	<0.222	<0.222	<0.224	<0.231	<0.222
2-Amino-4,6-Dinitrotoluene	73 {nc}	ug/L	<0.222	<0.222	<0.222	<0.226	<0.222 [<0.222]	<0.224	<0.222	<0.222	<0.222	<0.226	<0.222	<0.222	<0.224	<0.231	<0.222
4-Amino-2,6-Dinitrotoluene	73 {nc}	ug/L	<0.222	<0.222	<0.222	<0.226	<0.222 [<0.222]	<0.224	<0.222	<0.222	<0.222	<0.226	<0.222	<0.222	<0.224	<0.231	<0.222
HMX	1,800 {nc}	ug/L	<0.222	<0.222	<0.222	<0.226	<0.222 [<0.222]	<0.224	<0.222	<0.222	<0.222	<0.226	<0.222	<0.222	<0.224	<0.231	<0.222
m-Nitrotoluene	- -	ug/L	<0.222	<0.222	<0.222	<0.226	<0.222 [<0.222]	<0.224	<0.222	<0.222	<0.222	<0.226	<0.222	<0.222	<0.224	<0.231	<0.222
Nitrobenzene	0.12 {nc}	ug/L	<0.222	<0.222	<0.222	<0.226	<0.222 [<0.222]	<0.224	<0.222	<0.222	<0.222	<0.226	**0.512**	<0.222	<0.224	<0.231	<0.222
Nitroglycerine	3.7 {nc}	ug/L	<1.11	<1.11	<1.11	<1.13	<1.11 [<1.11]	<1.12	<1.11	<1.11	<1.11	<1.13	<1.11	<1.11	<1.12	<1.15	<1.11
o-Nitrotoluene	0.31 {nc}	ug/L	<0.222	**0.293 J**	<0.222	<0.226	<0.222 [<0.222]	<0.224	<0.222	<0.222	<0.222	<0.226	<0.222	<0.222	<0.224	<0.231	<0.222
Pentaerythritol Tetranitrate	- -	ug/L	<1.11	<1.11	<1.11	**1.39**	<1.11 [<1.11]	<1.12	<1.11	<1.11	<1.11	<1.13	<1.11	<1.11	<1.12	<1.15	<1.11
p-Nitrotoluene	4.2 {ca*}	ug/L	<0.222	<0.222	<0.222	<0.226	<0.222 [<0.222]	<0.224	<0.222	<0.222	<0.222	<0.226	<0.222	<0.222	<0.224	<0.231	<0.222
RDX	0.61 {ca}	ug/L	<0.222	<0.222	<0.222	<0.226	<0.222 [<0.222]	<0.224	<0.222	<0.222	<0.222	<0.226	<0.222	<0.222	<0.224	<0.231	<0.222
Tetryl	150 {nc}	ug/L	<0.222	<0.222	<0.222	<0.226	<0.222 [<0.222]	<0.224	<0.222	**0.45**	<0.222	<0.226	<0.222	<0.222	**0.302**	<0.231	<0.222

Notes found at end of table.

Table 10-3. Groundwater and Spring Water Analytical Results, Facility-Wide Groundwater Sampling Event, 2010 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: / Date Collected:	Tapwater Screening Values [1]	Units	BLAMW01 04/06/10	BLAMW02 04/07/10	IAAMW01 04/06/10	IAAMW02 04/06/10	IAAMW03 04/06/10	IAAMW04 04/06/10	NBG-MW-01 04/07/10	NBG-MW-02 04/07/10	WBGMW01 04/07/10	WBGMW02 04/07/10	WBGMW03 04/07/10	WBG-SPRING01 04/06/10	RY-SPRING02 04/06/10	SPRING03 04/07/10	SPRING04 04/07/10
PCBs																	
Aroclor-1016	0.96 {ca**}	ug/L	<0.46 J	<0.47 J	<0.46 J	<0.47 J	<0.46 J [<0.47 J]	<0.50 J	<0.47 J	<0.47 J	<0.47 J	<0.47 J	<0.46 J	<0.46 J	<0.47 J	<0.47 J	<0.50 J
Aroclor-1221	0.0068 {ca**}	ug/L	<0.46 J	<0.47 J	<0.46 J	<0.47 J	<0.46 J [<0.47 J]	<0.50 J	<0.47 J	<0.47 J	<0.47 J	<0.47 J	<0.46 J	<0.46 J	<0.47 J	<0.47 J	<0.50 J
Aroclor-1232	0.0068 {ca**}	ug/L	<0.46 J	<0.47 J	<0.46 J	<0.47 J	<0.46 J [<0.47 J]	<0.50 J	<0.47 J	<0.47 J	<0.47 J	<0.47 J	<0.46 J	<0.46 J	<0.47 J	<0.47 J	<0.50 J
Aroclor-1242	0.034 {ca**}	ug/L	<0.46 J	<0.47 J	<0.46 J	<0.47 J	<0.46 J [<0.47 J]	<0.50 J	<0.47 J	<0.47 J	<0.47 J	<0.47 J	<0.46 J	<0.46 J	<0.47 J	<0.47 J	<0.50 J
Aroclor-1248	0.034 {ca**}	ug/L	<0.46 J	<0.47 J	<0.46 J	<0.47 J	<0.46 J [<0.47 J]	<0.50 J	<0.47 J	<0.47 J	<0.47 J	<0.47 J	<0.46 J	<0.46 J	<0.47 J	<0.47 J	<0.50 J
Aroclor-1254	0.034 {ca*}	ug/L	<0.46 J	<0.47 J	<0.46 J	<0.47 J	<0.46 J [<0.47 J]	<0.50 J	<0.47 J	<0.47 J	<0.47 J	<0.47 J	<0.46 J	<0.46 J	<0.47 J	<0.47 J	<0.50 J
Aroclor-1260	0.034 {ca**}	ug/L	<0.46 J	<0.47 J	<0.46 J	<0.47 J	<0.46 J [<0.47 J]	<0.50 J	<0.47 J	<0.47 J	<0.47 J	<0.47 J	<0.46 J	<0.46 J	<0.47 J	<0.47 J	<0.50 J
Volatile Organics																	
1,1,1-Trichloroethane	9,100 {nc}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2,2-Tetrachloroethane	0.067 {ca**}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2-trichloro-1,2,2-trifluoroethane	59,000 {nc}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2-Trichloroethane	0.24 {ca}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane	2.4 {ca}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethene	340 {nc}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2,3-Trichlorobenzene	- -	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2,4-Trichlorobenzene	2.3 {ca*}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dibromo-3-chloropropane	0.00032 {ca}	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0 [<2.0]	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,2-Dibromoethane	0.0065 {ca}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichlorobenzene	370 {nc}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichloroethane	0.15 {ca}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichloropropane	0.39 {ca*}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,3-Dichlorobenzene	- -	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,4-Dichlorobenzene	0.43 {ca}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,4-Dioxane	6.1 {ca**}	ug/L	<10	<10	<10	<10	<10 [<10]	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
2-Butanone	7,100 {nc}	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2-Hexanone	- -	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4-Methyl-2-pentanone	2,000 {nc}	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0 [<5.0]	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Acetone	22,000 {nc}	ug/L	<5.0	**11**	<5.0	**3.6 J**	<5.0 [<5.0]	**1.9 J**	<5.0	<5.0	<5.0	**41**	<5.0	<5.0	<5.0	<5.0	<5.0
Benzene	0.41 {ca}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromochloromethane	- -	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromodichloromethane	0.12 {ca}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromoform	8.5 {ca*}	ug/L	<1.5	<1.5	<1.5	<1.5	<1.5 [<1.5]	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
Bromomethane	8.7 {nc}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Carbon Disulfide	1,000 {nc}	ug/L	<1.0	<1.0	<1.0	**0.45 J**	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Carbon Tetrachloride	0.2 {ca}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chlorobenzene	91 {nc}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chloroethane	21,000 {nc}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chloroform	0.19 {ca}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**0.85 J**	<1.0	<1.0	<1.0
Chloromethane	190 {ca}	ug/L	**0.96 J**	**1.2**	<1.0	**1.3**	**1.3 [1.0]**	**0.93 J**	**1.3**	**1.1**	**1.7**	**1.2**	**1.1**	**1.1**	<1.0	**1.1**	**0.98 J**
cis-1,2-Dichloroethene	370 {nc}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
cis-1,3-Dichloropropene	- -	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cyclohexane	13,000 {nc}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dibromochloromethane	0.15 {ca}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dichlorodifluoromethane	390 {nc}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Ethylbenzene	1.5 {ca}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Isopropylbenzene	680 {nc}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Methyl acetate	37,000 {nc}	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0 [<2.0]	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Methyl tert-butyl ether	12 {ca}	ug/L	<1.0	<1.0	<1.0	**11**	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Methylcylohexane	6,300 {nc}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Methylene Chloride	4.8 {ca}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Styrene	1,600 {nc}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Tetrachloroethene	0.11 {ca}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Toluene	2,300 {nc}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,2-Dichloroethene	110 {nc}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,3-Dichloropropene	- -	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Trichloroethene	2 {ca}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Trichlorofluoromethane	1,300 {nc}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Vinyl Chloride	0.016 {ca}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Xylenes (total)	200 {nc}	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0 [<1.0]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Notes found at end of table.

Table 10-3. Groundwater and Spring Water Analytical Results, Facility-Wide Groundwater Sampling Event, 2010 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: / Date Collected:	Tapwater Screening Values [1]	Units	BLAMW01 04/06/10	BLAMW02 04/07/10	IAAMW01 04/06/10	IAAMW02 04/06/10	IAAMW03 04/06/10	IAAMW04 04/06/10	NBG-MW-01 04/07/10	NBG-MW-02 04/07/10	WBGMW01 04/07/10	WBGMW02 04/07/10	WBGMW03 04/07/10	WBG-SPRING01 04/06/10	RY-SPRING02 04/06/10	SPRING03 04/07/10	SPRING04 04/07/10
Semivolatile Organics																	
1-Methylnaphthalene	2.3 {ca}	ug/L	<0.093	<0.093	<0.093	<0.094	<0.093 [<0.093]	<0.093	<0.093	<0.094	<0.093	<0.094	<0.093	<0.094	<0.093	<0.096	<0.093
2-Methylnaphthalene	150 {nc}	ug/L	<0.093	<0.093	<0.093	<0.094	<0.093 [<0.093]	<0.093	<0.093	<0.094	<0.093	<0.094	<0.093	<0.094	<0.093	<0.096	<0.093
Acenaphthene	2,200 {nc}	ug/L	<0.093	<0.093	<0.093	<0.094	<0.093 [<0.093]	<0.093	<0.093	<0.094	<0.093	<0.094	<0.093	<0.094	<0.093	<0.096	<0.093
Acenaphthylene	- -	ug/L	<0.093	<0.093	<0.093	<0.094	<0.093 [<0.093]	<0.093	<0.093	<0.094	<0.093	<0.094	<0.093	<0.094	<0.093	<0.096	<0.093
Anthracene	11,000 {nc}	ug/L	<0.093	<0.093	<0.093	<0.094	<0.093 [<0.093]	<0.093	<0.093	<0.094	<0.093	<0.094	<0.093	<0.094	**0.021 J**	<0.096	<0.093
Benzo(a)anthracene	0.029 {ca**}	ug/L	<0.093	<0.093	<0.093	<0.094	<0.093 [<0.093]	<0.093	<0.093	<0.094	<0.093	<0.094	<0.093	<0.094	<0.093	<0.096	<0.093
Benzo(a)pyrene	0.0029 {ca**}	ug/L	<0.093	<0.093	<0.093	<0.094	<0.093 [<0.093]	<0.093	<0.093	<0.094	<0.093	<0.094	<0.093	<0.094	<0.093	<0.096	<0.093
Benzo(b)fluoranthene	0.029 {ca**}	ug/L	<0.093	<0.093	<0.093	<0.094	<0.093 [<0.093]	<0.093	<0.093	<0.094	<0.093	<0.094	<0.093	<0.094	<0.093	<0.096	<0.093
Benzo(g,h,i)perylene	- -	ug/L	<0.093	<0.093	<0.093	<0.094	<0.093 [<0.093]	<0.093	<0.093	<0.094	<0.093	<0.094	<0.093	<0.094	<0.093	<0.096	<0.093
Benzo(k)fluoranthene	0.29 {ca**}	ug/L	<0.093	<0.093	<0.093	<0.094	<0.093 [<0.093]	<0.093	<0.093	<0.094	<0.093	<0.094	<0.093	<0.094	<0.093	<0.096	<0.093
Chrysene	2.9 {ca**}	ug/L	<0.093	<0.093	<0.093	<0.094	<0.093 [<0.093]	<0.093	<0.093	<0.094	<0.093	<0.094	<0.093	<0.094	<0.093	<0.096	<0.093
Dibenzo(a,h)anthracene	0.0029 {ca**}	ug/L	<0.093	<0.093	<0.093	<0.094	<0.093 [<0.093]	<0.093	<0.093	<0.094	<0.093	<0.094	<0.093	<0.094	<0.093	<0.096	<0.093
Fluoranthene	1,500 {nc}	ug/L	<0.093	<0.093	<0.093	<0.094	0.019 J [<0.093]	<0.093	<0.093	<0.094	<0.093	<0.094	<0.093	<0.094	<0.093	<0.096	<0.093
Fluorene	1,500 {nc}	ug/L	<0.093	<0.093	<0.093	<0.094	<0.093 [<0.093]	<0.093	<0.093	<0.094	<0.093	<0.094	<0.093	<0.094	<0.093	<0.096	<0.093
Indeno(1,2,3-cd)pyrene	0.029 {ca**}	ug/L	<0.093	<0.093	<0.093	<0.094	<0.093 [<0.093]	<0.093	<0.093	<0.094	<0.093	<0.094	<0.093	<0.094	<0.093	<0.096	<0.093
Naphthalene	0.14 {nc}	ug/L	<0.093	<0.093	<0.093	<0.094	<0.093 [<0.093]	<0.093	<0.093	<0.094	<0.093	<0.094	<0.093	<0.094	<0.093	<0.096	<0.093
Phenanthrene	- -	ug/L	**0.022 J**	<0.093	<0.093	<0.094	<0.093 [<0.093]	<0.093	<0.093	<0.094	<0.093	<0.094	<0.093	<0.094	<0.093	<0.096	<0.093
Pyrene	1,100 {nc}	ug/L	**0.019 J**	<0.093	<0.093	<0.094	<0.093 [<0.093]	<0.093	<0.093	<0.094	<0.093	<0.094	<0.093	<0.094	<0.093	<0.096	<0.093
Inorganics																	
Aluminum	37,000 {nc}	ug/L	**133**	**84.5**	**6,670**	**73.7**	**89.0 [104]**	**66,600**	**991**	**600**	**25,700**	**120**	**91.8**	**89.8**	**73.7**	**66.0**	**65.2**
Antimony	15 {nc}	ug/L	<3.75	<3.75	<3.75	<3.75	<3.75 [<3.75]	<7.50	<3.75	<3.75	<7.50	<3.75	<3.75	<3.75	<3.75	<3.75	<3.75
Arsenic	0.045 {ca}	ug/L	<1.25	<1.25	**4.56**	**1.74**	<1.25 [<1.25]	14.1	<1.25	<1.25	**8.49**	**1.62**	**2.71**	<1.25	<1.25	<1.25	<1.25
Barium	7,300 {nc}	ug/L	**138**	**60.7**	**32.6**	**147**	**55.3 [58.5]**	**363**	**38.6**	**80.0**	**207**	**109**	**239**	**54.7**	**42.5**	**40.5**	**51.3**
Beryllium	73 {nc}	ug/L	<1.25	<1.25	**2.31**	<1.25	<1.25 [<1.25]	**7.91**	<1.25	<1.25	**1.29 J**	<1.25	<1.25	<1.25	<1.25	<1.25	<1.25
Cadmium	18 {nc}	ug/L	**0.450 J**	**0.507 J**	**0.373 J**	**0.481 J**	**0.396 J [0.434 J]**	<2.50	**0.441 J**	**0.525 J**	**1.12 J**	**0.486 J**	**0.560 J**	**0.420 J**	**0.476 J**	**0.378 J**	**0.444 J**
Calcium	- -	ug/L	**55,400**	**51,900**	**50,400**	**67,300**	**62,400 [65,400]**	**85,300**	**59,700**	**70,300**	**288,000**	**72,400**	**82,900**	**65,100**	**50,800 J**	**47,400**	**40,200 J**
Chromium	- -	ug/L	**4.74 J**	**1.57 J**	**15.4 J**	**12.0 J**	**2.71 J [2.90 J]**	**318 J**	**17.6 J**	**21.2**	**60.1**	**4.82**	**7.76**	**1.55 J**	<1.25	**0.806 J**	<1.25
Cobalt	- -	ug/L	<3.12	<3.12	**3.75**	<3.12	<3.12 [<3.12]	**39.3**	**4.67**	<3.12	**15.3**	<3.12	**5.26**	<3.12	<3.12	<3.12	<3.12
Copper	1,500 {nc}	ug/L	<2.50	<2.50	**8.52**	<2.50	<2.50 [<2.50]	**70.7**	**5.80**	**1.25 J**	**25.0**	<2.50	**2.28 J**	<2.50	<2.50	<2.50	<2.50
Iron	26,000 {nc}	ug/L	**127**	**28.4**	**13,600**	**906**	**43.9 [57.4]**	**107,000**	**1,320**	**845**	**18,800**	**3,110**	**3,780**	**35.6**	**16.8 J**	<25.0	**8.37 J**
Lead	- -	ug/L	<0.750	<0.750	**13.5**	<0.750	<0.750 [<0.750]	**40.5**	**1.36**	<0.750	**31.9**	<0.750	**34.1**	<0.750	<0.750	<0.750	<0.750
Magnesium	- -	ug/L	**16,000**	**19,100**	**6,100**	**25,000**	**8,850 [9,300]**	**51,900**	**9,600**	**15,600 J**	**84,800 J**	**38,300 J**	**31,700 J**	**10,900**	**22,800 J**	**8,230**	**13,500 J**
Manganese	880 {nc}	ug/L	**4.22**	**5.77**	**300**	**27.8**	**2.08 J [1.91 J]**	**3,550**	**18.7**	**8.71**	**201**	**74.9**	**30.0**	**1.59 J**	**0.785 J**	<3.75	<3.75
Mercury	0.57 {nc}	ug/L	<0.200	<0.200	**0.0956 J**	<0.200	<0.200 [<0.200]	**0.353**	<0.200	<0.200	**0.439**	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200
Nickel	730 {nc}	ug/L	**3.43**	**7.23**	**11.2**	**10.1**	**2.00 J [2.11 J]**	**246**	**11.9**	**14.5**	**34.7**	**4.72**	**4.58**	<2.50	<2.50	<2.50	<2.50
Potassium	- -	ug/L	**2,440**	**1,440**	**2,360**	**2,640**	**1,520 [1,590]**	**9,100**	**3,300**	**2,720**	**8,010**	**2,930 J**	**2,800**	**2,220**	**1,840**	**1,240 J**	**1,720**
Selenium	180 {nc}	ug/L	<1.50	<1.50	<1.50	<1.50	<1.50 [<1.50]	<3.00	<1.50	<1.50	<3.00	<1.50	<1.50	<1.50	<1.50	<1.50	<1.50
Silver	180 {nc}	ug/L	<1.25	<1.25	<1.25	<1.25	<1.25 [<1.25]	<6.25	**0.277 J**	<1.25	<2.50	<1.25	<1.25	<1.25	<1.25	<1.25	<1.25
Sodium	- -	ug/L	**2,120**	**3,500**	**1,240 J**	**57,600**	**3,020 [3,180]**	**1,150 J**	**1,110 J**	**2,240**	**26,300**	**3,560 J**	**5,050**	**7,630**	**802 J**	**771 J**	**826 J**
Thallium	2.4 {nc}	ug/L	<2.00	<2.00	<2.00	<2.00	<2.00 [<2.00]	<4.00	<2.00	<2.00	<4.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00
Vanadium	2.6 {nc}	ug/L	<3.12	<3.12	**19.5**	<3.12	<3.12 [<3.12]	**167**	**2.91 J**	**2.06 J**	**42.4**	<3.12	<3.12	<3.12	<3.12	<3.12	<3.12
Zinc	11,000 {nc}	ug/L	**1.47 J**	**1.88 J**	**30.8**	**3.03 J**	<5.00 [1.63 J]	**91.4**	**8.92**	**3.29 J**	**73.4**	**3.26 J**	**13.1**	**1.78 J**	<5.00	<5.00	**2.95 J**

Notes found at end of table.

Table 10-3. Groundwater and Spring Water Analytical Results, Facility-Wide Groundwater Sampling Event, 2010 ARCADIS Remedial Investigation, Radford Army Ammunition Plant, Radford, Virginia.

Location ID: / Date Collected:	Tapwater Screening Values [1]	Units	BLAMW01 04/06/10	BLAMW02 04/07/10	IAAMW01 04/06/10	IAAMW02 04/06/10	IAAMW03 04/06/10	IAAMW04 04/06/10	NBG-MW-01 04/07/10	NBG-MW-02 04/07/10	WBGMW01 04/07/10	WBGMW02 04/07/10	WBGMW03 04/07/10	WBG-SPRING01 04/06/10	RY-SPRING02 04/06/10	SPRING03 04/07/10	SPRING04 04/07/10
Inorganics-Filtered																	
Aluminum	37,000 {nc}	ug/L	**69.2**	**70.2**	**66.4**	**72.0**	**64.6 [61.4]**	**64.3**	**65.6**	**61.6**	**65.3**	**60.7**	**63.1**	NA	NA	NA	NA
Antimony	15 {nc}	ug/L	<3.75	<3.75	<3.75	<3.75	<3.75 [<3.75]	<3.75	<3.75	<3.75	<3.75	<3.75	<3.75	NA	NA	NA	NA
Arsenic	0.045 {ca}	ug/L	<1.25	<1.25	<1.25	**1.83**	<1.25 [<1.25]	<1.25	<1.25	<1.25	<1.25	<1.25	<1.25	NA	NA	NA	NA
Barium	7,300 {nc}	ug/L	**123**	**60.2**	**10.8**	**155**	**55.7 [59.3]**	**37.8**	**35.4**	**59.3**	**89.5**	**108**	**200**	NA	NA	NA	NA
Beryllium	73 {nc}	ug/L	<1.25	<1.25	<1.25	<1.25	<1.25 [<1.25]	<1.25	<1.25	<1.25	<1.25	<1.25	<1.25	NA	NA	NA	NA
Cadmium	18 {nc}	ug/L	**0.447 J**	**0.488 J**	**0.416 J**	**0.574 J**	**0.453 J [0.481 J]**	**0.450 J**	**0.464 J**	**0.448 J**	**0.556 J**	**0.548 J**	**0.499 J**	NA	NA	NA	NA
Calcium	- -	ug/L	**47,800 J**	**50,400 J**	**41,700 J**	**64,800 J**	**62,000 J [64,700 J]**	**49,700 J**	**55,300 J**	**52,200 J**	**69,800 J**	**77,800 J**	**73,000 J**	NA	NA	NA	NA
Chromium	- -	ug/L	**2.20**	**0.768 J**	**0.656 J**	**1.48**	**0.928 J [1.19 J]**	<1.25	**0.968 J**	**0.772 J**	<1.25	<1.25	<1.25	NA	NA	NA	NA
Cobalt	- -	ug/L	<3.12	<3.12	<3.12	<3.12	<3.12 [<3.12]	<3.12	<3.12	<3.12	2.55 J	<3.12	<3.12	NA	NA	NA	NA
Copper	1,500 {nc}	ug/L	<2.50	<2.50	<2.50	<2.50	<2.50 [<2.50]	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	NA	NA	NA	NA
Iron	26,000 {nc}	ug/L	**13.9 J**	<25.0	**14.1 J**	**539**	<25.0 [<25.0]	<25.0	<25.0	<25.0	<25.0	<25.0	<25.0	NA	NA	NA	NA
Lead	- -	ug/L	<0.750	<0.750	<0.750	<0.750	<0.750 [<0.750]	<0.750	<0.750	<0.750	<0.750	<0.750	<0.750	NA	NA	NA	NA
Magnesium	- -	ug/L	**14,100 J**	**18,700 J**	**4,110 J**	**24,200 J**	**8,810 J [9,160 J]**	**24,200 J**	**8,400 J**	**11,500 J**	**37,500 J**	**41,300 J**	**27,900 J**	NA	NA	NA	NA
Manganese	880 {nc}	ug/L	<3.75	**5.30**	<3.75	**25.5**	<3.75 [<3.75]	**25.2**	**1.62 J**	<3.75	**10.5**	**23.0**	**18.0**	NA	NA	NA	NA
Mercury	0.57 {nc}	ug/L	<0.200	<0.200	<0.200	<0.200	<0.200 [<0.200]	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	NA	NA	NA	NA
Nickel	730 {nc}	ug/L	**2.66**	**6.98**	**0.880 J**	<2.50	**1.56 J [1.64 J]**	**16.9**	**4.26**	**4.06**	**18.6**	**0.777 J**	**3.70**	NA	NA	NA	NA
Potassium	- -	ug/L	**2,200**	**1,460**	**1,070 J**	2,480	**1,530 [1,620]**	**1,610**	**3,070**	**1,990**	**4,500**	**3,260 J**	**2,510**	NA	NA	NA	NA
Selenium	180 {nc}	ug/L	<1.50	<1.50	<1.50	<1.50	<1.50 [<1.50]	<1.50	<1.50	<1.50	<1.50	<1.50	<1.50	NA	NA	NA	NA
Silver	180 {nc}	ug/L	<1.25	<1.25	<1.25	<1.25	<1.25 [<1.25]	<1.25	<1.25	<1.25	<1.25	<1.25	<1.25	NA	NA	NA	NA
Sodium	- -	ug/L	**1,950**	**3,630**	**1,270**	**58,500**	**3,110 [3,250]**	**1,010 J**	**1,190 J**	**1,730**	**23,300**	**4,020 J**	**4,650**	NA	NA	NA	NA
Thallium	2.4 {nc}	ug/L	<2.00	<2.00	<2.00	<2.00	<2.00 [<2.00]	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	NA	NA	NA	NA
Vanadium	2.6 {nc}	ug/L	<3.12	<3.12	<3.12	<3.12	<3.12 [<3.12]	<3.12	<3.12	<3.12	<3.12	<3.12	<3.12	NA	NA	NA	NA
Zinc	11,000 {nc}	ug/L	<5.00	**1.64 J**	**2.45 J**	<5.00	**5.07 [<5.00]**	<5.00	**4.99 J**	**2.52 J**	**4.91 J**	**5.66**	**3.71 J**	NA	NA	NA	NA

Notes:

J	Indicates an estimated value.
UJ	The compound was analyzed for but not detected. The associated value is the compound
1.83	Shading denotes that the detected concentration exceeded the screening level.

1. The tap water screening levels were obtained from the USEPA's RSL Table (December 2009)

Table 10-4
Groundwater Risk Assessment Dataset
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples	FOD %	Detects Min - Max (mg/L) - (mg/L)	Detection Limits Min - Max (mg/L) - (mg/L)	Maximum Location	Exposure Point Concentration [c] (mg/L)
Volatile Organic Compounds							
Acetone	67-64-1	6 - 26	23	1.90E-03 - 4.10E-02	5.00E-03 - 2.50E-02	WBGMW02	0.007986
Carbon Disulfide	75-15-0	1 - 26	4	4.50E-04 - 4.50E-04	1.00E-03 - 2.00E-03	IAAMW02	0.00045 m
Chloroform	67-66-3	2 - 26	8	8.50E-04 - 1.20E-03	1.00E-03 - 1.00E-03	WBGMW01	0.0012 m
Chloromethane	74-87-3	13 - 25	52	9.30E-04 - 1.70E-03	1.00E-03 - 2.00E-03	WBGMW01	0.001224
Methyl tert-butyl ether	1634-4-4	1 - 15	7	1.10E-02 - 1.10E-02	1.00E-03 - 1.00E-03	IAAMW02	0.011 m
Toluene	108-88-3	1 - 26	4	7.00E-04 - 7.00E-04	1.00E-03 - 1.00E-03	BLAMW01	0.0007 m
Semi-Volatile Organic Compounds							
2,6-Dinitrotoluene	606-20-2	1 - 25	4	3.90E-04 - 3.90E-04	2.00E-04 - 3.80E-04	NBG-MW-02	0.00039 m
Dioxin/Furan Compounds							
1,2,3,4,6,7,8-HpCDD	35822-46-9	4 - 15	27	3.12E-09 - 4.79E-08	5.39E-09 - 5.17E-08	WBGMW01	4.79E-08 m
1,2,3,4,6,7,8-HpCDF	67562-39-4	9 - 15	60	1.38E-09 - 3.08E-08	5.98E-09 - 5.17E-08	WBGMW01	1.3525E-08
1,2,3,4,7,8,9-HpCDF	55673-89-7	1 - 15	7	4.12E-09 - 4.12E-09	5.46E-09 - 5.17E-08	NBG-MW-01	4.12E-09 m
1,2,3,4,7,8-HxCDD	39227-28-6	2 - 15	13	2.84E-09 - 5.75E-09	5.39E-09 - 5.17E-08	NBG-MW-01	5.75E-09 m
1,2,3,4,7,8-HxCDF	70648-26-9	8 - 15	53	1.73E-09 - 8.02E-09	5.46E-09 - 5.17E-08	WBGMW01	5.3504E-09
1,2,3,6,7,8-HxCDD	57653-85-7	2 - 15	13	3.24E-09 - 5.13E-09	5.39E-09 - 5.17E-08	NBG-MW-01	5.13E-09 m
1,2,3,6,7,8-HxCDF	57117-44-9	7 - 15	47	1.10E-09 - 6.25E-09	5.39E-09 - 5.17E-08	NBG-MW-01	3.4897E-09
1,2,3,7,8,9-HxCDD	19408-74-3	2 - 15	13	3.33E-09 - 5.54E-09	5.39E-09 - 5.17E-08	NBG-MW-01	5.54E-09 m
1,2,3,7,8,9-HxCDF	72918-21-9	2 - 15	13	2.36E-09 - 6.23E-09	5.39E-09 - 5.17E-08	NBG-MW-01	6.23E-09 m
1,2,3,7,8-PeCDD	40321-76-4	4 - 15	27	2.94E-09 - 7.77E-09	5.39E-09 - 5.17E-08	NBG-MW-01	7.77E-09 m
1,2,3,7,8-PeCDF	57117-41-6	6 - 15	40	9.01E-10 - 1.90E-08	5.39E-09 - 5.17E-08	BLAMW02	9.3357E-09
2,3,4,6,7,8-HxCDF	60851-34-5	4 - 15	27	9.89E-10 - 4.19E-09	5.39E-09 - 5.17E-08	NBG-MW-01	4.19E-09 m
2,3,4,7,8-PeCDF	57117-31-4	8 - 15	53	9.68E-10 - 1.58E-08	5.46E-09 - 5.17E-08	BLAMW02	7.3631E-09
2,3,7,8-TCDD	1746-01-6	3 - 15	20	3.15E-09 - 4.25E-09	1.13E-09 - 5.05E-08	BLAMW02	4.25E-09 m
2,3,7,8-TCDF	51207-31-9	5 - 15	33	7.43E-10 - 1.21E-08	2.31E-09 - 1.03E-08	BLAMW02	1.21E-08 m
OCDD	3268-87-9	10 - 15	67	6.28E-09 - 3.95E-07	1.00E-08 - 1.09E-08	WBGMW01	2.4064E-07
OCDF	39001-02-0	7 - 15	47	5.05E-09 - 9.26E-08	1.00E-08 - 1.20E-08	WBGMW01	2.7599E-08
Explosives							
Nitrobenzene	98-95-3	1 - 25	4	5.10E-04 - 5.10E-04	2.00E-04 - 3.80E-04	WBGMW03	0.00051 m
o-Nitrotoluene	88-72-2	1 - 25	4	2.93E-04 - 2.93E-04	2.00E-04 - 3.80E-04	BLAMW02	0.000293 m
Pentaerythritol Tetranitrate	78-11-5	1 - 25	4	1.39E-03 - 1.39E-03	1.11E-03 - 3.80E-03	IAAMW02	0.00139 m
Perchlorate	14797-73-0	7 - 11	64	9.10E-05 - 2.00E-04	2.00E-04 - 2.00E-04	IAAMW04	0.0002 m
Tetryl	479-45-8	2 - 25	8	3.02E-04 - 4.50E-04	2.00E-04 - 3.80E-04	NBG-MW-02	0.00045 m
Polycyclic Aromatic Hydrocarbons							
Anthracene	120-12-7	1 - 29	3	2.10E-05 - 2.10E-05	9.20E-05 - 1.30E-03	SPRING02	0.000021 m
Fluoranthene	206-44-0	1 - 29	3	1.90E-05 - 1.90E-05	9.20E-05 - 1.30E-03	IAAMW03	0.000019 m
Naphthalene	91-20-3	2 - 29	7	3.20E-05 - 4.40E-05	9.20E-05 - 1.30E-03	RY_SPRING002	0.000044 m
Phenanthrene	85-01-8	2 - 29	7	2.20E-05 - 3.80E-05	9.20E-05 - 1.30E-03	RY_SPRING002	0.000038 m
Pyrene	129-00-0	1 - 29	3	1.90E-05 - 1.90E-05	9.20E-05 - 1.30E-03	BLAMW01	0.000019 m
Inorganics Unfiltered							
Aluminum	7429-90-5	11 - 18	61	6.07E-02 - 7.20E-02	2.00E-01 - 2.00E-01	IAAMW02	0.06748
Arsenic	7440-38-2	1 - 18	6	1.83E-03 - 1.83E-03	1.25E-03 - 5.00E-03	IAAMW02	0.00183 m
Barium	7440-39-3	17 - 18	94	1.08E-02 - 2.00E-01	4.00E-02 - 4.00E-02	WBGMW03	0.09416
Cadmium	7440-43-9	11 - 18	61	4.16E-04 - 5.74E-04	5.00E-03 - 5.00E-03	IAAMW02	0.000514
Calcium	7440-70-2	18 - 18	100	4.17E+01 - 1.03E+02	ND - ND	IAAMW03	71.414
Chromium	7440-47-3	7 - 18	39	6.56E-04 - 2.20E-03	1.25E-03 - 1.00E-02	BLAMW01	0.001281
Cobalt	7440-48-4	1 - 18	6	2.55E-03 - 2.55E-03	3.12E-03 - 1.50E-02	WBGMW01	0.00255 m
Iron	7439-89-6	3 - 18	17	1.39E-02 - 5.39E-01	2.50E-02 - 1.00E-01	IAAMW02	0.539 m
Magnesium	7439-95-4	18 - 18	100	4.11E+00 - 4.31E+01	ND - ND	WBGMW01	25.19
Manganese	7439-96-5	13 - 18	72	1.62E-03 - 2.85E-02	3.75E-03 - 1.50E-02	BLAMW02	0.01817
Nickel	7440-02-0	11 - 18	61	7.77E-04 - 3.38E-02	2.50E-03 - 1.00E-02	BLAMW02	0.01023
Potassium	7440-09-7	17 - 18	94	1.07E+00 - 5.22E+00	5.00E+00 - 5.00E+00	WBGMW01	2.926
Sodium	7440-23-5	18 - 18	100	1.01E+00 - 5.85E+01	ND - ND	IAAMW02	40.692
Zinc	7440-66-6	10 - 18	56	1.64E-03 - 7.10E-03	5.00E-03 - 2.00E-02	NBG-MW-01	0.005044

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/L = Milligrams per liter.
ND = Non-detects.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.
[c] The exposure point concentration (EPC) was the upper confidence level on the mean (UCL) or the maximum concentration where the UCL was incalculable.
EPCs marked with "m" are based on the maximum detected concentration.
The UCLs were calculated using ProUCL 4.2. The UCL used is the one recommended by ProUCL 4.2.

Table 10-5
Selection of Constituents of Potential Concern for Groundwater
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentrations [a]	Adjusted Tap Water Regional Screening Level (RSL) [b]			Is Constituent a Groundwater COPC? [c]
		(mg/L)	(mg/L)		Surrogate	(YES, no)
Volatile Organic Compounds						
Acetone	67-64-1	4.10E-02	2.20E+00	n		no
Carbon Disulfide	75-15-0	4.50E-04	1.00E-01	n		no
Chloroform	67-66-3	1.20E-03	1.90E-04	c		**YES**
Chloromethane	74-87-3	1.70E-03	1.90E-02	n		no
Methyl tert-butyl ether	1634-4-4	1.10E-02	1.20E-02	c		no
Toluene	108-88-3	7.00E-04	2.30E-01	n		no
Semi-Volatile Organic Compounds						
2,6-Dinitrotoluene	606-20-2	3.90E-04	3.70E-03	n		no
Dioxin/Furan Compounds						
1,2,3,4,6,7,8-HpCDD	35822-46-9	4.79E-08	5.20E-08	c	Total HpCDD	no
1,2,3,4,6,7,8-HpCDF	67562-39-4	3.08E-08	5.20E-08	c	Total HpCDF	no
1,2,3,4,7,8,9-HpCDF	55673-89-7	4.12E-09	5.20E-08	c	Total HpCDF	no
1,2,3,4,7,8-HxCDD	39227-28-6	5.75E-09	5.20E-09	c	Total HxCDD	**YES**
1,2,3,4,7,8-HxCDF	70648-26-9	8.02E-09	5.20E-09	c	Total HxCDF	**YES**
1,2,3,6,7,8-HxCDD	57653-85-7	5.13E-09	5.20E-09	c	Total HxCDD	no
1,2,3,6,7,8-HxCDF	57117-44-9	6.25E-09	5.20E-09	c	Total HxCDF	**YES**
1,2,3,7,8,9-HxCDD	19408-74-3	5.54E-09	5.20E-09	c	Total HxCDD	**YES**
1,2,3,7,8,9-HxCDF	72918-21-9	6.23E-09	5.20E-09	c	Total HxCDF	**YES**
1,2,3,7,8-PeCDD	40321-76-4	7.77E-09	5.20E-10	c	Total PeCDD	**YES**
1,2,3,7,8-PeCDF	57117-41-6	1.90E-08	1.70E-08	c		**YES**
2,3,4,6,7,8-HxCDF	60851-34-5	4.19E-09	5.20E-09	c	Total HxCDF	no
2,3,4,7,8-PeCDF	57117-31-4	1.58E-08	1.70E-09	c		**YES**
2,3,7,8-TCDD	1746-01-6	4.25E-09	5.20E-10	c*		**YES**
2,3,7,8-TCDF	51207-31-9	1.21E-08	5.20E-09	c		**YES**
OCDD	3268-87-9	3.95E-07	1.70E-06	c		no
OCDF	39001-02-0	9.26E-08	1.70E-06	c		no
Explosives						
Nitrobenzene	98-95-3	5.10E-04	1.20E-04	n		**YES**
o-Nitrotoluene	88-72-2	2.93E-04	3.10E-04	c		no
Pentaerythritol Tetranitrate	78-11-5	1.39E-03	NA			**YES**
Perchlorate	14797-73-0	2.00E-04	2.60E-03	n		no
Tetryl	479-45-8	4.50E-04	1.50E-02	n		no
Polycyclic Aromatic Hydrocarbons						
Anthracene	120-12-7	2.10E-05	1.10E+00	n		no
Fluoranthene	206-44-0	1.90E-05	1.50E-01	n		no
Naphthalene	91-20-3	4.40E-05	1.40E-04	c*		no
Phenanthrene	85-01-8	3.80E-05	1.10E+00	n	Anthracene	no
Pyrene	129-00-0	1.90E-05	1.10E-01	n		no
Inorganics Unfiltered						
Aluminum	7429-90-5	7.20E-02	3.70E+00	n		no
Arsenic	7440-38-2	1.83E-03	4.50E-05	c		**YES**
Barium	7440-39-3	2.00E-01	7.30E-01	n		no
Cadmium	7440-43-9	5.74E-04	1.80E-03	n		no
Calcium	7440-70-2	1.03E+02	NA			no
Chromium [d]	7440-47-3	2.20E-03	5.50E+00	n		no
Cobalt	7440-48-4	2.55E-03	1.10E-03	n		**YES**
Iron	7439-89-6	5.39E-01	2.60E+00	n		no
Magnesium	7439-95-4	4.31E+01	NA			no
Manganese	7439-96-5	2.85E-02	8.80E-02	n		no
Nickel	7440-02-0	3.38E-02	7.30E-02	n		no
Potassium	7440-09-7	5.22E+00	NA			no
Sodium	7440-23-5	5.85E+01	NA			no
Zinc	7440-66-6	7.10E-03	1.10E+00	n		no

Notes:
CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
mg/L = Milligrams per liter.
NA = Not available or not applicable.
RSL = Regional Screening Level.
USEPA = United States Environmental Protection Agency.

[a] Maximum concentrations in groundwater.
[b] The screening levels used were risk screening levels for tap water from USEPA (2008a). Screening levels based on non-cancer effects were adjusted by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = Concentration may exceed ceiling limit;
Some RSL values were based on surrogates as identified next to each value.
[c] Constituents detected with maximum concentrations greater than screening levels were considered COPCs unless they were known laboratory contaminants or essential nutrients.
[d] Chromium (III) (Insoluble Salts) was used for the tap-water RSL value.

Table 10-6
Groundwater Exposure Point Concentrations
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

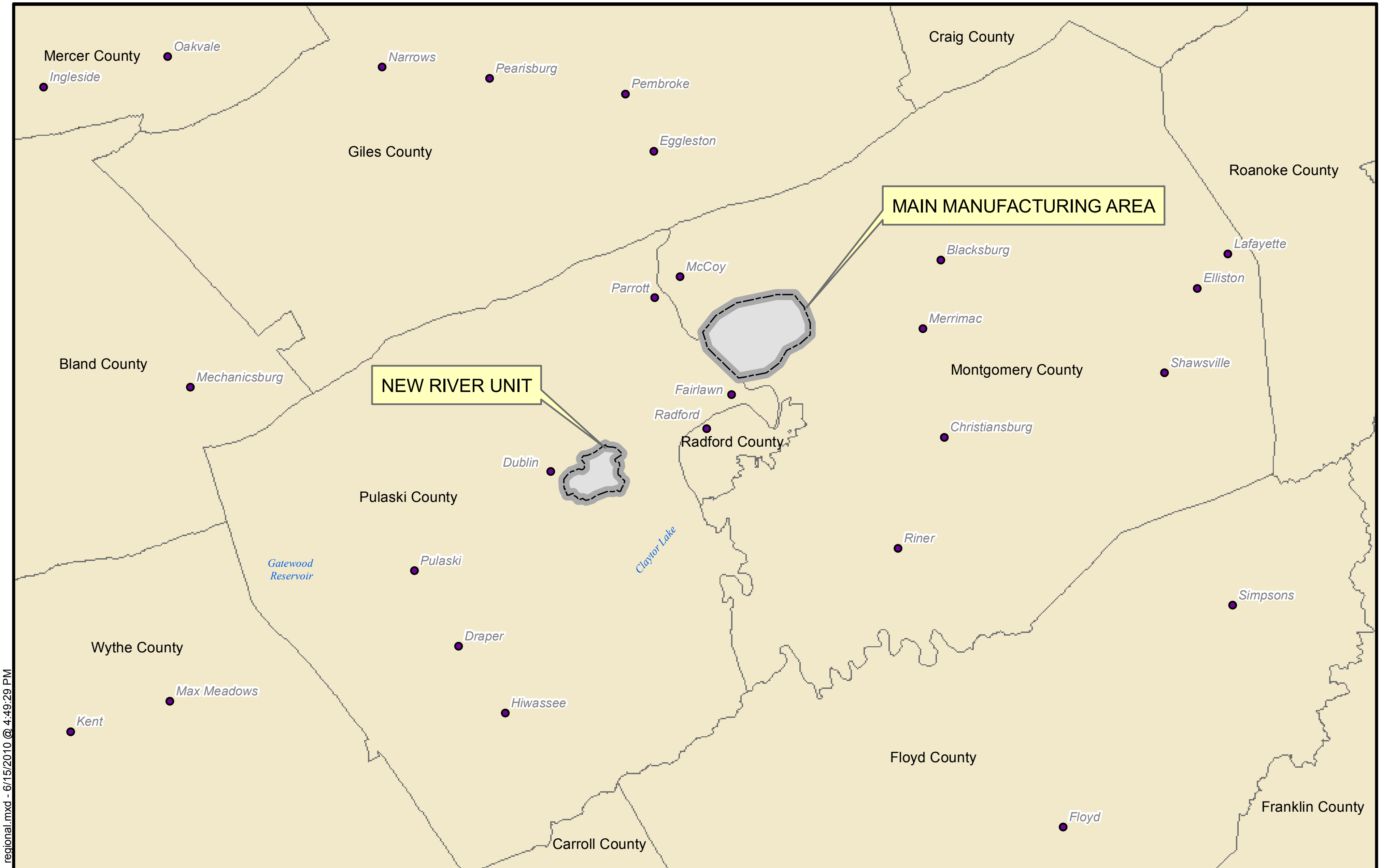
Constituent of Potential Concern (COPC)	CASN	Is Constuituent a Chemical of Potential Concern (COPC)?	Exposure Point Concentration (EPC) [a] (mg/L)
Volatile Organic Compounds			
Acetone	67-64-1	no	–
Carbon Disulfide	75-15-0	no	–
Chloroform	67-66-3	**YES**	1.20E-03 m
Chloromethane	74-87-3	no	–
Methyl tert-butyl ether	1634-4-4	no	–
Toluene	108-88-3	no	–
2,6-Dinitrotoluene	606-20-2	no	–
Dioxin/Furan Compounds			
1,2,3,4,6,7,8-HpCDD	35822-46-9	no	–
1,2,3,4,6,7,8-HpCDF	67562-39-4	no	–
1,2,3,4,7,8,9-HpCDF	55673-89-7	no	–
1,2,3,4,7,8-HxCDD	39227-28-6	**YES**	5.75E-09 m
1,2,3,4,7,8-HxCDF	70648-26-9	**YES**	5.35E-09
1,2,3,6,7,8-HxCDD	57653-85-7	no	–
1,2,3,6,7,8-HxCDF	57117-44-9	**YES**	3.49E-09
1,2,3,7,8,9-HxCDD	19408-74-3	**YES**	5.54E-09 m
1,2,3,7,8,9-HxCDF	72918-21-9	**YES**	6.23E-09 m
1,2,3,7,8-PeCDD	40321-76-4	**YES**	7.77E-09 m
1,2,3,7,8-PeCDF	57117-41-6	**YES**	9.34E-09
2,3,4,6,7,8-HxCDF	60851-34-5	no	–
2,3,4,7,8-PeCDF	57117-31-4	**YES**	7.36E-09
2,3,7,8-TCDD	1746-01-6	**YES**	4.25E-09 m
2,3,7,8-TCDF	51207-31-9	**YES**	1.21E-08 m
OCDD	3268-87-9	no	–
OCDF	39001-02-0	no	–
Explosives			
Nitrobenzene	98-95-3	**YES**	5.10E-04 m
o-Nitrotoluene	88-72-2	no	–
Pentaerythritol Tetranitrate	78-11-5	**YES**	1.39E-03 m
Perchlorate	14797-73-0	no	–
Tetryl	479-45-8	no	–
Polycyclic Aromatic Hydrocarbons			
Anthracene	120-12-7	no	–
Fluoranthene	206-44-0	no	–
Naphthalene	91-20-3	no	–
Phenanthrene	85-01-8	no	–
Pyrene	129-00-0	no	–
Inorganics Unfiltered			
Aluminum	7429-90-5	no	–
Arsenic	7440-38-2	**YES**	1.83E-03 m
Barium	7440-39-3	no	–
Cadmium	7440-43-9	no	–
Calcium	7440-70-2	no	–
Chromium	7440-47-3	no	–
Cobalt	7440-48-4	**YES**	2.55E-03 m
Iron	7439-89-6	no	–
Magnesium	7439-95-4	no	–
Manganese	7439-96-5	no	–
Nickel	7440-02-0	no	–
Potassium	7440-09-7	no	–
Sodium	7440-23-5	no	–
Zinc	7440-66-6	no	–

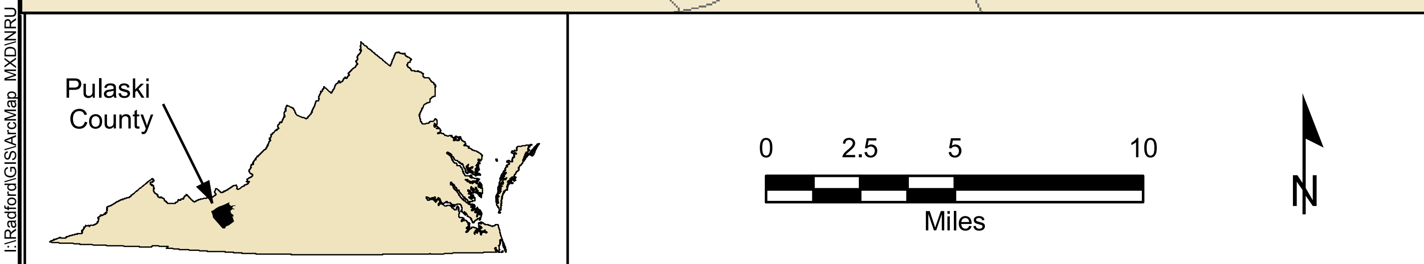
Notes:
mg/L = Milligrams per liter.

[a] The exposure point concentration (EPC) was the upper confidence level on the mean (UCL) or the maximum concentration where the UCL was incalculable.
EPCs marked with "m" are based on the maximum detected concentration.
The UCLs were calculated using ProUCL 4.2. The UCL used is the one recommended by ProUCL 4.2.

Table 10-7
Summary of Calculated Risks and Hazards, New River Unit, Radford Army Ammunition Plant, Radford, Virginia
SITEWIDE GROUNDWATER EVALUATION
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

RECEPTOR / Exposure Medium - Scenario	Total Excess Lifetime Cancer Risk	Total Non-Cancer Hazard
Using filtered data for inorganic COPCs		
Hypothetical Future Adult Resident		
Groundwater - Potable Use	1E-04	0.6
Hypothetical Future Child Resident		
Groundwater - Potable Use	8E-05	1
Site Worker		
Groundwater - Potable Use	4E-05	0.4





RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

RFAAP - NRU
FACILITY LOCATION

ARCADIS

FIGURE
1-1

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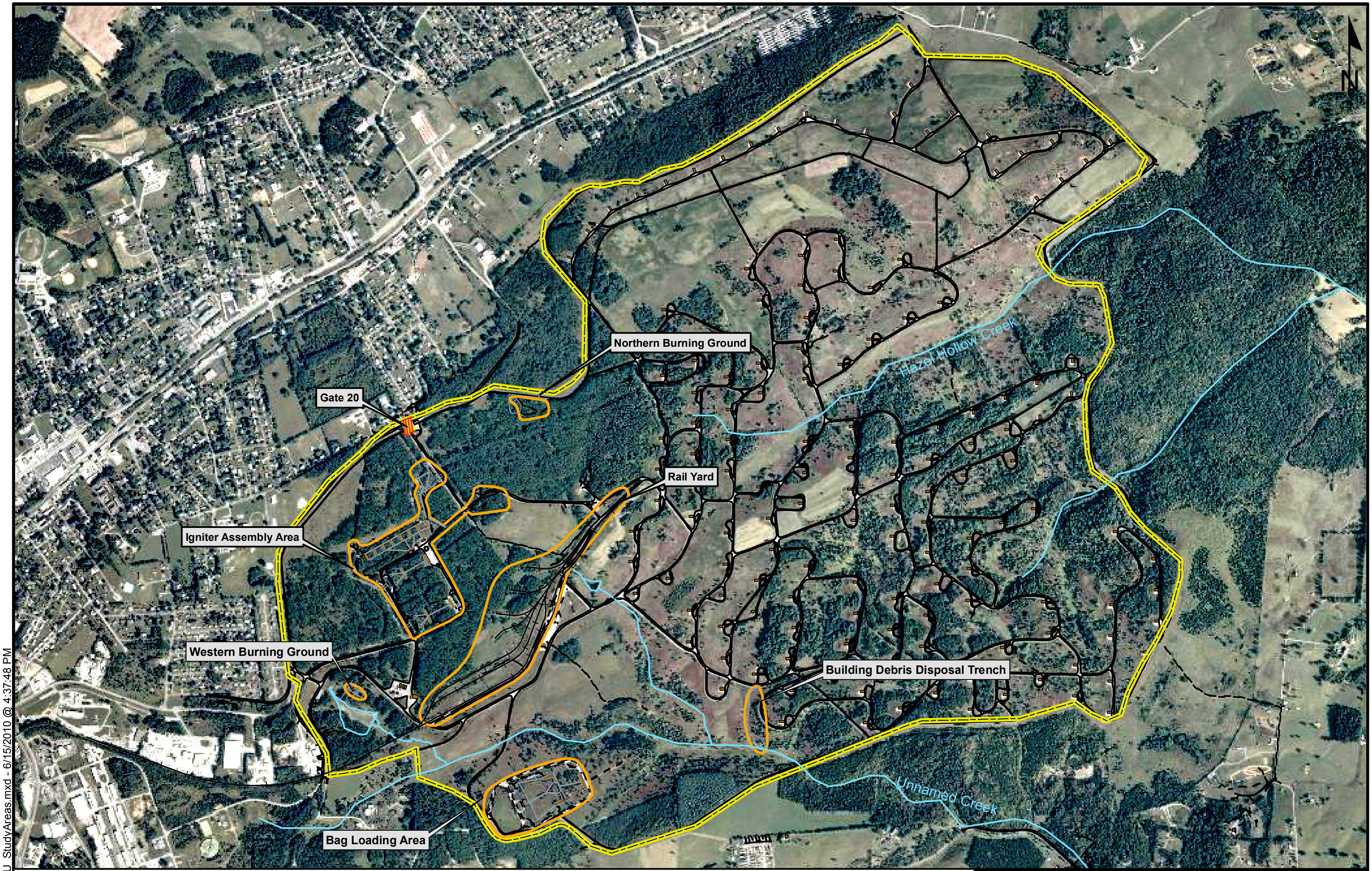

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LEGEND

- SITE FEATURES
- RAIL SPUR
- SURFACE WATER
- PAVED ROADS
- DIRT ROADS
- STUDY AREA
- NRU BOUNDARY
- BUILDINGS

NOTES:

1. GIS SPATIAL LAYERS OBTAINED FROM SHAW ENVIRONMENTAL, INC. AS REFERENCED IN THEIR REPORT TITLED NRU ADDITIOANL CHARACTERIZATION SAMPLING & GROUNDWATER INVESTIGATION DATA REPORT IN OCTOBER 2007.

0 900 1,800 Feet

GRAPHIC SCALE

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

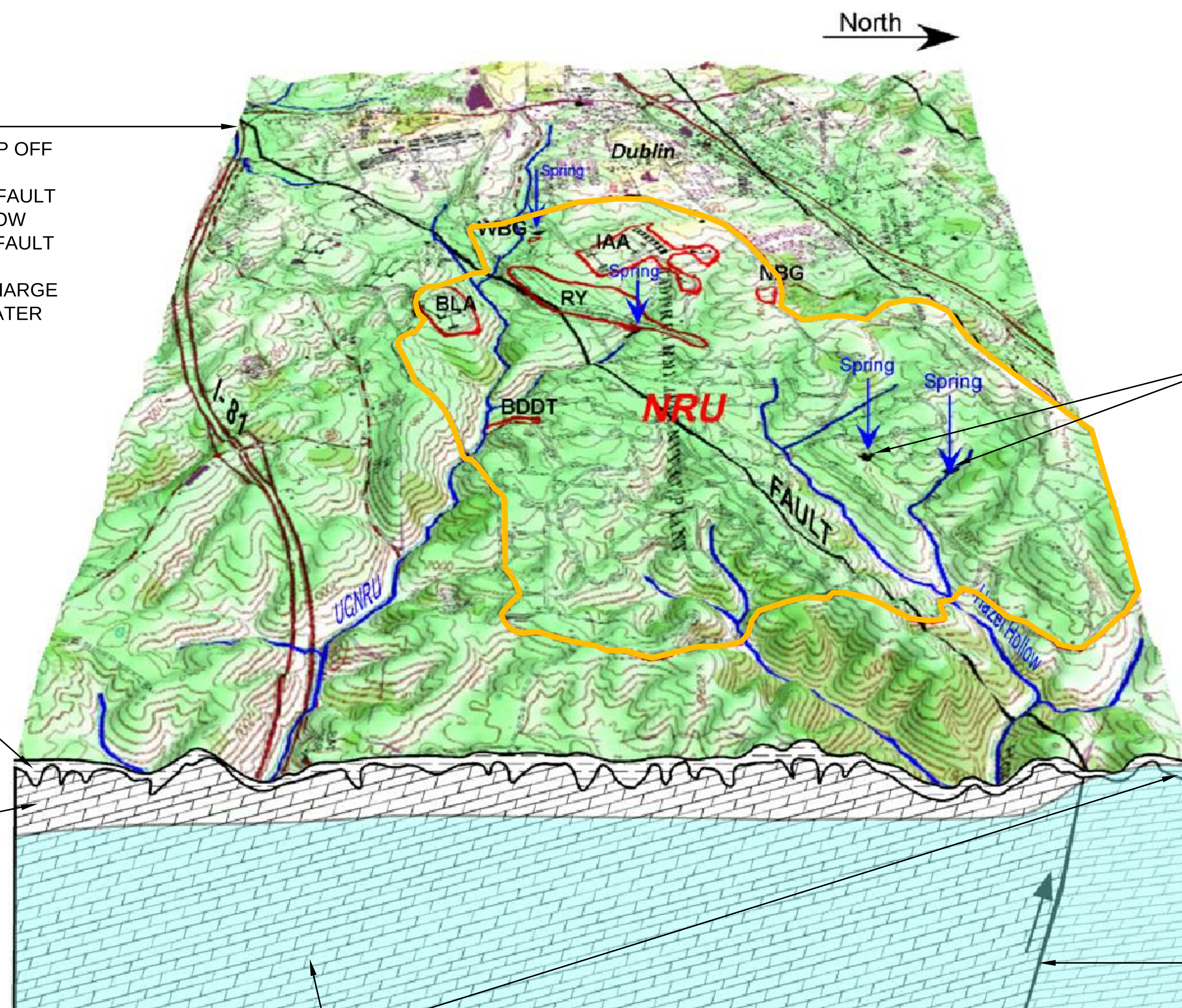
RFAAP - NRU
STUDY AREAS

ARCADIS

FIGURE
1-2

FAULT
- GROUNDWATER ELEVATIONS DROP OFF ON SOUTH SIDE OF FAULT
- FAULT RESTRICTS FLOW ACROSS FAULT SCARP AND CONFINES THE SHALLOW FLOW SYSTEM IN THE NORTHERN FAULT BLOCK
- EXPLAINS LINE OF SPRINGS/ DISCHARGE POINTS FOR SHALLOW GROUNDWATER SYSTEM

GENERAL NOTES
- HUMMOCKY TERRAIN
- LOW PERMEABILITY RESIDUUM INHIBITS DIFFUSE GROUNDWATER RECHARGE
- GROUNDWATER RECHARGE CONCENTRATED IN SINKHOLES



SPRINGS
- DISCHARGE POINTS FOR SHALLOW GROUNDWATER SYSTEM IN BEDROCK

OVERBURDEN/RESIDUUM
- DOMINANTLY CLAY AND SILT
- RANGES IN THICKNESS ACROSS FACILITY
  - 0 FT THICK IN MANY PLACES
  - < 5 FT THICK AT THE BDDT
  - > 55 FT THICK AT THE NBG

TOP OF BEDROCK
- PINNACLED AND GROOVED
- DEPTH VARIES ACROSS SITE
- UPPER ZONE IS AN EPIKARST

BEDROCK
- CONOCOCHEAGUE FORMATION
- PRINCIPALLY BLUE-GRAY LIMESTONE AND DOLOMITE W/ THIN BEDS OF SANDSTONE, SILTSTONE AND SHALE
- FAULTED, STRUCTURALLY COMPLEX, KARST WEATHERED
- HUNDREDS OF FEET THICK

FAULT

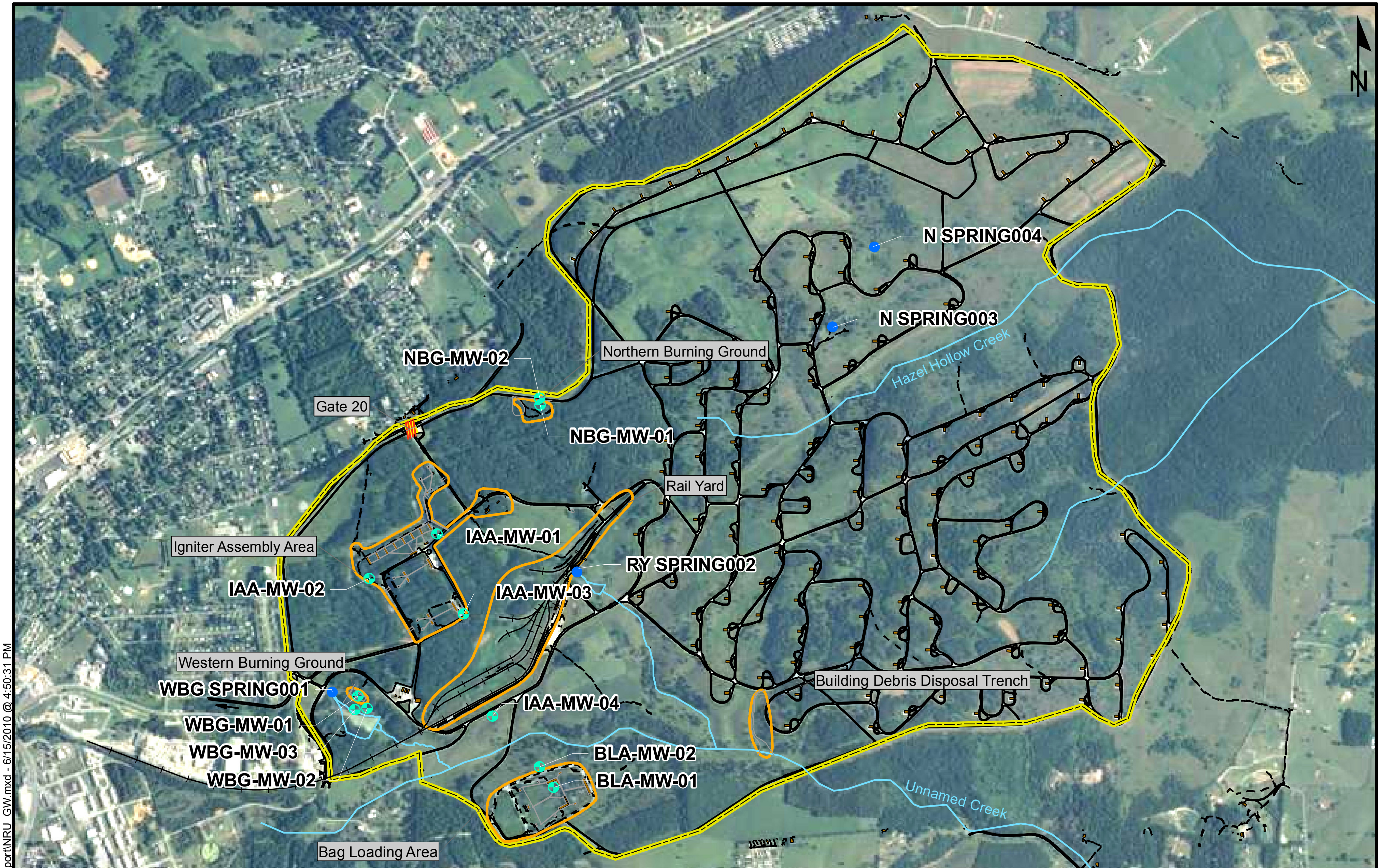
GROUNDWATER
- SATURATION IN OVERBURDEN LOCALIZED IN BEDROCK DEPRESSIONS
- KARST SOLUTION POROSITY DOMINATES FACILITY WIDE GW SYSTEM
- DEPTH TO GROUNDWATER INCREASES ON SOUTH SIDE OF FAULT

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

HYDROGEOLOGIC CONCEPTUAL MODEL

ARCADIS

FIGURE
3-1



LEGEND

- SPRINGS
- MONITORING WELLS
- SITE FEATURES
- RAIL SPUR
- SURFACE WATER
- PAVED ROADS
- DIRT ROADS
- STUDY AREA
- INSTALLATION BOUNDARY
- BUILDINGS

NOTES:

1. GIS SPATIAL LAYERS OBTAINED FROM SHAW ENVIRONMENTAL, INC. AS REFERENCED IN THEIR REPORT TITLED NRU ADDITIOANL CHARACTERIZATION SAMPLING & GROUNDWATER INVESTIGATION DATA REPORT IN OCTOBER 2007.

0 900 1,800 Feet

GRAPHIC SCALE

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

GROUNDWATER MONITORING WELL AND SPRING SAMPLE LOCATIONS

ARCADIS

FIGURE
3-2

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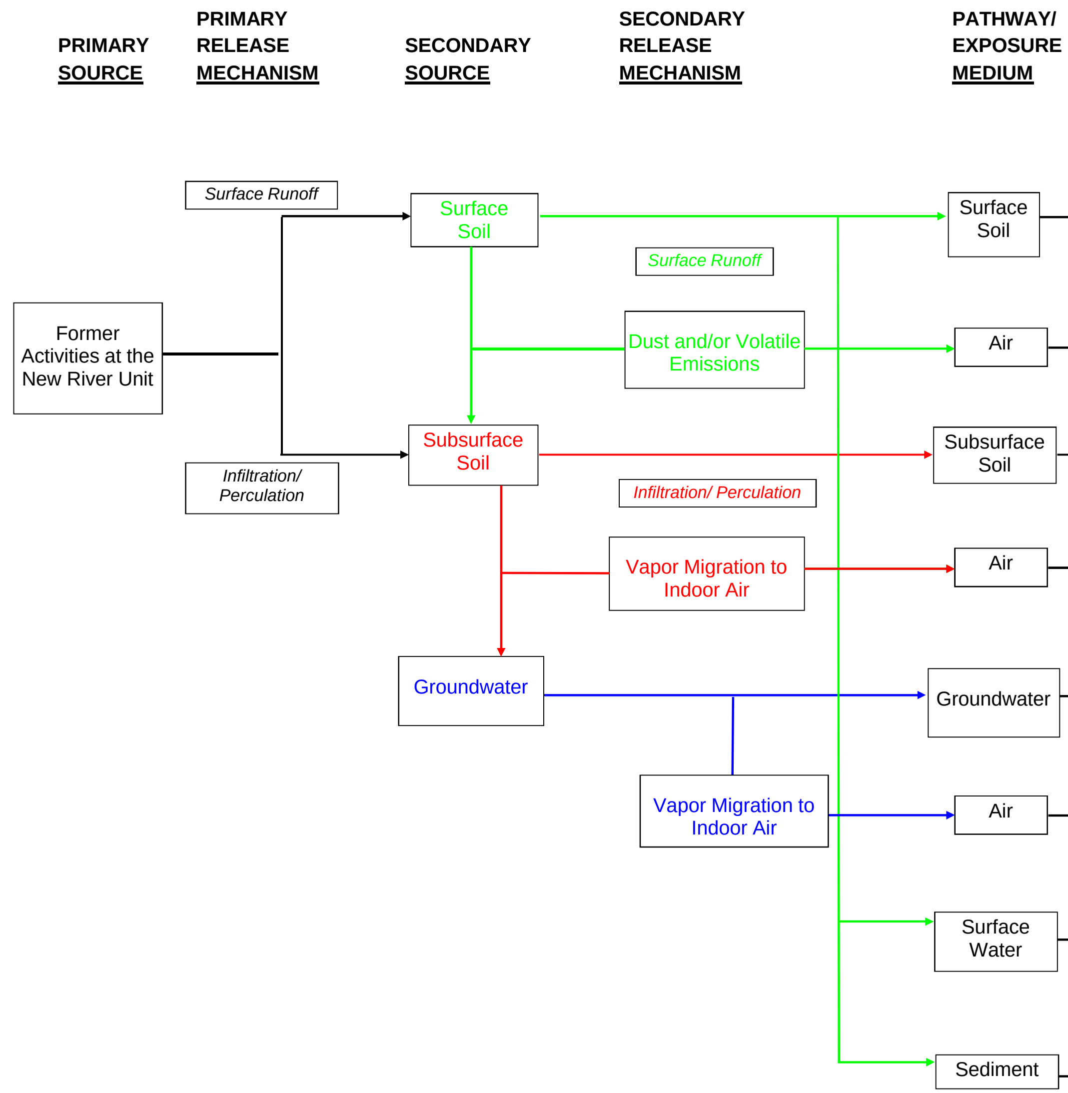


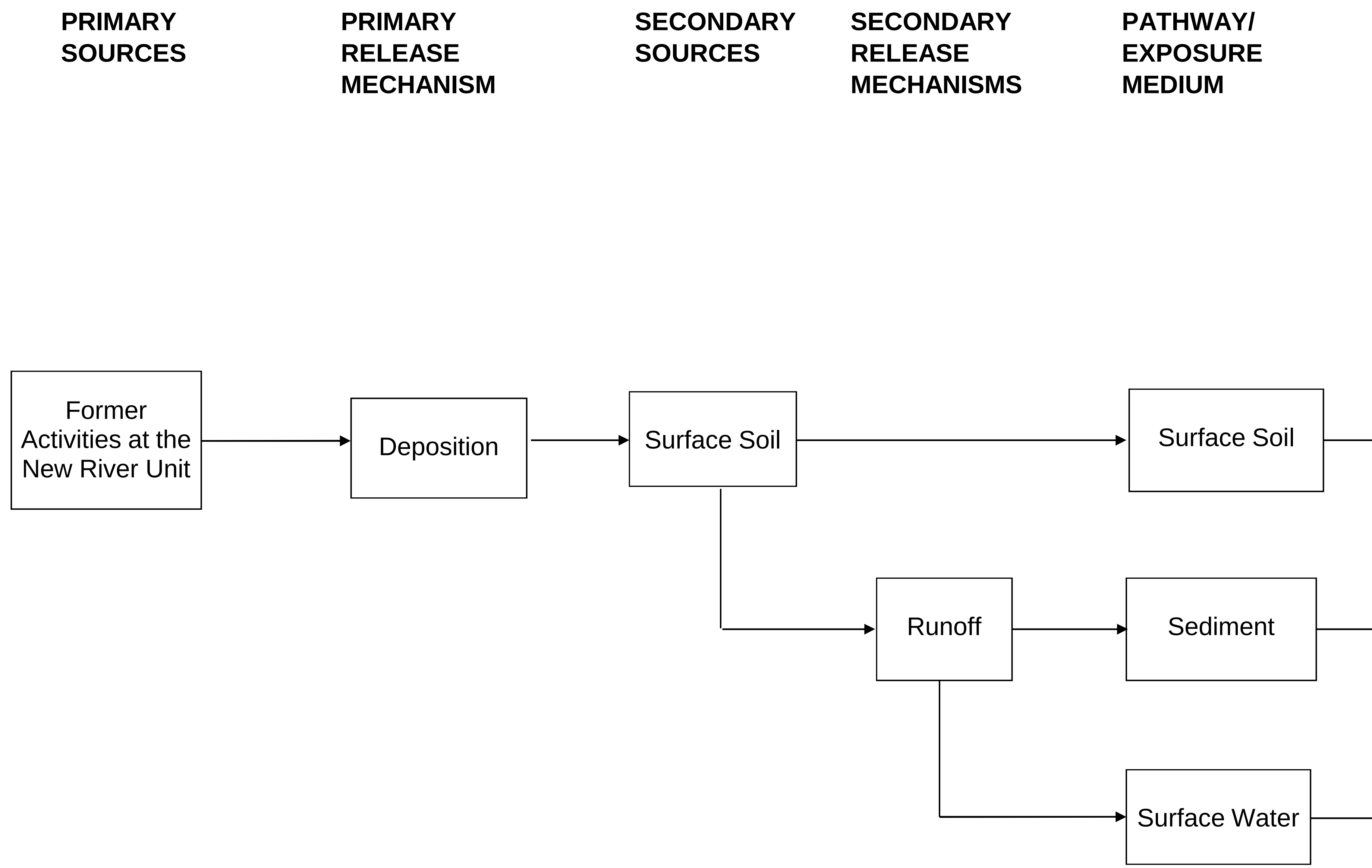
		Current		Future		
Pathway/Exposure Medium	EXPOSURE ROUTE	Site Worker	Trespasser	Construction Worke	Adult Resident	Child Resident
Surface Soil	Ingestion	x	x	NA	x	x
	Dermal	x	x	NA	x	x
	Inhalation	x	x	NA	x	x
Air	Inhalation	x	x	x	x	x
Subsurface Soil	Ingestion	NA	NA	x	x	x
	Dermal	NA	NA	x	x	x
	Inhalation	NA	NA	x	x	x
Air	Inhalation	x	NA	x	x	x
Groundwater	Ingestion	NA	NA	NA	x	x
	Dermal	NA	NA	NA	x	x
	Inhalation	NA	NA	NA	x	x
Air	Inhalation	NA	NA	NA	x	x
Surface Water	Ingestion	x	x	NA	x	x
	Dermal	x	x	NA	x	x
	Inhalation	x	x	NA	x	x
	Fish Ingestion	NA	x	NA	x	x
Sediment	Ingestion	x	x	NA	x	x
	Dermal	x	x	NA	x	x

NA Pathway not applicable.
x Potential pathway.

ARCADIS

Conceptual Site Model for Potential Human Health Receptors
New River Unit
Radford Army Ammunition Plant
RADFORD, VIRGINIA

Figure 3-3



RECEPTORS

EXPOSURE ROUTE

Pathway/Exposure Medium	Exposure Route	Terrestrial Wildlife	Terrestrial Plants	Benthic or Aquatic Organisms
Surface Soil	Ingestion	x	NA	NA
	Direct Contact	x	x	NA
	Food Web	x	NA	NA
	Uptake	NA	x	NA
Sediment	Ingestion	x	NA	x
	Direct Contact	x	NA	x
	Food Web	x	NA	x
	Uptake	NA	NA	x
Surface Water	Ingestion	x	NA	x
	Direct Contact	x	NA	x
	Food Web	x	NA	x
	Uptake	NA	NA	x

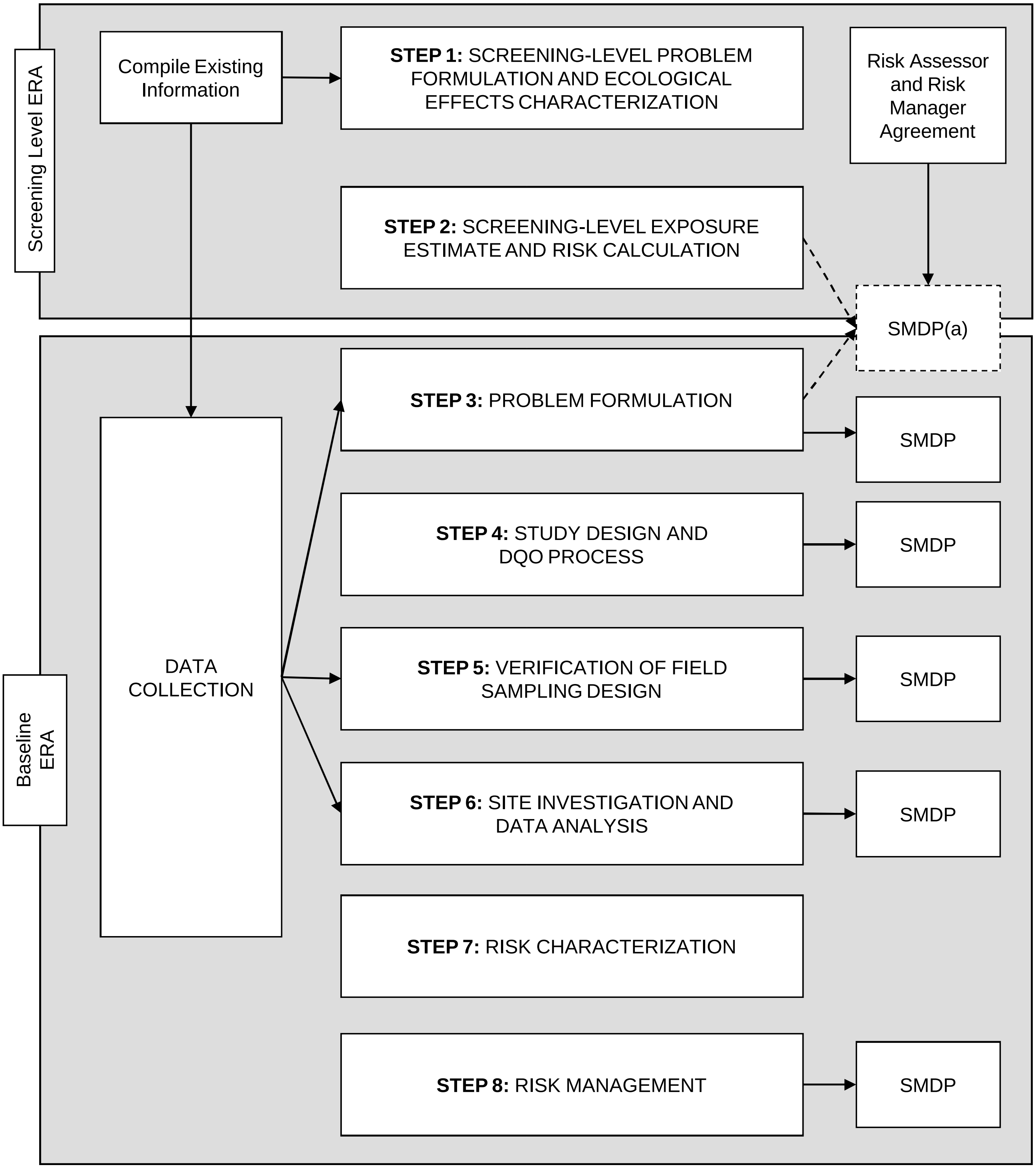
NA Pathway not applicable.
x Potential pathway.

ARCADIS

Conceptual Site Model for Potential Ecological Receptors
New River Unit
Radford Army Ammunition Plant
RADFORD, VIRGINIA

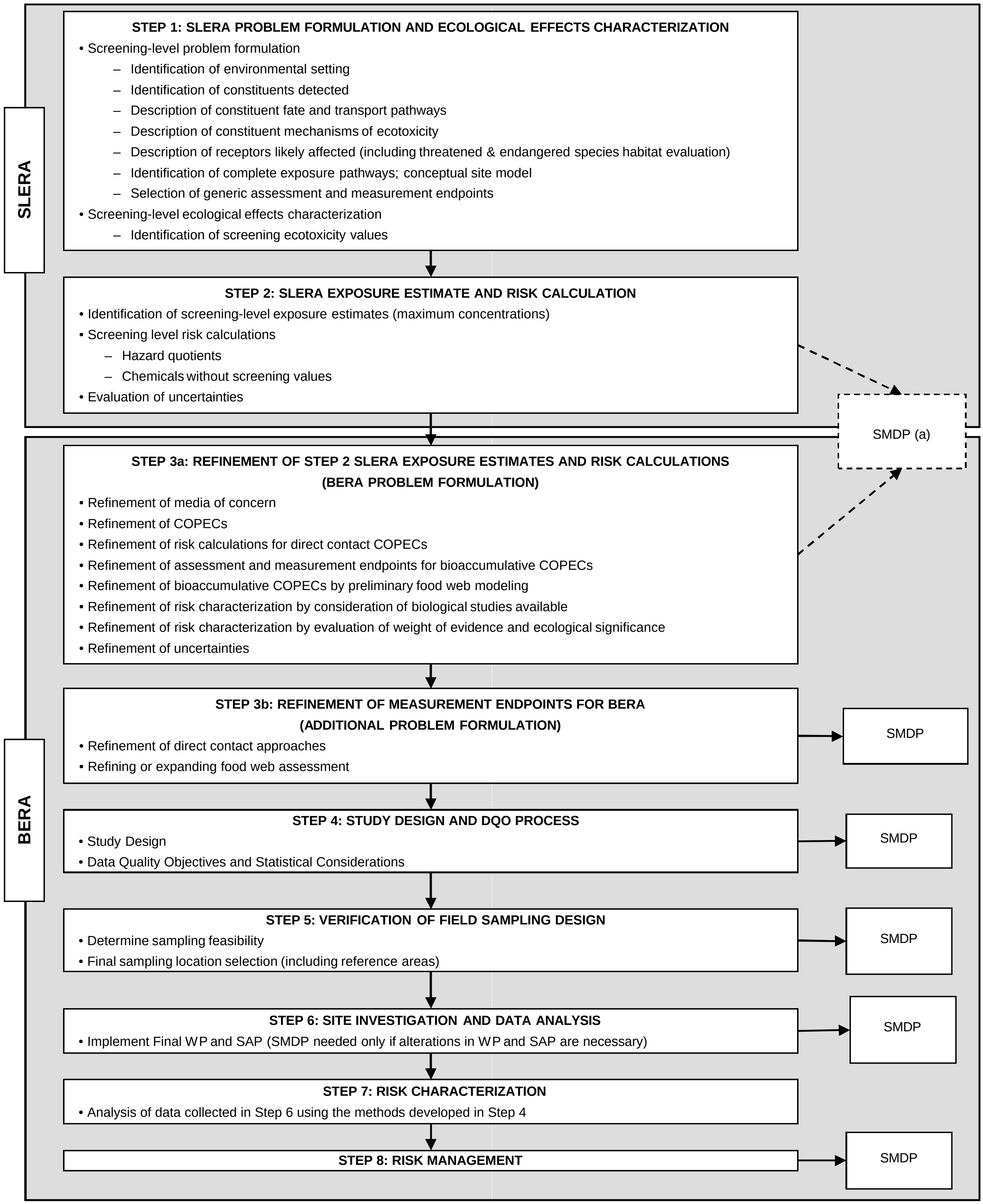
Figure 3-4

Figure 4-1
Eight-Step Ecological Risk Assessment Process



Notes:
(a) SMDP occurs EITHER after Step 2 or after Step 3a
ERA Ecological Risk Assessment
SMDP Scientific Management Decision Point
Source Adapted from USEPA 2000a

Figure 4-2
Expanded Eight-Step Ecological Risk Assessment Process

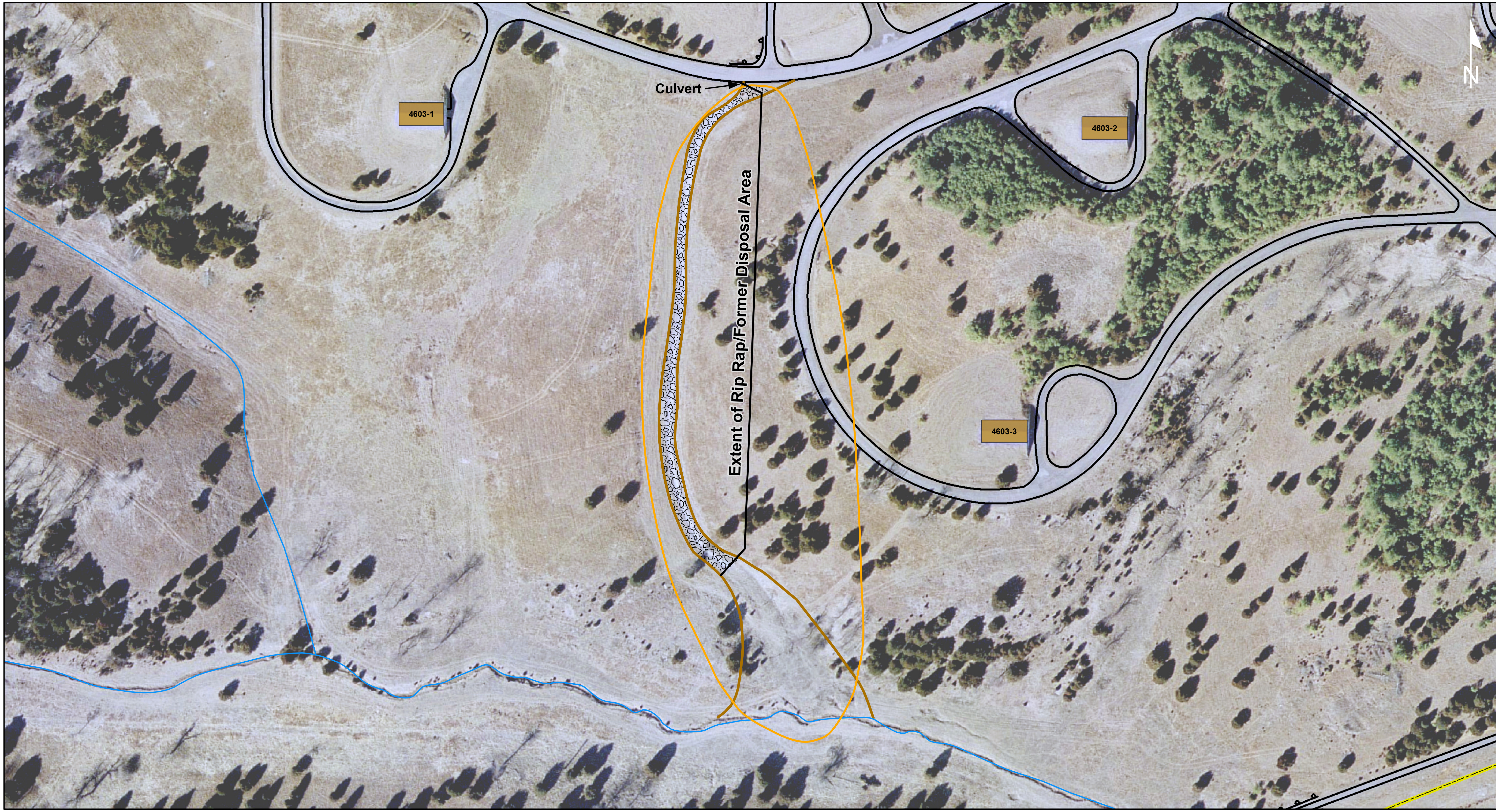


Notes:

(a) SMDP occurs EITHER after Step 2 or after Step 3a
COPECs Constituents of Potential Ecological Concern
DQO Data Quality Objectives
GW Groundwater
SAP Sampling and Analysis Plan

SMDP Scientific Management Decision Point
WP Work Plan
BERA Baseline ERA
SLERA Screening-level ERA

Source: Adapted from USEPA 1997 and 2000a



LEGEND

- SITE FEATURES
- SURFACE WATER
- TRENCH
- PAVED ROADS
- DIRT ROADS
- RIPRAP
- STUDY AREA
- BUILDINGS
- INSTALLATION BOUNDARY

0 150 300 Feet

GRAPHIC SCALE

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

BUILDING DEBRIS DISPOSAL TRENCH SITE LAYOUT

ARCADIS

FIGURE **5-1**

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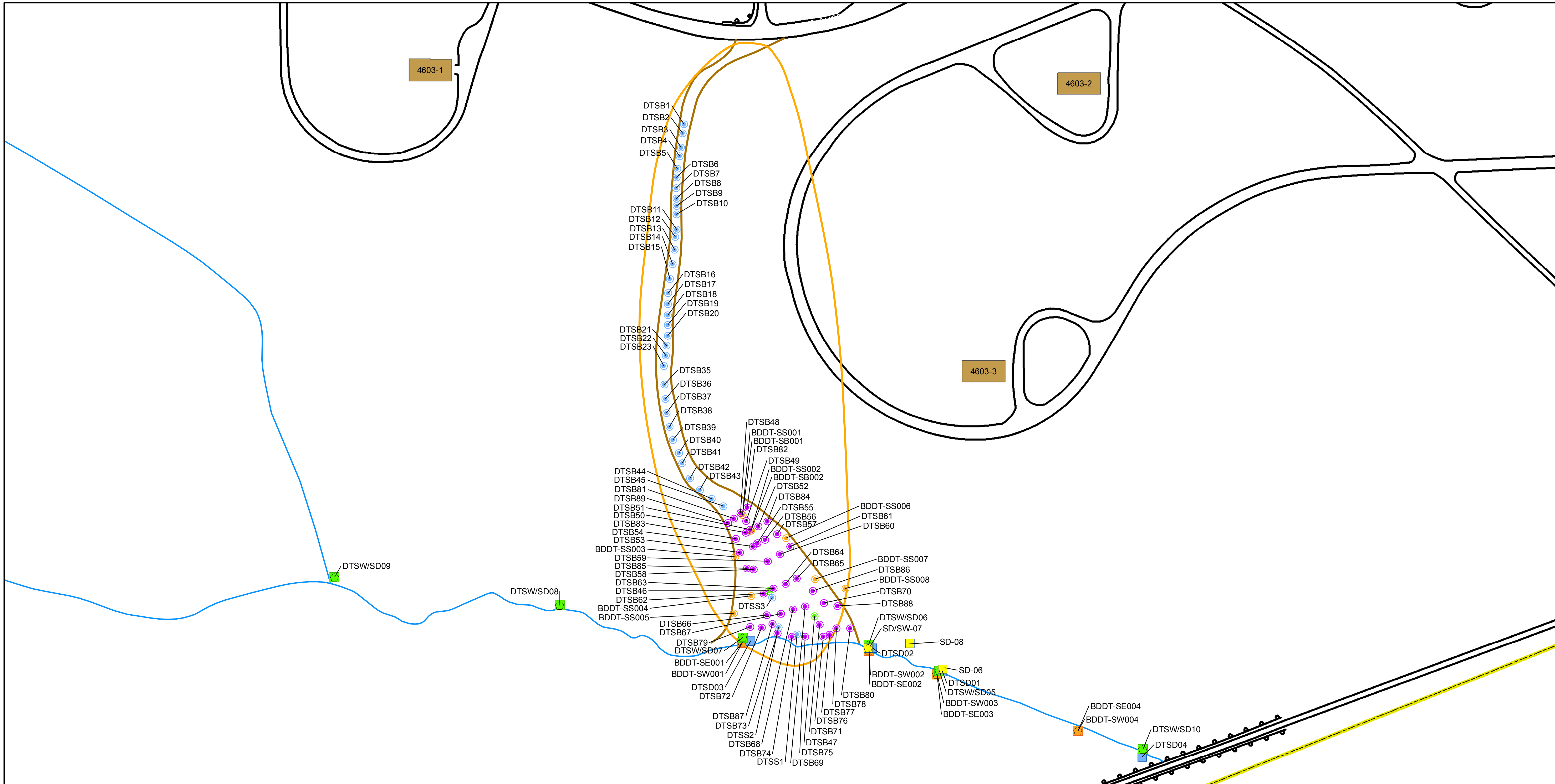

NOTE:
The following samples were not located:
Soil/Creosote 1997 Soil Sample (ATK)

LEGEND

- 1998 SEDIMENT SAMPLE (GANNET FLEMING)
- 1998 SURFACE WATER SAMPLE (GANNET FLEMING)
- 1998 SOIL SAMPLE (ICF KE)
- 1998 SEDIMENT SAMPLE (ICF KE)
- 1998 SURFACE WATER SAMPLE (ICF KE)
- 2002 SOIL SAMPLE (SHAW)
- 2002 SEDIMENT SAMPLE (SHAW)
- 2002 SURFACE WATER SAMPLE (SHAW)
- 2004 SOIL SAMPLE (SHAW)
- 2008 SOIL SAMPLE (ARCADIS)
- 2008 SEDIMENT SAMPLE (ARCADIS)
- 2008 SURFACE WATER SAMPLE (ARCADIS)
- BUILDINGS
- STUDY AREA
- INSTALLATION BOUNDARY
- PAVED ROADS
- DIRT ROADS
- SITE FEATURES
- SURFACE WATER
- TRENCH

N

0 150 300 Feet

GRAPHIC SCALE

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

BUILDING DEBRIS DISPOSAL TRENCH SAMPLE LOCATIONS

ARCADIS

FIGURE **5-2**

NYC: SER 4/AIT: DB: TBR LD: TBR PIC: TL
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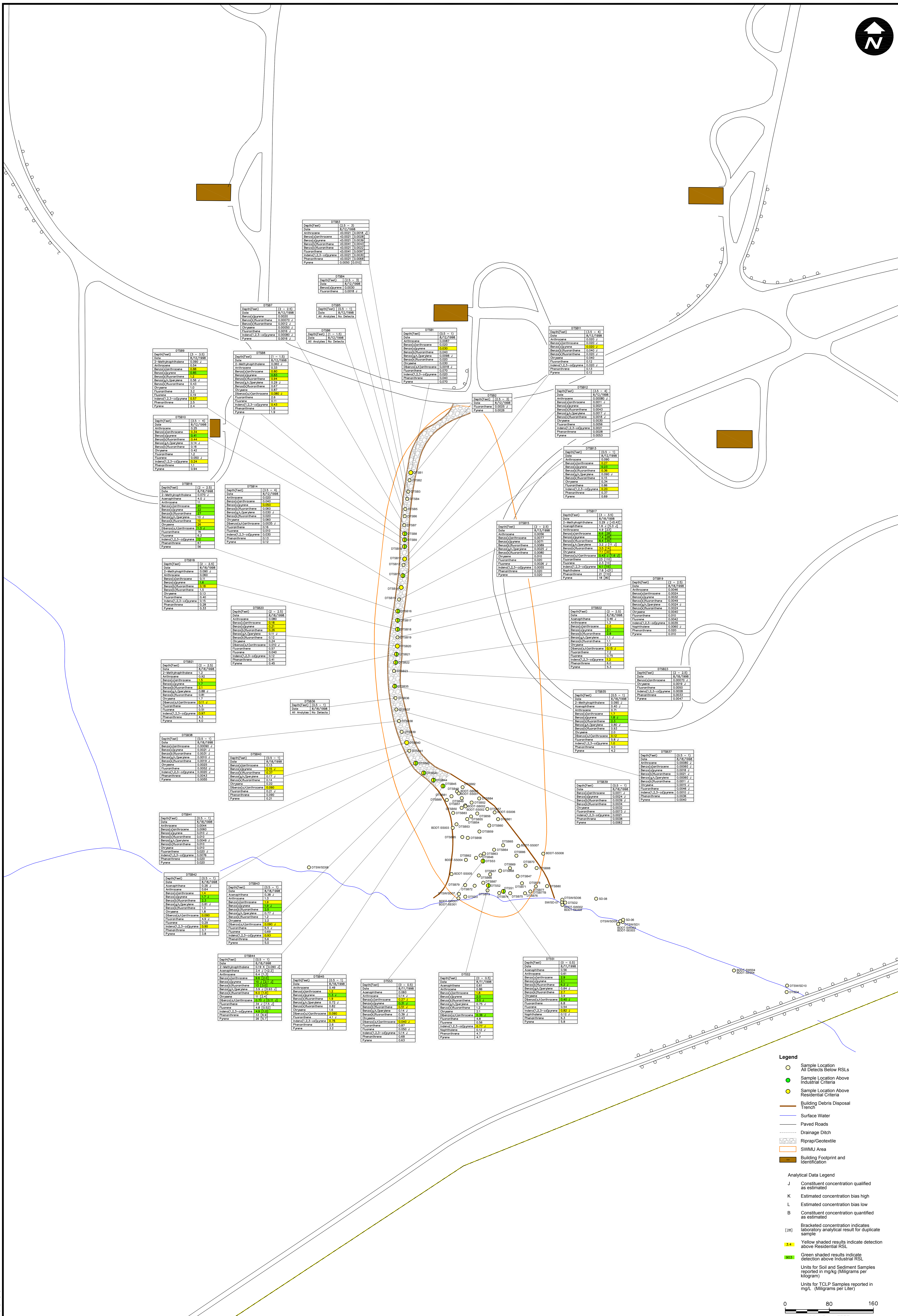

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

1998 PAH DETECTIONS IN SOIL BUILDING DEBRIS DISPOSAL TRENCH

ARCADIS

FIGURE
5-3

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

2002, 2004, AND 2008 PAH DETECTIONS IN SOIL
BUILDING DEBRIS DISPOSAL TRENCH

ARCADIS

FIGURE 5-4

Legend

- Sample Location All Detects Below RSLs
- Sample Location Above Industrial Criteria and Background (Inorganics only)
- Sample Location Above Residential Criteria and Background (Inorganics only)
- Building Debris Disposal Trench
- Surface Water
- Paved Roads
- Drainage Ditch
- Riprap/Geotextile
- SWMU Area
- Building Footprint and Identification

Analytical Data Legend

J	Constituent concentration qualified as estimated
K	Estimated concentration bias high
L	Estimated concentration bias low
B	Constituent concentration quantified as estimated
3.4	Yellow shaded results indicate detection above Residential RSL
903	Green shaded results indicate detection above Industrial RSL
903	Bolded results indicate detection above Background (Inorganics only)
	Units for Soil and Sediment Samples reported in mg/kg (Miligrams per kilogram)
	Units for TCLP Samples reported in mg/L (Miligrams per Liter)

0 80 160
SCALE IN FEET

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

NON-PAH DETECTIONS IN SOIL
BUILDING DEBRIS DISPOSAL TRENCH

ARCADIS

FIGURE
5-5

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

CONSTITUENT DETECTIONS IN SEDIMENT
BUILDING DEBRIS DISPOSAL TRENCH

ARCADIS

FIGURE
5-6

DTSW/SD09	
Date	6/20/2002
PAHs	
2-Methylnaphthalene	0.030 B
Naphthalene	0.040 B
VOCs	
Carbon Disulfide	0.31 B
Inorganics	
Aluminum	603
Barium	77.4
Calcium	48,300
Iron	507 J
Lead	0.480 B
Magnesium	15,900
Manganese	19.8
Potassium	3,360
Sodium	32,200

DTSW/SD08	
Date	6/20/2002
PAHs	
Naphthalene	0.030 B
VOCs	
Carbon Disulfide	0.34 B
Chloroform	0.080 J
Inorganics	
Aluminum	343
Barium	82.5
Calcium	52,500
Iron	328 J
Lead	0.210 B
Magnesium	17,400
Manganese	17.2
Potassium	3,670
Sodium	35,300

DTSW/SD07	
Date	6/20/2002
Organochlorine Pesticides	
Dieldrin	0.00591 J
Endrin Ketone	0.00599 J
PAHs	
Naphthalene	0.030 B
VOCs	
Carbon Disulfide	0.22 B
Chloroform	0.070 J
Inorganics	
Aluminum	120 J
Antimony	0.380 B
Barium	72.6
Calcium	47,000
Iron	203 J
Lead	0.300 B
Magnesium	15,400
Manganese	12.2
Potassium	3,210
Sodium	31,200
Miscellaneous	
Hardness	181,000

BDDT-SW001	
Date	7/28/2008
All Analytes	No Detects

DTSW3		
Date	7/17/1998	8/17/1998
VOCs		
Bromodichloromethane	<1.0	23
Chloroform	<1.0	4.0
Inorganics		
Aluminum	76.7 B	49.8 J
Barium	66.2 B	60.0 L
Calcium	55,100 B	56,000
Copper	30.7 B	12.0 K
Iron	115 B	76.3 J
Magnesium	15,000 B	12,700
Manganese	5.40 B	4.00 J
Nickel	2.70 K	3.40 K
Potassium	2,110 B	2,340 K
Sodium	29,300	22,400 K
Thallium	2.30 B	<2.00 L
Zinc	20.4 B	38.7 K

BDDT-SW-07	
Date	3/31/1998
Inorganics	
Calcium	60,300
Iron	165
Magnesium	14,800
Potassium	2,800
Sodium	32,400

BDDT-SW002	
Date	7/28/2008
All Analytes	No Detects

DTSW2		
Date	7/17/1998	8/17/1998
SVOCs		
Di-n-Butylphthalate	3.0 B	<10
Inorganics		
Aluminum	67.9 B	78.5 J
Barium	60.1 B	66.5 K
Calcium	50,100 B	65,000 J
Copper	19.8 B	27.4 J
Iron	127 B	106
Lead	<2.00	2.30 K
Magnesium	13,600 B	14,600
Manganese	5.30 B	3.60 J
Nickel	2.80 K	5.00 J
Potassium	1,980 B	2,510 K
Sodium	26,900	25,300 K
Thallium	5.70 B	6.10 L
Zinc	21.9 B	34.2 J

DTSW/SD06	
Date	6/20/2002
PAHs	
2-Methylnaphthalene	0.030 B
Naphthalene	0.040 B
VOCs	
Chloroform	0.11 J
Inorganics	
Aluminum	245
Antimony	0.740 B
Barium	75.7
Calcium	52,300
Iron	314 J
Lead	0.340 B
Magnesium	15,900
Manganese	11.5
Potassium	3,050
Sodium	31,100
Miscellaneous	
Hardness	196,000

DTSW/SD05	
Date	6/20/2002
Organochlorine Pesticides	
4,4'-DDT	0.00516 J
Dieldrin	0.00548 J
Endrin Ketone	0.00437 J
PAHs	
2-Methylnaphthalene	0.030 B
Naphthalene	0.040 B
VOCs	
Carbon Disulfide	0.30 B
Chloroform	0.11 J
Inorganics	
Aluminum	340
Barium	77.1
Calcium	54,100
Iron	238 J
Lead	1.10 B
Magnesium	16,200
Manganese	10.8
Potassium	3,250
Sodium	31,500
Miscellaneous	
Hardness	202,000

DTSW1		
Date	7/17/1998	8/17/1998
SVOCs		
Di-n-Butylphthalate	2.0 B	<10
Inorganics		
Aluminum	68.5 B	82.3 J
Barium	60.6 B	64.5 K
Calcium	50,600 B	63,100 J
Copper	18.1 B	34.8 J
Iron	114 B	105
Lead	<2.00	4.60 K
Magnesium	13,700 B	14,100
Manganese	5.60 B	3.40 J
Nickel	2.80 K	5.50 J
Potassium	1,930 B	2,490 K
Silver	2.10 B	<2.00
Sodium	26,900	26,500 K
Zinc	20.2 B	46.2 J

BDDT-SW003	
Date	7/28/2008
All Analytes	No Detects

BDDT-SW004	
Date	7/28/2008
All Analytes	No Detects

DTSW/SD10	
Date	6/20/2002
PAHs	
2-Methylnaphthalene	0.13 B
Acenaphthene	0.050
Acenaphthylene	0.040 J
Fluorene	0.030 J
Naphthalene	0.13 B
VOCs	
Carbon Disulfide	0.29 B
Chloroform	0.090 J
Inorganics	
Aluminum	300
Barium	77.6
Calcium	54,900
Iron	294 J
Lead	0.150 B
Magnesium	16,100
Manganese	10.8
Potassium	3,160
Sodium	31,200
Miscellaneous	
Hardness	204,000

DTSW4	
Date	8/17/1998
Inorganics	
Aluminum	67.4 J
Barium	61.0 K
Calcium	59,900 J
Copper	16.7 J
Iron	87.6 J
Magnesium	13,200
Manganese	3.40 J
Nickel	3.20 J
Potassium	2,260 K
Sodium	25,600 K
Thallium	7.20 L
Zinc	21.6 J

Legend

- Sample Location All Detects Below RSLs
- Sample Location Above Industrial Criteria and Background (Inorganics only)
- Sample Location Above Residential Criteria and Background (Inorganics only)
- Building Debris Disposal Trench
- Surface Water
- Paved Roads
- Drainage Ditch
- Riprap/Geotextile
- SWMU Area
- Building Footprint and Identification

Analytical Data Legend

- J Constituent concentration qualified as estimated
- K Estimated concentration bias high
- L Estimated concentration bias low
- B Constituent concentration quantified as estimated
- 3.4 Yellow shaded results indicate detection above Residential RSL
- 903 Green shaded results indicate detection above Industrial RSL
- **903** Bolded results indicate detection above Background (Inorganics only)
- Units for Soil and Sediment Samples reported in mg/kg (Miligrams per kilogram)
- Units for TCLP Samples reported in mg/L (Miligrams per Liter)

0 80 160

SCALE IN FEET

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

CONSTITUENT DETECTIONS IN SURFACE WATER BUILDING DEBRIS DISPOSAL TRENCH

ARCADIS

FIGURE 5-7

Legend

- PAVED ROADS
- DIRT ROADS
- SITE FEATURES
- SURFACE WATER
- FORMER RAISED WALKWAY PLATFORMS
- STUDY AREA
- INSTALLATION BOUNDARY

BUILDINGS

- NO CONDUCTIVE FLOORING
- YES CONDUCTIVE FLOORING

NOTE:
BUILDINGS 404 AND 405 ARE TWO STORY BUILDINGS

0 200 400 Feet

GRAPHIC SCALE

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

BAG LOADING AREA SITE LAYOUT

ARCADIS

FIGURE
6-1

NYC: SER 4/AIT: DB: TBR LD: TBR PIC: TL
Radford (GP08RAAP.00PM)
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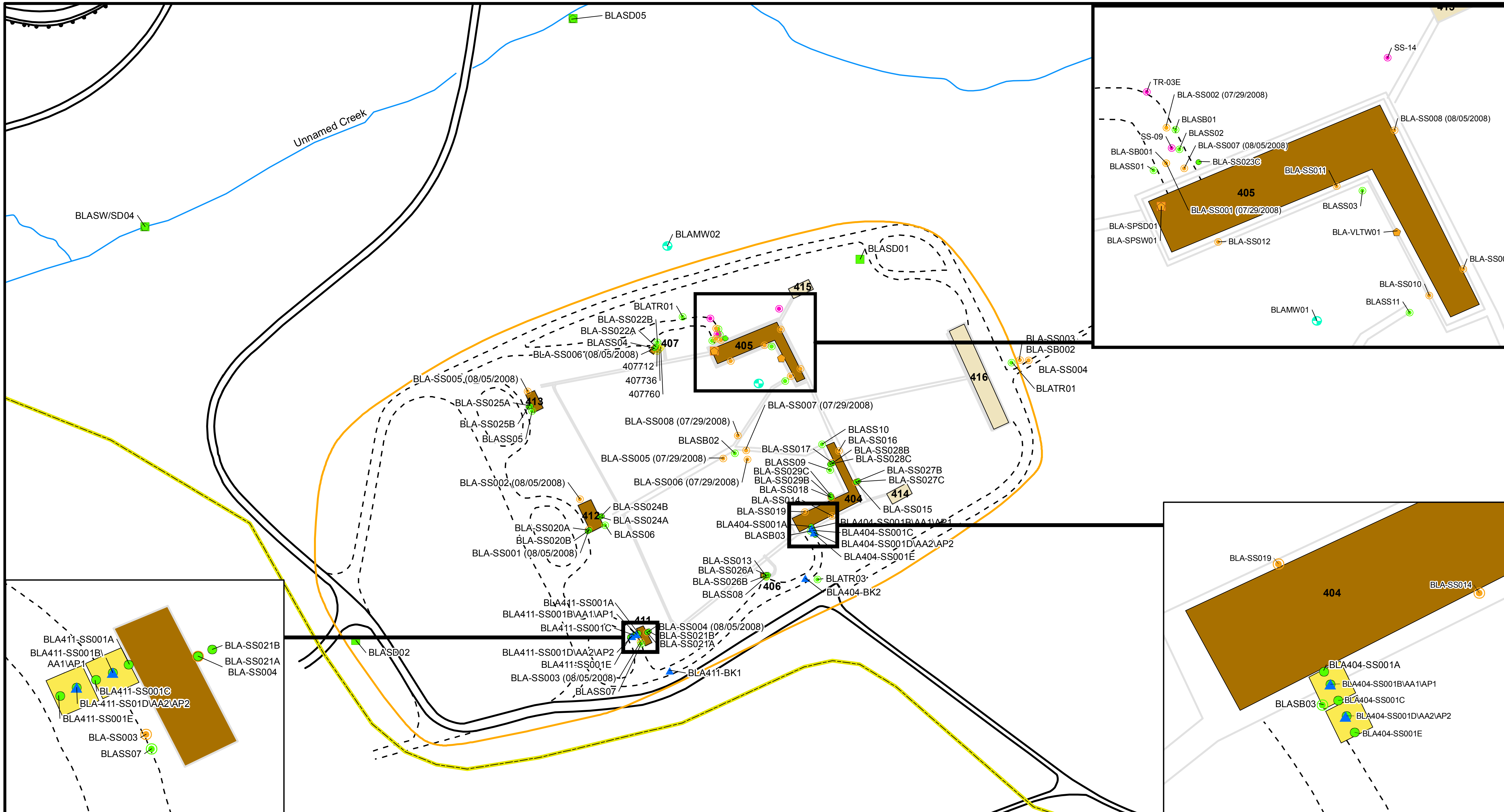

LEGEND

- JULY 2009 AIR SAMPLES (ARCADIS)
- JULY 2009 SOIL SAMPLES (ARCADIS)
- MONITORING WELL
- 1997 SOIL SAMPLE (DAMES & MOORE)
- 1997 & 1998 SOIL SAMPLE (GANNETT FLEMMING)
- 2002 SOIL SAMPLE (SHAW)
- 2002 SEDIMENT SAMPLE (SHAW)
- 2002 SURFACE WATER & SEDIMENT SAMPLE (SHAW)
- 2008 SOIL SAMPLE (ARCADIS)
- 2008 SEDIMENT SAMPLE (ARCADIS)
- 2008 SURFACE WATER SAMPLE (ARCADIS)
- PAVED ROADS
- DIRT ROADS
- SITE FEATURES
- RAIL SPUR
- SURFACE WATER
- WALKWAY
- ASBESTOS SAMPLING GRID
- STUDY AREA
- INSTALLATION BOUNDARY

BUILDINGS
- NO CONDUCTIVE FLOORING
- YES CONDUCTIVE FLOORING

0 200 400 Feet

N

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

BAG LOADING AREA SAMPLE LOCATIONS

ARCADIS

FIGURE
6-2

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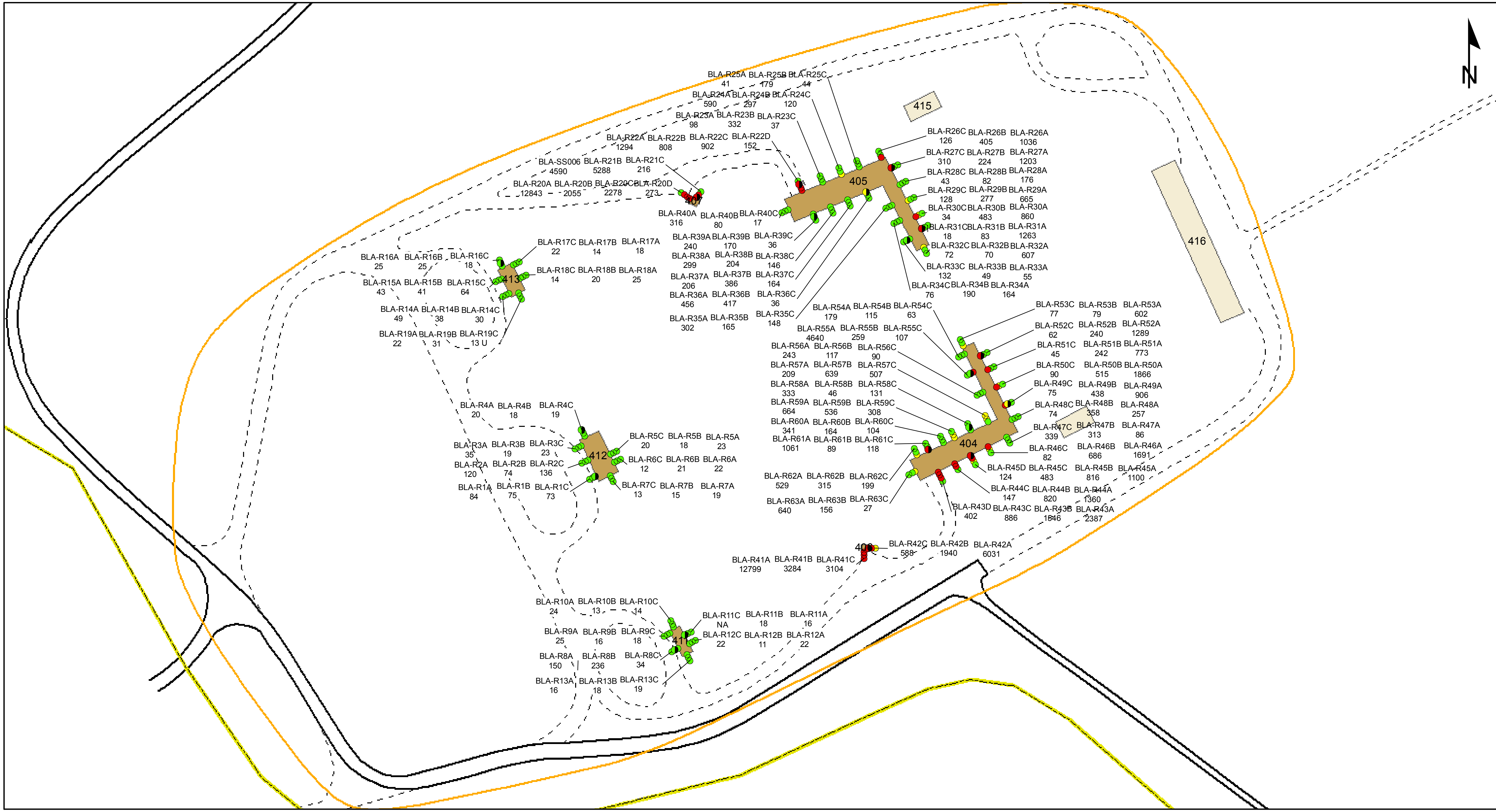

Legend

XRF LEAD SCREENING RESULT

- <400 MG/KG
- 400 - 750 MG/KG
- >750 MG/KG
- ASBESTOS PRESENT IN SAMPLE

- SITE FEATURES
- WALKWAY
- DIRT ROADS
- PAVED ROADS
- STUDY AREA

- INSTALLATION BOUNDARY

BUILDINGS

- NO CONDUCTIVE FLOORING
- YES CONDUCTIVE FLOORING

NOTES:
DISTANCE FROM BUILDINGS:
A: 1 FOOT (CLOSEST TO BUILDING)
B: 5 FEET
C: 10 FEET
D: 15 FEET (FARTHEST FROM BUILDING)

0 130 260 Feet
GRAPHIC SCALE

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

XRF SAMPLE LOCATIONS AND RESULTS BAG LOADING AREA

ARCADIS

FIGURE
6-3

NYC: SER 4/AIT: DB: TBR LD: TBR PIC: TL
Radford (GP08RAAP.00PM)
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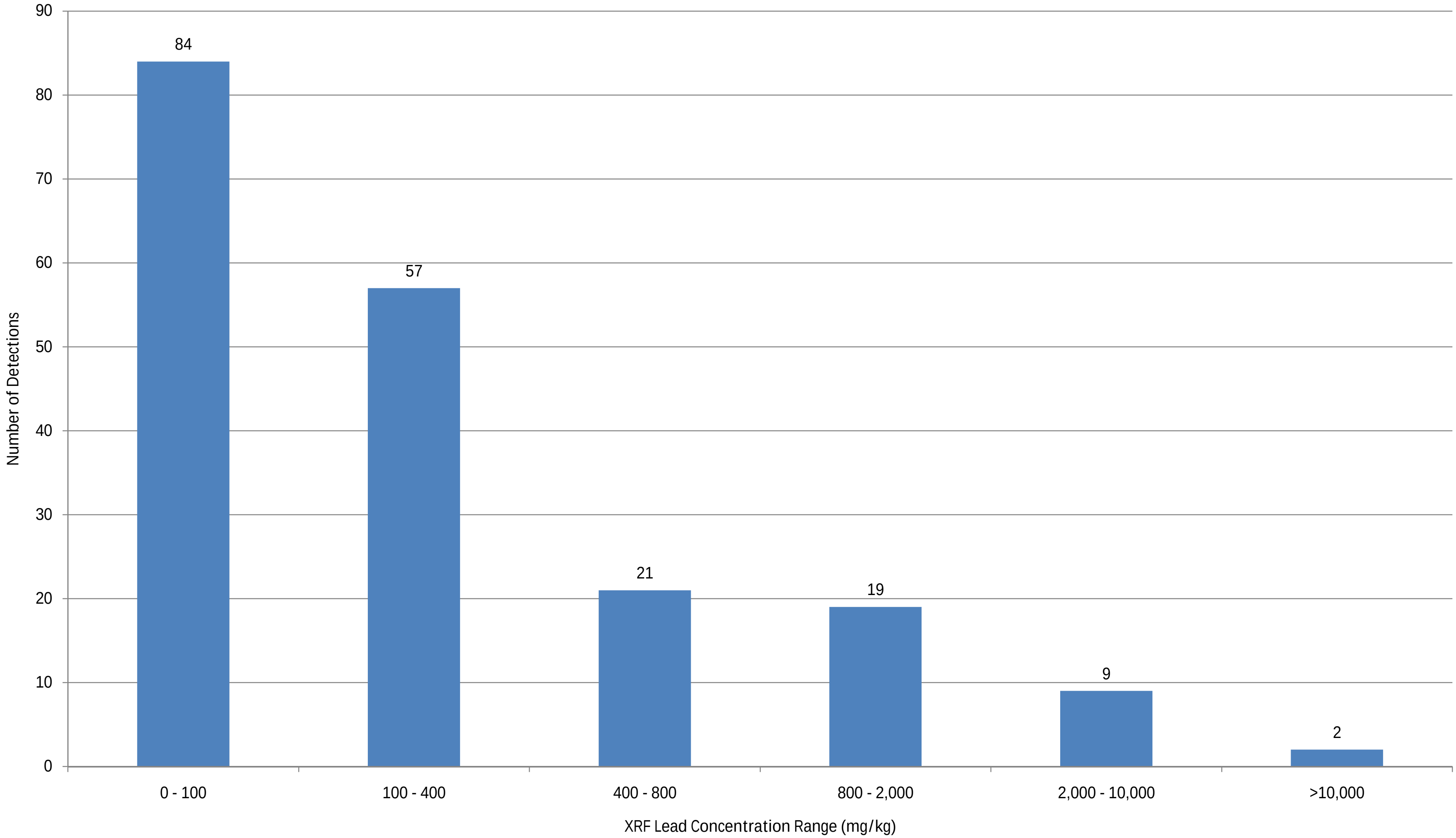
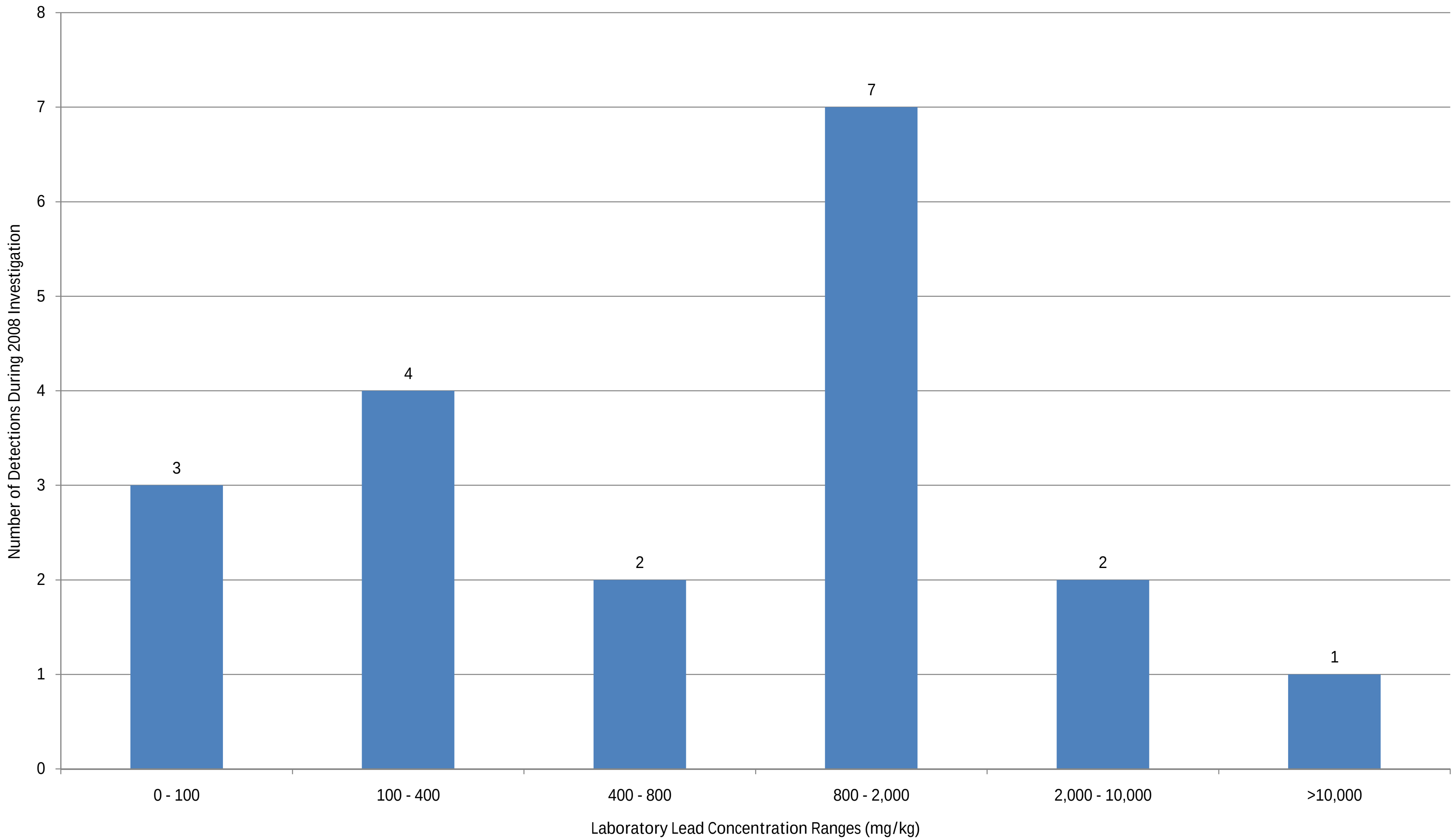
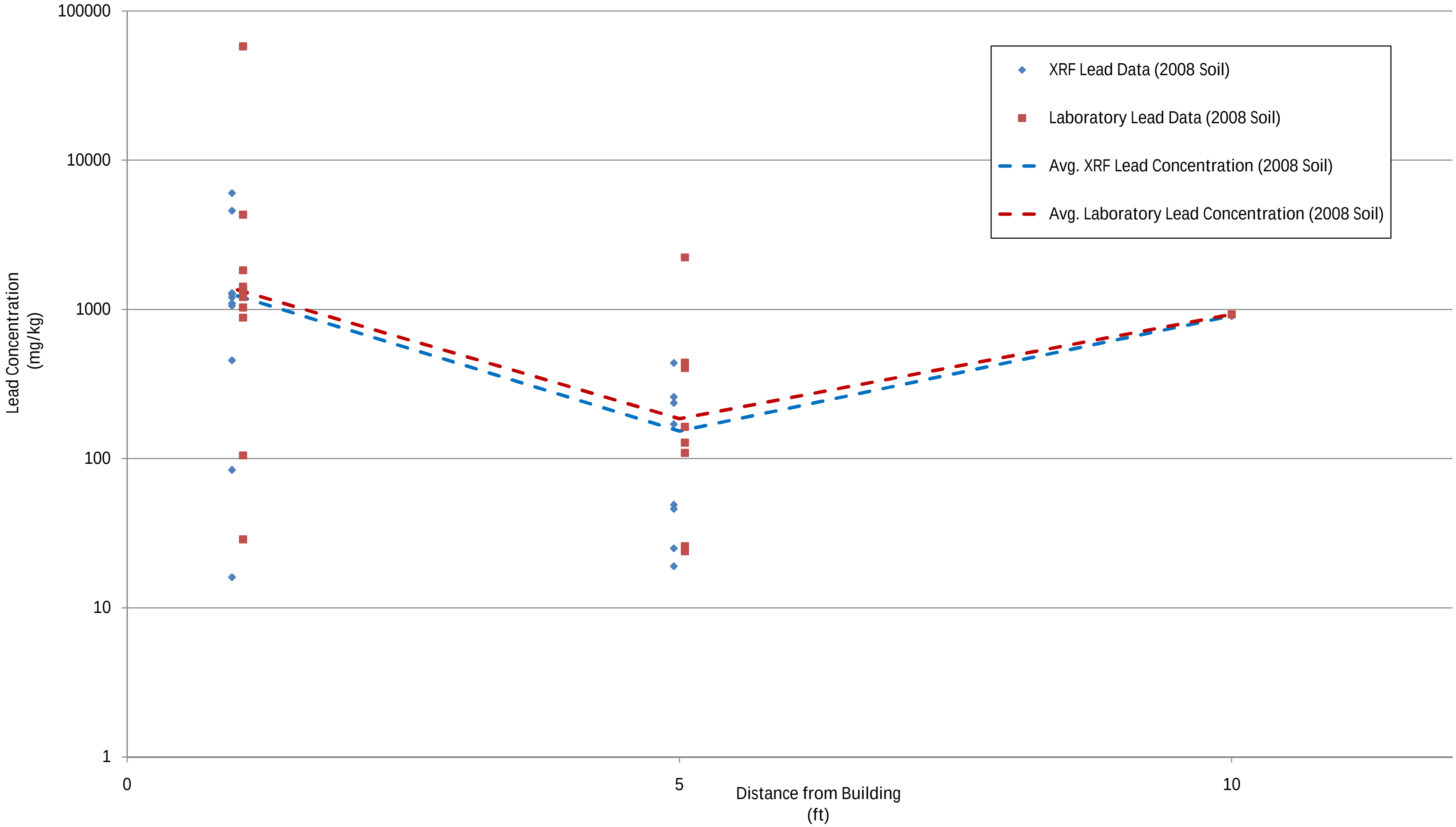


ARCADIS	ARCADIS U.S., Inc. 1114 Benfield Boulevard, Suite A Millersville, Maryland 21108	PROJECT MANAGER: C. Kalinowski DRAFTER: J. Tillotson	PROJECT NUMBER: GP08RAAP.0044	2008 XRF Lead Data Ranges Bag Loading Area	FIGURE: **6-4**



ARCADIS	ARCADIS U.S., Inc. 1114 Benfield Boulevard, Suite A Millersville, Maryland 21108	PROJECT MANAGER: C. Kalinowski DRAFTER: J. Tillotson	PROJECT NUMBER: GP08RAAP.0044	2008 Laboratory Lead Data Ranges Bag Loading Area	FIGURE: **6-5**



Note: Data only includes sample locations where both XRF and laboratory samples were collected.

ARCADIS	ARCADIS U.S., Inc. 1114 Benfield Boulevard, Suite A Millersville, Maryland 21108	PROJECT MANAGER: C. Kalinowski DRAFTER: J. Tillotson	PROJECT NUMBER: GP08RAAP.0044	XRF vs. Laboratory Lead Data Comparison, Bag Loading Area	FIGURE: **6-6**

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

INORGANIC CONSTITUENT DETECTIONS IN SOIL BAG LOADING AREA

ARCADIS

FIGURE 6-7

Legend

- Sample Location All Detects Below RSLs
- Sample Location Above Industrial Criteria and Background (Inorganics only)
- Sample Location Above Residential Criteria and Background (Inorganics only)
- Surface Water
- Paved Roads
- Drainage Ditch
- SWMU Area
- Building Footprint and Identification
- No Conductive Flooring Present
- Conductive Flooring Present

Analytical Data Legend

J	Constituent concentration qualified as estimated
K	Estimated concentration bias high
L	Estimated concentration bias low
B	Constituent concentration quantified as estimated
3.4	Yellow shaded results indicate detection above Residential RSL
903	Green shaded results indicate detection above Industrial RSL
903	Bolded results indicate detection above Background (Inorganics only)

Units for Soil and Sediment Samples reported in mg/kg (Miligrams per kilogram)

Units for TCLP Samples reported in mg/L (Miligrams per Liter)

0 70 140

SCALE IN FEET

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

ORGANIC CONSTITUENT DETECTIONS IN SOIL BAG LOADING AREA

ARCADIS

FIGURE 6-8

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

2009 ASBESTOS SOIL SAMPLING RESULTS
BAG LOADING AREA

ARCADIS

FIGURE
6-9

BLASW04	
Date	6/24/2002
Explosives	
m-Nitrotoluene	0.43 J
Herbicides	
2,4-D	3.26
Organochlorine Pesticides	
Dieldrin	0.0041 J
VOCs	
Carbon Disulfide	0.12 B
Chloroform	0.18 J
SVOCs	
Butylbenzylphthalate	0.44 B
Di-n-Butylphthalate	0.90 B
Inorganics	
Aluminum	140 J
Barium	85.1
Calcium	57,200
Iron	274
Lead	0.500 B
Magnesium	16,400
Manganese	30.4
Potassium	3,300
Selenium	0.510 B
Sodium	34,200
Miscellaneous	
Hardness	210,000

BLASD04	
Depth(Feet)	(0 – 0.5)
Date	6/24/2002
Organochlorine Pesticides	
4,4'-DDD	0.00073 J
4,4'-DDE	0.00182 B
4,4'-DDT	0.00077 B
Alpha-Chlordane	0.00038 J
Beta-BHC	0.00029 J
Dieldrin	0.00094 K
Gamma-Chlordane	0.00041 J
PAHs	
2-Methylnaphthalene	0.0018 B
Anthracene	0.0017 J
Benzo(a)anthracene	0.013
Benzo(a)pyrene	0.012
Benzo(b)fluoranthene	0.019
Benzo(g,h,i)perylene	0.0071
Benzo(k)fluoranthene	0.0071
Chrysene	0.013
Dibenzo(a,h)anthracene	0.0021 J
Fluoranthene	0.019
Fluorene	0.0012 J
Indeno(1,2,3-cd)pyrene	0.0081
Naphthalene	0.0021 B
Phenanthrene	0.0090
Pyrene	0.019
SVOCs	
bis(2-Ethylhexyl)phthalate	0.058 B
Fluoranthene	0.029 J
Phenanthrene	0.018 J
Pyrene	0.022 J
Inorganics	
Aluminum	13,300
Antimony	0.280 B
Arsenic	2.10 L
Barium	77.2
Beryllium	0.890
Calcium	61,200 J
Chromium	26.8
Cobalt	7.30 J
Copper	8.89
Iron	17,600 J
Lead	14.6
Magnesium	3,200 J
Manganese	681 J
Nickel	11.5 J
Potassium	1,240
Sodium	81.9 J
Thallium	0.180 J
Vanadium	31.7 J
Zinc	36.0 J

BLASD05	
Depth(Feet)	(0 – 0.5)
Date	6/24/2002
Organochlorine Pesticides	
4,4'-DDD	0.00059 J
4,4'-DDE	0.00102 B
4,4'-DDT	0.00062 B
Alpha-Chlordane	0.00025 J
PAHs	
2-Methylnaphthalene	0.0013 B
Benzo(a)anthracene	0.0059
Benzo(a)pyrene	0.0050
Benzo(b)fluoranthene	0.013
Benzo(g,h,i)perylene	0.0031
Benzo(k)fluoranthene	0.0033
Chrysene	0.0073
Dibenzo(a,h)anthracene	0.0013 J
Fluoranthene	0.0078
Indeno(1,2,3-cd)pyrene	0.0039
Naphthalene	0.0020 B
Phenanthrene	0.0037
Pyrene	0.0091
VOCs	
Acetone	0.028 B
Toluene	0.00096 B
SVOCs	
Fluoranthene	0.013 J
Phenanthrene	0.012 J
Pyrene	0.010 J
Inorganics	
Aluminum	7,900
Antimony	0.370 B
Arsenic	4.60 L
Barium	74.8
Beryllium	0.920
Calcium	102,000 J
Chromium	28.5
Cobalt	10.5 J
Copper	6.06
Iron	23,300 J
Lead	19.3
Magnesium	9,810 J
Manganese	649 J
Nickel	10.9 J
Potassium	1,310
Sodium	83.6 J
Thallium	0.290 J
Vanadium	37.8 J
Zinc	25.8 J

BLASW05	
Date	6/24/2002
Explosives	
m-Nitrotoluene	0.42 J
Organochlorine Pesticides	
Dieldrin	0.00582 J
VOCs	
Carbon Disulfide	0.070 B
Chloroform	0.13 J
Inorganics	
Aluminum	384
Antimony	0.770 B
Barium	84.7
Calcium	54,600
Iron	297
Lead	0.340 B
Magnesium	16,400
Manganese	18.4
Potassium	3,310
Sodium	34,700
Miscellaneous	
Hardness	204,000

BLA-SPSW01	
Date	8/1/2008
Inorganics	
Aluminum	549
Arsenic	10.0
Barium	58.8
Calcium	86,500
Copper	828
Iron	554
Lead	2.20 J
Magnesium	496,000
Manganese	377
Potassium	146,000
Sodium	107,000
Zinc	26.3

BLA-VLTW01	
Date	8/1/2008
SVOCs	
Benzo(a)anthracene	0.024 J
Benzo(b)fluoranthene	0.025 J
Chrysene	0.030 J
Fluoranthene	0.066
Phenanthrene	0.036 J
Pyrene	0.041 J
Inorganics	
Aluminum	273
Arsenic	3.40 J
Barium	98.1
Calcium	25,600
Chromium	2.70 J
Copper	646
Iron	742
Lead	247
Magnesium	23,300
Manganese	44.3
Mercury	0.200 J
Potassium	43,600
Sodium	22,100
Zinc	116

Legend

- Sample Location All Detects Below RSLs
- Sample Location Above Industrial Criteria and Background (Inorganics only)
- Sample Location Above Residential Criteria and Background (Inorganics only)
- Surface Water
- Paved Roads
- Drainage Ditch
- SWMU Area
- 1303 Building Footprint and Identification
- No Conductive Flooring Present
- Conductive Flooring Present

Analytical Data Legend

J	Constituent concentration qualified as estimated
K	Estimated concentration bias high
L	Estimated concentration bias low
B	Constituent concentration quantified as estimated
3.4	Yellow shaded results indicate detection above Residential RSL
903	Green shaded results indicate detection above Industrial RSL
903	Bolded results indicate detection above Background (Inorganics only)

Units for Soil and Sediment Samples reported in mg/kg (Miligrams per kilogram)

Units for TCLP Samples reported in mg/L (Miligrams per Liter)

0 70 140
SCALE IN FEET

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

CONSTITUENT DETECTIONS IN SEDIMENT AND SURFACE WATER BAG LOADING AREA

ARCADIS

FIGURE 6-10

LEGEND

- SEWER LINE
- SITE FEATURES
- RAIL SPUR
- SURFACE WATER
- CULVERT
- PAVED ROADS
- DIRT ROADS

BUILDINGS

- NO CONDUCTIVE FLOORING
- YES CONDUCTIVE FLOORING
- STUDY AREA
- INSTALLATION BOUNDARY

0 340 680 Feet

GRAPHIC SCALE

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

IGNITER ASSEMBLY AREA SITE LAYOUT

ARCADIS

FIGURE **7-1**

NYC: SER 4/AT DB: TBR LD: TBR PIC: TL
Radford (GP09RAAP.00PM)
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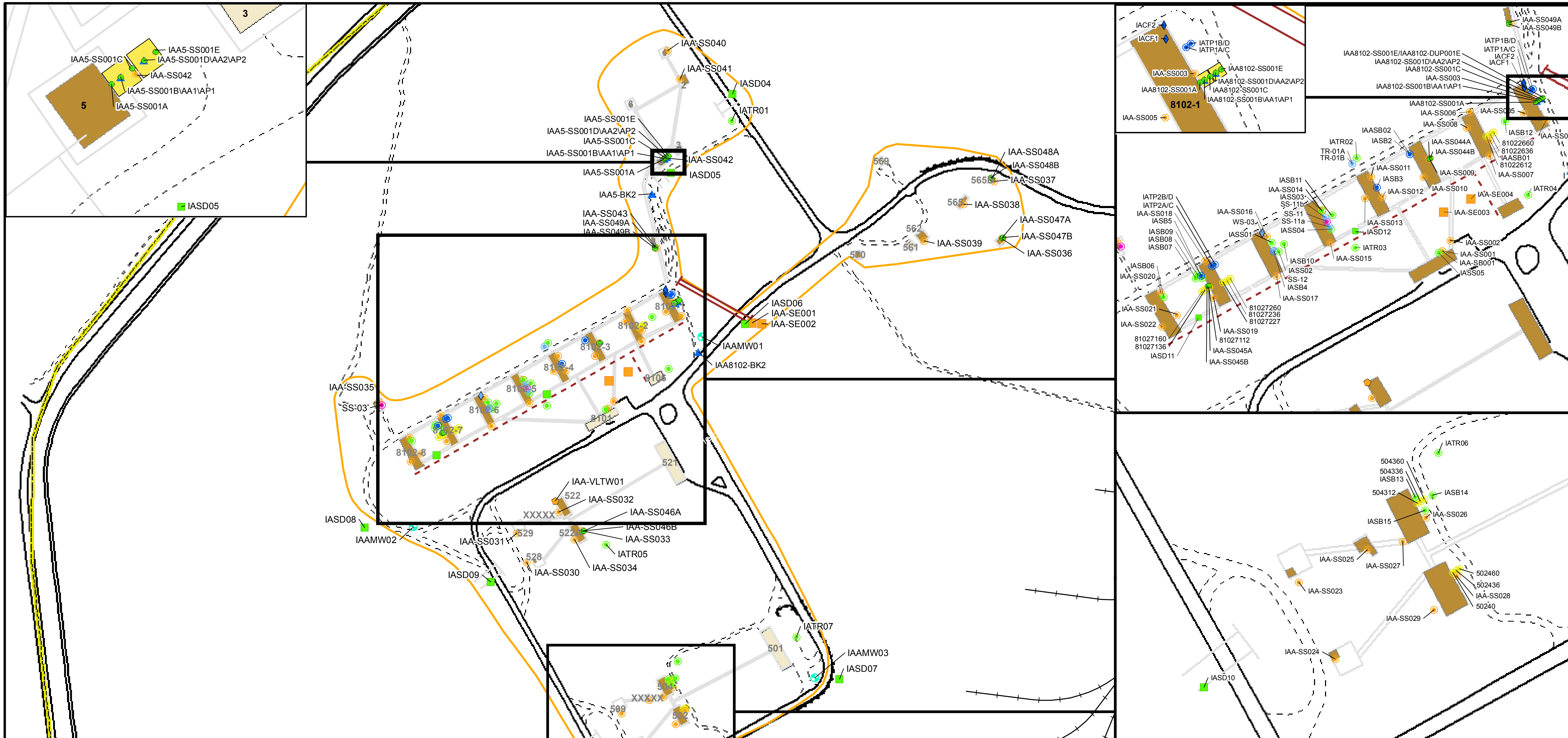

NOTE:
Historical flooring and asbestos-only samples were not located and previous consultant did not survey. Locations IDs are:
CF-1
BPASS01
BPASS02
BPASS03

N

0 325 650 Feet

LEGEND

- JULY 2009 AIR SAMPLES (ARCADIS)
- JULY 2009 SOIL SAMPLES (ARCADIS)
- MONITORING WELLS
- SOIL SAMPLE
- 1997 SOIL SAMPLE (DAMES & MOORE)
- 1997 SOIL SAMPLE (GANNETT FLEMMING)
- 1998 SOIL SAMPLE (GANNETT FLEMMING)
- 1998 FLOORING SAMPLE (GANNETT FLEMMING)
- 1998 SOIL SAMPLE (ICF KAISER)
- 1998 FLOORING SAMPLE (ICF KAISER)
- 2002 SOIL SAMPLE (SHAW)
- 2002 SEDIMENT SAMPLE (SHAW)
- 2002 SOIL SAMPLE (ASBESTOS-ONLY) (SHAW)
- 2008 SOIL SAMPLE (ARCADIS)
- 2008 SEDIMENT SAMPLE (ARCADIS)
- 2008 SURFACE WATER SAMPLE (ARCADIS)
- SEWER LINE
- ASBESTOS SAMPLING GRID
- SITE FEATURES
- RAIL SPUR
- SURFACE WATER
- CULVERT
- PAVED ROADS
- DIRT ROADS
- STUDY AREA
- INSTALLATION BOUNDARY
- BUILDINGS
- NO CONDUCTIVE FLOORING
- YES CONDUCTIVE FLOORING

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

IGNITER ASSEMBLY AREA SAMPLE LOCATIONS

ARCADIS

FIGURE
7-2

NYC: SER 4/AIT: DB: TBR LD: TBR PIC: TL
Radford (GP08RAAP.00PM)
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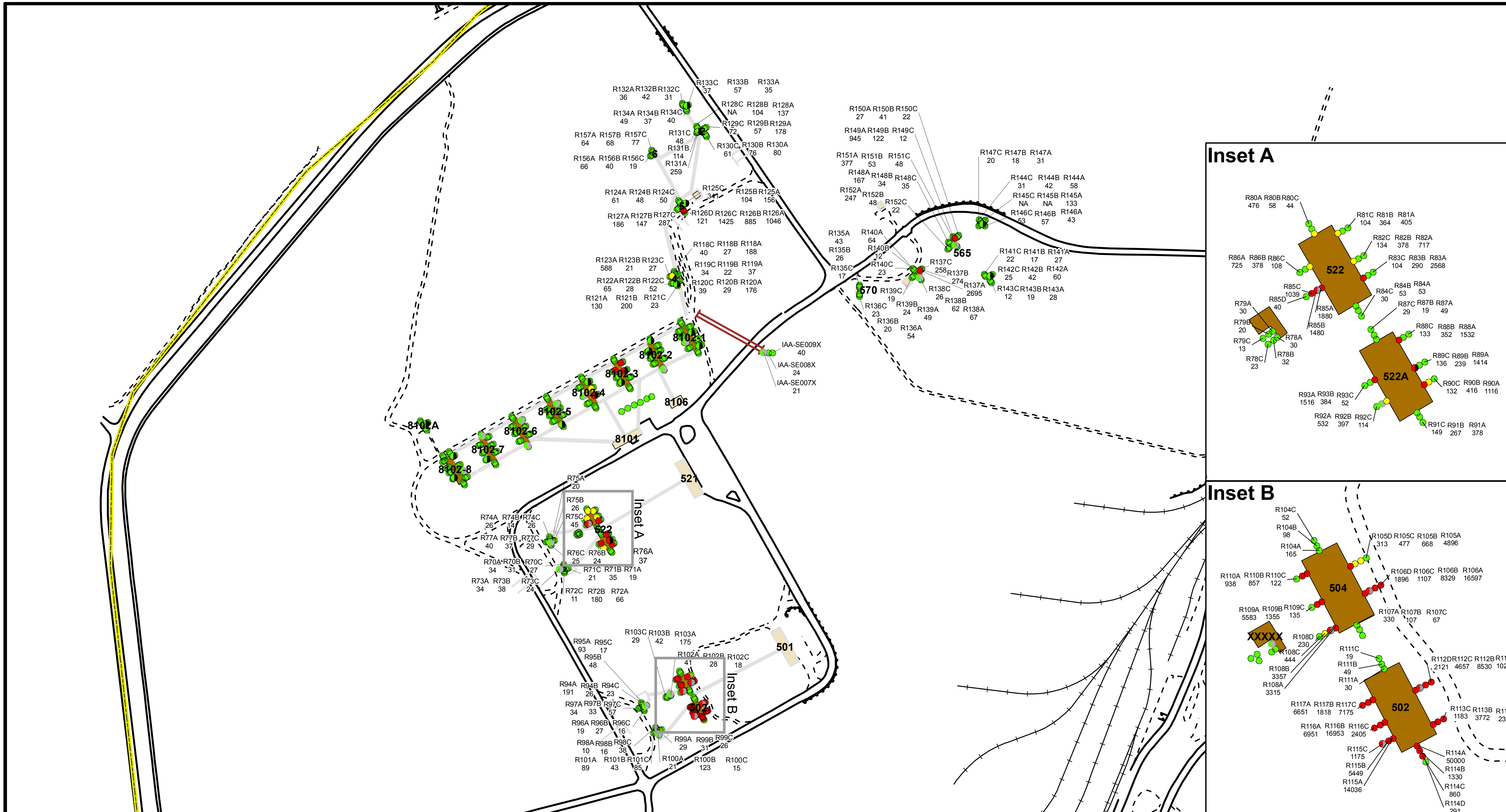

LEGEND

XRF LEAD SCREENING RESULT

- <400 MG/KG
- 400 - 750 MG/KG
- >750 MG/KG
- ASBESTOS PRESENT IN SAMPLE
- ASBESTOS NOT PRESENT IN SAMPLE

- PAVED ROADS
- DIRT ROADS
- SITE FEATURES
- RAIL SPUR
- SURFACE WATER
- CULVERT

- STUDY AREA
- INSTALLATION BOUNDARY

BUILDINGS

- NO CONDUCTIVE FLOORING
- YES CONDUCTIVE FLOORING

NOTES:
DISTANCE FROM BUILDINGS:
A: 1 FOOT (CLOSEST TO BUILDING)
B: 5 FEET
C: 10 FEET
D: 15 FEET (FARTHEST FROM BUILDING)

0 345 690 Feet

GRAPHIC SCALE

N

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

XRF FIELD SCREENING RESULTS
IGNITER ASSEMBLY AREA

ARCADIS

FIGURE
7-3A

NYC: SER 4/AIT: DB: TBR LD: TBR PIC: TL
Radford (GP08RAAP.00PM)
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LEGEND

XRF LEAD SCREENING RESULT

- <400 MG/KG
- 400 - 750 MG/KG
- >750 MG/KG
- ASBESTOS PRESENT IN SAMPLE
- ASBESTOS NOT PRESENT IN SAMPLE

- PAVED ROADS
- DIRT ROADS
- STUDY AREA
- INSTALLATION BOUNDARY

BUILDINGS

- NO CONDUCTIVE FLOORING
- YES CONDUCTIVE FLOORING

NOTES:
DISTANCE FROM BUILDINGS:
A: 1 FOOT (CLOSEST TO BUILDING)
B: 5 FEET
C: 10 FEET
D: 15 FEET (FARTHEST FROM BUILDING)

N

0 100 200 Feet
GRAPHIC SCALE

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

XRF FIELD SCREENING RESULTS
IGNITER ASSEMBLY AREA

ARCADIS

FIGURE
7-3B

NYC: SER 4/AIT: DB: TBR LD: TBR PIC: TL
Radford (GP08RAAP.00PM)
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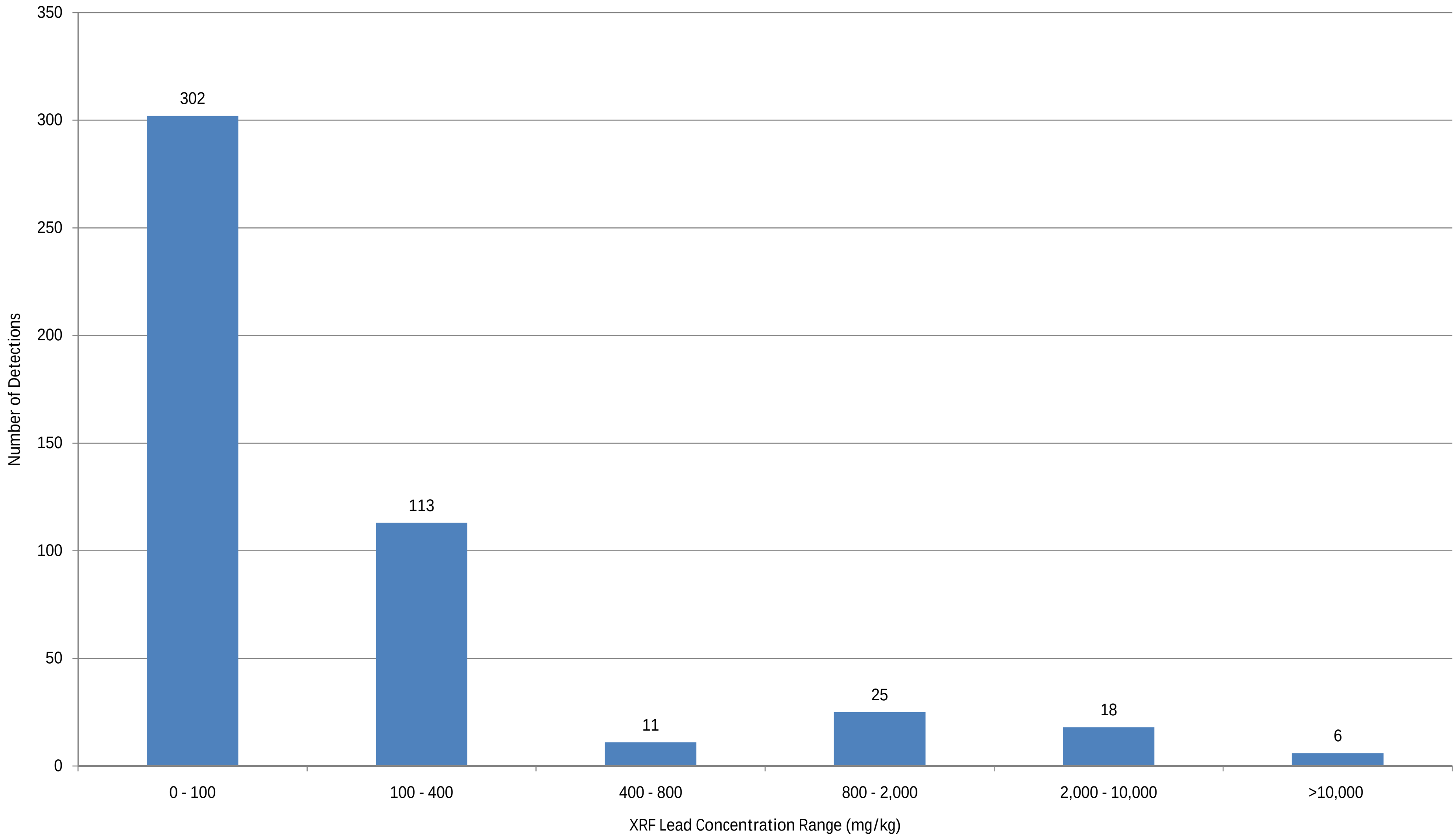
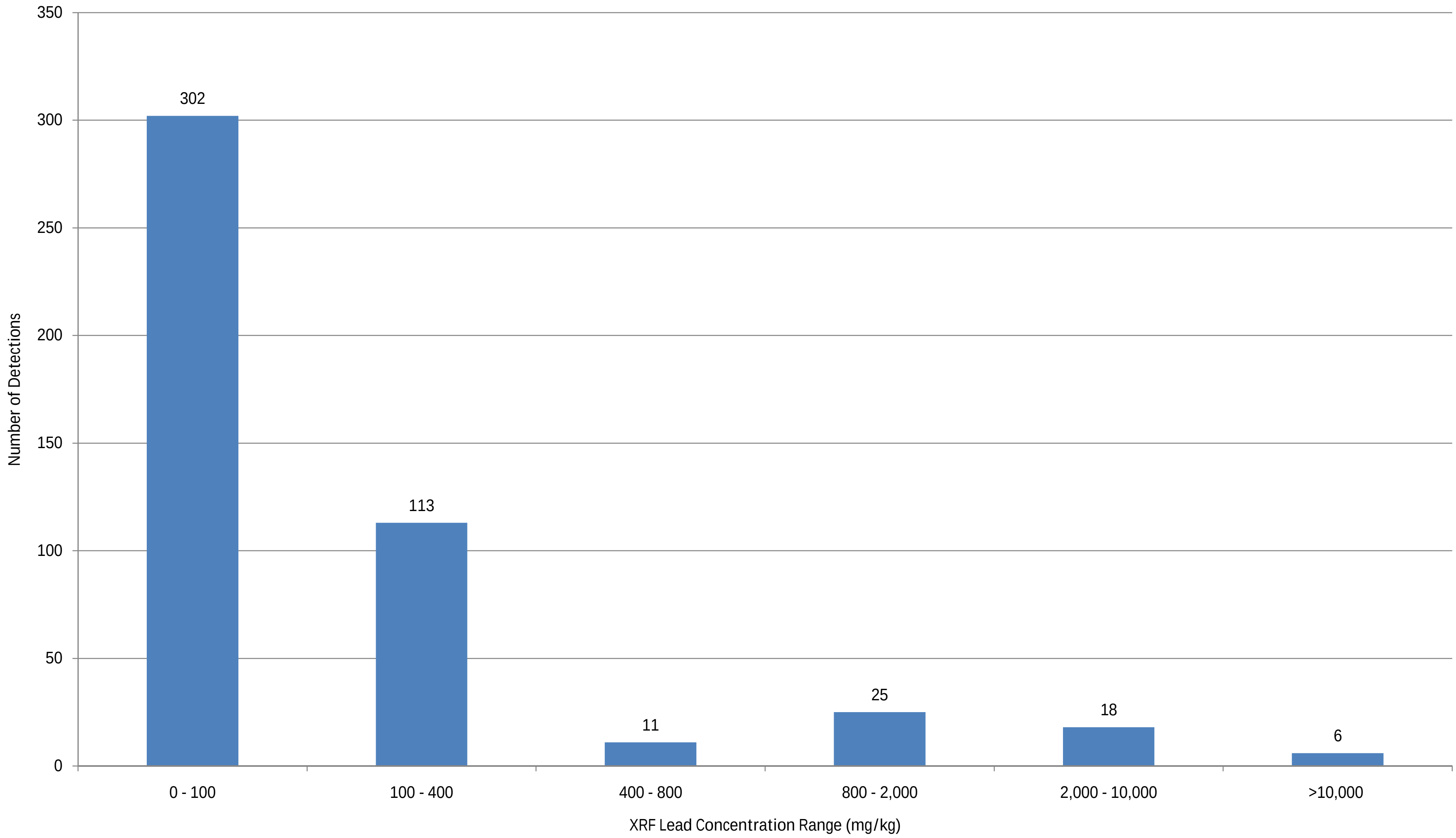
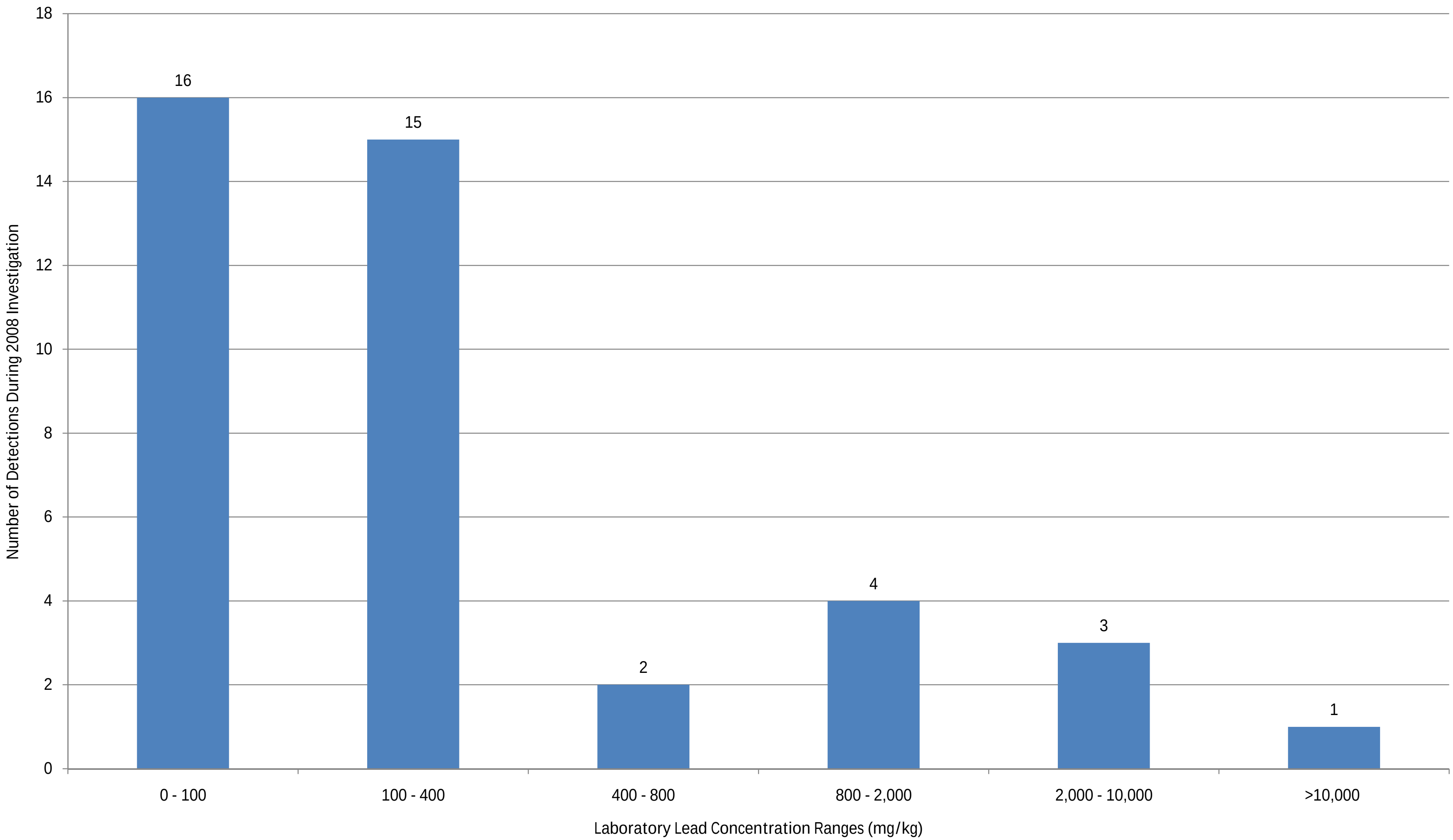


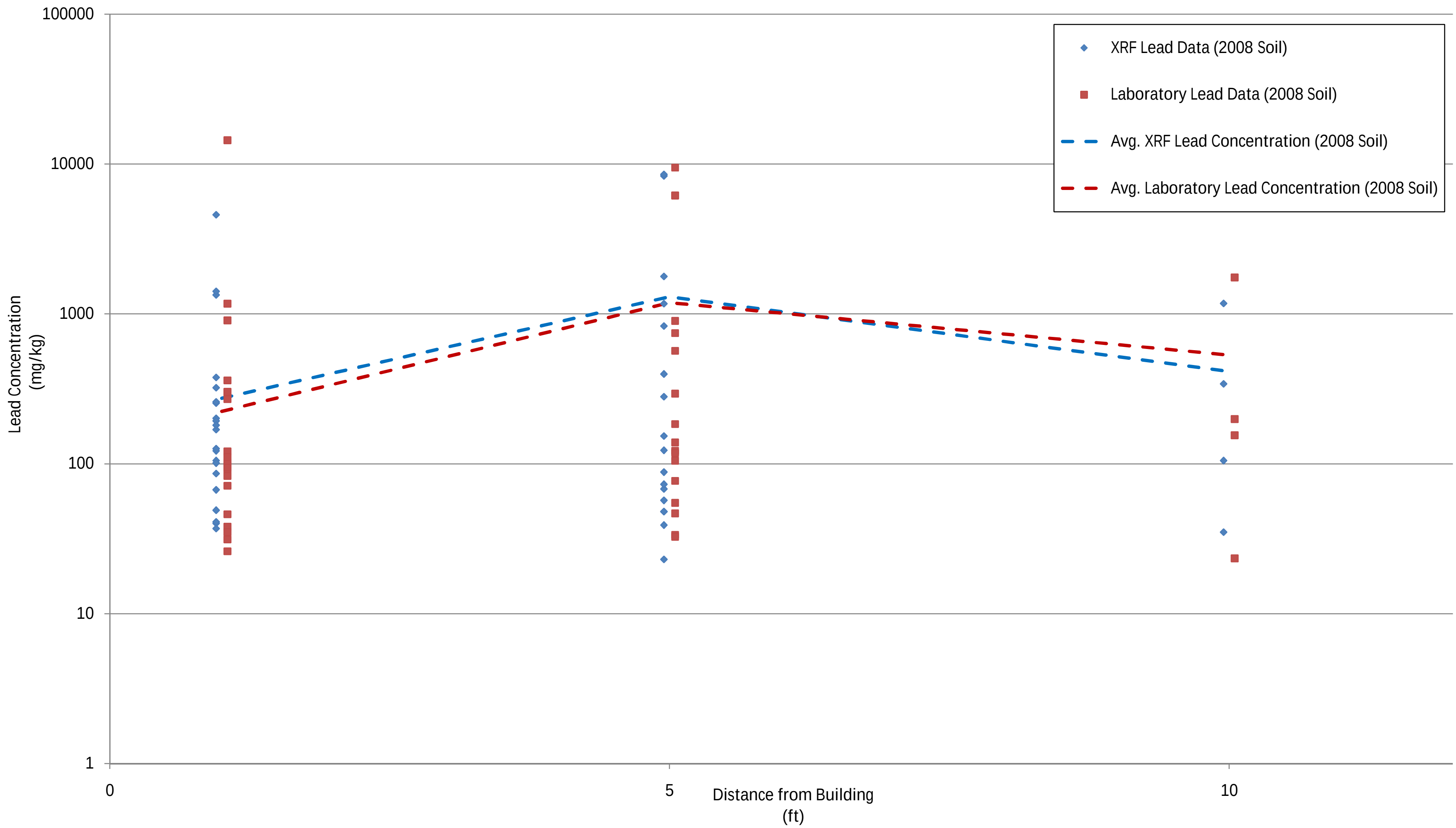
ARCADIS	ARCADIS U.S., Inc. 1114 Benfield Boulevard, Suite A Millersville, Maryland 21108	PROJECT MANAGER: C. Kalinowski DRAFTER: J. Tillotson	PROJECT NUMBER: GP08RAAP.0044	2008 XRF Lead Data Ranges Igniter Assembly Area	FIGURE: **7-4**



ARCADIS	ARCADIS U.S., Inc. 1114 Benfield Boulevard, Suite A Millersville, Maryland 21108	PROJECT MANAGER: C. Kalinowski DRAFTER: J. Tillotson	PROJECT NUMBER: GP08RAAP.0044	2008 XRF Lead Data Ranges Igniter Assembly Area	FIGURE: **7-4**



ARCADIS	ARCADIS U.S., Inc. 1114 Benfield Boulevard, Suite A Millersville, Maryland 21108	PROJECT MANAGER: C. Kalinowski DRAFTER: J. Tillotson	PROJECT NUMBER: GP08RAAP.0044	2008 Laboratory Lead Data Ranges Igniter Assembly Area	FIGURE: **7-5**



Note: Data only includes sample locations where both XRF and laboratory samples were collected.

ARCADIS	ARCADIS U.S., Inc. 1114 Benfield Boulevard, Suite A Millersville, Maryland 21108	PROJECT MANAGER: C. Kalinowski DRAFTER: J. Tillotson	PROJECT NUMBER: GP08RAAP.0044	XRF vs. Laboratory Lead Data Comparison, Igniter Assembly Area	FIGURE: 7-6

Legend

- Sample Location All Detects Below RSLs
- Sample Location Above Industrial Criteria and Background (Inorganics only)
- Sample Location Above Residential Criteria and Background (Inorganics only)
- Monitoring Well
- Surface Water
- Paved Roads
- Railway Spur
- Drainage Ditch
- SWMU Area
- Building Footprint and Identification
- No Conductive Flooring Present
- Conductive Flooring Present

Analytical Data Legend

J	Constituent concentration qualified as estimated
K	Estimated concentration bias high
L	Estimated concentration bias low
B	Constituent concentration quantified as estimated
3.4	Yellow shaded results indicate detection above Residential RSL
903	Green shaded results indicate detection above Industrial RSL
903	Bolded results indicate detection above Background (Inorganics only)
	Units for Soil and Sediment Samples reported in mg/kg (Miligrams per kilogram)
	Units for TCLP Samples reported in mg/L (Miligrams per Liter)

0 70 140
SCALE IN FEET

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

CONSTITUENT DETECTIONS IN SOIL
IGNITER ASSEMBLY AREA

ARCADIS

FIGURE 7-7

Legend

- Sample Location All Detects Below RSLs
- Sample Location Above Industrial Criteria and Background (Inorganics only)
- Sample Location Above Residential Criteria and Background (Inorganics only)
- Monitoring Well
- Surface Water
- Paved Roads
- Railway Spur
- Drainage Ditch
- SWMU Area
- Building Footprint and Identification
- No Conductive Flooring Present
- Conductive Flooring Present

Analytical Data Legend

J	Constituent concentration qualified as estimated
K	Estimated concentration bias high
L	Estimated concentration bias low
B	Constituent concentration quantified as estimated
3.4	Yellow shaded results indicate detection above Residential RSL
903	Green shaded results indicate detection above Industrial RSL
903	Bolded results indicate detection above Background (Inorganics only)

Units for Soil and Sediment Samples reported in mg/kg (Miligrams per kilogram)

Units for TCLP Samples reported in mg/L (Miligrams per Liter)

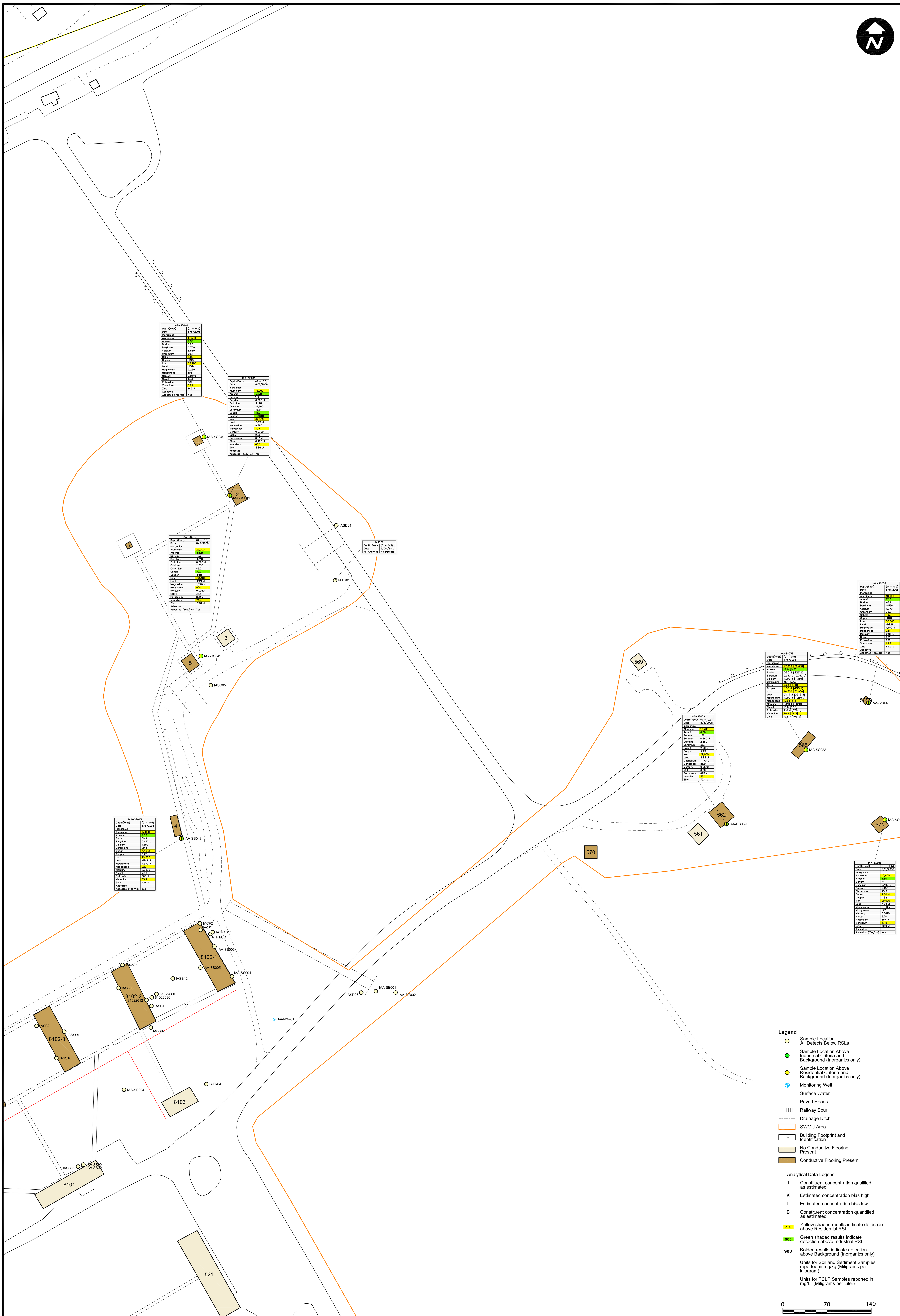
0 60 120
SCALE IN FEET

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

CONSTITUENT DETECTIONS IN SOILIGNITER ASSEMBLY AREA

ARCADIS

FIGURE 7-8



RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

CONSTITUENT DETECTIONS IN SOIL
IGNITER ASSEMBLY AREA

ARCADIS

FIGURE
7-9

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

2009 ASBESTOS SOIL SAMPLING RESULTS
IGNITER ASSEMBLY AREA

ARCADIS

FIGURE
7-10

Legend

- Sample Location All Detects Below RSLs
- Sample Location Above Industrial Criteria and Background (Inorganics only)
- Sample Location Above Residential Criteria and Background (Inorganics only)
- Monitoring Well
- Surface Water
- Paved Roads
- Railway Spur
- Drainage Ditch
- SWMU Area
- Building Footprint and Identification
- No Conductive Flooring Present
- Conductive Flooring Present

Analytical Data Legend

J	Constituent concentration qualified as estimated
K	Estimated concentration bias high
L	Estimated concentration bias low
B	Constituent concentration quantified as estimated
3.4	Yellow shaded results indicate detection above Residential RSL
903	Green shaded results indicate detection above Industrial RSL
903	Bolded results indicate detection above Background (Inorganics only)
	Units for Soil and Sediment Samples reported in mg/kg (Milligrams per kilogram)
	Units for TCLP Samples reported in mg/L (Milligrams per Liter)

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

CONSTITUENT DETECTIONS IN SEDIMENT AND SURFACE WATER IGNITER ASSEMBLY AREA

ARCADIS

FIGURE
7-11

LEGEND

- SITE FEATURES
- RAIL SPUR
- SURFACE WATER
- PAVED ROADS
- DIRT ROADS
- BUILDINGS
- STUDY AREA
- INSTALLATION BOUNDARY

0 425 850 Feet

GRAPHIC SCALE

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

RAIL YARD
SITE LAYOUT

ARCADIS

FIGURE
8-1

NYC: SER 4/AIT: DB: TBR LD: TBR PIC: TL
Radford (GP08RAAP.00PM)
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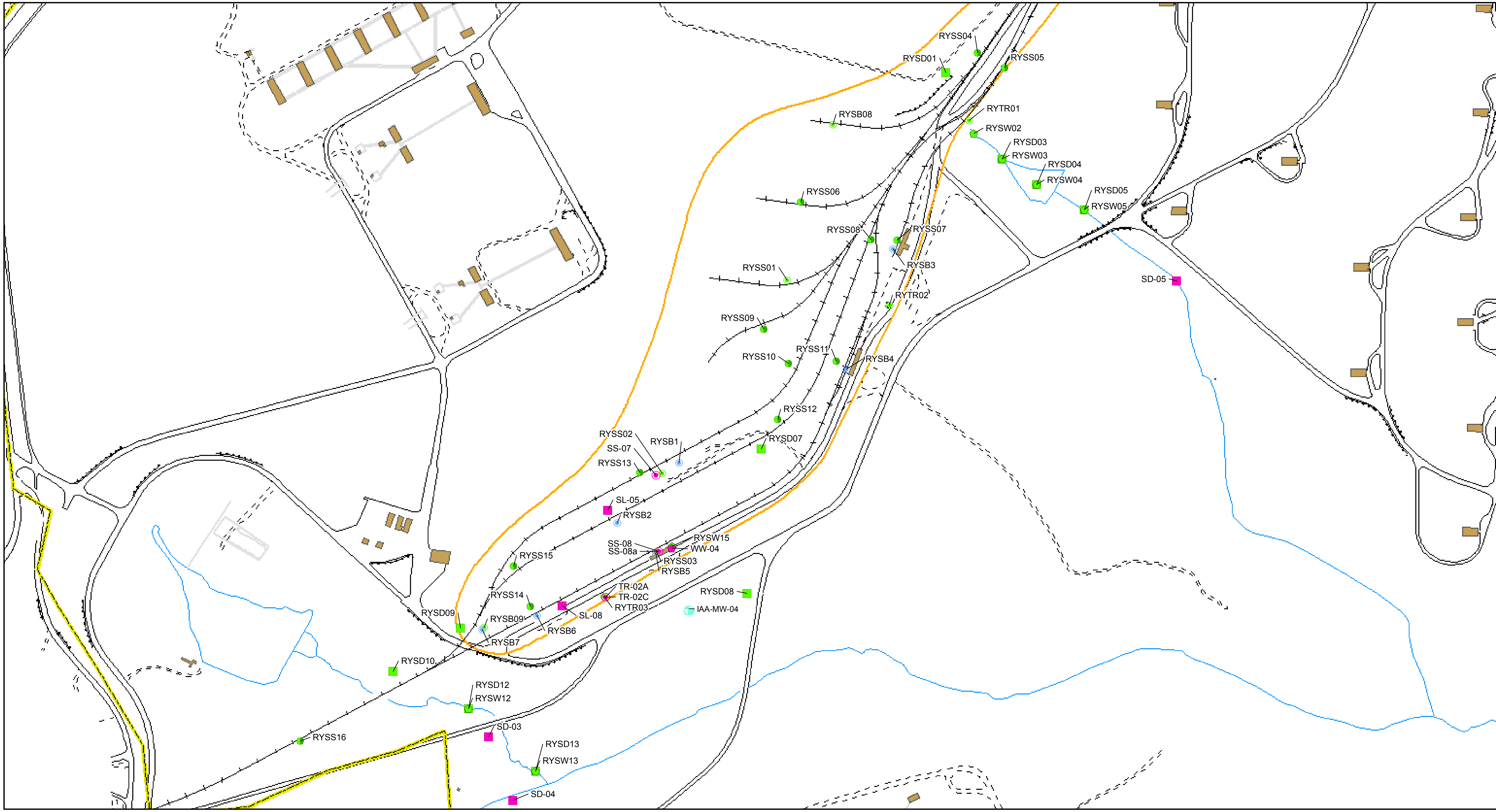

LEGEND

◉	1997 & 1998 SOIL SAMPLE (GANNETT FLEMMING)	●	2002 SOIL BASELINE SAMPLING (SHAW)		SITE FEATURES		BUILDINGS
■	1997 & 1998 SEDIMENT SAMPLE (GANNETT FLEMMING)	◉	2002 SOIL SAMPLE (SHAW)		RAIL SPUR		STUDY AREA
⬟	1997 & 1998 SURFACE WATER SAMPLE (GANNETT FLEMMING)	■	2002 SEDIMENT SAMPLE (SHAW)		SURFACE WATER		INSTALLATION BOUNDARY
◉	1998 SOIL SAMPLE (ICF KE)	⬟	2002 SURFACE WATER SAMPLE (SHAW)		PAVED ROADS		
		◉	MONITORING WELLS		DIRT ROADS		

N

0 400 800 Feet

GRAPHIC SCALE

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

RAIL YARD
SAMPLE LOCATIONS

ARCADIS

FIGURE
8-2

NYC: SER 4/AIT: DB: TBR LD: TBR PIC: TL
Radford (GP08RAAP.00PM)
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RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

INORGANIC CONSTITUENT DETECTIONS IN SOIL RAIL YARD

ARCADIS

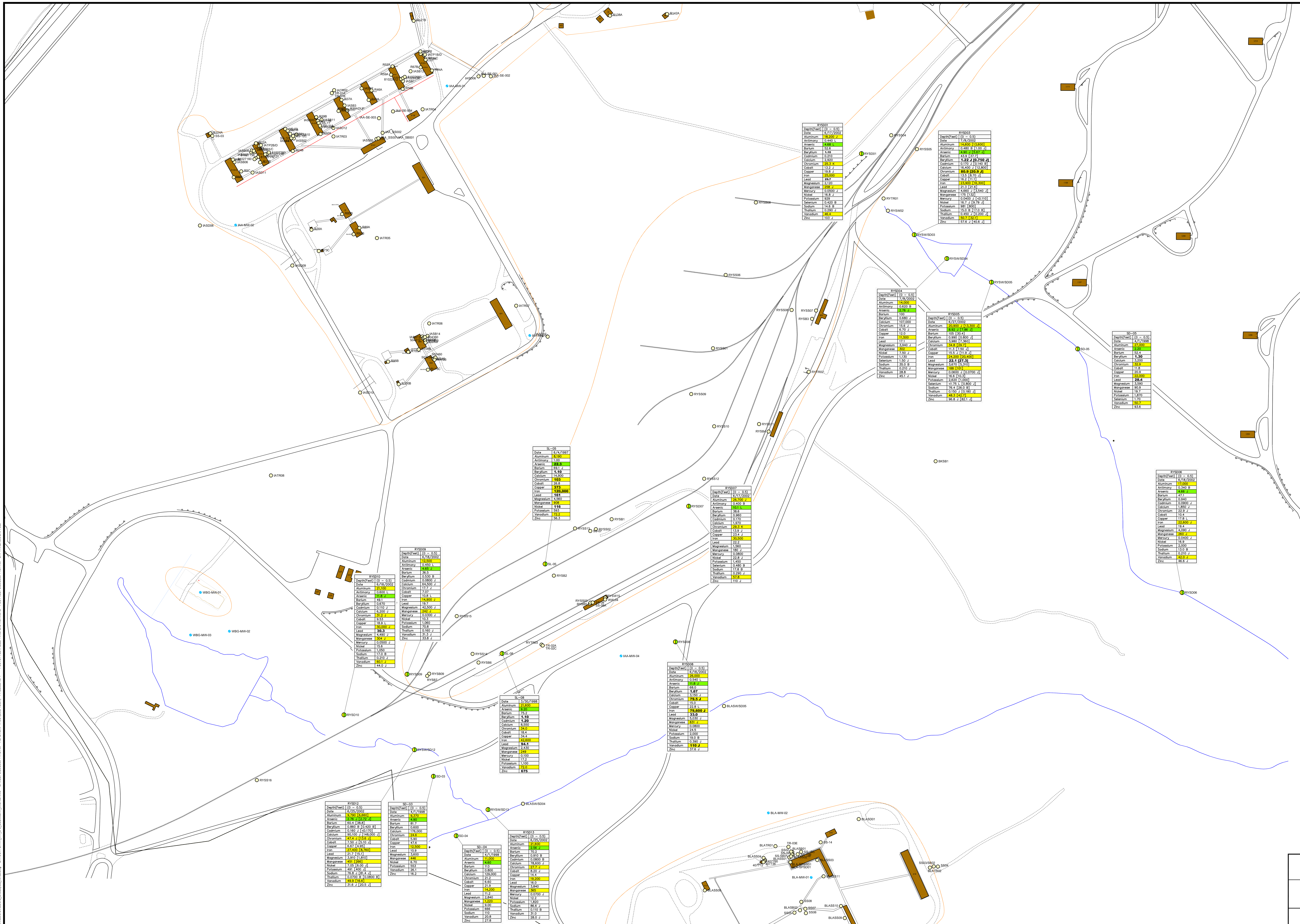
FIGURE 8-3

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

ORGANIC CONSTITUENT DETECTIONS IN SOIL RAIL YARD

ARCADIS

FIGURE 8-4



Legend

Symbol	Description
○	Sample Location All Detects Below RSLs
● (green)	Sample Location Above Industrial Criteria and Background (Inorganics only)
● (yellow)	Sample Location Above Residential Criteria and Background (Inorganics only)
	Monitoring Well
	Surface Water
	Paved Roads
	Railway Spur
	Drainage Ditch
	SWMU Area
1303	Building Footprint and Identification

Analytical Data Legend

J	Constituent concentration qualified as estimated
K	Estimated concentration bias high
L	Estimated concentration bias low
B	Constituent concentration quantified as estimated
3.4	Yellow shaded results indicate detection above Residential RSL
903	Green shaded results indicate detection above Industrial RSL
903	Bolded results indicate detection above Background (Inorganics only)
	Units for Soil and Sediment Samples reported in mg/kg (Miligrams per kilogram)
	Units for TCLP Samples reported in mg/L (Miligrams per Liter)

Note: Sample Location SL-108 not located

0 200 400
SCALE IN FEET

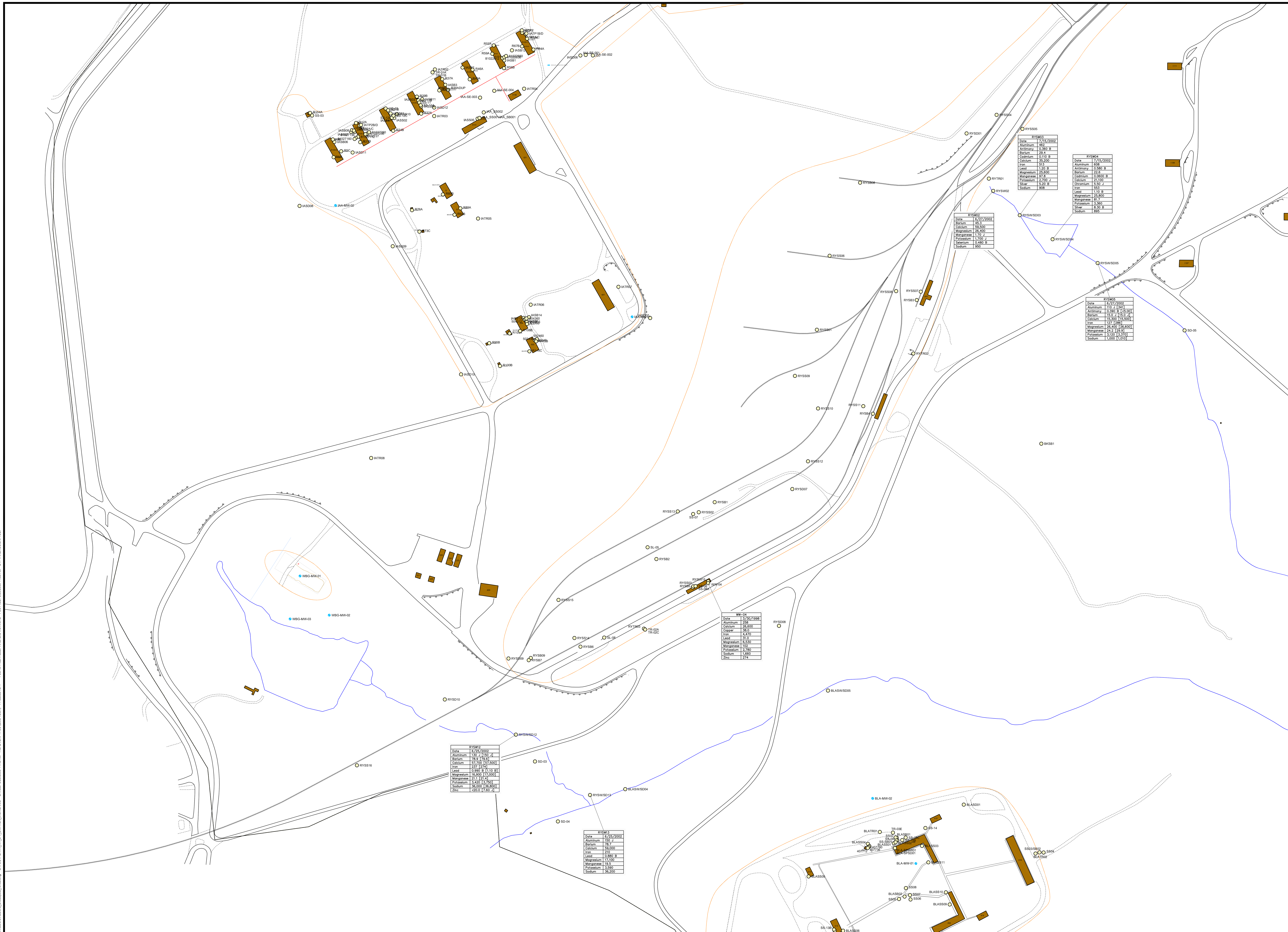
RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

INORGANIC CONSTITUENT DETECTIONS IN SEDIMENT RAIL YARD

ARCADIS

FIGURE
8-5


Legend
Sample Location All Detects Below RSLs
Sample Location Above Industrial Criteria and Background (Inorganics only)
Sample Location Above Residential Criteria and Background (Inorganics only)
Monitoring Well
Surface Water
Paved Roads
Railway Spur
Drainage Ditch
SWMU Area
Building Footprint and Identification
Analytical Data Legend
J Constituent concentration qualified as estimated
K Estimated concentration bias high
L Estimated concentration bias low
B Constituent concentration quantified as estimated
3.4 Yellow shaded results indicate detection above Residential RSL
903 Green shaded results indicate detection above Industrial RSL
903 Bolded results indicate detection above Background (Inorganics only)
Units for Soil and Sediment Samples reported in mg/kg (Miligrams per kilogram)
Units for TCLP Samples reported in mg/L (Miligrams per Liter)
Note: Sample Location SL-108 not located
0 200 400
SCALE IN FEET
RADFORD ARMY AMMUNITION PLANT
RADFORD, VA
ORGANIC CONSTITUENT DETECTIONS IN SEDIMENT RAIL YARD
ARCADIS
FIGURE
8-6



RYSW02	
Date	6/27/2002
Barium	45.3
Calcium	59,500
Magnesium	26,400
Manganese	1.70 J
Potassium	1,700 J
Selenium	0.480 B
Sodium	950

RYSW03	
Date	7/15/2002
Aluminum	462
Antimony	0.360 B
Barium	29.4
Cadmium	0.110 B
Calcium	35,200
Iron	513
Lead	1.20 B
Magnesium	25,600
Manganese	97.8
Potassium	2,700 J
Silver	5.20 B
Sodium	908

RYSW04	
Date	7/15/2002
Aluminum	608
Antimony	0.580 B
Barium	22.6
Cadmium	0.0600 B
Calcium	21,100
Chromium	5.50 J
Iron	553
Lead	1.10 B
Magnesium	25,800
Manganese	81.7
Potassium	3,360
Silver	8.30 B
Sodium	895

RYSW05	
Date	6/27/2002
Aluminum	110 J [341]
Antimony	0.390 B [<5.00]
Barium	15.0 J [15.0 J]
Calcium	15,300 [15,500]
Iron	127 [286]
Magnesium	26,400 [26,600]
Manganese	24.2 [29.9]
Potassium	3,120 [3,370]
Sodium	1,000 [1,010]

WW–04	
Date	3/30/1998
Aluminum	258
Calcium	26,600
Copper	38.0
Iron	4,470
Lead	31.0
Magnesium	6,530
Manganese	102
Potassium	2,780
Sodium	1,660
Zinc	274

RYSW12	
Date	6/25/2002
Aluminum	130 J [150 J]
Barium	78.9 [79.6]
Calcium	57,700 [57,500]
Iron	237 [274]
Lead	0.990 B [1.10 B]
Magnesium	16,900 [17,000]
Manganese	21.1 [21.4]
Potassium	3,420 [3,750]
Sodium	36,000 [36,800]
Zinc	<20.0 [7.60 J]

RYSW13	
Date	6/25/2002
Aluminum	150 J
Barium	78.7
Calcium	59,000
Iron	210
Lead	0.880 B
Magnesium	17,100
Manganese	19.5
Potassium	3,590
Sodium	36,200

Legend

- Sample Location All Detects Below RSLs
- Sample Location Above Industrial Criteria and Background (Inorganics only)
- Sample Location Above Residential Criteria and Background (Inorganics only)
- Monitoring Well
- Surface Water
- Paved Roads
- Railway Spur
- Drainage Ditch
- SWMU Area
- Building Footprint and Identification

Analytical Data Legend

J	Constituent concentration qualified as estimated
K	Estimated concentration bias high
L	Estimated concentration bias low
B	Constituent concentration quantified as estimated
3.4	Yellow shaded results indicate detection above Residential RSL
903	Green shaded results indicate detection above Industrial RSL
903	Bolded results indicate detection above Background (Inorganics only)
	Units for Soil and Sediment Samples reported in mg/kg (Miligrams per kilogram)
	Units for TCLP Samples reported in mg/L (Miligrams per Liter)

0 200 400

SCALE IN FEET

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

INOGANIC CONSTITUENT DETECTIONS IN SURFACE WATER RAIL YARD

ARCADIS

FIGURE 8-7

RYSW02	
Date	6/27/2002
Naphthalene	0.020 B

RYSW03	
Date	7/15/2002
Nitrobenzene	0.13 J
Nitroglycerine	0.61 J
2,4,5-TP	0.05 J
Delta-BHC	0.01 J
Naphthalene	0.030 B
Benzoic Acid	4.5 J
bis(2-Ethylhexyl)phthalate	4.8 B

RYSW04	
Date	7/15/2002
m-Nitrotoluene	1.25
Nitrobenzene	0.2 J
Naphthalene	0.030 B
Benzoic Acid	6.0 J
bis(2-Ethylhexyl)phthalate	5.8 B

RYSW05	
Date	6/27/2002
Nitrobenzene	0.15 J [0.14 J]
Endosulfan Sulfate	0.03 [0.02]
Endrin Aldehyde	0.01 J [<0.02]
2-Methylnaphthalene	0.020 J [0.030 J]
Naphthalene	0.020 B [0.020 B]
Phenanthrene	<0.050 [0.020 J]
Carbon Disulfide	0.17 B [0.30 B]
Benzoic Acid	5.7 J [4.8 J]
Butylbenzylphthalate	0.37 B [<5.0]
Di-n-Butylphthalate	1.0 B [<5.0]

RYSW15	
Date	7/11/2002
All Analytes	No Detects

RYSW12	
Date	6/25/2002
m-Nitrotoluene	0.4 J [0.45 J]
2,4-D	4.2 [4.66]
2,4-DB	<2 [0.41 J]
MCPA	<125 [110 J]
MCPP	46.3 J [<125]
Dieldrin	0.00719 J [0.00672 J]
Endrin Ketone	<0.02 [0.00828 J]
Carbon Disulfide	0.15 B [0.16 B]
Chloroform	0.36 J [0.37 J]
Benzoic Acid	6.1 J [<25]
bis(2-Ethylhexyl)phthalate	3.5 J [8.0]
Butylbenzylphthalate	1.1 B [0.32 B]
Diethylphthalate	0.37 J [<5.0]
Di-n-Butylphthalate	0.86 B [0.94 B]

RYSW13	
Date	6/25/2002
m-Nitrotoluene	0.38 J
2,4-D	4.09
4,4'-DDT	0.01 J
Dieldrin	0.0063 J
Chloroform	0.36 J
Benzoic Acid	5.7 J
bis(2-Ethylhexyl)phthalate	2.0 J
Butylbenzylphthalate	0.68 B
Di-n-Butylphthalate	0.89 B

Legend

- Sample Location All Detects Below RSLs
- Sample Location Above Industrial Criteria and Background (Inorganics only)
- Sample Location Above Residential Criteria and Background (Inorganics only)
- Monitoring Well
- Surface Water
- Paved Roads
- Railway Spur
- Drainage Ditch
- SWMU Area
- 1303 Building Footprint and Identification

Analytical Data Legend

- J Constituent concentration qualified as estimated
- K Estimated concentration bias high
- L Estimated concentration bias low
- B Constituent concentration quantified as estimated
- 3.4 Yellow shaded results indicate detection above Residential RSL
- 903 Green shaded results indicate detection above Industrial RSL
- **903** Bolded results indicate detection above Background (Inorganics only)
- Units for Soil and Sediment Samples reported in mg/kg (Miligrams per kilogram)
- Units for TCLP Samples reported in mg/L (Miligrams per Liter)

0 200 400
SCALE IN FEET

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

ORGANIC CONSTITUENT DETECTIONS IN SURFACE WATER RAIL YARD

ARCADIS

FIGURE 8-8

LEGEND

- TOP OF BERM
- FORMER BURN CAGE
- BREAK BETWEEN ASPHALT AND DIRT ROAD
- UNLINED DRAINAGE DITCH
- TEST PIT AREA (1999 RI)
- SURFACE WATER
- PAVED ROADS
- DIRT ROADS
- BUILDINGS
- STUDY AREA
- INSTALLATION BOUNDARY

N

0 100 200 Feet

GRAPHIC SCALE

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

WESTERN BURNING GROUND SITE LAYOUT

ARCADIS

FIGURE 9-1

NYC: SER 4/AIT: DB: TBR LD: TBR PIC: TL
Radford (GP08RAAP.00PM)
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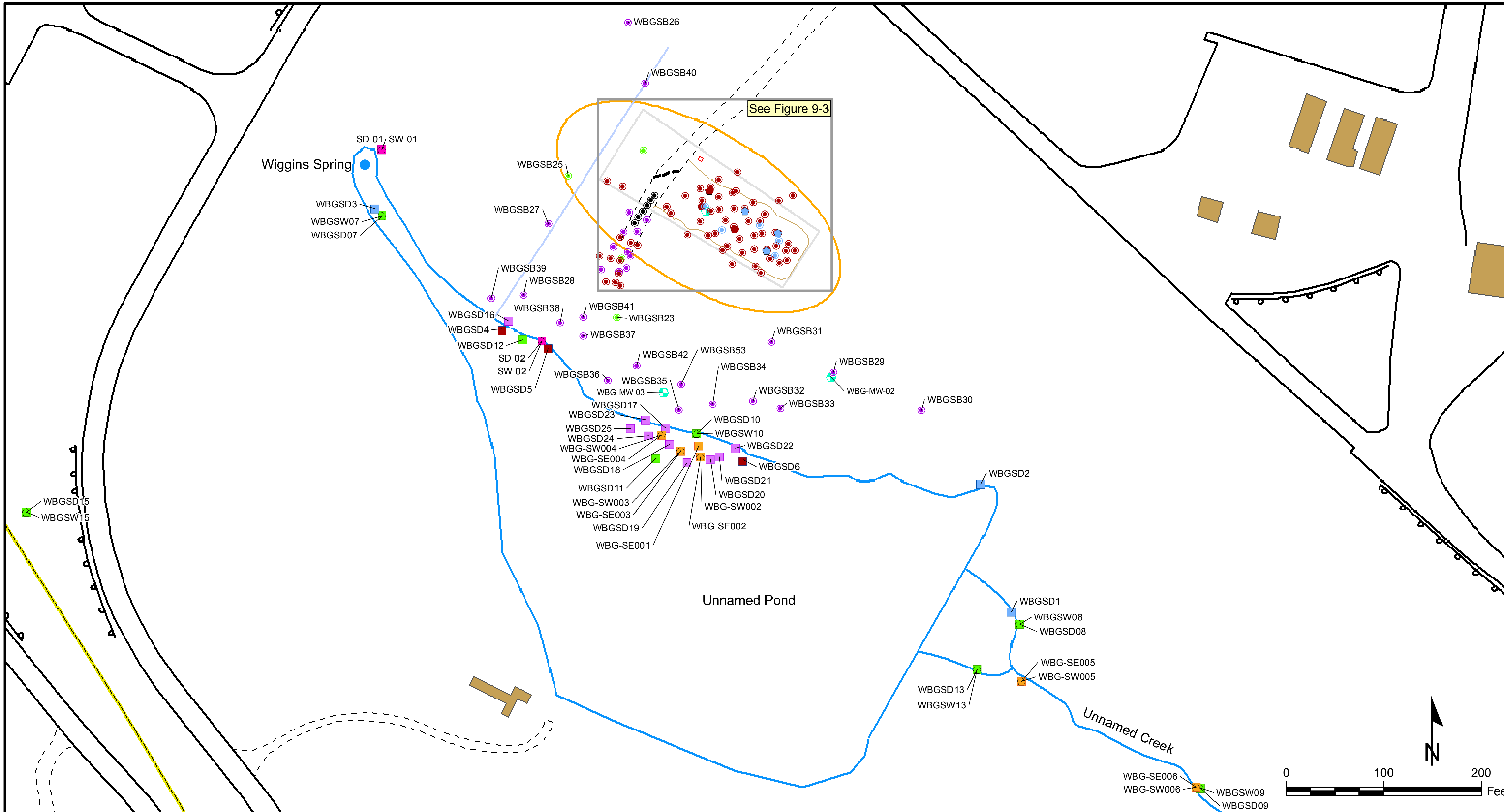

LEGEND

- SPRINGS
- 1997 GANNETT FLEMMING, SEDIMENT
- 1997 GANNETT FLEMMING, SURFACE WATER
- 1998 ICF KE, SOIL
- 1998 ICF KE, SEDIMENT
- 1998 ICF KE, SURFACE WATER
- 1999 ICF KE, SOIL
- 1999 ICF KE, SEDIMENT
- 1999 ICF KE, SURFACE WATER
- SHAW 2002, SOIL
- SHAW 2002, SEDIMENT
- SHAW 2002, SURFACE WATER
- SHAW 2004, SOIL
- SHAW 2004, SEDIMENT
- SHAW 2004, SURFACE WATER
- ARCADIS 2008, SEDIMENT
- ARCADIS 2008, SURFACE WATER
- 1999 QUALITATIVE SOIL BORING LOCATION
- MONITORING WELLS
- STUDY AREA
- INSTALLATION BOUNDARY
- PAVED ROADS
- DIRT ROADS
- TOP OF BERM
- FORMER BURN CAGE
- BREAK BETWEEN ASPHALT AND DIRT ROAD
- UNLINED DRAINAGE DITCH
- TEST PIT AREA (1999 RI)
- SURFACE WATER

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

WESTERN BURNING GROUND SAMPLE LOCATIONS

ARCADIS

FIGURE
9-2

NYC: SER 4/AIT: DB: TBR LD: TBR PIC: TL
Radford (GP08RAAP.00PM)
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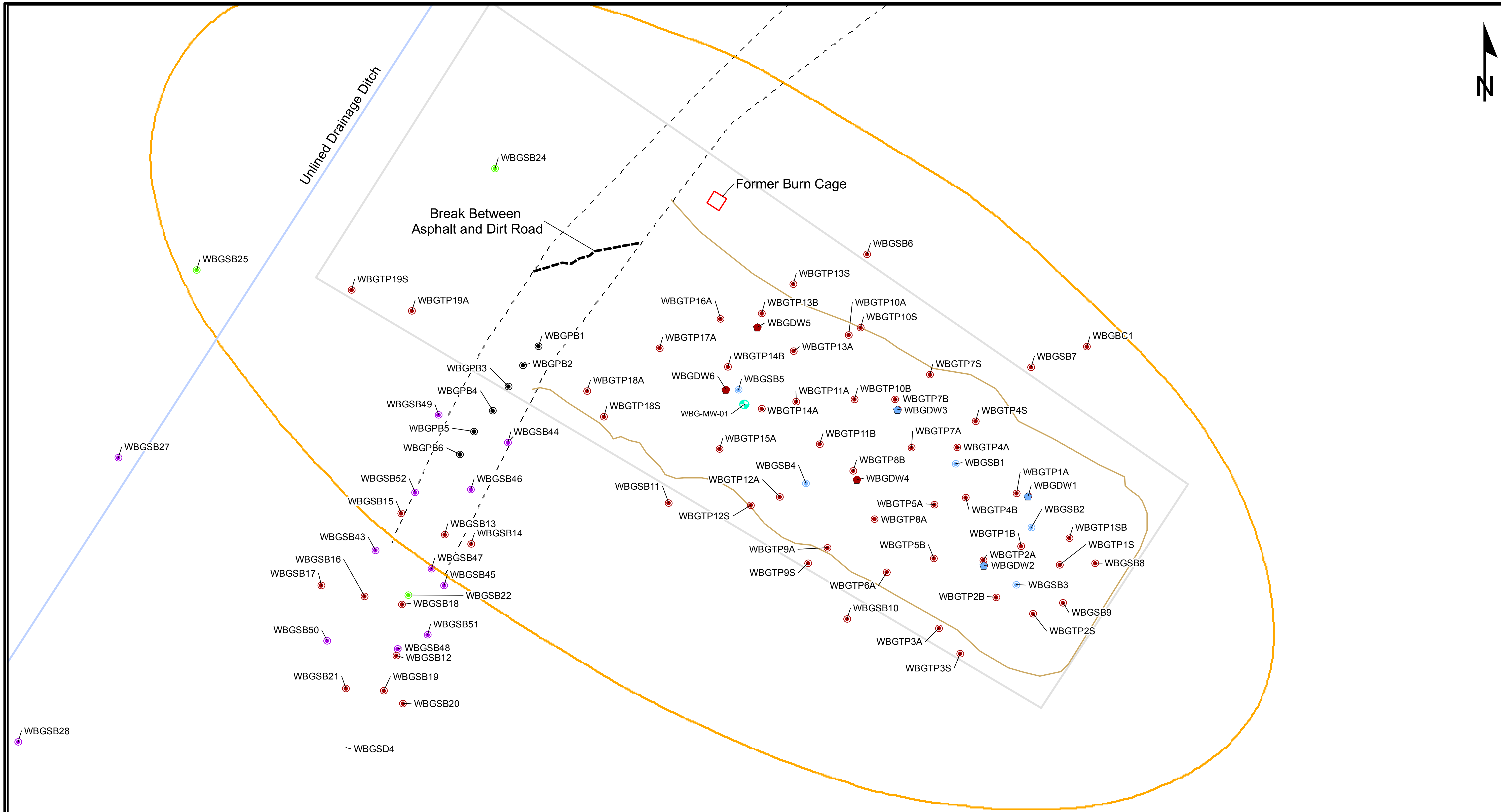

LEGEND

- SPRINGS
- 1997 GANNETT FLEMMING, SEDIMENT
- 1997 GANNETT FLEMMING, SURFACE WATER
- 1998 ICF KE, SOIL
- 1998 ICF KE, SEDIMENT
- 1998 ICF KE, SURFACE WATER
- 1999 ICF KE, SOIL
- 1999 ICF KE, SEDIMENT
- 1999 ICF KE, SURFACE WATER
- SHAW 2002, SOIL
- SHAW 2002, SEDIMENT
- SHAW 2002, SURFACE WATER
- SHAW 2004, SOIL
- SHAW 2004, SEDIMENT
- SHAW 2004, SURFACE WATER
- ARCADIS 2008, SEDIMENT
- ARCADIS 2008, SURFACE WATER
- 1999 QUALITATIVE SOIL BORING LOCATION
- MONITORING WELL
- STUDY AREA
- INSTALLATION BOUNDARY
- PAVED ROADS
- DIRT ROADS
- TOP OF BERM
- FORMER BURN CAGE
- BREAK BETWEEN ASPHALT AND DIRT ROAD
- UNLINED DRAINAGE DITCH
- TEST PIT AREA (1999 RI)
- SURFACE WATER

0 10 20 40
Scale in Feet

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

WESTERN BURNING GROUND TEST PIT SAMPLE LOCATIONS

ARCADIS

FIGURE
9-3

NYC: SER 4/AIT: DB: TBR LD: TBR PIC: TL
Radford (GP08RAAP.00PM)
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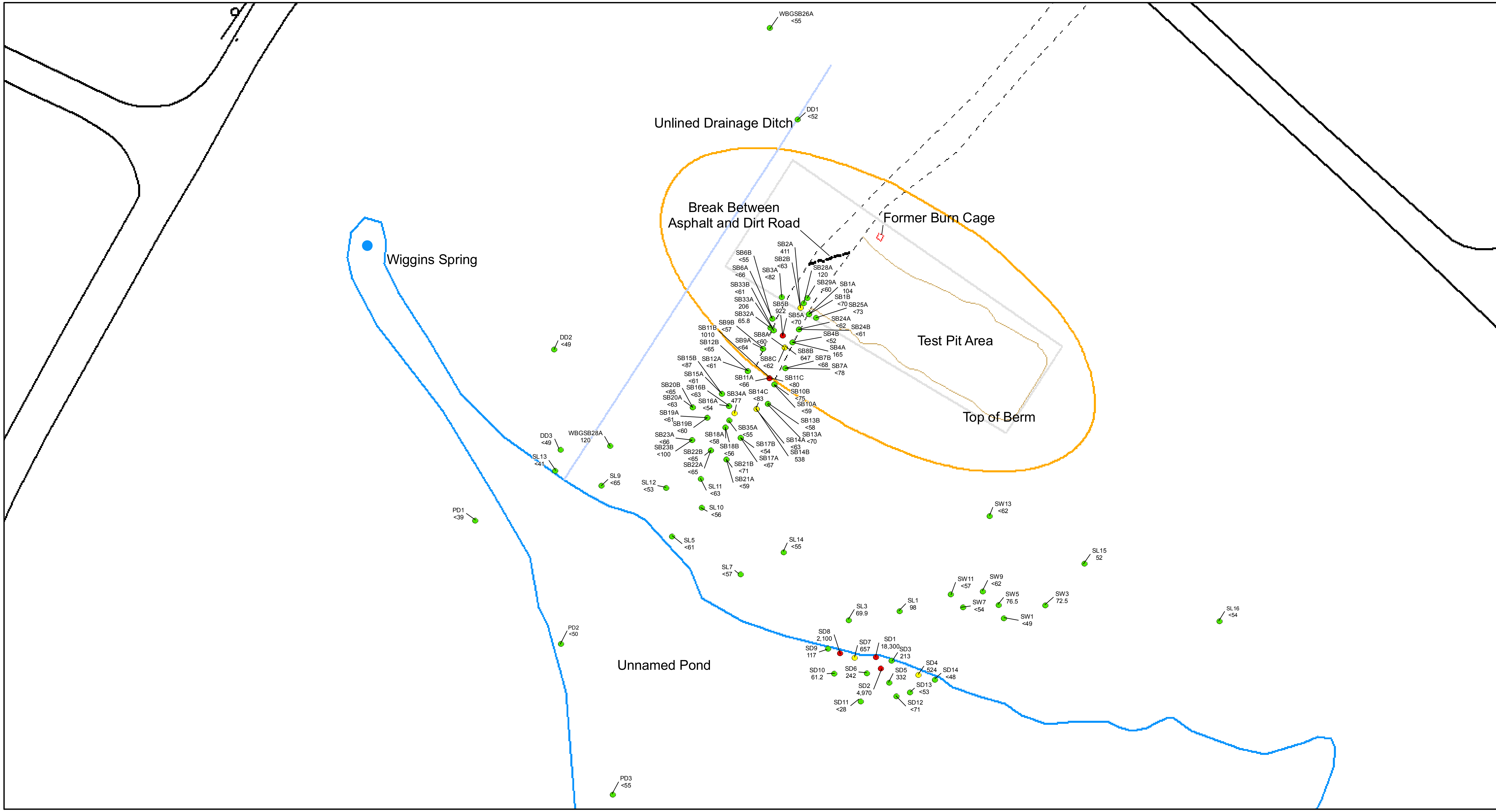

LEGEND

XRF LEAD SCREENING RESULT
- <400 MG/KG
- 400-750 MG/KG
- >750 MG/KG

- TOP OF BERM
- FORMER BURN CAGE
- BREAK BETWEEN ASPHALT AND DIRT ROAD
- UNLINED DRAINAGE DITCH
- TEST PIT AREA (1999 RI)
- SURFACE WATER
- PAVED ROADS
- DIRT ROADS
- BUILDINGS
- STUDY AREA
- INSTALLATION BOUNDARY

N

0 65 130 Feet

GRAPHIC SCALE

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

XRF FIELD SCREENING LOCATIONS AND RESULTS
WESTERN BURNING GROUND

ARCADIS

FIGURE
9-4

NYC: SER 4/AIT: DB: TBR LD: TBR PIC: TL
Radford (GP08RAAP.00PM)
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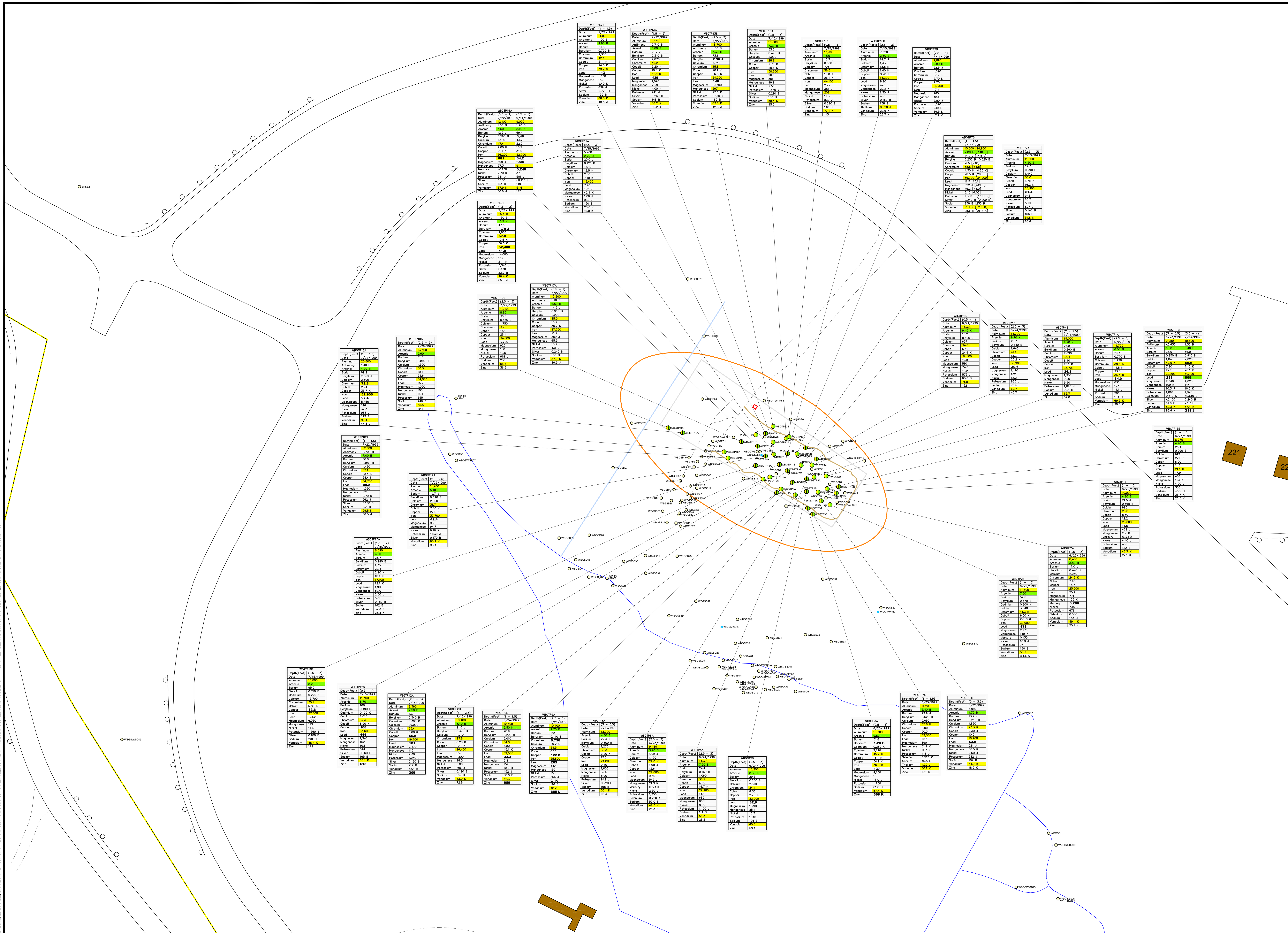


Legend

- Sample Location All Detects Below RSLs
- Sample Location Above Industrial Criteria and Background (Inorganics only)
- Sample Location Above Residential Criteria and Background (Inorganics only)
- Monitoring Well
- Surface Water
- Paved Roads
- Railway Spur
- Drainage Ditch
- Unlined Drainage Ditch
- Top of Berm
- Test Pit Area (1999 RI)
- Former Burn Cage
- SWMU Area
- Building Footprint and Identification

Analytical Data Legend

J	Constituent concentration qualified as estimated
K	Estimated concentration bias high
L	Estimated concentration bias low
B	Constituent concentration quantified as estimated
3.4	Yellow shaded results indicate detection above Residential RSL
903	Green shaded results indicate detection above Industrial RSL
903	Bolded results indicate detection above Background (Inorganics only)
	Units for Soil and Sediment Samples reported in mg/kg (Miligrams per kilogram)
	Units for TCLP Samples reported in mg/L (Miligrams per Liter)
Note:	Sample Locations SS-04, SS-04a, and SS-05 not located

0 50 100

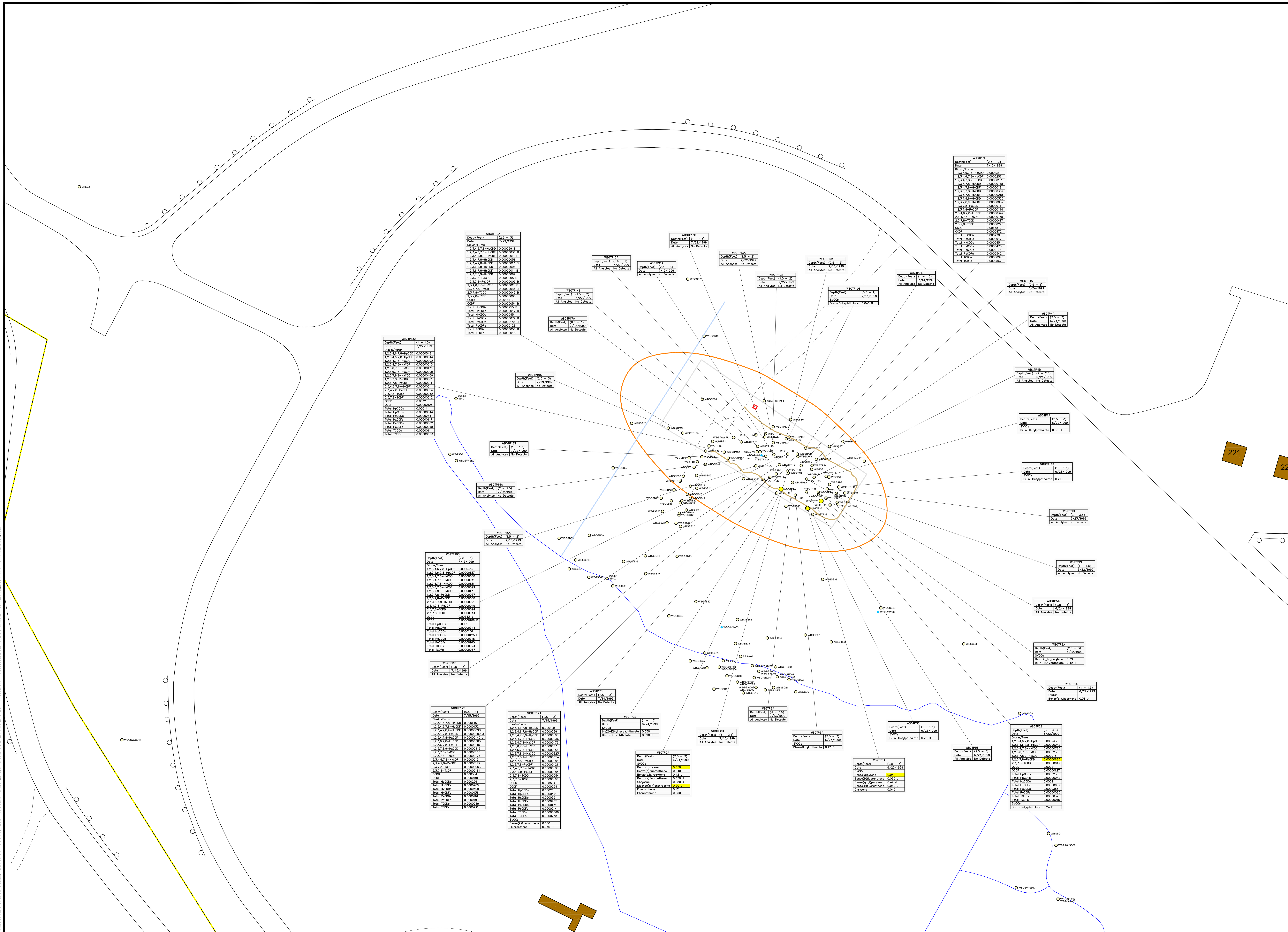
SCALE IN FEET

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

TEST PIT INORGANIC SAMPLING RESULTS WESTERN BURNING GROUND

ARCADIS

FIGURE 9-5



Legend

- Sample Location All Detects Below RSLs
- Sample Location Above Industrial Criteria and Background (Inorganics only)
- Sample Location Above Residential Criteria and Background (Inorganics only)
- Monitoring Well
- Surface Water
- Paved Roads
- Railway Spur
- Drainage Ditch
- Unlined Drainage Ditch
- Top of Berm
- Test Pit Area (1999 RI)
- Former Burn Cage
- SWMU Area
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Analytical Data Legend

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	Units for Soil and Sediment Samples reported in mg/kg (Miligrams per kilogram)
	Units for TCLP Samples reported in mg/L (Miligrams per Liter)
Note:	Sample Locations SS-04, SS-04a, and SS-05 not located

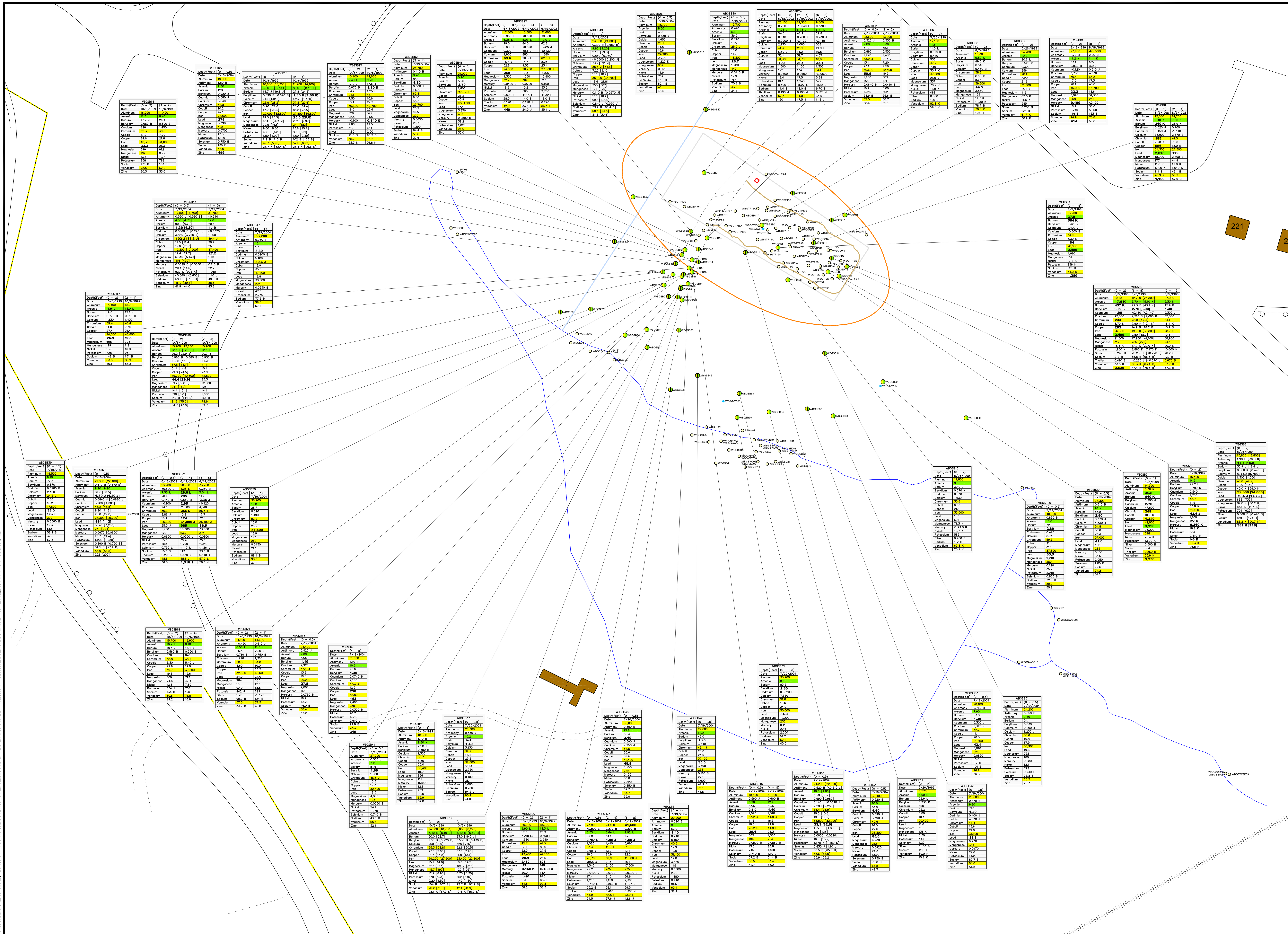
0 50 100
SCALE IN FEET

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

TEST PIT ORGANIC
SAMPLING RESULTS
WESTERN BURNING GROUND

ARCADIS

FIGURE
9-6



WBGSB14		
Depth(Feet)	(0 – 2)	(2 – 4)
Date	10/6/1999	10/6/1999
Aluminum	16,000	11,400
Arsenic	11.3 L	8.40 L
Barium	17.2 J	24.4 J
Beryllium	0.680 B	0.690 B
Calcium	826	1,450
Chromium	32.3	30.6
Cobalt	17.9	7.70
Copper	24.6	21.8
Iron	40,300	31,600
Lead	**33.3**	21.3
Magnesium	699	912
Manganese	192	83.2
Nickel	13.8	10.7
Potassium	858	788
Sodium	176 B	163 B
Vanadium	78.5	62.2
Zinc	30.3	33.0

WBGSB27	
Depth(Feet)	(0 – 0.5)
Date	7/16/2004
Aluminum	19,000
Antimony	1.60 B
Arsenic	9.50
Barium	128
Beryllium	0.920 J
Cadmium	0.380 J
Calcium	8,840
Chromium	44.8
Cobalt	10.2
Copper	47.1
Iron	24,600
Lead	**279**
Magnesium	3,390
Manganese	428
Mercury	0.0700
Nickel	17.3
Potassium	1,120
Selenium	0.750 B
Sodium	136 B
Vanadium	48.0
Zinc	**459**

WBGSB13		
Depth(Feet)	(0 – 2)	(2 – 4)
Date	10/6/1999	10/6/1999
Aluminum	10,600 [10,300]	11,700 [14,100]
Arsenic	6.80 B [8.70 L]	8.00 L [8.40 L]
Barium	14.7 J [19.8 J]	27.8 [24.3]
Beryllium	0.590 B [0.620 B]	**1.30 B [1.00 B]**
Calcium	714 [1,040]	1,230 [1,480]
Chromium	23.9 [28.2]	37.3 [29.6]
Cobalt	6.20 [22.6]	23.0 [14.4]
Copper	17.7 [20.4]	18.2 [25.5]
Iron	29,000 [32,800]	27,800 [39,800]
Lead	19.3 [25.3]	**25.5 [29.0]**
Magnesium	434 J [474 J]	2,510 [897]
Manganese	79.9 [162]	241 [183]
Nickel	9.00 [8.60]	13.6 [15.7]
Potassium	488 J [528]	861 [619]
Silver	1.50 [1.90]	1.60 [2.30]
Sodium	119 B [113 B]	102 B [103 B]
Vanadium	49.7 [58.5]	52.5 [68.9]
Zinc	25.7 K [32.4 K]	28.4 K [29.6 K]

WBGSB15		
Depth(Feet)	(0 – 2)	(2 – 4)
Date	10/6/1999	10/6/1999
Aluminum	10,400	14,600
Arsenic	7.40 B	9.20 L
Barium	17.0 J	17.6 J
Beryllium	0.670 B	**1.10 B**
Calcium	643	1,250
Chromium	24.1	43.1
Cobalt	7.50	10.6
Copper	18.4	27.2
Iron	30,300	42,700
Lead	18.0	25.6
Magnesium	526	372 J
Manganese	92.5	71.5
Mercury	<0.100	**0.140 K**
Nickel	9.60	19.5
Potassium	512	634
Silver	1.80	2.00
Sodium	91.8 B	95.7 B
Vanadium	55.7	76.2
Zinc	23.7 K	31.8 K

WBGSB52	
Depth(Feet)	(3 – 4)
Date	7/19/2004
Aluminum	26,700
Antimony	0.410 B
Arsenic	8.70
Barium	88.1
Beryllium	**1.80**
Cadmium	0.300 J
Calcium	14,700
Chromium	62.8
Cobalt	9.30
Copper	18.7
Iron	23,700
Lead	20.7
Magnesium	16,500
Manganese	220
Mercury	0.0650
Nickel	23.7
Potassium	1,290
Sodium	84.4 B
Vanadium	56.8
Zinc	39.6

WBGSB46	
Depth(Feet)	(4 – 5)
Date	7/19/2004
Aluminum	31,000
Arsenic	5.90
Barium	58.6
Beryllium	**2.70**
Calcium	1,800
Chromium	**75.3 J**
Cobalt	23.2
Copper	40.9
Iron	**52,100**
Lead	17.4
Magnesium	3,270
Manganese	489
Mercury	0.0500 B
Nickel	38.2
Potassium	1,020
Vanadium	96.0
Zinc	32.0

WBGSB25			
Depth(Feet)	(0 – 0.5)	(2 – 4)	(6 – 8)
Date	6/18/2002	6/19/2002	6/19/2002
Aluminum	17,500	15,300	31,600
Antimony	0.850 L	<0.590 L	<0.650 L
Arsenic	6.38 L	5.03 L	10.0 L
Barium	99.0	84.0	62.2
Beryllium	0.600 L	<0.590	**3.25 J**
Cadmium	0.300	<0.110	<0.130
Calcium	4,900	885	1,880
Chromium	**69.6**	20.8 L	62.3 L
Cobalt	11.7 J	14.7	8.28
Copper	52.8	9.52	23.4
Iron	24,000	20,700 J	27,800 J
Lead	**259**	19.3	**30.5**
Magnesium	4,300	1,050	13,400
Manganese	323	309	71.1
Mercury	0.0400 J	0.0700	0.100
Nickel	18.9	10.2	33.3
Potassium	1,070	565	2,780
Selenium	0.500 L	<1.18 L	<1.32 L
Sodium	28.3	14.0 B	18.0 B
Thallium	0.170 J	0.170 J	0.220 J
Vanadium	42.9	33.6 L	56.5 L
Zinc	**449**	24.0 J	35.1 J

WBGSB49	
Depth(Feet)	(1 – 2)
Date	7/19/2004
Aluminum	23,800 [24,000]
Antimony	0.390 B [0.650 B]
Arsenic	9.90 [9.20]
Barium	27.0 [29.8]
Beryllium	0.880 [0.980]
Cadmium	<0.0300 [0.200 J]
Calcium	733 [691 J]
Chromium	35.6 J [34.6]
Cobalt	7.20 [9.10]
Copper	18.1 [18.2]
Iron	35,000 [33,200]
Lead	18.6 [21.8]
Magnesium	758 [807]
Manganese	127 [176]
Mercury	0.110 B [0.0570 J]
Nickel	16.1 [16.9]
Potassium	990 [1,020]
Selenium	0.840 J [0.950 J]
Sodium	53.9 B [88.4 B]
Vanadium	68.5 [64.5]
Zinc	31.3 [30.6]

WBGSB26	
Depth(Feet)	(0 – 0.5)
Date	7/16/2004
Aluminum	15,700
Arsenic	8.30
Barium	45.5
Beryllium	0.830 J
Calcium	1,650
Chromium	26.7
Cobalt	14.5
Copper	15.6
Iron	24,900
Lead	**32.5**
Magnesium	1,220 K
Manganese	637
Mercury	0.0610
Nickel	14.9
Potassium	702
Selenium	1.10 B
Sodium	62.1 B
Vanadium	46.1
Zinc	43.6

WBGSB40	
Depth(Feet)	(0 – 0.5)
Date	7/19/2004
Aluminum	15,700
Antimony	0.490 J
Arsenic	5.60
Barium	39.2
Beryllium	0.740
Calcium	1,150
Chromium	25.0 J
Cobalt	16.0
Copper	11.7
Iron	18,300
Lead	**28.7**
Magnesium	1,780
Manganese	449
Mercury	0.0410 B
Nickel	12.9
Potassium	764
Sodium	75.8 B
Vanadium	43.0
Zinc	34.1

WBGSB24			
Depth(Feet)	(0 – 0.5)	(2 – 4)	(6 – 8)
Date	6/18/2002	6/19/2002	6/19/2002
Aluminum	22,100	19,300	9,600
Antimony	0.290 B	<0.630 L	0.530 L
Arsenic	7.73 L	6.73 L	6.41 L
Barium	54.3	42.9	29.8
Beryllium	0.640 L	0.780 J	0.730 J
Cadmium	0.0900 J	<0.120	<0.110
Calcium	2,130	1,060	538
Chromium	41.3	25.9 L	21.9 L
Cobalt	6.59 J	14.2	19.8
Copper	32.1	31.7	4.37
Iron	31,300	31,700 J	16,600 J
Lead	**79.1**	23.3	**33.1**
Magnesium	1,500	1,150	1,300
Manganese	122	134	344
Mercury	0.0600	0.0600	<0.0500
Nickel	18.4	17.5	5.94
Potassium	813	1,240	592
Selenium	0.590 L	<1.27 L	<1.18 L
Sodium	14.4 B	18.0 B	9.70 B
Thallium	0.190 J	0.190 J	0.120 J
Vanadium	57.5	41.0 L	35.6 L
Zinc	130	17.5 J	11.8 J

WBGSB44		
Depth(Feet)	(0 – 0.5)	(1 – 2)
Date	7/19/2004	7/19/2004
Aluminum	23,600	13,200
Antimony	0.320 J	0.330 B
Arsenic	9.80	5.30
Barium	31.0	35.1
Beryllium	0.890	0.550
Calcium	1,220	1,460
Chromium	43.9 J	21.5 J
Cobalt	13.4	7.20
Copper	23.1	9.50
Iron	40,600	19,500
Lead	**59.6**	19.5
Magnesium	1,260	583
Manganese	158	171
Mercury	0.0640 B	0.0410 B
Nickel	16.4	8.00
Potassium	1,030	602
Sodium	58.9 B	55.6 B
Vanadium	67.5	38.7
Zinc	68.6	61.6

WBGSB6	
Depth(Feet)	(0 – 2)
Date	5/26/1999
Aluminum	17,100
Arsenic	11.6
Barium	11.5 L
Beryllium	0.610 K
Cadmium	0.440
Calcium	533
Chromium	37.7
Cobalt	7.10
Copper	35.7 K
Iron	37,600
Lead	21.0 J
Magnesium	337
Manganese	70.7 K
Nickel	17.9 K
Potassium	488
Silver	0.350 B
Sodium	120 B
Vanadium	82.8 K
Zinc	59.5 K

WBGSB5	
Depth(Feet)	(0 – 2)
Date	8/5/1998
Aluminum	15,300
Arsenic	9.80 K
Barium	49.6 K
Beryllium	0.540 J
Calcium	9,430 B
Chromium	38.2
Cobalt	8.60 K
Copper	53.4
Iron	39,300
Lead	**44.5**
Magnesium	3,560
Manganese	139
Nickel	11.7 K
Potassium	1,030 K
Sodium	78.7 B
Vanadium	70.3 K
Zinc	126 B

WBGSB7	
Depth(Feet)	(0 – 2)
Date	5/26/1999
Aluminum	14,700
Arsenic	10.0
Barium	20.6 L
Beryllium	0.520 K
Cadmium	0.300
Calcium	856
Chromium	28.1
Cobalt	8.20
Copper	21.6
Iron	31,800
Lead	15.1 J
Magnesium	416
Manganese	87.0 K
Nickel	11.5 K
Potassium	545
Silver	0.280 B
Sodium	123 B
Vanadium	61.7 K
Zinc	30.9 K

WBGBC1		
Depth(Feet)	(0 – 2)	(5 – 7)
Date	8/18/1999	8/18/1999
Aluminum	27,900	**46,500**
Antimony	1.70 B	2.20 B
Arsenic	11.2 K	11.4 K
Barium	33.1	105
Beryllium	0.830 B	**2.50**
Cadmium	<0.120	0.310 J
Calcium	3,730	4,630
Chromium	39.4	65.3
Cobalt	17.0	17.3
Copper	28.1	43.0
Iron	46,000	43,700
Lead	**33.2**	18.6
Magnesium	3,990	31,300
Manganese	268	256
Mercury	**0.190**	<0.120
Nickel	18.4	36.0
Potassium	1,240	5,960
Sodium	116 B	153 B
Vanadium	74.9	75.8
Zinc	**414**	59.5

WBGSB1		
Depth(Feet)	(0 – 2)	(2 – 4)
Date	8/5/1998	8/5/1998
Aluminum	12,500	14,200
Arsenic	9.40 K	7.80 K
Barium	**210 K**	26.9 K
Beryllium	0.320 J	0.700
Cadmium	0.450 J	<0.110
Calcium	33,900	2,570 B
Chromium	**195**	41.5
Cobalt	7.20 K	7.80 K
Copper	**556**	18.0 B
Iron	34,500	27,300
Lead	**2,070**	**179**
Magnesium	18,900	2,490 B
Manganese	177	44.9
Nickel	11.6 K	12.0 K
Potassium	1,100 K	1,040 K
Sodium	111 B	49.1 B
Vanadium	45.9 K	56.2 K
Zinc	**1,100**	57.6 B

WBGSB4	
Depth(Feet)	(0 – 1.5)
Date	8/5/1998
Aluminum	13,200
Arsenic	**37.9**
Barium	**584 K**
Beryllium	0.420 J
Cadmium	0.400 J
Calcium	10,600 B
Chromium	34.9
Cobalt	8.30 K
Copper	**194**
Iron	28,000
Lead	**2,480**
Magnesium	4,910
Manganese	161
Nickel	17.7 K
Potassium	836 K
Sodium	123 B
Vanadium	54.0 K
Zinc	**1,280**

WBGSB2			
Depth(Feet)	(0 – 2)	(6 – 8)	(9 – 11)
Date	8/5/1998	8/5/1998	8/5/1998
Aluminum	10,100	12,700 [23,500]	27,000
Arsenic	**17.0 K**	3.70 K [5.10 K]	5.30 K
Barium	**457 K**	22.3 B [43.1 K]	45.9 K
Beryllium	0.480 J	**2.70 [3.00]**	**1.40**
Cadmium	**1.90**	<0.140 [<0.140]	0.300 J
Calcium	97,300	4,710 B [7,060 B]	37,300
Chromium	**233**	28.0 [47.4]	64.1
Cobalt	8.70 K	7.90 K [12.1 K]	16.4 K
Copper	**203**	14.9 B [18.2 B]	13.9 B
Iron	26,300	19,900 [30,800]	28,700
Lead	**2,450**	9.50 [18.7]	13.3
Magnesium	21,000	17,900 [41,100]	58,900
Manganese	312	255 [222]	247
Nickel	18.6 K	17.7 K [29.0 K]	20.0 K
Potassium	1,950 K	2,860 K [7,170 K]	10,600 K
Silver	0.240 B	<0.280 L [<0.270 L]	<0.280 L
Sodium	217 B	65.8 B [66.8 B]	120 B
Thallium	0.410 B	<0.280 L [<0.270 L]	0.670 B
Vanadium	33.5 K	38.3 K [63.4 K]	67.7 K
Zinc	**2,520**	47.4 B [75.5 B]	57.3 B

WBGSB43		
Depth(Feet)	(0 – 0.5)	(4 – 5)
Date	7/19/2004	7/19/2004
Aluminum	17,500 [16,500]	31,700
Antimony	0.530 L [0.580 B]	<0.340
Arsenic	4.50 [4.70]	12.6
Barium	90.0 [93.9]	20.6
Beryllium	**1.30 [1.20]**	**1.10**
Cadmium	0.0660 B [0.220 J]	<0.0370
Calcium	3,860 [3,760 J]	1,060
Chromium	**102 J [33.3 J]**	49.4 J
Cobalt	11.0 [11.4]	20.2
Copper	12.9 [12.7]	25.8
Iron	19,300 [17,900]	47,400
Lead	19.4 [19.7]	**27.2**
Magnesium	5,340 [5,130]	1,190
Manganese	416 [430]	146
Mercury	0.0320 B [0.0300 J]	0.110 B
Nickel	20.4 [14.6]	22.7
Potassium	929 K [925 K]	1,060
Selenium	<0.560 [<0.600]	1.40 J
Sodium	58.1 B [81.8 B]	48.6 B
Vanadium	46.9 [39.3]	88.5
Zinc	41.9 [44.0]	43.8

WBGSB47	
Depth(Feet)	(5 – 6)
Date	7/19/2004
Aluminum	**53,700**
Antimony	0.950 B
Arsenic	10.1
Barium	181
Beryllium	**3.30**
Cadmium	0.0900 B
Calcium	5,180
Chromium	**80.6 J**
Cobalt	12.9
Copper	35.5
Iron	47,700
Lead	19.8
Magnesium	38,500
Manganese	294
Mercury	0.0330 B
Nickel	47.5
Potassium	2,230
Sodium	77.6 B
Vanadium	99.8
Zinc	67.1

WBGSB17		
Depth(Feet)	(0 – 2)	(2 – 4)
Date	10/6/1999	10/6/1999
Aluminum	15,400	15,700
Arsenic	11.9 L	13.0 L
Barium	19.6 J	17.1 J
Beryllium	0.770 B	0.810 B
Calcium	1,130	1,430
Chromium	39.4	40.4
Cobalt	11.0	7.30
Copper	27.4	31.4
Iron	44,300	48,800
Lead	**26.9**	**26.9**
Magnesium	698	708
Manganese	119	119
Nickel	13.8	16.0
Potassium	728	981
Sodium	142 B	151 B
Vanadium	83.5	88.9
Zinc	40.1	53.3

WBGSB16		
Depth(Feet)	(0 – 2)	(2 – 4)
Date	10/6/1999	10/6/1999
Aluminum	13,700 [13,200]	15,900
Arsenic	12.5 L [12.0 L]	12.5 L
Barium	26.3 [22.9 J]	20.7 J
Beryllium	0.960 B [0.680 B]	0.930 B
Calcium	1,300 [1,190]	1,420
Chromium	37.5 [34.1]	41.1
Cobalt	31.4 [14.8]	10.1
Copper	29.8 [24.5]	23.9
Iron	46,700 [40,300]	42,500
Lead	**44.4 [29.9]**	25.3
Magnesium	693 [588 J]	12,000
Manganese	241 [160]	125
Nickel	14.4 [12.1]	14.1
Potassium	690 [621]	1,030
Sodium	149 B [144 B]	163 B
Vanadium	81.6 [75.0]	74.9
Zinc	54.7 [43.9]	39.7

WBGSB39	
Depth(Feet)	(0 – 0.5)
Date	7/19/2004
Aluminum	16,500
Arsenic	6.10
Barium	72.5
Beryllium	0.870
Cadmium	0.0780 B
Calcium	2,400
Chromium	24.2 J
Cobalt	7.50
Copper	16.2
Iron	17,600
Lead	**38.0**
Magnesium	1,530
Manganese	292
Mercury	0.0360 B
Nickel	12.3
Potassium	612
Sodium	58.4 B
Vanadium	37.5
Zinc	67.5

WBGSB28	
Depth(Feet)	(0 – 0.5)
Date	7/16/2004
Aluminum	21,800 [22,400]
Antimony	0.610 B [0.570 B]
Arsenic	9.40 [9.90]
Barium	81.7 [86.5]
Beryllium	**1.30 J [1.40 J]**
Cadmium	0.0840 J [0.0880 J]
Calcium	3,980 [4,000]
Chromium	45.2 [45.5]
Cobalt	9.80 [11.2]
Copper	28.6 [29.8]
Iron	28,300 [29,200]
Lead	**114 [112]**
Magnesium	3,140 [3,230]
Manganese	251 [294]
Mercury	0.0670 [0.0600]
Nickel	20.7 [21.4]
Potassium	1,200 [1,250]
Selenium	0.860 B [0.720 B]
Sodium	84.5 B [77.9 B]
Vanadium	53.9 [56.5]
Zinc	202 [200]

WBGSB22			
Depth(Feet)	(0 – 0.5)	(2 – 4)	(6 – 8)
Date	6/18/2002	6/19/2002	6/19/2002
Aluminum	18,200	20,900	33,200
Antimony	<0.500 L	4.26 L	0.280 B
Arsenic	7.53 L	**29.0 L**	7.54 L
Barium	26.9	**295**	147
Beryllium	0.440 B	0.560 B	**2.35 J**
Cadmium	<0.100	**2.95**	<0.120
Calcium	947	31,500	4,310
Chromium	30.3	**256 L**	56.6 L
Cobalt	8.86 J	10.8	17.7
Copper	16.4	**174**	32.5
Iron	26,300	**61,800 J**	36,100 J
Lead	25.3 J	**965**	**86.5**
Magnesium	1,700	18,300	33,000
Manganese	122	633	374
Mercury	0.0600	0.0500 J	0.0800
Nickel	15.3	35.4	35.6
Potassium	759	1,790	2,050
Selenium	0.750 L	<1.17 L	<1.26 L
Sodium	10.5 B	113	23.0 B
Thallium	0.200 J	0.150 J	0.410 J
Vanadium	48.6	48.1 L	57.2 L
Zinc	36.3	**1,510 J**	50.0 J

WBGSB50	
Depth(Feet)	(3 – 4)
Date	7/19/2004
Aluminum	38,200
Arsenic	12.8
Barium	28.7
Beryllium	0.890
Calcium	1,490
Chromium	52.2
Cobalt	18.0
Copper	26.2
Iron	**51,500**
Lead	18.9
Magnesium	1,010
Manganese	262
Mercury	0.0450
Nickel	21.1
Potassium	1,130
Sodium	88.4 B
Vanadium	98.6
Zinc	37.2

WBGSB10	
Depth(Feet)	(0 – 2)
Date	5/26/1999
Aluminum	14,800
Arsenic	8.50
Barium	30.0 L
Beryllium	0.570 K
Cadmium	0.330
Calcium	1,630
Chromium	30.6
Cobalt	6.00
Copper	21.1
Iron	35,000
Lead	11.6
Magnesium	601
Manganese	71.3 K
Mercury	**0.210 K**
Nickel	10.7 K
Potassium	583
Silver	0.280 B
Sodium	112 B
Vanadium	63.8 K
Zinc	25.7 K

WBGSB29	
Depth(Feet)	(0 – 0.5)
Date	7/19/2004
Aluminum	40,000
Antimony	0.830 B
Arsenic	10.8
Barium	72.9
Beryllium	**2.80**
Cadmium	0.420 J
Calcium	5,740 J
Chromium	59.5
Cobalt	21.1
Copper	31.2
Iron	37,800
Lead	**33.5**
Magnesium	9,210
Manganese	280
Mercury	0.120
Nickel	35.2
Potassium	2,910
Selenium	0.830 B
Sodium	72.0 B
Vanadium	80.9
Zinc	55.9

WBGSB30	
Depth(Feet)	(0 – 0.5)
Date	7/19/2004
Aluminum	34,300
Antimony	0.610 B
Arsenic	13.3
Barium	55.8
Beryllium	**2.90**
Cadmium	0.370 J
Calcium	4,330 J
Chromium	54.8
Cobalt	30.6
Copper	28.3
Iron	37,000
Lead	**41.0**
Magnesium	4,710
Manganese	283
Mercury	0.130
Nickel	33.6
Potassium	2,050
Selenium	1.00 B
Sodium	72.5 B
Vanadium	74.2
Zinc	51.6

WBGSB3	
Depth(Feet)	(0 – 1)
Date	8/5/1998
Aluminum	14,500
Antimony	5.30 K
Arsenic	**35.8**
Barium	**610 K**
Beryllium	0.290 J
Cadmium	**2.70**
Calcium	47,600
Chromium	**249**
Cobalt	10.9 K
Copper	**1,340**
Iron	42,900
Lead	**3,990**
Magnesium	23,200
Manganese	548
Nickel	28.4 K
Potassium	1,620 K
Silver	0.500 B
Sodium	384 B
Thallium	0.860 B
Vanadium	53.9 K
Zinc	**3,250**

WBGSB9	
Depth(Feet)	(0 – 2)
Date	5/26/1999
Aluminum	15,500
Arsenic	14.9
Barium	72.2 L
Beryllium	0.780 K
Cadmium	0.540
Calcium	1,780
Chromium	45.7
Cobalt	11.9
Copper	33.8 K
Iron	39,100
Lead	**43.6 J**
Magnesium	1,100
Manganese	122 K
Mercury	**0.210 K**
Nickel	16.2 K
Potassium	684
Silver	0.410 B
Sodium	148 B
Vanadium	82.3 K
Zinc	96.5 K

WBGSB8	
Depth(Feet)	(0 – 2)
Date	5/26/1999
Aluminum	15,800 [18,800]
Antimony	1.90 B [<0.650]
Arsenic	**17.1 [15.8]**
Barium	35.9 L [19.4 L]
Beryllium	0.650 K [0.490 K]
Cadmium	**0.740 [0.790]**
Calcium	1,300 [1,050]
Chromium	46.6 [49.7]
Cobalt	7.20 [4.80]
Copper	40.0 K [29.0 K]
Iron	**39,300 [54,000]**
Lead	**79.4 J [17.7 J]**
Magnesium	688 [735]
Manganese	82.8 K [60.2 K]
Nickel	15.1 K [11.3 K]
Potassium	704 [625]
Silver	0.360 B [0.470 B]
Sodium	159 B [124 B]
Vanadium	86.2 K [90.7 K]
Zinc	**381 K [118]**

WBGSB18		
Depth(Feet)	(0 – 2)	(2 – 4)
Date	10/6/1999	10/6/1999
Aluminum	15,700	12,900
Arsenic	10.2 L	8.10 L
Barium	18.5 J	16.4 J
Beryllium	0.560 B	0.350 B
Calcium	836	843
Chromium	38.8	38.7
Cobalt	6.30	5.40 J
Copper	22.9	19.9
Iron	39,700	39,800
Lead	19.6	12.6
Magnesium	609	713
Manganese	74.6	47.4
Nickel	12.6	7.60
Potassium	534 J	708
Sodium	134 B	126 B
Vanadium	80.6	71.0
Zinc	29.2	16.9

WBGSB21		
Depth(Feet)	(0 – 2)	(2 – 4)
Date	10/6/1999	10/6/1999
Aluminum	11,100	14,600
Antimony	<0.490	0.610 J
Arsenic	8.50 L	11.6 L
Barium	25.5	22.0 J
Beryllium	0.710 B	0.750 B
Calcium	1,220	1,360
Chromium	28.8	34.8
Cobalt	8.60	10.0
Copper	19.3	26.5
Iron	32,300	40,600
Lead	24.0	24.0
Magnesium	784	605
Manganese	158	127
Nickel	9.40	13.8
Potassium	442 J	629
Silver	1.70	<0.120
Sodium	95.2 B	124 B
Vanadium	57.3	77.5
Zinc	33.7 K	40.0

WBGSB38	
Depth(Feet)	(0 – 0.5)
Date	7/19/2004
Aluminum	24,400
Antimony	0.420 J
Arsenic	9.00
Barium	43.5
Beryllium	**1.10**
Calcium	2,920
Chromium	37.4 J
Cobalt	13.6
Copper	19.3
Iron	29,200
Lead	**27.8**
Magnesium	2,800
Manganese	166
Mercury	0.0760 B
Nickel	19.2
Potassium	1,470
Sodium	46.0 B
Vanadium	58.4
Zinc	37.2

WBGSB48	
Depth(Feet)	(4 – 5)
Date	7/19/2004
Aluminum	31,600
Antimony	1.10 B
Arsenic	10.3
Barium	95.6
Beryllium	**1.40**
Cadmium	0.0740 B
Calcium	7,160
Chromium	57.3 J
Cobalt	12.5
Copper	**258**
Iron	38,800
Lead	**163**
Magnesium	7,490
Manganese	230
Mercury	0.0300 B
Nickel	26.7
Potassium	1,380
Selenium	0.610 J
Sodium	99.8 B
Vanadium	73.3
Zinc	**315**

WBGSB41	
Depth(Feet)	(0 – 0.5)
Date	7/19/2004
Aluminum	27,000
Antimony	0.360 J
Arsenic	7.20
Barium	51.6
Beryllium	**1.60**
Calcium	1,600
Chromium	46.8 J
Cobalt	13.3
Copper	19.3
Iron	32,400
Lead	19.3
Magnesium	4,850
Manganese	193
Mercury	0.0530 B
Nickel	24.1
Potassium	1,270
Selenium	0.740 B
Sodium	43.0 B
Vanadium	65.6
Zinc	32.1

WBGSB12	
Depth(Feet)	(0 – 4)
Date	8/18/1999
Aluminum	18,300
Antimony	1.70 B
Arsenic	9.80 K
Barium	23.8 J
Beryllium	0.550 B
Calcium	1,300
Chromium	35.7
Cobalt	8.30
Copper	20.0
Iron	36,400
Lead	19.0
Magnesium	866
Manganese	111
Mercury	**0.200**
Nickel	12.8
Potassium	969
Sodium	90.0 B
Vanadium	65.9
Zinc	32.8

WBGSB37	
Depth(Feet)	(0 – 0.5)
Date	7/20/2004
Aluminum	26,300
Antimony	0.530 J
Arsenic	10.2
Barium	34.4
Beryllium	**1.40**
Calcium	3,130
Chromium	39.7 J
Cobalt	17.4
Copper	25.2
Iron	32,000
Lead	**29.1**
Magnesium	2,750
Manganese	154
Mercury	0.100
Nickel	21.1
Potassium	1,600
Selenium	0.780 B
Sodium	54.2 J
Vanadium	63.4
Zinc	41.0

WBGSB19		
Depth(Feet)	(0 – 2)	(2 – 4)
Date	10/6/1999	10/6/1999
Aluminum	14,500 [10,700]	8,650 [8,290]
Arsenic	5.40 B [5.10 B]	6.40 B [5.60 B]
Barium	20.0 [22.7]	23.0 [19.0 J]
Beryllium	1.00 B [0.720 B]	0.530 B [0.430 B]
Calcium	760 [920]	828 [776]
Chromium	35.3 [28.8]	22.6 [20.5]
Cobalt	7.10 [7.60]	8.10 [7.90]
Copper	21.3 [15.5]	11.9 [13.1]
Iron	39,200 [27,300]	23,400 [22,800]
Lead	15.1 [14.8]	18.0 [14.5]
Magnesium	627 [967]	481 J [518]
Manganese	45.7 [197]	129 [103]
Nickel	12.2 [8.90]	6.70 [5.30]
Potassium	670 [523]	652 [646]
Silver	2.20 [1.50]	1.40 [1.30]
Sodium	104 B [107 B]	92.7 B [97.2 B]
Vanadium	70.2 [51.0]	42.1 [41.9]
Zinc	28.1 K [17.7 K]	17.6 K [16.2 K]

WBGSB20		
Depth(Feet)	(0 – 2)	(2 – 4)
Date	10/6/1999	10/6/1999
Aluminum	20,900	15,700
Arsenic	9.90 L	14.3 L
Barium	17.5 J	23.9 J
Beryllium	**1.10 B**	0.660 B
Calcium	1,680	2,940
Chromium	45.7	41.3
Cobalt	17.7	8.90
Copper	32.3	27.5
Iron	43,400	47,100
Lead	**28.9**	23.6
Magnesium	2,480	808
Manganese	119	148
Mercury	**0.160 K**	**0.180 K**
Nickel	20.0	14.4
Potassium	1,420	973
Sodium	131 B	154 B
Vanadium	84.6	92.3
Zinc	38.2	38.3

WBGSB23			
Depth(Feet)	(0 – 0.5)	(2 – 4)	(6 – 8)
Date	6/18/2002	6/19/2002	6/19/2002
Aluminum	23,900	24,100	**41,600**
Antimony	<0.500 L	0.270 B	0.390 B
Arsenic	6.55 L	8.64 L	9.92 L
Barium	37.8	34.1	136
Beryllium	0.750 L	**1.09 J**	**1.55 J**
Calcium	1,020	1,410	3,610
Chromium	33.3	41.6 L	61.5 L
Cobalt	9.60 J	13.0	13.1
Copper	19.3	23.9	22.2
Iron	28,700	36,900 J	41,000 J
Lead	**26.9 J**	21.5	18.1
Magnesium	1,540	2,150	17,600
Manganese	72.2	235	275
Mercury	0.0400 J	0.0700	0.0300 J
Nickel	17.4	21.0	36.9
Potassium	1,260	1,150	2,300
Selenium	0.740 L	0.860 B	<1.27 L
Sodium	25.2 B	58.1	59.5
Thallium	0.190 J	0.410 J	0.300 J
Vanadium	54.9	68.5 L	73.9 L
Zinc	34.5	37.6 J	42.6 J

WBGSB36	
Depth(Feet)	(0 – 0.5)
Date	7/20/2004
Aluminum	39,000
Antimony	0.800 B
Arsenic	15.8
Barium	56.4
Beryllium	**3.10**
Cadmium	0.590 J
Calcium	7,950 J
Chromium	58.5
Cobalt	30.6
Copper	31.4
Iron	41,400
Lead	**45.8**
Magnesium	6,750
Manganese	282
Mercury	0.130
Nickel	36.8
Potassium	2,820
Selenium	0.850 B
Sodium	82.7 B
Vanadium	84.7
Zinc	52.0

WBGSB42	
Depth(Feet)	(0 – 0.5)
Date	7/19/2004
Aluminum	29,800
Arsenic	12.9
Barium	43.0
Beryllium	**1.90**
Calcium	3,840
Chromium	46.1 J
Cobalt	25.0
Copper	24.6
Iron	37,100
Lead	**35.5**
Magnesium	3,490
Manganese	238
Mercury	0.110 B
Nickel	27.1
Potassium	1,600
Sodium	47.9 B
Vanadium	73.1
Zinc	41.8

WBGSB51	
Depth(Feet)	(3 – 4)
Date	7/19/2004
Aluminum	29,200
Antimony	0.520 B
Arsenic	8.00
Barium	62.0
Beryllium	**1.40**
Cadmium	0.240 B
Calcium	5,150
Chromium	40.3
Cobalt	17.9
Copper	19.0
Iron	31,100
Lead	17.0
Magnesium	3,880
Manganese	145
Mercury	0.0580
Nickel	23.0
Potassium	1,480
Selenium	0.740 J
Sodium	81.6 B
Vanadium	63.4
Zinc	32.4

WBGSB45		
Depth(Feet)	(0 – 0.5)	(4 – 5)
Date	7/19/2004	7/19/2004
Aluminum	19,600	31,900
Antimony	0.560 J	0.600 B
Arsenic	8.70	12.7
Barium	33.6	39.6
Beryllium	0.810	**1.40**
Calcium	1,020	1,310
Chromium	33.2 J	44.8 J
Cobalt	11.5	16.5
Copper	16.6	24.6
Iron	28,200	44,800
Lead	**29.1**	24.3
Magnesium	865	1,350
Manganese	184	203
Mercury	0.0590 B	0.0860 B
Nickel	13.3	26.8
Potassium	745	1,160
Selenium	0.740 B	1.10 J
Sodium	57.2 B	51.4 B
Vanadium	56.5	83.4
Zinc	42.7	38.2

WBGSB35	
Depth(Feet)	(0 – 0.5)
Date	7/20/2004
Aluminum	33,700
Arsenic	8.60
Barium	83.5
Beryllium	**2.30**
Cadmium	0.0820 B
Calcium	7,550
Chromium	51.8 J
Cobalt	16.6
Copper	24.0
Iron	30,000
Lead	**54.9**
Magnesium	12,200
Manganese	233
Mercury	0.110
Nickel	29.6
Potassium	2,530
Sodium	51.2 J
Vanadium	62.1
Zinc	45.5

WBGSB53	
Depth(Feet)	(0 – 0.5)
Date	9/14/2004
Aluminum	24,200 [22,000]
Antimony	0.520 B [<0.310 L]
Arsenic	10.3 [9.80]
Barium	32.8 [31.7]
Beryllium	0.990 [0.980]
Cadmium	0.140 J [0.0690 J]
Calcium	2,280 [2,250]
Chromium	38.4 [36.9]
Cobalt	10.3 [10.8]
Copper	19.6 [19.2]
Iron	33,500 [32,700]
Lead	**33.3 [32.0]**
Magnesium	1,720 K [1,800 K]
Manganese	136 [136]
Mercury	0.0650 [0.0690]
Nickel	16.6 [15.7]
Potassium	1,170 K [1,150 K]
Selenium	0.830 J [1.10 J]
Sodium	66.5 B [65.6 B]
Vanadium	65.6 [64.0]
Zinc	35.9 [33.2]

WBGSB34	
Depth(Feet)	(0 – 0.5)
Date	7/19/2004
Aluminum	30,400
Antimony	0.520 B
Arsenic	10.8
Barium	54.9
Beryllium	**1.60**
Cadmium	0.390 J
Calcium	3,390 J
Chromium	49.6
Cobalt	16.5
Copper	22.6
Iron	33,300
Lead	**85.6**
Magnesium	4,230
Manganese	212
Mercury	0.0920
Nickel	24.3
Potassium	1,690
Selenium	0.730 B
Sodium	70.6 B
Vanadium	66.5
Zinc	48.7

WBGSB11	
Depth(Feet)	(0 – 2)
Date	5/26/1999
Aluminum	8,570
Arsenic	6.00 B
Barium	22.9 L
Beryllium	0.230 K
Calcium	660
Chromium	22.2
Cobalt	5.80
Copper	10.4
Iron	20,400
Lead	11.6
Magnesium	319
Manganese	131 K
Nickel	5.30
Potassium	444
Selenium	1.20
Silver	0.130 B
Sodium	119 B
Vanadium	39.0 K
Zinc	15.2 K

WBGSB32	
Depth(Feet)	(0 – 0.5)
Date	7/19/2004
Aluminum	28,500
Antimony	0.470 B
Arsenic	9.80
Barium	74.1
Beryllium	**1.40**
Cadmium	0.400 J
Calcium	4,030 J
Chromium	43.4
Cobalt	13.6
Copper	21.0
Iron	31,100
Lead	**31.8**
Magnesium	6,230
Manganese	364
Mercury	0.0970
Nickel	22.6
Potassium	1,620
Sodium	80.7 B
Vanadium	63.0
Zinc	51.9

WBGSB33	
Depth(Feet)	(0 – 0.5)
Date	7/19/2004
Aluminum	20,100
Antimony	0.760 B
Arsenic	7.90
Barium	53.8
Beryllium	**1.30**
Cadmium	0.300 J
Calcium	5,320 J
Chromium	32.7
Cobalt	11.1
Copper	20.5
Iron	21,600
Lead	**43.1**
Magnesium	3,010
Manganese	224
Mercury	0.0850
Nickel	16.6
Potassium	1,200
Sodium	101 B
Vanadium	46.1
Zinc	56.3

WBGSB31	
Depth(Feet)	(0 – 0.5)
Date	7/19/2004
Aluminum	24,200
Antimony	0.850 B
Arsenic	9.40
Barium	34.1
Beryllium	0.630
Cadmium	0.200 J
Calcium	1,230 J
Chromium	35.6
Cobalt	10.8
Copper	17.5
Iron	30,900
Lead	19.6
Magnesium	752
Manganese	180
Mercury	0.0800
Nickel	12.1
Potassium	792
Selenium	0.740 B
Sodium	75.8 B
Vanadium	63.5
Zinc	28.7

Legend

- Sample Location All Detects Below RSLs
- Sample Location Above Industrial Criteria and Background (Inorganics only)
- Sample Location Above Residential Criteria and Background (Inorganics only)
- Monitoring Well
- Surface Water
- Paved Roads
- Railway Spur
- Drainage Ditch
- Unlined Drainage Ditch
- Top of Berm
- Test Pit Area (1999 RI)
- Former Burn Cage
- SWMU Area
- Building Footprint and Identification

Analytical Data Legend

J	Constituent concentration qualified as estimated
K	Estimated concentration bias high
L	Estimated concentration bias low
B	Constituent concentration quantified as estimated
3.4	Yellow shaded results indicate detection above Residential RSL
903	Green shaded results indicate detection above Industrial RSL
903	Bolded results indicate detection above Background (Inorganics only)
	Units for Soil and Sediment Samples reported in mg/kg (Miligrams per kilogram)
	Units for TCLP Samples reported in mg/L (Miligrams per Liter)

Note: Sample Locations SS-04, SS-04a, and SS-05 not located

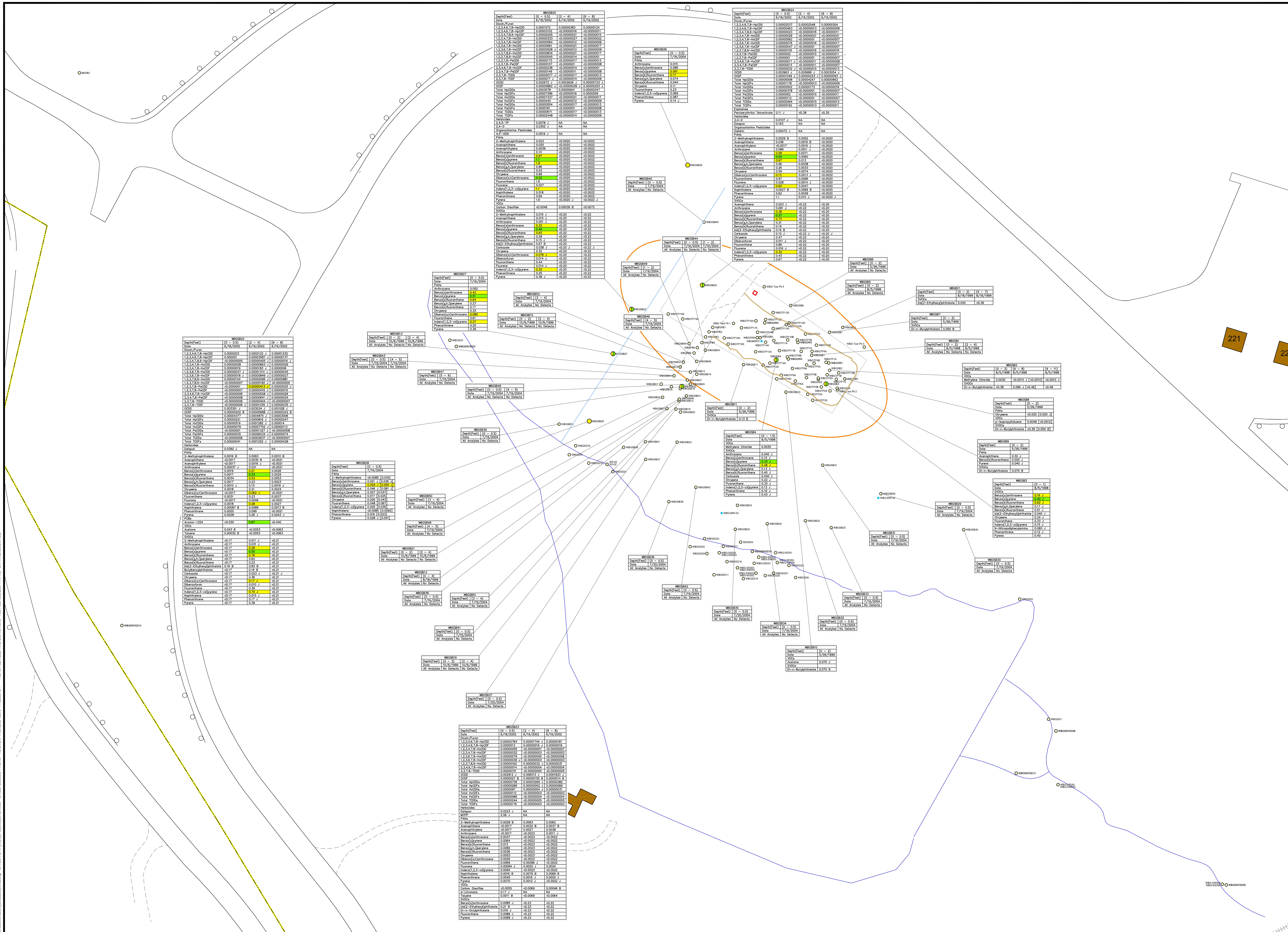
0 50 100
SCALE IN FEET

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

INORGANIC CONSTITUENT DETECTIONS IN SOIL WESTERN BURNING GROUND

ARCADIS

FIGURE
9-7



Legend

- Sample Location All Detects Below RSLs
- Sample Location Above Industrial Criteria and Background (Inorganics only)
- Sample Location Above Residential Criteria and Background (Inorganics only)
- Monitoring Well
- Surface Water
- Paved Roads
- Railway Spur
- Drainage Ditch
- Unlined Drainage Ditch
- Top of Berm
- Test Pit Area (1999 RI)
- Former Burn Cage
- SWMU Area
- 1303 Building Footprint and Identification

Analytical Data Legend

J	Constituent concentration qualified as estimated
K	Estimated concentration bias high
L	Estimated concentration bias low
B	Constituent concentration quantified as estimated
3.4	Yellow shaded results indicate detection above Residential RSL
903	Green shaded results indicate detection above Industrial RSL
903	Bolded results indicate detection above Background (Inorganics only)

Units for Soil and Sediment Samples reported in mg/kg (Miligrams per kilogram)

Units for TCLP Samples reported in mg/L (Miligrams per Liter)

Note: Sample Locations SS-04, SS-04a, and SS-05 not located

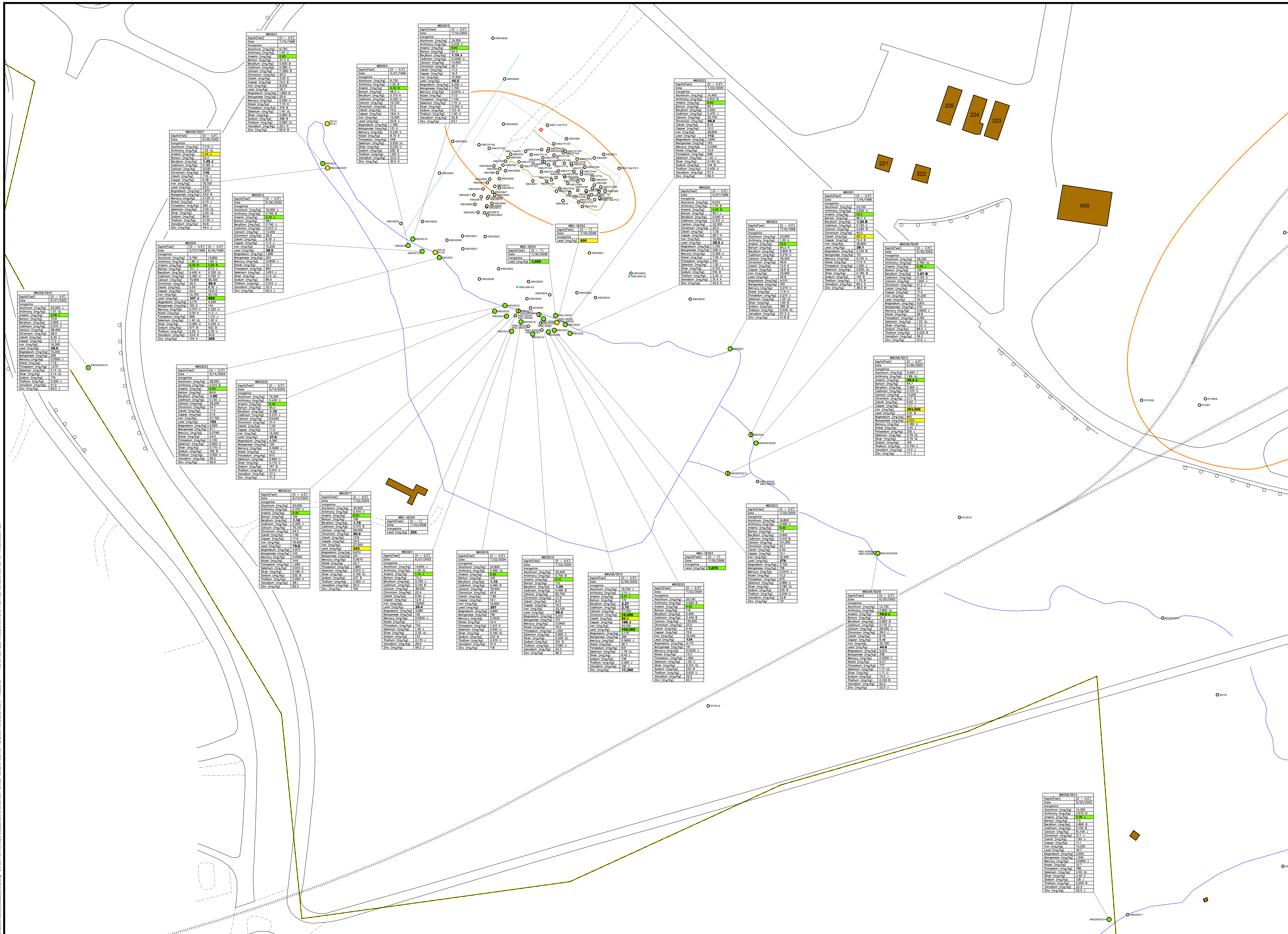
0 50 100
SCALE IN FEET

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

ORGANIC CONSTITUENT DETECTIONS IN SOIL WESTERN BURNING GROUND

ARCADIS

FIGURE
9-8



Legend

Symbol	Description
Yellow-white circle	Sample Location All Detects Below RSLs
Green circle	Sample Location Above Industrial Criteria and Background (Inorganics only)
Yellow circle	Sample Location Above Residential Criteria and Background (Inorganics only)
Blue circle	Monitoring Well
Blue line	Surface Water
Black line	Paved Roads
Hatched line	Railway Spur
Dashed line	Drainage Ditch
Light blue line	Unlined Drainage Ditch
Tan line	Top of Berm
Grey line	Test Pit Area (1999 RI)
Red line	Former Burn Cage
Orange box	SWMU Area
1303	Building Footprint and Identification

Analytical Data Legend

J	Constituent concentration qualified as estimated
K	Estimated concentration bias high
L	Estimated concentration bias low
B	Constituent concentration quantified as estimated
3.4	Yellow shaded results indicate detection above Residential RSL
903	Green shaded results indicate detection above Industrial RSL
903	Bolded results indicate detection above Background (Inorganics only)
	Units for Soil and Sediment Samples reported in mg/kg (Miligrams per kilogram)
	Units for TCLP Samples reported in mg/L (Miligrams per Liter)

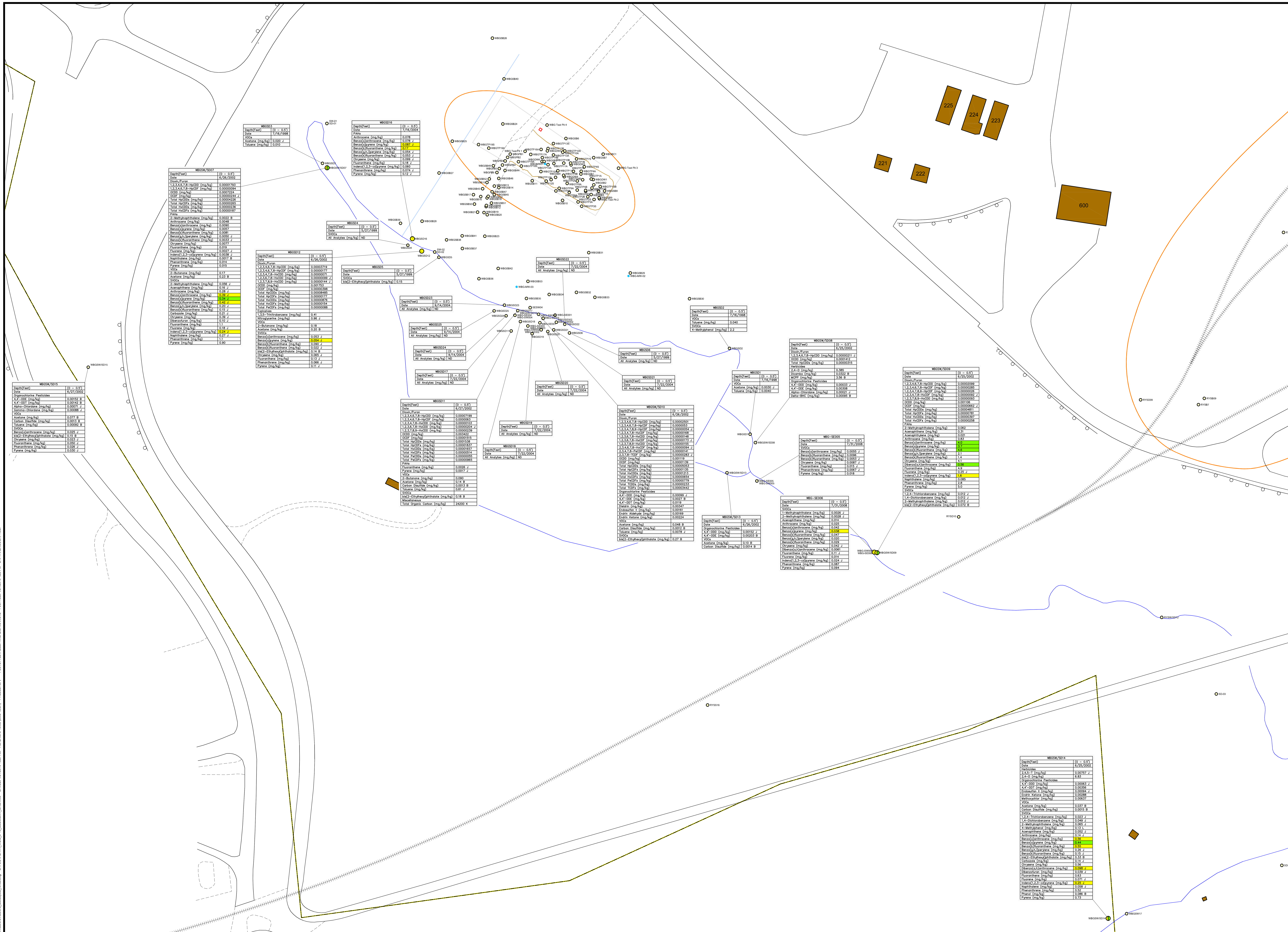
0 70 140
SCALE IN FEET

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

INORGANIC CONSTITUENT DETECTIONS IN SEDIMENT WESTERN BURNING GROUND

ARCADIS

FIGURE
9-9



Legend

- Sample Location All Detects Below RSLs
- Sample Location Above Industrial Criteria and Background (Inorganics only)
- Sample Location Above Residential Criteria and Background (Inorganics only)
- Monitoring Well
- Surface Water
- Paved Roads
- Railway Spur
- Drainage Ditch
- Unlined Drainage Ditch
- Top of Berm
- Test Pit Area (1999 RI)
- Former Burn Cage
- SWMU Area
- Building Footprint and Identification

Analytical Data Legend

J	Constituent concentration qualified as estimated
K	Estimated concentration bias high
L	Estimated concentration bias low
B	Constituent concentration quantified as estimated
3.4	Yellow shaded results indicate detection above Residential RSL
903	Green shaded results indicate detection above Industrial RSL
903	Bolded results indicate detection above Background (Inorganics only)

Units for Soil and Sediment Samples reported in mg/kg (Miligrams per kilogram)

Units for TCLP Samples reported in mg/L (Miligrams per Liter)

0 70 140

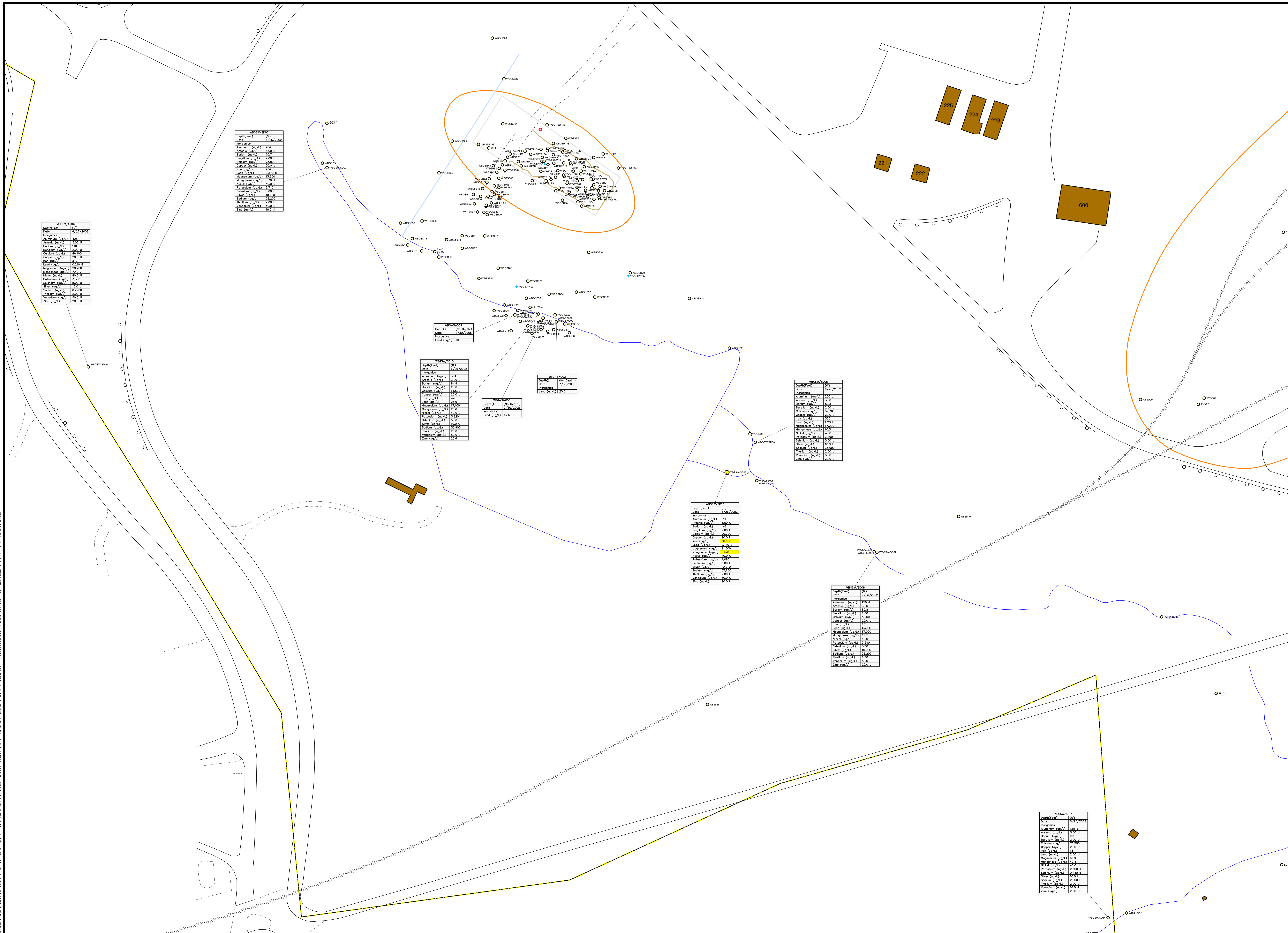
SCALE IN FEET

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

ORGANIC CONSTITUENT DETECTIONS IN SEDIMENT WESTERN BURNING GROUND

ARCADIS

FIGURE 9-10



WBGSW/SD15	
Depth(Feet)	(0')
Date	6/27/2002
Inorganics	
Aluminum (ug/L)	428
Arsenic (ug/L)	3.00 U
Barium (ug/L)	110
Beryllium (ug/L)	2.00 U
Calcium (ug/L)	86,100
Copper (ug/L)	20.0 U
Iron (ug/L)	310
Lead (ug/L)	0.210 B
Magnesium (ug/L)	20,200
Manganese (ug/L)	7.40 J
Nickel (ug/L)	40.0 U
Potassium (ug/L)	3,300
Selenium (ug/L)	5.00 U
Silver (ug/L)	10.0 U
Sodium (ug/L)	63,900
Thallium (ug/L)	2.00 U
Vanadium (ug/L)	50.0 U
Zinc (ug/L)	20.0 U

WBGSW/SD07	
Depth(Feet)	(0')
Date	6/26/2002
Inorganics	
Aluminum (ug/L)	284
Arsenic (ug/L)	3.00 U
Barium (ug/L)	70.7
Beryllium (ug/L)	2.00 U
Calcium (ug/L)	73,800
Copper (ug/L)	20.0 U
Iron (ug/L)	204
Lead (ug/L)	0.370 B
Magnesium (ug/L)	13,900
Manganese (ug/L)	5.30 J
Nickel (ug/L)	40.0 U
Potassium (ug/L)	3,710
Selenium (ug/L)	5.00 U
Silver (ug/L)	10.0 U
Sodium (ug/L)	22,200
Thallium (ug/L)	2.00 U
Vanadium (ug/L)	50.0 U
Zinc (ug/L)	18.0 J

WBG–SW004	
Depth()	(No Depth')
Date	7/30/2008
Inorganics	
Lead (ug/L)	106

WBGSW/SD10	
Depth(Feet)	(0')
Date	6/26/2002
Inorganics	
Aluminum (ug/L)	304
Arsenic (ug/L)	3.00 U
Barium (ug/L)	84.9
Beryllium (ug/L)	2.00 U
Calcium (ug/L)	61,500
Copper (ug/L)	20.0 U
Iron (ug/L)	428
Lead (ug/L)	28.9
Magnesium (ug/L)	17,100
Manganese (ug/L)	23.6
Nickel (ug/L)	40.0 U
Potassium (ug/L)	3,820
Selenium (ug/L)	5.00 U
Silver (ug/L)	10.0 U
Sodium (ug/L)	35,900
Thallium (ug/L)	2.00 U
Vanadium (ug/L)	50.0 U
Zinc (ug/L)	20.6

WBG–SW003	
Depth()	(No Depth')
Date	7/30/2008
Inorganics	
Lead (ug/L)	47.5

WBG–SW002	
Depth()	(No Depth')
Date	7/30/2008
Inorganics	
Lead (ug/L)	20.5

WBGSW/SD08	
Depth(Feet)	(0')
Date	6/25/2002
Inorganics	
Aluminum (ug/L)	200 J
Arsenic (ug/L)	3.00 U
Barium (ug/L)	80.3
Beryllium (ug/L)	2.00 U
Calcium (ug/L)	59,300
Copper (ug/L)	20.0 U
Iron (ug/L)	303
Lead (ug/L)	1.20 B
Magnesium (ug/L)	17,200
Manganese (ug/L)	10.3
Nickel (ug/L)	40.0 U
Potassium (ug/L)	3,790
Selenium (ug/L)	5.00 U
Silver (ug/L)	10.0 U
Sodium (ug/L)	36,600
Thallium (ug/L)	2.00 U
Vanadium (ug/L)	50.0 U
Zinc (ug/L)	20.0 U

WBGSW/SD13	
Depth(Feet)	(0')
Date	6/26/2002
Inorganics	
Aluminum (ug/L)	811
Arsenic (ug/L)	3.00 U
Barium (ug/L)	148
Beryllium (ug/L)	2.00 U
Calcium (ug/L)	90,700
Copper (ug/L)	20.0 U
Iron (ug/L)	50,900
Lead (ug/L)	0.170 B
Magnesium (ug/L)	21,000
Manganese (ug/L)	1,470
Nickel (ug/L)	40.0 U
Potassium (ug/L)	4,080
Selenium (ug/L)	5.00 U
Silver (ug/L)	10.0 U
Sodium (ug/L)	37,600
Thallium (ug/L)	2.00 U
Vanadium (ug/L)	50.0 U
Zinc (ug/L)	20.0 U

WBGSW/SD09	
Depth(Feet)	(0')
Date	6/25/2002
Inorganics	
Aluminum (ug/L)	150 J
Arsenic (ug/L)	3.00 U
Barium (ug/L)	80.8
Beryllium (ug/L)	2.00 U
Calcium (ug/L)	59,000
Copper (ug/L)	20.0 U
Iron (ug/L)	281
Lead (ug/L)	1.30 B
Magnesium (ug/L)	17,000
Manganese (ug/L)	21.7
Nickel (ug/L)	40.0 U
Potassium (ug/L)	3,540
Selenium (ug/L)	5.00 U
Silver (ug/L)	10.0 U
Sodium (ug/L)	36,200
Thallium (ug/L)	2.00 U
Vanadium (ug/L)	50.0 U
Zinc (ug/L)	20.0 U

WBGSW/SD14	
Depth(Feet)	(0')
Date	6/25/2002
Inorganics	
Aluminum (ug/L)	120 J
Arsenic (ug/L)	3.00 U
Barium (ug/L)	101
Beryllium (ug/L)	2.00 U
Calcium (ug/L)	70,700
Copper (ug/L)	20.0 U
Iron (ug/L)	131
Lead (ug/L)	2.00 U
Magnesium (ug/L)	15,800
Manganese (ug/L)	47.4
Nickel (ug/L)	40.0 U
Potassium (ug/L)	2,500 J
Selenium (ug/L)	0.440 B
Silver (ug/L)	10.0 U
Sodium (ug/L)	29,000
Thallium (ug/L)	2.00 U
Vanadium (ug/L)	16.0 J
Zinc (ug/L)	20.0 U

Legend

Sample Location All Detects Below RSLs
Sample Location Above Industrial Criteria and Background (Inorganics only)
Sample Location Above Residential Criteria and Background (Inorganics only)
Monitoring Well
Surface Water
Paved Roads
Railway Spur
Drainage Ditch
Unlined Drainage Ditch
Top of Berm
Test Pit Area (1999 RI)
Former Burn Cage
SWMU Area
Building Footprint and Identification

Analytical Data Legend

J Constituent concentration qualified as estimated
K Estimated concentration bias high
L Estimated concentration bias low
B Constituent concentration quantified as estimated
3.4 Yellow shaded results indicate detection above Residential RSL
903 Green shaded results indicate detection above Industrial RSL
903 Bolded results indicate detection above Background (Inorganics only)
Units for Soil and Sediment Samples reported in mg/kg (Miligrams per kilogram)
Units for TCLP Samples reported in mg/L (Miligrams per Liter)

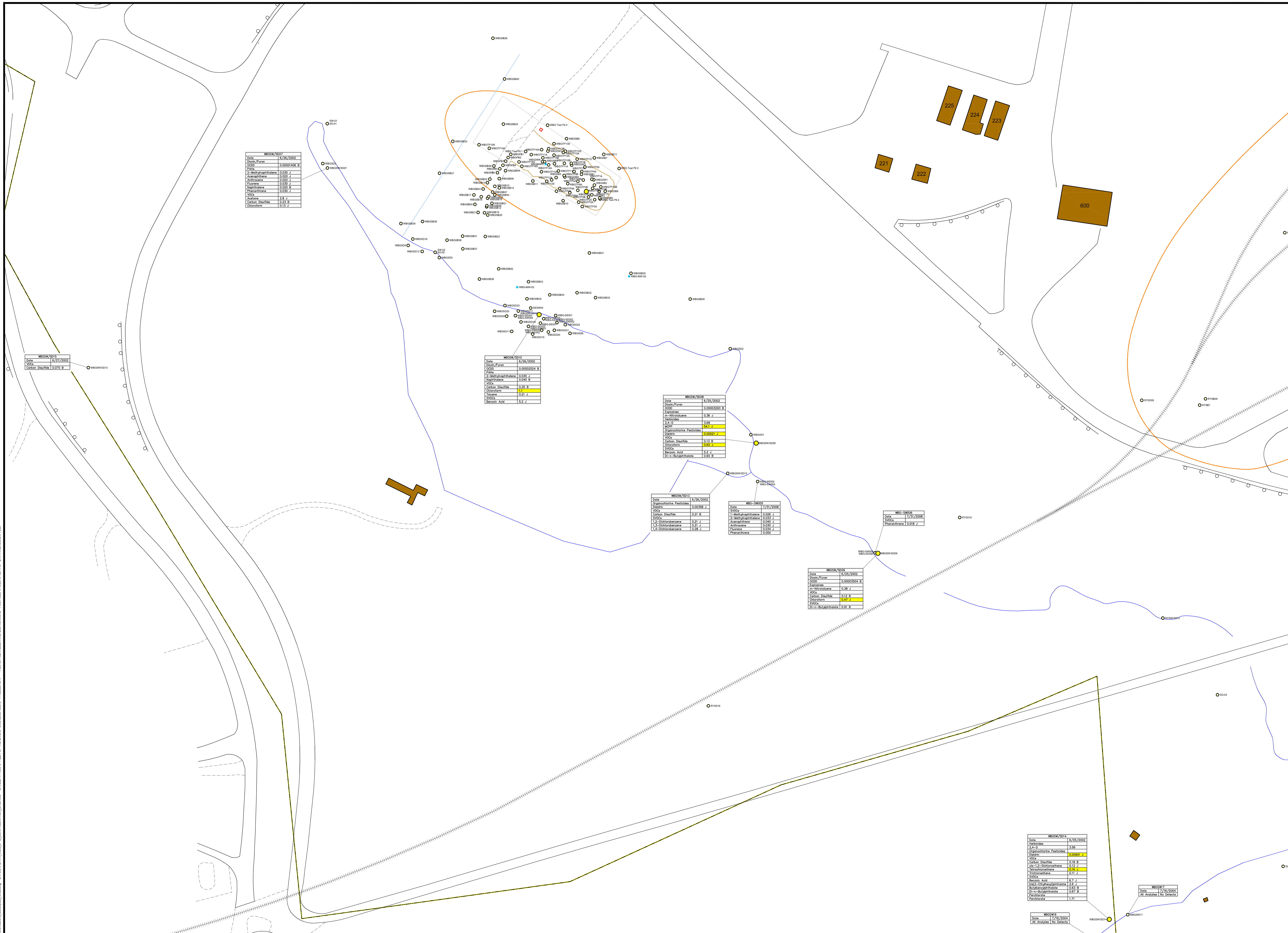
0 70 140
SCALE IN FEET

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

INORGANIC CONSTITUENT DETECTIONS IN SURFACE WATER WESTERN BURNING GROUND

ARCADIS

FIGURE 9-11



WBGSW/SD07	
Date	6/26/2002
Dioxin/Furan	
OCDD	0.00001406 B
PAHs	
2-Methylnaphthalene	0.030 J
Acenaphthene	0.020 J
Anthracene	0.020 J
Fluorene	0.030 J
Naphthalene	0.020 B
Phenanthrene	0.030 J
VOCs	
Acetone	2.8 J
Carbon Disulfide	0.23 B
Chloroform	0.13 J

WBGSW/SD15	
Date	6/27/2002
VOCs	
Carbon Disulfide	0.070 B

WBGSW/SD10	
Date	6/26/2002
Dioxin/Furan	
OCDD	0.00002524 B
PAHs	
2-Methylnaphthalene	0.030 J
Naphthalene	0.040 B
VOCs	
Carbon Disulfide	0.25 B
Chloroform	1.1
Toluene	0.21 J
SVOCs	
Benzoic Acid	5.2 J

WBGSW/SD08	
Date	6/25/2002
Dioxin/Furan	
OCDD	0.00003293 B
Explosives	
m-Nitrotoluene	0.36 J
Herbicides	
2,4-D	3.68
MCPP	54.1 J
Organochlorine Pesticides	
Dieldrin	0.00521 J
VOCs	
Carbon Disulfide	0.13 B
Chloroform	0.60 J
SVOCs	
Benzoic Acid	5.2 J
Di-n-Butylphthalate	0.60 B

WBGSW/SD13	
Date	6/26/2002
Organochlorine Pesticides	
Dieldrin	0.00358 J
VOCs	
Carbon Disulfide	0.21 B
SVOCs	
1,2-Dichlorobenzene	0.21 J
1,3-Dichlorobenzene	0.21 J
1,4-Dichlorobenzene	0.28 J

WBG-SW005	
Date	7/31/2008
SVOCs	
1-Methylnaphthalene	0.026 J
2-Methylnaphthalene	0.033 J
Acenaphthene	0.040 J
Anthracene	0.030 J
Fluorene	0.034 J
Phenanthrene	0.050

WBG-SW006	
Date	7/31/2008
SVOCs	
Phenanthrene	0.018 J

WBGSW/SD09	
Date	6/25/2002
Dioxin/Furan	
OCDD	0.00003504 B
Explosives	
m-Nitrotoluene	0.38 J
VOCs	
Carbon Disulfide	0.12 B
Chloroform	0.47 J
SVOCs	
Di-n-Butylphthalate	0.91 B

WBGSW/SD14	
Date	6/25/2002
Herbicides	
2,4-D	3.56
Organochlorine Pesticides	
Dieldrin	0.00901 J
VOCs	
Carbon Disulfide	0.18 B
cis-1,2-Dichloroethene	0.12 J
Tetrachloroethene	0.16 J
Trichloroethene	0.11 J
SVOCs	
Benzoic Acid	6.7 J
bis(2-Ethylhexyl)phthalate	2.6 J
Butylbenzylphthalate	0.63 B
Di-n-Butylphthalate	0.67 B
Perchlorate	
Perchlorate	1.71

WBGSW16	
Date	7/16/2004
All Analytes	No Detects

WBGSW17	
Date	7/16/2004
All Analytes	No Detects

Legend

- Sample Location All Detects Below RSLs
- Sample Location Above Industrial Criteria and Background (Inorganics only)
- Sample Location Above Residential Criteria and Background (Inorganics only)
- Monitoring Well
- Surface Water
- Paved Roads
- Railway Spur
- Drainage Ditch
- Unlined Drainage Ditch
- Top of Berm
- Test Pit Area (1999 RI)
- Former Burn Cage
- SWMU Area
- 1303 Building Footprint and Identification

Analytical Data Legend

- J Constituent concentration qualified as estimated
- K Estimated concentration bias high
- L Estimated concentration bias low
- B Constituent concentration quantified as estimated
- 3.4 Yellow shaded results indicate detection above Residential RSL
- 903 Green shaded results indicate detection above Industrial RSL
- **903** Bolded results indicate detection above Background (Inorganics only)
- Units for Soil and Sediment Samples reported in mg/kg (Miligrams per kilogram)
- Units for TCLP Samples reported in mg/L (Miligrams per Liter)

0 70 140
SCALE IN FEET

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

ORGANIC CONSTITUENT DETECTIONS IN SURFACE WATER WESTERN BURNING GROUND

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FIGURE 9-12

Legend

- GROUNDWATER LOCATIONS
- PAVED ROADS
- DIRT ROADS
- LOW AREA
- DRAINAGE DITCH
- CULVERT
- STUDY AREA
- NRU BOUNDARY

0 60 120 Feet

GRAPHIC SCALE

THE NORTHERN BURNING GROUND AT THE NEW RIVER UNIT
RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

NORTHERN BURNING GROUND SITE LAYOUT

ARCADIS

FIGURE **10-1**

NYC: SER 4/AIT: DB: TBR LD: TBR PIC: TL
Radford (GP08RAAP.00PM)
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Appendix A

Risk Assessment

Appendix A: Risk Assessment for New River Unit Remedial Investigation

Radford Army Ammunition Plant,
Radford, Virginia

June 2010

Tables

Figures

Acronyms and Abbreviations

ADAF	Age-dependent adjustment factor
AEC	U.S. Army Environmental Command
amsl	Above Mean Sea Level
ARAR	Applicable or Relevant and Appropriate Requirements
ARCS	Assessment and Remediation of Contaminated Sediments
ATSDR	Agency for Toxic Substances and Disease Registry
AUF	Area Use Factor
BCF	Backward Control Field
BDDT	Building Debris Disposal Trench
BERA	Baseline Ecological Risk Assessment
bgs	Below Ground Surface
BLA	Bag Loading Area
BW	Body Weight
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Constituent of Concern
COPC	Constituents of Potential Concern
COPEC	Constituents of Potential Environmental Concern
CSF	Cancer Slope Factor
CSM	Conceptual Site Model
CFR	Code of Federal Regulations
CY	Cubic yard
DAF	Dilution Attenuation Factor
DB	Data Base
DDD	Data Definition Language
EE/CA	Engineering Evaluation/Cost Analysis
ELCR	Excess Lifetime Cancer Risk
EPA	Environmental Protection Agency
EPC	Exposure Point Concentration
EPSBTU	Equilibrium Partitioning Sediment Benchmark Toxic Unit
ERA	Ecological Risk Assessment
ESL	Ecotoxicity Screening Level
FCV	Final Chronic Value
FOD	Frequency of Detection
FS	Feasibility Study
ft	Feet
ft bgs	Feet Below Ground Surface
ft msl	Feet Above Mean Sea Level
HEAST	Health Effects Assessment Summary Tables
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
IAA	Igniter Assembly Area
IRIS	Integrated Risk Information System

IRP	Installation Restoration Program
LOAEL	Lowest Observed Adverse Effect Level
MMA	Main Manufacturing Area
MCL	Maximum Contaminant Level
NA	Not Applicable
NBG	Northern Burning Ground
NCP	National Contingency Plan
NOAEL	No Observed Adverse Effect Level
NROW	New River Ordinance Works
NRU	New River Unit
NTU	Nephelometric Turbidity Unit
PAH	Polycyclic Aromatic Hydrocarbon
PBC	Performance Based Contract
PCB	Polychlorinated Biphenyl
PCDF	Polychlorinated Dibenzo Furans
PHH	Planar Halogenated Hydrocarbon
PLM	Polarized Light Microscopy
QA/QC	Quality Assurance/Quality Control
QAPA	Draft Quality Assurance Plan Addendum
RAO	Removal Action Objective
RCRA	Resource Conservation and Recovery Act
RFAAP	Radford Army Ammunition Plant
RfD	Reference Dose
RI	Remedial Investigation
RSL	Regional Screening Levels
SARA	Superfund Amendments and Reauthorization Act
SLERA	Screening-Level Ecological Risk Assessment
SMDP	Scientific Management Decision Point
SSL	Soil Screening Level
SVOC	semi-volatile organic compound
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leachate Procedure
TEF	Toxicity Equivalency Factors
TEQ	Toxic Equivalents
TOC	Total Organic Carbon
TRV	Toxicity Reference Value
TSCA	Toxic Substances Control Act
TU	Toxic Unit
UF	Uncertainty Factors
UNC	Unnamed Creek
UTL	Upper Tolerance Limit
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
VDEQ	Virginia Department of Environmental Quality

WBG	Western Burning Ground
µg/dL	Micrograms per Deciliter
µg/mL	Micrograms per Milliliter

1. Introduction

The purpose of this risk assessment is to evaluate current and reasonably anticipated future risks to human health and the environment associated with exposure to constituents detected in environmental media at the New River Unit (NRU) at the Radford Army Ammunition Plant (RFAAP).

ARCADIS prepared this human health and ecological risk assessment appendix to summarize the methodology and results of the risk assessments performed for the RFAAP-NRU. This appendix is divided into several sections and draws heavily on the information provided in the main body of the text. As such, it is not designed to be a stand alone document. Rather, it provides the general methodology used to evaluate potential exposures to receptors at the Study Areas identified at the RFAAP-NRU. The Study Areas are:

- Building Debris Disposal Trench (BDDT)
- Bag Loading Area (BLA)
- Igniter Assembly Area (IAA)
- Rail Yard (RY), and
- Western Burning Ground (WBG)

In addition to these five Study Areas, the risk assessment will evaluate potential exposure to facility-wide groundwater.

The purpose of the risk assessments was to evaluate the potential current and future excess lifetime cancer risks and potential hazards to both human and ecological receptors at the site from exposure to constituents detected in soil, groundwater, surface water, and sediment at the RFAAP-NRU. The risk assessments were conducted in a manner consistent with the approach outlined in the Master Work Plan (URS 2003) in compliance with Comprehensive Environmental Response, Compensation, and Liability Act/ Superfund Amendments and Reauthorization Act (CERCLA/SARA).

This human health and ecological risk assessment appendix is organized as follows:

- **Section 1 – Introduction.** This section provides background information related to the risk assessment.

- **Section 2 – Methods and Procedures.** This section provides the rational for the methods and procedures used during the evaluation of the data collected during the various phases of environmental investigation.

- **Sections 3 through 8 – Site Discussions.** These sections summarize the human health risk assessment (HHRA) and the ecological risk assessment (ERA) for each of the Study Areas and for facility-wide groundwater.

- **Section 9 – Conclusions and Recommendations.** This section presents a summary of the conclusions drawn from the HHRAs and ERAs.

- **Section 10 – References**.

2. Methods and Procedures

This section discusses the methods and procedures utilized to prepare the HHRA and ERAs at each of the five Study Areas (i.e., BDDT, IAA, BLA, WBG, and RY) and site-wide groundwater at the RFAAP-NRU.

2.1 Risk Assessment Data Sets

Samples collected during site investigations conducted from 1997 through 2008 were considered for inclusion in the risk assessment. The environmental data collected throughout the various phases of investigation were grouped by medium of interest (e.g., soil, sediment, groundwater and surface water) and then evaluated to produce risk assessment datasets.

2.1.1 Sample and Result Type

The following criteria were employed to determine whether a particular sample result is usable for risk assessment purposes:

- All soil sample types (i.e., hand auger, continuous core, direct-push technique) were considered usable for the risk assessment.

- Analytical results from soil samples collected from different depths at the same sampling location during the same sampling event were evaluated as independent samples.

- Data from field duplicate samples were generally considered usable for risk assessment. During statistical analysis of the data, data from a sample and its duplicate were treated as follows. In the case where an analyte was detected in either the sample or its duplicate, or in both, the higher concentration was conservatively used. Where the analyte was not detected, the lower detection method was used.

- Analytical results for the same constituent in one sample obtained by two or three different analytical methods (e.g., naphthalene, 2,4-dinitrotoluene) were generally considered usable for risk assessment. During statistical analysis of the data for constituents analyzed by two methods, the result of the more precise method was used (i.e., USEPA method 8260 over USEPA method 8270 for VOCs, USEPA method 8270-SIM over USEPA method 8270 for polycyclic aromatic hydrocarbons (PAHs), and USEPA method 8330 over USEPA method 8260 or USEPA method 8270 for explosives).

- Both filtered and unfiltered groundwater samples were collected at the RFAAP-NRU during the 2008 and 2010 sampling events, providing total and dissolved metals concentrations. Filtered groundwater data offers a better measure of the water quality as unfiltered data might have a high level of uncertainty associated with it as it could reflect constituents absorbed/adsorbed on particles in the water and not dissolved in the water itself. Filtered samples were available for those wells where the turbidity could not be reduced to an appropriate level. For these wells, the filtered samples were used rather than the unfiltered samples. If the turbidity was low, then a filtered sample was not collected. Because of the uncertainty in the turbidity levels in the groundwater samples collected in 2007, the total inorganics data from the 2007 sampling event were not used in the groundwater evaluation. However, the data for the organic constituents detected during the 2007 sampling event were included in the evaluation, along with the data from the 2008 and 2010 events.

- Fish tissue samples (fillet and whole body) were collected from the unnamed pond in the WBG. The fish filets data were used in the HHRA and the whole body data were used in the ERA.

2.1.2 Evaluation of Vertical and Spatial Data Distribution

Each of the five Study Areas was considered one exposure unit in the HHRA and the ERA. Therefore, soil, sediment and surface water data were spatially distributed into the five Study Areas: BDDT, IAA, BLA, WBG, and RY. However, groundwater was handled on a regional basis, rather than site-by-site. Groundwater is mobile and flows beneath the NRU and as such is therefore better handled on a site-wide basis.

Soil data were further subdivided by sample depth interval based on the exposure pathways identified at the site. In brief, data were categorized as follows:

- Surface soil, including soil samples collected from depths of 0 to 2 ft bgs, were used to evaluate current and potential future exposures to surface soils in the HHRA. These included samples collected from the 0-0.5, 0-1, 1-2 and 0-2 foot depth increments.

- For ecological receptors, surface soil is defined as soil from the ground surface to a depth of one foot below ground surface (bgs). Soil samples collected from depths greater than one foot bgs are not considered because wildlife typically inhabit only the uppermost portion of the soil column (USEPA 1993a,b) Thus, for the ecological risk assessment, only data from those samples collected from depths of 0 to 1 foot bgs were used to evaluate exposure.

- Surface and subsurface soil data were combined and used to evaluate the scenarios involving potential future exposure to subsurface soils in the HHRA.

2.1.3 Evaluation of Constituent Classes

Some constituents, especially those in the same class of compounds, behave similarly, thus they were grouped together for evaluation in the HHRA and/or the ERA, as discussed below.

The toxicity of dioxins and furans has been studied in relation to the toxicity of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). Screening levels and toxicity values for human health effects are available for most of the individual dioxins and furans. However, ecological screening levels are only available for 2,3,7,8-TCDD. To evaluate exposure to other dioxin congeners in the ERA, their TCDD toxic equivalents (TEQ) were calculated using the 2005 World Health Organization (WHO) toxicity equivalency factors (TEFs) (WHO 2005) following USEPA guidance (USEPA 2003a).

2.1.4 Data Summaries

After the risk assessment datasets were prepared, the data included in each dataset were summarized, statistically analyzed, and then tabularized by highlighting: the number of detects, number of samples, frequency of detection (FOD), minimum and maximum detected concentrations, minimum and maximum detection limits, and the exposure point concentrations (EPCs) following applicable guidance (USEPA 1992; 1989).

The data summaries, including maximum concentrations and EPCs for soil, sediment, and surface water for the five Study Areas, whole body and fish fillet tissue data from the unmanned pond in the WBG, and for site-wide groundwater at the RFAAP-NRU are presented and discussed in the report sections devoted to those areas.

2.2 Human Health Risk Assessment Methods and Procedures

The purpose of the HHRA is to evaluate the potential current and future risks and potential hazards to human health associated with constituents detected in surface and subsurface soil, groundwater, sediment and surface water samples collected at the RFAAP-NRU. The HHRA approach is based on the Master Work Plan (URS 2003) in compliance with CERCLA/SARA and pursuant to RCRA Corrective Action requirements. Methods used in the HHRA were in compliance with USEPA guidance for risk assessments (USEPA 2005; 2004a; 2000a; 1997a; 1992; 1991a; 1989). The HHRA discussion is organized into the following components:

- **Constituent Characterization**: identifies the most prevalent and toxic constituents to be carried through the HHRA – the constituents of potential concern (COPCs). The physical and chemical properties of those constituents are also identified in this step.

- **Toxicity Assessment**: identifies and presents summaries of the general toxicological properties of the COPCs.

- **Exposure Assessment**: identifies the potential human exposure scenarios relevant to the risk assessment.

- **Risk Characterization**: presents the estimated human health risks associated with the identified COPCs and the relevant human exposure scenarios.

- **Uncertainty Analysis**: discusses the inherent uncertainties in the risk assessment process.

- **Summary and Conclusions**: summarizes the results of the HHRA.

2.2.1 Constituent Characterization

This section discusses the methods used to select COPCs for the HHRA and the physical and chemical properties of the selected COPCs.

2.2.1.1 Selection of Constituents of Potential Concern

Environmental data collected from each of the Study Areas are initially discussed by comparison to screening criteria. Comparison criteria are constituent and medium specific concentrations that are used to provide a reference value for site specific analytical data. Comparison criteria are typically published values that are based on calculations which assess the increase in risk under default assumptions to a given population based on the concentrations of constituents in environmental media at a site. These values can be used to assess the risk to a human population or to an ecological population.

COPCs were identified for each of the Study Areas by comparing maximum detected concentrations to human health based screening levels. If the maximum detected concentration was greater than the screening level, the constituent was identified as a COPC and quantitatively evaluated in the HHRA. Screening levels used for soil and sediment COPC selection were based on residential and industrial soil RSLs presented in the USEPA's RSL table (USEPA 2009a). Screening levels used for surface water COPC selection were based on the tap water RSLs (USEPA 2009a). Groundwater COPC selection also relied upon tap water RSLs (USEPA 2009a). Because substantial groundwater data have been collected at the Site, it was not necessary to complete a COPC screen using the soil RSLs that have been derived based on potential leaching to groundwater.

The Study Area assessments presented in this appendix utilize human health based screening levels derived from those presented in the United States Environmental Protection Agency's (USEPA's) Regional Screening Level (RSL) table (USEPA 2009a) as comparison criteria. Screening levels for soil and sediment were based on industrial and residential soil RSLs while screening levels for groundwater and surface water were based on tap water RSLs. The RSLs are calculated to demonstrate the concentration of a given constituent that will not result in an increase in risk to an individual beyond a hazard quotient (HQ) of 1 for non-carcinogenic compounds and an increase in cancer risk of 1×10^{-6} for potentially carcinogenic compounds. Because the Study Areas presented in this report are potentially contaminated with multiple constituents, and because noncarcinogenic effects can sometimes be cumulative, the RSLs based on noncarcinogenic effects were adjusted to reflect a target HQ of 0.1, where applicable (i.e., the published RSLs for non-carcinogens were divided by 10). For screening levels based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c** in RSL table), the non-cancer level was used after adjustment. Where appropriate, surrogate RSLs were used for constituents that lack screening levels. The adjusted RSLs are referred to as industrial and residential RSLs in this report. Table A.2-1 presents a summary of the RSLs utilized during the data comparison process.

It should be noted that there is no RSL available for asbestos. However, it is known that concrete slab floors in some buildings in the BLA and IAA Buildings were covered in a conductive flooring material that contained asbestos. Removal of the walls and roofs of the buildings has exposed the conductive flooring to weather, causing it to degrade and break away from the underlying concrete. In some cases, the flooring has degraded into a red powder-like material and washed onto the surrounding soils. Since it is known that asbestos is present in some portions of the site, this was carried through as a COPC. However, asbestos is evaluated somewhat differently from other constituents. Thus the general approach used to evaluate it is provided in Section 2.2.4 with site-specific discussions included for both the BLA and IAA soils.

In addition to the RSLs, inorganic constituents detected in soil were compared to the background inorganics concentrations presented in the *Facility-Wide Background Study Report* (IT 2001). The background inorganics concentrations are based on calculated 95% UTLs generated from a facility-wide data set that incorporates both surface and subsurface soil from the RFAAP-MMA and the RFAAP-NRU. The calculated background concentrations are utilized to help differentiate between naturally occurring inorganic concentrations and concentrations resulting from human influence. Inorganics are not considered to be site related contaminants unless the concentrations are above the background concentrations. Table A.2-2 presents a summary of the background inorganics concentrations for the RFAAP. As indicated in this table, some of the background concentrations are greater than the soil RSLs.

Fish tissue data can be compared to fish consumption limits as set in USEPA's Guidance for Assessing Chemical Contamination Data for Use in Fish Advisories (USEPA 2000a). However, the guidance did not include any of the detected constituents in fish tissue. Therefore, all constituents detected were selected as fish tissue COPCs.

Constituents selected as COPCs based on human health protection were carried forward into the HHRA.

2.2.1.2 Physical and Chemical Properties

The environmental fate and transport of constituents depend on the physical and chemical properties of the constituents, the environmental transformation processes affecting them, and the media through which the constituents are migrating. The physical and chemical properties for the COPCs used in the risk assessment are summarized in Table A.2-3. This table includes the molecular weight, water solubility, vapor pressure, Henry's Law Constant, diffusivity in air and water, the organic carbon partition coefficient (K_{oc}), and the octanol-water partition coefficient (K_{ow}).

2.2.2 Toxicity Assessment

The toxicity assessment discusses the two general categories of toxic effects (non-carcinogenic and carcinogenic) and constituent-specific toxicity values used to calculate potential risks for these two types of toxic effects. Toxicity values for potential non-carcinogenic and carcinogenic effects are determined from available databases. For the HHRA, toxicity values were obtained from the following sources in order of priority as recommended by USEPA (2003b):

- USEPA Integrated Risk Information System (IRIS) database (USEPA 2009b)
- USEPA's National Center for Environmental Assessment Provisional Peer-Reviewed Toxicity Values as reported in USEPA RSL Tables (USEPA 2009a)
- USEPA's Health Effects Assessment Summary Tables (HEAST; USEPA, 1997b)

Other sources used included the California Environmental Protection Agency (Cal EPA), the Agency for Toxic Substances and Disease Registry (ATSDR) and the World Health Organization (WHO), as referenced by USEPA (2009a).

2.2.2.1 Toxicity Values for Non-carcinogenic Constituents

For many non-carcinogenic effects, protective mechanisms must be overcome before an effect is manifested. Therefore, a finite dose (threshold), below which adverse effects will not occur, exists for non-carcinogens. Depending on the dose, a single compound might elicit several adverse effects within a given exposure route or during the duration of exposure. The susceptibility of the individual may also influence the adverse effect caused by various constituents. Constituents may exhibit their toxic effects at the point of application or contact (local effect) or at other sites (systemic effects) after they have been distributed throughout the body. Most constituents can produce more than one type of toxic effect, depending on the dose and the susceptibility of the exposed individual or receptor. The goal of toxicity studies for application in risk assessment is to identify the most sensitive toxic effect and the exposure levels that are expected to be safe. The potential for non-carcinogenic effects is estimated by comparing a calculated exposure dose with a reference dose (RfD) for each individual constituent. The RfD represents a daily exposure level that is designed to be protective of human health, even for sensitive individuals or subpopulations.

For a given constituent, the dose or concentration that elicits no adverse effect when evaluating the most sensitive response in the most sensitive species is referred to as the “no observed adverse effect level” (NOAEL). The NOAEL is used to establish non-cancer toxicity values (called RfDs). The RfD represents a daily exposure level that is not expected to cause adverse non-carcinogenic health effects. Chronic RfDs are used to assess long-term exposures ranging from 7 years to a lifetime. Subchronic RfDs are used to evaluate the potential for adverse health effects associated with exposure to constituents over a period of 2 weeks to 7 years. HEAST was the primary source for subchronic RfDs. Where subchronic RfDs were not available from HEAST, chronic RfDs were used. Where the chronic to subchronic uncertainty factor had been reported, the subchronic to chronic uncertainty factor was removed from the chronic RfD and the subchronic RfD was used in the evaluation. If the subchronic to chronic uncertainty factor was not available, the chronic RfDs were used.

Table A.2-4 presents the RfDs used to assess oral and dermal exposure, and Table A.2-5 presents the RfDs used to assess inhalation exposure. Tables A.2-4 and A.2-5 also present the target sites associated with the non-carcinogenic toxicity values for each constituent varying with the exposure route. USEPA confidence values and uncertainty factors associated with the RfDs also are listed (USEPA 2009b). The uncertainty factor represents areas of uncertainty inherent in the extrapolation from the available data. The confidence levels (low, medium, high) assess the degree of confidence in the extrapolation of available data.

2.2.2.2 Toxicity Values for Carcinogenic Constituents

Cancer induction in humans and animals by constituents proceeds through a complex series of reactions and processes. Carcinogenic constituents may produce tumors at the point of application or contact, or they may produce tumors in other tissues after they have been distributed throughout the body. Some constituents are associated only with one or two tumor types while others may cause tumors at many different sites.

USEPA uses a cancer weight-of-evidence (WOE) descriptor to describe a substance’s potential to cause cancer in humans and the conditions under which the carcinogenic effects may be expressed. This judgment is independent of consideration of the agent’s carcinogenic potency. Under EPA’s 1986 guidelines for carcinogen risk assessment, the WOE was described by categories “A through E”—Group A for known human carcinogens through Group E for agents with evidence of noncarcinogenicity. Under the EPA’s 2005 guidelines for carcinogen risk assessment, a narrative approach, rather than categories, is used to characterize carcinogenicity. Five standard weight-of-evidence descriptors (*Carcinogenic to Humans, Likely to Be Carcinogenic to Humans, Suggestive Evidence of Carcinogenic Potential, Inadequate Information to Assess Carcinogenic Potential, and Not Likely to Be Carcinogenic to Humans*) are used as part of the narrative (USEPA 2005d).

For carcinogens, USEPA has historically used an extremely conservative approach in which it is assumed that any level of exposure could cause cancer. Based on this assumption, USEPA extrapolates from laboratory animal data using a mathematical model known as the linear multi-stage model. This model plots a line through the zero point and, based on the slope of this dose-response line, assigns a risk level for increasingly smaller doses of a particular compound. The 95 percent upper confidence limit for the slope of this line, called the cancer slope factor (CSF), is used to calculate the probability of an effect associated with a given dose. USEPA's slope factors thus are determined by a methodology that is likely to overestimate real risk.

Tables A.2-6 and A.2-7 present the carcinogenic toxicity values for oral and dermal exposure and inhalation exposure (respectively) for the COPCs at the site. The carcinogenic toxicity value used in the calculation of potential cancer risks is the CSF, which is derived from the conservative assumption that any dose level has a possibility of causing cancer. The cumulative dose, regardless of the particular exposure period, determines the risk; therefore, separate CSFs are not derived for subchronic and chronic exposure periods.

In accordance with USEPA (2005c) *Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens* (Supplemental Guidance) PAHs, which have been identified as potentially acting using a mutagenic mode of action, were evaluated using age-dependent adjustment factors (ADAFs) for assessing carcinogenic risk associated with early-life exposures. Because site workers and hypothetical future construction workers are assumed to be adults (i.e., 18 years of age or older), these adjustments for early-life exposure were only necessary for the residential scenarios. USEPA guidance recommends the application of a default ADAF of 10 for exposure up to the age of 2 years, an ADAF of 3 for exposures during 2 to 16 years of age, and no adjustment for ages 16 and older. However, as stated in the Supplemental Guidance, "Default adjustment factors are meant to be used only when no chemical specific data are available to directly address cancer susceptibility from early-life exposure to a carcinogen acting through a mutagenic mode of action" (USEPA 2005c, p. vi). Consistent with this approach, chemical-specific ADAFs were calculated for PAHs using the methodology outlined in the Supplemental Guidance. Using the data on only benzo(a)pyrene from both 1 and 15 day old mice, USEPA determined that the average ratio of the potency factors of the animals exposed early in life to those exposed later in life was a factor of 4.6. This differs from the average default ratio of 10 because the default value is dominated by data on other chemicals. The chemical-specific ADAF for 2-16 year old receptors is derived in the same manner as that used in the Supplemental Guidance to derive the default value. The ADAF of 2.1 for the 2 to 16 year old is half the difference between 1 and 4.6 on a logarithmic scale. Based on this chemical-specific analysis, chemical-specific ADAFs of 4.6 were used for 0 to 2 years, 2.1 for 2 to 16 years of age, and no adjustment for ages 16 and older.

In this assessment, the residential scenario was evaluated in two parts: the first six years as a young child (0-6 years) and the remaining 24 years as an older child/adult (6-30 years). These two cancer risk calculations were then summed to derive a total cancer risk over the 30-year exposure period. For the mutagenic calculations, the specific ADAFs were incorporated appropriately into the child- and adult-specific calculations. Specifically, an ADAF of 4.6 was applied when assessing exposures during the first two years of life. An ADAF of 2.1 was applied for the remaining four years (ages 2 to 6 years) in the child scenario. For the adult residential scenario, an ADAF of 2.1 was used for 10 years of exposure to address exposures between the ages of 6 and 16, and no ADAF was applied for the remaining 14 years of exposure up to age 30 (USEPA 2005c).

2.2.2.3 Dermal Toxicity Values and Dermal Absorption

Whenever possible, route-specific toxicity values have been used; however, USEPA has not yet developed toxicity values for dermal exposures. For this reason, the oral toxicity values (RfD_o and CSF_o) and the oral absorption efficiency were used to derive adjusted toxicity values (RfD_a and CSF_a) (adjusted to the absorbed dose) for use in assessing dermal exposure (USEPA 1989):

$$RfD_a = RfD_o \times \text{Oral Absorption Efficiency}$$

$$CSF_a = CSF_o / \text{Oral Absorption Efficiency}$$

The adjusted toxicity values represent the theoretical toxicity of the orally absorbed dose of the constituent. The USEPA (2004a) guidance recommends that the oral toxicity values for organic constituents should not be adjusted to assess dermal exposure (i.e., oral absorption efficiency = 1). Table A.2-4 presents the oral absorption efficiency values and the RfD_as used to assess risk for the dermal exposure route. Table A.2-6 presents the CSF_as. Uncertainty is associated with the adjusted toxicity values and with the dermal risks derived using these values due to the uncertainty in the oral toxicity values combined with the uncertainty in the oral absorption efficiency default and constituent-specific values. However, the calculated dermal risks are expected to be very conservative and, therefore, will overestimate human health risks.

Table A.2-8 presents the dermal absorption efficiencies for COPCs identified at the RFAAP-NRU. The dermal absorption efficiency is used to estimate dermal uptake from a soil matrix.

2.2.2.4 Toxicity of Lead

The USEPA identifies lead as a "probable human carcinogen" based on sufficient animal evidence but inadequate human evidence (USEPA 2007b). However, the USEPA does not recommend evaluating lead cancer risk using a CSF (USEPA 2003c). Instead, lead non-carcinogenic risks (identified as neurological effects) are evaluated by predicting blood-lead concentrations using toxicokinetic modeling. This is because there is a strong correlation between lead exposure and resulting blood lead levels.

2.2.3 Exposure Assessment

Exposure pathways were identified based on the site characterization information and the fate and transport properties of the COPCs to identify likely points where human receptors may come in contact with affected media under current or potential future conditions at the site. The principal pathways by which exposure could occur were identified for human receptors.

An exposure pathway is defined by the following four elements:

(1) a source and mechanism of constituent release to the environment;

(2) an environmental transport medium for the released constituent;

(3) a point of potential contact with the contaminated medium (the exposure point); and

(4) an exposure route at the exposure point.

The purpose of the exposure assessment is to estimate the way(s) a population may potentially be exposed to constituents at a site. This typically involves projecting concentrations along potential pathways between sources and receptors. The projection usually is accomplished using site-specific data and, when necessary, mathematical modeling. Exposure can occur only when the potential exists for a receptor to contact released constituents directly or when there is a mechanism for released constituents to be transported to a receptor. Without exposure there is no risk; therefore, the exposure assessment is a critical component of the risk assessment.

2.2.3.1 Conceptual Site Model

The conceptual site model (CSM) provides the risk assessment framework. It characterizes the primary and secondary potential sources and release mechanisms and identifies the primary exposure points, receptors, and exposure routes. Exposure points are places or "points" where exposure could potentially occur, and exposure routes include the basic pathways through which COPCs may potentially be taken up by the receptor. The potential exposure pathways for the RFAAP-NRU are presented in Figure 2-1.

The potentially exposed receptors at the site have been identified based on both current and reasonably anticipated future land use of the areas located in the vicinity of the site. As discussed in Section 1.1, the site is currently utilized as a storage facility for operations at the RFAAP-MMA. There are no active manufacturing operations taking place and there are no residents at the site. RFAAP-NRU is not currently used. There are buildings and facilities that remain from previous operations at this unit. There are areas of undeveloped area as well. While the surrounding land use is rural, the industrialized nature of RFAAP is unlikely to change in the future. Depth to groundwater ranges from 13 feet bgs to more than 150 feet bgs. Groundwater in the vicinity of the site is not being used as a potable water source; however, as a conservative measure, consumption of groundwater as a drinking source and dermal exposure due to employee handwashing were evaluated for a site commercial/industrial worker.

The only potential current receptors are site workers who are involved in maintenance and mowing activities. It is possible, however, that the site may be redeveloped in the future for commercial purposes. For this reason, the exposure scenarios for site workers assume an annual occupational exposure frequency of 250 days/year, even though the exposure frequency for current site workers is less frequent. All of these current and future site workers could have potential exposure to surface soils.

Due to the industrialized/military nature of the site, redevelopment of the site for residential purposes is highly unlikely. Remedial decisions will be based on the current and reasonably expected future use (military industrial). However, hypothetical exposure of residential receptors was evaluated in the risk assessment as a conservative measure and to assist the Army in making risk management decisions.

Exposure scenarios in the future could potentially include exposure to surface and subsurface soil, sediment, surface water, and groundwater used as a potable water source. Exposure to soil for the residential receptor could occur through ingestion, dermal contact, and inhalation of vapors and/or COPCs adhered to fugitive dust. Exposure to sediment for the resident receptor could occur through ingestion and dermal contact during wading. Exposure to surface water could occur through ingestion or dermal contact during wading while exposure to groundwater could occur though all routes if groundwater is used as a domestic water supply. Further, resident receptors may also be exposed to constituents that might have accumulated in fish tissue samples collected from the unnamed pond in the WBG.

In the event of site redevelopment, construction workers may, in the future, be exposed to surface and subsurface soil if excavation activities take place.

Exposures of hypothetical current or future trespassers were not evaluated because their exposures, if any, would be of a limited frequency and duration since the site is completely fenced and access is controlled. This hypothetical receptor would have far less exposure than the receptors selected for quantitative evaluation (e.g., an exposure duration of five days per year for a trespasser versus 250 days per year for the industrial site worker or 350 days per year for a residential scenario).

Likewise, exposure of hypothetical current or future angler receptors from ingestion of fish from the unnamed pond at the WBG was not evaluated because the exposure, if any, would be of a limited frequency and duration since the site is completely fenced and access is controlled. In addition, a hypothetical angler receptor would have far less exposure than the resident angler selected for quantitative evaluation.

In addition, the potential for exposure to vapors migrating to indoor air from combined surface and subsurface soil and from groundwater was evaluated for future site workers as well as hypothetical future adult and child residents using the screening-Level Johnson and Ettinger Model (USEPA 2004b). The USEPA (2004b) screening models estimate the potential associated risk and calculate risk-based concentrations for residential and industrial settings. The individual concentration sheets produced during the model runs are presented, along with the exposure parameters and site-specific soil information available for the site.

2.2.3.2 Exposure Point Concentrations

EPCs were calculated for each constituent at each Study Area. The EPC is a representative constituent concentration that a receptor may contact at an exposure point over the exposure period (USEPA 1989). According to USEPA risk assessment guidance (2007a; 2002a,b; 2000a; 1992), the EPC is an estimate of the arithmetic average concentration for a constituent. Ideally, the EPC should be the true average concentration; however, because of the uncertainty associated with estimating the true average concentration based on a limited dataset, the estimated upper confidence level (UCL) on the mean (i.e., a UCL of 95 percent or higher) should be used as the EPC.

Calculation of UCLs was performed using the USEPA's ProUCL (Version 4.0; USEPA 2007a). UCLs recommended by the software were used. UCLs were calculated where there were a minimum of eight samples in the dataset and the constituent was detected in a minimum of five samples. The maximum concentration was used as the EPC where the UCL could not be calculated. For the human health risk assessment, ingestion of fish caught from the pond in the WBG was based on the maximum concentration of the fish fillet data. This is a highly conservative assumption and is discussed in the uncertainty section (Sections 2.3.5 and 2.4.3.6). Following USEPA (2007a) guidance, exposure to lead was evaluated using arithmetic average concentrations rather than UCLs.

Soil, sediment, surface water, and groundwater EPCs are presented within the data summary tables in the report sections devoted to the Study Areas.

EPCs in air for non-volatiles that would adhere to dust were estimated using a dust Particulate Emission Factors (PEF). EPCs for volatile COPCs were estimated using volatilization factors (VFs) where applicable. Those factors are presented in Table A.2-9.

2.2.3.3 Exposure Assumptions

The receptors and the receptor-specific exposure parameters are summarized in Table A.2-10, and are discussed below.

2.2.3.3.1 Site Worker

Site workers are potential receptors at the RFAAP-NRU. They may occasionally be exposed to site-related constituents through contact with surface soil. They may also contact surface water and sediment while cutting the grass on the stream banks. This possibility was assessed via a wading scenario. The exposure assumptions for this receptor are included in Table A.2-10 and are summarized as follows:

- Adult body weight of 70 kilograms (kg) (USEPA 1991a; 1989)

- Exposure duration 25 years (USEPA 1991a; 1989)
- Exposure frequency of 250 days/year (USEPA 1991a; 1989)
- Exposure frequency – wading scenario 26 days/year (professional judgment assuming activity occurs one day per week for six months of the year)
- Groundwater exposure time of 0.17 hour/day, assuming workers wash their hands 5 times a day, for 2 minutes each time (USEPA 1997a)
- Soil exposure air-inhalation rate of 20 cubic meters per day (m^3/day) (USEPA 1991a; 1989)
- Surface water exposure air-inhalation rate of 2 m^3/day (USEPA 1997a)
- Soil incidental ingestion rate of 100 milligrams per day (mg/day; USEPA 2002a)
- Sediment incidental ingestion rate of 50 milligrams per day (mg/day; USEPA 1991a)
- Groundwater ingestion rate of 2 L/day (USEPA 1991a; 1989)
- Surface water ingestion rate of 0.05 liters per hour (L/hour) (USEPA 1989)
- Soil exposed skin surface area of 3,300 square centimeters (cm^2), which is the sum of the mean values for hands, forearms, and face for an adult (USEPA 2004a)
- Groundwater skin surface area exposure of 2,400 cm^2 , averaging surface are of the face, hands, and forearms (USEPA 2004a)
- Sediment and surface water exposed skin surface area exposure of 5,000 cm^2, averaging surface area of feet, lower legs, hands, and forearms (USEPA 1997a)
- Soil to skin adherence rate of 0.2 milligrams per square centimeter per day (mg/cm^2/day; USEPA 2004a)
- Sediment to skin adherence rate of 0.6 mg/cm^2/day (USEPA 2004a)
- Surface water exposure time of 1 hour/day (USEPA 1997a)

2.2.3.3.2 Hypothetical Future Residents

Residential development of the RFAAP-NRU is not expected to occur and the current land use associated with the site is not expected to change. As a result, future use of the site for residential purposes is considered unlikely, but will be considered here to assist the Army in making risk management decisions. Residential scenarios include exposure to site-related constituents through contact with surface and subsurface soil, sediment, surface water and with groundwater if it is used as a potable water source. The exposure assumptions for the hypothetical future residents are presented in Table A.2-10 and are summarized below.

- Adult body weight of 70 kg and a young child body weight of 15 kg (USEPA 1991a; 1989)
- Exposure duration of 24 years for an adult and 6 years for a child (USEPA 1989; 1991a)
- Soil and groundwater exposure frequency of 350 days/year (USEPA 1991a; 1989)
- Wading exposure frequency of 48 days/year (professional judgment assuming twice per week during the six warm months of the year) and that there would be rain four of those days and exposure would not occur
- Wading exposure time of 1 hour/day (USEPA 1997a)
- Soil and groundwater exposure air-inhalation rates of 20 m^3/day for an adult (USEPA 1991; 1997a), and 10 m^3/day for a child (USEPA 1997a)
- Surface water exposure air-inhalation rate of 2 m^3/day (USEPA 1997a)
- Soil incidental ingestion rate of 100 mg/kg for adults and 200 mg/kg for young children (USEPA 1991a)
- Groundwater ingestion rate of 2 L/day for adults and 1 L/day for young children (USEPA 1991a; 1989)
- Surface water incidental ingestion rate of 0.05 liters per hour (L/hour) (USEPA 1989)
- Soil adherence rate of 0.07 mg/cm²/day for adults and 0.2 mg/cm²/day for young children (USEPA 2004a)
- Sediment to skin adherence rate of 0.6 mg/cm^2/day for adults and 0.2 mg/cm^2/day for young children, based on exposure to wet soil (USEPA 2004a)
- Soil skin surface area exposure of 5,700 cm^2 for adults and 2,800 cm^2 for young children, which are the sum of the 50th percentile values for the face, feet, lower legs, hands, and forearms (USEPA 2004a)
- Groundwater skin surface area (whole body) exposure of 18,000 cm^2 for adults and 6,600 cm^2 for young children (USEPA 2004a)

- Sediment and surface water skin surface area exposure of 5,000 cm^2 for adults and 1,900 cm^2 for young children, which are the sum of the 50th percentile values for feet, lower legs, hands, and forearms (USEPA 1997a)
- Ingestion rate of fish of 0.054 kg/day for both child and adult (USEPA 1997a)

2.2.3.3.3 Hypothetical Future Construction Worker

Construction workers may be present at the RFAAP-NRU in the future to work on new construction or excavation activities; therefore, this exposure scenario was evaluated based on a hypothetical construction project. The construction project was assumed to take 6 months (130 working days) to complete. Construction workers are not likely to come into contact with shallow groundwater during a hypothetical construction project. This assumption is based upon the consideration that, typical foundation construction work would not require soil contact below 10 feet, whereas the depth to shallow groundwater is at least 10 feet. In fact, the depth to groundwater for a majority of the sites at the NRU is far greater than 10 ft; in particular, the depth to groundwater at the BLA, IAA, and NBG site are 120 ft, 30 ft, and 90 ft; respectively. Furthermore, the possibility of trenching equipment/operators being exposed to groundwater is minimized because the groundwater is located within the karst bedrock underlying the site, and standard trenching equipment/techniques are not suitable for working within the karst bedrock. .

The exposure assumptions for this potential receptor are included in Table A.2-10 and are summarized as follows:

- Adult body weight of 70 kg (USEPA 1991a; 1989)
- Exposure duration 1 year (professional judgment)
- Exposure frequency of 130 days/year (professional judgment assuming 5 workdays/week for 6 months)
- Inhalation rate of 20 m^3/day (USEPA 1991a; 1989)
- Incidental soil ingestion rate of 330 mg/day (USEPA 2002a)
- Soil to skin adherence factor of 0.3 mg/cm^2/day (USEPA 2002a)
- Exposed skin surface area of 3,300 cm^2, which is the sum of the 50th percentile values for hands, forearms, and face for an adult (USEPA 1997a)

2.2.4 Risk Characterization

The equations used in the risk characterization calculations for exposure to soil, surface water, and sediment are presented in Tables A.2-11 through A.2-13. Equations for exposure to fish ingestion are presented in Table A.2-14, and equations for exposure to groundwater used as a domestic water supply are presented in Table A.2-15.

Potential risks to human health are evaluated quantitatively by combining calculated exposure levels and toxicity data. A distinction is made between non-carcinogenic and carcinogenic endpoints as discussed in the subsections below.

2.2.4.1 Non-carcinogenic Effects – Hazard Quotients and Hazard Indices

Exposure doses are averaged over the expected exposure period to evaluate non-carcinogenic effects. The hazard quotient (HQ) is the ratio of the estimated exposure dose and the RfD. An HQ greater than 1 indicates that the estimated exposure level for that constituent is greater than the RfD. This ratio does not provide the probability of an adverse effect. Although an HQ of 1 indicates that health effects should not occur, an HQ that is greater than 1 does not imply that health effects will occur, but that health effects are possible.

The sum of the HQs is the hazard index (HI). A limitation with the HI approach is the assumption of dose additivity is applied to compounds that may induce different effects by different mechanisms of action. Consequently, the summing of HQs for a number of compounds that are not expected to induce the same type of effects or that do not act by the same mechanism may overestimate the potential for toxic effects (USEPA 1989). Consistent with USEPA risk assessment guidelines for constituent mixtures, in the event that the total HI for an exposure scenario is greater than 1, it is incumbent on a risk assessor to segregate HQs by target organ/critical effect (USEPA 1989). Therefore, if the calculated HI is greater than 1 as a consequence of summing several HQs for constituents not expected to induce the same type of effects or that do not act by the same mechanism, the HIs may be segregated by effect and mechanism of action to derive separate HIs for each target-organ/critical-effect group (USEPA 1989). The conclusions of the risk assessment are used to identify constituents of concern (COCs) that are used to focus remedial efforts at a site. COCs are those constituents with an HI greater than 1.

2.2.4.2 Carcinogenic Effects - Excess Lifetime Cancer Risk

The excess lifetime cancer risk (ELCR) is an estimate of the potential increased risk of cancer that results from lifetime exposure, at specified average daily dosages, to constituents detected in media at a site. Estimated doses or intakes for each constituent are averaged over the hypothesized lifetime of 70 years. It is assumed that a large dose received over a short period is equivalent to a smaller dose received over a longer period, as long as the total doses are equal. The ELCR is calculated as the product of the exposure dose and the CSF. The risk estimate is considered to be an upper-bound estimate; therefore, it is likely that the true risk is far less than that predicted by the model.

The USEPA considers ELCRs within the target risk range of 10^{-6} to 10^{-4} to be generally acceptable. USEPA (1991b) generally considers remediation of sites with risks less than 1×10^{-4} not to be warranted. The conclusions of the risk assessment are used to identify COCs that are used to focus remedial efforts at a site. COCs are those constituents with ELCRs greater than 1×10^{-4}.

2.2.4.3 Evaluation of Lead Exposures

Exposure to lead is evaluated differently than the other constituents. Cancer risk and non-cancer hazard quotients are not estimated from exposure to lead because health effects from exposure to lead are better characterized by estimating the amount of lead that may reach the bloodstream following exposure.

Consistent with current USEPA guidance (USEPA 2003c), USEPA's Adult Lead Methodology (ALM) model (USEPA 2003d) and USEPA's Integrated Exposure Uptake Biokinetic Model for Lead in Children (IEUBK; USEPA, 2005a) were used to evaluate the potential for adverse health effects from exposure to lead by adults and children, respectively. The models were used to calculate upper percentile blood-lead concentrations for each receptor, which were compared to the target blood-lead concentration of 10 micrograms per deciliter (µg/dL). While the ALM was designed to evaluate exposure to lead by workers, it was also used in this risk assessment to evaluate exposure to lead by adult residents.

The ALM calculates 95th percentile blood-lead concentrations by applying a geometric standard deviation to a central tendency estimate calculated from the user specified input parameters. Because the soil ingestion rates used to evaluate exposure to soil constituents other than lead are upper bound estimates, different soil ingestion rates are needed to evaluate exposure using the ALM. The USEPA (1997a) recommends 50 mg/day as a central tendency estimate of soil ingestion by adults. This value was used to evaluate exposure to lead by the commercial/industrial worker and the adult resident receptors. USEPA (2003c) recommends 100 mg/day as a central tendency estimate of soil ingestion rate for construction workers. This value represents the central tendency ingestion rate for soil contact intensive activities (including soil derived indoor dust) (USEPA 1997a; 2003c). This value is a conservative parameter to use for assessing daily exposure for the construction worker as heavy construction will most likely not occur continuously at the site during the entire construction period.

Default input parameters were used to evaluate the commercial/ industrial worker receptor using the ALM. The default intake rate is 50 mg/kg and the default exposure frequency is 219 days/year for a commercial scenario.

To evaluate an adult construction worker receptor by the ALM, the exposure frequency was set equal to 130 days/year and the intake rate was set at 100 mg/kg.

To evaluate an adult resident by the ALM, the exposure frequency was set equal to 350 days/year for exposure to soil and 48 days/year for exposure to sediment. Because of the intermittent nature of exposure of the adult resident to lead in sediment, a time-weighted average lead concentration was used at the Western Burning Ground to evaluate exposure to lead in soil and sediments together. This is the only area at the site where lead was identified as a COPC in both soil and sediments.

Default input parameters were used to evaluate exposure to soil for the child resident using the IEUBK. The IEUBK was used to assess potential for adverse health effects from lead in soil to children. At the Western Burning Ground, exposure to lead was evaluated using the time weighted average lead concentration in soil and sediments. However, because the sediments would not routinely produce dust in the home, but soil would, the indoor dust concentration was set at 70 mg/kg which was equal to the average soil concentration multiplied by the IEUBK default dust percentage (45 percent) as specified in the model.

Blood lead levels were estimated for the three areas where lead was a COPC: the IAA, the BLA, and the WBG. The model runs and the result summaries for each Study Area are discussed in the section of the report devoted to those Study Areas.

2.2.4.4 Evaluation of Asbestos Exposure

USEPA has recently developed a recommended framework for evaluating potential risks associated with asbestos in soil. This framework addresses the fact that asbestos concentrations in soil are not always good predictors of the level of exposure and risk that may be experienced by individuals who come into contact with that soil. This is because the potential risk experienced by those individuals is not a function of the concentration in the soil but is instead a function of their potential inhalation of asbestos fibers that may become airborne when and if soil is disturbed.

In recognition of this framework, a different approach was used to evaluate potential risks associated with asbestos in surface soil. This approach involved the calculation of air action levels (AALs) by combining the methodology outlined in USEPA's framework document with some of the scenario-specific exposure parameters discussed above. The AALs were then compared with airborne asbestos concentrations measured during activity-based air sampling, to determine whether asbestos might pose a potential risk to individuals who come into contact with that soil. The specific methodology for calculating the AALs is provided in Section 4.4.5.

2.2.5 Uncertainties in the Human Health Risk Assessment

The risk estimate presented here is a conservative estimate of potential risks associated with exposure to constituents detected in soil, groundwater, sediment, and surface water at the RFAAP-NRU. Uncertainty is inherent in the risk assessment process, and a discussion of these uncertainties is presented in this section. Each of the three basic building blocks for risk assessment (monitoring data, exposure scenarios, and toxicity values) contributes uncertainties. Each of the uncertainties is accounted for by using conservative assumptions wherever specific data are unavailable.

This risk assessment is based on the assumption that the available monitoring data adequately describe the occurrence of constituents in media at the site. Environmental sampling itself introduces uncertainty. This source of uncertainty can be reduced through a well-designed sampling plan, use of appropriate sampling techniques, and implementation of laboratory data validation and quality assurance and quality control (QA/QC). The data utilized in this report meet QA/QC requirements and are appropriate for use in a risk assessment.

The assumption that the concentrations will remain constant throughout the exposure period is a conservative approach, because ongoing natural attenuation and degradation processes likely will reduce the concentrations over time. Using the UCL or the maximum concentration as the EPC is also conservative. It is highly unlikely that receptors would be exposed to those upper bound concentrations over an extended period of time.

The toxicity values and other toxicological information used in this report likewise are associated with significant uncertainty. Many toxicity values are developed using results of studies in which laboratory animals are exposed to massively high doses of particular constituents in a controlled environment. As such, these studies do not represent realistic examples of lower level and variable human environmental exposures. In addition, many of the strains of laboratory animals used in toxicological studies are genetically homogeneous and are specifically selected because of their known sensitivities for certain endpoints (e.g., tumor formation) and thus are not representative of the more genetically diverse and heterogeneous human population. In addition, the effects shown by the animals in the high-dose studies often differ from effects reported for humans in parallel epidemiological studies. This is because a particular compound may have a different mechanism of action in laboratory animals than it does in humans. Even epidemiological studies, which are generally preferable to animal toxicity studies, are characterized by several uncertainties, such as differential exposures, confounding factors, and unknown (and uncontrolled) doses. Furthermore, some toxicity values are based on draft toxicity values and therefore may also produce uncertainty within the results.

PAHs were evaluated using a mutagenic adjustment for early life stage exposures. Much of the data used to calculate the ADAFs are based on tumor response rates in newborn and neonatal mice given very large bolus doses (75 – 150 ug/kg body weight) injected into their intraperitoneal cavities. Because this administration method has little relevance to human health risk assessment or exposure, it is likely that any mutagenic adjustment will overestimate potential risks.

Toxicity values are not available for dermal exposure. The USEPA-recommended approach to derivation of dermal toxicity values based on available oral toxicity values and oral absorption efficiencies contributes considerable uncertainty to the risk assessment.

Toxicity values were not available for d-limonene and 3-octanone. However, both of these compounds are naturally occurring and are also used in a variety of consumer products. For example, d-limonene is used as a flavoring agent and both are used in fragrances. Therefore, while toxicity values are not available for these two constituents, it is unlikely that their presence will significantly alter the conclusions of the risk assessment.

Uncertainty is also associated with constituent mixtures. Information on the toxicity of specific mixtures is rarely available. The procedure generally applied to a potential event of simultaneous exposure to multiple constituents from a variety of sources assumes dose additivity, although it is possible that the interaction of multiple constituents could be synergistic or antagonistic.

Potential exposure scenarios contribute uncertainty to the risk assessment as well. Exposure scenarios were developed based on site-specific information, USEPA exposure guidance documents, and conservative professional judgment. The hypothetical future residential scenarios which assumes that receptors will be exposed to site soil and also to groundwater that will be used as a potable water supply is highly unrealistic because the site will most likely never be used for residential use. Although uncertainty is inherent in the exposure assessment, and the exposure assumptions also were chosen to err on the side of conservatism, this uncertainty could lead to an overestimation or underestimation of potential risk.

2.3 Ecological Risk Assessment Methods and Procedures

Site-specific ERAs were conducted at each of the five Study Areas evaluated in this RI. The purpose of the ERAs was to evaluate the potential current and future risks and potential hazards to ecological receptors associated with constituents detected in surface soil, sediment, and surface water conditions at each of the Study Areas within RFAAP-NRU.

The ERAs were conducted in a manner consistent with USEPA guidance for ecological risk assessment (USEPA 2001a; 2000b; 1997c) and follow the approach in the Master Work Plan (URS 2003). The ERAs are intended to provide a conservative understanding of environmental conditions as they relate to the protection of wildlife populations and communities for risk management decision-making at the RFAAP-NRU

In accordance with USEPA guidance, the ERAs conducted for the five Study Areas at the RFAAP-NRU are comprised of a SLERA and a baseline ERA (BERA) (USEPA 2000b; 1997c). The SLERA evaluates the potential risk to terrestrial and aquatic ecological receptors exposed to detected constituents in surface soil, sediment, and surface water. The SLERA provides a conservative estimate of potential ecological risks and compensates for uncertainty by incorporating numerous conservative assumptions. The purpose of the SLERA is to determine whether or not there is a high probability that there are no ecologically significant risks that would merit additional evaluated as provided by a BERA (USEPA 2000b; 1997c). If the results of the SLERA warrant a BERA, the information developed in the SLERA is used to help focus the BERA. The BERA is more complex than the SLERA and uses more realistic and site-specific information about potential exposures and effects in order to evaluate potential ecological risks. Both a SLERA and a BERA were conducted for each of the five Study Areas at the RFAAP-NRU.

The approach used to assess ecological risks associated with the RFAAP-NRU is based on the USEPA eight-step process (USEPA 2001a; 2000b; 1997c), as summarized in Figure 2-2. An expanded view of the USEPA eight-step process is provided in Figure 2-3. As illustrated on Figure 2-3, the USEPA paradigm divides Step 3 into two pieces, Step 3a and Step 3b (USEPA 2000b). Step 3a allows for a more refined analysis of available information, while Steps 3b and beyond focus on further evaluation(s) for only those receptors, media, and constituents that are identified in previous steps. According to the USEPA (2000b), “for the majority of sites, ERA activities will cease after the completion of Step 3a.” The details of each step and how they relate to the site ERA are described in this section.

The ERA process culminates in clearly defined scientific management decision points (SMDPs). The SMDPs represent critical steps where risk management decision-making occurs. Generally, the following types of decisions are considered at the SMDPs.

- Whether the available information is adequate to conclude that ecological risks (if any) are negligible and, therefore, there is no need for further action on the basis of ecological risk.

- Whether the available information is inadequate to make a decision at this point and the ecological risk assessment process should continue.

- Whether the available information indicates a potential for adverse ecological effects and a more thorough assessment or remediation is warranted.

The remainder of this Section presents the methods used in the ERA and is organized as follows:

- Screening Level Ecological Risk Assessment – this section discusses the steps taken in the SLERA and indentifies elements that would indicate the need for a more refined BERA.

- Baseline Ecological Risk Assessment– this section discusses the steps taken in the BERA.

2.3.1 Screening Level Ecological Risk Assessment

A SLERA conservatively estimates potential risks that may affect ecological receptors, including terrestrial and aquatic organisms. The SLERA typically compensates for uncertainty in a precautionary manner, by incorporating numerous conservative assumptions. The outcome of the SLERA is the conclusion that either there is a high probability that ecologically significant risks are not posed to receptors, or further investigation in the form of a BERA is warranted. Consistent with USEPA (1997c) guidance, the SLERA is comprised of the following steps:

- Step 1: Screening-Level Problem Formation
- Step 1: Screening Level Ecological Effects Evaluation
- Step 2: Screening Level Exposure Estimate and Risk Calculation
- Scientific Management Decision Point (SMDP)

For each of the five Study Areas, a modified SLERA was conducted following the typical steps in a SLERA and also incorporating some steps typically taken later in the BERA, as a BERA was anticipated in each Study Area. Methods used during those steps of the SLERA are described below.

2.3.1.1 Step 1: Screening-Level Problem Formulation

Step 1 of a SLERA consists of both a screening level problem formulation and a screening level ecological effects evaluation. The screening-level problem formulation presents background information on site characterization, receptors, ecosystem characteristics, as well as information on the sources and effects of the stressors (USEPA 1998). This information is used to develop a CSM that illustrates the potential relationships between stressors, pathways, and receptors. The screening-level problem formulation provides information used to establish the overall goals, breadth, and focus of an ERA (USEPA 1998; 1997c).

The remainder of this section discusses the following components of the screening-level problem formulation for the RFAAP-NRU:

- Environmental Setting
- Identification of Constituents Detected
- Description of Constituent Fate and Transport Pathways

- Description of Constituent Mechanisms of Ecotoxicity
- Description of Potentially Exposed Receptors
- Identification of Potentially Complete Exposure Pathways
- Selection of Generic Assessment and Measurement Endpoints

2.3.1.1.1 Environmental Setting

This section describes the general habitat types present at and in the immediate vicinity of the site. As mentioned in Section 1, RFAAP-NRU is located in the mountains of southwestern Virginia and is comprised of two distinct areas: the MMA and the NRU. The NRU itself is also comprised of several Study Areas and this ERA is focused on the following five areas within the NRU: the BDDT, the IAA, the BLA, the WBG, and the RY. Terrestrial habitat and aquatic habitat is present at each of these areas. The terrestrial habitat consists of mixed forest, open fields, and grassy areas. The aquatic habitat consists of various storm water drainage channels, the unnamed creek in all areas of the NRU and Wiggins Spring and an unnamed pond in the WBG. A brief description of the environmental setting at each Study Area is presented in the report section devoted to that Study Area.

2.3.1.1.2 Identification of Constituents Detected

Ecological receptors at the site could potentially have direct contact with surface soil, sediment, and surface water. For the purposes of the ERA, surface soil is defined as soil from the ground surface to a depth of 1 foot bgs. Soil samples collected from depths greater than 1 foot bgs are generally not considered in ERAs because wildlife typically inhabit only the uppermost portion of the soil column (USEPA 1993a,b).

Soil data from ground-surface to a depth of 1 foot bgs, surface water data, and sediment data for five of the Study Areas in the RFAAP-NRU were evaluated as discussed in Section 2.1 and data summaries were prepared for each medium. The data summary tables present the frequency of detection, the range of sample quantitation limits, the range of detected concentrations, and the EPC for each detected constituent in each medium.

2.3.1.1.3 Description of Constituent Fate and Transport Pathways

Knowledge about the potential constituent fate and transport pathways is vital to understanding which constituents and receptors are associated with potentially complete current and future exposure pathways. This is because a constituent may reach an ecological receptor in a variety of ways. In addition, the pathway and route of exposure may have a strong influence on the ecological effect of a constituent. This information is used in the development of a CSM for potential ecological receptors. Constituent fate and transport pathways for the site are illustrated on Figure 2-4**.**

Terrestrial receptors can potentially be exposed to constituents in soil via direct contact. Further, constituents associated with soil may be carried via overland run-off to aquatic habitat. Likewise, aquatic receptors can potentially be exposed to constituents in sediment and surface water via direct contact.

2.3.1.1.4 Description of Constituent Mechanisms of Ecotoxicity

The mechanisms of ecotoxicity for constituents vary depending on a wide range of factors, such as constituent concentrations, the receptor species exposed, the exposure route (e.g., ingestion or direct contact), and physical factors (e.g., pH, temperature, oxygen levels, water hardness). Some of the effects that could be observed in wildlife are mortality, reduced reproductive ability, decreased fertility, decreased offspring survival, alteration of immune and behavioral function, decreased hatching success of eggs/larvae, and retarded growth (Sample et al. 1996; USEPA 2001b). The remainder of this subsection discusses mechanisms of ecotoxicity for the classes of constituents detected at the site. These descriptions of constituent mechanisms of toxicity are presented without consideration of constituent concentrations, as the descriptions are intended to convey an understanding of possible effects, rather than to describe the concentrations at which these effects might occur.

Volatile Organic Compounds

VOCs tend to attenuate rapidly in surface soil, sediment and surface water due to their inherent volatility. Although the effects of VOCs on ecological receptors are not well-understood, there have been extensive inhalation studies of the effects of VOCs under laboratory conditions. Inhaled volatile organics are typically metabolized in the body (often the liver), which may cause liver damage (depending on the organism) or the release of more toxic secondary metabolites. The VOCs or their metabolites may also cause neurological damage, and many are mutagenic or carcinogenic. Additionally, some VOCs are fetotoxic and/or teratogenic (USEPA 2009b; Sample et al. 1996).

Semi-Volatile Organic Compounds

SVOCs include a wide variety of compound classes, such as phenols, organochlorine alkenes, phthalates, and PAHs. SVOCs vary greatly in regard to their toxicity, mechanism of action, bioaccumulative potential, and susceptibility to being metabolized. Phthalates, a class of SVOCs, are known endocrine disruptors affecting sexual development in males. They are common in the environment, but do not dissolve in water easily and generally attach strongly to soil particles. They are primarily found in plastics used in soft toys, flooring, cosmetics, air fresheners and medical products (ATSDR 2008). PAHs such as acenaphthene and naphthalene, are often released to the environment as a result of human activities, including the incomplete combustion of fossil fuels or other organic materials. Most PAHs are sorbed to solid particles in the environment, which radically reduces the bioavailability and toxicity of the sorbed PAHs. PAHs have been shown to cause changes in liver enzymes and to perturb cell membranes, but in general, are not viewed as acutely toxic. Sublethal effects attributed to PAHs in aquatic animals include reduced reproductive ability and fertility, developmental abnormalities, delayed or retarded maturation, histological changes, and carcinogenesis (Neff 1985).

Dioxins and Furans

Polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) are formed as by-products during the production of some herbicides, chlorophenols, and PCBs. They are also generated during the incineration of chlorinated compounds. There are 75 possible PCDD congeners and 135 possible PCDF congeners, and as with PCBs, their toxicity is dependent on the number and location of chlorine atoms. Additionally, dioxins and furans have large K_{ow} values which dictate their mobility and partitioning in environmental and biological media (Eisler 1986). Due to their low mobility and high persistence and lipophilicity, dioxins and furans are accumulated in sediments, soils and sludge, bioconcentrated in aquatic organisms, and bioaccumulated in adipose tissue of aquatic and terrestrial organisms (Geyer et al. 2002).

Substantial toxicity testing has identified 17 different 2,3,7,8-substituted PCDD and PCDF congeners (congeners reported to have dioxin-like toxicity with chlorine substitutions in at least the 2,3,7,8 positions) that present significant toxicological risk to humans and wildlife. The most toxic and frequently studied of these congeners is 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD). Toxicological effects associated with exposure to TCDD include: mortality, reproductive distress and failure, developmental effects, and decreased growth (Carey et al., 1998).

Herbicides and Organochlorine Pesticides

While some herbicides and organochlorine pesticides may exhibit acute toxicity, the most toxicity is due to long-term, chronic effects. These effects may include reduced fecundity, chronic lethality, neurological effects, cessation of feeding, and bone degeneration (Nimmo and McEwen 1994; Fontenot et al. 1999a,b). The mode of action for herbicides and organochlorine pesticides is not well understood, but they generally disrupt electrolyte balance in neurons and prevent them from conducting nerve impulses normally (Ware 1994). This manifests neurological effects such as reduced mobility, tremors, loss of equilibrium, convulsions, abnormal flexure, and lethargy or prostration. In addition, pesticides are well-known for causing eggshell thinning in birds and, thereby, reducing reproductive success (Newman 1998; Sample et al. 1996). In general, the organochlorine pesticides have very low water solubility and are considered insoluble (Nimmo 1985). However, they are soluble in polar solvents, and will preferentially move into fatty tissues. This fact, combined with the very slow breakdown rates, indicates that they will bioconcentrate into organisms in the lower levels of the food chain (such as worms) and will biomagnify into organisms in the higher levels of the food chain (such as raptors).

Polychlorinated Biphenyls

PCBs (like Aroclor 1260 and Aroclor 1254) were designed for use in “closed” electrical systems like transformers, capacitors, and vacuum pumps. These compounds typically have low solubility, and low vapor pressures, and therefore tend to sorb to solid, organic material in the aquatic environment. However, PCBs can be transported in the air, and have been known to be present in measurable quantities in remote areas, far from where they were produced or used (Niimi 1994). PCBs are known to bioaccumulate and biomagnify; however, they usually do not cause acute toxic responses, and their major effects are thought to be sublethal. In addition, PCBs are currently under scrutiny for endocrine disruption, and effects on the nervous and immune systems in higher order taxa within the food chain (Fontenot 1999b; Niimi 1994).

Inorganics

Many trace inorganics (e.g., cobalt, copper, chromium, iron, manganese, nickel, molybdenum, selenium, and zinc) are important in plant and animal nutrition, but the optimal concentration ranges are usually narrow (Leland and Kuwabara 1985). Other inorganics are nonessential, such as lead, cadmium, and mercury, and are toxic to receptors at very low concentrations.

Mechanisms of toxicity of inorganics to plants tend to depend on the nature of the reactivity of the inorganic itself (Efroymson et al. 1997a). They may alter or inhibit enzyme activity, interfere with deoxyribonucleic acid (DNA) synthesis or electron transport, or block uptake of essential elements. Little is known about mechanisms of toxicity of constituents in earthworms (Efroymson et al. 1997b).

Trace metals (such as arsenic, barium, beryllium, chromium, copper, lead, and zinc) are better understood than PAHs and PCBs with respect to their potential adverse impacts on aquatic wildlife (Newman 1998). Chromium, copper, and zinc are essential for healthy enzyme function, and some organisms cannot survive without these metals.

However, these naturally occurring constituents may cause adverse effects when exposure occurs at concentrations that significantly exceed background concentrations. The toxicity and effects of trace metals may be greatly influenced by pH, hardness, and organic carbon content of the water in which they occur (Leland and Kuwabara 1985).

Imbalances in the essential trace metals may cause a decrease in photosynthetic ability, poor spawning/hatching success, teratogenesis, susceptibility to predation and disease, reduced growth, mortality, histopathological changes, organ dysfunction of the liver or kidneys, neurological defects, changes in respiration and osmoregulation, and anemia. Some metals may bioaccumulate, but this mechanism is thought to be a less important ecological concern. Because these constituents are naturally occurring, many organisms have a capacity (albeit limited) to biotransform and/or eliminate naturally occurring inorganics (Newman 1998; Leland and Kuwabara 1985).

2.3.1.1.5 Description of Potentially Exposed Receptors

The identification of the categories of receptors most likely to be exposed helps to focus the SLERA. Potentially exposed receptors are designated based on the available habitat associated with the site. As described above and presented in the CSM, potentially exposed receptors include terrestrial wildlife (including mammals, birds, reptiles, and invertebrates), terrestrial plants, and aquatic biota (fish and invertebrates directly within the aquatic habitat).

This section also provides an evaluation of potential exposures to individual organisms of threatened and endangered species at the sites. Threatened and endangered species information was obtained from a biological survey that was conducted by the Virginia Department of Game and Inland Fisheries for the Radford Army Ammunition Plant in 1997-1998 (VDGIF 1999). The results of the VDGIF survey were also included in the RFAAP Integrated Natural Resource Management Plan (INRMP) (RAAP 2005). The VDGIF survey report included the identification of listed species observed on the plant property and their preferred habitats. Based on the information obtained from the survey, each Study Area was evaluated to determine whether suitable habitat for a listed species was present within that area.

Table A.2-16 presents the species listed in the biological survey (VDGIF 1999), their preferred habitats, and whether suitable habitat is present at one or more of the Study Areas (BDDT, BLA, IAA, RY, and WBG). This table shows that a total of 19 threatened, rare or watch-listed species were observed within the NRU during the 1997-1998 survey (VDGIF 1999). The list of 19 species is comprised of 16 terrestrial plants, 2 birds, and 1 terrestrial invertebrate. There were no federally listed species observed during the survey at the NRU. Three state threatened species were observed (i.e., Regal fritillary, Henslow's sparrow and Loggerhead shrike). Preferred habitats are not present at any of the SWMUs for any of these state threatened species, with two possible exceptions.

Grassland habitat present around the BLA could potentially provide suitable habitat for the butterfly Regal fritillary (*Speyeria idalia*). This butterfly was observed at the BLA and in the northern portions of the NRU during the 1997-1998 VDGIF survey.

The open field habitat present around the RY could potentially provide suitable habitat for Henslow's sparrow (*Ammodramus henslowii*). Four colonies were delineated in the NRU; all four were located in the northern portion of the NRU (i.e., north of the Northern Burning Ground) and not near the five Study Areas. Other sightings in the NRU were along the central grassland areas of the unit and not in close proximity with any of the Study Areas. Typically Henslow's sparrow habitat is comprised of tall dense vegetation with little or no woody vegetation (VDGIF 1999).

Based on this analysis, it is uncertain whether the two state listed species discussed above are present at any of the five ACOs, including the BLA and RY. The VDGIF survey was conducted ten years ago and species' occurrence may have been altered based on time and resource management at the NRU. However, if colonies of Henslow's sparrow and Regal fritillary do currently utilize areas of the BLA or RY, soil impacts at these Study Areas are generally near buildings, roads or other structures and not within open grassland areas (if available). Consequently, any potential exposure to the impacted areas would likely be minimal. Therefore, state listed threatened species are not considered a concern at the RFAAP-NRU.

2.3.1.1.6 Identification of Potentially Complete Exposure Pathways

A complete exposure pathway is "one in which the chemical can be traced or expected to travel from the source to a receptor that can be affected by the chemicals" (USEPA 2001c). Therefore, a constituent, its release and migration from the source, a receptor, and the mechanisms of toxicity of that constituent must be demonstrated before a complete exposure pathway can be identified. The table below summarizes the potential exposure routes for ecological receptors at the RFAAP-NRU (also illustrated on Figure 2-4).

Organism	Possible Exposure Routes
Terrestrial wildlife	Ingestion, direct contact, inhalation, and food chain
Terrestrial plants	Direct contact, uptake
Aquatic biota	Direct contact with, and uptake from, sediment and surface water and via food chain
Soil invertebrates	Direct contact with and uptake from sediment and soil

2.3.1.1.7 Selection of Generic Assessment and Measurement Endpoints

Assessment endpoints are the explicit expression of the ecological values to be protected (USEPA 1997c). The selection of assessment endpoints depends on knowledge of the receiving environment, knowledge about the constituents released (including their toxicological properties and the relevant concentrations), and understanding of the values that will drive risk management decisions (Suter et al. 1995a). Consistent with USEPA (1998) guidance, two elements are required to define an assessment endpoint: the specific valued ecological entity and the characteristic about the entity that is important to protect.

USEPA guidance provides that remedial actions should be designed not to protect organisms on an individual basis, but to protect local populations and communities of biota (USEPA 1999b). Thus, the first management principle for conducting an ERA is to provide a basis for selecting a response action “that will result in the recovery and/or maintenance of healthy local populations/communities of ecological receptors that are or should be present at or near the site” (USEPA 1999b). The USEPA guidance also notes, as an exception to this rule, that threatened and endangered species may be evaluated on an individual basis. This focus is justified on the basis that, given the stressed nature of a threatened and endangered population, effects on individuals could influence the local population.

Furthermore, it is important to realize that the size or space of an affected area is directly related to the potential for ecological exposure if ecological habitat is present. Spatial scale can be useful as a screening criterion if used in conjunction with other considerations, such as the valued ecological resources that may be present, current and future land use, the likelihood for COPEC migration from the site, and the proximity to a valued or sensitive ecological habitat. Spatial scale screening criteria are used widely in ERA guidance. The concept of spatial scale in ecological risk assessment is discussed in federal (USEPA) literature and guidance for determining if risk estimates are ecologically significant (USEPA 1998; 1997; 1994). While USEPA guidance notes the importance of examining spatial and temporal pattern of contaminants identified in low frequency and/or magnitude, it does not specify exact spatial scale criteria for a given site (USEPA 2001a). Although no information on spatial scale screening could be found in the Virginia DEQ guidance, the following spatial scale screening criteria are used by the following states: 1 to 2 acres for Minnesota (the smaller scale for bioaccumulative compounds); 1 acre for Texas, Louisiana, and Mississippi; 2 acres for Pennsylvania; and 2 acres or 1,000 square feet of sediments for Massachusetts (MPCA 1998; TCEQ 2001; MDEQ 1997; LDEQ 2003; PADEP 1998; MADEP 1996). This spatial scale criterion has often been referred to as *de minimus* because it is not expected to cause adverse effects to the population, community, or ecosystem, provided other conditions are met (Suter et al., 1995b; Henning and Shear 1998). These other conditions typically require that similar but unaffected habitat be available adjacent to the affected area, that sensitive habitat not be present within ¼ mile if the COPECs will migrate off site, and COPEC fate and transport must be unlikely to increase the spatial extent to greater than the current spatial extent. Provided these conditions are met, a 1-acre screening criterion is considered a conservative size criterion for determination of *de minimis* risk.

For the RFAAP-NRU, hypothetical assessment endpoints include the following:

- Sustainability of small mammal populations
- Sustainability of avian populations
- Sustainability of terrestrial plant communities
- Sustainability of soil invertebrate communities
- Sustainability of aquatic communities (i.e., fish and invertebrates)

Because direct measurement of assessment endpoints is often difficult or impossible, surrogate endpoints called measurement endpoints are used to provide the information necessary to evaluate whether the values associated with the assessment endpoint are being protected. A measurement endpoint is defined as a measurable ecological characteristic and/or response to a stressor (USEPA 1998). HQs typically serve as the measurement endpoints for SLERAs.

2.3.1.2 Screening-Level Ecological Effects Evaluation

The screening-level ecological effects evaluation involves the identification of ecological screening levels (ESLs) for each detected constituent found in each environmental medium at the RFAAP-NRU. ESLs are generally based on effects such as mortality and reproductive impairment, and are assumed to be widely applicable to sites around the United States for screening purposes (USEPA 1997c). For most constituents and receptors, the data available to generate ESLs are limited and related to effects on individual organisms, rather than populations or communities. Given these limitations, conservative assumptions are typically used to ensure that the ESLs are protective. ESLs available in the literature are screening values and do not constitute remediation goals, as they are sometimes based on highly conservative exposure assumptions and/or wildlife receptors that may not be applicable to a particular site. As such, their robustness and biological association with the assessment endpoint may be limited. However, conservative benchmarks provide a starting point for the SLERA in that they may provide an indication of the worst-case measure of the potential for adverse effects. Typically in a SLERA, ESLs are gathered from one or two sources leaving constituents without ESLs to be evaluated in the BERA. In this SLERA, ESLs were gathered from several sources during the modified SLERA to preserve effort in the BERA.

The following sources were considered in identifying soil ESLs for the SLERA:

- USEPA Ecological Soil Screening Levels (EcoSSLs) (USEPA, 2005b)
- Region 5 Ecological Screening Levels (USEPA 2003e)
- Oak Ridge National Laboratory (Efroymson et. al. 1997a,b; ORNL)

The following sources were considered in identifying sediment ESLs for the SLERA:

- Region 3 Sediment Screening Levels (USEPA 2008d)
- Oak Ridge National Laboratory (Jones et al. 1997)
- Region 5 Sediment Screening Levels (USEPA 2003e)
- USEPA Assessment and Remediation of Contaminated Sediments Program (ARCS) – used for aluminum ESLs

The following sources were considered in identifying surface water ESLs for the SLERA:

- Region 3 Fresh Water Screening Levels (USEPA 2008c)
- Oak Ridge National Laboratory (Suter and Tsao 1996)
- Region 5 Surface Water Screening Levels (USEPA 2003e)
- USEPA National Ambient Water Quality Criteria (USEPA 2008e)

Where multiple values were provided by sources, the lowest values were conservatively selected as is appropriate for a SLERA (USEPA 2000b; 1998; 1997c), if they were considered to have equal relevance and technical basis. The rationale for the selection of ESLs are provided in the following sections.

Further, in this step, constituents that have a tendency to bioaccumulate were also identified if they were designated as such by USEPA Region 3 (USEPA 2008c,d) or are included in the USEPA list of bioaccumulative compounds (USEPA 2000c).

Soil, sediment, and surface water ESLs for constituents detected onsite and their bioaccumulation potential are presented in Table A.2-18.

2.3.1.3 Step 2: Screening-Level Exposure Estimate and Risk Calculation

The screening-level exposure assessment is comprised of the identification of exposure estimates, risk calculations, and the evaluation of uncertainties (USEPA 2001a; 1997c). These components form the lines of evidence necessary to support the SMDP at the conclusion of the SLERA.

2.3.1.3.1 Identification of Screening-Level Exposure Estimates

Exposure estimates used for the modified SLERA were the maximum detected concentrations for each constituent (USEPA 2001a; 1997c). This conservative approach (i.e., using only the maximum detected concentrations) is appropriate for a screening-level effort.

The data summaries, including maximum concentrations and EPCs for soil, sediment, and surface water for the five Study Areas, whole body and fish fillet tissue data from the unnamed pond in the WBG, and for site-wide groundwater at the RFAAP-NRU are presented and discussed in the report sections devoted to those areas.

2.3.1.3.2 Screening-Level Risk Calculations

The screening level risk calculations provide an estimate of potential risk to ecological receptors. Risks to ecological receptors are calculated by dividing the exposure estimates (i.e., the maximum detected concentrations) by the conservative ESLs. The resulting ratio, the “maximum HQ”, is a highly conservative surrogate for the assessment endpoints. HQs equal to or less than a value of 1 (to one significant figure) indicate that adverse or significant ecological effects are unlikely (USEPA 1997c). Maximum HQs greater than 1 indicate that further evaluation is warranted to evaluate the potential for adverse ecological effects. Therefore, the constituents with HQs greater than 1 are identified as Constituents of Potential Ecological Concern

(COPECs) and carried forward into Step 3a of the BERA, except where the constituents are inorganics with maximum concentrations that are not greater than background levels. The background inorganics concentrations are based on calculated 95% UTLs generated from a facility-wide data set that incorporates both surface and subsurface soil from the RFAAP-MMA and the RFAAP-NRU. The calculated background concentrations are utilized to help differentiate between naturally occurring inorganic concentrations and concentrations resulting from human influence. The comparison with background is typically done in the first step of a BERA, however it was done here in the modified SLERA. Constituents were also identified as COPECs if no ESL was available or if the constituent was identified as bioaccumulative.

2.3.1.3.3 Evaluation of Uncertainties

SLERAs are designed to provide estimates of the risks that may exist for ecological receptors and to incorporate uncertainty in a precautionary manner. Uncertainty is “the imperfect knowledge concerning the present or future state of the system under consideration; a component of risk resulting from imperfect knowledge of the degree of hazard or of its spatial and temporal distribution" (USEPA 1997c). Uncertainties that may lead to either an overestimate or underestimate of risk are associated with each stage of risk assessment. Because the SLERA is intended to provide a precautionary approach to evaluating risks to ecological receptors, the majority of the SLERA uncertainties tend toward an overestimate of risk. Uncertainties associated with the SLERA are identified on Table A.2-17.

2.3.2 Scientific Management Decision Point

SMDPs represent critical steps in the ecological risk assessment process where risk management decision-making occurs. As was previously stated, the BERA is conducted for constituents with HQs that exceed 1 or are bioaccumulative and constituents that lack ESLs. Reporting occurs after either Step 2 or Step 3a, depending on the results obtained in Step 2, so that additional evaluation of risks can be evaluated if needed and reporting can be streamlined into a single report (USEPA, 2000a). Generally, the following types of decisions are considered at this SMDP:

- Whether the available information is adequate to conclude that ecological risks are negligible and, therefore, there is no need for remediation on the basis of ecological risk.

- Whether the available information is not adequate to make a decision at this point, and the ecological risk assessment process should continue.

- Whether the available information indicates a potential for adverse ecological effects, and a more thorough assessment or remediation is warranted.

The results of the screening-level risk calculations determine if the ERA should continue into the BERA as described in the following sections.

2.3.3 Baseline Ecological Risk Assessment

The BERA is designed to more realistically identify the nature and extent of ecological risks to support informed risk management decision-making (USEPA 2000b; 1997c). This approach contrasts with the SLERA, which is designed to conservatively rule out further evaluation of constituents and media that clearly do not pose a significant ecological risk. As indicated on Figures 2-2 and 2-3, the BERA process involves numerous steps. These steps are executed in a manner appropriate to the conditions at each individual site (USEPA 2000b; 1997c).

This section presents Step 3a of the BERA for the RFAAP-NRU, which is a refinement of the Step 2 exposure estimates and risk characterization, and focuses only on COPECs that were not eliminated in the SLERA. The refinement of the assessment presented in Step 1 and Step 2 is necessary to help focus and streamline further risk assessment activities on the constituents that pose the greatest potential risk to ecological receptors (USEPA 2001a; 2000b; 1997c). It is intended as an “incremental iteration of exposure, effects, and risk characterization” (USEPA 2001a). The outcome of this refined screening process is a list of COPECs to be retained for further evaluation in the BERA process.

The Step 3a discussion for the RFAAP-NRU is comprised of the following:

- Refinement of Constituents of Potential Ecological Concern,
- Refinement of Risk Calculations for Direct Contact COPECs,
- Assessment for Bioaccumulative COPECs, and
- Uncertainties.

Step 3a is followed by a SMDP that involves the reporting of results of Steps 1 through 3a.

2.3.3.1 Refinement of Constituents of Potential Ecological Concern

Typically, the process for refining the COPECs starts with 1) the comparison of maximum detected concentrations of naturally occurring inorganic constituents with background concentrations for each medium, and 2) the comparison of more realistic/refined EPCs (i.e., the lesser of the maximum detected concentration and the UCL) with the ESLs used in the SLERA. In some instances, these refinements were not applicable to the BERA. For example, comparison with background was not applicable because the modified SLERA already incorporated the comparison to background concentration for inorganics and comparison with background is generally not appropriate for organic constituents. Further, in some instances refined EPCs were not calculable due to limited data, therefore refined HQs were not able to be calculated.

2.3.3.2 Refinement of Risk Calculations for Direct-Contact COPECs

Risk calculations are typically refined by 1) using refined EPCs and 2) using refined ESLs. As mentioned in the section above, refined EPCs are UCLs on the mean versus maximum concentrations. There are numerous reasons to include alternative ESLs, most notably to fill any gaps in the set of ESLs used in the SLERA and to identify concentrations at which adverse effects are likely (e.g., probable effects values), rather than just possible. However, in this BERA, ESLs were not refined as the ESLs were already gathered from several sources during the initial SLERA and no further gaps could be filled.

The list of COPECs was refined in this BERA by refining the HQs. The refined HQs were calculated for the COPECs identified in the SLERA, using refined EPCs which is consistent with the approach for “incremental iteration of exposure, effects, and risk characterization” (USEPA 2001a; 1997c). Constituents identified as COPECs in the BERA that were bioaccumulative were evaluated using food chain models.

Further, it is well known that sediment toxicity of a substance is related to the bioavailable fraction of that substance in the pore water of sediments. Substances that are not sequestered by sediment ligands are neither bioavailable nor toxic to benthic organisms. It has been shown that both inorganics and organic compounds behave in that fashion. Organic compounds typically adhere to other organics in sediment such as humic acid. Inorganics can be sequestered by both organic matter in sediment and by sulfides present in the anoxic region of sediment.

Organic partitioning techniques have long been used to assess risk to aquatic communities from organic substances in sediment using measurements of total organic carbon (TOC) content in the sediment. Based on this information, the USEPA

(2003g) developed guidance for evaluating the bioavailability and toxicity of PAHs in sediments: *Procedures for Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures.* The ESBs represent defensible, numerical, and chemical-specific concentration limits of substances applicable across a range of sediment types to assess the extent of ecological risks of contaminated sediments, determine pollution control, and identify, prioritize, and implement appropriate cleanup levels (USEPA 2003g).

PAHs occur as mixtures rather than individual chemicals in the environment; ESBs for individual PAHs tend to be underprotective as they do not account for co-occurring PAHs. Therefore, ESBs are based on mixtures of PAHs in order to represent substantial and ecologically relevant protection of benthic organisms. The toxicity of mixtures of narcotic chemicals such as PAHs has been shown to be approximately additive. Therefore, the combined toxic contribution of PAHs in a mixture is the sum of the quotients of measured concentrations or final chronic values (FCVs) for each individual PAH in the sediment divided by its critical concentration (product of PAH-specific FVC and the respective TOC: water partition coefficient [K_{oc}]).

The quotient is called an Equilibrium Partitioning Sediment Benchmark Toxic Unit ($ESBTU_{FCV}$ or TU) and the summation as represented by $\Sigma ESBTU_{FCV}$ (total TU) is the HQ. If the HQ (total TUs) is equal to or less than one in a given sediment sample, the concentration of the PAH mixture in sediment is acceptable for the protection of benthic organisms. If the HQ exceeds one, the concentration of the PAH mixture in the sediment may not be acceptable for the protection of benthic organisms.

PAHs were identified as COPECs in this ERA, therefore, the ESBTU approach was used. The ESBTU approach was used to calculate a total TU which was compared to the benchmark of one. Where available, sample specific TOC was used otherwise the average total organic carbon (TOC) at the site was used instead. TOC ranged between 2.2% to 5.4% at the site and averaged at 3.4 percent.

USEPA's sediment quality guidelines are designed to be applied to a minimum of 34 PAHs, including alkylated PAHs. Default uncertainty factors (UFs) are provided for the assessment of smaller subsets of the total PAH concentration, in the absence of site-specific data for alkylated PAHs (USEPA 2003g). For this ERA, the use of a default UF was required, because alkylated PAHs were not measured in sediment samples collected from the Study Area and because the number of parent PAHs analyzed in sediment varied under 16. Therefore, a default UF of 2.75 was applied to the $\Sigma ESBTU_{FCV}$ to obtain an accurate estimation of the $\Sigma ESBGTU_{FCV,TOT}$ with 50% confidence.

2.3.3.3 Assessment and Measurement Endpoints for Bioaccumulative COPECs

Following the identification of bioaccumulative COPECs, the assessment and measurement endpoints at the RAAFP-NRU were refined. Additional assessment and measurement endpoint are summarized below:

Additional Assessment and Measurement Endpoints

Assessment Endpoint	Measurement Endpoint	Effects Measured
Survival and reproductive success of mammals exposed to bioaccumulative compounds in the terrestrial and aquatic food chain	Adverse changes in survival and reproduction as indicated by food chain modeling for short-tailed shrews and mink	NOAELs and LOAELs related to adverse chronic effects, such as reduced survival and reduced litter size
Survival and reproductive success of birds exposed to bioaccumulative compounds in the terrestrial and aquatic food chain	Adverse changes in survival and reproduction as indicated by food chain modeling for American robins and for the Great Blue Heron	NOAELs and LOAELs related to adverse chronic effects, such as eggshell thinning or reduced fledgling survival

NOAEL no observed adverse effect level.
LOAEL lowest observed adverse effect level.

2.3.3.3.1.1 Wildlife Receptors

The short-tailed shrew (*Blarina brevicauda*) and American robin (*Turdus migratorius*) were selected as terrestrial wildlife receptors and the mink (*Mustela vison*) and the great blue heron (*Ardea Herodias*) were selected as aquatic wildlife receptors for food chain modeling in the BERA. The shrew and robin were selected because these species are known to be susceptible to food chain exposures. Earthworms comprise a major component of the shrew and robin diets and earthworms are known to bioaccumulate persistent compounds (USEPA 1993a,b). The mink and heron were also selected because they are known to be susceptible to food chain exposures. Both species are piscivorous and fish are known to bioaccumulate persistent constituents. As such, if risks are not predicted for these species, then risks would not be expected for species with lesser exposures to bioaccumulative constituents (e.g., herbivores). In addition, dietary and toxicological information is available for these species, (e.g., USEPA 1993a,b; Sample et al. 1996) making food chain modeling feasible.

The short-tailed shrew is one of the most common mammals in America and is likely present at RFAAP-NRU. The short-tailed shrew also represents a conservative species for use in the BERA because it has a very high ingestion rate, and it consumes a high percentage of earthworms in its diet compared with other mammalian species. If risks are not predicted for this species, then risks should not be expected for species with lesser exposures to bioaccumulative constituents (e.g., herbivorous mammals).

The American robin is prolific throughout the United States, with a home range that includes Virginia. This bird is likely to forage in open areas and the ecotone between woodlands and open areas (i.e., edge habitat), and thus may be exposed to bioaccumulative COPECs at the RFAAP-NRU. The American robin also can be used as a surrogate species to represent other species that are likely to be present at the RFAAP-NRU and in the adjacent woodlands, but for which less exposure-related and toxicological information is available. Risks to the American robin could identify potential risks to other species with similar diets.

Much like the shrew, the mink is also a common mammal in North America, and would likely inhabit parts of Virginia including the RFAAP-NRU. Mink are found in a variety of aquatic habitats, including waterways such as rivers, streams, lakes, and ditches, as well as swamps, marshes, and backwater areas. Mink hunt primarily along the shorelines and emergent vegetation, consuming whatever prey is most abundant. While their diet can include mammals, fish, amphibians, crustaceans, birds, reptiles, and insects, typically mink found in a stream habitat like the ones predominantly found at the RFAAP-NRU feed mainly on fish, plants, and small mammals (USEPA 1993a,b). Similar to the shrew, if risks are not predicted for this species, then risks should not be expected for species with lesser exposures to bioaccumulative constituents.

The great blue heron is the largest member of the wading bird group in North America. This species can be found in a variety of aquatic habitats, including freshwater lakes and rivers, brackish marshes, lagoons, mangroves, and coastal wetlands. Fish make up the majority of the heron's diet, but great blues also eat amphibians, reptiles, crustaceans, insects, birds, and mammals (USEPA 1993a,b). The great blue heron can be used as a surrogate species to represent other species that are likely to be present at the RFAAP-NRU and in the adjacent aquatic habitats, but for which less exposure-related and toxicological information is available. Risks to the great blue heron could identify potential risks to other species with similar diets.

Wildlife receptor exposure parameters were gathered from USEPA (1993a,b) and from literature sources as applicable. Wildlife receptor exposure parameters are summarized in Table A.2-19.

2.3.3.4 Food chain Modeling

The food chain modeling evaluation of a BERA includes exposure assessment and effects assessment. The exposure assessment describes the EPCs for the COPEC and discusses the types of exposure models and their parameters. The effects assessment describes the types of receptor- and COPEC-specific toxicological benchmarks that were used in the BERA.

2.3.3.4.1 Exposure Assessment

Exposure assessment describes the potential contact of COPECs with ecological communities or receptors. The objective of the exposure assessment is to provide an exposure profile that identifies ecological communities or receptors and exposure pathways, and describe the intensity and spatial and temporal extent of contact of ecological communities or receptors to COPECs. The receptors that were evaluated are consistent with the identified Measurement endpoints. The intensity, spatial, and temporal extent of contact to COPECs are described by the EPCs, exposure assumptions, and intakes (or dose estimates), as discussed in the following sections.

2.3.3.4.1.1 Exposure Point Concentrations

Two types of exposure concentrations were used in the BERA. For the maximum risk estimates, maximum concentrations were used as exposure concentrations while for the refined scenario, EPCs based on the lower of the maximum and the UCL (where calculable) were used as the exposure concentrations. Methods used to calculate EPCs are outlined in Section 2.

2.3.3.4.1.2 Exposure Parameters

Exposures to ecological communities are expressed in terms of abiotic media concentrations, whereas exposures to ecological receptors (mammals and birds) are expressed in terms of dose. For ecological receptors, numerous exposure parameters such as contact rates, body weights, and absorption factors were defined prior to estimation of exposure dose. Exposure and intake parameters are defined on the basis of available literature information and best professional judgment. Wildlife receptor exposure parameters were gathered from USEPA (1993a,b) and from literature sources as applicable. Wildlife receptor exposure parameters are summarized in Table A.2-19.

2.3.3.4.1.2.1 Body Weight

Body weights (BWs) for mammals and birds expressed in kilograms (kg) were based on the average weights for male and female (combined) for both adults and juveniles, consistent with USEPA guidance (USEPA 1997c). These BWs were obtained from the USEPA's Wildlife Exposure Factors Handbook (USEPA 1993a) for all receptors.

2.3.3.4.1.2.2 Dietary Composition

The composition of the diet for mammals and birds expressed as a fraction of the total diet were based on information on the feeding guilds for each of the species. Consistent with USEPA guidance (USEPA, 1997c), it was assumed that the diet for each receptor consists of 100% of the primary food source (i.e., biota) initially in the maximum scenario and then was refined to reflect actual diet proportions in the refined scenario. The proportions of material ingested (biota, soil) were based on available literature (USEPA 1993a; Beyer et. al.1994).

2.3.3.4.1.2.3 Food Ingestion Rates

Total food ingestion rates (IRf) for mammals and birds expressed in kilograms per day (kg/day) were obtained from available literature (USEPA 1993a; Beyer et. al. 1994). If an IRf was not available for a receptor, an IRf was calculated as a function of body weight using allometric equations (Nagy 2001).

2.3.3.4.1.2.4 Home Range and Area Use Factors

Home range is defined as the geographic area encompassed by an animal's activities (except migration) during a specified time and the area use factor (AUF) is unitless and represents the fraction of the exposure area for the receptor represented by the area of contamination. The AUF is generally calculated by dividing the area of contamination by the home or foraging range of the receptor. While the home ranges of birds and mammals, such as heron and mink, can be quite substantial, it was conservatively assumed that each receptor spends 100 percent of its time foraging within the area of contamination. This likely resulted in substantially overestimated risks for these species.

2.3.3.4.1.3 Assessment of Bioaccumulation

Bioaccumulative COPECs were identified and were assessed via the food chain modeling in both the terrestrial and aquatic food chains. Food chain models predict detrimental effects to wildlife survival and reproduction. Intake measurements are a conservative estimate of exposure through the food chain. Food sources for terrestrial model include soil, vegetation, invertebrates and small mammals and food sources for aquatic food chains include sediment, surface water, vegetation, invertebrates, small mammals, and fish. Measured concentrations in the food sources were used where available (i.e., soil, sediment, and surface water in all Study Areas and whole body fish tissue concentrations in the unnamed pond in the WBG). To estimate concentrations in plants, invertebrates and small mammals, and fish, bioconcentration factors (BCFs) and bioaccumulation factors (BAFs) were used. BCFs describe the transfer (uptake) of a constituent from environmental media into tissues of vegetation and organisms in the food chain, while BAFs describe the transfer (uptake) of a constituent from dietary tissue into tissues of organisms in the food chain. The following medium-biota BCFs and BAFs were developed:

- Soil-to-Vegetation Uptake ($BCFsl_v$)
- Soil-to-Invertebrate Uptake ($BCFsl_i$)
- Soil-to-Mammal/Bird Uptake ($BAFsl_{mam}$)
- Sediment-to-Plant Uptake ($BCFsed_{plant;}$ dw)
- Sediment-to-Invertebrate ($BCFsed_{inv}$)
- Sediment-to-Mammal ($BAFsed_{mam}$)
- Sediment-to-Fish ($BAFsed_{fish}$)

The soil BCFs and BAFs for the COPECs are identified in Table A.2-20 and the sediment BCFs and BAFs are presented in Table A.2-21, and include the sources where each value was obtained.

2.3.3.4.2 Intake Assessment

Daily intake represents an estimate of a COPEC dose that a receptor might receive on a daily basis, and is calculated by summing intakes for assumed exposure pathways (i.e., dietary composition types) for each receptor. Intake is calculated by combining the concentration of a COPEC in an exposure media (soil/sediment, food, and water) with applicable receptor exposure assumptions. To estimate the concentration of a bioaccumulative COPEC in a food source (vegetation, invertebrates, small mammals, fish), bioaccumulation factors (BAFs) are used. The sections below discuss receptor exposure parameters and BAFs used to estimate intake for wildlife receptors at the site.

2.3.3.4.3 Effects Assessment

Food chain modeling requires the use of toxicity reference values (TRVs) to describe the potential toxicity of the COPECs to ecological receptors. The TRV is the assumed safe dose (in milligrams per kilogram body weight per day [mg/kg-BW-day]) to the receptor species. Calculation of TRVs generally relies on the use of laboratory toxicity benchmarks for laboratory species, as data on wildlife species usually are not available. Ecotoxicity benchmarks are typically reported as no observed adverse effect levels (NOAELs) and lowest observed adverse effect levels (LOAELs) for the laboratory species upon which testing was conducted.

For mammalian receptors, NOAELs and LOAELs are adjusted to account for the differences in body weights between the species tested and the receptor species (Sample et al. 1996). The extrapolation is based on the premise that metabolic function and toxicity are related to body size (i.e., constituents are less toxic to smaller animals because they metabolize and excrete constituents faster). Therefore, mammalian toxicity values were derived from toxicity values from laboratory studies using the Sample et al. (1996) equation. Toxicity values for birds are not adjusted to reflect the different weights of test species and wildlife receptor species (Sample et al. 1996).

Avian and mammalian TRVs used in this BERA are presented in Tables A.2-22, and A.2-23, respectively.

2.3.3.5 Risk Characterization

Potential risk was estimated using HQs, which were the ratio of the concentration in a given media to the screening level in the media. For the assessment endpoint on higher trophic levels, the HQ was the ratio of the daily intake to the TRV. Equations used for risk characterization including intake equations and equation used to estimate mammalian and avian TRVs are presented in Table A.2-24.

2.3.3.5.1 Maximum Risk Estimates

Maximum risk estimates were calculated by combining maximum concentrations and conservative (maximum) exposure assumptions in the food chain models.

2.3.3.5.2 Refined Risk Estimates

Refined risk estimates were calculated by combining EPCs, based on the UCL where calculable and maximum concentrations if not, and screening levels or refined exposure assumptions in the food chain models.

2.3.3.6 Refined Uncertainties

A BERA is designed to evaluate potential risks for wildlife by incorporating iterative changes that reduce uncertainty (when possible) and provides more realistic exposure assumptions. Uncertainties associated with the BERA are summarized on Table A.2-17.

2.3.3.7 Scientific Management Decision Point

As discussed previously, the SMDP represents a critical step in the ecological risk assessment process where risk management decision-making occurs (Figures 2-2 and 2-3). An SMDP occurs after Step 2 and Step 3a (if necessary based on the results of Step 2), so that additional evaluation of risks can be conducted if needed and reporting can be streamlined into a single report (USEPA 2000b). Generally, the following types of decisions are considered at this SMDP:

- Whether the available information is adequate to conclude that ecological risks are negligible and, therefore, there is no need for remediation to mitigate ecological risks.

- Whether the available information is not adequate to make a decision at this point, and the ecological risk assessment process should continue.

- Whether the available information indicates a potential for adverse ecological effects, and a more thorough assessment or remediation is warranted.

- If the SMDP indicates that either information is not adequate to make a decision or information indicates a potential for adverse ecological effects, then the ERA process should continue.

3. Building Debris Disposal Trench Area

3.1 Site Description and History

The BDDT is located in the southern portion of the RFAAP-NRU, south of A Avenue. The trench was formerly an ephemeral unlined natural drainage channel that had eroded into the clay surficial soil. The trench channels surface water runoff from the surrounding area down the length of the trench towards the unnamed creek (UNC-NRU) which passes through the area at the base of the BDDT. An approximately 600 ft long portion of the natural depression formed by the trench was previously utilized for the disposal of miscellaneous building debris derived from the dismantling of various structures at the RFAAP-NRU. The building debris consisted of concrete, wood, and rusted and broken drums of a black, tarry substance believed to be roofing tar. The building debris and any visibly stained soil were removed from the trench in 1998. The excavated material was replaced with clean fill and the trench was lined with a geotextile fabric and filled with riprap to minimize the potential for erosion. The area downgradient of the trench did not contain any debris and is covered with a thick grass groundcover.

3.2 Physical Setting

Rolling, grass-covered hills with incised drainage channels provide the setting for the BDDT. The trench runs from north to south between two hills and is approximately 650ft long by 15 ft wide. The head of the trench begins at A Avenue, at an approximate elevation of 2,000 ft above mean sea level (amsl) and slopes downward to the south ending an elevation of approximately 1970 ft amsl. The area downgradient of the trench widens into an open area between the two hills before ending at a small unnamed creek (UNC-NRU) that runs through the southern portion of the RFAAP-NRU. The elevation of the creek bed downgradient of the BDDT is approximately 1960 ft amsl.

The surface soils in the BDDT area generally consist of an organic-rich silty-clay approximately 1 ft deep, which is typical of topsoil throughout the vegetated areas of the RFAAP-NRU. A silty-clay layer with a lower organic content, typical of the Carbo Unit, underlies the surface soils. This unit ranges from strong brown to brownish yellow in color and extends to approximately 4 ft bgs. Bedrock is generally encountered around 5.5 ft bgs, with a saprolitic weathering zone extending from 4 ft bgs to refusal at the bedrock surface. The reported depths are approximate, since the bedrock surface is variable and consists of weathered shale interbedded with layers of limestone and dolomite. Bedrock outcrops are visible along the length of the trench.

3.3 Risk Assessment Datasets

Data generated from the site characterization activities were used in the risk assessment. Risk assessment datasets for soil, sediment, and surface water for the BDDT were prepared then summarized and statistically analyzed per methods described in Section 2. Risk assessment datasets summaries highlighting: the number of detects, number of samples, FOD, minimum and maximum detected concentrations, minimum and maximum detection limits, and EPC are presented in Tables A.3.Data-1 through A.3.Data-5.

As discussed in Section 5.1 of the RI, previous site restoration activities mitigated the source area and potential exposure pathways along the portion of the trench that is now covered by a geotextile liner and riprap. Although the soils in the riprap covered portion of the BDDT are not currently accessible for either human or wildlife exposures, the data from these locations were included in the soil dataset to evaluate potential risks if the rip rap was to be removed in the future so that the soils under it would become accessible. Because the source of COPCs in the rip rap area (the ditch) differed from the source in the remainder of the BDDT, an additional analysis was conducted to determine if potential risks would differ if the soils in that portion of the BDDT were to become accessible in the future and future activities were focused on that area (Section 3.3.4.4).

The purpose of this risk assessment is to evaluate the potential current and future risks and hazards to human health associated with constituents detected in soil, sediment and surface water samples collected at the BDDT. The risk assessment approach follows the Radford Army Ammunition Plant Final Master Work Plan (URS 2003) and the information included in Section 2 of this appendix.

3.4 Human Health Risk Assessment

3.4.1 Selection of Constituents of Potential Concern

This section discusses the selection of COPCs for the HHRA for each medium at the BDDT.

3.4.1.1 Surface Soil

Surface soil COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for residential soil. Table A.3.HHRA-1 presents the selection of surface soil COPCs for the human health risk assessment. As summarized in Table A.3.HHRA-1, 13 constituents were identified as COPCs in surface soil as follows:

Three VOCs (1,2,4-trimethylbenzene; m,p-xylene, and xylenes [total]) were detected in surface soil. All of these constituents were detected in concentrations below the USEPA (2009a) residential soil RSL values, and as a result, were not identified as COPCs in surface soil.

Two SVOCs (carbazole and dibenzofuran) were detected in surface soil. While dibenzofuran was detected in concentrations below the USEPA (2009a) residential soil RSL value, no value was available for carbazole; as a result, this constituent was identified as a COPC for surface soil.

Four herbicides (2,4-D; dalapon; dicamba; and MCPP) were detected in surface soil. Only MCPP was detected in concentrations above the USEPA (2009a) residential soil RSL value and was identified as a COPC for surface soil.

Two pesticides (4,4'-DDD and methoxychlor) were detected in surface soil; however, both of these constituents were detected in concentrations below the USEPA (2009a) residential soil RSL values.

Eight PAHs (benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; benzo[k]fluoranthene; chrysene; dibenzo[a,h]anthracene; indeno[1,2,3-cd]pyrene; and naphthalene) were detected at concentrations greater than the USEPA (2009a) residential soil RSL values and were identified as COPCs for surface soil.

Twenty-two inorganics were detected in surface soil. Four constituents (calcium, magnesium, potassium, and sodium) were identified as essential nutrients and were not evaluated further in the HHRA. Cobalt, iron, and manganese were identified as COPCs for surface soil, as they exceeded both their residential RBCs and their background concentrations.

3.4.1.2 Combined Surface and Subsurface Soil

Combined surface and subsurface soil COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for residential soil. Table A.3.HHRA.2 presents the selection of the combined surface and subsurface soil COPCs for the human health risk assessment. As summarized in Table A.3.HHRA.2, 13 constituents were identified as COPCs in combined surface and subsurface soil as follows:

Building Debris Disposal Trench Area

Three VOCs (1,2,4-trimethylbenzene; m,p-xylene, and xylenes [total]) were detected in combined surface and subsurface soil; however, all of these constituents were detected in concentrations below the USEPA (2009a) residential soil RSL values and were not identified as COPCs for combined surface and subsurface soil.

Two SVOCs (carbazole and dibenzofuran) were detected in combined surface and subsurface soil. Dibenzofuran was detected in concentrations above the residential RSL value and no USEPA (2009a) residential soil RSL value was available for carbazole; as a result, both constituents were identified as COPCs for combined surface and subsurface soil.

Four herbicides (2,4-D; dalapon; dicamba; and MCPP) were detected in combined surface and subsurface soil. Only MCPP was detected in concentrations above the USEPA (2009a) residential soil RSL value and was identified as a COPC for combined surface and subsurface soil.

Two pesticides (4,4'-DDD and methoxychlor) were detected in combined surface and subsurface soil; however, both of these constituents were detected in concentrations below the USEPA (2009a) residential soil RSL values.

Eighteen PAHs (1-methylnaphthalene; 2-methylnaphthalene; acenaphthene; acenaphthylene; anthracene; benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; benzo[g,h,i]perylene; benzo[k]fluoranthene; chrysene; dibenzo[a,h]anthracene; fluoranthene; fluorene; indeno[1,2,3-cd]pyrene; naphthalene; phenanthrene; and pyrene) were detected in combined surface and subsurface soil. Eight of these detected constituents (benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; benzo[k]fluoranthene; chrysene; dibenzo[a,h]anthracene; indeno[1,2,3-cd]pyrene; and naphthalene) were detected at concentrations greater than the USEPA (2009a) residential soil RSL values and were identified as COPCs for combined surface and subsurface soil.

Twenty-two inorganics (aluminum; antimony; arsenic; barium; beryllium; cadmium; calcium; chromium; cobalt; copper; iron; lead; magnesium; manganese; mercury; nickel; potassium; selenium; sodium; thallium; vanadium; and zinc) were detected in combined surface and subsurface soil. Four constituents (calcium; magnesium; potassium; and sodium) were identified as essential nutrients and were not evaluated further in the HHRA. Six of these constituents (aluminum; arsenic; cobalt; iron; manganese; and vanadium) were detected at maximum concentrations greater than the USEPA (2009a) residential soil RSL values; however, aluminum, arsenic, and vanadium were detected below the background concentrations. As a result, only

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cobalt, iron, and manganese were identified as COPCs for combined surface and subsurface soil.

3.4.1.3 Sediment

Sediment COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for residential soil. Table A.3.HHRA.3 presents the selection of sediment COPCs for the human health risk assessment. As summarized in Table A.3.HHRA.3, 12 constituents were identified as COPCs in sediment as follows:

Six VOCs (acetone; carbon disulfide; methylene chloride; p-isopropyltoluene; toluene; and trichloroethene) were detected in sediment; however, all of these constituents were below the USEPA (2009a) residential soil RSL values.

Two SVOCs (4-methylphenol and di-n-butylphthalate) were detected in sediment; however, both of these constituents were detected in concentrations below the USEPA (2009a) residential soil RSL values.

Six pesticides (4,4'-DDD; 4,4'-DDE; 4,4'-DDT; delta-BHC; alpha-chlordane; and dieldrin) were detected in sediment; however, all of these constituents were detected in concentrations below the USEPA (2009a) residential soil RSL values.

Eighteen PAHs (1-methylnaphthalene; 2-methylnaphthalene; acenaphthene; acenaphthylene; anthracene; benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; benzo[g,h,i]perylene; benzo[k]fluoranthene; chrysene; dibenzo[a,h]anthracene; fluoranthene; fluorene; indeno[1,2,3-cd]pyrene; naphthalene; phenanthrene; and pyrene) were detected in sediment. Five of these constituents (benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; dibenzo[a,h]anthracene; and indeno[1,2,3-cd]pyrene) were detected at concentrations greater than the USEPA (2009a) residential soil RSLs and were identified as COPCs for sediment.

Twenty-one inorganics (aluminum; antimony; arsenic; barium; beryllium; calcium; chromium; cobalt; copper; iron; lead; magnesium; manganese; mercury; nickel; potassium; silver; sodium; thallium; vanadium; and zinc) were detected in sediment. Seven of these constituents (aluminum; arsenic; cobalt; iron; manganese; thallium; and vanadium) were detected at concentrations greater than the USEPA (2009a) residential soil RSL values, and four constituents (calcium; magnesium; potassium; and sodium) were identified as essential nutrients. Consequently, only aluminum, arsenic, cobalt, iron, manganese, thallium, and vanadium were identified as COPCs for sediment.

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3.4.1.4 Surface Water

Surface water COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for tap water. Table A.3.HHRA.4 presents the selection of surface water COPCs for the human health risk assessment. As summarized in Table A.3.HHRA.4, four constituents were identified as COPCs in surface water as follows:

Three VOCs (bromodichloromethane; carbon disulfide; and chloroform) were detected in surface water. Two these constituents, including bromodichloromethane and chloroform, were detected above the USEPA (2009a) tap water RSL values and were identified as COPCs for surface water.

One SVOC (di-n-butylphthalate) was detected in surface water; however, this constituent was detected in concentrations below the USEPA (2009a) tap water RSL value, and as a result, was not identified as a COPC for surface water.

Three pesticides (4,4'-DDT; dieldrin; and endrin ketone) were detected in surface water. Of these three constituents, only dieldrin was detected in concentrations above the USEPA (2009a) tap water RSL and was identified as a COPC for surface water.

Five PAHs (2-methylnaphthalene; acenaphthene; acenaphthylene; fluorene; and naphthalene) were detected in surface water. All five of these constituents were detected in concentrations below the USEPA (2009a) tap water RSL values and were not identified as COPCs for surface water.

Fifteen inorganics (aluminum; antimony; barium; calcium; copper; iron; lead; magnesium; manganese; nickel; potassium; silver; sodium; thallium; and zinc) were detected in surface water. Four constituents (calcium; magnesium; potassium; and sodium) were identified as essential nutrients and were not evaluated further in the HHRA. Of these detected constituents, thallium was detected at a maximum concentration above the USEPA (2009a) tap water RSL value. As a result, only thallium was identified as a COPC for surface water.

3.4.2 Summary of Selected Constituents of Potential Concern

Fourteen constituents were selected as COPCs in surface soil and combined surface and subsurface soil at the BDDT, including one SVOC (carbazole), eight PAHs (benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; benzo[k]fluoranthene; chrysene; dibenzo[a,h]anthracene; indeno[1,2,3-cd]pyrene; and naphthalene), one herbicide (MCPP), and four inorganics (cobalt; iron; lead; and manganese).

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Twelve constituents were selected as COPCs in sediment at the BDDT, including five PAHs (benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; dibenzo[a,h]anthracene; and indeno[1,2,3-cd]pyrene), and seven inorganics (aluminum; arsenic; cobalt; iron; manganese; thallium; and vanadium).

Four constituents were selected as COPCs in surface water at the BDDT, including two VOCs (bromodichloromethane and chloroform), one pesticide (dieldrin), and one inorganic (thallium).

3.4.3 Determination of Exposure Point Concentrations

Fourteen constituents were selected as COPCs in both surface soil and combined surface and subsurface soil, twelve constituents were selected as COPCs in sediment, and four constituents were selected as COPCs in surface water because the maximum detected concentrations were greater than the corresponding USEPA (2009a) RSL or no RSL was available. The EPCs for these COPCs are summarized in Table A.3.HHRA.5.

3.4.4 Human Health Risk Characterization

The physical and chemical properties and toxicity values used to evaluate excess lifetime cancer risks and non-cancer hazards are presented in Tables A.2-3 through A.2-9. The exposure assumptions used to evaluate potentially exposed receptors are presented in Table A.2-10. The equations used in the risk characterization calculations are presented in Tables A.2-11 through A.2-15. The soil, sediment, and surface water COPCs were evaluated for direct contact. VOCs identified as COPCs in the BDDT were also evaluated for inhalation via vapor migration into hypothetical future buildings. Potential exposures of a site worker, construction worker and hypothetical future adult and child residents were evaluated for the BDDT. The excess lifetime cancer risks and non-cancer hazards for each potentially exposed receptor included in the risk assessment for the BDDT are summarized in the tables and subsections below.

3.4.4.1 Site Worker

A current or future site worker could be present at the BDDT area, and could be exposed to surface soil, sediment, surface water, or combined surface and subsurface soil via vapor migration to indoor air. The ELCR and non-cancer hazard index for site worker exposure to each medium are presented in Tables A.3.HHRA-6 through A-3.HHRA-9, and are summarized in Table A.3.HHRA-19.

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The total cumulative ELCR for site workers exposed to surface soil, sediment, surface water, and air at the BDDT is 7×10^{-5}, which is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for site workers is 0.6, which is less than the benchmark of 1.

3.4.4.2 Hypothetical Future Construction Worker

A hypothetical future construction worker could be present at the BDDT area, and could be exposed to combined surface and subsurface soil. The ELCR and non-cancer hazard index for hypothetical future construction worker exposure to soil are presented in Table A.-HHRA-10.

The total cumulative ELCR for hypothetical future construction workers exposed to combined surface and subsurface soil at the BDDT was 2×10^{-6}, which is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for hypothetical future construction workers is 1, which is equal to the benchmark of 1. When the HI is segregated into target site and critical effects, all hazards are less than the benchmark of 1.

3.4.4.3 Hypothetical Future Residents

A hypothetical future resident could be present at the BDDT area, and could be exposed to combined surface and subsurface soil, sediment, surface water or combined surface and subsurface soil via vapor migration to indoor air. The ELCRs and non-cancer hazard indices for a hypothetical future resident's exposure to each medium are presented in Tables A.3.HHRA-11 through A.3-HHRA-18, and are summarized in Table A.3.HHRA-19, where the cancer risks for the adult and child resident are summed to to provide the estimated ELCR over the entire 30-year exposure period.

The total cumulative ELCR for a hypothetical resident exposed to combined surface and subsurface soil, sediment, surface water, and air at the BDDT is 4×10^{-4}, which is above the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The COPC that contributed the most to ELCR (i.e., the risk driver), is benzo(a)pyrene.

The total cumulative HI for hypothetical future adult residents is 0.6, which is less than than the benchmark of 1.

The total cumulative HI for hypothetical future child residents is 5, which is greater than the benchmark of 1. When the HI is segregated into target site and critical effects,

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hazards were only greater than the benchmark of 1 in the skin due to the presence of cobalt. Cobalt may be present due to naturally occurring conditions at the BDDT.

3.4.4.4 Future Exposure to Soils Under the Rip rap

In order to evaluate the risks specific to the rip rap portion of the BDDT, EPCs, ELCRs, and HIs were calculated for each receptor using the data available for the riprap area, as indicated in Tables A.3.Data-1 through A.3.Data-5. The sample locations that are located under the rip rap include DTSB1, DTSB2, DTSB3, DTSB4, DTSB5, DTSB6, DTSB7, DTSB8, DTSB9, DTSB10, DTSB11, DTSB12, DTSB13, DTSB14, DTSB15, DTSB16, DTSB17, DTSB18, DTSB19, DTSB20, DTSB21, DTSB22, DTSB23, DTSB35, DTSB36, DTSB37, DTSB38, DTSB39, DTSB40, DTSB41, DTSB42, DTSB43, DTSB44, and DTSB45. EPCs for the subset of BDDT data corresponding to the riprap area are presented in Table A.3.HHRA-5. Because no subsurface soil samples were collected at the rip rap area, unique EPCs were calculated only for surface soils, and calculated risks represent exposure to surface soils only.

The ELCR and non-cancer hazard index for site worker exposure to each medium are presented in Tables A.3.HHRA-20 and A-HHRA-21, and are summarized in Table A.3.HHRA-27. The total cumulative ELCR for site workers exposed to surface soil, sediment, surface water, and air at the rip rap portion of the BDDT is 2×10^{-5}, which is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for site workers is 0.3, which is less than the benchmark of 1.

The ELCR and non-cancer hazard index for hypothetical future construction worker exposure to soil are presented in Table A.-HHRA-22. The total cumulative ELCR for hypothetical future construction workers exposed to combined surface and subsurface soil at the riprap portion is 2×10^{-6}, which is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for hypothetical future construction workers is 0.4, which is below the benchmark of 1.

The ELCR and non-cancer hazard index for hypothetical future adult or child resident exposure to each medium at the riprap portion of the BDDT are presented in Tables A.3.HHRA-23 through A.3-HHRA-26, and are summarized in Table A.3.HHRA-27.

The total cumulative ELCR for hypothetical future residents exposed to combined surface and subsurface soil, sediment, surface water, and air is 3×10^{-4}, which is above the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for hypothetical future adult residents is 0.4, which is less than the benchmark of 1. The total cumulative HI for hypothetical future child residents is 2, which is greater than the benchmark of 1. When the HI is segregated into target site and critical effects, all hazards are less than the benchmark of 1.

EPCs, ELCRs, and HIs for the riprap portion of the BDDT are generally lower than those for the BDDT as a whole, indicating that the riprap area would not pose a higher risk or hazard if the rip rap area were to be used in the future. This analysis is highly conservative as it presumes that future individuals would spend all of their time in the rip rap area alone. Given the nature of this area, this is not likely to occur.

3.4.5 Human Health Risk Summary

Table A.3.HHRA-19 summarizes the calculated cancer risks and non-cancer hazards for each potentially exposed receptor included in the risk assessment for the BDDT. Table A.3.HHRA-27 summarizes the same information for the riprap portion only. As shown in the table below, the total ELCR values for all surface soil, combined surface and subsurface soil, sediment, and surface water exposures for each exposure scenario are below or within the benchmark range of 10^{-6} to 10^{-4} for cancer risk except for the hypothetical future resident. Therefore, it is unlikely that significant cancer risk would occur either from exposure to the BDDT as a whole or from exposure in the rip rap area only, except to the hypothetical future resident.

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Summary of Calculated ELCRs for Receptor Exposure Scenarios for Entire BDDT and Riprap Portion Only

RECEPTOR/ EXPOSURE MEDIUM – SCENARIO	**ELCR at BDDT**	**ELCR for Rip rap portion**
Site Worker		
Surface Soil - Direct Contact	5×10^{-5}	2×10^{-5}
Combined Surface and Subsurface Soil - Vapor Migration to Indoor Air	NA	NA
Sediment – Wading	1×10^{-5}	NA
Surface Water – Wading	4×10^{-7}	NA
TOTAL SITE RISKS (Site Worker):	**7×10^{-5}**	**2×10^{-5}**
Hypothetical Future Construction Worker		
Combined Surface and Subsurface Soil - Direct Contact	2×10^{-6}	2×10^{-6}
TOTAL SITE RISKS (Construction Worker):	**2×10^{-6}**	**2×10^{-6}**
Hypothetical Future Resident		
Combined Surface and Subsurface Soil - Direct Contact	4×10^{-4}	3×10^{-4}
Combined Surface and Subsurface Soil - Vapor Migration to Indoor Air	NA	NA
Sediment – Wading	5×10^{-5}	NA
Surface Water – Wading	2×10^{-7}	NA
TOTAL SITE RISKS (Resident):	**4×10^{-4}**	**3×10^{-4}**

As shown in the table below, the total HI values for all surface soil, combined surface and subsurface soil, sediment, and surface water exposures for each exposure scenario are at or below the benchmark of 1 for non-cancer hazard for both the entire BDDT and the riprap portion only, with the exception of hypothetical future child resident exposure to combined surface and subsurface soil. When the HIs are segregated into target site and critical effects, hazards were greater than the benchmark of 1 in the skin for hypothetical future child resident exposure to the entire BDDT. Cobalt is the constituent exceeding the benchmark in this exposure scenario.

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Summary of Calculated HIs for Receptor Exposure Scenarios for Entire BDDT and Riprap Portion Only

RECEPTOR/ EXPOSURE MEDIUM – SCENARIO	HI at BDDT	HI for Riprap portion
Site Worker		
Surface Soil - Direct Contact	0.5	0.1
Combined Surface and Subsurface Soil - Vapor Migration to Indoor Air	0.04	0.1
Sediment – Wading	0.02	NA
Surface Water – Wading	0.04	NA
TOTAL SITE RISKS (Site Worker):	**0.6**	**0.3**
Hypothetical Future Construction Worker		
Combined Surface and Subsurface Soil - Direct Contact	1	0.4
TOTAL SITE RISKS (Construction Worker):	**1**	**0.4**
Hypothetical Future Adult Resident		
Combined Surface and Subsurface Soil - Direct Contact	0.5	0.2
Combined Surface and Subsurface Soil - Vapor Migration to Indoor Air	0.06	0.2
Sediment – Wading	0.04	NA
Surface Water – Wading	0.01	NA
TOTAL SITE RISKS (Adult Resident):	**0.6**	**0.4**
Hypothetical Future Child Resident		
Combined Surface and Subsurface Soil - Direct Contact	4	2
Combined Surface and Subsurface Soil - Vapor Migration to Indoor Air	0.06	0.2
Sediment – Wading	0.3	NA
Surface Water – Wading	0.04	NA
TOTAL SITE RISKS (Child Resident):	**5**	**2**

Potential exposure to the COPCs during industrial use of the BDDT and riprap portion only resulted in ELCRs and HIs within the target risk range and equal to, or less than, the hazard benchmark.

The results of the risk assessment indicate that residential redevelopment of the BDDT area as a whole or the rip rap portion alone would result in risks or hazards outside the regulatory benchmarks. The cancer risk driver for hypothetical future residents is benzo(a)pyrene. Exposure to cobalt, which was estimated using the maximum detected concentration, resulted in slightly elevated non-cancer hazards for hypothetical child residents. All of the other detections of cobalt at the BDDT were within the background range.

3.5 Ecological Risk Assessment

The purpose of the ERA is to evaluate whether ecological receptors may be adversely impacted by exposure to site-related constituents detected in surface soil, sediment, and surface water at the BDDT. The ERA approach is based on the Master Work Plan (URS 2003). The ERA was conducted in a manner consistent with Virginia policy and USEPA guidance for ecological risk assessment (USEPA 2001a; 2000b; 1997c). This ERA is intended to provide input for risk management decision-making for the BDDT, while maintaining a conservative approach protective of wildlife populations and communities. In accordance with USEPA guidance, the ERA for the BDDT commenced with a SLERA and then concluded with a BERA (USEPA 1997c).

This section summarizes the occurrence of constituents in each medium and identifies COPECs at the BDDT for the ERA; identifies the potential ecological exposure scenarios relevant to the BDDT; and presents the estimated ecological risks associated with the identified COPECs and the relevant ecological exposure scenarios at the BDDT. Methodologies for data summary and selection of COPECs, exposure assessment, and toxicity assessment for the ERA were presented in Section 2.4.

3.5.1 Selection of Constituents of Potential Ecological Concern

This section discusses the selection of COPECs for each medium. Risks to ecological receptors are calculated by dividing the exposure estimates (i.e., the maximum detected concentrations) by the conservative ESLs. The resulting ratio, the hazard quotient (HQ), is a highly conservative surrogate for the assessment endpoints identified in Section 2.4. HQs equal to or less than a value of 1 (to one significant figure) indicate that adverse ecological effects are unlikely (USEPA 1997c). HQs greater than 1 indicate that further evaluation is warranted. Therefore, the constituents with HQs greater than 1 are carried forward as COPECs into the BERA. Because the majority of the ESLs measure direct exposures and do not take into account exposures to upper trophic level species, chemicals identified as bioaccumulative were also carried forward as COPECs regardless of whether or not the associated HQ was greater than 1. Finally, as previously described, concentrations of inorganic constituents in soil were compared to background soil concentrations; those with concentrations below background were not considered as COPEC. The COPEC selection process for the BDDT is summarized below.

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3.5.1.1 Surface Soil

Surface soil COPECs were selected by comparing the analytical data with ecological screening levels (ESLs) from the following sources in order of priority: USEPA (2005b) EcoSSLs, USEPA (2003e) Region 5 Ecological Screening Levels, and ORNL values for soil (Efroymson et al. 1997a,b). Table 3-25 presents the selection of surface soil COPECs for the ecological risk assessment. As summarized in Table A.3.ERA-1, 30constituents were identified as COPECs in surface soil as follows:

Three VOCs (1,2,4-trimethylbenzene; m,p-xylene, and xylenes [total]) were detected in surface soil. HQs were less than or equal to 1 for all three constituents, and as a result, no VOCs were identified as COPECs in surface soil.

Two SVOCs (carbazole and dibenzofuran) were detected in surface soil. Neither of these constituents had an ESL and so HQs could not be calculated; as a result, both were identified as COPECs for surface soil.

Four herbicides (2,4-D; dalapon; dicamba; and MCPP) were detected in surface soil. 2,4-D had a calculated HQ of less than or equal to 1; however, ESLs were not available for dalapon, dicamba, and MCPP and so HQs could not be calculated. As a result, these three herbicides were identified as COPECs for surface soil.

Two pesticides (4,4'-DDD and methoxychlor) were detected in surface soil; however, both of these constituents had HQs less than or equal to 1 however they are considered bioaccumulative and were therefore identified as COPECs for surface soil.

Eighteen PAHs were detected in surface soil. Seven of these detected constituents had HQs greater than 1, while the remaining constituents were less than or equal to 1. However, ten of the PAHs with HQs less than 1 are considered bioaccumulative. As a result, all of the detected PAHs except 1-methylnaphthalene were identified as COPECs for surface soil.

Twenty-two inorganics were detected in surface soil. Four constituents are vital electrolytes and/or essential nutrients (i.e., calcium; magnesium; potassium; and sodium) and therefore were identified as non-toxic and not evaluated further. Fourteen constituents had HQs greater than 1 or were considered bioaccumulative, and two constituents (antimony and iron) did not have an ESL available and so an HQ could not be calculated. However, maximum concentrations of aluminum, chromium, , thallium, and vanadium were all below the background concentrations; as a result, only cobalt, copper, iron,manganese, selenium, and lead were identified as COPECs.

3.5.1.2 Sediment

Sediment COPECs were selected by comparing the analytical data with ESLs from the following sources in order of priority: USEPA (2008d) Region 3 Sediment Screening Levels; ORNL values (Jones et al. 1997); and USEPA (2008d) Region 5 Ecological Screening Levels for sediment. Table 3-26 presents the selection of sediment COPECs for the ecological risk assessment. As summarized in Table A3.ERA-2, 37constituents were identified as COPECs in sediment as follows:

Six VOCs were detected in sediment. Only two of these constituents (acetone and carbon disulfide) had an HQ greater than 1. As a result, these two constituents were identified as COPCs for sediment.

Two SVOCs (4-methylphenol and di-n-butylphthalate) were detected in sediment; however, both of these constituents had an HQ of less than or equal to 1 and were not identified as COPCs for sediment.

Six pesticides were detected in sediment; all of these constituents had an HQ of less than or equal to 1 but are considered bioacculative and were therefore identified as COPCs for sediment.

Eighteen PAHs were detected in sediment. All but two (naphthalene and 1-methylnapthlane) were either identified as bioccumulative or had an HQ greater than 1 and were identified as COPECs for sediment.

Twenty-one inorganics were detected in sediment. Four constituents are vital electrolytes and/or essential nutrients (i.e., calcium; magnesium; potassium; and sodium) and therefore were identified as non-toxic and not evaluated further. Nine constituents were either identified as bioaccumulative or had an HQ greater than one, and four constituents (barium; beryllium; thallium; and vanadium) did not have ESLs. There were no background data available for sediments. Consequently, arsenic, barium, beryllium, chromium, copper, iron, lead, manganese, nickel, thallium, vanadium, and zinc were identified as COPECs for sediment.

3.5.1.3 Surface Water

Surface water COPECs were selected by comparing the analytical data with ESLs from the following sources in order of priority: USEPA (2008c) Region 3 Surface Water Screening Levels; ORNL values (Suter and Tsao 1996); USEPA (2003e) Region 5 Ecological Screening Levels; and USEPA (2008e) Ambient Water Quality Criteria for surface water. Table A.3.ERA-3 presents the selection of surface water COPECs for the ecological risk assessment.

Three VOCs were detected in surface water. Only one of these constituents, chloroform, had an HQ greater than 1. In addition, an ESL was not available for bromodichloromethane, and an HQ could not be calculated. As a result, both bromodichloromethane and chloroform were identified as COPECs for surface water.

Three pesticides were detected in surface water. Dieldrin was identified as bioaccumulative and 4,4'-DDT had an HQ greater than 1. As a result, these constituents were identified as COPEC for surface water.

Five PAHs were detected in surface water. All but naphthalene and 2-methylnapthalene were either identified as bioaccumulative or had HQs greater than 1 and were identified as COPECs for surface water.

Fifteen inorganics were detected in surface water. Four constituents are vital electrolytes and/or essential nutrients (i.e., calcium; magnesium; potassium; and sodium) and therefore were identified as non-toxic and not evaluated further. Of the remaining inorganics, nine were either identified as bioaccumulative or had HQs greater than 1 and therefore considered COPECs for surface water.

3.5.2 Summary of Selected Constituents of Potential Ecological Concern

Thirty constituents were selected as COPECs in surface soil, thirty-seven constituents were selected as COPECs in sediment, and sixteen constituents were selected as COPECs in surface water because the HQs were greater than 1, the chemical was bioaccumulative or an HQ could not be calculated because an ESL was not available.

3.5.3 Refinement of Risk Calculations for Direct Contact Constituents of Potential Ecological Concern

The list of COPECs identified in the BERA was reevaluated by calculating refined HQs. The refined HQs were calculated for the COPECs identified in the SLERA using refined EPCs. As indicated for the SLERA screen, constituents identified as bioaccumulative were carried forward into food chain models. The results of the recalculation of the HQs for the BDDT are summarized in the subsections below.

3.5.3.1 Surface Soil

Thirty COPECs in surface soil were carried forward into the BERA. When refined EPCs were compared with the ESLs, only eight constituents (benzo[a]anthracene; benzo[a]pyrene; chrysene; naphthalene; cobalt; copper; lead; and manganese) had a refined HQ greater than 1. In addition, ESLs were not available for six other constituents (carbazole; dibenzofuran; dalapon; dicamba; MCPP; and iron). The BERA results for surface soil COPECs at the BDDT are presented in Table A.3.ERA-4 and are discussed below:

<u>Semi-Volatile Organic Compounds</u>: Two SVOCs (carbazole and dibenzofuran) were retained in the BERA because an ESL was not available and so HQs could not be calculated. Due to the relatively low concentrations detected (less than 5 mg/kg), and the physical properties of these two SVOCs (e.g., biodegradation in soil and low potential for bioaccumulation), adverse effects to wildlife due to SVOC exposure are considered unlikely.

<u>Herbicides</u>: Three herbicides (dalapon; dicamba; and MCPP) were retained in the BERA because an ESL was not available and so HQs could not be calculated. These three constituents were detected in the one sample that was analyzed for these herbicides. The concentrations detected were relatively low, and none of the three herbicides were detected in any surface water or sediment samples downgradient of the site. Based on this information, adverse effects to wildlife exposed to herbicides at the site are unlikely.

<u>Polycyclic Aromatic Hydrocarbons</u>: Four PAHs (benzo[a]anthracene; benzo[a]pyrene; chrysene; and naphthalene) were retained in the BERA because the calculated HQs were greater than the benchmark value of 1. The ESLs for the four constituents with HQs greater than 1 were obtained from USEPA (2003e) Region 5, and are especially conservative values based on toxicity to the masked shrew. These results are further discussed below.

- Naphthalene was the only PAH not identified as a bioaccumulative COPEC. The HQ calculated using the USEPA (2003e) Region 5 value for this PAH was 70; however, as previously mentioned this Region 5 ESL was based on a conservative food chain model. While alternate toxicologically based ESLs were not available for naphthalene, additional dietary benchmarks were available from Sample et al (1996) for other PAHs. The benchmarks developed by Sample et al (1996) are NOAEL-based dietary benchmarks for mammals exposed to a constituent via ingestion of food. Since naphthalene is not a bioaccumulative COPEC, assuming the naphthalene concentration in all food items is equivalent to the concentration in surface soil provides a conservative estimate of dietary exposure. That is, the receptor would have to have a diet of 100 percent soil to receive the dose associated with the Sample et al (1996) benchmark. The NOAEL benchmark values for benzo(a)pyrene, the most conservative of the PAHs, ranged from 1.98 mg/kg (for short-tailed shrew) to 8.0 mg/kg (for meadow vole) (Sample et al 1996). The EPC for naphthalene, 6.839 mg/kg, is within this range of reported benchmark concentrations. In addition, while the concentrations above the ESL may cause localized impacts to ecological receptors; overall, the total area of concern is within 1 acre and is unlikely to pose a significant adverse ecological impact to ecological receptors at the population-level.

Based on these considerations, adverse effects to wildlife exposed to PAHs at the BDDT are unlikely given the site-specific food chain model results and the similarity of naphthalene concentrations with those below NOAEL-based benchmark values.

Inorganics: Five inorganics (cobalt; copper; iron; manganese; and lead) were retained in the BERA because the calculated HQs were greater than the benchmark value of 1, or an HQ could not be calculated because an ESL was not available. In addition, selenium was retained because it was identified as bioaccumulative. These results are discussed below:

- Cobalt –Only one sample exceeded the background value of 72.3 mg/kg established at the site. Consequently, adverse effects to wildlife exposed to cobalt are unlikely given the similarity of detected concentrations with the site background value.

- Copper –Only three concentrations were above the background value of 53.5 mg/kg established at the site. In addition, as discussed in the sections below, when this COPEC was further evaluated in the site-specific terrestrial food chain model, the calculated HQ values were all less than 1. Based on these considerations, adverse impacts are not expected for wildlife exposed to copper at the BDDT area.

- Iron –One sample was detected above site background. All of the concentrations were within the range of background samples detected at the site. Consequently, adverse effects to wildlife exposed to iron are unlikely given the similarity of detected concentrations with the site background value and range.

- Manganese –Only one concentration was above the background value of 2,543 mg/kg established at the site. Consequently, adverse effects to wildlife exposed to manganese are unlikely given the similarity of detected concentrations with the site background value.

- Lead –Only one concentration was detected outside of the range of background samples detected at the site (2.1 mg/kg to 256 mg/kg). In addition, as discussed in the sections below, when this COPEC was further evaluated in the site-specific terrestrial food chain model, the calculated HQ values were all less than 1. Based on these considerations, adverse impacts are not expected for wildlife exposed to lead at the BDDT area.

- Selenium—The maximum detected concentration of selenium was below the ESL, therefore, it was only retained in the BERA for evaluation in the food chain model. As discussed in the sections below, when this COPEC was further evaluated in the site-specific terrestrial food chain model, the calculated HQ values were all less than 1. Based on these considerations, adverse impacts are not expected for wildlife exposed to selenium at the BDDT area.

In addition to this analysis, twenty COPECs were evaluated in the terrestrial food chain model presented in Section 3.5.4.1.

3.5.3.2 Sediment

Thirty-seven COPECs in sediment were carried forward into the BERA. When refined EPCs were compared with the ESLs, 15 constituents had a refined HQ greater than 1. In addition, ESLs were not available for four other constituents. The BERA results for sediment COPECs at the BDDT are presented in Table A.3.ERA-5 and are discussed below:

Volatile Organic Compounds: Two VOCs (acetone and carbon disulfide) were retained in the BERA because the calculated HQs were greater than the benchmark value of 1 as follows:

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Acetone – Acetone was detected in 5 out of 13 sediment samples, with concentrations ranging from 0.022 mg/kg to 0.037 mg/kg. While all of these concentrations were above the ESL of 0.0099 mg/kg, acetone is a common laboratory contaminant and was also detected in the laboratory blank. Consequently, adverse effects to aquatic life exposed to acetone are unlikely given the low concentrations and the uncertainty that the VOC was actually detected in the sediment samples.

Carbon disulfide – Carbon disulfide was detected in 6 out of 13 sediment samples, with concentrations ranging from 0.00099 mg/kg to 0.0015 mg/kg. While all of these concentrations were above the ESL of 0.000851 mg/kg, the HQ calculated was only slightly greater than the benchmark value of 1 (HQ=2). Consequently, adverse effects to aquatic life exposed to carbon disulfide are unlikely given the low detected concentrations.

Polycyclic Aromatic Hydrocarbons: Eleven PAHs were retained in the BERA because the calculated HQs were greater than the benchmark value of 1 as seen in Table A.3.ERA-5. Calculated HQs for these PAHs ranged from 2 to 10. Since PAHs were COPECs in this ERA, the ESBTU approach was used to calculate a total TU which was compared to the target TU benchmark of one (Table A.3.ERA-6). When available,sample specific TOC were used. TOC ranged from 2.2% to 5.4% at the BDDT, with an average of 3.4%. As previously discussed, a default UF of 2.75 was applied to the total TU to obtain an accurate estimation with 50% confidence. The total TU for 16 of the 17 sediment samples taken at the BDDT were below the benchmark of one and the total TU for the other sample was equal to one, indicating that the potential for adverse effects to aquatic life at the BDDT is unlikely. Consequently, adverse effects to aquatic life exposed to PAHs are unlikely.

Inorganics: Six inorganics were retained in the BERA because the calculated HQs were greater than the benchmark value of 1, or an HQ could not be calculated because an ESL was not available. These results are discussed below:

Barium –All but one of these detected concentration were below the soil background value of 209 mg/kg established at the site (sediment background data is unavailable). Consequently, adverse effects to aquatic life exposed to barium are unlikely given the similarity of detected concentrations with the site background value.

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Beryllium – Beryllium was detected in 13 out of 13 sediment samples, with concentrations ranging from 0.7 mg/kg to 1.3 mg/kg. While no screening value was available for beryllium and no background sediment data were collected, all of these detected concentrations were within the range of soil background values at the site (0.61 mg/kg to 2.5 mg/kg). Consequently, adverse effects to aquatic life exposed to beryllium are unlikely given the similarity of detected concentrations with the range of site background values.

Iron – Iron was detected in 13 out of 13 sediment samples, with concentrations ranging from 16,400 mg/kg to 56,200 mg/kg. While all but three of these concentrations were above the ESL of 20,000 mg/kg, and no background sediment data was collected, all of these detected concentrations were within the range of soil background values (7,250 mg/kg to 67,700 mg/kg) detected at the site. Consequently, adverse effects to aquatic life exposed to iron are unlikely given the similarity of detected concentrations with the range of site background values.

Manganese – Manganese was detected in 13 out of 13 sediment samples, with concentrations ranging from 387 mg/kg to 3,340 mg/kg. All but one of these concentrations was detected above the ESL of 460 mg/kg. While no background sediment data were collected, all of these detected concentrations were below the soil background value of 2,543 mg/kg established for the site. Consequently, adverse effects to aquatic life exposed to manganese are unlikely given the similarity of detected concentrations with the site background value.

Thallium – Thallium was detected in 9 out of 13 sediment samples, with concentrations ranging from 0.09 mg/kg to 1.1 mg/kg. While no screening value was available for thallium and no background sediment data were collected, all of these detected concentrations were below the soil background value of 2.11 mg/kg established for the site. Consequently, adverse effects to aquatic life exposed to thallium are unlikely given the similarity of detected concentrations with the site background value.

Vanadium – Vanadium was detected in 13 out of 13 sediment samples, with concentrations ranging from 31.6 mg/kg to 75.7 mg/kg. While no screening value was available for vanadium and no background sediment data were collected, all of these detected concentrations were below the established soil background values at the site. Consequently, adverse effects to aquatic life exposed to vanadium are unlikely given the similarity of detected concentrations with the site background value.

In addition to this analysis, twenty-seven COPECs were evaluated in the aquatic food chain model described in Section 3.5.4.2.

3.5.3.3 Surface Water

Sixteen COPECs in surface water were carried forward into the BERA. When refined EPCs were compared with the ESLs, only five constituents had a refined HQ greater than 1. In addition, an ESL was not available for bromodichloromethane. The BERA results for surface water COPECs at the BDDT are presented in Table A.3.ERA-7 and are discussed below:

Volatile Organic Compounds: Bromodichloromethane was detected in only 1 out of 13 surface water samples, at a concentration of 0.023 mg/L. Due to the low frequency of detection and the physical properties of this VOC (e.g., high vapor pressure; low bioaccumulative potential), adverse effects to aquatic life due to VOC exposure are considered unlikely.

Pesticides: One pesticide, 4,4'-DDT, was retained in the BERA because the calculated HQ was greater than the benchmark value of 1 (HQ=10). This constituent was detected in only 1 out of 2 samples that analyzed for pesticides and had an HQ of 0.0002 in the sediment. 4,4'-DDT and dieldrin, which was retained because it is bioaccumulative were further evaluated in the aquatic food chain model, as discussed in Section 3.5.4.2.

Inorganics: Four inorganics (aluminum; barium; copper; and thallium) were retained in the BERA because the calculated HQs were greater than the benchmark value of 1. These results are discussed below:

Aluminum – Aluminum was detected in all 13 surface water samples, with concentrations ranging from 0.0498 mg/L to 0.603 mg/L. While six of these samples were greater than the ESL of 0.087 mg/L, the HQ calculated was only slightly greater than the benchmark value of 1 (HQ=4). Furthermore, the ESL used from USEPA (2008c) Region 3 and was based on a water quality criterion protective of salmonids (i.e., coldwater habitat species of fish such as trout and salmon) which is likely overly conservative for the type of warmwater habitat (and associated aquatic species) that is prevalent in this locale. When an alternative screening value of 0.46 mg/L from Sample et al. 1996 was used, an HQ of less than 1 was calculated. This alternative screening value is based on the lowest chronic value of aquatic life, and is considered to be a more representative screening value for aluminum at the BDDT. In addition, aluminum was also detected in the laboratory blank, indicating that the aluminum detected in the surface water may have been a laboratory contaminant. Based on these considerations, adverse effects to aquatic life exposed to aluminum are unlikely.

Barium – Barium was detected in all 13 surface water samples, with concentrations ranging from 0.06 mg/L to 0.0825 mg/L. While all of these samples were greater than the ESL of 0.004 mg/L, the ESL used from USEPA (2008c) Region 3 was based on a secondary chronic value from Suter and Tsao 1996, and was established using an extremely limited dataset. An alternative aquatic screening value of 0.22 mg/L from USEPA (2008c) Region 5 was found, which is considered to be a more representative screening value. When this ESL was used, an HQ of less than 1 was calculated. This alternative screening value is based on the chronic standards for aquatic life, and is a more representative screening value for barium at the BDDT. Based on these considerations, adverse effects to aquatic life exposed to barium are unlikely.

Copper – Copper was detected in all 13 surface water samples, with concentrations ranging from 0.012 mg/L to 0.0348 mg/L. While all of these samples were above the ESL of 0.009 mg/L, the HQ calculated was only slightly above the benchmark value of 1 (HQ=3). In addition, the ESL is based on a default surface water hardness value of 100 mg/L. A site-specific hardness value of 196 mg/L (average at the BDDT area) was used to calculate an ESL of 0.01592 mg/L. When this ESL was used, an HQ of 2 was calculated, which again is only slightly above the benchmark value of 1. Based on these considerations, adverse effects to aquatic life exposed to copper are unlikely.

Thallium – Thallium was detected in 4 out of 13 surface water samples, with concentrations ranging from 0.0023 mg/L to 0.0072 mg/L. While all of these samples were above the ESL of 0.0008 mg/L, the ESL used from USEPA (2008c) Region 3 was based on a Canadian Water Quality value. When an alternative ESL of 0.01 mg/L from USEPA (2003e) Region 5 was used, an HQ of less than 1 was calculated. This alternative screening value is based on a Tier II Michigan water quality value established using a robust set of toxicological data for aquatic life. This value is considered to be a more representative screening value for thallium. Based on these considerations, adverse effects to aquatic life exposed to thallium are unlikely.

In addition to this analysis, eight COPECs in surface water were identified as bioaccumulative (dieldrin; acenaphthene, acenaphthylene; fluorene; lead; nickel; silver; zinc) and were evaluated in the aquatic food chain analysis described in Section 3.5.4.2 along with 4,4'-DDT.

3.5.4 Refinement of Assessment and Measurement Endpoints for Bioaccumulative COPECs

Food chain modeling was conducted at the BDDT in order to evaluate the potential ecological effects of the bioaccumulative COPEC in soil, sediment, and surface water on the receptors identified in Section 2.3. COPECs identified in soil were evaluated in the terrestrial food chain, and COPECs identified in sediment and surface water were evaluated in the aquatic food chain. The results for both the maximum and refined scenarios of these models are discussed below.

3.5.4.1 Terrestrial Food chain Model

As summarized in Tables A.3.ERA-8 through A.3.ERA-11, the refined scenario LOAEL and NOAEL HQs for both the short-tailed shrew and the American robin were less than or equal to 1 for all most COPECs. A few PAHs have NOAEL HQs above 1, however, with the exception of dibenzo(ah)anthracene none has a LOAEL HQ above 1 or a NOAEL HQ above 10. It is important to note that dibenzo(ah)anthracene was only detected in 44% of the samples and the TRVs for this chemical were conservatively extrapolated from acute toxicity values so the risks presented are likely to significantly overestimate actual risks. Based on this assessment, it is concluded that . shrews and robins (or other insectivorous mammals and birds) exposed to these COPECs are not expected to experience adverse effects.

Based on the overall analysis of terrestrial food chain modeling HQs, adverse effects are not expected for wildlife exposed to bioaccumulative COPECs in soil at the BDDT.

3.5.4.2 Aquatic Food chain Model

As presented in Tables A.3.ERA-12 through A.3.ERA-15, the refined scenario LOAEL and NOAEL HQs for both the mink and the great blue heron were less than or equal to 1 for all OPECs identified in sediment and/or surface water with the exception of arsenic, which had a slight exceedance of the NOAEL HQ for the mink. These results indicate that mink and herons (or other piscivorous mammals and birds) exposed to these COPECs are not expected to experience adverse effects.

Based on the overall analysis of aquatic food chain modeling HQs, adverse effects are not expected for wildlife exposed to bioaccumulative COPECs in sediment and/or surface water at the BDDT.

3.5.5 Ecological Risk Summary

Screening-level and baseline risk assessments were completed for the BDDT. After the SLERA, 30 constituents were selected as COPECs in surface soil, 37constituents were selected as COPECs in sediment, and 16 constituents were selected as COPECs in surface water because the HQs were greater than 1, the chemical was considered bioaccumulative, or an HQ could not be calculated because an ESL was not available. After the BERA, 14 constituents in surface soil, 19 constituents in sediment, and six constituents in surface water were retained because the HQs were greater than 1 or an HQ could not be calculated because an ESL was not available. In addition, food chain modeling was evaluated for all those constituents identified as bioaccumulative.

Tables A.3.ERA-16 and A.3.ERA-17 summarize the constituents in surface soil, sediment, and surface water carried through the BERA and evaluated in the terrestrial and/or aquatic food chain models. As shown in these tables, the majority of constituents evaluated in the terrestrial and aquatic food chain refined scenarios had LOAEL and NOAEL HQs less than or equal to 1. Those that exceeded 1 were below 10 with the exception of the NOAEL HQ associated with dibenzo(a,h)anthracene exposures to shrew. However, as noted previously, that chemical was detected in less than half of the samples analyzed, and the TRVs evaluated were conservatively extrapolated from acute studies, so the risks are likely ovestimated Based on the overall analysis of the ERA for the BDDT, the results indicate that adverse effects are not expected for wildlife at the site.

As discussed in Section 5.1 of the RI, previous site restoration activities mitigated the source area and potential exposure pathways along the trench. Because the soils in the riprap covered portion of the BDDT were not included in the soil dataset for the ERA (as discussed in Section 3.3), the potential impact of this approach was evaluated by comparing the concentrations of constituents in the soils in the riprap covered portion of the BDDT with the concentrations used to develop the EPCs for the ERA.

To do this, the data from the 14 surface soil locations under the riprap (DTSB1, DTSB5, DTSB13, DTSB35, DTSB36, DTSB37, DTSB38, DTSB39, DTSB40, DTSB41, DTSB42, DTSB43, DTSB44, and DTSB45) were evaluated EPCs were calculated for evaluation in the ERA. As shown in Table A.3.ERA-18, all HQs for short-tailed shrew were below 1 with the exception of dibenzo(a,h)anthracene and ideno(1,2,3-cd)pyrene. The HQs were comparable to those calculated for the rest of the BDDT area and are likely due to the conservatism inherent in the PAH TRVs as previously discussed. Based on this analysis, adverse affects to wildlife are not expected to be associated with the rip-rap area.

3.6 BDDT Summary and Conclusions

An HHRA was conducted to evaluate exposure to COPCs in surface soil, combined surface and subsurface soil, sediment, and surface water for site workers, construction workers, hypothetical adult residents, and hypothetical child residents under both current and future land-use conditions. Soils in the entire BDDT area and soils in the rip rap portion of the BDDT were evaluated separately to determine if soils under the rip rap would present a higher risks in the event that they become accessible in the future. The calculated excess lifetime cancer risks and hazards were within the USEPA's target risk range of 1×10^{-6} to 1×10^{-4} or less than or equal to the hazard index of 1,with the exception of the future resident. The ELCR for the resident exceeded 1×10^{-4} mostly due to benzo(a)pyrene. Hazards exceeded 1 for the child resident due to exposure to the maximum concentration of cobalt in subsurface soil, the only sample result for cobalt that exceeded the background range.

Potential exposure to the COPCs during industrial use of the BDDT and riprap portion only resulted in ELCRs and HIs within the target risk range and equal to the hazard benchmark.

The results of the human health risk assessment indicate that residential redevelopment of the BDDT area as a whole or the rip rap portion alone may result in risks or hazards outside the regulatory benchmarks. Exposure to benzo(a)pyrene resulted in risks greater than 1×10^{-4} for the hypothetical future resident. Exposure to cobalt resulted in slightly elevated hazards for child residents. However, the cobalt hazards were driven by a single sample with an elevated concentration. All of the other detections of cobalt at the BDDT were within the background range.

A SLERA and BERA were completed for the BDDT, to evaluate surface soil, sediment, and surface water for ecological receptors, and food chain modeling was evaluated for all those constituents identified as bioaccumulative. The results of the evaluation of the SLERA and BERA for direct contact and the constituents evaluated in the terrestrial

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and aquatic food chain models indicate that adverse effects are not expected for wildlife at the BDDT.

Overall, the results of the HHRA and ERA indicated that potential risks associated with the site are within acceptable ranges for current and future industrial use of the site. However, risks are present under the hypothetical residential land use scenario. The primary risk driver under the residential land use scenario is benzo(a)pyrene. The only non-cancer risk driver for a residential use scenario is cobalt, and that constituent was only detected at a concentration above an applicable screening level in one isolated sample. The elevated cobalt detection is unlikely to be the result of disposal activities at the site and is likely naturally occurring.

4. Bag Loading Area

4.1 Site Description and History

The BLA is located along the southwestern boundary of the RFAAP-NRU, to the south of the RY. The BLA ran two black powder bag loading production lines from 1941-1943. Ten buildings were once present onsite; however, all process equipment, wooden roofs, and wooden walls have been removed from the buildings, leaving only concrete slabs and cinder block walls. The concrete slab floors in Buildings 404 through 413 (including the second story floors of Buildings 404 and 407) were covered in a conductive flooring material that contained various metals and asbestos. This conductive flooring was used to prevent the build-up of static charges in areas where energetic materials were handled. Removal of the walls and roofs of the buildings has exposed the conductive flooring to weather, causing it to degrade and break away from the underlying concrete. In some cases, the flooring has degraded into a red powder-like material and washed onto the surrounding soils. The concrete walls of these buildings were also painted with lead-based paint. Deterioration of the paint may have provided a potential source of lead to the soils immediately surrounding the former building areas. Buildings 414 through 416 did not contain conductive flooring or concrete walls and are not considered an environmental concern at BLA. Surface water at the BLA generally drains to the unnamed stream located to the north of the BLA via overland flow and through series of drainage ditches/culverts.

4.2 Physical Setting

Topography in the vicinity of the BLA buildings is generally flat. Vegetation is mostly limited to grass and small shrubs. Surface water is drained through a series of drainage ditches and culverts. Surface soil at the BLA consists of tan to dark brown silty clay and clay. The BLA is located on a hilltop and the soil is typical of the Lowell Silt Loam which forms from the weathering of limestone and interbedded shale. The Lowell Silt Loam is found on the hills and ridges throughout the NRU.

4.3 Risk Assessment Datasets

Data generated from the site characterization activities were used in the risk assessment. Risk assessment datasets for soil, sediment, and surface water for the BLA were prepared then summarized and statistically analyzed. Risk assessment datasets summaries highlighting: the number of detects, number of samples, FOD, minimum and maximum detected concentrations, minimum and maximum detection limits, and EPC are presented in Tables A.4.Data-1 through A.4.Data-5.

4.4 Human Health Risk Assessment

The purpose of this risk assessment is to evaluate the potential current and future risks and hazards to human health associated with constituents detected in soil, sediment and surface water samples collected at the BLA. The risk assessment approach follows the Radford Army Ammunition Plant Final Master Work Plan (URS 2003). The risk assessment approach is based on Virginia and USEPA guidance for risk assessments (USEPA 2004a; 2000a; 1997a; 1992; 1991a; 1989). This section summarizes the occurrence of constituents in each medium and identifies COPCs at the BLA for the human health risk assessment; identifies the potential human exposure scenarios relevant to the BLA; and presents the estimated human health risks associated with the identified COPCs and the relevant human exposure scenarios at the BLA.

4.4.1 Selection of Constituents of Potential Concern

This section discusses the selection of COPCs for each medium.

4.4.1.1 Surface Soil

Surface soil COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for residential soil. Table A.4.Data-1 summarizes the selection of surface soil COPCs for the HHRA.

Nine VOCs were detected in surface soil. All of these constituents were detected at concentrations below the USEPA (2009a) residential soil RSL values with the exception of 3-octanone and d-limonene, which did not have USEPA (2009a) residential soil RSLs. As a result, only 3-octanone and d-limonene were identified as COPCs for surface soil.

Nine SVOCs were detected in surface soil. All of these constituents were detected at concentrations below the USEPA (2009a) residential soil RSL values with the exception of carbazole, which did not have a value. As a result, carbazole was identified as a COPC for surface soil.

Seven explosives were detected in surface soil. All of these constituents were detected at concentrations below the USEPA (2009a) residential soil RSLs with the exception of pentaerythritol tetranitrate, which did not have a value. As a result, only pentaerythritol tetranitrate was identified as a COPC for surface soil.

Nine pesticides were detected in surface soil. All of these constituents were detected at concentrations below the USEPA (2009a) residential soil RSL values and were not identified as COPCs in surface soil.

Eighteen PAHs were detected in surface soil. Seven of these detected constituents (benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; benzo[k]fluoranthene; chrysene; dibenzo[a,h]anthracene; and indeno[1,2,3-cd]pyrene) were detected at concentrations above the USEPA (2009a) residential soil RSLs and were identified as COPCs for surface soil.

One PCB, Aroclor 1254, was detected in surface soil. This constituent was detected above the USEPA (2009a) residential soil RSL value and was identified as a COPC for surface soil.

Twenty-three inorganics were detected in surface soil. Four constituents (calcium; magnesium; potassium; and sodium) were identified as essential nutrients and were not evaluated further in the HHRA. Eight of these constituents (aluminum; antimony; arsenic; barium; cadmium; cobalt; copper; iron; lead; manganese; mercury; thallium; vanadium; and zinc) were above the USEPA (2009a) residential soil RSL values. However, aluminum, thallium, and vanadium were all detected below the background concentrations. As a result, only antimony, arsenic, barium, cadmium, cobalt, copper, iron, lead, manganese, mercury and zinc were identified as COPCs for surface soil.

Finally, asbestos has also been detected in surface soils around some of the buildings in the BLA in areas where conductive flooring has degraded into a red powder-like material that has washed onto the surrounding soils adjacent to those buildings. Soil sampling and activity-based air sampling have been conducted in selected areas of the BLA and are discussed in Section 6.4.7 of the RI. The results of this sampling indicate that asbestos is also a COPC for surface soil at this site. However, because asbestos is evaluated differently than other chemical COPCs, the evaluation of asbestos is separately discussed in Section 4.4.5 of this HHRA.

4.4.1.2 Combined Surface and Subsurface Soil

Combined surface and subsurface soil COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for residential soil. Table A.4.Data-2 presents the selection of combined surface and subsurface soil COPCs for the HHRA. As summarized in Table A.4.Data-2, 24 constituents were identified as COPCs in combined surface and subsurface soil.

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Nine VOCs were detected in combined surface and subsurface soil. All of these constituents were detected at concentrations below their respective USEPA (2009a) residential soil RSLs with the exception of 3-octanone and d-limonene, which didn't have USEPA (2009a) residential soil RSLs. As a result, only 3-octanone and d-limonene were identified as COPCs for combined surface and subsurface soil.

Nine SVOCs were detected in combined surface and subsurface soil. All of these constituents were detected at concentrations below the USEPA (2009a) residential soil RSL values with the exception of carbazole, which did not have a value. As a result, only carbazole was identified as a COPC for combined surface and subsurface soil.

Seven explosives were detected in combined surface and subsurface soil. All of these constituents were detected at concentrations below the USEPA (2009a) residential soil RSL values with the exception of pentaerythritol tetranitrate, which did not have a value. As a result, only pentaerythritol tetranitrate was identified as a COPC for combined surface and subsurface soil.

Nine pesticides were detected in combined surface and subsurface soil. All of these constituents were detected at concentrations below the USEPA (2009a) residential soil RSL values and were not identified as COPCs for combined surface and subsurface soil.

Eighteen PAHs were detected in combined surface and subsurface soil. Seven of these detected constituents were detected at a maximum concentration above the USEPA (2009a) residential soil RSL values and were identified as COPCs for combined surface and subsurface soil.

One PCB, Aroclor 1254, was detected in combined surface and subsurface soil. This constituent was detected at concentrations above the USEPA (2009a) residential soil RSL and was identified as a COPC for combined surface and subsurface soil.

Twenty-three inorganics were detected in combined surface and subsurface soil. Four constituents (calcium; magnesium; potassium; and sodium) were identified as essential nutrients and were not evaluated further in the HHRA. Fourteen of these constituents (aluminum; antimony; arsenic; barium; cadmium; cobalt; copper; iron; lead; manganese; mercury; thallium; vanadium; and zinc) were detected at maximum concentrations above the USEPA (2009a) residential soil RSL values. However, thallium and vanadium were both detected below the background concentrations. As a result, only aluminum, antimony, arsenic, barium, cadmium, cobalt, copper, iron, lead, manganese, mercury and zinc were identified as COPCs for combined surface and subsurface soil.

4.4.1.3 Sediment

Sediment COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for residential soil. Table A.4.Data-3 presents the selection of sediment COPCs for the HHRA. As summarized in Table A.4.Data-3, five constituents were identified as COPCs in sediment.

Two VOCs (acetone and toluene) were detected in sediment. Both of these constituents were detected at concentrations below the USEPA (2009a) residential soil RSL values and were not identified as COPCs in sediment.

One SVOC, bis(2-ethylhexyl)phthalate, was detected in sediment. This constituent was detected at a maximum concentration below the USEPA (2009a) residential soil RSL value and was not identified as a COPC in sediment.

Seven pesticides (4,4'-DDD; 4,4'-DDE; 4,4'-DDT; beta-BHC; alpha-chlordane; gamma-chlordane; and dieldrin) were detected in sediment; however, all of these constituents were below the USEPA (2009a) residential soil RSL values and were not identified as COPCs in sediment.

Fifteen PAHs (2-methylnaphthalene; anthracene; benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; benzo[g,h,i]perylene; benzo[k]fluoranthene; chrysene; dibenzo[a,h]anthracene; fluoranthene; fluorene; indeno[1,2,3-cd]pyrene; naphthalene; phenanthrene; and pyrene) were detected in sediment; however, all of these constituents were detected at concentrations below the USEPA (2009a) residential soil RSL values and were not identified as COPCs in sediment.

Nineteen inorganics (aluminum; antimony; arsenic; barium; beryllium; calcium; chromium; cobalt; copper; iron; lead; magnesium; manganese; nickel; potassium; sodium; thallium; vanadium; and zinc) were detected in sediment. Four constituents (calcium; magnesium; potassium; and sodium) were identified as essential nutrients and were not evaluated further in the HHRA. Five of these constituents (aluminum; arsenic; cobalt; iron; and manganese) were above the USEPA (2009a) residential soil RSL values. Consequently, only aluminum, arsenic, cobalt, iron, and manganese were identified as COPCs for sediment.

4.4.1.4 Surface Water

Surface water COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for tap water. Table A.4.Data-4 presents the selection of surface water COPCs for the HHRA. As summarized in Table A.4.Data-4, six constituents were identified as COPCs.

Two VOCs (carbon disulfide and chloroform) were detected in surface water. Both of these constituents were detected at concentrations below the USEPA (2009a) tap water RSL values and were not identified as COPCs for surface water.

Two SVOCs (butylbenzylphthalate and di-n-buthylphthalate) were detected in surface water; however, both of these constituents were detected at concentrations below the USEPA (2009a) tap water RSL values and were not identified as COPCs for surface water.

One explosive, m-nitrotoluene, was detected in surface water. This constituent was detected at concentrations below the USEPA (2009a) tap water RSL value and was not identified as a COPC for surface water.

One herbicide, 2,4-D, was detected in surface water. This constituent was detected at concentrations below the USEPA (2009a) tap water RSL value and was not identified as a COPC for surface water.

One pesticide, dieldrin, was detected in surface water. This constituent was detected at a maximum concentration above the USEPA (2009a) tap water RSL value and was identified as a COPC for surface water.

Six PAHs (benzo[a]anthracene; benzo[b]fluoranthene; chrysene; fluoranthene; phenanthrene; and pyrene) were detected in surface water. All six of these detected constituents were detected at concentrations below the USEPA (2009a) tap water RSL values and were not identified as COPCs for surface water.

Sixteen inorganics (aluminum; antimony; arsenic; barium; calcium; chromium; copper; iron; lead; magnesium; manganese; mercury; potassium; selenium; sodium; and zinc) were detected in surface water. Four constituents (calcium; magnesium; potassium; and sodium) were identified as essential nutrients and were not evaluated further in the HHRA. Five of these detected constituents (arsenic; copper; lead; manganese; and mercury) were detected above the USEPA (2009a) tap water RSL values. As a result, only arsenic, copper, lead, manganese, and mercury were identified as COPCs for surface water.

4.4.2 Summary of Selected Constituents of Potential Concern

Twenty-three constituents were selected as COPCs in surface soil at the BLA, including two VOCs (3-octanone and d-limonene), one SVOC (carbazole), seven PAHs (benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; benzo[k]fluoranthene; chrysene; dibenzo[a,h]anthracene; and indeno[1,2,3-cd]pyrene), one PCB (Aroclor 1254), one explosive (pentaerythritol tetranitrate), and eleven inorganics (antimony; arsenic; barium; cadmium; cobalt; copper; iron; lead; manganese; mercury; and zinc).

Twenty-four constituents were selected as COPCs in combined surface and subsurface soil at the BDDT, including two VOCs (3-octanone and d-limonene), one SVOC (carbazole), seven PAHs (benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; benzo[k]fluoranthene; chrysene; dibenzo[a,h]anthracene; and indeno[1,2,3-cd]pyrene), one PCB (Aroclor 1254), one explosive (pentaerythritol tetranitrate), and twelve inorganics (aluminum; antimony; arsenic; barium; cadmium; cobalt; copper; iron; lead; manganese; mercury; and zinc).

Five inorganics were selected as COPCs in sediment at the BDDT, including aluminum, arsenic, cobalt, iron, and manganese.

Six constituents were selected as COPCs in surface water at the BDDT, including one pesticide (dieldrin), and five inorganics (arsenic; copper; lead; manganese; and mercury).

4.4.3 Determination of Exposure Point Concentrations

Twenty-three constituents were selected as COPCs in surface soil, twenty-four constituents were selected as COPCs in combined surface and subsurface soil, five constituents were selected as COPCs in sediment, and six constituents were selected as COPCs in surface water because the maximum detected concentrations were greater than the corresponding USEPA (2009a) RSL or no RSL was available. The EPCs for these COPCs are summarized in Table A.4.HHRA-5.

4.4.4 Human Health Risk Characterization

The physical and chemical properties and toxicity values used to evaluate excess lifetime cancer risks and non-cancer hazards are presented in Tables A.2-3 through A.2-9. The exposure assumptions used to evaluate potentially exposed receptors are presented in Table A.2-10. The equations used in the risk characterization calculations are presented in Tables A.2-11 through A.2-15.

Exposure to the COPCs in soil, sediment, and surface water were evaluated for direct contact. VOCs identified as COPCs in the BLA were also evaluated for inhalation via vapor migration into buildings. Two VOCs, 3-octanone and d-limonene, were identified as soil COPCs at the BLA. Those two COPCs do not have identified inhalation toxicity values; therefore, the indoor vapor intrusion pathway could not be assessed at this Study Area.

Results of the risk characterization are discussed below. The ELCRs and non-cancer hazards are summarized in Table A.4.HHRA-16. The blood lead level model estimates for each potentially exposed receptor included in the risk assessment for the BLA are summarized in Table A.4.HHRA-20.

4.4.4.1 Site Worker

A current or future site worker could be present at the BLA area, and could be exposed to surface soil, sediment, or surface water. The ELCR and non-cancer hazard index for site worker exposure to each medium are presented in Tables A.4.HHRA-6 through A.4.HHRA-8. The ELCRs for surface soil, sediment, and surface water are all within or equal to the high end of the USEPA target risk range, and the HIs for each medium are all below the benchmark value of 1.

The total cumulative ELCR for site workers exposed to surface soil, sediment, and surface water at the BLA is 1×10^{-4}, which is equal to the high end of the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. This is due to the presence of benzo(a)pyrene in surface soil. The total cumulative HI for site workers is 0.8, which is less than the benchmark of 1.

The 50th percentile blood lead level estimates for the site worker receptor was at 4.9 micrograms per deciliter (µg/dL), below the benchmark of 10 µg/dL; however the 95th percentile fetal blood lead level was at 17 µg/dL which exceeds the benchmark, as seen in Table A.4.HHRA-17.

4.4.4.2 Hypothetical Future Construction Worker

A hypothetical future construction worker could be present at the BLA area, and could be exposed to combined surface and subsurface soil. The ELCR and non-cancer hazard index for hypothetical future construction worker exposure to soil are presented in Table A.4.HHRA-9. The ELCR for combined surface and subsurface soil is within the USEPA target risk range, and the HI is above the benchmark value of 1.

The total cumulative ELCR for hypothetical future construction workers exposed to combined surface and subsurface soil at the BLA is 7×10^{-6}, which is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for hypothetical future construction workers is 3, which is above the benchmark of 1. When the HI is segregated into target site and critical effects, hazards were above the benchmark of 1 in the gastrointestinal tract due to the presence of copper.

The 50th percentile blood lead level estimates for the construction worker receptor was at 5.2 µg/dL below the target level of 10 µg/dL; however the 95th percentile fetal blood lead levels was calculated to be 18 µg/dL which exceeds the benchmark, as seen in Table A.4.HHRA-19.

4.4.4.3 Hypothetical Future Residents

A hypothetical future adult or child resident could be present at the BLA area, and could be exposed to surface soil, sediment, or surface water. The ELCR and non-cancer hazard index for hypothetical future adult or child resident exposure to each medium are presented in Tables A.4.HHRA-10 through A.4.HHRA-15. The ELCRs for sediment and surface water are both below the USEPA target risk range; however, the ELCR for combined surface and subsurface soil was above the USEPA risk range. The HIs for each medium are below or equal to the benchmark value of 1, with the exception of the child resident exposure to combined surface and subsurface soil.

The total cumulative ELCR for hypothetical future residents exposed to combined surface and subsurface soil, sediment, and surface water at the BLA is 1×10^{-3}, which is greater than the USEPA target risk range of 1×10^{-6} to 1×10^{-4}, primarily due to the presence of benzo(a)pyrene and other PAHs. The total cumulative HI for hypothetical future adult residents is equal to the benchmark of 1. The total cumulative HI for hypothetical future child residents is 12, which is greater than the benchmark of 1. When the HI is segregated into target site and critical effects, hazards were above the benchmark of 1 for the central nervous system, whole body, and immune system, for the gastrointestinal tract, and for the eyes, nails, hair, and skin, due to the presence of Aroclor 1254, copper, and cobalt.

The 50th percentile blood lead level estimates for the hypothetical adult resident receptor was at 6.5 µg/dL which is well below the benchmark of 10 µg/dL; however the 95th percentile fetal blood lead levels was predicted to be 23 µg/dL, which is above the benchmark. The range of blood lead level estimates for the child receptor was 11 µg/dL to 18 µg/dL,, as seen in Table A.4.HHRA-20. The predicted exposure of a child over a seven year period resulted in a geometric mean blood lead concentration of 14.9 µg/dL, also above the 10 µg/dL benchmark, and a prediction of 80 percent of the population having blood lead concentrations above the 10 µg/dL benchmark. Input assumptions to and output for the lead modeling for the child receptor are presented in Table A.4.HHRA-18.

4.4.5 Evaluation of Asbestos

USEPA (2008f) has developed a recommended framework for evaluating asbestos-contaminated sites. That framework states that the measurement of asbestos in soils may not be a good indicator of potential for exposure, due to the fact that the main route of asbestos toxicity is through inhalation of fibers. Thus, the important metric is the measurement of asbestos fibers in air within a breathable zone.

Based on this information, USEPA recommends that activity-based air sampling be conducted in addition to soil sampling, to determine whether disturbance of soils in areas known to contain asbestos can result in the mobilization of asbestos into air where it may be inhaled by the individuals engaged in activities there. Thus the goal of activity-based sampling is to disturb the soil, through an intensive activity such as raking, and then measuring the amount of asbestos that is found in air during that activity.

As discussed in Section 6.4.7 of the RI, ARCADIS conducted an additional investigation in July 2009 to facilitate the evaluation of potential health risks associated with asbestos in soil. This investigation was conducted in accordance with the May 2009 Supplemental Remedial Investigation Work Plan and included the collection of delineation soil samples and the conduct of activity-based air sampling.

Delineation soil samples were collected at select surface soil locations where asbestos had previously been detected or at buildings that lacked historical data. The samples were collected at distances of 1, 5, 10, 15, and 20 ft from buildings and analyzed for asbestos by transmission electron microscopy (TEM) via USEPA method 600/R-

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93/116 with sample preparation using California Air Resources Board (CARB) Method 435 and an analytical sensitivity of 0.1% (TEM CARB Level B). This analysis allowed for a quantitative evaluation of asbestos content in soil

To evaluate the risk of exposure to airborne asbestos fibers resulting from asbestos in soil in those areas, ARCADIS also conducted activity-based sampling at two of the BLA buildings (Buildings 404 and 411). This sampling program, which was performed in accordance with USEPA guidance (2008f), included the following:

- Two 10 ft by 10 ft grids were established at Buildings 404 and 411 (total of 4 grids), at 0-10 and 10-20 feet from the building edges, in areas that have had historic asbestos detections.

- Each grid was vigorously raked by a participant wearing Level C personal protection equipment, so that the soil was disturbed. During the raking activity, the participant wore a personal air monitoring pump fitted with a 0.8 µm mixed cellulose ester (MCE) filter and sampling tube mounted in the subjects breathing zone to collect air samples during the raking activity. A stationary air monitoring pump fitted with a 0.8µm filter and sampling tube mounted at a height of 5 feet was also set on the downwind perimeter of the grid to collect air samples during the raking activity. The raking activity was performed for a duration that allowed at least 750 to 1,000 liters of air to be pulled through the filters. The filters from the personal pump and stationary pump were both submitted for laboratory analysis of asbestos by TEM Method 10312.

A complete summary of the samples collected at the BLA during the 2008 and 2009 investigations are included within the historical sampling matrix presented in Table 2-2 of the RI.

To evaluate the results of the air sampling that was conducted, ARCADIS developed risk-based air action levels (AALs) for relevant, site-specific exposure scenarios, using the methodology outlined in USEPA's framework (2008f). These AALs were calculated using the following equation:

$$AAL = \frac{TargetRisk}{\left(IUR_{LTL} * \frac{ET}{CF_1} * \frac{EF}{CF_2}\right)}$$

Where:

AAL = Air action level (fibers/cc)

Target Risk = Target carcinogenic risk level (unitless)
IUR = Inhalation Unit Risk $(f/cc)^{-1}$
ET = Exposure time (hours exposed per day)
CF_1 = Conversion factor (24 hours/day)
EF = Exposure frequency (days exposed per year)
CF_2 = Conversion factor (365 days/year)

As discussed in Section 4.4.4, the exposure scenarios evaluated for the BLA included the current and future site worker, the hypothetical future construction worker, the hypothetical future child resident, and the hypothetical future adult resident. Thus AALs were calculated for these four exposure scenarios, using the exposure frequencies and exposure times, outlined in Table A.2-10, and the inhalation unit risk factors provided in USEPA (2008f; see Table 2) guidance based on the age of first exposure and the duration of exposure provided in Table A.2-10, presented below.

	Current/ Future Site Worker	**Hypothetical Future Construction Worker**	**Hypothetical Future Child Resident**	**Hypothetical Future Adult Resident**
IUR $(f/cc)^{-1}$	0.066	0.0046	0.055	0.075
Start Age	20	20	0	20
Duration	25	1	6	30
ET (hr/day)	8	8	24	24
EF (days/yr)	250	130	350	350

AALs were calculated for each potential receptor group at the 1E-06 and 1E-04 risk levels, representing the lower and upper ends of USEPA's acceptable risk range. The calculated AALs are presented in the following table.

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	Calculated AAL (f/cc) at Indicated Target Risk Level	
Receptor Group	**Target Risk = 1E-06**	**Target Risk = 1E-04**
Current/Future Site Worker	0.00007	0.007
Hypothetical Future Construction Worker	0.002	0.2
Hypothetical Future Child Resident	0.00002	0.002
Hypothetical Future Adult Resident	0.00001	0.001

The total asbestos concentration measured in air at Building 404 was non-detect in samples taken from the grid at 10-20 feet from the building edge (BLA404-AA2 and BLA404-AP2). However, asbestos was detected in air samples taken from the grid adjacent to the building (0-10 feet from building edge) (BLA404-AA1 and BLA404-AP1). At BLA404-AA1, the total asbestos structures (specifically chrysotile) measured by Total TEM were 0.022 f/cc[1]; total asbestos structures (i.e., chrysotile) measured at BLA404-AP1 were 0.090 f/cc. The average of all asbestos samples, including the two locations where it was non-detect, was 0.028 g/cc. All of these exceed the AAL of 0.007 f/cc (based on a 1E-04 risk level) calculated for the current and future site worker, as well as the AALs of 0.001 and 0.002 f/cc calculated for the hypothetical future child and adult residents, respectively. None of these exceed the AAL of 0.2 calculated for the hypothetical future construction worker.

The total asbestos concentration measured in air at Building 411 was similar with the total asbestos concentrations nearest the building (BLA411-AA1 and BLA411-AP1) measured to be 0.078 and 0.034 f/cc, respectively. The single concentration measured in the grid located 10-20 feet from the building (BLA411-AP2) was non-detect for asbestos. For all three samples, the average concentration is 0.037 f/cc.

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[1] Sampling results are reported as structures per cc (s/cc). This is equivalent to fibers per cc (f/cc)

These exceed the calculated AALs for the current/future site worker and the hypothetical future residents, but do not exceed the calculated AAL for the hypothetical future construction worker.

This comparison indicates that the presence of asbestos in the soils closest to Buildings 404 and 411 may result in unacceptable air concentrations if those soils are subject to intensive disturbance. Consequently, they may potentially present a risk to individuals who are engaged in soil-disturbance activities there.

4.4.6 Human Health Risk Summary

Table A.4.HHRA-16 summarizes the calculated cancer risks and non-cancer hazards for each potentially exposed receptor included in the risk assessment for the BLA. As shown in the table below, the total ELCR values for all surface soil, combined surface and subsurface soil, sediment, and surface water exposures for each exposure scenario are below or within the benchmark range of 10^{-6} to 10^{-4} for cancer risk, with the exception of hypothetical future residential exposure to combined surface and subsurface soil. The primary contributor to the risk estimates for hypothetical residents is benzo(a)pyrene.

Summary of Calculated ELCRs and HIs for Receptor Exposure Scenarios

RECEPTOR/ EXPOSURE MEDIUM - SCENARIO	ELCR	HI
Site Worker		
Surface Soil - Direct Contact	1E-04	0.7
Sediment – Wading	4E-07	0.007
Surface Water – Wading	2E-06	0.05
TOTAL SITE RISKS (Site Worker):	**1E-04**	**0.8**
Hypothetical Future Construction Worker		
Combined Surface and Subsurface Soil - Direct Contact	7E-06	3
TOTAL SITE RISKS (Construction Worker):	**7E-06**	**3**
Hypothetical Future Adult Resident		
Combined Surface and Subsurface Soil - Direct Contact	-	1
Sediment – Wading	-	0.01
Surface Water – Wading	-	0.01
TOTAL SITE RISKS (Adult Resident):	**-**	**1**
Hypothetical Future Child Resident		
Combined Surface and Subsurface Soil - Direct Contact	-	12
Sediment – Wading	-	0.09
Surface Water – Wading	-	0.04
TOTAL SITE RISKS (Child Resident):	**-**	**12**

Hypothetical Future Aggregate Resident (Adult and Child)		
Combined Surface and Subsurface Soil - Direct Contact	1E-03	-
Sediment – Wading	1E-06	-
Surface Water – Wading	1E-06	-
TOTAL SITE RISKS (Aggregate Resident):	**1E-03**	**-**

The total HI values for all surface soil, combined surface and subsurface soil, sediment, and surface water exposures for each exposure scenario are at or below the benchmark of 1 for non-cancer hazard, with the exception of hypothetical future construction worker and hypothetical future child resident exposure to combined surface and subsurface soil. When the HIs are segregated into target site and critical effects, hazards were only greater than the benchmark of 1 in the gastrointestinal (GI) tract for the hypothetical future construction worker, due to copper. For the hypothetical future child resident exposure to surface soil, hazards exceed the benchmark of 1 for the GI tract, due to copper; the eyes, nails hair and skin, due to cobalt and Aroclor 1254; and the immune system, due to Aroclor 1254.

The results of the risk assessment indicated that under industrial exposure scenarios, exposure to lead may pose an unacceptable risk. The predicted blood lead levels for the worker were below the benchmark, but for an unborn fetus were above the benchmark. While there were some samples of lead with concentrations below the screening levels, many of the surface soil concentrations were above the RSL of 750 mg/kg.

Summary of Estimated Blood Lead Levels for Receptor Exposure Scenarios

RECEPTOR	Estimated Blood Lead Level (µg/dL)		
	Adult	Child	Fetus
	50th percentile	Range	95th percentile
SOIL AND SEDIMENT			
Site Worker	4.9	–	17
Hypothetical Future Child	–	11-18	–
Hypothetical Future Adult	6.5	–	23
SOIL			
Hypothetical Future Construction Worker	5.2	–	18

The results of the risks assessment for hypothetical future residential receptors also indicated that lead was a constituent of concern for both adult and child residents. Additionally, benzo(a)pyrene, Aroclor 1254, cobalt and copper were the primary risk and hazard drivers.

As discussed in Section 4.1, removal of the walls and roofs of the buildings has exposed the conductive flooring to weather, causing it to degrade and wash onto the surrounding soils. Based on a comparison of measured asbestos levels in air following intensive activity-based sampling with AALs developed in Section 4.4.5, it appears that asbestos in soils could present risks to current and future site workers or hypothetical future residents.

4.5 Ecological Risk Assessment

The purpose of the ERA is to evaluate whether ecological receptors may be adversely impacted by exposure to site-related constituents detected in surface soil, sediment, and surface water at the BLA. The ERA approach is based on the Master Work Plan (URS 2003) in compliance with CERCLA/SARA and pursuant to RCRA Corrective Action requirements. The ERA was conducted in a manner consistent with Virginia policy and USEPA guidance for ecological risk assessment (USEPA 2001a; 2000b; 1997c). This ERA is intended to provide input for risk management decision-making for the BLA, while maintaining a conservative approach protective of wildlife populations and communities. In accordance with USEPA guidance, the ERA for the BLA commenced with a SLERA and then concluded with a BERA (USEPA 1997c).

This section summarizes the occurrence of constituents in each medium and identifies COPECs at the BLA for the ecological risk assessment; identifies the potential ecological exposure scenarios relevant to the BLA; and presents the estimated ecological risks associated with the identified COPECs and the relevant ecological exposure scenarios at the BLA. Methodologies for data summary and selection of COPECs, exposure assessment, and toxicity assessment for the ERA were presented in Section 2.3.

4.5.1 Selection of Constituents of Potential Ecological Concern

This section discusses the selection of COPECs for each medium. Risks to ecological receptors are calculated by dividing the exposure estimates (i.e., the maximum detected concentrations) by the conservative ESLs. The resulting ratio, the hazard quotient (HQ), is a highly conservative surrogate for the assessment endpoints identified in Section 2.3. HQs equal to or less than a value of 1 (to one significant figure) indicate that adverse ecological effects are unlikely (USEPA 1997c). HQs greater than 1 indicate that further evaluation is warranted. Therefore, the constituents with HQs greater than 1 are carried forward as COPECs into the BERA. Because the majority of the ESLs measure direct exposures and do not take into account exposures to upper trophic level species, chemicals identified as bioaccumulative were also carried forward as COPECs regardless of whether or not the associated HQ was greater than 1. Finally, as previously described, concentrations of inorganic constituents in soil were compared to soil background concentrations; those with concentrations below background were not considered as COPEC. The COPEC selection process for the BLA area are summarized in the subsections below.

4.5.1.1 Surface Soil

Surface soil COPECs were selected by comparing the analytical data with USEPA (2005b) EcoSSLs, USEPA (2003e) Region 5 ESLs, and ORNL values (Efroymson et al. 1997a,b) for surface soil. Table A.4.ERA-1 presents the selection of surface soil COPECs for the ERA. Fifty-three constituents were identified as COPECs in surface soil.

Nine VOCs (2-butanone; 3-octanone; 4-methyl-2-pentanone; acetone; carbon disulfide; d-limonene; methylene chloride; tetrachloroethene; and toluene) were detected in surface soil. With the exception of 3-octanone and d-limonene, all of these constituents had HQs less than or equal to 1. Neither octanone nor d-limonene had an ESL available and so an HQ could not be calculated. As a result, both 3-octanone and d-limonene were identified as COPECs for surface soil.

Nine SVOCs (2,4-dinitrotoluene; 2,6-dinitrotoluene; benzoic acid; bis[2-ethylhexyl]phthalate; carbazole; dibenzofuran; di-n-butylphthalate; n-nitrosodiphenylamine; and phenol) were detected in surface soil. Four of these constituents (2,4-dinitrotoluene; 2,6-dinitrotoluene; di-n-butylphthalate; and n-nitrosodiphenylamine) had an HQ greater than 1, and three constituents (benzoic acid; carbazole; and dibenzofuran) did not have an ESL so an HQ could not be calculated. As a result, 2,4-dinitrotoluene,2,6-dinitrotoluene, benzoic acid, carbazole, dibenzofuran, di-n-butylphthalate, and n-nitrosodiphenylamine were identified as COPECs for surface soil.

Seven explosives (1,3,5-trinitrobenzene; 1,4-dinitrobenzene; 2,4,6-trinitrotoluene; 4-amino-2,6-dinitrotoluene; m-nitrotoluene; nitroglycerine; and pentaerythritol tetranitrate) were detected in surface soil. ESLs were not available for 2,4,6-trinitrotoluene, m-nitrotoluene, nitroglycerine, and pentaerythritol tetranitrate. As a result these chemicals were all identified as COPECs for surface soil.

Nine pesticides (4,4'-DDD; 4,4'-DDE; beta-BHC; alpha-chlordane; gamma-chlordane; endosulfan I; endrin; heptachlor epoxide; and methoxyclor) were detected in surface soil. Two of these constituents (4,4'-DDD and methoxychlor) had an HQ greater than

1. In addition, an ESL was not available for endosulfan and 4,4'-DDE, beta-BHC, alpha-chlordane, endrin, and heptachlor epoxide were all identified as bioaccumulative. As a result, 4,4'-DDD, 4,4'-DDE, endosulfan, methoxychlor, beta-BHC, alpha-chlordane, endrin, and heptachlor epoxide were identified as COPECs in surface soil.

Eighteen PAHs (1-methylnaphthalene; 2-methylnaphthalene; acenaphthene; acenaphthylene; anthracene; benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; benzo[g,h,i]perylene; benzo[k]fluoranthene; chrysene; dibenzo[a,h]anthracene; fluoranthene; fluorene; indeno[1,2,3-cd]pyrene; naphthalene; phenanthrene; and pyrene) were detected in surface soil. Five of these constituents (benzo[a]anthracene; benzo[a]pyrene; chrysene; naphthalene; and phenanthrene) had an HQ greater than 1 and an additional eleven were identified as bioaccumulative. As a result, all of the detected PAHs except 1-methylnapthalene and 2-methylnapthalene were identified as COPECs for surface soil.

One PCB, Aroclor 1254, was detected in surface soil. This constituent did not have an ESL and so an HQ could not be calculated. Based on that, and the fact that it was identified as bioaccumulative, Aroclor 1254 was identified as a COPEC for surface soil.

Twenty-three inorganics (aluminum; antimony; arsenic; barium; beryllium; cadmium; calcium; chromium; cobalt; copper; iron; lead; magnesium; manganese; mercury; nickel; potassium; selenium; silver; sodium; thallium; vanadium; and zinc) were detected in surface soil. Four constituents are vital electrolytes and/or essential nutrients (i.e., calcium; magnesium; potassium; and sodium) and therefore were identified as non-toxic and not evaluated further. Sixteen of these constituents (aluminum, antimony; arsenic; barium; cadmium; chromium; cobalt; copper; lead; manganese; mercury; nickel; selenium; thallium; vanadium; and zinc) had HQs greater than 1, and one (iron) did not have an ESL available and so an HQ could not be calculated. In addition, silver was identified as bioaccumulative. However, three constituents (aluminum; thallium; and vanadium) had maximum concentrations below the background concentrations. As a result, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, selenium, silver, and zinc were identified as COPECs for surface soil.

Finally, asbestos has also been detected in surface soils around some of the buildings in the BLA in areas where conductive flooring has degraded into a red powder-like material that has washed onto the surrounding soils adjacent to those buildings. Soil sampling and activity-based air sampling have been conducted in selected areas of the BLA and are discussed in Section6.4.7 of the RI. The results of this sampling indicate that asbestos is also a COPC for surface soil at this site.

4.5.1.2 Sediment

Sediment COPECs were selected by comparing the analytical data with ESLs from the following sources in order of priority: USEPA (2008d) Region 3 Sediment Screening Levels; ORNL values (Jones et al. 1997); and USEPA (2003e) Region 5 Ecological Screening Levels for sediment. Table A.4.ERA-2 presents the selection of sediment COPECs for the ERA. Thirty constituents were identified as COPECs in sediment.

Two VOCs (acetone and toluene) were detected in sediment. Only acetone had an HQ greater than 1, and as a result, was identified as a COPEC in sediment. One SVOC, bis(2-ethylhexyl)phthalate, was detected in sediment; however, this constituent had an HQ less than or equal to 1 and was not identified as a COPEC in sediment.

Seven pesticides (4,4'-DDD; 4,4'-DDE; 4,4'-DDT; beta-BHC; alpha-chlordane; gamma-chlordane; and dieldrin) were detected in sediment. All of these constituents had HQs less than or equal to 1, however, six (4,4'-DDD; 4,4'-DDE; 4,4'-DDT; beta-BHC; alpha-chlordane; and dieldrin) were identified as bioaccumulative and were therefore identified as COPECs in sediment.

Fifteen PAHs (2-methylnaphthalene; anthracene; benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; benzo[g,h,i]perylene; benzo[k]fluoranthene; chrysene; dibenzo[a,h]anthracene; fluoranthene; fluorene; indeno[1,2,3-cd]pyrene; naphthalene; phenanthrene; and pyrene) were detected in sediment. All had HQs less than 1, however, all were identified as bioaccumulative except 2-methylnapthalene and naphthalene and were therefore dentified as COPECs in sediment.

Nineteen inorganics (aluminum; antimony; arsenic; barium; beryllium; calcium; chromium; cobalt; copper; iron; lead; magnesium; manganese; nickel; potassium; sodium; thallium; vanadium; and zinc) were detected in sediment. Four constituents are vital electrolytes and/or essential nutrients (i.e., calcium; magnesium; potassium; and sodium) and therefore were identified as non-toxic and not evaluated further. Four constituents (barium; beryllium; thallium; and vanadium) did not have ESLs. Six constituents (arsenic; chromium; copper; lead; nickel; and zinc) were identified as bioaccumulative. Based on this assessment, barium, beryllium, thallium, vanadium, arsenic, chromium, copper, lead, nickel, and zinc were identified as COPECs for sediment.

4.5.1.3 Surface Water

Surface water COPECs were selected by comparing the analytical data with ESLs from the following sources in order of priority: USEPA (2008d) Region 3 Surface Water Screening Levels; ORNL values (Suter and Tsao 1996); USEPA (2003e) Region 5 Ecological Screening Levels; and USEPA (2008e) Ambient Water Quality Criteria for surface water. Table A.4.ERA-3 presents the selection of surface water COPECs for the ERA. Eighteen constituents were identified as COPECs in surface water as follows:

Two VOCs (carbon disulfide and chloroform) were detected in surface water; however, both of these constituents had an HQ of less than or equal to 1 and were not identified as COPECs for surface water.

Two SVOCs (butylbenzylphthalate and di-n-buthylphthalate) were detected in surface water; however, both of these constituents had an HQ of less than or equal to 1 and were not identified as COPECs for surface water.

One explosive, m-nitrotoluene, was detected in surface water; however, this constituent had an HQ of less than or equal to 1 and was not identified as a COPEC for surface water.

One herbicide, 2,4-D, was detected in surface water; however, this constituent had an HQ of less than or equal to 1 and was not identified as a COPEC for surface water.

One pesticide, dieldrin, was detected in surface water. This constituent had an HQ of less than or equal to 1, however, it is considered bioaccumulative and was therefore identified as a COPEC for surface water.

Six PAHs (benzo[a]anthracene; benzo[b]fluoranthene; chrysene; fluoranthene; phenanthrene; and pyrene) were detected in surface water. Only two of these detected constituents (fluoranthene and pyrene) had an HQ greater than 1, however, the other four were identified as bioaccumulative, therefore all six were identified as COPECs for surface water.

Sixteen inorganics (aluminum; antimony; arsenic; barium; calcium; chromium; copper; iron; lead; magnesium; manganese; mercury; potassium; selenium; sodium; and zinc) were detected in surface water. Four constituents are vital electrolytes and/or essential nutrients (i.e., calcium; magnesium; potassium; and sodium) and therefore were identified as non-toxic and not evaluated further. Eight of these constituents (aluminum; arsenic; barium; copper; iron; lead; manganese; and mercury) had an HQ greater than 1. An additional three (chromium; selenium; and zinc) were identified as bioaccumulative. Therefore, aluminum, arsenic, barium, chromium, copper, iron, lead, manganese, mercury, selenium, and zinc were identified as COPECs for surface water.

4.5.2 Summary of Selected Constituents of Potential Ecological Concern

Fifty-three constituents were selected as COPECs in surface soil, thirty constituents were selected as COPECs in sediment, and eighteen constituents were selected as COPECs in surface water because the HQs were greater than 1, the chemical was identified as bioaccumulative, or an HQ couldn't be calculated because an ESL was not available.

4.5.3 Refinement of Risk Calculations for Direct Contact COPECs

The list of COPECs identified in the BERA was reevaluated by calculating refined HQs. The refined HQs were calculated for the COPECs identified in the SLERA using refined EPCs. Constituents identified as COPECs in the BERA that were bioaccumulative were carried forward into food chain models. The results of the recalculation of the HQs for the BDDT are summarized in the subsections below.

4.5.3.1 Surface Soil

Fifty-three COPECs in surface soil were carried forward into the BERA. When refined EPCs were compared with the ESLs, 20 constituents (2,6-dinitrotoluene; di-n-butylphthalate; n-nitrosodiphenylamine; 4,4'-DDD; methoxychlor; benzo[a]anthracene; benzo[a]pyrene; chrysene; naphthalene; antimony; barium; cadmium; chromium; cobalt; copper; lead; mercury; selenium; and zinc) had a refined HQ greater than 1. In addition, ESLs were not available for 12 other constituents (3-octanone; d-limonene; benzoic acid; carbazole; dibenzofuran; 2,4,6-trinitrotoluene; m-nitrotoluene; nitroglycerine; pentaerythritol tetranitrate; endosulfan; Aroclor 1254; and iron). The BERA results for surface soil COPECs at the BLA are presented in Table A.4.ERA-4 and are discussed below:

> <u>Volatile Organic Compounds</u>: Two VOCs (3-octanone and d-limonene) were retained in the BERA because an ESL was not available and so HQs could not be calculated. These VOCs were each detected at very low concentrations (i.e., < 1 mg/kg) in one sample. Based on the low detected concentrations, adverse effects to wildlife due to potential VOC exposure are considered unlikely.

Semi-Volatile Organic Compounds: Seven SVOCs (2,4-dinitrotoluene, 2,6-dinitrotoluene; benzoic acid; carbazole; dibenzofuran; di-n-butylphthalate; and n-nitrosodiphenylamine) were retained in the BERA because the calculated HQs were greater than the benchmark value of 1 or because an ESL was not available and so HQs could not be calculated. These results are discussed below:

2,4-Dinitrotoluene – 2,4-Dinitrotouene was detected in only 9 of the 20 surface samples. Only one of the detected concentrations exceeded the ESL, therefore, adverse effects to wildlife exposed to 2,4-dinitrotoluene are unlikely given the low frequency of detection and low detected concentrations.

2,6-Dinitrotoluene – 2,6-Dinitrotoluene was detected in 3 out of 20 surface soil samples, with concentrations ranging from 0.07mg/kg to 1.9 mg/kg. While all three concentrations were above the ESL of 0.0328 mg/kg, adverse effects to wildlife exposed to 2,6-dinitrotoluene are unlikely given the low frequency of detection and low detected concentrations.

Benzoic acid – Benzoic acid was detected in 4 out of 15 surface soil samples, with concentrations ranging from 0.14 mg/kg to 0.3 mg/kg. While no ESL was available for this SVOC and no HQ could be calculated, it is unlikely that benzoic acid would cause adverse effects to wildlife due to the low frequency of detection and low detected concentrations.

Carbazole – Carbazole was detected in 10 out of 14 surface soil samples, with concentrations ranging from 0.045 mg/kg to 13 mg/kg. While no ESL was available for this SVOC and no HQ could be calculated, it is unlikely that carbazole would cause adverse effects to wildlife due to the physical properties of this constituent (e.g., biodegradation in soil).

Dibenzofuran – Dibenzofuran was detected in 9 out of 14 surface soil samples, with concentrations ranging from 0.016 mg/kg to 2.8 mg/kg. While no ESL was available for this SVOC and no HQ could be calculated, it is unlikely that dibenzofuran would cause adverse effects to wildlife due to the physical properties of this constituent (e.g., biodegradation in soil).

Di-n-butylphthalate – Di-n-butylphthalate was detected in 6 out of 14 surface soil samples, with concentrations ranging from 0.061 mg/kg to 120 mg/kg. While five of these concentrations were above the ESL of 0.15 mg/kg, given the physical properties of this constituent, it is unlikely that di-n-butylphthalate would cause adverse effects to wildlife.

Bag Loading Area

n-Nitrosodiphenylamine – n-Nitrosodiphenylamine was detected in 2 out of 13 surface soil samples, with concentrations ranging from 0.1 mg/kg to 8.3 mg/kg. Only one of these concentrations was above the ESL of 0.545 mg/kg. As a result, it is unlikely that n-nitrosodiphenylamine would cause adverse effects to wildlife due the low frequency of detection and to the physical properties of this constituent (e.g., biodegradation in soil).

Explosives: Four explosives (2,4,6-trinitrotoluene; m-nitrotoluene; nitroglycerine; pentaerythritol tetranitrate) were retained in the BERA because an ESL was not available and so HQs could not be calculated. These constituents were each detected in only 1 out of 16 samples, and at relatively low concentrations. Consequently, adverse effects to wildlife potentially exposed to explosives in soil are unlikely due to their limited occurrence and relatively low concentrations.

Pesticides: Three pesticides (4,4'-DDD; endosulfan; and methoxychlor) were retained in the BERA because the calculated HQs were greater than the benchmark value of 1 or because an ESL was not available and so HQs could not be calculated. An ESL was not available for endosulfan and as a result, an HQ could not be calculated; however, this constituent was detected in only 1 out of 5 samples and at a low concentration. 4,4'-DDD and methoxyclor both had a calculated HQ slightly above the benchmark value of 1 (HQ=2 and HQ=3, respectively). Consequently, adverse effects to wildlife potentially exposed to pesticides are unlikely due to the low frequency of detection and/or the relatively low detected concentrations. In addition, when these COPECs were further evaluated in the site-specific terrestrial food chain model, along with the five additional pesticides identified as being bioaccumulative, all had HQs below the benchmark of 1.

Polycyclic Aromatic Hydrocarbons: Four PAHs (benzo[a]anthracene; benzo[a]pyrene; chrysene; and naphthalene) were retained in the BERA because the calculated HQs were greater than the benchmark value of 1. Calculated HQs for these PAHs ranged from 2 to 10. The ESLs for these constituents were obtained from USEPA (2003e) Region 5, and are especially conservative values based on toxicity to the masked shrew.

Naphthalene was the only PAH not identified as a bioaccumulative COPEC. The HQ calculated using the USEPA (2003e) Region 5 value for this PAH was 2, which is only slightly above the benchmark of 1. While alternate ESLs were not available for naphthalene, additional toxicologically-based benchmarks were available from Sample et al (1996) for other PAHs. The benchmarks developed by Sample et al

(1996) are NOAEL-based dietary benchmarks for mammals exposed to a constituent via ingestion of food. Since naphthalene is not a bioaccumulative COPEC, assuming the naphthalene concentration in all food items is equivalent to the concentration in surface soil provides a conservative estimate of dietary exposure. That is, the receptor would have to have a diet of 100 percent soil to receive the dose associated with the Sample et al (1996) benchmark. The NOAEL benchmark values for benzo(a)pyrene, the most conservative of the PAHs, ranged from 1.98 mg/kg to 8.0 mg/kg. The EPC for naphthalene, 0.194 mg/kg, was below this range of acceptable concentrations.

As indicated in Section 4.5.4, with the exception of the dibenzo(a,h)anthracene NOAEL for the shrew, all terrestrial HQs were below 10. It is important to note that the TRVs for this chemical are based on conservative extrapolations from acute toxicity tests and are therefore likely to overestimate risks. Emphasizing the conservative nature of the TRVs, the ESL selected for evaluation of dibenzo(a,h)anthracene in this assessment is actually based on exposures to the masked shrew, and the maximum detected concentration is well below. Consequently, adverse effects to wildlife exposed to PAHs at the site are unlikely given the site-specific food chain model results and the similarity of naphthalene concentrations with those below NOAEL-based benchmark values.

<u>Polychlorinated Biphenyls</u>: One PCB, Aroclor 1254, was retained in the BERA because an ESL was not available from Region 3 or Region 5, and so an HQ could not be calculated. Aroclor 1254 was detected in 9 out of 17 surface soil samples with concentrations ranging from 0.0066 mg/kg to 8.3 mg/kg.

While there are no Aroclor-specific ESLs from Region 5, Region 5 does provide an ESL of 0.000332 mg/kg for PCBs as a group. The maximum and UCL Aroclor 1254 concentrations at the BLA are above this ESL; however, site-specific food chain modeling for the short-tailed shrew and American robin (Section 4.7.4), using conservative exposure assumptions, indicates that the potential risk from exposure to Aroclor 1254 at the BLA is very low. Based on these considerations, adverse impacts are not expected for populations of ecological receptors exposed to Aroclor 1254 at the BLA.

<u>Inorganics</u>: Twelve inorganics (antimony; barium; cadmium; chromium; cobalt; copper; iron; lead; manganese; mercury; selenium; and zinc) were retained in the BERA because the calculated HQs were greater than the benchmark value of 1, or an HQ could not be calculated because an ESL was not available. These results are discussed below:

Bag Loading Area

Antimony – Antimony was detected in 17 out of 38 surface soil samples, with concentrations ranging from 0.2 mg/kg to 8.1 mg/kg. Nine of these concentrations were above the ESL of 0.27 mg/kg. While site-specific background values for antimony were not available, these detected concentrations were compared to the mean soil inorganic background concentrations of 1.2 mg/kg reported for Virginia (USEPA 2003f). The EPC for antimony at the BLA was 1.2 mg/kg, which was equal to the reported background soil concentration for antimony in Virginia. Consequently, adverse effects to wildlife exposed to antimony are unlikely given the similarity of detected concentrations with the state background soil value.

Barium – Barium, like most of the inorganics, occurs naturally at the RFAAP-NRU. However, barium is also one of the known components of the conductive flooring material used in the BLA and IAA buildings. Barium was detected in 40 out of 40 surface soil samples, with concentrations ranging from 45.4 mg/kg to 11,100 mg/kg, with an EPC of 6,101 mg/kg. Sixteen concentrations were greater than the ESL of 330 mg/kg, and nineteen concentrations were above the background value of 209 mg/kg established at the site.

Although there are some soil samples at the BLA with elevated concentrations of barium, a closer examination of the location of those samples in relation to the concrete building foundations, and their spatial extent indicates that the concentrations of barium (and other metals) in samples collected from immediately adjacent to the foundations contain higher concentrations than in samples collected further away from the foundation (i.e., in general, concentrations decrease with distance from the foundations; Figure 4-1). For example, in sample location BLA-SS009 (collected 1-foot from the building foundation) the concentration of barium is 1,550 mg/kg; in comparison, the concentration of barium is 115 mg/kg in sample location BLA-SS010 (collected approximately 10 feet away from the foundation), below the background value of 209 mg/kg established at the site. This trend is repeated in other sample locations (i.e., BLA-SS016, which is located within 1 foot of the foundation, versus BLASS10). The areal extent of the affected soils that are around the perimeter of the 7 buildings with conductive flooring at the BLA encompass an area of 40,245 ft^2. When the area of the foundations (17,875 ft^2) is subtracted, the extent of affected soil available for ecological exposure is 16,850 ft^2, or approximately 0.4 acre. Based on these considerations, adverse impacts at the population-level are not considered likely for ecological receptors exposed to barium at the BLA.

Cadmium – Cadmium was detected in 30 out of 35 surface soil samples, with concentrations ranging from 0.09 mg/kg to 44.8 mg/kg. Twenty-four concentrations were above the ESL of 0.36 mg/kg, and twenty-three concentrations were above the background value of 0.69 mg/kg established at the site. As previously discussed, a closer examination of the location of those soil samples with elevated levels of cadmium indicates that the concentrations of cadmium in samples collected from immediately adjacent to the foundations contain higher concentrations than in samples collected further away from the foundation (Figure 4-1). For example, in sample location BLA-SS009 (located 1 foot from the building foundation) the concentration of cadmium is 5.6 mg/kg, compared to 1.5 mg/kg in sample location BLA-SS11 (located approximately 15 feet away from the foundation), which is within the detected range of background values (0.62 mg/kg to 2.5 mg/kg) at the site. This trend is repeated in other sample locations (i.e., BLA-SS016, which is located within 1 foot of the foundation, versus BLASS10, which is approximately 10 feet away from the foundation). The areal extent of the affected soils that are around the perimeter of the 7 buildings at the BLA encompass an area of 40,245 ft^2. When the area of the foundations (17,875 ft^2) is subtracted, the extent of affected soil available for ecological exposure is 16,850 ft^2, or approximately 0.4 acre. Based on these considerations, adverse impacts at the population-level are not considered likely for ecological receptors exposed to cadmium at the BLA. Additionally, cadmium was further evaluated in the terrestrial food chain model.

Chromium – Chromium was detected in 40 out of 40 surface soil samples, with concentrations ranging from 11.2 mg/kg to 106 mg/kg. While all but one concentration was above the ESL of 26 mg/kg, only five concentrations were above the background value of 65.3 mg/kg established at the site. When the EPC was calculated, this value was below the background value. In addition, the calculated HQ was only slightly above the benchmark value of 1 (HQ=2). Consequently, adverse effects to wildlife exposed to chromium are unlikely given the similarity of detected concentrations with the site background values and the low calculated HQ.

Cobalt – Cobalt was detected in 37 out of 40 surface soil samples, with concentrations ranging from 3.9 mg/kg to 149 mg/kg. While twenty-seven concentrations were above the ESL of 13 mg/kg, only one concentration was above the range of background samples (5.9 mg/kg to 130 mg/kg) detected at the site. In addition, the calculated HQ was only slightly above the benchmark value of 1 (HQ=3). Consequently, adverse effects to wildlife exposed to cobalt are unlikely given the similarity of detected concentrations with the site background values and the low calculated HQ.

Copper – Copper was detected in 40 out of 40 surface soil samples, with concentrations ranging from 23.5 mg/kg to 72,000 mg/kg. Thirty-six concentrations were above the ESL of 28 mg/kg, and twenty-nine concentrations were above the background value of 53.5 mg/kg established at the site. As previously discussed, a closer examination of the location of those soil samples with elevated levels of copper indicates that the concentrations of copper in samples collected from immediately adjacent to the foundations contain higher concentrations than in samples collected further away from the foundation (Figure 4-1). For example, in sample location BLA-SS009 (located 1 foot from the building foundation) the concentration of copper is 3,890 mg/kg, compared to 53.4 mg/kg in sample location BLA-SS11 (located approximately 15 feet away from the foundation), which is below the soil background value of 53.5 mg/kg established at the site. This trend is repeated in other sample locations (i.e., BLA-SS016, which is located within 1 foot of the foundation, versus BLASS10, which is approximately 10 feet away from the foundation). The areal extent of the affected soils that are around the perimeter of the 7 buildings at the BLA encompass an area of 40,245 ft^2. When the area of the foundations (17,875 ft^2) is subtracted, the extent of affected soil available for ecological exposure is 16,850 ft^2, or approximately 0.4 acre. Based on these considerations, adverse impacts at the population-level are not considered likely for ecological receptors exposed to copper at the BLA. Additionally, copper was further evaluated in the terrestrial food chain model.

Iron – Iron was detected in 40 out of 40 sediment samples, with concentrations ranging from 8,500 mg/kg to 61,500 mg/kg. While no ESL was available for iron, all but one of these concentrations were below the background value of 50,962 mg/kg established for the site, and all of the concentrations were within the range of background samples detected at the site. Consequently, adverse effects to wildlife exposed to iron are unlikely given the similarity of detected concentrations with the site background value and range.

Lead – Lead was detected in 40 out of 40 surface soil samples, with concentrations ranging from 14.7 mg/kg to 58,000 mg/kg. While all of these concentrations were above the ESL of 11 mg/kg, and 32 concentrations were above the established background value, only 16 concentrations were detected outside of the range of background samples (2.1 mg/kg to 256 mg/kg) detected at the site. As previously discussed, a closer examination of the location of those soil samples with elevated levels of lead indicates that the concentrations of lead in samples collected from immediately adjacent to the foundations contain higher concentrations than in samples collected further away from the foundation (Figure 4-1). For example, in sample location BLA-SS009 (located 1 foot from the building foundation) the concentration of lead is 1,830 mg/kg, compared to 143 mg/kg in sample location BLA-SS11 (located approximately 15 feet away from the foundation), which is within the detected range of background values (2.1 mg/kg to 256 mg/kg) at the site. This trend is repeated in other sample locations (i.e., BLA-SS016, which is located within 1 foot of the foundation, versus BLA-SS10, which is approximately 10 feet away from the foundation). The areal extent of the affected soils that are around the perimeter of the 7 buildings at the BLA encompass an area of 40,245 ft^2. When the area of the foundations (17,875 ft^2) is subtracted, the extent of affected soil available for ecological exposure is 16,850 ft^2, or approximately 0.4 acre. Based on these considerations, adverse impacts at the population-level are not considered likely for ecological receptors exposed to lead at the BLA. Additionally, lead was further evaluated in the terrestrial food chain model.

<u>Manganese –</u> Manganese was detected in all of the surface soil samples (i.e., 47) at concentrations ranging from 71 to 3,080 mg/kg. While many of the samples have concentrations exceeding the ESL of 220 mg/kg, only one sample exceeds the background concentration of 2,543 mg/kg. Based on these considerations, adverse impacts at the population-level are not considered likely for ecological receptors exposed to manganese at the BLA.

<u>Mercury</u> – Mercury was detected in 33 out of 35 surface soil samples, with concentrations ranging from 0.02 mg/kg to 16.8 mg/kg. Seventeen concentrations were above the ESL of 0.1 mg/kg and the background value of 0.13 mg/kg established for the site. As previously discussed, a closer examination of the location of those soil samples with elevated levels of mercury indicates that the concentrations of mercury in samples collected from immediately adjacent to the foundations contain higher concentrations than in samples collected further away from the foundation (Figure 4-1). For example, in sample location BLA-SS009 (located 1 foot from the building foundation) the concentration of mercury is 16.8 mg/kg, compared to 0.14 mg/kg in sample location BLA-SS11 (located approximately 15 feet away from the foundation), which is within the detected range of background values (0.038 mg/kg to 1.2 mg/kg) at the site. This trend is repeated in other sample locations (i.e., BLA-

SS016, which is located within 1 foot of the foundation, versus BLASS10, which is approximately 10 feet away from the foundation). The areal extent of the affected soils that are around the perimeter of the 7 buildings at the BLA encompass an area of 40,245 ft^2. When the area of the foundations (17,875 ft^2) is subtracted, the extent of affected soil available for ecological exposure is 16,850 ft^2, or approximately 0.4 acre. Based on these considerations, adverse impacts at the population-level are not considered likely for ecological receptors exposed to mercury at the BLA.

<u>Selenium</u> – Selenium was detected in 8 out of 39 surface soil samples, with concentrations ranging from 0.39 mg/kg to 1.9 mg/kg. While five concentrations were above the ESL of 0.52 mg/kg, the calculated HQ was only slightly above the benchmark value of 1 (HQ=2). Consequently, adverse effects to wildlife exposed to selenium are unlikely given the low calculated HQ. This COPEC was further evaluated in the terrestrial food chain model.

<u>Zinc</u> – Zinc was detected in 40 out of 40 surface soil samples, with concentrations ranging from 37.2 mg/kg to 12,500 mg/kg. Twenty-nine concentrations were greater than the ESL of 46 mg/kg, and twenty-one concentrations were above the background value of 202 mg/kg established at the site. As previously discussed, a closer examination of the location of those soil samples with elevated levels of zinc indicates that the concentrations of zinc in samples collected from immediately adjacent to the foundations contain higher concentrations than in samples collected further away from the foundation (Figure 4-1). For example, in sample location BLA-SS009 (located approximately 1 foot from the foundation of the building) the concentration of zinc is 2,600 mg/kg, compared to 164 mg/kg in sample location BLA-SS11 (located approximately 15 feet away from the foundation), which is below the background value of 202 mg/kg established at the site. This trend is repeated in other sample locations (i.e., BLA-SS016, which is located within 1 foot of the foundation, versus BLASS10, which is approximately 10 feet away from the foundation). The areal extent of the affected soils that are around the perimeter of the 7 buildings at the BLA encompass an area of 40,245 ft^2. When the area of the foundations (17,875 ft^2) is subtracted, the extent of affected soil available for ecological exposure is 16,850 ft^2, or approximately 0.4 acre. Based on these considerations, adverse impacts at the population-level are not considered likely for ecological receptors exposed to zinc at the BLA. Additionally, zinc was further evaluated in the terrestrial food chain model.

Thirty-two of the soil COPECs were also identified as bioaccumulative and were evaluated in the terrestrial food chain model.

4.5.3.2 Sediment

Thirty COPECs in sediment were carried forward into the BERA. When refined EPCs were compared with the ESLs, only one constituent, acetone, had a refined HQ greater than 1. In addition, ESLs were not available for four other constituents (barium; beryllium; thallium; and vanadium). The BERA results for sediment COPECs at the BLA are presented in Table A.4.ERA-5 and are discussed below:

Volatile Organic Compounds: One VOC, acetone, was retained in the BERA because the calculated HQ was greater than the benchmark value of 1. This VOC was detected in 1 out of 2 samples, and had a calculated HQ only slightly above the benchmark value of 1 (HQ=3). Consequently, adverse effects to aquatic life exposed to acetone are unlikely given the low calculated HQ.

Inorganics: Four inorganics (barium; beryllium; thallium; and vanadium) were retained in the BERA because an ESL was not available and no HQ could be calculated. All four constituents were detected in 2 out of 2 samples. While no background sediment data were collected, barium, beryllium, thallium, and vanadium were detected at concentrations below the corresponding soil background values established at the site (209 mg/kg; 1.02 mg/kg; 2.11 mg/kg; and 108 mg/kg, respectively). Consequently, adverse effects to aquatic life exposed to inorganics are unlikely given the similarity of detected concentrations with the site soil background values.

In addition to the COPEC discussed above, six pesticides, thirteen PAHs, and five inorganics were evaluated in the aquatic food chain model.

4.5.3.3 Surface Water

Eighteen COPECs in surface water were carried forward into the BERA. When refined EPCs were compared with the ESLs, 10 constituents (fluoranthene; pyrene; aluminum; arsenic; barium; copper; iron; lead; manganese; and mercury) had a refined HQ greater than 1. The BERA results for surface water COPECs at the BLA are presented in Table A.4.ERA-6 and are discussed below:

Polycyclic Aromatic Hydrocarbons: Two PAHs (fluoranthene and pyrene) were retained in the BERA because the calculated HQs were greater than the benchmark value of 1. Both PAHs were detected in 1 out of 4 samples, and had calculated HQs only slightly above the benchmark of 1 (HQs=2). Consequently, adverse effects to aquatic life exposed to PAHs are unlikely given the limited occurrence of the PAHs and the low calculated HQs.

Inorganics: Eight inorganics (aluminum; arsenic; barium; copper; iron; lead; manganese; and mercury) were retained in the BERA because the calculated HQs were greater than the benchmark value of 1 or because an ESL was not available and no HQ could be calculated. These results are discussed below:

Aluminum – Aluminum was detected in 4 out of 4 surface water samples, with concentrations ranging from 0.14 mg/L to 0.549 mg/L. All four of these concentrations were above the ESL of 0.087 mg/L, however, the ESL used from USEPA (2008c) Region 3 was based on a water quality criterion protective of salmonids (i.e., coldwater habitat species of fish such as trout and salmon), which is likely overly conservative for the type of warmwater habitat (and associated aquatic species) that is prevalent in this locale. When an alternative screening value of 0.46 mg/L from Sample et al. 1996 was used, an HQ of less than 1 was calculated. This alternative screening value is based on the lowest chronic value of aquatic life, and is considered to be a more representative screening value for aluminum at the BLA. Based on these considerations, adverse effects to aquatic life exposed to aluminum are unlikely.

Arsenic – Arsenic was detected in 2 out of 4 surface water samples, with concentrations ranging from 0.0034 mg/L to 0.01 mg/L. Both samples were collected from the utility vaults in one of the BLA buildings. Arsenic was not detected in the stream samples collected in 2002. Only one of the detected concentrations was above the ESL of 0.005 mg/L, and the calculated HQ for the maximum concentration was only slightly above the benchmark value of 1 (HQ=2). Consequently, adverse effects to aquatic life exposed to arsenic are unlikely given the low calculated HQ. This COPEC was further evaluated in the aquatic food chain model.

Barium – Barium was detected in 4 out of 4 surface water samples, with concentrations ranging from 0.0588 mg/L to 0.0981 mg/L. While all four of these samples were greater than the ESL of 0.004 mg/L, the ESL used from USEPA (2008c) Region 3 was based on a secondary chronic value from Suter et al. 1996, and was established using an extremely limited dataset. An alternative aquatic screening value of 0.22 mg/L from USEPA (2003e) Region

5 was found, which is considered to be a more representative screening value. When this ESL was used, an HQ of less than 1 was calculated. This alternative screening value is based on the chronic standards for aquatic life, and is a more representative screening value for barium at the BLA. Based on these considerations, adverse effects to aquatic life exposed to barium are unlikely.

Copper – Copper was detected in 2 out of 4 surface water samples, with concentrations ranging from 0.646 mg/L to 0.828 mg/L. Both samples were collected from the utility vaults in one of the BLA buildings. Copper was not detected in the stream samples collected in 2002. While both detected concentrations were above the ESL of 0.009 mg/L, the ESL is based on a default hardness value of 100 mg/L. A site-specific hardness value of 207 mg/L (average in surface water samples collected from the stream at the BLA area) was used to calculate an ESL of 0.01668 mg/L. When this ESL was used, an HQ of 50 was calculated. It should be noted that the surface water samples were not filtered, and as such the results represent total copper. Therefore, it is not known what portion, if any, of the copper is in the dissolved (i.e., filtered) form. This is important because the dissolved form of copper (and most other metals) is the bioavailable form. It is likely that even though the total copper concentrations exceed the ESL, the dissolved (and therefore bioavailable) copper concentrations may in actuality not exceed the ESL. This is an uncertainty in the ERA evaluation. If aquatic organisms were exposed, on a chronic basis, to dissolved copper concentrations of 0.828 mg/L, then the potential exists for adverse effects to occur. However, given the fact that the water sample was collected from a utility vault rather than a true surface water body indicates that the potential for adverse effects is unlikely. This COPEC was further evaluated in the aquatic food chain model.

Iron – Iron was detected in 4 out of 4 surface water samples, with concentrations ranging from 0.274 mg/L to 0.742 mg/L. Two of these concentrations were above the ESL of 0.3 mg/L, and the calculated HQ for the maximum detected concentration was only slightly above the benchmark value of 1 (HQ=2). Consequently, adverse effects to aquatic life exposed to iron are unlikely given the low concentrations and calculated HQs.

Lead – Lead was detected in 4 out of 4 surface water samples, with concentrations ranging from 0.00034 mg/L to 0.247 mg/L. Only one of the detected concentrations (collected from a utility vault), was above the ESL of 0.0025 mg/L, which was based on a default hardness value of 100 mg/L. A site-specific hardness value of 207 mg/L (average at the BLA area) was used to calculate an ESL of 0.03411 mg/L. When this ESL was used, an HQ of 7 was calculated, which is only slightly above the benchmark value of 1. Furthermore, as previously stated, the surface water samples were not filtered, and as such the results represent total lead. Therefore, it is not known what portion, if any, of the lead is in the dissolved (i.e., filtered) form. It is possible that even though the total lead concentrations exceed the ESL, the dissolved (and therefore bioavailable) lead concentrations may in actuality not exceed the ESL. Consequently, adverse effects to aquatic life exposed to lead are unlikely given the low calculated HQ. Furthermore, the fact that the sample was collected from a utility vault rather than a true surface water body indicates that the potential for adverse effects are unlikely. This COPEC was further evaluated in the aquatic food chain model.

Manganese – Manganese was detected in 4 out of 4 surface water samples, with concentrations ranging from 0.0184 mg/L to 0.377 mg/L. Only one of these concentrations was above the ESL of 0.12 mg/L, and the calculated HQ for the maximum detected concentration was only slightly above the benchmark value of 1 (HQ=3). Consequently, adverse effects to aquatic life exposed to manganese are unlikely given the relatively low concentrations and the low calculated HQ.

Mercury – Mercury was detected in 1 out of 4 surface water samples, with a concentration of 0.0002 mg/L. The detected concentration was above the ESL of 0.000026 mg/L. This sample was collected from a utility vault in a BLA building. Mercury was not detected in the unnamed stream to the north of the BLA. Based on these considerations, it is unlikely that adverse effects to wildlife potentially exposed to mercury would occur at the BLA.

Of the COPECs identified for surface water, all but chromium were identified as bioaccumulative and evaluated in the aquatic food chain model.

4.5.4 Refinement of Assessment and Measurement Endpoints for Bioaccumulative COPECs

Food chain modeling was conducted at the BLA in order to evaluate the potential ecological effects of the bioaccumulative COPEC in soil, sediment, and surface water on the receptors identified in Section 2.4. COPECs identified in soil were evaluated in the terrestrial food chain, and COPECs identified in sediment and surface water were evaluated in the aquatic food chain. The results for both the maximum and refined scenarios of these models are presented in Tables A.4.ERA-7 through A.4.ERA-14, and the results of each of the refined scenarios are discussed in the subsections below.

4.5.4.1 Terrestrial Food chain Model

The refined scenario LOAEL and NOAEL HQs for all pesticides and most PAHs for both the short-tailed shrew (Tables A.4.ERA-7 and A.4.ERA-8) and the American robin (Tables A.4.ERA-9 and A.4.ERA-10) were less than 1, and the LOAELs and NOAELs for Aroclor 1254 were below 1 for the American robin.

Under the refined scenario for the American robin, all PAH HQs were below 1. For the short-tailed shrew, all LOAEL HQs were below 1 except dibenzo(a,h)anthracene (HQ=6). Similarly, all NOAEL HQs were below 10 except for dibenzo(a,h)anthracene (HQ=60). As previously noted, the TRV for dibenzo(a,h)anthracene was conservatively estimated from an acute toxicity test, and is therefore likely to overestimate risks to the short-tailed shrew. The ESL selected for evaluation of dibenzo(a,h)anthracene in this assessment is actually based on exposures to the masked shrew, and the maximum detected concentration is well below. Consequently, adverse effects to wildlife exposed to PAHs at the site are unlikely.

Under the refined scenario for Aroclor 1254 exposure for the short-tailed shrew, the NOAEL HQ and the LOAEL HQ were 5 and 0.5, respectively. The NOAEL, by definition, is a very conservative screening criterion. The LOAEL indicates a concentration above which adverse impacts to individual mammals may occur. While the HQ calculated using the conservative NOAEL is greater than 1, this HQ likely overestimates both the exposure of shrews and other insectivorous mammals to Aroclor 1254 at the BLA and the toxicity of Aroclor 1254 to these populations. The HQ calculated using the LOAEL (a more realistic indicator of toxicity) is less than 1, when using the UCL concentration in the refined scenario. Based on the consideration of NOAELs and LOAELs, the UCL concentrations, and the relatively limited spatial extent of affected soils associated with the perimeters of the concrete foundations, adverse impacts at the population-level are considered unlikely for the shrew or any other insectivorous mammals exposed to Aroclor 1254 at the BLA. Under the refined scenario for Aroclor 1254 exposure for the American robin, the NOAEL HQ and LOAEL HQ were both below 1, indicating that adverse affects at the population-level are considered unlikely for the robin or any other insectivorous birds exposed to Aroclor 1254 at the BLA.

Under the refined scenario for cadmium exposure for the short-tailed shrew, the NOAEL HQ and the LOAEL HQ were 2 and 20, respectively. The NOAEL is a very conservative screening criterion while the LOAEL indicates a concentration above which adverse impacts to individual mammals may occur. While the HQ calculated using the conservative LOAEL is greater than 1, as previously discussed, a closer examination of the location of those soil samples with elevated levels of cadmium indicates that the concentrations of cadmium in samples collected from immediately adjacent to the foundations contain higher concentrations than in samples collected further away from the foundation. The extent of affected soil available for ecological exposure is 16,850 ft^2, or approximately 0.4 acre. Based on the consideration of NOAELs and LOAELs and the relatively limited spatial extent of affected soils associated with the perimeters of the concrete foundations, adverse impacts at the population-level are considered unlikely for the shrew or any other insectivorous mammals potentially exposed to cadmium at the BLA. Under the refined scenario for cadmium exposure for the American robin, the NOAEL HQ and LOAEL HQ were both below 1, indicating that adverse affects at the population-level are considered unlikely for the robin or any other insectivorous birds exposed to cadmium at the BLA.

Under the refined short-tailed shrew scenario, the NOAEL HQ and LOAEL HQ for copper were both 10, the NOAEL HQ and LOAEL HQ for lead were 20 (NOAEL) and 2 (LOAEL), and the NOAEL HQ and LOAEL HQ for zinc were 70 (NOAEL) and 7 (LOAEL). Similarly, under the refined American robin scenario the NOAEL HQ and LOAEL HQ for lead were 10 (NOAEL) and 8 (LOAEL), the NOAEL HQ and LOAEL HQ for lead were 70 (NOAEL) and 7 (LOAEL), and the NOAEL HQ and LOAEL HQ for zinc were 20 (NOAEL) and 2 (LOAEL). The NOAEL is a very conservative screening criterion while the LOAEL indicates a concentration above which adverse impacts to individual mammals and birds may occur. While the HQs calculated using the conservative LOAEL were greater than 1, as previously discussed, a closer examination of the location of those soil samples with elevated levels of copper, lead, and zinc indicates that the concentrations of these metals in samples collected from immediately adjacent to the foundations contain higher concentrations than in samples collected further away from the foundation. The extent of affected soil available for ecological exposure is 16,850 ft^2, or approximately 0.4 acre. While these elevated levels of copper, lead, and zinc may cause localized affects to individual shrews and robins; overall, the total affected area is unlikely to pose a significant adverse ecological impact to ecological receptors at the population-level.

Based on the overall analysis of terrestrial food chain modeling HQs and consideration of the limited spatial extent of affected soils, adverse effects are not expected for short-tailed shrews (and other insectivorous mammals) and American robins (and other insectivorous birds) populations exposed to bioaccumulative COPECs in soil at the BLA.

4.5.4.2 Aquatic Food chain Model

The refined scenario LOAEL and NOAEL HQs for both the mink (Tables A.4.ERA-11 and A.4.ERA-12) and the great blue heron (Tables A.4.ERA-13 and A.4.ERA-14) were less than or equal to 1 for all bioaccumulative COPECs identified in sediment and/or surface water. These results indicate that mink and herons (or other piscivorous mammals and birds) exposed to these COPECs are not expected to experience adverse effects.

Based on the overall analysis of aquatic food chain modeling HQs, adverse effects are not expected for mink (and other piscivorous mammals) and great blue herons (and other piscivorous birds) populations exposed to bioaccumulative COPECs in sediment and/or surface water at the BLA.

4.5.5 Ecological Risk Summary

Screening-level and baseline risk assessments were completed for the BLA. After the SLERA, 53 constituents were selected as COPECs in surface soil, 30 constituents were selected as COPECs in sediment, and 18constituents were selected as COPECs in surface water because the HQs were greater than 1, the chemical was bioaccumulative or an HQ could not be calculated because an ESL was not available. After the BERA, 52 constituents in surface soil, 29 constituents in sediment, and 17 constituents in surface water were retained because the HQs were greater than 1, the chemical was bioaccumulative or an HQ could not be calculated because an ESL was not available. Food chain modeling was evaluated for all those constituents identified as bioaccumulative.

Tables A.4.ERA-15 and A.4.ERA-16 summarize the constituents in surface soil, sediment, and surface water carried through the BERA and evaluated in the terrestrial and/or aquatic food chain model. As shown in Table A.4.ERA-15, Aroclor 1254 had NOAEL HQs greater than 1 and cadmium, copper, lead, and zinc had both NOAEL and LOAEL HQs greater than 1 for the short-tailed shrew. In addition, copper, lead, and zinc had both NOAEL and LOAEL HQs greater than 1 for the American robin. However, when these results are considered in conjunction with pertinent site information on the limited spatial distribution and extent of these constituents in surface soil, while the potential does exist for unacceptable risk to individual insectivorous mammals and birds exposed to surface soils containing affected concentrations of these COPECs, the potential for population-level effects is low. As shown in Table A.4.ERA-16, all constituents evaluated in the aquatic food chain refined scenarios had LOAEL and NOAEL HQs less than or equal to 1. These results indicate that individual mink and herons (or other piscivorous mammals and birds) potentially exposed to these COPECs are not expected to experience adverse effects.

Based on the overall analysis of the ERA for the BLA, the results indicate that adverse effects are not expected for wildlife at the site.

4.6 BLA Summary and Conclusions

For the purposes of the HHRA, surface soil, total soil, surface water and sediment were evaluated for both current and future land-use conditions. Under current land-use conditions, site worker exposures to surface soil, surface water, and sediment were evaluated. Under future conditions, the site worker exposures remained the same as the current exposures and construction worker, residential exposures to total soil, surface water, and sediment were evaluated.

The potential cumulative risk for site workers exposed to surface soil and sediment at the BLA under current and future land-use conditions was 1×10^{-4}, which is at the high end of USEPA's target risk range of 1×10^{-6} to 1×10^{-4} for health protectiveness at Superfund sites (USEPA, 1990). The potential cumulative HI for site workers was 0.8, which was less than the benchmark of 1.

The potential cumulative risk for construction workers exposed to total soil and sediment at the BLA under future land-use conditions was 7×10^{-6}, which is within the USEPA's target risk range of 1×10^{-6} to 1×10^{-4} for health protectiveness at Superfund sites (USEPA, 1990). The potential cumulative HI for construction workers of 3 exceeded the benchmark of 1 mostly due to exposure to copper.

The total cumulative ELCR for hypothetical future residents exposed to combined surface and subsurface soil, sediment, and surface water at the BLA is 1×10^{-3}, which is greater than the USEPA target risk range of 1×10^{-6} to 1×10^{-4}, due to the presence of benzo(a)pyrene.

The total cumulative HI for hypothetical future adult residents is equal to the benchmark of 1. The total cumulative HI for hypothetical future child residents is 12, which is greater than the benchmark of 1. When the HI is segregated into target site and critical effects, hazards were above the benchmark of 1 in the central nervous system, whole body, and immune system, in the gastrointestinal tract, and in the eyes, nails, hair, and skin, due to the presence of copper and cobalt.

Bag Loading Area

Lead was a constituent of potential concern for each of the receptors considered in the BLA risk assessment. Exposure to lead is evaluated differently than the other constituents with the point of comparison based on a predicted blood lead level. For each of the receptors, exposure to lead resulted in predicted blood lead levels above the acceptable benchmark. Therefore, exposure to lead could result in an unacceptable risk.

Removal of the walls and roofs of the BLA buildings has exposed conductive flooring material to weather, causing it to degrade and wash onto the surrounding soils. Based on the results of activity-based air sampling conducted in soils surrounding some of those buildings, it appears that the presence of asbestos may present a potential risks for current and future site workers and hypothetical future residents.

A SLERA and BERA were completed for the BLA, to evaluate surface soil, sediment, and surface water for ecological receptors, and food chain modeling was evaluated for all those constituents identified as bioaccumulative. The results of the evaluation of the SLERA and BERA for direct contact and the constituents evaluated in the terrestrial and aquatic food chain models indicate that while some of the NOAEL and LOAEL HQs were greater than 1, when these results are considered in conjunction with pertinent site information on the limited spatial distribution and extent of these constituents, as well as the conservatism inherent in the dose calculation, effects of these COPECs at the population-level are unlikely at the BLA.

5. Igniter Assembly Area

5.1 Site Description and History

The IAA is located in the western portion of the RFAAP-NRU. Buildings at the site were used for igniter assembly, as well as the shipping and receiving of materials related to the IAA. The walls of the buildings were painted with lead-based paint. Deterioration of these materials may have provided a potential source of lead to the soils immediately surrounding the former building areas. The main igniter assembly buildings (Buildings 8102-1 through 8102-8) and multiple outparcel buildings at the IAA also had a conductive flooring material similar to the BLA. Locations of the conductive flooring on specified buildings are depicted on this figure. The buildings were constructed with conductive flooring to prevent build up of static electrical charges which could have potentially ignited explosive materials during assembly operations. This flooring material contains various heavy inorganics and asbestos and was exposed to the weather when the wooden roof and walls were removed from the buildings. As a result, the conductive flooring has degraded into a red powder-like substance very similar to what has been observed at the BLA. In many areas, the degraded conductive flooring material has washed off the concrete pads onto surrounding surface soils.

5.2 Physical Setting

The areas surrounding the main assembly buildings and multiple outparcel buildings are generally flat and vegetated with tall grass, shrubs, and pine trees. Previously maintained grassy areas have been allowed to revert to more natural conditions. Raised concrete sidewalks connect the assembly buildings with various outbuildings; however, none of these sidewalks were constructed with conductive flooring. A change-house/canteen (Building 8101) has been removed to its foundation. Building 8101 also contains no conductive flooring material. An engineered drainage system around the IAA consists of a series of culverts to divert water under the sidewalks to ditches which eventually drain into the unnamed creek that provides drainage for much of the RFAAP-NRU. However, the length of the unlined ditches suggests that runoff from normal rain events would infiltrate prior to arriving at the creek.

5.3 Risk Assessment Datasets

Data generated from the site characterization activities were used in the risk assessment. Risk assessment datasets for soil, sediment, and surface water for the IAA were prepared then summarized and statistically analyzed. Risk assessment datasets summaries highlighting the number of detects, number of samples, FOD, minimum and maximum detected concentrations, minimum and maximum detection limits, and EPCs are presented in Tables A.5.Data-1 through Table A.5.Data-4.

5.4 Human Health Risk Assessment

The purpose of this risk assessment is to evaluate the potential current and future risks and hazards to human health associated with constituents detected in soil and sediment samples collected at the IAA. No surface water samples were collected at the IAA; as a result, this medium was not evaluated. The risk assessment approach follows the Radford Army Ammunition Plant Final Master Work Plan (URS 2003).

The risk assessment approach is based on Virginia and USEPA guidance for risk assessments (VDEQ 2008; USEPA 2004a, 2000a, 1997a, 1992, 1991a, 1989). This section summarizes the occurrence of constituents in each medium and identifies COPCs at the IAA for the human health risk assessment; identifies the potential human exposure scenarios relevant to the IAA; and presents the estimated human health risks associated with the identified COPCs and the relevant human exposure scenarios at the IAA.

5.4.1 Selection of Constituents of Potential Concern

This section discusses the selection of COPCs for each medium.

5.4.1.1 Surface Soil

Surface soil COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for residential soil. Table A.5.HHRA-1 presents the selection of surface COPCs for the HHRA. Twenty-seven constituents were identified as COPCs.

Four VOCs (3-octanone; acetone; d-limonene; and methylene chloride) were detected in surface soil. Acetone and methylene chloride were both detected at concentrations below their USEPA (2009a) residential soil RSL values. No USEPA (2009a) residential soil RSL values were available for 3-octanone or d-limonene. As a result, 3-octanone and d-limonene were identified as COPCs for surface soil.

Nine SVOCs (2,4-dinitrotoluene; benzoic acid; bis[2-ethylhexyl]phthalate; butylbenzylphthalate; carbazole; dibenzofuran; diethylphthalate; di-n-butylphthalate; and di-n-octylphthalate) were detected in surface soil. Only 2,4-dinitrotoluene and bis(2-ethylhexyl)phthalate were detected at concentrations that were greater than their

USEPA (2009a) residential soil RSL values. In addition, a USEPA (2009a) residential soil RSL value was not available for carbazole; as a result, these three constituents were identified as COPCs for surface soil.

Three explosives (1,3,5-trinitrobenzene; 4-amino-2,6-dinitrotoluene; and nitroglycerine) were detected in surface soil. All three of these constituents were detected at concentrations below the USEPA (2009a) residential soil RSL values and were not identified as COPCs for surface soil.

Thirteen pesticides (4,4'-DDD; 4,4'-DDE; 4,4'-DDT; beta-BHC; delta-BHC; alpha-chlordane; gamma-chlordane; dieldrin; endosulfan II; endrin; endrin ketone; heptachlor epoxide; and methoxyclor) were detected in surface soil. None of the constituents were detected at concentrations above the USEPA (2009a) residential soil RSL values, and as a result, were not identified as COPCs in surface soil.

Eighteen PAHs (1-methylnaphthalene; 2-methylnaphthalene; acenaphthene; acenaphthylene; anthracene; benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; benzo[g,h,i]perylene; benzo[k]fluoranthene; chrysene; dibenzo[a,h]anthracene; fluoranthene; fluorene; indeno[1,2,3-cd]pyrene; naphthalene; phenanthrene; and pyrene) were detected in surface soil. Seven of these detected constituents (benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; benzo[k]fluoranthene; chrysene; dibenzo[a,h]anthracene; and indeno[1,2,3-cd]pyrene) had maximum concentrations greater than the USEPA (2009a) residential soil RSL values and were identified as COPCs for surface soil.

Two PCBs (Aroclor 1254 and Aroclor 1260) were detected in surface soil. Both of these constituents were detected at concentrations above the USEPA (2009a) residential soil RSL values and were identified as COPCs for surface soil.

Twenty-three inorganics (aluminum; antimony; arsenic; barium; beryllium; cadmium; calcium; chromium; cobalt; copper; iron; lead; magnesium; manganese; mercury; nickel; potassium; selenium; silver; sodium; thallium; vanadium; and zinc) were detected in surface soil. Four constituents (calcium; magnesium; potassium; and sodium) were identified as essential nutrients and were not evaluated further in the HHRA. Sixteen of these constituents (aluminum; antimony; arsenic; barium; cadmium; chromium; cobalt; copper; iron; lead; manganese; mercury; nickel; thallium; vanadium; and zinc) were greater than the USEPA (2009a) residential soil RSL values. However, manganese, thallium, and vanadium were all detected below the background concentrations. As a result, only aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, mercury, nickel, and zinc were identified as COPCs for surface soil.

Finally, asbestos has also been detected in surface soils around some of the buildings in the IAA in areas where conductive flooring has degraded into a red powder-like material that has washed onto the surrounding soils adjacent to those buildings. Soil sampling and activity-based air sampling have been conducted in selected areas of the IAA and are discussed in Section 7.4.9 of the RI. The results of this sampling indicate that asbestos is also a COPC for surface soil at this site.

5.4.1.2 Combined Surface and Subsurface Soil

Combined surface and subsurface soil COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for residential soil. Table A.5.HHRA-2 presents the selection of combined surface and subsurface soil COPCs for the HHRA. Twenty-seven constituents were identified as COPCs in combined surface and subsurface soil.

Five VOCs (3-octanone; acetone; d-limonene; methylene chloride, and toluene) were detected in combined surface and subsurface soil. Acetone and methylene chloride were both detected below their USEPA (2009a) residential soil RSL values. USEPA (2009a) residential soil RSL values were not available for 3-octanone or d-limonene. As a result, only 3-octanone and d-limonene were identified as COPCs for combined surface and subsurface soil.

Nine SVOCs (2,4-dinitrotoluene; benzoic acid; bis[2-ethylhexyl]phthalate; butylbenzylphthalate; carbazole; dibenzofuran; diethylphthalate; di-n-butylphthalate; and di-n-octylphthalate) were detected in combined surface and subsurface soil. Only 2,4-dinitrotoluene and bis(2-ethylhexyl)phthalate were detected at concentrations that were greater than their USEPA (2009a) residential soil RSL values. In addition, a USEPA (2009a) residential soil RSL value was not available for carbazole; as a result, these three constituents were identified as COPCs for combined surface and subsurface soil.

Three explosives (1,3,5-trinitrobenzene; 4-amino-2,6-dinitrotoluene; and nitroglycerine) were detected in combined surface and subsurface soil. All three of these constituents were detected at concentrations below the USEPA (2009a) residential soil RSL values.

Thirteen pesticides (4,4'-DDD; 4,4'-DDE; 4,4'-DDT; beta-BHC; delta-BHC; alpha-chlordane; gamma-chlordane; dieldrin; endosulfan II; endrin; endrin ketone; heptachlor epoxide; and methoxyclor) were detected in combined surface and subsurface soil. All 13 of these constituents were below the USEPA (2009a) residential soil RSL values.

Eighteen PAHs (1-methylnaphthalene; 2-methylnaphthalene; acenaphthene; acenaphthylene; anthracene; benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; benzo[g,h,i]perylene; benzo[k]fluoranthene; chrysene; dibenzo[a,h]anthracene; fluoranthene; fluorene; indeno[1,2,3-cd]pyrene; naphthalene; phenanthrene; and pyrene) were detected in combined surface and subsurface soil. Seven of these detected constituents (benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; benzo[k]fluoranthene; chrysene; dibenzo[a,h]anthracene; and indeno[1,2,3-cd]pyrene) were detected at concentrations greater than the USEPA (2009a) residential soil RSL values and were identified as COPCs for combined surface and subsurface soil.

Two PCBs (Aroclor 1254 and Aroclor 1260) were detected in combined surface and subsurface soil. Both of these constituents were detected at concentrations above the USEPA (2009a) residential soil RSL values and were identified as COPCs for combined surface and subsurface soil.

Twenty-three inorganics (aluminum; antimony; arsenic; barium; beryllium; cadmium; calcium; chromium; cobalt; copper; iron; lead; magnesium; manganese; mercury; nickel; potassium; selenium; silver; sodium; thallium; vanadium; and zinc) were detected in combined surface and subsurface soil. Four constituents (calcium; magnesium; potassium; and sodium) were identified as essential nutrients and were not evaluated further in the HHRA. Sixteen of these constituents (aluminum; antimony; arsenic; barium; cadmium; chromium; cobalt; copper; iron; lead; manganese; mercury; nickel; thallium; vanadium; and zinc) were greater than the USEPA (2009a) residential soil RSL values. However, manganese, thallium, and vanadium were all detected at concentrations below the background concentrations. As a result, only aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, mercury, nickel, and zinc were identified as COPCs for combined surface and subsurface soil.

5.4.1.3 Sediment

Sediment COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for residential soil. Table A.5.HHRA-3 presents the selection of sediment COPCs for the HHRA. Six constituents were identified as COPCs in sediment.

Eighteen inorganics (aluminum; arsenic; barium; beryllium; cadmium; calcium; chromium; cobalt; copper; iron; lead; magnesium; manganese; mercury; nickel;

potassium; vanadium; and zinc) were detected in sediment. Six of these constituents (aluminum; arsenic; cobalt; iron; manganese; and vanadium) were detected at concentrations greater than the USEPA (2009a) residential soil RSL values, and three constituents (calcium; magnesium; and potassium) were identified as essential nutrients. Consequently, only aluminum, arsenic, cobalt, iron, manganese, and vanadium were identified as COPCs for sediment.

5.4.2 Summary of Selected Constituents of Potential Concern

Twenty-seven constituents were selected as COPCs in surface soil and combined surface and subsurface soil at the IAA, including two VOCs (3-octanone and d-limonene), three SVOCs (2,4-dinitrotoluene; bis[2-ethylhexyl]phthalate; and carbazole), seven PAHs (benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; benzo[k]fluoranthene; chrysene; dibenzo[a,h]anthracene; and indeno[1,2,3-cd]pyrene), two PCBs (Aroclor 1254 and Aroclor 1260), and thirteen inorganics (aluminum; antimony; arsenic; barium; cadmium; chromium; cobalt; copper; iron; lead; mercury; nickel; and zinc).

Six inorganics were selected as COPCs in sediment at the IAA, including aluminum, arsenic, cobalt, iron, manganese, and vanadium.

5.4.3 Determination of Exposure Point Concentrations

Twenty-seven constituents were selected as COPCs in both surface soil and combined surface and subsurface soil, and seven constituents were selected as COPCs in sediment because the maximum detected concentrations were greater than the corresponding USEPA (2009a) RSL or no RSL was available. The EPCs for these COPCs are summarized in Table A.5.HHRA-4.

5.4.4 Human Health Risk Characterization

Exposure to the constituents detected in soil and sediment COPCs were evaluated for direct contact. VOCs identified as COPCs in the IAA were also evaluated for inhalation via vapor migration into buildings. Two VOCs, 3-octanone and d-limonene, were identified as soil COPCs at the IAA. Those two COPCs do not have identified inhalation toxicity values; therefore, the indoor vapor intrusion pathway could not be assessed at this Study Area.

Results of the risk characterization are discussed below. The ELCRs and non-cancer hazards are summarized in Table A.5.HHRA-12. The blood lead level model estimates for each potentially exposed receptor included in the risk assessment for the IAA are summarized in Table A.5.HHRA-16.

5.4.4.1 Site Worker

A current or future site worker could be present at the IAA area, and could be exposed to constituents detected in surface soil or sediment. The ELCR and non-cancer hazard index for site worker exposure to each medium are presented in Tables A.5.HHRA-5 and A.5.HHRA-6. The ELCRs for surface soil and sediment are all below or within the USEPA target risk range, and the HIs for each medium are all at or below the benchmark value of 1.

The total cumulative ELCR for site workers exposed to surface soil and sediment at the IAA is 1×10^{-4}, which is equal to the high end of the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for site workers is 1, which is equal to the benchmark of 1.

The 50th percentile blood lead level estimates for the site worker receptor was at 2.8 µg/dL which is well below the benchmark of 10 µg/dL, and the 95th percentile fetal blood lead level was approximately equal to the benchmark of 10 µg/dL, as summarized in A.5.HHRA-13.

5.4.4.2 Hypothetical Future Construction Worker

A hypothetical future construction worker could be present at the IAA area, and could be exposed to combined surface and subsurface soil. The ELCR and non-cancer hazard index for hypothetical future construction worker exposure to soil are presented in Table A.5.HHRA-7. As presented in the table above, the ELCR for combined surface and subsurface soil is within the USEPA target risk range, and the HI is above the benchmark value of 1.

The total cumulative ELCR for hypothetical future construction workers exposed to combined surface and subsurface soil at the IAA is 6×10^{-6}, which is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for hypothetical future construction workers is 3, which is above the benchmark of 1. When the HI is segregated into target site and critical effects, hazards were all below or equal to the benchmark of 1. The 50th percentile blood lead level estimates for the construction worker receptor was at 2.8 µg/dL which is well below the benchmark of 10 µg/dL and the 95th percentile fetal blood lead level was approximately equal to the benchmark, as seen in Table A.5.HHRA-15.

5.4.4.3 Hypothetical Future Residents

A hypothetical future resident could be present at the IAA area, and could be exposed to combined surface and subsurface soil or sediment. The ELCR and non-cancer hazard index for hypothetical future adult or child resident exposure to each medium are presented in Tables A.5.HHRA-8 through A.5.HHRA-11 and summarized in Table A.5.HHRA-12. The ELCR for sediment is within the USEPA target risk range; however, the ELCRs for combined surface and subsurface soil were greater than the USEPA risk range. The HIs for each medium are all at or below the benchmark value of 1, with the exception of child resident exposure to combined surface and subsurface soil.

The total cumulative ELCR for hypothetical future residents exposed to combined surface and subsurface soil and sediment at the IAA is 5×10^{-4}, which is above the USEPA target risk range of 1×10^{-6} to 1×10^{-4}.The primary risk driver is 2,4-dinitrotoluene in soil. Other contributors to the excess lifetime cancer risks were benzo(a)pyrene, Aroclor 1254, and arsenic.

The total cumulative HI for hypothetical future adult residents is 1, which is equal to the benchmark. When the hazards were segregated by target organ or critical effect, all of the HIs were less than 1. The total cumulative HI for hypothetical future child residents is 13, which is above the benchmark of 1. When the HI is segregated into target site and critical effects, hazards were greater than the benchmark of 1 in the central nervous system, whole body, and immune system, in the blood, in the gastrointestinal tract, and in the eyes, nails, hair, and skin. The risk drivers for non-cancer hazard are Aroclor 1254, copper, 2,4-dinitrotoluene, and cobalt.

The 50^{th} percentile blood lead level estimates for the hypothetical adult resident receptor was calculated to be 3.2 µg/dL which is well below the benchmark of 10 µg/dL, and the 95^{th} percentile fetal blood lead levels was calculated to be 11 µg/dL slightly above the benchmark of 10 µg/dL, as seen in Table A.5.HHRA-14. The range of annual mean blood lead level estimates over seven years for the child receptor was 4.4µg/dL to 8.2 µg/dL, which is below the benchmark of10 µg/dL, as seen in Table A.5.HHRA-14. However, exposure of a child over a seven year period resulted in a geometric mean blood lead concentration of 6.4 µg/dL, below the 10 µg/dL benchmark, but a prediction of 17 percent of the population having blood lead concentrations above the 10 µg/dL benchmark. Table A.5.HHRA-14 summarizes the input assumptions to and outputs from the lead modeling for the child resident.

5.4.5 Evaluation of Asbestos

As discussed in Section 4.4.5, ARCADIS conducted an additional investigation in July 2009 to facilitate the evaluation of potential health risks associated with asbestos in soil. During that investigation, ARCADIS collected delineation soil samples adjacent to a number of buildings in the IAA where asbestos had either been detected in soil or there were no historical sampling data. In addition, ARCADIS conducted activity-based air sampling at two buildings in the IAA (Building 5 and Building 8102) to determine if soil disturbance in those areas would result in unacceptable air concentrations of asbestos.

In Section 4.4.5, risk-based AALs were calculated, using USEPA (2008f) methodology, for the four exposure scenarios that have been evaluated for the IAA. These AALs, based on the 1E-04 risk level that represents the upper end of USEPA acceptable risk range, were 0.007 f/cc for the current/future site worker, 0.2 f/cc for the future hypothetical construction worker, 0.002 f/cc for the future hypothetical child resident, and 0.001 f/cc for the future hypothetical adult resident.

Results of the air sampling indicate that all air samples in the sampling grids adjacent to Building 5 were non-detect for asbestos, as were the delineation soil samples collected in this area. As a result, all of these samples were below the risk-based AALs for current, future, and future hypothetical exposure scenarios, indicating that risks due to asbestos were below levels of concern in this area.

Soil samples adjacent to Building 8102, however, had measureable concentrations of asbestos in the grid located 0-10 feet from the building perimeter. The total asbestos air concentrations measured at IAA8102-AA1 and IAA8102-AP1 were 0.0078 and 0.053 f/cc, respectively. The two samples collected from the grid located 10-20 feet from the building perimeter were non-detect for asbestos. The average concentration using all four samples is 0.015 f/cc. All of these exceed the AAL of 0.007 f/cc (based on a 1E-04 risk level) calculated for the current and future site worker, as well as the range of AALs calculated for hypothetical future residents. They do not exceed the AAL of 0.2 calculated for the hypothetical future construction worker.

These results indicate that the presence of asbestos in the soils closest to Building 8102 may result in unacceptable air concentrations if those soils are subject to intensive disturbance. Consequently, they may potentially present an unacceptable risk to individuals who are engaged in soil-disturbance activities there.

5.4.6 Human Health Risk Summary

Table A.5.HHRA-12 summarizes the calculated cancer risks and non-cancer hazards for each potentially exposed receptor included in the risk assessment for the IAA. As shown in the table below, the total ELCR values for all surface soil, combined surface and subsurface soil and sediment exposures for each exposure scenario are below or within the benchmark range of 10^{-6} to 10^{-4} for cancer risk, with the exception of hypothetical future residential exposure to combined surface and subsurface soil. The primary contributor to the risk estimates is 2,4-dinitrotoluene.

Summary of Calculated ELCRs and HIs for Receptor Exposure Scenarios

RECEPTOR/EXPOSURE MEDIUM – SCENARIO	ELCR	HI
Site Worker		
Surface Soil - Direct Contact	1E-04	1
Sediment – Wading	8E-07	0.01
TOTAL SITE RISKS (Site Worker):	**1E-04**	**1**
Hypothetical Future Construction Worker		
Combined Surface and Subsurface Soil - Direct Contact	6E-06	3
TOTAL SITE RISKS (Construction Worker):	**6E-06**	**3**
Hypothetical Future Adult Resident		
Combined Surface and Subsurface Soil - Direct Contact	-	1
Sediment – Wading	-	0.02
TOTAL SITE RISKS (Adult Resident):	**-**	**1**
Hypothetical Future Child Resident		
Combined Surface and Subsurface Soil - Direct Contact	-	13
Sediment – Wading	-	0.1
TOTAL SITE RISKS (Child Resident):	**-**	**13**
Hypothetical Future Resident (Adult and Child)		
Combined Surface and Subsurface Soil - Direct Contact	5E-04	-
Sediment – Wading	3E-06	-
TOTAL SITE RISKS (Aggregate Resident):	**5E-04**	**-**

The total HI values for all surface soil, combined surface and subsurface soil, and sediment exposures for each exposure scenario are at or below the benchmark of 1 for non-cancer hazard, with the exception of hypothetical future construction worker and hypothetical future child resident exposure to combined surface and subsurface soil. When the HI is segregated into target site and critical effects for the hypothetical future construction worker, hazards were all at or below the benchmark of 1. The primary contributors to the hazards above 1 for the hypothetical future child resident are Aroclor 1254, copper, 2,4-dinitrotoluene and cobalt.

The results of the risk assessment indicated that under industrial exposure scenarios the calculated ELCRs, noncancer hazards, and predicted blood lead levels were all within target risk ranges or less than or equal to benchmarks.

The results of the risk assessment for hypothetical future residential receptors indicated that 2,4-dinitrotoluene, Aroclor 1254, cobalt, copper, and lead were constituents of concern for both adult and child residents. 2,4-Dinitrotoluene was detected in two of thirty-six samples, with the two detections collected from two depths at sampling location 504360 during the December 1997 sampling event. No other detections of this constituent were confirmed during the subsequent sampling events. Finally, only the maximum concentration of cobalt (422 mg/kg) fell outside of the background concentration range of 5.9 mg/kg to 130 mg/kg.

Summary of Estimated Blood Lead Levels for Receptor Exposure Scenarios

RECEPTOR	Estimated Blood Lead Level (µg/dL)		
	Adult	Child	Fetus
	50th percentile	Range	95th percentile
SOIL			
Site Worker	2.8	–	10
Hypothetical Future Construction Worker	2.8	–	10
Hypothetical Future Child	–	4.4 - 8.2	–
Hypothetical Future Adult	3.2	–	11

As discussed in Section 5.1, removal of the walls and roofs of the IAA buildings has exposed conductive flooring to weather, causing it to degrade and wash onto the surrounding soils. Based on the results of activity-based air sampling conducted in soils surrounding some of those buildings, it appears that the presence of asbestos in soil may present an unacceptable risk for current and future site workers and hypothetical future future residents.

5.5 Ecological Risk Assessment

The purpose of the ERA is to evaluate whether ecological receptors may be adversely impacted by exposure to site-related constituents detected in surface soil, sediment, and surface water at the IAA. The ERA approach is based on the Master Work Plan (URS 2003) in compliance with CERCLA/SARA. The ERA was conducted in a manner consistent with Virginia policy and USEPA guidance for ecological risk assessment (USEPA 2001a; 2000b; 1997c). This ERA is intended to provide input for risk management decision-making for the IAA, while maintaining a conservative approach protective of wildlife populations and communities. In accordance with USEPA guidance, the ERA for the IAA commenced with a SLERA and then concluded with BERA (USEPA 1997c).

This section summarizes the occurrence of constituents in each medium and identifies COPECs at the IAA for the ERA; identifies the potential ecological exposure scenarios relevant to the IAA; and presents the estimated ecological risks associated with the identified COPECs and the relevant ecological exposure scenarios at the IAA. Methodologies for data summary and selection of COPECs, exposure assessment, and toxicity assessment for the ERA were presented in Section 2.4.

5.5.1 Selection of Constituents of Potential Ecological Concern

This section discusses the selection of COPECs for each medium. Risks to ecological receptors are calculated by dividing the exposure estimates (i.e., the maximum detected concentrations) by the conservative ESLs. The resulting ratio, the hazard quotient (HQ), is a conservative surrogate for the assessment endpoints identified in Section 2.4. HQs equal to or less than a value of 1 (to one significant figure) indicate that adverse ecological effects are unlikely (USEPA 1997c). HQs greater than 1 indicate that further evaluation is warranted. Therefore, the constituents with HQs greater than 1 are carried forward as COPECs into the BERA. Because the majority of the ESLs measure direct exposures and do not take into account exposures to upper trophic level species, chemicals identified as bioaccumulative were also carried forward as COPECs regardless of whether or not the associated HQ was greater than 1. Finally, as previously described, soil concentrations of inorganic constituents were compared to background soil concentrations; those with concentrations below background were not considered as COPEC. The COPEC selection process for the IAA are summarized in the subsections below.

Data were not collected for surface water at the IAA, therefore COPECs are only presented for soil and sediment.

5.5.1.1 Surface Soil

Surface soil COPECs were selected by comparing the analytical data with USEPA (2005b) EcoSSLs, USEPA (2003e) Region 5 ESLs, and ORNL values (Efroymson et al. 1997a,b) for surface soil. Table A.5.ERA-1 presents the selection of surface soil COPECs for the ERA. Fifty-three constituents were identified as COPECs in surface soil.

Four VOCs (3-octanone; acetone; d-limonene; and methylene chloride) were detected in surface soil. Acetone and methylene chloride both had an HQ less than or equal to 1; however, no ESLs were available for 3-octanone or d-limonene and so HQs could not be calculated. As a result, 3-octanone and d-limonene were identified as COPECs for surface soil.

Nine SVOCs (2,4-dinitrotoluene; benzoic acid; bis[2-ethylhexyl]phthalate; butylbenzylphthalate; carbazole; dibenzofuran; diethylphthalate; di-n-butylphthalate; and di-n-octylphthalate) were detected in surface soil. Four of these constituents (2,4-dinitrotoluene; bis[2-ethylhexyl]phthalate; diethylphthalate; and di-n-butylphthalate) had an HQ greater than 1. In addition, ESLs were not available for benzoic acid, carbazole, and dibenzofuran, and so HQs could not be calculated. As a result, 2,4-dinitrotoluene, benzoic acid, bis[2-ethylhexyl]phthalate, carbazole, dibenzofuran, diethylphthalate, and di-n-butylphthalate were identified as COPECs for surface soil.

Three explosives (1,3,5-trinitrobenzene; 4-amino-2,6-dinitrotoluene; and nitroglycerine) were detected in surface soil. An ESL was not available for nitroglycerine and so an HQ could not be calculated and it was identified as a COPEC for surface soil.

Thirteen pesticides (4,4'-DDD; 4,4'-DDE; 4,4'-DDT; beta-BHC; delta-BHC; alpha-chlordane; gamma-chlordane; dieldrin; endosulfan II; endrin; endrin ketone; heptachlor epoxide; and methoxyclor) were detected in surface soil. Only two of these constituents, dieldrin and endrin, had an HQ greater than 1. In addition, all of the detected pesticides except gamma-chlordane and endrin ketone were identified as bioaccumulative, therefore, 4,4'-DDD; 4,4'-DDE; 4,4'-DDT; beta-BHC; delta-BHC; alpha-chlordane; dieldrin; endosulfan II; endrin; heptachlor epoxide; and methoxyclor were identified as COPECs in surface soil.

Eighteen PAHs (1-methylnaphthalene; 2-methylnaphthalene; acenaphthene; acenaphthylene; anthracene; benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; benzo[g,h,i]perylene; benzo[k]fluoranthene; chrysene; dibenzo[a,h]anthracene; fluoranthene; fluorene; indeno[1,2,3-cd]pyrene; naphthalene; phenanthrene; and pyrene) were detected in surface soil. Three of these detected constituents (benzo[a]pyrene; chrysene; and naphthalene) had an HQ greater than 1, however, all except 1-methylnaphthalene and 2-methylnaphthalene were identified as bioaccumulative and, therefore, identified as COPECs for surface soil.

Two PCBs (Aroclor 1254 and Aroclor 1260) were detected in surface soil. Neither of these constituents had ESLs available and both were identified as bioaccumulative, therefore, they were identified as COPECs for surface soil.

Twenty-three inorganics were detected in surface soil. Four constituents are vital electrolytes and/or essential nutrients (i.e., calcium; magnesium; potassium; and sodium) and therefore were identified as non-toxic and not evaluated further. Seventeen of the detected constituents (aluminum, antimony; arsenic; barium; cadmium; chromium; cobalt; copper; lead; manganese; mercury; nickel; selenium; silver; thallium; vanadium; and zinc) had an HQ greater than 1, and one constituent (iron) did not have an ESL available and so an HQ could not be calculated. However, four constituents (aluminum, manganese; thallium; and vanadium) had maximum concentrations less than their respective background concentration established at the site. As a result, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, mercury, nickel, selenium, silver, and zinc were identified as COPECs for surface soil.

5.5.1.2 Sediment

Sediment COPECs were selected by comparing the analytical data with ESLs from the following sources in order of priority: USEPA (2008d) Region 3 Sediment Screening Levels; ORNL values (Jones et al. 1997); and USEPA (2003e) Region 5 Ecological Screening Levels for sediment. Table A.5.ERA-2 presents the selection of sediment COPECs for the ERA. Eighteen inorganics (aluminum; arsenic; barium; beryllium; cadmium; calcium; chromium; cobalt; copper; iron; lead; magnesium; manganese; mercury; nickel; potassium; vanadium; and zinc) were detected in sediment. Three constituents are vital electrolytes and/or essential nutrients (i.e., calcium; magnesium; and potassium) and therefore were identified as non-toxic and not evaluated further. Only one constituent (iron) had an HQ greater than 1, and three constituents (barium; beryllium; and vanadium) did not have an ESL available and an HQ could not be calculated. In addition, seven constituents were identified as bioaccumulative. Therefore, arsenic, barium, beryllium,cadmium, chromium, copper, iron, lead, nickel, vanadium, and zinc were identified as COPECs for sediment.

5.5.2 Summary of Selected Constituents of Potential Ecological Concern

Fifty-three constituents were selected as COPECs in surface soil and eleven constituents were selected as COPECs in sediment because the HQs were greater than 1, the chemical was bioaccumulative or an HQ could not be calculated because an ESL was not available.

5.5.3 Refinement of Risk Calculations for Direct Contact COPECs

The list of COPECs identified in the BERA was reevaluated by recalculating the HQs. The refined HQs were calculated for the COPECs identified in the SLERA using refined EPCs. Constituents identified as COPECs in the BERA that were bioaccumulative were carried forward into food chain models. The results of the recalculation of the HQs for the IAA are summarized in the subsections below.

5.5.3.1 Surface Soil

Fifty-three COPECs in surface soil were carried forward into the BERA. When refined EPCs were compared with the ESLs, 15 constituents (2,4-dinitrotoluene; bis[2-ethylhexyl]phthalate; diethylphthalate; di-n-butylphthalate; benzo[a]pyrene; naphthalene; antimony; barium; cadmium; chromium; cobalt; copper; lead; mercury; and zinc) had a refined HQ greater than 1. In addition, ESLs were not available for 9 other constituents (3-octanone; d-limonene; benzoic acid; carbazole; dibenzofuran; nitroglycerine; Aroclor 1254; Aroclor 1260;; and iron). The BERA results for surface soil COPECs at the IAA are presented in Table A.5.ERA-3.

Volatile Organic Compounds: Two VOCs (3-octanone and d-limonene) were retained in the BERA because an ESL was not available and so HQs could not be calculated. These VOCs were detected in 4 out of 4 and 3 out of 3 surface soil samples, respectively. Due to the low detected concentrations for these two VOCs (i.e., < 1 mg/kg) and their physical and chemical properties (e.g., relatively high vapor pressure and solubility; relatively low Kow and low potential to bioaccumulate), adverse effects to wildlife due to potential VOC exposure are considered unlikely.

Semi-Volatile Organic Compounds: Seven SVOCs (2,4-dinitrotoluene; benzoic acid; bis[2-ethylhexyl]phthalate; carbazole; dibenzofuran; diethylphthalate; and di-n-butylphthalate) were retained in the BERA because the calculated HQ was greater than the benchmark value of 1 or because an ESL was not available and so HQs could not be calculated. These results are discussed below:

2,4-Dinitrotoluene – 2,4-Dinitrotoluene was detected in 1 out of 30 surface soil samples, with a concentration of 48 mg/kg. While this concentration was above the ESL of 1.28 mg/kg, given the low frequency of detection, it is unlikely that potential exposure to 2,4-dinitrotoluene will cause adverse effects to wildlife.

Benzoic acid – Benzoic acid was detected in 7 out of 22 surface soil samples, with concentrations ranging from 0.1 mg/kg to 0.3 mg/kg. While no ESL was available and an HQ could not be calculated, given the low frequency of detection, and the very low concentrations (i.e., < 1 mg/kg), it is unlikely that potential exposure to benzoic acid will cause adverse effects to wildlife.

Bis(2-ethylhexyl)phthalate – Bis(2-ethylhexyl)phthalate was detected in 23 out of 31 surface soil samples, with concentrations ranging from 0.03 mg/kg to 750 mg/kg. Only eight of these concentrations were above the ESL of 0.92594 mg/kg. In addition, bis(2-ethylhexyl)phthalate was also detected in the laboratory blank. Consequently, adverse effects to wildlife exposed to bis(2-ethylhexyl)phthalate are unlikely given the low concentrations and the uncertainty that the VOC was actually detected in the sediment samples.

Carbazole – Carbazole was detected in 5 out of 22 surface soil samples, with concentrations ranging from 0.016 mg/kg to 2.4 mg/kg. While no ESL was available and an HQ could not be calculated, given the low frequency of detection and the relatively low detected concentrations, it is unlikely that potential exposure to carbazole will cause adverse effects to wildlife.

Dibenzofuran – Dibenzofuran was detected in 4 out of 20 surface soil samples, with concentrations ranging from 0.018 mg/kg to 0.74 mg/kg. While no ESL was available and an HQ could not be calculated, given the low frequency of detection and the very low concentrations (i.e., < 1 mg/kg), it is unlikely that potential exposure to dibenzofuran acid will cause adverse effects to wildlife.

Di-n-butylphthalate – Di-n-butylphthalate was detected in 2 out of 22 surface soil samples, with concentrations ranging from 0.07 mg/kg to 0.31 mg/kg. Only one of these concentrations was above the ESL of 0.15 mg/kg, and this concentration was qualified with a B flag, indicating that the constituent was also detected in the blank. Based on these considerations, it is unlikely that di-n-butylphthalate will cause adverse effects to wildlife.

Explosives: One explosive, nitroglycerine, was retained in the BERA because an ESL was not available and so an HQ could not be calculated. This constituent was detected in 1 out of 19 samples, at a concentration of 0.57 mg/kg. Due to the low frequency of detection and the low detected concentration, adverse effects to wildlife potentially exposed to explosives are unlikely.

Polycyclic Aromatic Hydrocarbons: Two PAHs (benzo[a]pyrene and naphthalene) were retained in the BERA because the calculated HQs were greater than the benchmark value of 1. Calculated HQs for these PAHs were 2 and 4, respectively. Although these two PAHs were detected relatively frequently (55% detection frequency for benzo[a]pyrene and 45% for naphthalene), as discussed previously the ESLs for these constituents were obtained from USEPA (2003e) Region 5, and are especially conservative values based on toxicity to the masked shrew. When site-specific food chain modeling was evaluated for PAHs, the HQs for the refined scenarios were below the benchmark value of 1 for the LOAEL for all chemicals and for all but two chemicals for the NOAEL. These results are further discussed in the sections below.

Naphthalene was not identified as a bioaccumulative COPEC. The HQ calculated using the USEPA (2003e) Region 5 value for this PAH was 4, which is only slightly above the benchmark of 1. While alternate ESLs were not available for naphthalene, additional toxicologically-based benchmarks were available from Sample et al (1996) for other PAHs. The benchmarks developed by Sample et al (1996) are NOAEL-based dietary benchmarks for mammals exposed to a constituent via ingestion of food. Since naphthalene is not a bioaccumulative COPEC, assuming the naphthalene concentration in all food items is equivalent to the concentration in surface soil provides a conservative estimate of dietary exposure. That is, the receptor would have to have a diet of 100 percent soil to receive the dose associated with the Sample et al (1996) benchmark. The NOAEL benchmark values for benzo(a)pyrene, the most conservative of the PAHs, ranged from 1.98 mg/kg to 8.0 mg/kg. The EPC for naphthalene, 0.357 mg/kg, was below this range of acceptable concentrations.

Consequently, adverse effects to wildlife exposed to PAHs at the site are unlikely given the site-specific food chain model results and the similarity of naphthalene concentrations with those below NOAEL-based benchmark values.

Polychlorinated Biphenyls: Two PCBs (Aroclor 1254 and Aroclor 1260) were retained in the BERA because ESLs were not available and so HQs could not be calculated. Aroclor 1254 was detected in 12 out of 35 surface soil samples, with concentrations ranging from 0.0049 mg/kg to 12 mg/kg. Aroclor 1260 was only detected in 3 of 27 samples, with concentrations ranging from 0.37 mg/kg to 1 mg/kg.

While there are no Aroclor-specific ESLs from Region 5, Region 5 does provide an ESL of 0.000332 mg/kg for PCBs as a group. The maximum and UCL concentrations for Aroclor 1254 and the maximum concentration for Aroclor 1260 at the IAA are above this ESL; however, site-specific food chain modeling for the short-tailed shrew and American robin (Section 5.7.4), using conservative exposure assumptions, indicates that the potential risk from exposure to both Aroclor 1254 and 1260 at the IAA is very low. Although there are some soil samples at the IAA with elevated concentrations of PCBs, specifically Aroclor 1254, a closer examination of the location of those samples in relation to the concrete building foundations, and their spatial extent indicates that the concentrations of Aroclor 1254 (and other PCBs) in samples collected from immediately adjacent to the foundations contain higher concentrations than in samples collected further away from the foundation (i.e., in general, concentrations decrease with distance from the foundations; Figure 5-1). For example, in sample location 504312 (located approximately 1-ft from the building foundation), the concentration of Aroclor 1254 is 0.89 mg/kg, compared to 0.04 mg/kg in sample location IASB15 (located approximately 10 feet away from the foundation). This trend is repeated in other sample locations (i.e., 502436, which is located approximately 3 feet of the foundation, versus 502460, which is approximately 5 feet away from the foundation). The areal extent of the affected soils that are around the perimeter of the 29 buildings at the IAA encompass an area of 72,191 ft^2. When the area of the foundations (37,641 ft2) is subtracted, the extent of affected soil available for ecological exposure is 34,550 ft2, or approximately 0.8 acre. While very small areas may provide occasional foraging habitat or cover, they are unlikely to support a viable population or represent a significant percentage of the overall exposure. Of the receptors identified for consideration at the site, the short-tailed shrew would have the smallest foraging range, however, even that species requires approximately 1 acre (0.0015 mi^2; USEPA, 1993d). Based on these considerations, adverse impacts at the population-level are not considered likely for ecological receptors exposed to PCBs at the IAA.

<u>Inorganics</u>: Ten inorganics (antimony; barium; cadmium; chromium; cobalt; copper; iron; lead; mercury; and zinc) were retained in the BERA because the calculated HQs were greater than the benchmark value of 1, or an HQ could not be calculated because an ESL was not available. These results are discussed below:

<u>Antimony</u> – Antimony was detected in 30 out of 96 surface soil samples, with concentrations ranging from 0.21 mg/kg to 16.9 mg/kg. Twenty-three of these concentrations were above the ESL of 0.27 mg/kg. While site-specific background values for antimony were not available, these detected concentrations were compared to the mean reported soil inorganic background

concentrations developed for Virginia (USEPA 1995). The EPC for antimony at the IAA was 1.2 mg/kg, which was equal to the reported background soil concentration of antimony in Virginia (USEPA 1995). Consequently, adverse effects to wildlife exposed to antimony are unlikely given the similarity of detected concentrations with the state background value.

Barium – Barium occurs naturally in soil at the RFAAP-NRU and is also one of the known components in the conductive flooring material at the BLA and IAA. Barium was detected in 99 out of 99 surface soil samples, with concentrations ranging from 8.5 mg/kg to 11,800 mg/kg. Seventeen of these concentrations were above the ESL of 330 mg/kg, and twenty-eight concentrations were above the background value of 209 mg/kg established at the site. Although there are some soil samples at the IAA with elevated concentrations of barium, a closer examination of the location of those samples in relation to the concrete building foundations, and their spatial extent indicates that the concentrations of barium (and other metals) in samples collected from immediately adjacent to the foundations contain higher concentrations than in samples collected further away from the foundation (i.e., in general, concentrations decrease with distance from the foundations; Figure 5-2). For example, in sample location SS-12 (located approximately 5 ft from the foundation of the building) the concentration of barium is 3,220 mg/kg, compared to 72.9 mg/kg in sample location IASS02 (located approximately 15 feet away from the foundation), which is below the background value of 209 mg/kg established at the site. This trend is repeated in other sample locations (i.e., IATP2A/C, which is located within 1 foot of the foundation, versus 81027236, which is approximately 3 feet away from the foundation). The areal extent of the affected soils that are around the perimeter of the 29 buildings at the IAA encompass an area of 72,191 ft^2. When the area of the foundations (37,641 ft^2) is subtracted, the extent of affected soil available for ecological exposure is 34,550 ft^2, or approximately 0.8 acre. Based on these considerations, adverse impacts at the population-level are not considered likely for ecological receptors exposed to barium at the IAA.

Cadmium – Cadmium was detected in 52 out of 90 surface soil samples, with concentrations ranging from 0.06 mg/kg to 15.2 mg/kg. Thirty-six concentrations were above the ESL of 0.36 mg/kg, and twenty-six concentrations were above the background value of 0.69 mg/kg established at the site. However, when the EPC of 2.198 mg/kg was calculated, this value was within the range of background samples detected at the site. Consequently, adverse effects to wildlife exposed to cadmium are unlikely given the similarity of detected concentrations with the range of site background values. This COPEC was further evaluated in the terrestrial food chain model.

Chromium – Chromium was detected in 99 out of 99 surface soil samples, with concentrations ranging from 11.9 mg/kg to 1,920 mg/kg. Seventy-nine of these concentrations were above the ESL of 26 mg/kg, and 13 concentrations were above the background value of 65.3 mg/kg established at the site. As previously discussed, a closer examination of the location of those soil samples with elevated levels of chromium indicates that the concentrations of chromium in samples collected from immediately adjacent to the foundations contain higher concentrations than in samples collected further away from the foundation (Figure 5-2). For example, in sample location SS-12 (collected approximately 5 feet from the building foundation) the concentration of chromium is 99.2 mg/kg, compared to 36.8 mg/kg in sample location IASS02 (collected approximately 15 feet away from the foundation), which is below the background value of 65.3 mg/kg established at the site. This trend is repeated in other sample locations (i.e., IATP2A/C, which is located within 1 foot of the foundation, versus 81027236, which is approximately 3 feet away from the foundation). The areal extent of the affected soils that are around the perimeter of the 29 buildings at the IAA encompass an area of 72,191 ft^2. When the area of the foundations (37,641 ft^2) is subtracted, the extent of affected soil available for ecological exposure is 34,550 ft^2, or approximately 0.8 acre. Based on these considerations, adverse impacts at the population-level are not considered likely for ecological receptors exposed to chromium at the IAA.

Cobalt – Cobalt was detected in 97 out of 99 surface soil samples, with concentrations ranging from 0.26 mg/kg to 422 mg/kg. While 36 concentrations were above the ESL of 13 mg/kg, only the maximum concentration was above the range of background samples detected at the site (5.9 mg/kg to 130 mg/kg). When the EPC of 38.29 mg/kg was calculated, this value was below the background value of 72.3 mg/kg established at the site. In addition, the calculated HQ was only slightly above the benchmark value of 1 (HQ=3). Consequently, adverse effects to wildlife exposed to cobalt are unlikely given the similarity of detected concentrations with the site background values and the likely overestimate of potential risks to wildlife presented by the HQ.

Copper – Copper was detected in 99 out of 99 surface soil samples, with concentrations ranging from 9.1 mg/kg to 56,500 mg/kg. Seventy-six concentrations were above the ESL of 28 mg/kg, and 58 concentrations were above the background value of 53.5 mg/kg established at the site. As previously discussed, a closer examination of the location of those soil samples with elevated levels of copper indicates that the concentrations of copper in samples collected from immediately adjacent to the foundations contain higher concentrations than in samples collected further away from the foundation (Figure 5-2). For example, in sample location SS-12 (located approximately 5 ft from the building foundation) the concentration of copper is 56,500 mg/kg, compared to 97.2 mg/kg in sample location IASS02 (located approximately 15 feet away from the foundation), which is within the detected range of background values (1.6 mg/kg to 38.7 mg/kg) at the site. This trend is repeated in other sample locations (i.e., IATP2A/C, which is located within 1 foot of the foundation, versus 81027236, which is approximately 3 feet away from the foundation). The areal extent of the affected soils that are around the perimeter of the 29 buildings at the IAA encompass an area of 72,191 ft^2. When the area of the foundations (37,641 ft^2) is subtracted, the extent of affected soil available for ecological exposure is 34,550 ft^2, or approximately 0.8 acre. Based on these considerations, adverse impacts at the population-level are not considered likely for ecological receptors exposed to copper at the IAA. Additionally, copper was further evaluated in the terrestrial food chain model.

Iron – Iron was detected in 99 out of 99 surface soil samples, with concentrations ranging from 9,450 mg/kg to 328,000 mg/kg. While no ESL was available for iron, all but two of these concentrations were within the range of background values (7,250 mg/kg to 67,700 mg/kg) detected at the site. Consequently, adverse effects to wildlife exposed to iron are unlikely given the similarity of detected concentrations with the range of site background values.

Lead – Lead was detected in 99 out of 99 surface soil samples, with concentrations ranging from 6.4 mg/kg to 16,200 mg/kg. All but five of these concentrations were above the ESL of 11 mg/kg, and 28 concentrations were detected outside of the range of background samples (2.1 mg/kg to 256 mg/kg) detected at the site. As previously discussed, a closer examination of the location of those soil samples with elevated levels of lead indicates that the concentrations of lead in samples collected from immediately adjacent to the foundations contain higher concentrations than in samples collected further away from the foundation (Figure 5-2). For example, in sample location SS-12 (located approximately 5 ft from the building foundation) the concentration of lead is 563 mg/kg, compared to 49.1 mg/kg in sample location IASS02 (located approximately 15 feet away from the foundation), which is within the detected range of background values (2.1 mg/kg to 256 mg/kg) at the site. This trend is repeated in other sample locations (i.e., IATP2A/C, which is located within 1 foot of the foundation, versus 81027236, which is approximately 3 feet away from the foundation). The areal extent of the affected soils that are around the perimeter of the 29 buildings at the IAA encompass an area of 72,191 ft^2. When the area of the foundations (37,641 ft^2) is subtracted, the extent of affected soil available for ecological exposure is 34,550 ft^2, or approximately 0.8 acre. Based on these considerations, adverse impacts at the population-level are not considered likely for ecological receptors exposed to lead at the IAA. Additionally, lead was further evaluated in the terrestrial food chain model.

<u>Mercury</u> – Mercury was detected in 75 out of 84 surface soil samples, with concentrations ranging from 0.015 mg/kg to 79.5 mg/kg. Twenty-four of these concentrations were above the ESL of 0.1 mg/kg. As previously discussed, a closer examination of the location of those soil samples with elevated levels of mercury indicates that the concentrations of mercury in samples collected from immediately adjacent to the foundations contain higher concentrations than in samples collected further away from the foundation (Figure 5-2). For example, in sample location IAA-SS026 (located approximately 5 ft from the building foundation) the concentration of mercury is 1.9 mg/kg, compared to <0.050 mg/kg in sample location IASB15 (located approximately 10 feet away from the foundation), which is below the background value of 0.13 mg/kg established at the site. This trend is repeated in other sample locations (i.e., IATP2A/C, which is located within 1 foot of the foundation, versus 81027236, which is approximately 3 feet away from the foundation). The areal extent of the affected soils that are around the perimeter of the 29 buildings at the IAA encompass an area of 72,191 ft^2. When the area of the foundations (37,641 ft^2) is subtracted, the extent of affected soil available for ecological exposure is 34,550 ft^2, or approximately 0.8 acre. Based on these considerations, adverse impacts at the population-level are not considered likely for ecological receptors exposed to mercury at the IAA.

<u>Zinc</u> – Zinc was detected in 99 out of 99 surface soil samples, with concentrations ranging from 6 mg/kg to 21,800 mg/kg. Seventy-four of these concentrations were greater than the ESL of 46 mg/kg, and forty-one concentrations were above the background value of 202 mg/kg established at

the site. As previously discussed, a closer examination of the location of those soil samples with elevated levels of zinc indicates that the concentrations of zinc in samples collected from immediately adjacent to the foundations contain higher concentrations than in samples collected further away from the foundation (Figure 5-2). For example, in sample location SS-12 (located approximately 5 ft from the building foundation) the concentration of zinc is 6,460 mg/kg, compared to 88.1 mg/kg in sample location IASS02 (located approximately 15 feet away from the foundation), which is below the background value of 202 mg/kg established at the site. This trend is repeated in other sample locations (i.e., IATP2A/C, which is located within 1 foot of the foundation, versus 81027236, which is approximately 3 feet away from the foundation). The areal extent of the affected soils that are around the perimeter of the 29 buildings at the IAA encompass an area of 72,191 ft^2. When the area of the foundations (37,641 ft^2) is subtracted, the extent of affected soil available for ecological exposure is 34,550 ft^2, or approximately 0.8 acre. Based on these considerations, adverse impacts at the population-level are not considered likely for ecological receptors exposed to zinc at the IAA. Additionally, zinc was further evaluated in the terrestrial food chain model.

Thirty-six COPECs were identified as bioaccumulative and evaluated in the terrestrial food chain model.

5.5.3.2 Sediment

Eleven COPECs in sediment were carried forward into the BERA. When refined EPCs were compared with the ESLs, only one constituent, iron, had a refined HQ greater than 1. In addition, ESLs were not available for three other constituents (barium; beryllium; and vanadium). The BERA results for sediment COPECs at the IAA are presented in Table A.5.ERA-4 and are discussed below:

Inorganics: Four inorganics (barium; beryllium; iron; and vanadium) were retained in the BERA because the calculated HQs were greater than the benchmark value of 1, or an HQ could be calculated because an ESL was not available. These results are discussed below:

Barium – Barium was detected in 4 out of 4 sediment samples, with concentrations ranging from 36.8 mg/kg to 48.9 mg/kg. While no screening value was available for barium and no background sediment data was collected, all of these detected concentrations were below the soil background value of 209 mg/kg established at the site. Consequently, adverse effects to aquatic life exposed to barium are unlikely given the similarity of detected concentrations with the site background value.

Beryllium – Beryllium was detected in 4 out of 4 sediment samples, with concentrations ranging from 0.61 mg/kg to 1.2 mg/kg. While no screening value was available for beryllium and no background sediment data was collected, all of these detected concentrations were within the range of detected soil background values (0.61 mg/kg to 5.4 mg/kg) at the site. Consequently, adverse effects to aquatic life exposed to beryllium are unlikely given the similarity of detected concentrations with the range of site background values.

Iron – Iron was detected in 4 out of 4 sediment samples, with concentrations ranging from 27,900 mg/kg to 32,300 mg/kg. While no ESL was available for iron, and no background sediment data was collected, all of these detected concentrations were below the soil background value of 50,962 mg/kg established at the site. Consequently, adverse effects to aquatic life exposed to iron are unlikely given the similarity of detected concentrations with the soil background value.

Vanadium –Vanadium was detected in 4 out of 4 sediment samples, with concentrations ranging from 50.7 mg/kg to 62.6 mg/kg. While no screening value was available for vanadium and no background sediment data was collected, all of these detected concentrations were within the range of detected soil background values (12.2 mg/kg to 114 mg/kg) at the site. Consequently, adverse effects to aquatic life exposed to vanadium are unlikely given the similarity of detected concentrations with the range of site background values.

Six constituents were also defined as bioaccumulative (arsenic; cadmium; copper; lead; nickel; and zinc) and were evaluated in the aquatic food web model..

5.5.4 Refinement of Assessment and Measurement Endpoints for Bioaccumulative COPECs

Food chain modeling was conducted at the IAA in order to evaluate the potential ecological effects of the bioaccumulative COPEC in soil on the receptors identified in Section 2.4. COPECs identified in soil and sediment were evaluated in the terrestrial and aquatic food chains, respectively.. The results for both the maximum and refined scenarios of the terrestrial and aquatic models are presented in Tables A.5.ERA-5 through A.5.ERA-12

5.5.4.1 Terrestrial Food chain Model

The refined scenario NOAEL and LOAEL HQs for the short-tailed shrew (Tables A.5.ERA-5 and A.5.ERA-6) were less than 1 for all pesticides and for all PAHs except the NOAEL HQ for dibenzo(ah)anthracene and indeno(1,2,3-cd)pyrene .In addition, the the remaining six constituents (Aroclor 1254, Aroclor 1260, cadmium, copper, lead, and zinc) had a NOAEL HQ greater than 1 and/or a LOAEL HQ above 1 as discussed below.

The NOAEL HQs for short-tailed shrew for dibenzo(ah)anthracene and indeno(1,2,3-cd)pyrene were very low (HQ=3 for both COPEC) indicating only a slight risk. Taking into account the conservative nature of the mammalian TRVs applied, it is likely that this risk is overestimated. As previously noted, the soil ESLs applied to PAHs were based on exposures to the masked shrew and maximum concentrations for both these chemicals were well below the reported values. Based on this assessment, risks associated with these two chemicals is unlikely.

Two PCBs, Aroclor 1254 and Aroclor 1260, had NOAEL HQs above 1. Aroclor 1254 had a NOAEL HQ of 7 and a LOAEL HQ of 0.7. However, when looking at the Aroclor 1254 dataset, the maximum concentration was detected at 12 mg/kg, while the next highest concentration was 0.89 mg/kg. If the maximum concentration of 12 mg/kg was excluded, an EPC of 0.23 mg/kg was calculated, which would produce a shrew NOAEL HQ below 1. Aroclor 1260 had a NOAEL HQ of 2 and a LOAEL HQ of 0.2. However, due to the overly conservative criterion of the NOAEL and the low frequency of detection (i.e., 10 % in surface soil), these results indicate that individual shrews (or other insectivorous mammals) exposed to PCBs are not expected to experience adverse effects.

Similarly two inorganics, cadmium and lead, both had NOAEL HQs of 2 and LOAEL HQs of 0.2. As previously discussed, the NOAEL is a very conservative screening criterion, while the LOAEL indicates a concentration above which adverse impacts to individual mammals may occur. In addition, the cadmium EPC of 2.198 mg/kg was within the range of detected concentrations at the site (0.62 mg/kg to 2.5 mg/kg), and the lead EPC of 200 mg/kg was below the established site background value of 202 mg/kg. Based on this information, these results indicate that individual shrews (or other insectivorous mammals) exposed to cadmium and lead are not expected to experience adverse effect.

Refined NOAEL and LOAEL HQs for copper (HQ=8; HQ=6) and zinc (HQ=40; HQ=4) were above 1. As discussed in the BERA above, although there are some soil samples at the IAA with elevated concentrations of both copper and zinc, a closer examination of the location of those samples in relation to the concrete building foundations, and their spatial extent indicates that the concentrations of copper and zinc in samples collected from immediately adjacent to the foundations contain higher concentrations than in samples collected farther away from the foundation (i.e., in general, concentrations decrease with distance from the foundations). The areal extent of the affected soils that are around the perimeter of the 29 buildings (excluding the area of the building foundation itself) at the IAA encompass an area of 34,550 ft^2 or roughly 0.8 acre. This is the extent of affected soil available for ecological exposure. While these elevated levels of copper and zinc may cause localized impacts to individual shrews; overall, the total impact area is less than 1 acre and is unlikely to pose a significant adverse ecological impact to ecological receptors at the population-level.

The refined scenario NOAEL and LOAEL HQs for the American robin were presented in Tables A.5.ERA-7 and A.5.ERA-8. Here, the NOAEL and LOAEL HQs for benzo(a)pyrene, Aroclor 1254, Aroclor 1260, and cadmium, while the remaining three constituents (copper, lead, and zinc) a NOAEL HQ greater than 1 and/or a LOAEL HQ above 1 as discussed below.

Lead and zinc both had NOAEL HQs above 1. Lead had a NOAEL HQ of 8 and a LOAEL HQ of 0.8. Zinc had a NOAEL HQ of 10 and a LOAEL HQ of 1. Copper had a NOAEL HQ of 6 and a LOAEL HQ of 5. As previously discussed, the NOAEL is a very conservative screening criterion, while the LOAEL indicates a concentration above which adverse impacts to individual mammals may occur. In addition, although there are some soil samples at the IAA with elevated concentrations of both copper, lead, and zinc, the areal extent of ecological exposure to the affected soils that are around the perimeter of the 29 buildings (excluding the area of the building foundation itself) at the IAA encompass an area of less than 1 acre and is unlikely to pose a significant adverse ecological impact to ecological receptors at the population-level. While these elevated levels of copper, lead, and zinc may cause localized impacts to individual robins; overall, the total affected area is unlikely to pose a significant adverse ecological impact to ecological receptors at the population-level.

Based on the overall analysis of terrestrial food chain modeling HQs and consideration of the limited spatial extent of affected soils, adverse effects are not expected for short-tailed shrews (and other insectivorous mammals) and American robins (and other insectivorous birds) populations exposed to bioaccumulative COPECs in soil at the IAA.

5.5.4.2 Aquatic Food Chain Model

The results of the aquatic food chain model indicate that all HQs were below 1 for both great blue heron and mink (Tables A.5.ERA-9 through A.5.ERA-12) with the exception of the zinc NOAEL HQ for mink which was 2. Given the very low exceedance and the conservatism inherent in the assessment, it was concluded that the area was unlikely to pose a significant adverse ecological impact to ecological receptors at the population-level.

5.5.5 Ecological Risk Summary

Screening-level and baseline risk assessments were completed for the IAA. After the SLERA, 53 constituents were selected as COPECs in surface soil, and 11 constituents were selected as COPECs in sediment because the HQs were greater than 1, the chemical was bioaccumulative or an HQ could not be calculated because an ESL was not available. After the BERA, all constituents in surface soil, and 10 constituents in sediment were retained. Food chain modeling was evaluated for all those constituents identified as bioaccumulative.

Tables A.5.ERA-13 and A.5.ERA-14 summarize the results of the terrestrial and aquatic food chain models, respectively. Based on these results, in conjunction with the information on the limited spatial distribution and extent of these constituents in surface soil and sediment, , the potential for population-level effects is low.

Based on the overall analysis of the ERA for the IAA, the results indicate that adverse population-level effects are not expected for wildlife at the site.

5.6 IAA Summary and Conclusions

An HHRA was conducted at the IAA to evaluate potential exposures to humans associated with site constituents. Site worker exposures to surface soil and sediment were evaluated under current and future land-use conditions; and construction worker, adult resident, and child resident exposures to total soil and sediment were evaluated under future land-use conditions.

The soil and sediment COPCs were evaluated for direct contact. VOCs identified as COPCs in the IAA were also evaluated for inhalation via vapor migration into buildings.

Igniter Assembly Area

Two VOCs, 3-octanone and d-limonene, do not have identified inhalation toxicity values; therefore, the indoor vapor intrusion pathway could not be assessed at this Study Area.

A current or future site worker could be present at the IAA area, and could be exposed to surface soil or sediment. The total cumulative ELCR for site workers exposed to surface soil and sediment at the IAA is 1×10^{-4}, which is equal to the high end of the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for site workers is 1, which is equal to the benchmark of 1; however, all segregated hazards were less than or equal to 1. Lead was also evaluated as a COPC, although the results are reported differently than those for the other COPCs. The predicted worker blood lead levels were below the benchmark and the predicted fetal lead level was equal to the benchmark.

A hypothetical future construction worker could be present at the IAA area, and could be exposed to combined surface and subsurface soil. The total cumulative ELCR for hypothetical future construction workers exposed to combined surface and subsurface soil at the IAA was 6×10^{-6}, which is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for hypothetical future construction workers is 3, which is above the benchmark of 1 due mostly to copper. Hazards are less than or equal to 1 when segregated by target organ. The predicted worker blood lead levels were below the benchmark and the predicted fetal lead level was equal to the benchmark.

The total cumulative ELCR for hypothetical future residents exposed to combined surface and subsurface soil and sediment at the IAA is 5×10^{-4}, which is above the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The primary contributor to risk estimates is 2,4-dinitrotoluene in soil. Other contributors to the excess lifetime cancer risks were benzo(a)pyrene, PCBs, and arsenic.

The total cumulative HI for hypothetical future adult residents is 1, which is equal to the benchmark. When the hazards were segregated by target organ or critical effect, all of the HIs were less than 1. The predicted adult resident blood lead levels were below the benchmark of 10 µg/dl, and the predicted fetal lead level was slightly greater than the benchmark.

The total cumulative HI for hypothetical future child residents is 13, which is above the benchmark of 1. When the HI was is segregated by target site and critical effects, hazards were greater than the benchmark of 1 due to the presence of Aroclor 1254, cobalt, and 2,4-dinitrotoluene. The predicted blood lead levels were all below the benchmark.

2,4-Dinitrotoluene was detected in two of thirty samples with the two detections collected from two depths at sampling location 504360 during the December 1997 sampling event. No other detections of this constituent were confirmed during the subsequent sampling events. Aroclor 1254 was detected in 18 of 61 surface soil samples with detected concentrations ranging from 0.03 to 12 mg/kg. Only six samples exceeded the RSL of 0.22 mg/kg for residential exposure and three samples exceeded the RSL of 0.74 mg/kg for industrial exposure. Finally, only the maximum concentration of cobalt (422 mg/kg) fell outside of the background concentration range of 5.9 mg/kg to 130 mg/kg.

Removal of the walls and roofs of the IAA buildings has exposed conductive flooring material to weather, causing it to degrade and wash onto the surrounding soils. Based on the results of activity-based air sampling conducted in soils surrounding some of those buildings, it appears that the presence of asbestos may present a potential risk for current and future site workers and hypothetical future residents.

A SLERA and BERA were completed for the IAA, to evaluate surface soil and sediment for ecological receptors, and food chain modeling was evaluated for all those constituents identified as bioaccumulative. The results of the evaluation of the SLERA and BERA for direct contact and the constituents evaluated in the terrestrial food chain models indicate that while some of the NOAEL and LOAEL HQs were greater than 1, when these results are considered in conjunction with pertinent site information on the limited spatial distribution and extent of these constituents, effects of these COPECs at the population-level are unlikely at the IAA.

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6. Rail Yard (RY)

6.1 Site Description and History

The RY encompasses an open area approximately 3,200 ft long by 350 ft wide (approximately 39 acres) in the central portion of the RFAAP-NRU. The RY was used for loading and unloading rail cars and the temporary storage of rail cars. The area contained three parallel sets of tracks and several spurs so that cars could be rearranged. Four of the spurs at the north end of the site were surrounded by earthen berms. Three open transfer platforms and one bermed transfer platform are located along the southernmost track for loading and unloading the trains. A decommissioned sewer line runs southwest from a building foundation to a branch of the RFAAP-NRU sewer system that is no longer in use.

6.2 Physical Setting

The RY area is relatively flat at an elevation of approximately 2,100 ft amsl. The area is very open with much of the site being covered with asphalt roadways, gravel, and grass groundcover. Surface water runoff from the RY is directed to two tributaries to the unnamed creek that flows through the southwest portion of the RFAAP-NRU. Engineered drainage control ditches channel runoff in the areas between the tracks, ultimately draining into one of the two tributaries.

6.3 Risk Assessment Datasets

Data generated from the site characterization activities were used in the risk assessment. Risk assessment datasets for soil, sediment, and surface water for the RY were prepared then summarized and statistically analyzed. Risk assessment datasets summaries highlighting: the number of detects, number of samples, FOD, minimum and maximum detected concentrations, minimum and maximum detection limits, and EPC are presented in Tables A.6.Data-1 through A.6.Data-5.

6.4 Human Health Risk Assessment

The purpose of this risk assessment is to evaluate the potential current and future risks and hazards to human health associated with constituents detected in soil, sediment and surface water samples collected at the RY. The risk assessment approach follows the Radford Army Ammunition Plant Final Master Work Plan (URS 2003).

The risk assessment approach is based on Virginia and USEPA guidance for risk assessments (VDEQ 2008; USEPA 2004a- 2000a- 1997a- 1992- 1991a- 1989). This section summarizes the occurrence of constituents in each medium and identifies COPCs at the RY for the human health risk assessment; identifies the potential human exposure scenarios relevant to the RY; and presents the estimated human health risks associated with the identified COPCs and the relevant human exposure scenarios at the RY. Methodologies for data summary and selection of COPCs, exposure assessment, and toxicity assessment for the HHRA were presented in Section 2.3.

6.4.1 Selection of Constituents of Potential Concern

This section discusses the selection of COPCs for each medium.

6.4.1.1 Surface Soil

Surface soil COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for residential soil. Table A.6.HHRA-1 presents the selection of surface soil COPCs for the HHRA. As summarized in Table A.6.HHRA-1, 14 constituents were identified as COPCs in surface soil as follows:

Five VOCs (2-butanone; 3-octanone; acetone; ethanol; and methylene chloride) were detected in surface soil. 2-Butanone, acetone, and methylene chloride were detected at concentrations below their USEPA (2009a) residential soil RSL values. USEPA (2009a) residential soil RSL values were not available for 3-octanone or ethanol. As a result, both 3-octanone and ethanol were identified as COPCs for surface soil.

Nine SVOCs (2,4-dinitrotoluene; 2,6-dinitrotoluene; benzoic acid; bis[2-ethylhexyl]phthalate; carbazole; dibenzofuran; diethylphthalate; di-n-butylphthalate; and pentachlorophenol) were detected in surface soil. Only pentachlorophenol was detected at a maximum concentration greater than the USEPA (2009a) residential soil RSL value. In addition, a USEPA (2009a) residential soil RSL value was not available for carbazole; as a result, these two constituent was identified as COPCs for surface soil.

One explosive-related compound, 4-amino-2,6-dinitrotoluene, was detected in surface soil. This constituent, which is a degradation product of 2,4,6-trinitrotoluene (TNT) (Hovatter et al. 1997) was detected at concentrations below the USEPA (2009a) residential soil RSL value, and as a result, was not identified as a COPC for surface soil.

Six pesticides (4,4'-DDE; alpha-BHC; beta-BHC; alpha-chlordane; dieldrin; and endrin aldehyde) were detected in surface soil. Only dieldrin was detected at concentrations above the USEPA (2009a) residential soil RSL value and was identified as a COPC for surface soil.

Seventeen PAHs (2-methylnaphthalene; acenaphthene; acenaphthylene; anthracene; benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; benzo[g,h,i]perylene; benzo[k]fluoranthene; chrysene; dibenzo[a,h]anthracene; fluoranthene; fluorene; indeno[1,2,3-cd]pyrene; naphthalene; phenanthrene; and pyrene) were detected in surface soil. Four of these detected constituents (benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; and dibenzo[a,h]anthracene) were greater than the USEPA (2009a) residential soil RSL values and were identified as COPCs for surface soil.

One PCB, Aroclor 1254, was detected in surface soil. This constituent was detected at concentrations above the USEPA (2009a) residential soil RSL value and was identified as a COPC for surface soil

Twenty-two inorganics (aluminum; antimony; arsenic; barium; beryllium; cadmium; calcium; chromium; cobalt; copper; iron; lead; magnesium; manganese; mercury; nickel; potassium; selenium; sodium; thallium; vanadium; and zinc) were detected in surface soil. Four constituents (calcium; magnesium; potassium; and sodium) were identified as essential nutrients and were not evaluated further in the HHRA. Eight of these constituents (aluminum; arsenic; barium; cobalt; iron; manganese; thallium; and vanadium) were greater than the USEPA (2009a) residential soil RSL values. However, iron, manganese, thallium, and vanadium were all detected below the background concentrations. As a result, only aluminum, arsenic, barium, and cobalt were identified as COPCs for surface soil.

6.4.1.2 Combined Surface and Subsurface Soil

Combined surface and subsurface soil COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for residential soil. Table A.6.HHRA-2 presents the selection of combined surface and subsurface soil COPCs for the HHRA. As summarized in Table A.6.HHRA-2, 14 constituents were identified as COPCs in combined surface and subsurface soil as follows:

Five VOCs (2-butanone; 3-octanone; acetone; ethanol; and methylene chloride) were detected in combined surface and subsurface soil. 2-Butanone, acetone, and methylene chloride were detected below their USEPA (2009a) residential soil RSL values. USEPA (2009a) residential soil RSL values were not available for 3-octanone or ethanol. As a result, only 3-octanone and ethanol were identified as COPCs for combined surface and subsurface soil.

Ten SVOCs (2,4-dinitrotoluene; 2,6-dinitrotoluene; benzoic acid; bis[2-ethylhexyl]phthalate; butylbenzylphthalate; carbazole; dibenzofuran; diethylphthalate; di-n-butylphthalate; and pentachlorophenol) were detected in combined surface and subsurface soil. Only pentachlorophenol was detected at concentrations that were greater than the USEPA (2009a) residential soil RSL value. In addition, a USEPA (2009a) residential soil RSL value was not available for carbazole. As a result, both of these constituents were identified as COPCs for combined surface and subsurface soil.

One explosive, 4-amino-2,6-dinitrotoluene, was detected in combined surface and subsurface soil. This constituent was detected at concentrations below the USEPA (2009a) residential soil RSL value and was not identified as a COPC in combined surface and subsurface soil.

Six pesticides (4,4'-DDE; alpha-BHC; beta-BHC; alpha-chlordane; dieldrin; and endrin aldehyde) were detected in combined surface and subsurface soil. Only dieldrin was detected at concentrations above the USEPA (2009a) residential soil RSL value and was identified as a COPC for combined surface and subsurface soil.

Seventeen PAHs (2-methylnaphthalene; acenaphthene; acenaphthylene; anthracene; benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; benzo[g,h,i]perylene; benzo[k]fluoranthene; chrysene; dibenzo[a,h]anthracene; fluoranthene; fluorene; indeno[1,2,3-cd]pyrene; naphthalene; phenanthrene; and pyrene) were detected in combined surface and subsurface soil. Four of these detected constituents (benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; and dibenzo[a,h]anthracene) were detected at concentrations greater than the USEPA (2009a) residential soil RSL values and were identified as COPCs for combined surface and subsurface soil.

One PCB, Aroclor 1254, was detected in combined surface and subsurface soil. This constituent was detected above the USEPA (2009a) residential soil RSL value and was identified as a COPC for combined surface and subsurface soil

Twenty-two inorganics (aluminum; antimony; arsenic; barium; beryllium; cadmium; calcium; chromium; cobalt; copper; iron; lead; magnesium; manganese; mercury; nickel; potassium; selenium; sodium; thallium; vanadium; and zinc) were detected in combined surface and subsurface soil. Four constituents (calcium; magnesium; potassium; and sodium) were identified as essential nutrients and were not evaluated further in the HHRA. Eight of these constituents (aluminum; arsenic; barium; cobalt; iron; manganese; thallium; and vanadium) were greater than the USEPA (2009a) residential soil RSL values. However, iron, manganese, thallium, and vanadium were all detected below the background concentrations; as a result, only aluminum, arsenic, barium, and cobalt were identified as COPCs for combined surface and subsurface soil.

6.4.1.3 Sediment

Sediment COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for residential soil. Table A.6.HHRA-3 presents the selection of sediment COPCs for the HHRA. As summarized in Table 6-18, 12 constituents were identified as COPCs in sediment as follows:

Four VOCs (2-butanone; acetone; carbon disulfide; and methylene chloride) were detected in sediment. All of these constituents were below the USEPA (2009a) residential soil RSL values and were not identified as COPCs for sediment.

Four SVOCs (4-methylphenol; benzoic acid; bis[2-ethylhexyl]phthalate; and di-n-butylphthalate) were detected in sediment. All of these constituents were detected at concentrations below the USEPA (2009a) residential soil RSL values.

Two explosives (nitroglycerine and pentaerythritol tetranitrate) were detected in sediment. Nitroglycerine was detected at concentrations below the USEPA (2009a) residential soil RSL value. No RSL was available for pentaerythritol tetranitrate. As a result, only pentaerythritol tetranitrate was identified as a COPC for sediment.

Seven herbicides (2,4,5-T; 2,4,5-TP; 2,4-D; dalapon; dicamba; dichlorprop; and MCPP) were detected in sediment. All detected herbicides were detected at concentrations below the USEPA (2009a) residential soil RSL values with the exception of dichlorprop, which did not have a value available. As a result, dichlorprop was the only herbicide identified as a COPC for sediment.

Sixteen pesticides (4,4’-DDD; 4,4’-DDE; 4,4’-DDT; alpha-BHC; delta-BHC; gamma-BHC; alpha-chlordane; gamma-chlordane; dieldrin; endosulfan II; endrin; endrin aldehyde; endrin ketone; heptachlor; heptachlor epoxide; and methoxyclor) were detected in sediment. All of these constituents were detected at concentrations below the USEPA (2009a) residential soil RSL values.

Seventeen PAHs (2-methylnaphthalene; acenaphthene; acenaphthylene; anthracene; benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; benzo[g,h,i]perylene; benzo[k]fluoranthene; chrysene; dibenzo[a,h]anthracene; fluoranthene; fluorene; indeno[1,2,3-cd]pyrene; naphthalene; phenanthrene; and pyrene) were detected in sediment. Four of these detected constituents (benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; and dibenzo[a,h]anthracene) were present at concentrations greater than the USEPA (2009a) residential soil RSL values and were identified as COPCs for sediment.

Twenty-two inorganics (aluminum; antimony; arsenic; barium; beryllium; cadmium; calcium; chromium; cobalt; copper; iron; lead; magnesium; manganese; mercury; nickel; potassium; selenium; sodium; thallium; vanadium; and zinc) were detected in sediment. Four constituents (calcium; magnesium; potassium; and sodium) were identified as essential nutrients and were not evaluated further in the HHRA. Six of these constituents (aluminum; arsenic; cobalt; iron; manganese; and vanadium) were greater than the USEPA (2009a) residential soil RSL values. Consequently, only aluminum, arsenic, cobalt, iron, manganese, and vanadium were identified as COPCs for sediment.

6.4.1.4 Surface Water

Surface water COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for tap water. Table A.6.HHRA-4 presents the selection of surface water COPCs for the HHRA. As summarized in Table A.6.HHRA-4, nine constituents were identified as COPCs in surface water as follows:

Two VOCs (carbon disulfide and chloroform) were detected in surface water. Of these two constituents, only chloroform was detected above the USEPA (2009a) tap water RSL values and was identified as a COPC for surface water.

Five SVOCs (benzoic acid; bis[2-ethylhexyl]phthalate; butylbenzylphthalate; diethylphthalate; and di-n-buthylphthalate) were detected in surface water. Of these detected constituents, only bis(2-ethylhexyl)phthalate was detected above the USEPA (2009a) tap water RSL value and was identified as a COPC for surface water.

One explosive (nitroglycerine) and two explosive degradation products (m-nitrotoluene and nitrobenzene) were detected in surface water. Only one of these three constituents, nitroglycerine, was detected at concentrations above the USEPA (2009a) tap water RSL value and was identified as a COPC for surface water.

Five herbicides (2,4,5-TP; 2,4-D; 2,4-DB; MCPA; and MCPP) were detected in surface water. Only MCPA and MCPP were detected at concentrations above the USEPA (2009a) tap water RSL values and were identified as COPCs for surface water.

Six pesticides (4,4'-DDT; delta-BHC; dieldrin; endosulfan sulfate; endrin aldehyde; and endrin ketone) were detected in surface water. Only dieldrin was detected at concentrations above the USEPA (2009a) tap water RSL value and was identified as a COPC for surface water.

Three PAHs (2-methylnaphthalene; naphthalene; and phenanthrene) were detected in surface water. All three constituents were detected at concentrations below the USEPA (2009a) tap water RSL values and were not identified as COPCs for surface water.

Sixteen inorganics (aluminum; antimony; barium; cadmium; calcium; chromium; copper; iron; lead; magnesium; manganese; potassium; selenium; silver; sodium; and zinc) were detected in surface water. Three of these detected constituents (iron; lead; and manganese) were detected above the USEPA (2009a) tap water RSL values. Four (calcium; magnesium; potassium; and sodium) were identified as essential nutrients. As a result, only iron, lead, and manganese were identified as COPCs for surface water.

6.4.2 Summary of Selected Constituents of Potential Concern

Fifteen constituents were selected as COPCs in surface soil and combined surface and subsurface soil at the RY, including two VOCs (3-octanone and ethanol), two SVOCs (carbazole and pentachlorophenol), four PAHs (benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; and dibenzo[a,h]anthracene), one pesticide (dieldrin), one PCB (Aroclor 1254), and five inorganics (aluminum; arsenic; barium; cobalt; and lead).

Twelve constituents were selected as COPCs in sediment at the RY, including four PAHs (benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; and dibenzo[a,h]anthracene), one herbicide (dichlorprop), one explosive (pentaerythritol tetranitrate), and six inorganics (aluminum; arsenic; cobalt; iron; manganese; and vanadium).

Nine constituents were selected as COPCs in surface water at the RY, including one VOC (chloroform), one SVOC (bis[2-ethylhexyl]phthalate, two herbicides (MCPA and

MCPP), one explosive (nitroglycerine), and four inorganics (cadmium; iron; lead; and manganese).

6.4.3 Determination of Exposure Point Concentrations

Fifteen constituents were selected as COPCs in both surface soil and combined surface and subsurface soil, twelve constituents were selected as COPCs in sediment, and ten constituents were selected as COPCs in surface water because the maximum detected concentrations were greater than the corresponding USEPA (2009a) RSL or no RSL was available. The distribution testing and UCL calculations were performed as described in Section 2.2.6.1, and the EPCs for these COPCs are summarized in Table A.6.HHRA-5.

6.4.4 Human Health Risk Characterization

The physical and chemical properties and toxicity values used to evaluate excess lifetime cancer risks and non-cancer hazards are presented in Tables A.2-3 through A.2-9. The exposure assumptions used to evaluate potentially exposed receptors are presented in Table A.2-10. The equations used in the risk characterization calculations are presented in Tables A.2-11 through A.2-15.

Exposure to the soil, sediment, and surface water COPCs were evaluated for direct contact. VOCs identified as COPCs in the RY were also evaluated for inhalation via vapor migration into buildings. Two VOCs, 3-octanone and ethanol, were identified as soil COPCs at the RY. These COPCs do not have identified inhalation toxicity values; therefore, the indoor vapor intrusion pathway could not be assessed at this Study Area.

The excess lifetime cancer risks and non-cancer hazards for each potentially exposed receptor included in the risk assessment for the RY are summarized in the table and subsections below.

6.4.4.1 Site Worker

A current or future site worker could be present at the RY area, and could be exposed to surface soil, sediment, or surface water. The ELCR and non-cancer hazard index for site worker exposure to each medium are presented in Tables A.6.HHRA-6 through A.6.HHRA-8 for surface water, and are summarized in Table A.6.HHRA-16. The ELCRs for surface soil, sediment, and surface water are all below or within the USEPA target risk range, and the HIs for each medium are all below the benchmark value of 1.

The total cumulative ELCR for site workers exposed to surface soil, sediment, and surface water at the RY is 1×10^{-4}, which is equal to the high end of the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for site workers is 0.4, which is less than the benchmark of 1.

6.4.4.2 Hypothetical Future Construction Worker

A hypothetical future construction worker could be present at the RY area, and could be exposed to combined surface and subsurface soil. The ELCR and non-cancer hazard index for hypothetical future construction worker exposure to soil are presented Table A.6.HHRA-9, and are summarized in Table A.6.HHRA-16.

The total cumulative ELCR for hypothetical future construction workers exposed to combined surface and subsurface soil at the RY was 5×10^{-6}, which is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for hypothetical future construction workers is 0.7, which is less than the benchmark of 1.

6.4.4.3 Hypothetical Future Residents

A hypothetical future adult or child resident could be present at the RY area, and could be exposed to combined surface and subsurface soil, sediment, or surface water. The ELCR and non-cancer hazard index for hypothetical future adult, child, or aggregate resident exposure to each medium are presented in Tables A.6.HHRA-10 through A.6.HHRA-15, and are summarized in Table A.6.HHRA-16.

The total cumulative ELCR for hypothetical future residents exposed to combined surface and subsurface soil, sediment, and surface water at the RY is 3×10^{-4}, which is slightly above the high end of the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The primary risk driver is pentachlorophenol in soil.

The total cumulative HI for hypothetical future adult residents is 0.6, which is less than the benchmark of 1.

The total cumulative HI for hypothetical future child residents is 3, which is greater than the benchmark of 1. When the HI is segregated into target site and critical effects, hazards were only above the benchmark of 1 in the eyes, nails, hair, and skin. The primary contributor to the non-cancer hazard above 1 is cobalt.

6.4.5 Human Health Risk Summary

Tables A.6.HHRA-16 summarizes the calculated cancer risks and non-cancer hazards for each potentially exposed receptor included in the risk assessment for the RY. As shown in the table below, the total ELCR values for all surface soil, combined surface and subsurface soil, sediment, and surface water exposures for each exposure scenario are below or within the USEPA target risk range of 10^{-6} to 10^{-4} for cancer risk, with the exception of hypothetical future residential exposure to combined surface and subsurface soil.

Summary of calculated ELCRs and HIs for Receptor Exposure Scenarios

RECEPTOR/ EXPOSURE MEDIUM – SCENARIO	Total ELCR	HI
Site Worker		
Surface Soil - Direct Contact	1E-04	0.3
Sediment – Wading	8E-07	0.01
Surface Water – Wading	2E-07	0.1
TOTAL SITE RISKS (Site Worker):	**1E-04**	**0.4**
Hypothetical Future Construction Worker		
Combined Surface and Subsurface Soil - Direct Contact	5E-06	0.7
TOTAL SITE RISKS (Construction Worker):	**5E-06**	**0.7**
Hypothetical Future Adult Resident		
Combined Surface and Subsurface Soil - Direct Contact		0.3
Sediment – Wading		0.02
Surface Water – Wading		0.2
TOTAL SITE RISKS (Adult Resident):		**0.6**
Hypothetical Future Child Resident		
Combined Surface and Subsurface Soil - Direct Contact		3
Sediment – Wading		0.1
Surface Water – Wading		0.1
TOTAL SITE RISKS (Child Resident):		**3**
Hypothetical Future Aggregate Resident (Adult and Child)		
Combined Surface and Subsurface Soil - Direct Contact	3E-04	
Sediment – Wading	3E-06	
Surface Water – Wading	1E-06	
TOTAL SITE RISKS (Aggregate Resident):	**3E-04**	

The potential risk to the hypothetical future resident is due to the presence of pentachlorophenol (PCP). PCP was detected at a concentration greater than the industrial RSL (9 mg/kg) in one surface soil sample [TR-02C (830 mg/kg)] which was collected in 1998 at a former pole-mounted transformer location. The concentration of PCP in a duplicate surface soil sample collected at this location (TR-02A) was only

0.11mg/kg. A total of 33 soil samples (20 surface soil samples and 13 subsurface soil samples) collected during subsequent investigations at the Rail Yard were analyzed for PCP. PCP was not detected in any of these samples, nor was PCP detected in any surface water or sediment samples at the Rail Yard. As PCP is known to have been used as a wood preservative for utility poles, the single elevated detection of PCP at sample location TR-02C has been linked to the former utility pole at this sample location. The observation that PCP was not detected at elevated levels in the duplicate sample at this location, or in any other soil samples at the site, indicates that the elevated detection was limited to the area in the immediate vicinity of the utility pole.

The risk assessment was based on the maximum detected concentration and thus likely overestimates potential exposures. Without pentachlorophenol, the ELCR would be 3×10^{-5} which is within the USEPA target cancer risk range.

The total HI values for all surface soil, combined surface and subsurface soil, sediment, and surface water exposures for each exposure scenario are below the benchmark of 1 for non-cancer hazard, with the exception of hypothetical future child resident exposure to combined surface and subsurface soil. The risk driver for non-cancer hazard is cobalt. The maximum cobalt concentration of 74.9 mg/kg is only slightly greater than the background concentration of 72.3 mg/kg and is well within the range of background levels. Therefore, it is likely that cobalt is present due to naturally occurring sources rather than due to activities at the RY.

The results of the human health risk assessment indicate that use of the RY for residential or industrial uses should not result in unacceptable risks to potential receptors.

6.5 Ecological Risk Assessment

The purpose of the ERA is to evaluate whether ecological receptors may be adversely impacted by exposure to site-related constituents detected in surface soil, sediment, and surface water at the RY. The ERA approach is based on the Master Work Plan (URS 2003) in compliance with CERCLA/SARA. The ERA was conducted in a manner consistent with Virginia policy USEPA guidance for ecological risk assessment (USEPA 2001a; 2000b; 1997c). In accordance with USEPA guidance, the ERA for the RY commenced with a SLERA and then concluded with BERA (USEPA 1997c).

This section summarizes the occurrence of constituents in each medium and identifies COPECs at the RY for the ecological risk assessment; identifies the potential ecological exposure scenarios relevant to the RY; and presents the estimated ecological risks associated with the identified COPECs and the relevant ecological exposure scenarios at the RY. Methodologies for data summary and selection of COPECs, exposure assessment, and toxicity assessment for the ERA were presented in Section 2.4.

6.5.1 Selection of Constituents of Potential Ecological Concern

This section discusses the selection of COPECs for each medium. Risks to ecological receptors are calculated by dividing the exposure estimates (i.e., the maximum detected concentrations) by the conservative ESLs. The resulting ratio, the hazard quotient (HQ), is a highly conservative surrogate for the assessment endpoints identified in Section 2.4. HQs equal to or less than a value of 1 (to one significant figure) indicate that adverse ecological effects are unlikely (USEPA 1997c). HQs greater than 1 indicate that further evaluation is warranted. Therefore, the constituents with HQs greater than 1 are carried forward as COPECs into the BERA. Because the majority of the ESLs measure direct exposures and do not take into account exposures to upper trophic level species, chemicals identified as bioaccumulative were also carried forward as COPECs regardless of whether or not the associated HQ was greater than 1. Finally, as previously described, concentrations of inorganic constituents in soil were compared to soil background concentrations; those with concentrations below background were not considered as COPEC. The COPEC selection process for the RY are summarized in the subsections below.

6.5.1.1 Surface Soil

Surface soil COPECs were selected by comparing the analytical data with USEPA (2008c) EcoSSLs, USEPA (2003e) Region 5 ESLs, and ORNL values (Efroymson et al. 1997a,b) for surface soil. Table A.6.ERA-1 presents the selection of surface soil COPECs for the ERA. As summarized in Table A.6.ERA-1, 42 constituents were identified as COPECs in surface soil as follows:

Five VOCs (2-butanone; 3-octanone; acetone; ethanol; and methylene chloride) were detected in surface soil. HQs were less than or equal to 1 for 2-butanone, acetone, and methylene chloride; however, ESLs were not available for 3-octanone or ethanol and an HQ could not be calculated for these constituents. As a result, both 3-octanone and ethanol were identified as COPECs in surface soil.

Nine SVOCs (2,4-dinitrotoluene; 2,6-dinitrotoluene; benzoic acid; bis[2-ethylhexyl]phthalate; carbazole; dibenzofuran; diethylphthalate; di-n-butylphthalate; and pentachlorophenol) were detected in surface soil. Four of these constituents (2,6-

dinitrotoluene; bis[2-ethylhexyl]phthalate; di-n-butylphthalate; and pentachlorophenol) had HQs greater than 1. In addition, ESLs were not available for benzoic acid, carbazole, or dibenzofuran and so HQs could not be calculated for these constituents. As a result, 2,6-dinitrotoluene, benzoic acid, bis(2-ethylhexyl)phthalate, carbazole, dibenzofuran, di-n-butylphthalate, and pentachlorophenol were identified as COPECs for surface soil.

One explosive, 4-amino-2,6-dinitrotoluene, was detected in surface soil. This constituent had an HQ greater than 1, and as a result, was identified as a COPEC for surface soil.

Six pesticides (4,4'-DDE; alpha-BHC; beta-BHC; alpha-chlordane; dieldrin; and endrin aldehyde) were detected in surface soil. Only three of these constituents (4,4'-DDE; dieldrin; and endrin aldehyde) had an HQ greater than 1, however, the other three were identified as bioacuumulative, therefore, all six were identified as COPECs for surface soil.

Seventeen PAHs (2-methylnaphthalene; acenaphthene; acenaphthylene; anthracene; benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; benzo[g,h,i]perylene; benzo[k]fluoranthene; chrysene; dibenzo[a,h]anthracene; fluoranthene; fluorene; indeno[1,2,3-cd]pyrene; naphthalene; phenanthrene; and pyrene) were detected in surface soil. All of these detected constituents had HQs less than or equal to 1 however, all but 2-methylnapthalene and naphthalene were identified as bioaccumulative and therefore identified as COPEC.

One PCB, Aroclor 1254, was detected in surface soil. This constituent did not have an ESL and is considered bioaccumulative; as a result, Aroclor 1254 was identified as a COPEC for surface soil

Twenty-two inorganics (aluminum; antimony; arsenic; barium; beryllium; cadmium; calcium; chromium; cobalt; copper; iron; lead; magnesium; manganese; mercury; nickel; potassium; selenium; sodium; thallium; vanadium; and zinc) were detected in surface soil. Four constituents are vital electrolytes and/or essential nutrients (i.e., calcium; magnesium; potassium; and sodium) and therefore were identified as non-toxic and not evaluated further. Fourteen of these constituents (aluminum, antimony; barium; cadmium; chromium; cobalt; copper; lead; manganese; mercury; selenium; thallium; vanadium; and zinc) had an HQ greater than 1, and one constituent (iron) did not have an ESL available and so an HQ could not be calculated. However, six constituents (chromium; iron; manganese; nickel, thallium; and vanadium) were detected below the background concentrations. As a result, aluminum, antimony, arsenic, barium, cadmium, cobalt, copper, lead, mercury, selenium, and zinc were identified as COPECs for surface soil.

6.5.1.2 Sediment

Sediment COPECs were selected by comparing the analytical data with ESLs from the following sources in order of priority: USEPA (2008d) Region 3 Sediment Screening Levels; ORNL values (Jones et al. 1997); and USEPA (2003e) Region 5 Ecological Screening Levels for sediment. As summarized in Table A.6.ERA-2, 54 constituents were identified as COPECs in sediment as follows:

Four VOCs (2-butanone; acetone; carbon disulfide; and methylene chloride) were detected in sediment. Three of these constituents (2-butanone; acetone; and carbon disulfide) had an HQ greater than 1 and were identified as COPECs in sediment.

Four SVOCs (4-methylphenol; benzoic acid; bis[2-ethylhexyl]phthalate; and di-n-butylphthalate) were detected in sediment. Only one of these constituents, bis(2-ethylhexyl)phthalate, had an HQ greater than 1 and was identified as a COPEC in sediment.

Two explosives (nitroglycerine and pentaerythritol tetranitrate) were detected in sediment. Neither of these constituents had an ESL available and so HQs could not be calculated. As a result, both nitroglycerine and pentaerythritol tetranitrate were identified as COPECs for sediment.

Seven herbicides (2,4,5-T; 2,4,5-TP; 2,4-D; dalapon; dicamba; dichlorprop; and MCPP) were detected in sediment. 2,4,5-T, 2,4,5-TP, and 2,4-D had an HQ less than or equal to 1. However, dalapon, dicamba, dichlorprop, and MCPP did not have ESLs and so an HQ could not be calculated for these constituents. As a result, dalapon, dicamba, dichlorprop, and MCPP were identified as COPECs for sediment.

Sixteen pesticides (4,4'-DDD; 4,4'-DDE; 4,4'-DDT; alpha-BHC; delta-BHC; gamma-BHC; alpha-chlordane; gamma-chlordane; dieldrin; endosulfan II; endrin; endrin aldehyde; endrin ketone; heptachlor; heptachlor epoxide; and methoxyclor) were detected in sediment. Only six of these detected constituents (4,4-DDE; alpha-chlordane; gamma-chlordane; dieldrin; endrin; and heptachlor epoxide) had an HQ greater than 1, however, all of the pesticides except endrin aldehyde and endrin ketone were identified as bioaccumulative and as a result, were identified as COPECs for sediment.

Seventeen PAHs (2-methylnaphthalene; acenaphthene; acenaphthylene; anthracene; benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; benzo[g,h,i]perylene; benzo[k]fluoranthene; chrysene; dibenzo[a,h]anthracene; fluoranthene; fluorene; indeno[1,2,3-cd]pyrene; naphthalene; phenanthrene; and pyrene) were detected in sediment. Seven of these detected constituents (2-methylnaphthalene; acenaphthene; acenaphthylene; benzo[a]anthracene; indeno[1,2,3-cd]pyrene; phenanthrene; and pyrene) had an HQ greater than 1 and all of the remaining PAHs except naphthalene were identified as bioaccumulative, and as a result, were identified as COPECs for sediment.

Twenty-two inorganics (aluminum; antimony; arsenic; barium; beryllium; cadmium; calcium; chromium; cobalt; copper; iron; lead; magnesium; manganese; mercury; nickel; potassium; selenium; sodium; thallium; vanadium; and zinc) were detected in sediment. Four constituents are vital electrolytes and/or essential nutrients (i.e., calcium; magnesium; potassium; and sodium) and therefore were identified as non-toxic and not evaluated further. Four of these constituents (chromium; copper; iron; and manganese) had an HQ greater than 1, and four constituents (barium; beryllium; thallium; and vanadium) did not have ESLs so an HQ could not be calculated. In addition, six inorganics (arsenic; cadmium; lead; nickel; selenium; and zinc) were identified as bioaccumulative. Consequently, arsenic, cadmium, lead, nickel, selenium, zinc, barium, beryllium, chromium; copper; iron; manganese; thallium, and vanadium were identified as COPECs for sediment.

6.5.1.3 Surface Water

Surface water COPECs were selected by comparing the analytical data with ESLs from the following sources in order of priority: USEPA (2008d) Region 3 Surface Water Screening Levels; ORNL values (Suter and Tsao 1996); USEPA (2003e) Region 5 Ecological Screening Levels; and USEPA (2008e) Ambient Water Quality Criteria for surface water. As summarized in Table A.6.ERA-3, 17 constituents were identified as COPECs in surface water as follows:

Two VOCs (carbon disulfide and chloroform) were detected in surface water. Both of these constituents had an HQ less than or equal to 1 and were not identified as COPECs for surface water.

Five SVOCs (benzoic acid; bis[2-ethylhexyl]phthalate; butylbenzylphthalate; diethylphthalate; and di-n-buthylphthalate) were detected in surface water. All five of these detected constituents had an HQ less than or equal to 1, and as a result, were not identified as COPECs for surface water.

Three explosives (m-nitrotoluene; nitrobenzene; and nitroglycerine) were detected in surface water. All three of these detected constituents had an HQ less than or equal to 1, and as a result, were not identified as COPECs for surface water.

Five herbicides (2,4,5-TP; 2,4-D; 2,4-DB; MCPA; and MCPP) were detected in surface water. Both 2,4,5-TP and 2,4-D had an HQ less than or equal to 1. However, 2,4-DB, MCPA, and MCPP did not have ESLs and so an HQ could not be calculated for these constituents. As a result, 2,4-DB, MCPA, and MCPP were identified as COPECs for surface water.

Six pesticides (4,4'-DDT; delta-BHC; dieldrin; endosulfan sulfate; endrin aldehyde; and endrin ketone) were detected in surface water. One of these detected constituents, 4,4'-DDT, had an HQ greater than 1 and two (delta-BHC and dieldrin) were identified as bioaccumulative. These three chemicals were identified as COPEC for surface water.

Three PAHs (2-methylnaphthalene; naphthalene; and phenanthrene) were detected in surface water. All three of these detected constituents had an HQ less than or equal to 1, however phenanthrene was identified as bioaccumulative and therefore considered a COPEC for surface water.

Sixteen inorganics (aluminum; antimony; barium; cadmium; calcium; chromium; copper; iron; lead; magnesium; manganese; potassium; selenium; silver; sodium; and zinc) were detected in surface water. Four constituents are vital electrolytes and/or essential nutrients (i.e., calcium; magnesium; potassium; and sodium) and therefore were identified as non-toxic and not evaluated further. Seven of these detected constituents (aluminum; barium; copper; iron; lead; silver; and zinc) had an HQ greater than 1. In addition three chemicals were identified as bioaccumulative. As a result, aluminum, barium, cadmium, chromium, copper, iron, lead, selenium, silver, and zinc were identified as COPECs for surface water.

One spring sample (RY_SPRING00Y) was also evaluated for surface water COPECs by comparing the analytical data with background spring data as well as ESLs. As shown in the table below, two PAHs and nine inorganics were detected in the spring sample. Four of the inorganics are vital electrolytes and/or essential nutrients (calcium, magnesium, potassium, and sodium) and therefore were identified as non-toxic and not evaluated further. Only two of the inorganics, aluminum and iron, were detected above the background concentrations or were above the corresponding ESL as discussed below.

Aluminum and iron were both detected above the ESL and the background spring sample concentrations. While the detected concentration of aluminum was above the ESL, the ESL used is from USEPA (2008c) Region 3 and is based on a water quality criterion protective of salmonids (i.e., coldwater habitat species of fish such as trout and salmon) which is likely overly conservative for the type of warmwater habitat (and associated aquatic species) that is prevalent in this locale. When an alternative screening value for aluminum of 0.46 mg/L from Sample et al. 1996 was used, an HQ of less than 1 was calculated. This alternative screening value is based on the lowest chronic value for aquatic life, and is considered to be a more representative screening value for aluminum at the RY than the Region 3 ESL.

For iron, although the detected concentration was above the ESL, the spring water sample was slightly turbid (22 NTUs – see Table 10-2) and the sample was not filtered; as such the results represent total iron. Samples collected from other groundwater sources (i.e., monitoring wells) at the RFAAP-NRU indicated the concentrations of iron and other inorganics decrease significantly when filtered samples were collected. Therefore, it is not known what portion, if any, of the iron is in the dissolved (i.e., filtered) form. It is possible that even though the total iron concentrations exceed the ESL, the dissolved (and therefore bioavailable) iron concentrations may in actuality not exceed the ESL. Based on these considerations, adverse effects to aquatic life potentially exposed to inorganics at the RY are unlikely.

Detected Constituents in Spring Sample – Rail Yard

		Background Spring Data			**Does Max**
Constituent	**ESL (µg/L)**	**NSPRING003 09/24/08**	**NSPRING004 09/24/08**	**RY_SPRING002 09/24/08**	**Exceed ESL or BKG?**
PAHs					
Naphthalene	**1.1**	<0.092	<0.092	0.044	no
Phenanthrene	**0.4**	<0.092	<0.092	0.038	no
Inorganics					
Aluminum	**87**	<200	<200	496	yes
Barium	**4**	49.8	66.1	48.7	no
Calcium	**116,000**	65900	59000	63400	NT
Iron	**300**	<100	<100	635	yes
Magnesium	**82,000**	11,900	19,000	27,600	NT
Manganese	**120**	<15.0	<15.0	28.1	no
Potassium	**NA**	1670	1820	1970	NT
Sodium	**680,000**	1430	<5,000	1420	NT
Zinc	**120**	9	7	15.4	no

µg/L Micrograms per liter.
NT Non-toxic.

6.5.2 Summary of Selected Constituents of Potential Ecological Concern

Fourty-two constituents were selected as COPECs in surface soil, fifty-four constituents were selected as COPECs in sediment, and seventeen constituents were selected as COPECs in surface water because the HQs were greater than 1 or an HQ could not be calculated because an ESL was not available.

6.5.3 Refinement of Risk Calculations for Direct Contact COPECs

The list of COPECs identified in the BERA was reevaluated by calculating refined HQs. The refined HQs were calculated for the COPECs identified in the SLERA using refined EPCs. Constituents identified as COPECs in the BERA that were bioaccumulative were carried forward into food chain models. The results of the recalculation of the HQs for the RY are summarized in the subsections below.

6.5.3.1 Surface Soil

Fourty-two COPECs in surface soil were carried forward into the BERA. When refined EPCs were compared with the ESLs, 10 constituents (2,6-dinitrotoluene; pentachlorophenol; 4,4'-DDE; dieldrin; endrin aldehyde; cobalt; lead; selenium; and zinc) had a refined HQ greater than 1. In addition, ESLs were not available for seven other constituents (3-octanone; ethanol; benzoic acid; carbazole; dibenzofuran, Aroclor 1254; and lead). The BERA results for surface soil COPECs at the RY are presented in Table A.6.ERA-4 and are discussed below:

Volatile Organic Compounds: Two VOCs (3-octanone and ethanol) were retained in the BERA because an ESL was not available and so HQs could not be calculated. These VOCs were detected in 3 out of 3 and 2 out of 2 surface soil samples, respectively, at very low concentrations (i.e., < 1 mg/kg). Due to the physical and chemical properties of these VOCs (e.g., high vapor pressure; and low bioaccumulative potential), and the relatively low detected concentrations, adverse effects to wildlife due to potential VOC exposure are considered unlikely.

Semi-Volatile Organic Compounds: Two SVOCs (2,6-dinitrotoluene and pentachlorophenol) were retained in the BERA because the calculated HQs were greater than the benchmark value of 1. These results are discussed below:

2,6-Dinitrotoluene – 2,6-Dinitrotoluene was detected in 1 out of 24 surface soil samples. The one sample where a detection was noted had a concentration of 0.32 mg/kg. While this concentration was above the ESL of 0.0328 mg/kg, adverse effects to wildlife exposed to 2,6-dinitrotoluene are unlikely given the low frequency of detection and the limited spatial extent of this SVOC. It should be noted that the one detection of 2,6-dinitrotoluene was detected in a sample analyzed for explosives and that a corresponding semi-volatile analysis conducted on the sample did not detected the analyte. It should also be noted that, 2,6-dinitrotoluene was not detected in any other samples analyzed for semi-volatiles or explosives.

<u>Pentachlorophenol</u> – Pentachlorophenol was detected in 2 out of 24 surface soil samples, with concentrations ranging from 0.11 mg/kg to 830 mg/kg. Only one of these concentrations was above the ESL of 2.1 mg/kg. Consequently, adverse effects to wildlife exposed to pentachlorophenol are unlikely given the low frequency of detection and the limited spatial extent of this SVOC.

<u>Pesticides</u>: Three pesticides (4,4'-DDE; dieldrin; and endrin aldehyde) were retained in the BERA because the calculated HQs were greater than the benchmark value of 1. These results are discussed below:

<u>4,4'-DDE</u> – 4,4'-DDE was detected in 2 out of 10 surface soil samples, with concentrations ranging from 0.01 mg/kg to 0.04 mg/kg. Only one of these concentrations were greater than the ESL of 0.021 mg/kg, and the calculated HQ was only slightly above the benchmark value of 1 (HQ=2). Based on the limited occurrence and the low calculated HQ, adverse effects to wildlife potentially exposed to 4,4'-DDE are considered unlikely.

<u>Dieldrin</u> – Dieldrin was detected in 1 out of 9 surface soil samples, with a concentration of 0.27 mg/kg. While this concentration was above the ESL of 0.0049 mg/kg, adverse effects to wildlife exposed to dieldrin are unlikely to represent a significant concern due to the limited occurrence at the site.

<u>Endrin aldehyde</u> – Endrin aldehyde was detected in 1 out of 8 surface soil samples, with a concentration of 0.04 mg/kg. This concentration was above the ESL of 0.0105 mg/kg, and the calculated HQ is only slightly above the benchmark value of 1 (HQ=4). Consequently, adverse effects to wildlife exposed to endrin aldehyde are unlikely due to limited occurrence of endrin aldehyde.

<u>Polychlorinated Biphenyls</u>: One PCB, Aroclor 1254, was retained in the BERA because an ESL was not available and so an HQ could not be calculated. Aroclor 1254 was detected in 7 out of 26 surface soil samples.

While there are no Aroclor-specific ESLs from Region 5, Region 5 does provide an ESL of 0.000332 mg/kg for PCBs as a group. The maximum and UCL Aroclor 1254 concentrations at the RY are above this ESL; however, site-specific food chain modeling for the short-tailed shrew and American robin (Section 6.5.4), using conservative exposure assumptions, indicates that the potential risk from exposure to Aroclor 1254 at the RY is very low. Based on these considerations, adverse impacts are not expected for populations of ecological receptors exposed to Aroclor 1254 at the RY.

Inorganics: Five inorganics (aluminum; cobalt; lead; selenium; and zinc) were retained in the BERA because the calculated HQs were greater than the benchmark value of 1, or an HQ could not be calculated because an ESL was not available. These results are discussed below:

Aluminum – Aluminum was detected in 25 out of 25 surface soil samples, with concentrations ranging from 338 mg/kg to 43,600 mg/kg. While no ESL was available for aluminum and an HQ could not be calculated, only one of these concentrations was detected above the site background value, and all of the concentrations were within the range of background concentrations detected at the site. Consequently, adverse effects to wildlife exposed to aluminum are unlikely given the similarity of detected concentrations with the site background value and range.

Cobalt – Cobalt was detected in 24 out of 25 surface soil samples, with concentrations ranging from 1.3 mg/kg to 74.9 mg/kg. While 16 concentrations were above the ESL of 13 mg/kg, only one of these concentrations was detected above the site background value, and all of the concentrations were within the range of background concentrations detected at the site. When an EPC was calculated for cobalt, this value was also below the background value established at the site. In addition, the calculated HQ was only slightly above the benchmark value of 1 (HQ=2). Consequently, adverse effects to wildlife exposed to cobalt are unlikely given the similarity of detected concentrations with the site background values and the low calculated HQ.

Lead – Lead was detected in 25 out of 25 surface soil samples, with concentrations ranging from 1.8 mg/kg to 149 mg/kg. While all but two of these concentrations were above the ESL of 11 mg/kg, all of the concentrations were detected within of the range of background samples found at the site. Consequently, adverse effects to wildlife exposed to lead are unlikely given the similarity of detected concentrations with the site background values.

Selenium – Selenium was detected in 3 out of 22 surface soil samples, with concentrations ranging from 0.43 mg/kg to 1 mg/kg. Only one of these concentrations was above the ESL of 0.52 mg/kg. In addition, the calculated HQ was only slightly above the benchmark value of 1 (HQ=2). Consequently, adverse effects to wildlife exposed to selenium are unlikely given the similarity of detected concentrations with the site background values and the low calculated HQ.

Zinc – Zinc was detected in 25 out of 25 surface soil samples, with concentrations ranging from 7.1 mg/kg to 752 mg/kg. While six concentrations were above the ESL of 46 mg/kg, only one concentration was above the background value established at the site. When an EPC was calculated for zinc, this value was also below the background value established at the site. Consequently, adverse effects to wildlife exposed to zinc are unlikely given the similarity of detected concentrations with the site background values.

Of the COPECs, 20 were also identified as bioaccumulative and were evaluated in the terrestrial food chain model.

6.5.3.2 Sediment

Fifty-four COPECs in sediment were carried forward into the BERA. When refined EPCs were compared with the ESLs, 12 constituents (2-butanone; acetone; carbon disulfide; alpha-chlordane; gamma-chlordane; dieldrin; endrin; heptachlor epoxide; acenaphthene; acenaphthylene; indeno[1,2,3-cd]pyrene; and iron), had a refined HQ greater than 1. In addition, ESLs were not available for 10 other constituents (nitroglycerine; pentaerythritol tetranitrate; dalapon; dicamba; dichlorprop; MCPP; barium; beryllium; and vanadium). The BERA results for sediment COPECs at the RY are presented in Table A.6.ERA-5 and are discussed below:

Explosives: Two explosives (nitroglycerine and pentaerythritol tetranitrate) were retained in the BERA because ESLs were not available and so HQs could not be calculated. Both constituents were detected in 2 out of 11 sediment samples, at very low detected concentrations (i.e., < 1 mg/kg). In addition, both detections of pentaerythritol tetranitrate were located in samples taken from an intermittent ditch that are usually dry, and do not provide high quality aquatic habitat. Based on these considerations, adverse effects to aquatic life due to potential explosive exposure are considered unlikely.

Herbicides: Four herbicides (dalapon; dicamba; dichlorprop; and MCPP) were retained in the BERA because ESLs were not available and so HQs could not be calculated. These four herbicides were each detected in 1 out of 11 samples, at very low concentrations (i.e., < 1 mg/kg). Based on the low concentrations and limited occurrence, adverse effects to aquatic life due to potential herbicide exposure are considered unlikely.

Pesticides: Five pesticides (alpha-chlordane; gamma-chlordane; dieldrin; endrin; and heptachlor epoxide) were retained in the BERA because the calculated HQs were greater than the benchmark value of 1. All five of these constituents were detected in the same sample. These results are discussed below:

alpha-Chlordane – alpha-Chlordane was detected in 4 out of 11 sediment samples, with concentrations ranging from 0.00087 mg/kg to 0.0101 mg/kg. Two of these concentrations were above the ESL of 0.00324 mg/kg; however, the calculated HQ for the maximum detected concentration was only slightly above the benchmark value of 1 (HQ=3). Consequently, adverse effects to aquatic life exposed to alpha-chlordane are unlikely given the relatively limited occurrence and low calculated HQ. This COPEC was further evaluated in the aquatic food chain model.

gamma-Chlordane – gamma-Chlordane was detected in 4 out of 11 sediment samples, with concentrations ranging from 0.00081 mg/kg to 0.013 mg/kg. Three of these concentrations were above the ESL of 0.00324 mg/kg; however, the calculated HQ for the maximum detected concentration was slightly above the benchmark value of 1 (HQ=4). Consequently, adverse effects to aquatic life exposed to gamma-chlordane are unlikely given the relatively limited occurrence and low calculated HQ. This COPEC was further evaluated in the aquatic food chain model.

Dieldrin – Dieldrin was detected in 4 out of 11 sediment samples, with concentrations ranging from 0.00174 mg/kg to 0.0041 mg/kg. Three of these concentrations were above the ESL of 0.0019 mg/kg; however, the calculated HQ for the maximum detected concentration was only slightly above the benchmark value of 1 (HQ=2). Consequently, adverse effects to aquatic life exposed to dieldrin are unlikely given the relatively limited occurrence and low calculated HQ. This COPEC was further evaluated in the aquatic food chain model.

Endrin – Endrin was detected in 1 out of 11 sediment samples, with concentration of 0.0125 mg/kg. While this concentration was above the ESL of 0.00222 mg/kg, adverse effects to aquatic life exposed to endrin are unlikely given the low frequency of detection and relatively low concentration. This COPEC was further evaluated in the aquatic food chain model.

Heptachlor epoxide – Heptachlor epoxide was detected in 2 out of 11 sediment samples, with concentrations ranging from 0.00399 mg/kg to 0.00726 mg/kg. Both concentrations were above the ESL of 0.00247 mg/kg; however, the calculated HQ for the maximum detected concentration was only slightly above the benchmark value of 1 (HQ=3). Consequently, adverse effects to aquatic life exposed to heptachlor epoxide are unlikely given the low frequency of detection and relatively low concentration. This COPEC was further evaluated in the aquatic food chain model.

Polycyclic Aromatic Hydrocarbons: Three PAHs (acenaphthene; acenaphthylene; and indeno[1,2,3-cd]pyrene) were retained in the BERA because the calculated HQs were greater than the benchmark value of 1. Calculated HQs for these PAHs ranged from 4 to 9. As described in Section 2.4.2.4.1.4, since PAHs were COPECs in this ERA, the ESBTU approach was used to calculate a total TU which was compared to the benchmark of one. TOC ranged between 2.2% to 5.4% in samples collected from across the NRU site and averaged at 3.4%. As previously discussed, a default UF of 2.75 was applied to the total TU to obtain an accurate estimation with 50% confidence. The total TU for all 12 sediment samples taken at the RY were below the benchmark of one (Table A.6.ERA-6), indicating that the potential for adverse effects to aquatic life at the RY is unlikely. In addition, severalPAHs were further evaluated in the aquatic food chain model.

Inorganics: Five inorganics (barium; beryllium; iron; thallium; and vanadium) were retained in the BERA because the calculated HQ was above the benchmark of 1 or because an ESL was not available and so an HQ could not be calculated. These results are discussed below:

Barium – Barium was detected in 14 out of 14 sediment samples, with concentrations ranging from 30.4 mg/kg to 113 mg/kg. While no screening value was available for barium and no background sediment data was collected, all of these detected concentrations were below the soil background value established at the site. Consequently, adverse effects to aquatic life exposed to barium are unlikely given the similarity of detected concentrations with the site background value.

Beryllium – Beryllium was detected in 14 out of 14 sediment samples, with concentrations ranging from 0.42 mg/kg to 1.67 mg/kg. While no screening value was available for beryllium and no background sediment data was collected, all of these detected concentrations were within the range of detected soil background values at the site. Consequently, adverse effects to aquatic life exposed to beryllium are unlikely given the similarity of detected concentrations with the range of site background values.

Iron – Iron was detected in 14 out of 14 sediment samples, with concentrations ranging from 8,760 mg/kg to 79,600 mg/kg. While nine of these concentrations were above the ESL of 20,000 mg/kg, and no background sediment data was collected, all but one of these detected concentrations were below the soil background value established at the site. In addition, when an EPC for iron was calculated, this concentration was below the soil background value at the site. Consequently, adverse effects to aquatic life exposed to iron are unlikely given the similarity of detected concentrations with the soil background value.

Thallium – Thallium was detected in 11 out of 11 sediment samples, with concentrations ranging from 0.07 mg/kg to 0.45 mg/kg. While no screening value was available for thallium and no background sediment data was collected, all of these detected concentrations were within the range of detected soil background values at the site. Consequently, adverse effects to aquatic life exposed to thallium are unlikely given the similarity of detected concentrations with the range of site background values.

Vanadium –Vanadium was detected in 14 out of 14 sediment samples, with concentrations ranging from 16.6 mg/kg to 110 mg/kg. While no screening value was available for vanadium and no background sediment data was collected, all of these detected concentrations were within the range of detected soil background values at the site. Consequently, adverse effects to aquatic life exposed to vanadium are unlikely given the similarity of detected concentrations with the range of site background values.

Of the sediment COPECs carried into the BERA, 28 were identified as bioaccumulative and were evaluated in the aquatic food chain model.

6.5.3.3 Surface Water

Seventeen COPECs in surface water were carried forward into the BERA. When refined EPCs were compared with the ESLs, eight constituents (4,4'-DDT; aluminum; barium; copper; iron; lead; silver; and zinc) had a refined HQ greater than 1. In addition, ESLs were not available for three other constituents (2,4-DB; MCPA; and MCPP). The BERA results for surface water COPECs at the RY are presented in Table A.6.ERA-7 and are discussed below:

Herbicides: Three herbicides (2,4-DB; MCPA; and MCPP) were retained in the BERA because an ESL was not available and so HQs could not be calculated. All three herbicides were detected in only 1 of 6 surface water samples, at very low concentrations (i.e., < 1 mg/L). While no ESLs were available for these constituents, due to the low frequency of detection and the low detected concentrations, adverse effects to aquatic life exposed to herbicides are unlikely.

Pesticides: One pesticide, 4,4'-DDT, was retained in the BERA because the calculated HQ was greater than the benchmark value of 1. This constituent was detected in only 1 out of 6 surface water samples, with a concentration of 0.0027 mg/L. While the calculated HQ of 20 for 4,4'-DDT was above the benchmark of 1, due to the low frequency of detection, it is unlikely that adverse effects to aquatic life exposed to pesticides would occur. 4,4'-DDT was further evaluated in the food chain.

Inorganics: Seven inorganics (aluminum; barium; copper; iron; lead; silver; and zinc) were retained in the BERA because the calculated HQs were greater than the benchmark value of 1. These results are discussed below:

Aluminum – Aluminum was detected in 6 out of 7 surface water samples, with concentrations ranging from 0.11 mg/ L to 0.608 mg/L. While all six concentrations were greater than the ESL of 0.087 mg/L, the ESL used from USEPA (2008c) Region 3 and was based on a water quality criterion protective of salmonids (i.e., coldwater habitat species of fish such as trout and salmon), which is likely overly conservative for the type of warmwater habitat (and associated aquatic species) that is prevalent in this locale. When an alternative screening value of 0.46 mg/L from Sample et al. 1996 was used, an HQ of less than 1 was calculated. This alternative screening value is based on the lowest chronic value of aquatic life, and is considered to be a more representative screening value for aluminum at the RY. Based on these considerations, adverse effects to aquatic life exposed to aluminum are unlikely.

Barium – Barium was detected in 6 out of 6 surface water samples, with concentrations ranging from 0.015 mg/L to 0.0796 mg/L. While all six concentrations were greater than the ESL of 0.004 mg/L, the ESL used from USEPA (2008c) Region 3 was based on a secondary chronic value from Suter et al. 1996, and was established using an extremely limited dataset. An alternative aquatic screening value of 0.22 mg/L from USEPA (2008c) Region 5 was found, which is considered to be a more representative screening value. When this ESL was used, an HQ of less than 1 was calculated. This alternative screening value is based on the chronic standards for aquatic life, and is a more representative screening value for barium at the RY. Based on these considerations, adverse effects to aquatic life exposed to barium are unlikely.

Copper – Copper was detected in 1 out of 7 surface water samples, with a concentration of 0.038 mg/L. This concentration was greater than the ESL of 0.009 mg/L, but the calculated HQ was only slightly greater than the benchmark value of 1 (HQ=4). In addition, the ESL is based on a default hardness value of 100 mg/L. A site-specific hardness value of 195 mg/L (average at the RY area) was used to calculate an ESL of 0.01585 mg/L. When this ESL was used, an HQ of 2 was calculated, which again is only slightly above the benchmark value of 1. Based on the low HQ calculations and the limited occurrence in surface water, adverse effects to aquatic life exposed to copper are unlikely. Copper was further evaluated in the aquatic food chain model.

Iron – Iron was detected in 6 out of 7 surface water samples, with concentrations ranging from 0.127 mg/L to 4.47 mg/L. While three of these concentrations were greater than the ESL of 0.3 mg/L, as previously stated, the surface water samples were not filtered, and as such the results represent total iron. Therefore, it is not known what portion, if any, of the iron is in the dissolved (i.e., filtered) form. It is possible that even though the total iron concentrations exceed the ESL, the dissolved (and therefore bioavailable) iron concentrations may in actuality not exceed the ESL. Consequently, adverse effects to aquatic life exposed to iron are unlikely.

Lead – Lead was detected in 5 out of 7 surface water samples, with concentrations ranging from 0.00088 mg/L to 0.031 mg/L. Only one of these concentrations was greater than the ESL of 0.0025 mg/L, and the calculated HQ was only slightly above the benchmark value of 1 (HQ=3). This HQ was based on an ESL value derived using a default hardness value of 100 mg/L. A site-specific hardness value of 195 mg/L (average at the RY area) was used to calculate an ESL of 0.03161 mg/L. When this ESL was used, an HQ of less than 1 was calculated. Consequently, adverse effects to aquatic life exposed to lead are unlikely. This COPEC was further evaluated in the aquatic food chain model.

<u>Silver</u> – Silver was detected in 2 out of 6 surface water samples, with concentrations ranging from 0.0052 mg/L to 0.0083 mg/L. While both concentrations were above the ESL of 0.0032 mg/L, the calculated HQ was only slightly above the benchmark value of 1 (HQ=3). This HQ was based on an ESL value derived using a default hardness value of 100 mg/L. A site-specific hardness value of 195 mg/L (average at the RY area) was used to calculate an ESL of 0.01088 mg/L. When this ESL was used, an HQ of less than 1 was calculated. Consequently, adverse effects to aquatic life exposed to silver are unlikely.

<u>Zinc</u> – Zinc was detected in 2 out of 7 surface water samples, with concentrations ranging from 0.0076 mg/L to 0.274 mg/L. Only one of these concentrations was above the ESL of 0.12 mg/L, and the calculated HQ was only slightly above the benchmark value of 1 (HQ=2). This HQ was based on an ESL value derived using a default hardness value of 100 mg/L. A site-specific hardness value of 195 mg/L (average at the RY area) was used to calculate an ESL of 0.208 mg/L. When this ESL was used, an HQ of 1 was calculated. Consequently, adverse effects to aquatic life exposed to zinc are unlikely. In addition, zinc was further evaluated in the aquatic food chain model.

Of the COPECs 10 were also identified as bioaccumulative and were evaluated in the aquatic food chain model.

6.5.4 Refinement of Assessment and Measurement Endpoints for Bioaccumulative COPECs

Food chain modeling was conducted at the RY in order to evaluate the potential ecological effects of the bioaccumulative COPECs in soil, sediment, and surface water on the receptors identified in Section 2.4. COPECs identified in soil were evaluated in the terrestrial food chain, and COPECs identified in sediment and surface water were evaluated in the aquatic food chain. The results for both the maximum and refined scenarios of these models are presented in Tables A.6.ERA-8 through A.6.ERA-15, and the results of each of the refined scenarios are discussed in the subsections below.

6.5.4.1 Terrestrial Food chain Model

The refined scenario NOAEL and LOAEL HQs for both the short-tailed shrew (Tables A.6.ERA-8 and A.6.ERA-9) and the American robin (Tables A.6.ERA-10 and A.6.ERA-11) were less than or equal to 1 for most of the bioaccumulative COPECs identified at the RY. Two other constituents, pentachlorophenol and zinc, had HQs greater than 1 for the short-tailed shrew as discussed below.

Pentachlorophenol had HQs of 100 (NOAEL) and 10 (LOAEL). The NOAEL is a very conservative screening criterion, while the LOAEL indicates a concentration above which adverse impacts to individual mammals may occur. Based on this information and considering the low frequency of detection of this constituent (i.e., 8 % in surface soil), these results indicate that individual shrews (or other insectivorous mammals) exposed to pentachlorophenol are not expected to experience adverse effect.

Zinc also had a NOAEL above the benchmark of one for the short-tailed shrew. This inorganic had a refined shrew NOAEL of 2, which is only slightly above 1, and a LOAEL of 0.2, which is below the benchmark of 1. As previously discussed, the NOAEL is a very conservative screening criterion, while the LOAEL indicates a concentration above which adverse impacts to individual mammals may occur. Given that the EPC of 186.4 mg/kg was below the background concentration of 202 mg/kg established at the site and based on the low detected concentrations, these results indicate that individual shrews (or other insectivorous mammals) potentially exposed to zinc are not expected to experience adverse effects.

Based on the overall analysis of terrestrial food chain modeling HQs and consideration of the limited spatial extent of impacted soils, adverse effects are not expected for short-tailed shrews (and other insectivorous mammals) and American robins (and other insectivorous birds) populations exposed to bioaccumulative COPECs in soil at the RY.

6.5.4.2 Aquatic Food chain Model

As summarized in Table A.6.ERA-17, the refined scenario NOAEL and LOAEL HQs for both the mink (Tables A.6.ERA-12 and A.6.ERA-13) and the great blue heron (Tables A.6.ERA-14 and A.6.ERA-15) were less than or equal to 1 for all of the bioaccumulative COPECs identified in sediment and/or surface water, with the exception of the mink NOAEL (HQ=2) and LOAEL (HQ=0.2) for zinc.

As previously discussed, the NOAEL, is a very conservative screening criterion, while the LOAEL indicates a concentration above which adverse impacts to individual mammals may occur. Based on this information and considering the low frequency of detection of this constituent, these results indicate that individual mink and herons (or other piscivorous mammals and birds) exposed to these COPECs are not expected to experience adverse effects.

Based on the overall analysis of aquatic food chain modeling HQs, adverse effects are not expected for mink (and other piscivorous mammals) and great blue herons (and other piscivorous birds) populations potentially exposed to bioaccumulative COPECs in sediment and/or surface water at the RY.

6.5.5 Ecological Risk Summary

Screening-level and baseline risk assessments were completed for the RY. After the SLERA, 42 constituents were selected as COPECs in surface soil, 54 constituents were selected as COPECs in sediment, and 17 constituents were selected as COPECs in surface water because the HQs were greater than 1, considered bioaccumulative or an HQ could not be calculated because an ESL was not available. After the BERA, 36 constituents in surface soil, 50 constituents in sediment, and 16 constituents in surface water were retained because the HQs were greater than 1 or an HQ could not be calculated because an ESL was not available. Food chain modeling was evaluated for all those constituents identified as bioaccumulative.

Tables A.6.ERA-16 and A.6.ERA-17 summarize the constituents in surface soil, sediment, and surface water carried through the BERA and evaluated in the terrestrial and/or aquatic food chain models. As shown in these tables, all constituents evaluated in the terrestrial and aquatic food chain refined scenarios had LOAEL and NOAEL HQs less than or equal to 1, with the exception of shrew HQs for pentachlorophenol and zinc and mink HQs for zinc. However, these HQs are based on the very conservative screening criterion of the NOAEL. In addition, there was a low frequency of detection of pentachlorophenol in surface soil and the EPC for zinc is very similar to its established site background concentration. Furthermore, zinc was not identified as a direct contact COPEC for sediment indicating that direct contact of ecological receptors with the zinc in sediment was not likely to result in any adverse effects. These results indicate that individual shrews (or other insectivorous mammals) and individual minks (or other piscivorous mammals) potentially exposed to these COPECs are not expected to experience adverse effects.

Based on the overall analysis of the ERA for the RY, the results indicate that adverse effects are not expected for wildlife at the site.

6.6 RY Summary and Conclusions

The HHRA for the RY evaluated current and future land-use conditions for site workers and hypothetical future use for construction workers and adult and child residents. Exposure of these receptors to the soil, sediment, and surface water COPCs was evaluated in the risk assessment. Although exposure to VOCs in soil migrating into buildings was identified as a potential exposure pathway, inhalation toxicity values were not available for the two VOCs, 3-octanone and ethanol, identified as soil COPCs at the RY. Therefore, this exposure pathway was not evaluated quantitatively.

A current or future site worker could be present at the RY area, and could be exposed to surface soil, sediment, or surface water. The total cumulative ELCR for site workers exposed to surface soil, sediment, and surface water at the RY is 1×10^{-4}, which is equal to the high end of the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for site workers is 0.4, which is less than the benchmark of 1.

A hypothetical future construction worker could be present at the RY area, and could be exposed to combined surface and subsurface soil. The total cumulative ELCR for hypothetical future construction workers exposed to combined surface and subsurface soil at the RY is 5×10^{-6}, which is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for hypothetical future construction workers is 0.7, which is less than the benchmark of 1.

A hypothetical future resident could be present at the RY area, and could be exposed to combined surface and subsurface soil, sediment, or surface water. The total cumulative ELCR for hypothetical future residents exposed to combined surface and subsurface soil, sediment, and surface water at the RY is 3×10^{-4}, which is slightly above the high end of the USEPA target risk range of 10^{-6} to 10^{-4}. This risk driver for cancer risk is pentachlorophenol, which was detected in two samples, one at an estimated value of 0.11 mg/kg and one at a maximum concentration of 830 mg/kg. The one high detection was from a sample collected in April of 1998 and the results were not duplicated in subsequent sampling. The risk assessment was based on the maximum detected concentration and thus likely overestimates potential exposures.

Rail Yard

The total cumulative HI for hypothetical future adult residents is 0.6, which is less than the benchmark of 1.

The total cumulative HI for hypothetical future child residents is 3, which is greater than the benchmark of 1. The primary contributor to the non-cancer hazard above 1 is cobalt. The maximum cobalt concentration of 74.9 mg/kg is only slightly greater than the background concentration of 72.3 mg/kg and is well within the range of background levels. Therefore, it is likely that cobalt is present due to naturally occurring sources rather than due to activities at the RY.

The results of the human health risk assessment indicate that use of the RY for industrial uses should not result in unacceptable risks to potential receptors.

A SLERA and BERA were completed for the RY, to evaluate surface soil, sediment, and surface water for ecological receptors, and food chain modeling was evaluated for all those constituents identified as bioaccumulative. The results of the evaluation of the SLERA and BERA for direct contact and the constituents evaluated in the terrestrial and aquatic food chain models indicate that a few of the NOAEL and LOAEL HQs were greater than 1, which suggests the potential for risk to individual insectivorous mammals and birds exposed to surface soils and individual piscivorous mammals and birds exposed to sediment and/or surface water, if all exposure assumptions are met. However, when these results are considered in conjunction with pertinent site information on the limited spatial distribution and extent of these constituents, adverse impacts at the population-level are considered unlikely for the shrew (or other insectivorous mammals) and the robin (or other insectivorous birds) exposed to the constituents at the RY.

7. Western Burning Ground (WBG)

7.1 Site Description and History

The WBG is a former burning ground located in the southwestern portion of the RFAAP-NRU, south of the IAA. The WBG was used as a burning ground to decontaminate explosives contaminated material and to dispose of excess and off-spec explosives/energetics. The main burn area was approximately 170 ft long by 100 ft wide and is surrounded on three sides by an approximately 4 ft high earthen berm. A dirt road runs parallel to the open side of the former burn area, leading north to Alger Road, and south to the top of a steep slope above an unnamed pond. The dirt road was reportedly constructed on top of an ashy layer of material extending from the burning ground at the time of the pond construction. The pond was constructed during the early 1990s and is fed by Wiggins Spring at the northwest (upgradient) end of the pond. The pond also collects runoff from the surrounding area through a series of storm water ditches/culverts. The WBG is no longer active.

7.2 Physical Setting

The WBG area is generally flat at an elevation of approximately 2,050 ft amsl but slopes increase to the south and southwest towards Wiggins Spring and an unnamed pond. Surface water runoff from the former burn area is expected to flow to the southwest. A small, unlined drainage ditch captures some runoff, channeling flow to the northwest before intersecting a second ditch that drains into the pond. The site is surrounded with wooded areas.

The unnamed pond, which is approximately 3.6 acres in size, was constructed south of the WBG during the early 1990s. The pond is fed by Wiggins Spring, a natural spring located at the head (i.e., northwest corner) of the pond. The pond also collects surface water drainage from the surrounding area. The pond drains under an earthen dam via a constant level drain on the southeastern side of the pond. The effluent flows into a tributary of the unnamed creek (UNC-NRU) that flows through the southwest portion of the RFAAP-NRU.

7.3 Risk Assessment Datasets

Data generated from the site characterization activities were used in the risk assessment. Risk assessment datasets for soil, sediment, surface water, and fish tissue for the WBG were prepared then summarized and statistically analyzed per methods described in Section 2.1. Risk assessment dataset summaries were prepared highlighting the number of detects, number of samples, FOD, minimum and maximum detected concentrations, minimum and maximum detection limits, and EPCs. To prepare a dataset representing what site conditions might be should the pond at the WBG be drained, data from soils and sediment were combined to calculate an EPC representing the merged samples. This information is presented in Tables A.7.Data-1 through A.7.Data-5.

Data for fish fillets and whole body fish (Tables A.7.Data-6 and A.7.Data-8, respectively) were each presented for use in the risk assessment datasets. The fish filets data were used in the HHRA and the whole body data were used in the ERA.

7.4 Human Health Risk Assessment

The purpose of this risk assessment is to evaluate the potential current and future risks and hazards to human health associated with constituents detected in soil, sediment, surface water, and fish tissue samples collected at the WBG. The risk assessment approach follows the Radford Army Ammunition Plant Final Master Work Plan (URS 2003).

The risk assessment approach is based on Virginia and USEPA guidance for risk assessments (VDEQ 2008; USEPA 2004a; 2000a; 1997a; 1992; 1991a; 1989). This section summarizes the occurrence of constituents in each medium and identifies COPCs at the WBG for the human health risk assessment; identifies the potential human exposure scenarios relevant to the WBG; and presents the estimated human health risks associated with the identified COPCs and the relevant human exposure scenarios at the WBG. Methodologies for data summary and selection of COPCs, exposure assessment, and toxicity assessment for the HHRA were presented in Section 2.3.

7.4.1 Selection of Constituents of Potential Concern

This section discusses the selection of COPCs for each medium.

7.4.1.1 Surface Soil

Surface soil COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for residential soil. Table A.7.HHRA-1 presents the selection of surface soil COPCs for the HHRA. As summarized in Table A.7.HHRA-1, 14 constituents were identified as COPCs in surface soil as follows:

Six VOCs (acetone; carbon disulfide; d-limonene; methylene chloride; p-isopropyltoluene; and toluene) were detected in surface soil. All of these constituents were detected below the USEPA (2009a) residential soil RSL values with the exception of d-limonene, which did not have a USEPA (2009a) residential soil RSL value. As a result, only d-limonene was identified as a COPC for surface soil.

Seven SVOCs (bis[2-ethylhexyl]phthalate; butylbenzylphthalate; carbazole; dibenzofuran; di-n-butylphthalate; di-n-octylphthalate; and n-nitrosodiphenylamine) were detected in surface soil. All of these constituents were detected below the USEPA (2009a) residential soil RSL values with the exception of carbazole, which did not have a value. As a result, carbazole was identified as a COPC for surface soil.

Seventeen dioxin/furan compounds (1,2,3,4,6,7,8-HpCDD; 1,2,3,4,6,7,8-HpCDF; 1,2,3,4,7,8,9-HpCDF; 1,2,3,4,7,8-HxCDD; 1,2,3,4,7,8-HxCDF; 1,2,3,6,7,8-HxCDD; 1,2,3,6,7,8-HxCDF; 1,2,3,7,8,9-HxCDD; 1,2,3,7,8,9-HxCDF; 1,2,3,7,8-PeCDD; 1,2,3,7,8-PeCDF; 2,3,4,6,7,8-HxCDF; 2,3,4,7,8-PeCDF; 2,3,7,8-TCDD; 2,3,7,8-TCDF; OCDD; and OCDF) were detected in surface soil. All of these constituents were detected below the USEPA (2009a) residential soil RSL values, and as a result, were not identified as COPCs for surface soil.

One explosive, pentaerythritol tetranitrate, was detected in surface soil. This constituent did not have a USEPA (2009a) residential soil RSL value; as a result, pentaerythritol tetranitrate was identified as a COPC for surface soil.

Four herbicides (2,4,5-TP; 2,4-D; dalapon; and MCPP) were detected in surface soil. All of these constituents were detected below the USEPA (2009a) residential soil RSL values, and as a result, were not identified as COPCs for surface soil.

Two pesticides (4,4'-DDD and dieldrin) were detected in surface soil. Both of these constituents were detected at concentrations below the USEPA (2009a) residential soil RSL values, and as a result, were not identified as COPCs for surface soil.

Seventeen PAHs (2-methylnaphthalene; acenaphthene; acenaphthylene; anthracene; benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; benzo[g,h,i]perylene; benzo[k]fluoranthene; chrysene; dibenzo[a,h]anthracene; fluoranthene; fluorene; indeno[1,2,3-cd]pyrene; naphthalene; phenanthrene; and pyrene) were detected in surface soil. Five of these detected constituents (benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; dibenzo[a,h]anthracene; and indeno[1,2,3-cd]pyrene) were detected at concentrations greater than their respective USEPA (2009a) residential soil RSL values and were identified as COPCs for surface soil.

One PCB, Aroclor 1254, was detected in surface soil. This constituent was detected below the USEPA (2009a) residential soil RSL value and was not identified as a COPC for surface soil.

Twenty-three inorganics (aluminum; antimony; arsenic; barium; beryllium; cadmium; calcium; chromium; cobalt; copper; iron; lead; magnesium; manganese; mercury; nickel; potassium; selenium; silver; sodium; thallium; vanadium; and zinc) were detected in surface soil. Four constituents (calcium; magnesium; potassium; and sodium) were identified as essential nutrients and were not evaluated further in the HHRA. Eleven of these constituents (aluminum; antimony; arsenic; cobalt; copper; iron; lead; manganese; thallium; vanadium; and zinc) were detected at concentrations greater than the USEPA (2009a) residential soil RSL values. However, aluminum, cobalt, manganese, thallium, and vanadium were all detected below the background concentrations. As a result, only antimony, arsenic, copper, iron, lead, and zinc were identified as COPCs for surface soil.

7.4.1.2 Combined Surface and Subsurface Soil

Combined surface and subsurface soil COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for residential soil. Table A.7.HHRA-2 presents the selection of combined surface and subsurface soil COPCs for the HHRA. As summarized in Table A.7.HHRA-2, 17 constituents were identified as COPCs in combined surface and subsurface soil as follows:

Six VOCs (acetone; carbon disulfide; d-limonene; methylene chloride; p-isopropyltoluene; and toluene) were detected in combined surface and subsurface soil. All of these constituents were detected below the USEPA (2009a) residential soil RSL values with the exception of d-limonene, which did not have a USEPA (2009a) residential soil RSL value. As a result, only d-limonene was identified as a COPC for combined surface and subsurface soil.

Seven SVOCs (bis[2-ethylhexyl]phthalate; butylbenzylphthalate; carbazole; dibenzofuran; di-n-butylphthalate; di-n-octylphthalate; and n-nitrosodiphenylamine) were detected in combined surface and subsurface soil. All of these constituents were detected below the USEPA (2009a) residential soil RSL values with the exception of carbazole, which did not have a value. As a result, carbazole was identified as a COPC for combined surface and subsurface soil.

Seventeen dioxin/furan compounds (1,2,3,4,6,7,8-HpCDD; 1,2,3,4,6,7,8-HpCDF; 1,2,3,4,7,8,9-HpCDF; 1,2,3,4,7,8-HxCDD; 1,2,3,4,7,8-HxCDF; 1,2,3,6,7,8-HxCDD;

1,2,3,6,7,8-HxCDF; 1,2,3,7,8,9-HxCDD; 1,2,3,7,8,9-HxCDF; 1,2,3,7,8-PeCDD; 1,2,3,7,8-PeCDF; 2,3,4,6,7,8-HxCDF; 2,3,4,7,8-PeCDF; 2,3,7,8-TCDD; 2,3,7,8-TCDF; OCDD; and OCDF) were detected in combined surface and subsurface soil. Only one constituent, 1,2,3,7,8-PeCDD, was detected at a maximum concentration greater than the USEPA (2009a) residential soil RSL values and was identified as a COPC for combined surface and subsurface soil.

One explosive, pentaerythritol tetranitrate, was detected in combined surface and subsurface soil. This constituent did not have a USEPA (2009a) residential soil RSL value; as a result, pentaerythritol tetranitrate was identified as a COPC for combined surface and subsurface soil.

Four herbicides (2,4,5-TP; 2,4-D; dalapon; and MCPP) were detected in combined surface and subsurface soil. All of these constituents were detected at concentrations below the USEPA (2009a) residential soil RSL values, and as a result, were not identified as COPCs for combined surface and subsurface soil.

Two pesticides (4,4'-DDD and dieldrin) were detected in combined surface and subsurface soil. Both of these constituents were detected at concentrations below the USEPA (2009a) residential soil RSL values, and as a result, were not identified as COPCs for combined surface and subsurface soil.

Seventeen PAHs (2-methylnaphthalene; acenaphthene; acenaphthylene; anthracene; benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; benzo[g,h,i]perylene; benzo[k]fluoranthene; chrysene; dibenzo[a,h]anthracene; fluoranthene; fluorene; indeno[1,2,3-cd]pyrene; naphthalene; phenanthrene; and pyrene) were detected in combined surface and subsurface soil. Five of these detected constituents (benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; dibenzo[a,h]anthracene; and indeno[1,2,3-cd]pyrene) were present at concentrations greater than the USEPA (2009a) residential soil RSL values and were identified as COPCs for combined surface and subsurface soil.

One PCB, Aroclor 1254, was detected in combined surface and subsurface soil. This constituent was detected at concentrations above the USEPA (2009a) residential soil RSL value and was identified as a COPC for combined surface and subsurface soil.

Twenty-three inorganics (aluminum; antimony; arsenic; barium; beryllium; cadmium; calcium; chromium; cobalt; copper; iron; lead; magnesium; manganese; mercury; nickel; potassium; selenium; silver; sodium; thallium; vanadium; and zinc) were detected in combined surface and subsurface soil. Four constituents (calcium;

magnesium; potassium; and sodium) were identified as essential nutrients and were not evaluated further in the HHRA. Eleven of these constituents (aluminum; antimony; arsenic; cobalt; copper; iron; lead; manganese; thallium; vanadium; and zinc) were greater than the USEPA (2009a) residential soil RSL values. However, cobalt, manganese, thallium, and vanadium were all detected below the background concentrations. As a result, only aluminum, antimony, arsenic, copper, iron, lead, and zinc were identified as COPCs for combined surface and subsurface soil.

7.4.1.3 Sediment

Sediment COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for residential soil. Table A.7.HHRA-3 presents the selection of sediment COPCs for the HHRA. As summarized in Table A.7.HHRA-3, 17 constituents were identified as COPCs in sediment as follows:

Five VOCs (2-butanone; acetone; carbon disulfide; methylene chloride; and toluene) were detected in sediment. All of these constituents were detected at concentrations below the USEPA (2009a) residential soil RSL values and were not identified as COPCs in sediment.

Seven SVOCs (1,2,4-trichlorobenzene; 1,4-dichlorobenzene; 4-methylphenol; bis[2-ethylhexyl]phthalate; carbazole; dibenzofuran; and phenol) were detected in sediment. All of these constituents were detected at concentrations below the USEPA (2009a) residential soil RSL values with the exception of carbazole, which did not have a value. As a result, only carbazole was identified as a COPC for sediment.

Thirteen dioxin/furan compounds (1,2,3,4,6,7,8-HpCDD; 1,2,3,4,6,7,8-HpCDF; 1,2,3,4,7,8,9-HpCDF; 1,2,3,4,7,8-HxCDD; 1,2,3,4,7,8-HxCDF; 1,2,3,6,7,8-HxCDD; 1,2,3,6,7,8-HxCDF; 1,2,3,7,8,9-HxCDD; 2,3,4,6,7,8-HxCDF; 2,3,4,7,8-PeCDF; 2,3,7,8-TCDF; OCDD; and OCDF) were detected in sediment. All of these constituents were detected at concentrations below the USEPA (2009a) residential soil RSL values, and as a result, were not identified as COPCs for sediment.

Two explosives (1,3,5-trinitrobenzene and nitroglycerine) were detected in sediment. Only nitroglycerine was detected at concentrations above the USEPA (2009a) residential soil RSL value and was identified as a COPC in sediment.

Four herbicides (2,4,5-T; 2,4-D; dicamba; and MCPP) were detected in sediment. All of these constituents were detected at concentrations below the USEPA (2009a) residential soil RSL values and were not identified as COPCs in sediment.

Eleven pesticides (4,4'-DDD; 4,4'-DDE; 4,4'-DDT; delta-BHC; alpha-chlordane; gamma-chlordane; dieldrin; endosulfan II; endrin aldehyde; endrin ketone; and methoxyclor) were detected in sediment; however, all of these constituents were detected at concentrations below their respective USEPA (2009a) residential soil RSL values and were not identified as COPCs in sediment.

Eighteen PAHs (1-methylnaphthalene; 2-methylnaphthalene; acenaphthene; acenaphthylene; anthracene; benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; benzo[g,h,i]perylene; benzo[k]fluoranthene; chrysene; dibenzo[a,h]anthracene; fluoranthene; fluorene; indeno[1,2,3-cd]pyrene; naphthalene; phenanthrene; and pyrene) were detected in sediment. Five of these detected constituents (benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; dibenzo[a,h]anthracene; and indeno[1,2,3-cd]pyrene) were present at concentrations greater than the USEPA (2009a) residential soil RSL values and were identified as COPCs in sediment.

Twenty-three inorganics (aluminum; antimony; arsenic; barium; beryllium; cadmium; calcium; chromium; cobalt; copper; iron; lead; magnesium; manganese; mercury; nickel; potassium; selenium; silver; sodium; thallium; vanadium; and zinc) were detected in sediment. Four constituents (calcium; magnesium; potassium; and sodium) were identified as essential nutrients and were not evaluated further in the HHRA. Ten of these constituents (aluminum; arsenic; chromium; cobalt; iron; lead; manganese; thallium; vanadium; and zinc) were greater than the USEPA (2009a) residential soil RSL values. Consequently, only aluminum, arsenic, chromium, cobalt, iron, lead, manganese, thallium, vanadium, and zinc were identified as COPCs for sediment.

7.4.1.4 Surface Water

Surface water COPCs were selected by comparing the analytical data with USEPA (2009a) RSLs for tap water. Table A.7.HHRA-4 presents the selection of surface water COPCs for the HHRA. As summarized in Table A.7.HHRA-4, 10 constituents were identified as COPCs in surface water as follows:

Eight VOCs (2-butanone; acetone; carbon disulfide; chloroform; cis-1,2-dichloroethene; tetrachloroethene; toluene; and trichloroethene) were detected in surface water. Two of these detected constituents, chloroform and tetrachloroethene, were detected at concentrations greater than their USEPA (2009a) tap water RSL values and were identified as COPCs for surface water.

Eight SVOCs (1,2-dichlorobenzene; 1,4-dichlorobenzene; 1,4-dichlorobenzene; benzoic acid; bis[2-ethylhexyl]phthalate; butylbenzylphthalate; diethylphthalate; and di-n-butylphthalate) were detected at concentrations in surface water. All of these constituents were detected below the USEPA (2009a) tap water RSL values and were not identified as COPCs for surface water.

One dioxin/furan compound, OCDD, was detected in surface water. This constituent was detected at concentrations below the USEPA (2009a) tap water RSL value and was not identified as a COPC for surface water.

One explosive, m-nitrotoluene, was detected in surface water. This constituent was detected at concentrations below the USEPA (2009a) tap water RSL value and was not identified as a COPC for surface water.

Two herbicides (2,4-D and MCPP) were detected in surface water. Only MCPP was detected at concentrations above the USEPA (2009a) tap water RSL value, and as a result, was identified as a COPC for surface water.

One pesticide, dieldrin, was detected in surface water. This constituent was at a maximum concentration greater than the USEPA (2009a) tap water RSL value and was identified as a COPC for surface water.

Seven PAHs (1-methylnaphthalene; 2-methylnaphthalene; acenaphthene; anthracene; fluorene; naphthalene; and phenanthrene) were detected in surface water. All of these constituents were detected at concentrations below their respective USEPA (2009a) tap water RSL values and were not identified as COPCs for surface water.

Eighteen inorganics (aluminum; arsenic; barium; beryllium; calcium; copper; iron; lead; magnesium; manganese; nickel; potassium; selenium; silver; sodium; thallium; vanadium; and zinc) were detected in surface water. Four constituents (calcium; magnesium; potassium; and sodium) were identified as essential nutrients and were not evaluated further in the HHRA. Five of these detected constituents (arsenic; iron; lead; manganese; thallium; and vanadium) were detected above the USEPA (2009a) tap water RSL values. As a result, only arsenic, iron, lead, manganese, thallium, and vanadium were identified as COPCs for surface water.

7.4.1.5 Fish Tissue

Fish tissue COPCs were to be selected by comparison to acceptable consumption levels (USEPA 2000); however, none of the constituents detected had identified acceptable consumption levels. As a result, all constituents detected with the exception of essential nutrients were selected as fish tissue COPCs. Table A.7.HHRA-5 presents the selection fish tissue COPCs for the HHRA.

The analyte list as presented in Table A.7.HHRA-5 was based upon constituent detections of fish samples. A total of 16 fish tissue samples were collected from the WBG pond and analyzed for TCL PCBs and TAL metals. Analysis of the fish tissue indicated detections of 11 metals with the remaining analytes being non-detects (see Table 9-16 of main document). The 11 fish tissue detections presented in Table 9-16 where then used for the selection fish tissue COPCs.

As a conservative measure, maximum concentrations were used as EPCs for fish ingestion. As summarized in Table A.7.HHRA-5, the following constituents were identified as COPCs in fish tissue for the HHRA: barium, chromium, copper, iron, manganese, mercury, and zinc.

7.4.2 Summary of Selected Constituents of Potential Concern

Fourteen constituents were selected as COPCs in surface soil at the WBG, including one VOC (d-limonene), one SVOC (carbazole), five PAHs (benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; dibenzo[a,h]anthracene; and indeno[1,2,3-cd]pyrene), one explosive (pentaerythritol tetranitrate), and six inorganics (antimony; arsenic; copper; iron; lead; and zinc).

Seventeen constituents were selected as COPCs in combined surface and subsurface soil at the WBG, including one VOC (d-limonene), one SVOC (carbazole), five PAHs (benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; dibenzo[a,h]anthracene; and indeno[1,2,3-cd]pyrene), one dioxin compound (1,2,3,7,8-PeCDD), one PCB (Aroclor 1254), one explosive (pentaerythritol tetranitrate), and seven inorganics (aluminum; antimony; arsenic; copper; iron; lead; and zinc).

Seventeen constituents were selected as COPCs in sediment at the WBG, including one SVOC (carbazole), five PAHs (benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; dibenzo[a,h]anthracene; and indeno[1,2,3-cd]pyrene), one explosive (nitroglycerine), and ten inorganics (aluminum; arsenic; chromium; cobalt; iron; lead; manganese; thallium; vanadium; and zinc).

Ten constituents were selected as COPCs in surface water at the WBG, including two VOCs (chloroform and tetrachloroethene), one herbicide (MCPP), one pesticide (dieldrin), and six inorganics (arsenic; iron; lead; manganese; thallium; and vanadium).

Seven COPCs were selected as COPCs in fish tissue at the WBG and they are: barium, chromium, copper, iron, manganese, mercury, and zinc.

7.4.3 Determination of Exposure Point Concentrations

Fourteen constituents were selected as COPCs in surface soil, seventeen constituents were selected as COPCs in and combined surface and subsurface soil, seventeen constituents were selected as COPCs in sediment, and ten constituents were selected as COPCs in surface water because the maximum detected concentrations were greater than the corresponding USEPA (2009a) RSL or no RSL was available. The distribution testing and UCL calculations were performed as described in Section 2.2.6.1, and the EPCs for these COPCs are summarized in Table A.7.HHRA-6.

7.4.4 Human Health Risk Characterization

Excess lifetime cancer risks and non-cancer hazards were calculated per methods described in section 2.2.4.1 and 2.2.4.2. Blood lead level estimates were calculated using methods described in Section 2.2.4.3. The physical and chemical properties and toxicity values used to evaluate excess lifetime cancer risks and non-cancer hazards are presented in Tables A.2-3 through A.2-9. The exposure assumptions used to evaluate potentially exposed receptors are presented in Table A.2-10. The equations used in the risk characterization calculations are presented in Tables A.2-11 through A.2-15.

The soil, sediment, and surface water COPCs were evaluated for direct contact. VOCs identified as COPCs in the WBG were also evaluated for inhalation via vapor migration into buildings. One VOC, d-limonene, was identified as a soil COPC at the WBG. This COPC does not have identified inhalation toxicity values; therefore, the indoor vapor intrusion pathway could not be assessed at this Study Area.

The excess lifetime cancer risks and non-cancer hazards and the estimated blood lead levels for each potentially exposed receptor included in the risk assessment for the WBG are discussed by receptor in following subsections. In addition to the site worker, construction worker, and resident scenarios evaluated for all areas, two additional sets of exposures were evaluated for the WBG area: exposures to participants (adults and children) who might be exposed to sediment via wading during the annual two-day fish rodeo; and exposures to site workers, hypothetical construction workers, and hypothetical future residents (adults and children) for whom soil exposure would encompass both current soil and sediment in the event that the pond at the WBG were drained.

7.4.4.1 Site Worker

A current or future site worker could be present at the WBG area, and could be exposed to surface soil, sediment, or surface water. The ELCR and non-cancer hazard index for site worker exposure to each medium are presented in Tables A.7.HHRA- 7 through A.7.HHRA-9, and are summarized in Table A.7.HHRA-25. As presented in the table above, the ELCRs for surface soil, sediment, and surface water are all within the USEPA target risk range, and the HIs for each medium are all below the benchmark value of 1.

The total cumulative ELCR for site workers exposed to surface soil, sediment, and surface water at the WBG is 1×10^{-5}, which is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for site workers is 0.4, which is less than the benchmark of 1.

The 50^{th} percentile blood lead level estimates for the site worker receptor, as seen in Table A.7.HHRA-27, from exposure to lead in soil was calculated to be 2 µg/dL and the 95^{th} percentile fetal blood lead levels was at 7 µg/dL. Both of these estimated blood lead levels are below the benchmark of 10 µg/dL.

7.4.4.2 Hypothetical Future Construction Worker

A hypothetical future construction worker could be present at the WBG area, and could be exposed to combined surface and subsurface soil. The ELCR and non-cancer hazard index for hypothetical future construction worker exposure to soil are presented in Table A.7.HHRA-10, and are summarized in Table A.7.HHRA-25.

The total cumulative ELCR for hypothetical future construction workers exposed to combined surface and subsurface soil at the WBG is 5×10^{-7}, which is below the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for hypothetical future construction workers is 0.5, which is less than the benchmark of 1.

The 50^{th} percentile blood lead level estimates for the hypothetical future construction worker, as seen in Table A.7.HHRA-30, from exposure to lead in soil was calculated to be 2 µg/dL and the 95^{th} percentile fetal blood lead levels was at 7 µg/dL. Both of these estimated blood lead levels are below the benchmark of 10 µg/dL.

7.4.4.3 Hypothetical Future Residents

A hypothetical future resident could be present at the WBG area, and could be exposed to combined surface and subsurface soil, sediment, or surface water. The ELCRs and non-cancer HIs for hypothetical future resident exposure to each medium are presented in Tables A.7.HHRA-11 through A.7.HHRA-18, and are summarized in Table A.7.HHRA-25.

The total cumulative ELCR for hypothetical future residents exposed to combined surface and subsurface soil, sediment, surface water, and ingestion of fish at the WBG is 5×10^{-5} , which is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}.

The total cumulative HI for hypothetical future adult residents is 0.8, which is less than the benchmark of 1.

The total cumulative HI for hypothetical future child residents is 6, which is above the benchmark of 1. When the HI for combined surface and subsurface soil is segregated into target site and critical effects, none of the hazards is above the benchmark of 1. When the HI for sediment is segregated into target site and critical effects, only the HI for chromium (which is based on a toxicological study in which no effects were observed via the oral route) exceeded the benchmark of 1. When the HI for fish ingestion is segregated by target site and critical effects, the HIs are all less than or equal to 1.

Lead was a COPC in both soil and sediments at the WBG. Exposure to the sediments is intermittent, but exposure to sediments needs to be combined with the exposure to soil to calculate a cumulative exposure to lead for each receptor. As a result, a time-weighted average lead concentration was calculated assuming 350 days/year exposure to lead in soil and 48 days/year exposure to lead in sediments. This resulted in an EPC of 623 mg/kg of lead. As shown on Table A.7.HHRA-29, the 50^{th} percentile blood lead level estimates for the adult resident receptor from exposure to lead in soil and sediment was calculated to be 2.8 µg/dL and the 95^{th} percentile fetal blood lead level was 10 µg/dL. The adult level is well below the benchmark and the fetal level is at the benchmark.

The IEUBK model for childhood exposure to lead includes the contribution of exposure to lead in dust. The time-weighted exposure point concentration included both soil and sediment contributions. However, soil is more likely to contribute to dust exposure than would sediment. As a result, the dust concentration was based on the soil EPC and was set at 70 mg/kg for the entire exposure period. As shown on Table A.7.HHRA-28, blood lead level estimates for the hypothetical child resident receptor from exposure to lead in soil and sediment were evaluated and the predicted annual blood lead levels ranged from 2.9 µg/dL to 5.5 µg/dL. Exposure of a child over a seven year period resulted in a geometric mean blood lead concentration of 4.26 µg/dL, below the 10 µg/dL benchmark, and a prediction of 3 percent of the population having blood lead concentrations above the 10 µg/dL benchmark.

7.4.4.4 Fish Rodeo Participants

Potential risks were evaluated for participants in the semi-annual fishing rodeo held at the WBG pond. The fishing rodeo would occur two days per year. Individuals who catch fish would be allowed to retain them. However, as the pond would be stocked with fish just before the rodeo begins, it is not likely that they would accumulate any COPCs during that time. Thus, the only potential risk to adults and children who participate in the rodeo would be through direct contact with sediments. Accordingly, ELCRs and HIs for this potential sediment exposure were calculated by using exposure factors for the residential scenario modified to replace the exposure frequency from 48 days/year to 2 days/year. The ELCRs and non-cancer hazard index for hypothetical adult and child partipants in the fish rodeo are presented in Tables A.7.HHRA-19 and A.7.HHRA-20.

The ELCR for the hypothetical fish rodeo participants exposed to sediments at the WBG was 4×10^{-7} which is below the USEPA target risk range of 1 x 10-6 to 1 x 10-4. The total cumulative HI for adult participants was 0.009, which is substantially less than the benchmark of 1. The total cumulative HI for child participants was 0.08, which is also less than the benchmark.

7.4.4.5 Site Worker, Hypothetical Future Construction Worker, and Hypothetical Resident – Drained Pond

The HHRA for the WBG area also estimated hypothetical risks to current and future site workers, hypothetical future construction workers, and hypothetical future residents if the pond is drained in the future, which could result in current sediments becoming part of the soil to which these residents might be exposed. To complete this evaluation, the EPCs were modified to represent combined soil and sediment samples. Exposure factor values were otherwise identical to those used in the evaluation of exposure to soils for these receptors. If the pond were to be drained, wading and fishing would no longer be possible, so exposures by those pathways were not included when characterizing risks if the pond were drained in the future. The ELCRs and HIs for potential receptors under a future drained pond scenario are presented in Tables A.7.HHRA-21 through A.7.HHRA-24 and summarized in Table A.7.HHRA-26.

The total cumulative ELCR for future site workers exposed to combined combined surface soil, subsurface soil, and current sediment at the WBG was 1×10^{-5}, which is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for hypothetical future site workers is 0.5, which is less than the benchmark of 1.

The total cumulative ELCR for hypothetical future construction workers exposed to combined combined surface soil, subsurface soil, and current sediment at the WBG was 6×10^{-7}, which is below the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for hypothetical future construction workers is 0.8, which is less than the benchmark of 1.

The total cumulative ELCR for hypothetical future residents exposed to combined surface soil, subsurface soil, and current sediment at the WBG was 5×10^{-5}, which is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for hypothetical adult residents is 0.7, which is below the benchmark of 1. The total cumulative HI for hypothetical child residents is 6, which is greater than the benchmark value of 1. When the HI is segregated into target site and critical effects, only the HI for chromium (which is based on a toxicological study in which no effects were observed via the oral route) exceeded the benchmark of 1.

These results indicate that risks to future site workers, hypothetical future construction workers, or hypothetical future adult residents would be acceptable if the pond at the WBG were drained in the future, thereby adding current sediment to the material to which direct contact soil exposures might occur. Exposures to child residents are slightly elevated and may be of concern.

7.4.5 Human Health Risk Summary

Table A.7.HHRA-25 summarizes the calculated cancer risks and non-cancer hazards for receptors at the WBG as currently characterized by soil, sediment, surface water, and fish tissue data. As shown in the table below, the total ELCR values for all surface soil, combined surface and subsurface soil, sediment, and surface water exposures for each exposure scenario are below or within the benchmark range of 10^{-6} to 10^{-4} for cancer risk.

Summary of Calculated ELCRs and HIs for Receptor Exposure Scenarios

RECEPTOR/ EXPOSURE MEDIUM - SCENARIO	ELCR	HI
Site Worker		
Surface Soil - Direct Contact	1E-05	0.1
Sediment – Wading	2E-06	0.1
Surface Water – Wading	3E-06	0.2
TOTAL SITE RISKS (Site Worker):	**1E-05**	**0.4**
Hypothetical Future Construction Worker		
Combined Surface and Subsurface Soil - Direct Contact	5E-07	0.5
TOTAL SITE RISKS (Construction Worker):	**5E-07**	**0.5**
Hypothetical Future Adult Resident		
Combined Surface and Subsurface Soil - Direct Contact	-	0.2
Sediment – Wading	-	0.2
Surface Water – Wading	-	0.04
Fish Consumption	-	0.3
TOTAL SITE RISKS (Adult Resident):	**-**	**0.8**
Hypothetical Future Child Resident		
Combined Surface and Subsurface Soil - Direct Contact	-	2
Combined Surface and Subsurface Soil - Vapor Migration to Indoor Air	-	–
Sediment – Wading	-	2
Surface Water – Wading	-	0.1
Fish Consumption	-	1
TOTAL SITE RISKS (Child Resident):	**-**	**6**
Hypothetical Future Resident (Adult and Child)		
Combined Surface and Subsurface Soil - Direct Contact	4E-05	-
Combined Surface and Subsurface Soil - Vapor Migration to Indoor Air	-	-
Sediment – Wading	1E-05	-
Surface Water – Wading	1E-06	-
Fish Consumption	NA	-
TOTAL SITE RISKS (Aggregate Resident):	**5E-05**	**-**
Hypothetical Future Adult Resident (Fishing Rodeo)		
Sediment - Wading	2E-07	0.009
Hypothetical Future Child Resident (Fishing Rodeo)		
Sediment - Wading	2E-07	0.08
Site Worker (Drained Pond)		
Combined Surface Soil and Sediment	1E-05	0.5
Hypothetical Future Construction Worker (Drained Pond)		
Combined Surface Soil and Sediment	6E-07	0.8
Hypothetical Future Adult Resident (Drained Pond)		
Combined Surface Soil and Sediment	1E-05	0.7
Hypothetical Future Child Resident (Drained Pond)		
Combined Surface Soil and Sediment	3E-05	6

The total HI values for all surface soil, combined surface and subsurface soil, sediment, and surface water exposures for each exposure scenario are equal to or below the benchmark of 1 for non-cancer hazard, with the exception of hypothetical future child resident exposure to combined surface and subsurface soil and exposure to sediment. When the HI for combined surface and subsurface soil is segregated into target site and critical effects, none of the hazards were greater than the benchmark of 1. When the HI for sediment is segregated into target site and critical effects, only the HIs associated with exposure to chromium are greater than the benchmark of 1.

Exposure to lead in soil by any of the receptors would not cause an elevated blood lead level to be predicted. When exposure to lead in soil and sediment was evaluated for the residential exposure scenarios, there were predicted elevated lead levels.

Summary of Estimated Blood Lead Levels for Receptor Exposure Scenarios

RECEPTOR	Estimated Blood Lead Level (µg/dL)		
	Adult	Child	Fetus
	50th percentile	Range	95th percentile
SOIL			
Hypothetical Future Construction Worker	2	–	7
SOIL AND SEDIMENT			
Site Worker	2	–	7
Hypothetical Future Child	–	2.9 – 5.5	–
Hypothetical Future Adult	2.8	–	10

Based on the results of the risk assessment, it is unlikely that industrial use of the property would result in adverse health effects. Likewise, no adverse effects would be expected for participants in the semi-annual fish rodeo. For the residential exposure scenarios, exposure to lead in sediments may pose an adverse health effect. Also, exposure to chromium in sediments may pose a slightly elevated hazard to children wading in surface water. Several (four) of the detections fell outside of the background chromium soil range. The maximum chromium sediment concentration of 15,400 mg/kg is well above the background range.

If the pond were drained in the future, it is unlikely that industrial or residential use of the property would result in adverse health effects with the exception of a slightly elevated hazard to children resulting from direct contact exposures to existing soils combined with sediment that would become soil.

7.5 Ecological Risk Assessment

The purpose of the ERA is to evaluate whether ecological receptors may be adversely impacted by exposure to site-related constituents detected in surface soil, sediment, surface water, and fish tissue at the WBG. The ERA approach is based on the Master Work Plan (URS 2003) in compliance with CERCLA/SARA and pursuant to RCRA Corrective Action requirements. The ERA was conducted in a manner consistent with USEPA guidance for ecological risk assessment (USEPA 2001a; 2000b; 1997c). This ERA is intended to provide input for risk management decision-making for the WBG, while maintaining a conservative approach protective of wildlife populations and communities. In accordance with USEPA guidance, the ERA for the WBG commenced with a SLERA and then concluded with BERA (USEPA 1997c).

This section summarizes the occurrence of constituents in each medium and identifies COPECs at the WBG for the ecological risk assessment; identifies the potential ecological exposure scenarios relevant to the WBG; and presents the estimated ecological risks associated with the identified COPECs and the relevant ecological exposure scenarios at the WBG. Methodologies for data summary and selection of COPECs, exposure assessment, and toxicity assessment for the ERA were presented in Section 2.4.

7.5.1 Selection of Constituents of Potential Ecological Concern

This section discusses the selection of COPECs for each medium. Risks to ecological receptors are calculated by dividing the exposure estimates (i.e., the maximum detected concentrations) by the conservative ESLs. The resulting ratio, the hazard quotient (HQ), is a highly conservative surrogate for the assessment endpoints identified in Section 2.4. HQs equal to or less than a value of 1 (to one significant figure) indicate that adverse ecological effects are unlikely (USEPA 1997c). HQs greater than 1 indicate that further evaluation is warranted. Therefore, the constituents with HQs greater than 1 are carried forward as COPECs into the BERA. Because the majority of the ESLs measure direct exposures and do not take into account exposures to upper trophic level species, chemicals identified as bioaccumulative were also carried forward as COPECs regardless of whether or not the associated HQ was greater than 1. Finally, as previously described, concentrations of inorganic constituents in soil were compared to background soil concentrations; those with concentrations below background were not considered as COPEC. The COPEC selection process for the WBG area are summarized in the subsections below.

7.5.1.1 Surface Soil

Surface soil COPECs were selected by comparing the analytical data with USEPA (2008c) EcoSSLs, USEPA (2003e) Region 5 ESLs, and ORNL values (Efroymson et al. 1997a,b) for surface soil. Table A.7.ERA-1 presents the selection of surface soil COPECs for the ERA. As summarized in Table A.7.ERA-1, 38constituents were identified as COPECs in surface soil as follows:

Six VOCs (acetone; carbon disulfide; d-limonene; methylene chloride; p-isopropyltoluene; and toluene) were detected in surface soil. HQs were less than or equal to 1 for acetone, carbon disulfide, methylene chloride, and toluene; however, ESLs were not available for d-limonene or p-isopropyltoluene and an HQ could not be calculated for these constituents. As a result, both d-limonene and p-isopropyltoluene were identified as COPECs in surface soil

Six SVOCs (bis[2-ethylhexyl]phthalate; carbazole; dibenzofuran; di-n-butylphthalate; di-n-octylphthalate; and n-nitrosodiphenylamine) were detected in surface soil. Four of these constituents had HQs less than or equal to 1; however, ESLs were not available for carbazole or dibenzofuran and so HQs could not be calculated for these constituents. As a result, both carbazole and dibenzofuran were identified as COPECs for surface soil.

Seventeen dioxin/furan compounds (1,2,3,4,6,7,8-HpCDD; 1,2,3,4,6,7,8-HpCDF; 1,2,3,4,7,8,9-HpCDF; 1,2,3,4,7,8-HxCDD; 1,2,3,4,7,8-HxCDF; 1,2,3,6,7,8-HxCDD; 1,2,3,6,7,8-HxCDF; 1,2,3,7,8,9-HxCDD; 1,2,3,7,8,9-HxCDF; 1,2,3,7,8-PeCDD; 1,2,3,7,8-PeCDF; 2,3,4,6,7,8-HxCDF; 2,3,4,7,8-PeCDF; 2,3,7,8-TCDD; 2,3,7,8-TCDF; OCDD; and OCDF) were detected in surface soil. Toxicity equivalency factors (TEFs) were used to evaluate the toxicity of each dioxin compound detected at the WBG. TEFs are weighted quantity measures that are based on the toxicity of each member of the dioxin and dioxin-like compound relative to the most toxic members of the category. In accordance with USEPA (USEPA 2003a) guidance, TEFs for the dioxin and dioxin-like compounds detected at the WBG were based on the relative toxicity with 2,3,7,8-TCDD and 1,2,3,7,8-PeCDD. The maximum concentrations for each dioxin and dioxin-like compound were multiplied by their corresponding TEF and then summed to get the dioxin toxicity equivalent, which was then compared to the available ESL. The dioxin toxicity equivalent had an HQ greater than 1, and as a result, was identified as a COPC for surface soil.

One explosive, pentaerythritol tetranitrate, was detected in surface soil. This constituent did not have an ESL and so an HQ could not be calculated. As a result, pentaerythritol tetranitrate was identified as a COPEC for surface soil.

Four herbicides (2,4,5-TP; 2,4-D; dalapon; and MCPP) were detected in surface soil. Both 2,4,5-TP and 2,4-D had an HQ of less than or equal to 1; however, an ESL was not available for dalapon or MCPP and so an HQ could not be calculated for these two constituents. As a result, both dalapon and MCPP were identified as COPECs in surface soil.

Two pesticides (4,4'-DDD and dieldrin) were detected in surface soil. Both of these constituents had an HQ less than or equal to 1, however, they were identified as bioaccumulative and as a result, were identified as COPECs for surface soil.

Seventeen PAHs (2-methylnaphthalene; acenaphthene; acenaphthylene; anthracene; benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; benzo[g,h,i]perylene; benzo[k]fluoranthene; chrysene; dibenzo[a,h]anthracene; fluoranthene; fluorene; indeno[1,2,3-cd]pyrene; naphthalene; phenanthrene; and pyrene) were detected in surface soil. All of these constituents had an HQ of less than or equal to 1, however, all but 2-methylnaphthalene and naphthalene were identified as bioaccumulative and as a result, were identified as COPECs for surface soil.

One PCB, Aroclor 1254, was detected in surface soil. This constituent did not have an ESL and so an HQ could not be calculated. However, it was identified as bioaccumulative and identified as a COPEC for surface soil.

Twenty-three inorganics (aluminum; antimony; arsenic; barium; beryllium; cadmium; calcium; chromium; cobalt; copper; iron; lead; magnesium; manganese; mercury; nickel; potassium; selenium; silver; sodium; thallium; vanadium; and zinc) were detected in surface soil. Four constituents are vital electrolytes and/or essential nutrients (i.e., calcium; magnesium; potassium; and sodium) and therefore were identified as non-toxic and not evaluated further. Fourteen of these constituents (antimony; arsenic; barium; cadmium; chromium; cobalt; copper; lead; manganese; mercury; selenium; thallium; vanadium; and zinc) had an HQ greater than 1, and two constituents (aluminum and iron) did not have an ESL available and so an HQ could not be calculated. However, five constituents (aluminum; cobalt; manganese; thallium; and vanadium) were detected below the background concentrations. In addition, silver was identified as bioaccmulative. As a result, antimony, arsenic, barium, cadmium, copper, chromium, iron, lead, mercury, selenium, silver, and zinc were identified as COPECs for surface soil.

7.5.1.2 Sediment

Sediment COPECs were selected by comparing the analytical data with ESLs from the following sources in order of priority: USEPA (2008d) Region 3 Sediment Screening Levels; ORNL values (Jones et al. 1997); and USEPA (2003e) Region 5 Ecological Screening Levels for sediment. Table A.7.ERA-2 presents the selection of sediment COPECs for the ERA, and 55 constituents were identified as COPECs in sediment as follows:

Five VOCs (2-butanone; acetone; carbon disulfide; methylene chloride; and toluene) were detected in sediment. Three of these constituents (2-butanone; acetone; and carbon disulfide) had an HQ greater than 1, and were identified as COPECs in sediment.

Seven SVOCs (1,2,4-trichlorobenzene; 1,4-dichlorobenzene; 4-methylphenol; bis[2-ethylhexyl]phthalate; carbazole; dibenzofuran; and phenol) were detected in sediment. Two of these constituents (4-methylphenol and bis[2-ethylhexyl]phthalate) had an HQ greater than 1. In addition, an ESL was not available for carbazole and the other two were considered bioaccumulative. As a result, all detected SVOCs except dibenzofuran and phenol were identified as COPECs for sediment.

Thirteen dioxin/furan compounds (1,2,3,4,6,7,8-HpCDD; 1,2,3,4,6,7,8-HpCDF; 1,2,3,4,7,8,9-HpCDF; 1,2,3,4,7,8-HxCDD; 1,2,3,4,7,8-HxCDF; 1,2,3,6,7,8-HxCDD; 1,2,3,6,7,8-HxCDF; 1,2,3,7,8,9-HxCDD; 2,3,4,6,7,8-HxCDF; 2,3,4,7,8-PeCDF; 2,3,7,8-TCDF; OCDD; and OCDF) were detected in sediment. TEFs were used to evaluate the toxicity of each dioxin compound detected in sediment at the WBG. The maximum concentrations for each dioxin and dioxin-like compound were multiplied by their corresponding TEF and then summed to get the dioxin toxicity equivalent, which was then compared to the available ESL. The dioxin toxicity equivalent had an HQ greater than 1, and as a result, was identified as a COPC for sediment.

Two explosives (1,3,5-trinitrobenzene and nitroglycerine) were detected in sediment. Neither of these constituents had an ESL and so an HQ could not be calculated. As a result, both 1,3,5-trinitrobenzene and nitroglycerine were identified as COPECs in sediment.

Four herbicides (2,4,5-T; 2,4-D; dicamba; and MCPP) were detected in sediment. Only 2,4-D had an HQ greater than 1. In addition, an ESL was not available for dicamba or MCPP and so an HQ could not be calculated for these two constituents. As a result, 2,4-D, dicamba, and MCPP were identified as COPECs in sediment.

Eleven pesticides (4,4'-DDD; 4,4'-DDE; 4,4'-DDT; delta-BHC; alpha-chlordane; gamma-chlordane; dieldrin; endosulfan II; endrin aldehyde; endrin ketone; and methoxyclor) were detected in sediment. Of these compounds, all but gamma-chlordane, endrin aldehyde, and endrin ketone either had HQs greater than 1 or were identified as bioaccumulative and therefore identified as COPEC.

Eighteen PAHs (1-methylnaphthalene; 2-methylnaphthalene; acenaphthene; acenaphthylene; anthracene; benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; benzo[g,h,i]perylene; benzo[k]fluoranthene; chrysene; dibenzo[a,h]anthracene; fluoranthene; fluorene; indeno[1,2,3-cd]pyrene; naphthalene; phenanthrene; and pyrene) were detected in sediment. All but two of these PAHs (1-methylnaphthalene and naphthalene) either had HQs greater than 1 or were identified as bioaccumulative and therefore identified as COPEC.

Twenty-three inorganics (aluminum; antimony; arsenic; barium; beryllium; cadmium; calcium; chromium; cobalt; copper; iron; lead; magnesium; manganese; mercury; nickel; potassium; selenium; silver; sodium; thallium; vanadium; and zinc) were detected in sediment. Four constituents are vital electrolytes and/or essential nutrients (i.e., calcium; magnesium; potassium; and sodium) and therefore were identified as non-toxic and not evaluated further. Eleven of these constituents (antimony; arsenic; cadmium; chromium; cobalt; copper; iron; lead; manganese; silver; and zinc) had an HQ greater than 1. Those constituents identified as bioaccumulative or without screening levels also were selected as COPECs. Consequently, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, nickel, selenium, silver, thallium, vanadium, and zinc were identified as COPECs for sediment.

7.5.1.3 Surface Water

Surface water COPECs were selected by comparing the analytical data with ESLs from the following sources in order of priority: USEPA (2008c) Region 3 Surface Water Screening Levels; ORNL values (Suter and Tsao 1996); USEPA (2003e) Region 5 Ecological Screening Levels; and USEPA (2008e) Ambient Water Quality Criteria for surface water. Table A.7.ERA-3 presents the selection of surface water COPECs for the ERA, and 25 constituents were identified as COPECs in surface water as follows:

Eight VOCs (2-butanone; acetone; carbon disulfide; chloroform; cis-1,2-dichloroethene; tetrachloroethene; toluene; and trichloroethene) were detected in surface water. Only one of these detected constituents, chloroform, had an HQ greater than 1, and as a result, was identified as a COPEC for surface water.

Eight SVOCs (1,2-dichlorobenzene; 1,3-dichlorobenzene; 1,4-dichlorobenzene; benzoic acid; bis[2-ethylhexyl]phthalate; butylbenzylphthalate; diethylphthalate; and di-n-butylphthalate) were detected at concentrations in surface water. All of these constituents had an HQ less than or equal to 1, however, 1,2-dichlorobenzene; 1,3-dichlorobenzene; 1,4-dichlorobenzene were identified as bioaccumulative and were identified as COPECs for surface water.

One dioxin/furan compound, OCDD, was detected in surface water. TEFs were used to evaluate the toxicity of each dioxin compound detected in surface water at the WBG. The maximum concentration for this dioxin was multiplied by the corresponding TEF to get the dioxin toxicity equivalent, which was then compared to the available ESL. The dioxin toxicity equivalent had an HQ less than or equal to 1, however was identified as bioaccumulative and as a result, was identified as a COPC for surface water.

One explosive, m-nitrotoluene, was detected in surface water; however, this constituent had an HQ less than or equal to 1, and was not identified as a COPEC for surface water.

Two herbicides (2,4-D and MCPP) were detected in surface water. While 2,4-D had an HQ less than or equal to 1, an ESL was not available for MCPP and so an HQ could not be calculated for this constituent. As a result, MCPP was identified as a COPEC for surface water.

One pesticide, dieldrin, was detected in surface water. This constituent had an HQ less than or equal to 1 but was identified as bioaccumulative and was identified as a COPEC in surface water.

Seven PAHs (1-methylnaphthalene; 2-methylnaphthalene; acenaphthene; anthracene; fluorene; naphthalene; and phenanthrene) were detected in surface water. Only one of these constituents, anthracene, had an HQ greater than 1, however, acenaphthene, fluorine, and phenanthrene were also identified as bioaccumulative. Therefore four PAHs were identified as a COPEC for surface water.

Eighteen inorganics (aluminum; arsenic; barium; beryllium; calcium; copper; iron; lead; magnesium; manganese; nickel; potassium; selenium; silver; sodium; thallium; vanadium; and zinc) were detected in surface water. Four constituents are vital electrolytes and/or essential nutrients (i.e., calcium; magnesium; potassium; and sodium) and therefore were identified as non-toxic and not evaluated further. Ten of these detected constituents (aluminum; arsenic; barium; beryllium; copper; iron; lead; manganese; thallium; and vanadium) had an HQ greater than 1 and four (nickel;

selenium; silver; and zinc) were identified as bioaccumulative. As a result, aluminum, arsenic, barium, beryllium, copper, iron, lead,nickel, manganese, silver, selenium thallium, zinc, and vanadium were identified as COPECs for surface water.

One spring sample (WBG_SPRING001) was also evaluated for surface water COPECs by comparing the analytical data with background spring data as well as ESLs. As shown in the table below, one PAH and six inorganics were detected in the spring sample. Four of the inorganics are vital electrolytes and/or essential nutrients (calcium, magnesium, potassium, and sodium) and therefore were identified as non-toxic and not evaluated further. The remaining constituents detected in the spring sample were within or below the background concentrations or were below the corresponding ESL, and as a result, were not evaluated further.

Comparison of Detected Constituents in WBG Spring Sample to Background and ESLs

Constituent	ESL (µg/L)	Background Spring Data NSPRING003 09/24/08	Background Spring Data NSPRING004 09/24/08	WBG_SPRING001 09/24/08	Does Max Exceed ESL or BKG?
PAHs					
Naphthalene	**1.1**	<0.092	<0.092	0.032	no
Inorganics					
Barium	**4**	49.8	66.1	57.2	no
Calcium	**116,000**	65900	59000	70,200	NT
Magnesium	**82,000**	11,900	19,000	11,800	NT
Potassium	**NA**	1670	1820	2,200	NT
Sodium	**680,000**	1430	<5,000	8750	NT
Zinc	**120**	9	7	9.3	no

µg/L Micrograms per liter.
NT Non-toxic.

7.5.2 Summary of Selected Constituents of Potential Ecological Concern

Thirty-eight constituents were selected as COPECs in surface soil, fifty-five constituents were selected as COPECs in sediment, and twenty-five constituents were selected as COPECs in surface water because the HQs were greater than 1, the chemical was bioaccumulative, or an HQ couldn't be calculated because an ESL was not available.

7.5.3 Refinement of Risk Calculations for Direct Contact COPECs

The list of COPECs identified in the BERA was reevaluated by calculating refined HQs. The refined HQs were calculated for the COPECs identified in the SLERA using refined EPCs. Constituents identified as COPECs in the BERA that were bioaccumulative were carried forward into food chain models. The results of the recalculation of the HQs for the WBG are summarized in the subsections below.

7.5.3.1 Surface Soil

Thirty-eight COPECs in surface soil were carried forward into the BERA. When refined EPCs were compared with the ESLs, six constituents (PCDDs/PCDFs; antimony; chromium; copper; lead; and zinc) had a refined HQ greater than 1. In addition, ESLs were not available for 9 other constituents (d-limonene; p-isopropyltoluene; carbazole; dibenzofuran; pentaerythritol tetranitrate; dalapon; MCPP; Aroclor 1254; and iron). The BERA results for surface soil COPECs at the WBG are presented in Table A.7.ERA-4 and are discussed below:

Volatile Organic Compounds: Two VOCs (d-limonene and p-isopropyltoluene) were retained in the BERA because an ESL was not available and so HQs could not be calculated. These samples were each detected in only one sample at very low concentrations (i.e., < 1 mg/kg). Based on the low detected concentrations, adverse effects to wildlife due to potential VOC exposure are considered unlikely.

Semi-Volatile Organic Compounds: Two SVOCs (carbazole and dibenzofuran) were retained in the BERA because an ESL was not available and so HQs could not be calculated. These samples were each detected in less than 5 out of 78 samples at very low concentrations (i.e., < 1 mg/kg). Based on the low detected concentrations and limited occurrence, adverse effects to wildlife due to potential SVOC exposure is considered unlikely.

Dioxin/Furan Compounds: PCDDs and PCDFs and dioxin-like PCBs have a wide range of relative potencies and are usually found in complex mixtures in the environment. This makes determination of risk expensive and difficult. To simplify this process, internationally recognized toxic equivalency factors (TEFs) are used to evaluate their toxicity (Van den Berg et al. 1998). The TEF is an order of magnitude estimate of the toxicity of an individual congener relative to 2,3,7,8-TCDD. The congener concentration in the particular medium (e.g., soil, sediment) multiplied by the TEF yields the TEQ concentration (USEPA 2003f). It is assumed and generally supported in the literature, that effects from different PCDDs and PCDFs congeners are concentration additive (Van den Berg et al. 1998; Tillitt 1999).

The rationale for the use of TEQ approach is based on a common mechanism of action described for planar halogenated hydrocarbons (PHHs) including dioxins, furans and some PCBs. The intracellular target of PHHs is the aryl hydrocarbon receptor (AhR), which, while bound to the ligand, mediates the transactivation and inhibition of a variety of target genes. This activity results in a wide-array of responses with deleterious effects. The structure of a ligand is critical to its affinity for the AhR and the affinity of a particular ligand for the AhR correlates well with the resulting toxicity and biochemical responses (Safe 1990; 1998). Due to its high potency, the AhR mediated toxicity of 2,3,7,8-TCDD is considered the standard by which all other PHH potencies are normalized. The relative AhR-mediated toxicity of PHHs has been determined using a combination of in vitro and in vivo studies and TEFs are available for mammalian, avian and fish species (Van den Berg et al. 1998). For each individual PHH constituent, the exposure concentration is divided by the TEQ resulting in the HQ for that specific constituent. Given that PHHs act through a common mechanism of toxicity for common species, the individual HQs are summed to account for the cumulative risk from exposure to the dioxin/furan group as a whole. A cumulative HQ greater than 1 indicates that there is potential risk to ecological receptors. The TEQ approach is applied to the dioxin and furan compounds detected in surface soil, sediment, and surface water at the WBG.

USEPA Region 5 has ESL values for PCDFs (0.0000386 mg/kg) and for PCDDs (0.000000199 mg/kg). The maximum concentrations of the detected dioxin and furan compounds at the site exceed these ESL values, which indicate the potential for adverse effects to exposed terrestrial receptors. However, the ESLs were based on a food chain exposure to a masked shrew, which is a highly sensitive receptor. Furthermore, these criteria are not an indicator of direct toxicity to mammals and other terrestrial wildlife. When site-specific food chain modeling was evaluated for PCDFs/PCDDs, the HQs for the refined scenarios were below the benchmark value of 1 for both the short-tailed shrew (Table A.7.ERA-9) and the American robin (Table A.7.ERA-11). Based on these considerations, adverse impacts are not expected for wildlife exposed to PCDFs/PCDDs at the WBG area.

Explosives: One explosive, pentaerythritol tetranitrate, was retained in the BERA because an ESL was not available and so an HQ could not be calculated. This constituent was detected in only 1 of 20 surface soil samples, with a concentration of 0.11 mg/kg. Based on the low frequency of detection and low detected concentration, adverse effects to wildlife due to potential explosive exposure are considered unlikely.

Herbicides: Two herbicides (dalapon and MCPP) were retained in the BERA because an ESL was not available and so HQs could not be calculated. Dalapon was detected in 3 of 4 surface soil samples, at very low concentrations (i.e., < 1 mg/kg), and MCPP was detected in only 1 of 4 surface soil samples, at a relatively low concentration. Based on the low frequency of detection and low detected concentrations, adverse effects to wildlife due to potential herbicide exposure are considered unlikely.

<u>Polychlorinated Biphenyls</u>: One PCB, Aroclor 1254, was retained in the BERA because an ESL was not available and so an HQ could not be calculated. Aroclor 1254 was detected in 2 out of 28 surface soil samples with concentrations ranging from 0.03 mg/kg to 0.05 mg/kg.

While there are no Aroclor-specific ESLs from Region 5, Region 5 does provide an ESL of 0.000332 mg/kg for PCBs as a group. The maximum Aroclor 1254 concentration at the WBG is above this ESL; however, site-specific food chain modeling for the short-tailed shrew and American robin (Section 7.5.4), using conservative exposure assumptions, indicates that the potential risk from exposure to Aroclor 1254 at the WBG is very low. Based on these considerations and the limited occurrence in surface soil at the WBG area, adverse impacts are not expected for populations of ecological receptors exposed to Aroclor 1254 at the WBG.

<u>Inorganics</u>: Six inorganics (antimony; chromium; copper; iron; lead; and zinc) were retained in the BERA because the calculated HQ was above the benchmark of 1 or because an ESL was not available and so an HQ could not be calculated. These results are discussed below:

> <u>Antimony</u> – Antimony was detected in 26 out of 53 surface soil samples, with concentrations ranging from 0.29 mg/kg to 5.3 mg/kg. While all of these concentrations were above the ESL of 0.27 mg/kg, the calculated HQ was only slightly above the benchmark value of 1 (HQ=3). In addition, while site-specific background values for antimony were not available, these detected concentrations were compared to the mean background concentrations for antimony in surface soil of 1.2 mg/kg reported for Virginia (USEPA 2005b). The EPC for antimony at the WBG was 0.836 mg/kg, which was below the reported background soil concentration of antimony in Virginia. Consequently, adverse effects to wildlife exposed to antimony are unlikely given the similarity of detected concentrations with the state background value and the low calculated HQ.

Chromium – Chromium was detected in 56 out of 56 surface soil samples, with concentrations ranging from 22 mg/kg to 249 mg/kg. While all but five of these concentrations were above the ESL of 26 mg/kg, the calculated HQ was only slightly above the benchmark value of 1 (HQ=3). In addition, the calculated EPC for chromium was below the soil background value established at the site. Consequently, adverse effects to wildlife exposed to chromium are unlikely given similarity of detected concentrations with the site background value, and the low calculated HQ.

Copper – Copper was detected in 56 out of 56 surface soil samples, with concentrations ranging from 10.4 mg/kg to 1,340 mg/kg. While 22 concentrations were above the ESL of 28 mg/kg, only five of these concentrations were detected above the site background value. These five samples are bounded by samples that contain copper at background levels Figure 7-1), and it is estimated that the area that exceeds the background level is approximately 0.08 acre (3,675 ft^2) in size. This is a small area and as such is unlikely to represent a significant concern to ecological receptors. Consequently, adverse effects to wildlife exposed to copper are unlikely given the similarity of the majority of detected concentrations with the site background values and the limited spatial extent of the few samples with copper concentrations above the background level.

Iron – Iron was detected in 56 out of 56 surface soil samples, with concentrations ranging from 17,600 mg/kg to 54,000 mg/kg. While no ESL was available, only one of these concentrations was detected above the site background value, and all of the concentrations were within the range of background concentrations detected at the site. In addition, the calculated EPC for iron was below the soil background value established at the site. Consequently, adverse effects to wildlife exposed to iron are unlikely given the similarity of detected concentrations with the site background values.

Lead – Lead was detected in 56 out of 56 surface soil samples, with concentrations ranging from 11.6 mg/kg to 3,990 mg/kg. While all of these concentrations were above the ESL of 11 mg/kg, only eight of the concentrations were detected outside the range of background samples found at the site (Figure 7-1). These eight detections are encompassed within an approximately 0.8 acre (34,300 ft^2) and are unlikely to pose a significant adverse population-level impact to ecological receptors. Additionally, lead was further evaluated in the terrestrial food chain model.

Zinc – Zinc was detected in 56 out of 56 surface soil samples, with concentrations ranging from 15.2 mg/kg to 3,250 mg/kg. While 31 concentrations were above the ESL of 46 mg/kg, only five of the concentrations were above the range of background values detected at the site (Figure 7-1). The calculated EPC for zinc was below the maximum background concentration of zinc detected at the site. These eight detections are encompassed within an approximately 0.08 acre (3,675 ft^2) and are unlikely to pose a significant adverse population-level impact to ecological receptors at the site. Additionally, this COPEC was further evaluated in the terrestrial food chain model.

Twenty-six COPECs were also identified as bioaccumulative and were evaluated in the terrestrial food chain model.

7.5.3.2 Sediment

Fifty-five COPECs in sediment were carried forward into the BERA. When refined EPCs were compared with the ESLs, 27 constituents (2-butanone; acetone; carbon disulfide; 4-methylphenol; dioxin TEQ; 2,4-D; dieldrin; 2-methylnaphthalene; acenaphthene; acenaphthylene; anthracene; benzo[a]anthracene; benzo[a]pyrene; benzo[g,h,i]perylene; chrysene; dibenzo[a,h]anthracene; fluoranthene; indeno[1,2,3-cd]pyrene; phenanthrene; pyrene; chromium; copper; iron; lead; manganese; silver; and zinc), had a refined HQ greater than 1. In addition, ESLs were not available for nine other constituents (carbazole; 1,3,5-trinitrobenzene; nitroglycerine; dicamba; MCPP; barium; beryllium; thallium; and vanadium). The BERA results for sediment COPECs at the WBG are presented in Table A.7.ERA-5 and are discussed below:

Volatile Organic Compounds: Three VOCs (2-butanone; acetone; and carbon disulfide) were retained in the BERA because the calculated HQ was above the benchmark of 1. These results are discussed below:

2-Butanone – 2-Butanone was detected in 5 out of 14 sediment samples, with concentrations ranging from 0.015 mg/kg to 0.18 mg/kg. While three of these concentrations were above the ESL of 0.0424 mg/kg, the calculated HQ was only slightly above the benchmark value of 1 (HQ=2). Based on these considerations, adverse effects to aquatic life due to potential 2-butanone exposure are considered unlikely.

Acetone – Acetone was detected in 11 out of 14 sediment samples, with concentrations ranging from 0.003 mg/kg to 0.23 mg/kg. While all but one of these concentrations were above the ESL of 0.0099 mg/kg, acetone is a common laboratory contaminant and was also detected in the laboratory blank. Consequently, adverse effects to aquatic life exposed to acetone are unlikely given the physical and chemical properties of the constituent (e.g., high vapor pressure; low Kow; and low potential for bioaccumulation) and the uncertainty that the VOC is a site-related constituent.

<u>Carbon disulfide</u> – Carbon disulfide was detected in 5 out of 12 sediment samples, with concentrations ranging from 0.0012 mg/kg to 0.0015 mg/kg. While all of these concentrations were above the ESL of 0.000851 mg/kg, the calculated HQ was only slightly above the benchmark value of 1 (HQ=2). USEPA Region 5 has a sediment ESL of 0.0239 mg/kg, and the HQ calculated for the maximum detected concentration is less than 1. Based on these considerations, adverse effects to aquatic life exposed to carbon disulfide are unlikely given the low detected concentrations and low calculated HQs.

<u>Semi-Volatile Organic Compounds</u>: Two SVOCs (4-methylphenol and carbazole) were retained in the BERA because the calculated HQ was above the benchmark of 1 or because an ESL was not available and so an HQ could not be calculated. These results are discussed below:

<u>4-Methylphenol</u> – 4-Methylphenol was detected in 4 out of 17 sediment samples, with concentrations ranging from 0.13 mg/kg to 2.2 mg/kg. Only one of these concentrations was above the ESL of 0.67 mg/kg, and the calculated HQ was only slightly above the benchmark value of 1 (HQ=3). Consequently, adverse effects to aquatic life exposed to carbon disulfide are unlikely given the low frequency of detection and the low detected concentrations.

<u>Carbazole</u> – Carbazole was detected in 2 out of 15 sediment samples, with concentrations ranging from 0.14 mg/kg to 0.21 mg/kg. While no ESL was available for this constituent, adverse effects to aquatic life exposed to carbazole are unlikely given the low frequency of detection, the low detected concentrations.

<u>Herbicides</u>: Three herbicides (2,4-D; dicamba; and MCPP) were retained in the BERA because the calculated HQ was above the benchmark of 1 or because an ESL was not available and so an HQ could not be calculated. 2,4-D was detected in 2 of 5 sediment samples, both of which were located along an unnamed stream below the WBG pond, and an HQ of 5 was calculated using the maximum concentration. The remaining two herbicides, dicamba and MCPP, were each

detected in only 1 of 5 sediment samples, also at a location in the unnamed stream, about 70 ft downstream from the pond. ESLs were not available for these herbicides and so HQs could not be calculated. Based on these considerations, adverse effects to aquatic life exposed to herbicides are unlikely given the low frequency of detection and the low calculated HQ.

Polycyclic Aromatic Hydrocarbons: Thirteen PAHs (2-methylnaphthalene; acenaphthene; acenaphthylene; anthracene; benzo[a]anthracene; benzo[a]pyrene; benzo[g,h,i]perylene; chrysene; dibenzo[a,h]anthracene; fluoranthene; indeno[1,2,3-cd]pyrene; phenanthrene; and pyrene) were retained in the BERA because the calculated HQ were above the benchmark of 1. Calculated HQs for these PAHs ranged from 2 to 50. As described in Section 2.4.2.4.1.4, since PAHs were COPECs in this ERA, the ESBTU approach was used to calculate a total TU which was compared to the benchmark of 1, as seen in Table A.7.ERA-6. TOC ranged between 2.2% to 5.4% at the site and averaged at 3.4%. As previously discussed, a default UF of 2.75 was applied to the total TU to obtain an accurate estimation of 50% confidence. The PAH TUs for all of the sediment samples collected from the pond at the WBG are less than 1, which means the potential for PAHs in the pond sediment to cause adverse effects to benthos (bottom dwelling aquatic organisms) is unlikely. Only 1 of the sediment samples collected from the WBG area had a PAH TU greater than 1, and that was for sample WBGSW/SD09, with a TU of 4 (Figure 7-2). This sample was collected from the unnamed stream, at a location approximately 300 ft downstream of the pond. There is another sediment sample location very close in proximity to the SD09 sample, and it is WBG-SE006; the PAH TU for this sample is less than 1 (0.07). In addition to WBG-SE006, there are 4 other sediment samples between WBGSW/SD09 and the pond, and their sample IDs are WBG-SE005, WBGSW/SD13, WBGSW/SD008, and WBGSD1. The PAH TUs for all of these locations are less than 1. Additionally, the nearest downstream sample from WBGSW/SD09 is RYSW/SD12 and the PAH TU for that location is less than 1 (0.2). Therefore, the available data suggests that the extent of sediment containing PAHs at concentrations that may present a hazard to benthic invertebrates is limited to one location (i.e., WGBSW/SD09) in the unnamed stream. No PAHs were detected in the surface water sample collected from this location. Based on these considerations, the potential for PAHs to represent a hazard to aquatic life in the WBG pond is very low, and in the unnamed stream any potential adverse effect would be limited to the immediate area near WBGSW/SD09.

Inorganics: Eleven inorganics (barium; beryllium; chromium; copper; iron; lead; manganese; silver; thallium; vanadium; and zinc) were retained in the BERA because the calculated HQ was above the benchmark of 1 or because an ESL was not available and so an HQ could not be calculated. These results are discussed below:

Barium – Barium was detected in 28 out of 28 sediment samples, with concentrations ranging from 32.3 mg/kg to 179 mg/kg. While no screening value was available for barium and no background sediment data was collected, all of these detected concentrations were below the soil background value established at the site. Consequently, adverse effects to aquatic life exposed to barium are unlikely given the similarity of detected concentrations with the site background value.

Beryllium – Beryllium was detected in 27 out of 28 sediment samples, with concentrations ranging from 0.45 mg/kg to 2.27 mg/kg. While no screening value was available for beryllium and no background sediment data was collected, all of these detected concentrations were within the range of detected soil background values at the site. Consequently, adverse effects to aquatic life exposed to beryllium are unlikely given the similarity of detected concentrations with the range of site background values.

Chromium – Chromium was detected in 28 out of 28 sediment samples, with concentrations ranging from 5.17 mg/kg to 15,400 mg/kg. While nine of these concentrations were above the ESL of 43.4 mg/kg, and no background sediment data was collected, only three of the detected concentrations were above the range of detected soil background values at the site. All nine samples above the ESL were located along the northern edge of the pond at the WBG (Figure 7-3). Five of these samples (WBGSD17, WBGSD18, WBGSD22, WBGSD23, and WBGSW/SD10) were all located within a 3,675 ft^2 area (roughly 0.08 acre), and were surrounded by samples with chromium concentrations below the ESL of 43.4 mg/kg. The remaining four samples were spread along the northern edge of the pond and could potentially cause adverse effects to sediment dwelling organisms if chronic exposure occurs to the elevated concentrations of chromium at the WBG.

Copper – Copper was detected in 28 out of 28 sediment samples, with concentrations ranging from 6.36 mg/kg to 188 mg/kg. Three of these concentrations were above the ESL of 31.6 mg/kg, and while no background sediment data was collected, all but two of the detected concentrations were below the established soil background value. In addition, the calculated HQ was only slightly above the benchmark value of 1 (HQ=2). Consequently, adverse effects to aquatic life exposed to copper are unlikely given the similarity of detected concentrations with the soil background value, and the low calculated HQ.

Iron – Iron was detected in 28 out of 28 sediment samples, with concentrations ranging from 8,530 mg/kg to 293,000 mg/kg. Twelve concentrations were above the ESL of 20,000 mg/kg, and while no background sediment data was collected, all but one of these detected concentrations were below the soil background value established at the site. In addition, the calculated HQ for the maximum concentration was only slightly above the benchmark value of 1 (HQ=4). Consequently, adverse effects to aquatic life exposed to iron are unlikely given the similarity of detected concentrations with the soil background value, and the low calculated HQ.

Lead – Lead was detected in 32 out of 32 sediment samples, with concentrations ranging from 5.61 mg/kg to 109,000 mg/kg. While 19 of these concentrations were above the ESL of 35.8 mg/kg, and no background sediment data was collected, only 8 detected concentrations were outside the range of soil background concentrations (2.1 mg/kg to 256 mg/kg) reported at the site. All but one of these concentrations were located within a 2,450 ft2 area (approximately 0.06 acre) along the northern edge of the pond at the WBG (Figure 7-3). In addition, the maximum detected concentration of 109,000 mg/kg was surrounded by samples below the ESL of 35.8 mg/kg, and this area encompasses approximately 0.06 acre (2,450 ft^2). While it is possible that adverse effects might occur to benthic organisms exposed to this elevated lead concentration, the potential for lead to represent a significant and widespread ecological hazard in the pond is unlikely due to the localized and small spatial extent. Overall, significant adverse effects to aquatic life exposed to lead are unlikely given the similarity of the majority of detected concentrations with the range of site background values, and the limited spatial extent of affected sediments. Additionally, lead was further evaluated in the aquatic food chain model.

Manganese – Manganese was detected in 28 out of 28 sediment samples, with concentrations ranging from 25.9 mg/kg to 2,310 mg/kg. While five of these concentrations were above the ESL of 460 mg/kg, and no background sediment data was collected, all of the detected concentrations were below the established soil background value. In addition, the calculated HQ was only slightly above the benchmark value of 1 (HQ=2). Consequently, adverse effects to aquatic life exposed to manganese are unlikely given the similarity of detected concentrations with the soil background value, and the low calculated HQ.

Silver – Silver was detected in 4 out of 26 sediment samples, with concentrations ranging from 0.79 mg/kg to 8.42 mg/kg. Only two of these concentrations were above the ESL of 1 mg/kg, which were both located on the northern edge of the pond, and the refined HQ of 8 was calculated using the maximum concentration. Based on the limited occurrence of silver and the relatively low calculated HQ, adverse effects to aquatic life exposed to silver are unlikely. Additionally, silver was further evaluated in the aquatic food chain model.

Thallium – Thallium was detected in 12 out of 28 sediment samples, with concentrations ranging from 0.1 mg/kg to 1.7 mg/kg. While no screening value was available for thallium and no background sediment data was collected, all of these detected concentrations were below the established soil background value at the site. Consequently, adverse effects to aquatic life exposed to thallium are unlikely given the similarity of detected concentrations with the site background value.

Vanadium –Vanadium was detected in 28 out of 28 sediment samples, with concentrations ranging from 14 mg/kg to 106 mg/kg. While no screening value was available for vanadium and no background sediment data was collected, all of these detected concentrations were below the established soil background value at the site. Consequently, adverse effects to aquatic life exposed to vanadium are unlikely given the similarity of detected concentrations with the site background value.

Zinc – Zinc was detected in 28 out of 28 sediment samples, with concentrations ranging from 17.1 mg/kg to 17,300 mg/kg. While three of these concentrations located at the pond were above the ESL of 121 mg/kg, only one concentration was detected above the range of detected soil background values at the site. In addition, the maximum concentration was surrounded by samples with zinc below the ESL (Figure 7-3). Based on this information, the spatial extent of affected sediment is limited in size and not expected to represent a significant ecological concern. Additionally, zinc was further evaluated in the aquatic food chain model.

Thirty-four constituents were identified as bioaccumulative and were evaluated in the aquatic food chain model.

7.5.3.3 Surface Water

Twenty-five COPECs in surface water were carried forward into the BERA. When refined EPCs were compared with the ESLs, 10 constituents (anthracene; aluminum; arsenic; barium; beryllium; copper; iron; lead; manganese; and thallium) had a refined HQ greater than 1. In addition, an ESLs was not available for MCPP. The BERA results for surface water COPECs at the WBG are presented in Table A.7.ERA-7 and are discussed below:

Herbicides: One herbicide, MCPP, was retained in the BERA because an ESL was not available and so an HQ could not be calculated. This COPEC was detected in only 1 of 5 samples, at a very low concentration (i.e., < 0.1 mg/kg). Based on these considerations, adverse effects to aquatic life potentially exposed to MCPP are unlikely.

Polycyclic Aromatic Hydrocarbons: One PAH, anthracene, as retained in the BERA because the calculated HQ was greater than the benchmark value of 1. This COPEC was detected in only 2 of the 15 surface water samples, with a calculated HQ that was only slightly above the benchmark of 1 (HQ=3). Consequently, adverse effects to aquatic life exposed to this PAH are unlikely given the limited occurrence and low calculated HQ.

Inorganics: Nine inorganics (aluminum; arsenic; barium; beryllium; copper; iron; lead; manganese; and silver) were retained in the BERA because the calculated HQs were greater than the benchmark value of 1. These results are discussed below:

Aluminum – Aluminum was detected in 13 out of 13 surface water samples, with concentrations ranging from 0.0392 mg/ L to 0.811 mg/L. While all of these concentrations were above the ESL of 0.087 mg/L, the calculated HQ was only slightly above the benchmark value of 1 (HQ=4). Furthermore, the ESL used is from USEPA (2008c) Region 3 and is based on a water quality criterion protective of salmonids (i.e., coldwater habitat species of fish such as trout and salmon) which is likely overly conservative for the type of warmwater habitat (and associated aquatic species) that is prevalent in this locale. When an alternative screening value of 0.46 mg/L from Sample et al. 1996 was used, an HQ of less than 1 was calculated. This alternative screening value is based on the lowest chronic value of aquatic life, and is considered to be a more representative screening value for aluminum at the WBG than the Region 3

ESL. Based on these considerations, adverse effects to aquatic life exposed to aluminum are unlikely.

Arsenic – Arsenic was detected in 2 out of 13 surface water samples, with concentrations ranging from 0.0086 mg/ L to 0.0104 mg/L. While both of these concentrations were above the ESL of 0.005 mg/L, the calculated HQ was only slightly above the benchmark value of 1 (HQ=2). Consequently, adverse effects to aquatic life exposed to arsenic are unlikely given the limited occurrence and the low calculated HQ. Additionally, arsenic was further evaluated in the aquatic food chain model.

Barium – Barium was detected in 13 out of 13 surface water samples, with concentrations ranging from 0.054 mg/L to 0.148 mg/L. While all of these samples were greater than the ESL of 0.004 mg/L, the ESL used from USEPA (2008c) Region 3 was based on a secondary chronic value from Suter et al. 1996a, and was established using an extremely limited dataset. An alternative aquatic ESL of 0.22 mg/L from USEPA (2003e) Region 5 was found, which is considered to be a more representative screening value. When this ESL was used, an HQ of less than 1 was calculated. Based on these considerations, adverse effects to aquatic life exposed to barium are unlikely.

Beryllium – Beryllium was detected in 1 out of 13 surface water samples, with a concentration of 0.0011 mg/L. Although this concentration was above the ESL of 0.00066 mg/L, the calculated HQ was only slightly above the benchmark value of 1 (HQ=2). Additionally, when an alternative ESL of 0.0036 mg/L from USEPA (2003e) Region 5 was used, an HQ of less than 1 was calculated. Based on these considerations, adverse effects to aquatic life exposed to beryllium are unlikely.

Copper – Copper was detected in 6 out of 13 surface water samples, with concentrations ranging from 0.0011 mg/L to 0.0235 mg/L. Only four of these concentrations were above than the ESL of 0.009 mg/L, and the calculated HQ was only slightly above the benchmark value of 1 (HQ=2). In addition, this ESL is based on a default hardness value of 100 mg/L. A site-specific hardness value of 251 mg/L (average at the WBG area) was used to calculate an ESL of 0.01966 mg/L. When this ESL was used, an HQ of less than 1 was calculated. Based on these considerations, adverse effects to aquatic life exposed to copper are unlikely given the low calculated HQs. Additionally, copper was further evaluated in the aquatic food chain model.

Iron – Iron was detected in 14 out of 15 surface water samples, with concentrations ranging from 0.0416 mg/L to 50.9 mg/L. While six of these concentrations were greater than the ESL of 0.3 mg/L, as previously stated, the surface water samples were not filtered, and as such the results represent total iron. Therefore, it is not known what portion, if any, of the iron is in the dissolved (i.e., filtered) form. It is possible that even though the total iron concentrations exceed the ESL, the dissolved (and therefore bioavailable) iron concentrations may in actuality not exceed the ESL. Based on these considerations, adverse effects to aquatic life exposed to iron may not occur.

Lead – Lead was detected in 11 out of 18 surface water samples, with concentrations ranging from 0.00017 mg/L to 0.106 mg/L. Only five of these concentrations were above than the ESL of 0.0025 mg/L, which was based on a default hardness value of 100 mg/L. A site-specific hardness value of 251 mg/L (average at the WBG area) was used to calculate an ESL of 0.044 mg/L. When the ESL of 0.044 mg/L was used along with the EPC of 0.0248 mg/L, an HQ of less than 1 was calculated. Consequently, adverse effects to wildlife exposed to lead are unlikely when using site-specific ESLs. Additionally, lead was further evaluated in the aquatic food chain model.

Manganese – Manganese was detected in 14 out of 15 surface water samples, with concentrations ranging from 0.002 mg/ L to 1.47 mg/L. Only one of these concentrations was above than the ESL of 0.12 mg/L. In addition, as previously stated the surface water samples were not filtered, and as such the results represent total manganese. Therefore, it is not known what portion, if any, of the manganese is in the dissolved (i.e., filtered) form. It is possible that even though the total manganese concentrations exceed the ESL, the dissolved (and therefore bioavailable) manganese concentrations may in actuality not exceed the ESL. Based on these considerations, adverse effects to wildlife exposed to manganese are unlikely.

Thallium – Thallium was detected in 2 out of 13 surface water samples, with concentrations ranging from 0.0023 mg/L to 0.0054 mg/L. While both concentrations were above the ESL of 0.0008 mg/L, the ESL used from USEPA (2008c) Region 3 was based on a Canadian Water Quality value. When an alternative ESL of 0.01 mg/L from USEPA (2005e) Region 5 was used, an HQ of less than 1 was calculated. This alternative screening value is based on a Tier II Michigan water quality value established using a robust set of toxicological data for aquatic life. This value is considered to be a more representative screening value for thallium. Based on these considerations and the low frequency of detection, adverse effects to aquatic life exposed to thallium are unlikely.

Twelve COPECs were also identified as bioaccumulative and were evaluated in the aquatic food chain model.

7.5.4 Refinement of Assessment and Measurement Endpoints for Bioaccumulative COPECs

Food chain modeling was conducted at the WBG in order to evaluate the potential ecological effects of the bioaccumulative COPEC in soil, sediment, and surface water on the receptors identified in Section 2.4. COPECs identified in soil were evaluated in the terrestrial food chain, and COPECs identified in sediment and surface water were evaluated in the aquatic food chain. The results for both the maximum and refined scenarios of these models are presented in Tables A.7.ERA-8 through A.7.ERA-15, and the results of each of the refined scenarios are discussed in the subsections below.

7.5.4.1 Terrestrial Food chain Model

As summarized in Table A.7.ERA-16, the refined scenario NOAEL HQs and LOAEL HQs for the short-tailed shrew (Tables A.7.ERA-8 and A.7.ERA-9) were less than 1 for all of the bioaccumulative COPECs, with the exception of dibenzo(a,h)anthracene and zinc. The dibenzo(a,h)anthracenen NOAEL HQ was 4 and the LOAEL HQ was 0.4 and the zinc NOAEL HQ was 8 and the LOAEL was 0.8. The NOAEL is a very conservative screening criterion while the LOAEL indicates a concentration above which adverse impacts to individual mammals and birds may occur. For the American robin (Tables A.7.ERA-10 and A.7.ERA-11), the refined scenario NOAEL HQs and LOAEL HQs were less than 1 for all of the bioaccumulative COPECs, with the exception of lead. The NOAEL and LOAEL HQs for lead were 3 and 0.3, respectively. When it is considered that the NOAEL is a very conservative toxicity screening value, and the HQs for the more realistic LOAEL are less than 1, then these results indicate that individual short-tailed shrews and American robins (or other insectivorous mammals and birds) exposed to these COPECs are not expected to experience adverse effects.

Based on the overall analysis of terrestrial food chain modeling HQs and consideration of the limited spatial extent of impacted soils, adverse effects are not expected for short-tailed shrews (and other insectivorous mammals) and American robins (and other insectivorous birds) populations exposed to bioaccumulative COPECs in soil at the WBG.

7.5.4.2 Aquatic Food chain Model

As summarized in Table A.7.ERA-17, the refined scenario NOAEL HQs and LOAEL HQs for both the mink (Tables A.7.ERA-12 and A.7.ERA-13) and the great blue heron (Tables A.7.ERA-14 and A.7.ERA-15) were less than or equal to 1 for all 34 of the bioaccumulative COPECs identified in sediment and/or surface water.

7.5.5 Ecological Risk Summary

Screening-level and baseline risk assessments were completed for the WBG. After the SLERA, 38 constituents were selected as COPECs in surface soil, 55 constituents were selected as COPECs in sediment, and 25constituents were selected as COPECs in surface water because the HQs were greater than 1 or an HQ could not be calculated because an ESL was not available. After the BERA, 36 constituents in surface soil, 52 constituents in sediment, and 23 constituents in surface water were retained because the HQs were greater than 1, the chemical was bioaccumulative or an HQ could not be calculated because an ESL was not available. Food chain modeling was evaluated for all those constituents identified as bioaccumulative.

Tables A.7.ERA-16 and A.7.ERA-17 summarize the constituents in surface soil, sediment, and surface water carried through the BERA and evaluated in the terrestrial and/or aquatic food chain model. As shown in Table A.7.ERA-16, the refined scenario NOAEL HQ for zinc was greater than 1 for the short-tailed shrew, and the refined scenario NOAEL HQs for lead and zinc were greater than 1 for the American robin. While the potential does exist for unacceptable risk to individual insectivorous mammals and birds exposed to surface soils containing affected concentrations of these COPECs, when these results are considered in conjunction with pertinent site information on the limited spatial distribution and extent of these constituents in surface soil, the potential for population-level effects are low.

As shown in Table A.7.ERA-17, the refined scenario NOAEL HQ for the mink and great blue heron were all below 1, indicating no risk to piscivorous species. Based on the overall analysis of aquatic food chain modeling HQs, adverse effects are not expected for aquatic life exposed to bioaccumulative COPECs in sediment and/or surface water at the WBG,.

7.6 WBG Summary and Conclusions

The WBG was formerly used as a burning ground to decontaminate explosives contaminated material and to dispose of excess and off-spec explosives/energetics

Western Burning Ground

during historical site operations. The main burn area was approximately 170 ft long by 100 ft wide and is surrounded on three sides by an approximately 4 ft high earthen berm. A dirt road runs parallel to the open side of the former burn area, leading north to Alger Road, and south to the top of a steep slope above an unnamed pond. The dirt road was reportedly constructed on top of an ashy layer of material extending from the burning ground at the time of the pond construction. The pond was constructed during the early 1990s and is fed by Wiggins Spring at the northwest (upgradient) end of the pond. The pond also collects runoff from the surrounding area through a series of storm water ditches/culverts. The WBG is no longer active.

The HHRA evaluated potential current exposure of site workers to surface soil, surface water, and sediment, potential future exposures of construction workers to total soil and potential future residential exposure to total soil, surface water, sediment, and fish caught in the pond at the WBG. In addition, the HHRA evaluated potential exposures to participants in the semi-annual fish rodeo and exposures to hypothetical workers and hypothetical residents under future conditions if the pond were drained. The soil, sediment, and surface water COPCs were evaluated for direct contact.

A current or future site worker could be present at the WBG area, and could be exposed to surface soil, sediment, or surface water. The total cumulative ELCR for site workers exposed to surface soil, sediment, and surface water at the WBG is 1×10^{-5}, which is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for site workers is 0.4, which is less than the benchmark of 1. The projected blood lead levels were below the benchmark of 10 µg/dL.

A hypothetical future construction worker could be present at the WBG area, and could be exposed to combined surface and subsurface soil. The total cumulative ELCR for hypothetical future construction workers exposed to combined surface and subsurface soil at the WBG was 5×10^{-7}, which is below the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for hypothetical future construction workers is 0.5, which is less than the benchmark of 1. The projected blood lead levels were below the benchmark of 10 µg/dL.

A hypothetical future resident could be present at the WBG area, and could be exposed to combined surface and subsurface soil, sediment, or surface water. The total cumulative ELCR for hypothetical future residents exposed to combined surface and subsurface soil, sediment, and surface water at the WBG is 5×10^{-5}, which is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for hypothetical future adult residents is 0.8, which is below the benchmark of 1. Exposure to lead in soil and sediment was evaluated and this exposure could cause elevated blood lead levels. Exposure to lead in sediments, although intermittent in nature, contributed to the elevated blood lead levels.

The total cumulative HI for hypothetical future child residents is 6, which is above the benchmark of 1. When the HIs were segregated by target site and critical effects, only exposure to chromium in sediments resulted in an HI greater than 1. None of the other HIs were greater than 1. Blood lead level estimates for the hypothetical child resident receptor from exposure to lead in soil and sediment could result in an elevated blood lead level based on a cumulative exposure. This elevated blood lead level was due to the contribution of sediments to the overall exposure. Exposure to lead in soil was not likely to cause elevated blood lead levels.

The total cumulative ELCRs for hypothetical future site workers, construction workers, and residents under future conditions were the pond to be drained were all below or within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The only total cumulative HI that exceeded the benchmark of 1 was for the hypothetical future child resident. When the HIs were segregated by target site and critical effects, only exposure to chromium in sediments resulted in an HI greater than 1. None of the other HIs were greater than 1.

Based on the results of the risk assessment, it is unlikely that industrial use of the property would result in adverse health effects. For the residential exposure scenarios, exposure to lead in sediments may pose an adverse health effect. Also, exposure to chromium in sediments may pose a slightly elevated hazard to children wading in surface water. The maximum chromium sediment concentration of 15,400 mg/kg is well above the background range.

A SLERA and BERA were completed for the WBG, to evaluate surface soil, sediment, and surface water for ecological receptors, and food chain modeling was evaluated for all those constituents identified as bioaccumulative. The results of the evaluation of the SLERA and BERA for direct contact and the constituents evaluated in the terrestrial food chain model indicate that while some of the NOAEL and LOAEL HQs were greater than 1, when these results are considered in conjunction with pertinent site information on the limited spatial distribution and extent of these constituents, adverse effects of these COPECs at the population-level are unlikely at the WBG.

Similarly, the results of the sediment and surface water evaluation of the SLERA and BERA for direct contact and the constituents evaluated in the aquatic food chain model indicate adverse effects are not expected for aquatic life exposed to bioaccumulative COPECs in sediment and/or surface water at the WBG.

8. RFAAP-NRU Groundwater

Groundwater at the RFAAP-NRU is considered to be a facility-wide resource, rather than specific to any of the individual Study Areas. Therefore, the groundwater investigation activities performed at the RFAAP-NRU will be discussed on a facility-wide basis. This section presents the human health and ecological risk assessments for groundwater.

8.1 Risk Assessment Datasets

Data generated from the site characterization activities were used in the risk assessment. The groundwater risk assessment dataset was prepared then summarized and statistically analyzed per methods described in Section 2.2. Table A.8.HHRA-1 presents the groundwater risk assessment dataset summary highlighting the number of detects, number of samples, FOD, minimum and maximum detected concentrations, minimum and maximum detection limits, and EPCs.

The groundwater dataset included data collected from the springs and the groundwater monitoring wells. While the spring samples were evaluated for both human health and ecological risk, the remaining groundwater samples were only evaluated for human health risk, as exposure to groundwater by ecological receptors is unlikely. The ecological risks for the spring samples collected at the RY and the WBG were evaluated as part of the surface water data sets collected at those sites, and are discussed in Sections 6 and 7, respectively. Due to the Karst formation, the presence of colloidal particles measured as turbidity in the groundwater samples resulted in elevated levels of trace metals. This was evidenced by the 2007 groundwater inorganic data. Therefore, a supplemental round of groundwater samples was collected in 2008 and analyzed for metals using low flow techniques to replace the 2007 inorganic data. An additional round of groundwater samples was collected in March 2010. Among these sampling events, adequate data were available to exclusively use inorganic data from filtered samples for assessing risk through exposure to dissolved phase inorganic constituents in groundwater used as a potable water supply.

8.2 Human Health Risk Assessment

The purpose of this risk assessment is to evaluate the potential current and future risks and hazards to human health associated with potential exposure to constituents detected in groundwater samples collected at the RFAAP-NRU. The risk assessment approach follows the approach outlined in the Radford Army Ammunition Plant Final

Master Work Plan (URS 2003) which is based on USEPA guidance for risk assessments (USEPA 2004a; 2000a; 1997a; 1992; 1991a; 1989).

This section summarizes the occurrence of constituents in groundwater and identifies groundwater and presents the estimated human health risks associated the relevant human exposure scenarios. The methodologies for the selection of COPCs, the exposure assessment, and the toxicity assessment for the HHRA are presented in Section 2.2.

8.2.1 Selection of Constituents of Potential Concern

Groundwater COPCs were selected by comparing the analytical data with USEPA (2009a) adjusted tap-water RSLs. Table A.8.HHRA-2 presents the selection of groundwater COPCs for the HHRA. Chloroform and dioxin/furan compounds were the only organic constituents that were identified as groundwater COPCs. Two explosive compounds were also detected and selected as COPCs. Several inorganic constituents were also identified as COPCs as discussed below.

Three VOCs (acetone, chloroform, and toluene) were detected in groundwater. Only chloroform was detected in concentrations above the USEPA (2009a) tap water RSL. As a result, only chloroform was identified as a groundwater COPC.

Seventeen dioxin/furan compounds (1,2,3,4,6,7,8-HpCDD; 1,2,3,4,6,7,8-HpCDF; 1,2,3,4,7,8,9-HpCDF; 1,2,3,4,7,8-HxCDD; 1,2,3,4,7,8-HxCDF; 1,2,3,6,7,8-HxCDD; 1,2,3,6,7,8-HxCDF; 1,2,3,7,8,9-HxCDD; 1,2,3,7,8,9-HxCDF; 1,2,3,7,8-PeCDD; 1,2,3,7,8-PeCDF; 2,3,4,6,7,8-HxCDF; 2,3,4,7,8-PeCDF; 2,3,7,8-TCDD; 2,3,7,8-TCDF; OCDD; and OCDF) were detected in groundwater. Ten of these constituents (11,2,3,4,7,8-HxCDD; 1,2,3,4,7,8-HxCDF; 1,2,3,6,7,8-HxCDF; 1,2,3,7,8,9-HxCDD; 1,2,3,7,8,9-HxCDF; 1,2,3,7,8-PeCDD; 1,2,3,7,8-PeCDF; 2,3,4,7,8-PeCDF; 2,3,7,8-TCDD; and 2,3,7,8-TCDF) were detected above the USEPA (2009a) tap water RSL values, and as a result, were identified as COPCs for groundwater.

Three explosives, nitrobenzene, pentaerythritol tetranitrate, and perchlorate, were detected in groundwater. Perchlorate was detected at concentrations below the USEPA (2009a) tap water RSL, and as a result, was not selected as a COPC for groundwater. Nitrobenzene was detected above the tapwater RSL, and thus was included as a COPC. Pentaerythritol tetranitrate was also detected; it was retained as a COPC based on the lack of a tapwater RSL.

Groundwater

Two PAHs (naphthalene and phenanthrene) were detected in groundwater. Both of these constituents were detected at concentrations below the adjusted tap water RSLs, and as a result, were not selected as COPCs for groundwater.

Fourteen inorganic constituents were detected in the groundwater samples namely: aluminum; arsenic; barium; calcium; chromium; cobalt; copper; iron; magnesium; manganese; nickel; potassium; sodium; and zinc. Four of these constituents (calcium; magnesium; potassium; and sodium) are essential nutrients and are not identified as groundwater COPCs. Maximum concentrations of threeother inorganic constituents (arsenic; iron; and manganese) in filtered groundwater samples exceeded the USEPA (2009a) tap water RSLs and were therefore identified as COPCs for groundwater.

8.2.2 Determination of Exposure Point Concentrations

Fifteen constituents were selected as COPCs in groundwater based on data from the groundwater samples because they were present at maximum concentrations that were above the adjusted tap-water RSL values. The distribution testing and UCL calculations were performed as described in Section 2.2.6.1, and the EPCs for these COPCs are summarized in Table A.8.HHRA-3.

8.2.3 Human Health Risk Characterization

Groundwater exposure pathways include direct contact pathways when groundwater is used as a potable water supply and inhalation of vapors from groundwater. The inhalation pathway is complete under two scenarios. Vapors can occur in ambient air from water used as a potable water supply (e.g., during residential showering). Vapors can also be present in indoor air through subsurface vapor intrusion into buildings.

The physical and chemical properties and toxicity values used to evaluate excess lifetime cancer risks and non-cancer hazards are presented in Tables A.2-3 through A.2-9. The exposure assumptions used to evaluate potentially exposed receptors are presented in Table A.2-10. The equations used in the risk characterization calculations are presented in Table A.2-15.

The excess lifetime cancer risks and non-cancer hazards for each potentially exposed receptor included in the risk assessment for the RFAAP-NRU are discussed in the subsections below.

Groundwater

8.2.3.1 Site Worker

Risks to commercial/industrial receptors (site workers) exposed to groundwater as a potable source at the NRU is not expected to occur and the current land use associated with the site is not expected to change. As a result, future use of the site groundwater as a potable source for industrial purposes is considered unlikely, but was considered as a conservative measure. Risks were estimated for all COPCs. Risks to commercial/industrial receptors exposed to vapors indoors due to subsurface vapor intrusion were assessed using the USEPA vapor intrusion model.

The ELCR and non-cancer hazard index for site worker exposure to ingestion and dermal contact with groundwater are presented in Table A.8.HHRA-6 and summarized in Table A.8.HHRA-7. The ELCR for groundwater is within the USEPA target risk range, and the HI is below the benchmark value of 1. Model outputs for the vapor intrusion evaluation are presented in Table A.8.HHRA-10. The ELCR for a site worker from exposure to vapors in indoor air due to subsurface vapor intrusion was 2×10^{-8} which is well below the target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative ELCR for site worker exposed to groundwater, presented in Table A.8.HHRA-4, is 4×10^{-5}, which is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for site workers is 0.4, which is below the benchmark of 1.

8.2.3.2 Hypothetical Future Residents

Residential development of the NRU is not expected to occur and the current land use associated with the site is not expected to change. As a result, future use of the site for residential purposes is considered unlikely, but was considered as a conservative measure. Risk to the potential future resident receptor from exposure to groundwater was evaluated. Risks were estimated for all COPCs. For inorganic COPCs, risks were calculated using EPCs based on the filtered groundwater samples.

The ELCRs and non-cancer hazard index for hypothetical future residential exposure to groundwater through the direct ingestion exposure pathway are presented in Tables A.8.HHRA-4 and A.8.HHRA-5, and are summarized in Table A.8.HHRA-7. Exposure of the hypothetical future adult and child resident was also evaluated for the vapor intrusion pathway. The results are summarized in Tables A.8.HHRA-8 and A.8.HHRA-9 and are discussed below.

The total cumulative ELCR for hypothetical future residents exposed to groundwater, presented in Table A.8.HHRA-4, is 2×10^{-4}, which is slightly above the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for hypothetical future adult residents is 0.6, which is below the benchmark of 1. The total cumulative HI for hypothetical future child residents is 1, which is equal to the benchmark of 1.

The risk drivers for cancer risk are arsenic and the combined dioxin and furan congeners. During the 2010 sampling event, arsenic was only detected in one filtered sample (IAA-MW02) at a concentration (1.83 µg/L) that was below the Federal maximum contaminant level (MCL) of 10 µg/L. Arsenic was not detected in any of the filtered samples during the 2008 sampling event. The dioxin and furan congeners that are driving the cancer risks were detected in several groundwater samples during the 2007 sampling event at concentrations greater than the USEPA RSLs. However, most of these constituents were also detected in the rinse blank associated with those samples, which indicated a potential cross contamination issue with the sampling or laboratory equipment. All of the detections during the 2007 sampling event were also below the reporting limit and were qualified as "estimated". During the 2010 sampling event, only one dioxin constituent was detected in a single monitoring well, and the concentration was well below the USEPA RSL, which further indicates dioxin/furan detections from the 2007 sampling event are likely not indicative of groundwater quality at RFAAP-NRU.

Tables A.8.HHRA-8 and A.8.HHRA-9 present the input parameters and the results of the vapor intrusion model for hypothetical future residents. The calculated ELCR was 3×10^{-8}, which is well below the USEPA target risk range of 1×10^{-6} to 1×10^{-4} and the risk estimate for the tapwater ingestion pathway. The hazard index was 3×10^{-6} for both the hypothetical future adult and child resident, which is well below the benchmark of 1.

8.3 NRU Groundwater Summary and Conclusions

An HHRA was conducted to evaluate potential exposure to constituents detected in groundwater. Exposure of hypothetical future residents and site workers to constituents in groundwater assuming the groundwater was used as a potable water supply was evaluated in the risk assessment. Potential exposure of site workers and potential future residents was also evaluated for the vapor migration pathway.

Groundwater

Summary of Calculated ELCRs and HIs for Receptor Exposure Scenarios

RECEPTOR/ EXPOSURE MEDIUM – SCENARIO	ELCR	HI
Site Worker		
Groundwater - Potable Use and Subsurface Vapor Intrusion	4E-05	0.4
Hypothetical Future Adult Resident		
Groundwater - Potable Use and Subsurface Vapor Intrusion		0.6
Hypothetical Future Child Resident		
Groundwater - Potable Use and Subsurface Vapor Intrusion		1
Hypothetical Future Resident (Adult and Child)		
Groundwater - Potable Use and Subsurface Vapor Intrusion	2E-04	

The excess lifetime cancer risks calculated for site worker exposure to groundwater used as a potable water supply was 4×10^{-5}. This is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The hazard index was calculated to be 0.4, which was below the benchmark of 1.

The excess lifetime cancer risks calculated for hypothetical futureresident exposure to groundwater used as a potable water supply was 2×10^{-4}. This is slightly above the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The risk drivers for cancer risk are arsenic and the dioxin and furan congeners.

The hazard index for a hypothetical adult resident was calculated to be 0.6, which was below the benchmark of 1. The hazard index or a hypothetical child resident was calculated to be 1, which is equal to the benchmark of 1.

The calculated risks to site workers via the vapor intrusion exposure pathway were well below the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. Exposure of hypothetical future adult and child residents through the vapor intrusion exposure pathway yielded similar, very low results.

The risk drivers for the excess lifetime cancer risk are arsenic and the dioxin and furan congeners. Arsenic was detected in 1 out of the 18 samples collected; however, this detection was below the MCL. The dioxin congeners were detected in three groundwater samples at concentrations greater than the USEPA RSLs. Many of the dioxin compounds were detected in the rinse blank which indicates a potential cross contamination issue associated with the sampling or laboratory equipment. All of the detections were below the reporting limit and were qualified as estimated. Furthermore, the dioxin and furan congeners were not detected in the groundwater samples collected during the 2010 confirmation sampling event which provides futher evidence that the detections driving the elevated risk levels are not indicative of groundwater quality at the facility.

9. NRU Summary and Conclusions

Human health and ecological risk assessments were performed for the areas of the RFAAP-NRU. The purpose of the risk assessments was to evaluate the potential current and future excess lifetime cancer risks and potential hazards to both human and ecological receptors at the site from exposure to constituents detected in soil, groundwater, surface water, and sediment at the RFAAP-NRU.

The primary findings of the assessment are summarized in table below and discussed in the following sections. In particular, discussions regarding the BDDT and the WBG describe the findings where alternative data combinations and receptors were considered. None of the risk estimates for these additional scenarios or receptors were significantly different from the findings of the primary evaluations. That is, no risk-based findings regarding of suitability of any area for a particular use would change under conditions considered in the additional evaluations at the BDDT or WBG.

Summary of Calculated Total ELCRs and HIs for All Constituents Except Lead

Exposure Area	Receptor	ELCR	HI	Risk/Hazard Drivers
BDDT (Entire)	Current Site Worker	7E-05	0.6	-
	Future Construction Worker	2E-06	1	-
	Future Resident	4E-04	0.6 adult, 5 child	Benzo(a)pyrene, Cobalt
BLA	Current Site Worker	1E-04	0.8	-
	Future Construction Worker	7E-06	3	Copper
	Future Resident	1E-03	1 adult, 12 child	Benzo(a)pyrene, Copper, Cobalt, Aroclor 1254
IAA	Current Site Worker	1E-04	1	-
	Future Construction Worker	6E-06	3	*
	Future Resident	5E-04	1 adult, 13 child	2,4-DNT, Aroclor 1254, copper
RY	Current Site Worker	1E-04	0.4	-
	Future Construction Worker	5E-06	0.7	-
	Future Resident	3E-04	0.6adult, 3 child	Pentachlorophenol, cobalt

Summary of Calculated Total ELCRs and HIs for All Constituents Except Lead (continued)

Exposure Area	Receptor	ELCR	HI	Risk/Hazard Drivers
WBG	Current Site Worker	1E-05	0.4	-
	Future Construction Worker	5E-07	0.5	-
	Future Resident	5E-05	0.8 adult, 6 child	Chromium
GW	Site Worker	4E-05	0.4	-
	Future Resident	2E-04	0.6 adult, 1 child	Arsenic, Dioxins/Furans

*When segregated by target organ/critical effect, HI did not exceed 1.

Summary of Estimated Blood Lead Levels

Exposure Area	Receptor	Estimated Blood Lead Level (µg/dL)		
		Adult	Child	Fetus
		50th	Range	95th percentile
BDDT	Not a COPC in this area			
BLA	Current Site Worker	5	–	17
	Future Construction worker	5	–	18
	Future Adult Resident	7	–	23
	Future Child Resident	–	11 - 18	–
IAA	Current Site Worker	3	–	10
	Future Construction	3	–	10
	Future Adult Resident	3	–	11
	Future Child Resident	–	4.4 - 8.2	–
RY	Not a COPC in this area			
WBG	Current Site Worker	2	–	7
	Future Construction	2	–	7
	Future Adult Resident	2	–	7
	Future Child Resident	–	3 - 6	–
GW	Not a COPC in groundwater			

9.1 BDDT

An HHRA was conducted to evaluate exposure to COPCs in surface soil, combined surface and subsurface soil, sediment, and surface water for site workers, construction workers, hypothetical adult residents, and hypothetical child residents under both current and future land-use conditions. Risk findings considering the entire BDDT are summarized above. The results of the HHRA indicate that potential risks associated with the site are within acceptable ranges for current and future industrial use of the site. For hypothetical residential exposures, the calculated excess lifetime cancer risks and hazards were above the USEPA's target risk range of 1 × 10^{-6} to 1 × 10^{-4} or greater than the hazard index of 1. Excess risks were associated with exposure to benzo(a)pyrene in soil. The hazard index was due to the maxium concentration of cobalt in surface soil, the only concentration exceeding the background range. An additional set of calculations evaluating exposure to the rip rap portion alone indicated that risks would be lower there than for the BDDT as a whole. The results of the HHRA indicate that residential redevelopment of the BDDT area as a whole or the rip rap portion alone would not result in risks or hazards outside the regulatory benchmarks, with the exception of residential exposure to benzo(a)pyrene and the maximum concentration of cobalt. Exposure to cobalt resulted in elevated hazards for adult and child residents. All of the other detections of cobalt at the BDDT were within the background range.

A SLERA and BERA were completed for the BDDT, to evaluate surface soil, sediment, and surface water for ecological receptors, and food chain modeling was evaluated for all those constituents identified as bioaccumulative. The results of the evaluation of the SLERA and BERA for direct contact and the constituents evaluated in the terrestrial and aquatic food chain models indicate that adverse effects are not expected for wildlife at the BDDT.

The results of the HHRA and ERA indicated that potential risks associated with the site are within acceptable ranges for current and future industrial use of the site. The risk drivers for a residential use scenario are benzo(a)pyrene and cobalt. Cobalt was only detected in one isolated sample at a concentration above an applicable screening level. The elevated cobalt detection is unlikely the result of disposal activities at the site and is likely naturally occurring.

9.2 BLA

For the purposes of the HHRA, surface soil, total soil, surface water and sediment were evaluated for both current and future land-use conditions. Under current land-use conditions, site worker exposures to surface soil, surface water, and sediment were evaluated. Under future conditions, the site worker exposures remained the same as the current exposures and construction or excavation worker, adult resident and child resident exposures to total soil, surface water, and sediment were evaluated.

The potential cumulative risk for site workers exposed to surface soil and sediment at the BLA under current and future land-use conditions was at the high end of USEPA's target risk range of 1 × 10^{-6} to 1 × 10^{-4} for health protectiveness at Superfund sites

(USEPA, 1990). The potential cumulative HI for site workers was less than the benchmark of 1.

The potential cumulative risk for construction workers were within the USEPA's target risk range of 1×10^{-6} to 1×10^{-4} for health protectiveness at Superfund sites (USEPA, 1990). The potential cumulative HI for construction workers was above the benchmark of 1. When the HI was segregated into target site and critical effects, hazards were above the benchmark of 1 for the gastrointestinal tract due to the presence of copper.

The total cumulative ELCR for hypothetical future residents exposed to combined surface and subsurface soil, sediment, and surface water was greater than the USEPA target risk range of 1×10^{-6} to 1×10^{-4}, due to the presence of benzo(a)pyrene. The total cumulative HI for hypothetical future adult residents was 1, which is equal to the benchmark of 1. The total cumulative HI for hypothetical future child residents is 12, which is greater than the benchmark of 1. When the HI is segregated into target site and critical effects, hazards were above the benchmark of 1 in the central nervous system, whole body, and immune system, in the gastrointestinal tract, and in the eyes, nails, hair, and skin, due to the presence of Aroclor 1254, copper, and cobalt.

Lead was a constituent of potential concern for each of the receptors considered in the BLA risk assessment. Exposure to lead is evaluated differently than the other constituents with the point of comparison based on a predicted blood lead level. For each of the receptors, exposure to lead resulted in predicted elevated blood lead levels. Therefore, exposure to lead could result in an unacceptable risk.

Removal of the walls and roofs of the BLA buildings has exposed conductive flooring material to weather, causing it to degrade and wash onto the surrounding soils. Based on the results of activity-based air sampling conducted in soils surrounding some of those buildings, it appears that the presence of asbestos in soil may present an unaccepble risk for current and future site workers and hypothetical future residents.

A SLERA and BERA were completed for the BLA, to evaluate surface soil, sediment, and surface water for ecological receptors, and food chain modeling was evaluated for all those constituents identified as bioaccumulative. The results of the evaluation of the SLERA and BERA for direct contact and the constituents evaluated in the terrestrial and aquatic food chain models indicate that some of the NOAEL and LOAEL HQs were greater than 1, which suggests the potential for risk to some individual insectivorous mammals and birds exposed to surface soils and some individual piscivorous mammals and birds exposed to sediment and/or surface water. However, when these results are considered in conjunction with pertinent site information on the limited spatial distribution and extent of these constituents, effects of these COPECs at the population-level are unlikely at the BLA.

The results of the HHRA activities indicated that exposure to lead by a site worker could result in adverse health effects. Benzo(a)pyrene, Aroclor 1254, cobalt, and copper were also found to be potential risk drivers under a residential land use scenario. The presence of asbestos in the conductive flooring and surrounding soils may also create risks for future site workers or residents. The ERA activities indicated the potential for risk to individual ecological receptors (i.e., short-tailed shrew and the American robin) due to Hazard Quotients (HQs) greater than 1 for Aroclor 1254, cadmium, copper, lead, and zinc; although no adverse population-level effects would be expected due to the limited areal distribution of these constituents.

9.3 IAA

An HHRA was conducted at the IAA to evaluate potential exposures associated with site constituents to humans. Site worker exposures to surface soil and sediment were evaluated under current and future land-use conditions; and construction worker, adult resident, and child resident exposures to total soil and sediment were evaluated under future land-use conditions.

The soil and sediment COPCs were evaluated for direct contact. VOCs identified as COPCs in the IAA were also evaluated for inhalation via vapor migration into buildings. Two VOCs, 3-octanone and d-limonene, do not have identified inhalation toxicity values; therefore, the indoor vapor intrusion pathway could not be assessed at this Study Area.

A current or future site worker could be present at the IAA area, and could be exposed to surface soil or sediment. The total cumulative ELCR for site workers exposed to surface soil and sediment is at the high end of the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for site workers is less than the benchmark of 1. Lead was also evaluated as a COPC, although the results are reported differently than those for the other COPCs. The predicted worker blood lead levels were below the benchmark and the predicted fetal lead level was equal to the benchmark.

A hypothetical future construction worker could be present at the IAA area, and could be exposed to combined surface and subsurface soil. The total cumulative ELCR for hypothetical future construction workers exposed to combined surface and subsurface soil at the IAA was within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for hypothetical future construction workers is greater than the benchmark of 1. However, when the hazard index was segregated by target organ or critical effect, all of the HIs were below the benchmark of 1. The predicted worker blood lead levels were below the benchmark and the predicted fetal lead level was equal to the benchmark.

The total cumulative ELCR for hypothetical future residents exposed to combined surface and subsurface soil and sediment at the IAA is slightly above the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The primary risk driver is 2,4-dinitrotoluene in soil. Other contributors to the excess lifetime cancer risks were benzo(a)pyrene and arsenic. The total cumulative HI for hypothetical future adult residents is 1, which is equal to the benchmark of 1. The predicted adult resident blood lead levels were below the benchmark and the predicted fetal lead level was slightly greater than the benchmark. The total cumulative HI for hypothetical future child residents is 13, which is above the benchmark of 1. When the HI was segregated by target site and critical effects, hazards were greater than the benchmark of 1 due to the presence of Aroclor 1254, copper, cobalt, and 2,4-dinitrotoluene. The predicted blood lead levels were all below the benchmark.

Removal of the walls and roofs of the IAA buildings has exposed conductive flooring material to weather, causing it to degrade and wash onto the surrounding soils. Based on the results of activity-based air sampling conducted in soils surrounding some of those buildings, it appears that the presence of asbestos in soil may present an unaccepblerisk for current and future site workers and hypothetical future residents.

A SLERA and BERA were completed for the IAA, to evaluate surface soil and sediment for ecological receptors, and food chain modeling was evaluated for all those constituents identified as bioaccumulative. The results of the evaluation of the SLERA and BERA for direct contact and the constituents evaluated in the terrestrial and aquatic food chain models indicate that some of the NOAEL and LOAEL HQs were greater than 1, which suggests the potential for risk to some individual insectivorous mammals and birds exposed to surface soils and some individual piscivorous mammals and birds exposed to sediment and/or surface water. However, when these results are considered in conjunction with pertinent site information on the limited spatial distribution and extent of these constituents, population-level effects of these COPECs are unlikely at the IAA.SLERA

The results of the HHRA activities indicated that exposure to 2,4-DNT, Aroclor 1254, copper, cobalt and lead were potential risk drivers under a hypothetical future residential use scenario. The presence of asbestos in the conductive flooring and surrounding soils may also create risks for future site workers or residents. The ERA activities indicated a potential for risk to individual ecological receptors due to HQs greater than 1, although no adverse population-level effects would be expected due to the limited areal distribution of these constituents.

9.4 RY

The HHRA for the RY evaluated current and future land-use conditions for site workers and hypothetical future use for construction workers and adult and child residents. Exposure of these receptors to the soil, sediment, and surface water COPCs was evaluated in the risk assessment. Although exposure to VOCs in soil migrating into buildings was identified as a potential exposure pathway, inhalation toxicity values were not available for the two VOCs, 3-octanone and ethanol, identified as soil COPCs at the RY. Therefore, this exposure pathway was not evaluated quantitatively.

A current or future site worker could be present at the RY area, and could be exposed to surface soil, sediment, or surface water. The total cumulative ELCR for site workers exposed to surface soil, sediment, and surface water at the RY is at the high end of the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for site workers is less than the benchmark of 1.

A hypothetical future construction worker could be present at the RY area, and could be exposed to combined surface and subsurface soil. The total cumulative ELCR for hypothetical future construction workers exposed to combined surface and subsurface soil at the RY was within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative HI for hypothetical future construction workers is less than the benchmark of 1.

A hypothetical future resident could be present at the RY area, and could be exposed to combined surface and subsurface soil, sediment, or surface water. The total cumulative ELCR for hypothetical future residents exposed to combined surface and subsurface soil, sediment, and surface water at the RY is slightly above the high end of the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. This risk driver for cancer risk is pentachlorophenol which was detected in two samples, one at an estimated value of 0.11 mg/kg and one at a maximum concentration of 830 mg/kg. The one high detection was from a sample collected in April of 1998 and the results were not duplicated in subsequent sampling. The risk assessment was based on the maximum detected concentration and thus may overestimate potential exposures. Without pentachlorophenol as a risk driver, the total cumulative ELCR for the hypothetical future child resident would be within the target risk range.

The total cumulative HI for hypothetical future adult residents is less than the benchmark of 1. The total cumulative HI for hypothetical future child residents is greater than the benchmark of 1. The primary contributor to the non-cancer hazard above 1 is cobalt. The maximum cobalt concentration of 74.9 mg/kg is only slightly greater than the background concentration of 72.3 mg/kg and is well within the range of background levels. Therefore, it is likely that cobalt is present due to naturally occurring sources rather than due to activities at the RY.

The results of the human health risk assessment indicate that use of the RY for residential or industrial uses should not result in unacceptable risks to potential receptors.

A SLERA and BERA were completed for the RY, to evaluate surface soil, sediment, and surface water for ecological receptors, and food chain modeling was evaluated for all those constituents identified as bioaccumulative. The results of the evaluation of the SLERA and BERA for direct contact and the constituents evaluated in the terrestrial and aquatic food chain models indicate that a few of the NOAEL and LOAEL HQs were greater than 1, which suggests the potential for risk to some individual insectivorous mammals and birds exposed to surface soils and some individual piscivorous mammals and birds exposed to sediment and/or surface water, if all exposure assumptions are met. However, when these results are considered in conjunction with pertinent site information on the limited spatial distribution and extent of these constituents, adverse affects at the population-level are considered unlikely for the shrew (or other insectivorous mammals) and the robin (or other insectivorous birds) exposed to the constituents at the RY.

9.5 WBG

The HHRA evaluated potential current exposure of site workers to surface soil, surface water, and sediment, potential future exposures of construction workers to total soil and potential future adult and child resident exposure to total soil, surface water, sediment, and fish caught in the pond at the WBG. The soil, sediment, and surface water COPCs were evaluated for direct contact. In addition, a scenario was evaluated that specifidally considered exposure to sediment during participation in the semi-annual fishing rodeo, and risks to all potential future receptors were evaluated in the event that the pond were drained and current sediments became eligible for direct contact in the same frequency, intensity, and duration as soils.

VOCs identified as COPCs in the WBG were also evaluated for inhalation via vapor migration into buildings. One VOC, d-limonene, was identified as a soil COPC at the

WBG, but since it does not have identified inhalation toxicity value, this exposure pathway was not evaluated quantitatively. Potential risks and hazards for site workers and construction workers, including exposure to lead, under current industrial land use conditions were within generally acceptable levels and benchmarks. Under a hypothetical future residential land use, potential hazards associated with chromium in sediment were slightly greater than the benchmark of 1 for the child resident. Potential risks associated with exposure to lead in soil and sediment could result in adverse health effects. The elevated blood lead levels were driven by the concentration of lead in the sediments. No other scenarios evaluated resulted in an unacceptable risk level. The risk findings are applicable to both current land use conditions and those that would result if the pond were drained and current sediments became part of the soil eligible for direct contact exposures.

Based on the results of the risk assessment, it is unlikely that industrial use of the property would result in adverse health effects. For the residential exposure scenarios, exposure to lead in sediments may pose an adverse health effect if the exposure assumptions are different than actual exposures. Also, exposure to chromium in sediments may pose a slightly elevated hazard to children wading in surface water. Several (four) of the detections fell outside of the background chromium soil range. The maximum chromium sediment concentration of 15,400 mg/kg is well above the background range.

A SLERA and BERA were completed for the WBG, to evaluate surface soil, sediment, and surface water for ecological receptors, and food chain modeling was evaluated for all those constituents identified as bioaccumulative. The results of the evaluation of the SLERA and BERA for direct contact and the constituents evaluated in the terrestrial food chain model indicate that some of the NOAEL and LOAEL HQs were greater than 1, which suggests the potential for risk to some individual insectivorous mammals and birds exposed to surface soils and some individual piscivorous mammals and birds exposed to sediment and/or surface water. However, when these results are considered in conjunction with pertinent site information on the limited spatial distribution and extent of these constituents, adverse affects of these COPECs at the population-level are unlikely at the WBG.

Similarly, the results of the sediment and surface water evaluation of the SLERA and BERA for direct contact and the constituents evaluated in the aquatic food chain model indicate that adverse population-level effects are not expected for aquatic life exposed to bioaccumulative COPECs in sediment and/or surface water at the WBG.

9.6 Groundwater

An HHRA was conducted to evaluate potential exposure to constituents detected in groundwater. Exposure of hypothetical future residents and site workers to constituents in groundwater assuming the groundwater was used as a potable water supply was evaluated in the risk assessment. Potential exposure of site workers and potential future residents was also evaluated for the vapor migration pathway. The excess lifetime cancer risks calculated for site worker exposure to groundwater used as a potable water supply was 4×10^{-5}. This is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The hazard index was calculated to be 0.4, which was below the benchmark of 1.

The excess lifetime cancer risks calculated for hypothetical futureresident exposure to groundwater used as a potable water supply was 2×10^{-4}. This is slightly above the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The risk drivers for cancer risk are arsenic and the dioxin and furan congeners.

The hazard index for a hypothetical adult resident was calculated to be 0.6, which was below the benchmark of 1. The hazard index or a hypothetical child resident was calculated to be 1, which is equal to the benchmark of 1.

The calculated risks to site workers via the vapor intrusion exposure pathway were well below the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. Exposure of hypothetical future adult and child residents through the vapor intrusion exposure pathway yielded similar, very low results.

The risk drivers for the excess lifetime cancer risk were arsenic and the dioxin congeners. Arsenic was detected in 1 out of the 18 samples collected; however, this detection was below the MCL. The dioxin congeners were detected in three groundwater samples at concentrations greater than the USEPA RSLs. Many of the dioxin compounds were detected in the rinse blank which indicates a potential cross contamination issue associated with the sampling or laboratory equipment. All of the detections were below the reporting limit and were qualified as estimated. Furthermore, dioxins were not detected in groundwater samples collected during the 2010 sampling event which provides additional evidence that the previous dioxin detections were not indicative of actual groundwater quality at the facility.

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Table A.2-1
Screening Levels for the Protection of Human Health
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Adjusted Soil Risk Screening Level [a,b]					Adjusted Tap Water Regional Screening Level (RSL) [a,c]		
		Residential Scenario (mg/kg)		Industrial Scenario (mg/kg)		Surrogate	(mg/L)		Surrogate
Volatile Organic Compounds									
1,2,3-Trichloropropane	96-18-4	9.10E-02	c	4.10E-01	c		9.60E-06	c	
1,2,4-Trimethylbenzene	95-63-6	6.70E+00	n	2.80E+01	ns		1.50E-03	n	
2-Butanone	78-93-3	2.80E+03	ns	1.90E+04	nms		7.10E-01	n	
3-Octanone	106-68-3	NA		NA			NA		
4-Methyl-2-pentanone	108-10-1	5.30E+02	ns	5.20E+03	ns		2.00E-01	n	
Acetone	67-64-1	6.10E+03	n	6.10E+04	nms		2.20E+00	n	
Bromodichloromethane	75-27-4	1.00E+01	c	4.60E+01	c		1.10E-03	c	
Carbon Disulfide	75-15-0	6.70E+01	ns	3.00E+02	ns		1.00E-01	n	
Chloroform	67-66-3	3.00E-01	c	1.50E+00	c		1.90E-04	c	
cis-1,2-Dichloroethene	156-59-2	7.80E+01	n	1.00E+03	ns		3.70E-02	n	
d-Limonene	5989-27-5	NA		NA			NA		
Ethanol	64-17-5	NA		NA			NA		
m,p-Xylene	136777612	6.00E+01	ns	2.60E+02	ns	p-Xylene	2.00E-02	n	p-Xylene
Methylene Chloride	75-09-2	1.10E+01	c	5.40E+01	c		4.80E-03	c	
p-Isopropyltoluene	99-87-6	2.20E+02	ns	1.10E+03	ns	Isopropylbenzene	6.80E-02	n	Isopropylbenzene
Tetrachloroethene	127-18-4	5.70E-01	c	2.70E+00	c		1.10E-04	c	
Toluene	108-88-3	5.00E+02	ns	4.60E+03	ns		2.30E-01	n	
Trichloroethene	79-01-6	2.80E+00	c	1.40E+01	c		1.70E-03	c	
Xylenes (total)	1330-20-7	6.00E+01	ns	2.60E+02	ns		2.00E-02	n	
Semi-Volatile Organic Compounds									
1,2,4-Trichlorobenzene	120-82-1	8.70E+00	n	4.00E+01	ns		8.20E-04	n	
1,2-Dichlorobenzene	95-50-1	2.00E+02	ns	1.00E+03	ns		3.70E-02	n	
1,3-Dichlorobenzene	541-73-1	2.00E+02	ns	1.00E+03	ns	1,2-Dichlorobenzene	3.70E-02	n	1,2-Dichlorobenzene
1,4-Dichlorobenzene	106-46-7	2.60E+00	c	1.30E+01	c		4.30E-04	c	
2,4-Dinitrotoluene	121-14-2	1.20E+01	n	1.20E+02	n		7.30E-03	n	
2,6-Dinitrotoluene	606-20-2	6.10E+00	n	6.20E+01	n		3.70E-03	n	
3,3'-Dichlorobenzidine	91-94-1	1.10E+00	c	3.80E+00	c		1.50E-04	c	
4-Methylphenol	106-44-5	3.10E+01	n	3.10E+02	n		1.80E-02	n	
Benzoic Acid	65-85-0	2.40E+04	nm	2.50E+05	nm		1.50E+01	n	
bis(2-Ethylhexyl)phthalate	117-81-7	3.50E+01	c*	1.20E+02	c*		4.80E-03	c	
Butylbenzylphthalate	85-68-7	2.60E+02	c*	9.10E+02	c		3.50E-02	c	
Carbazole	86-74-8	NA		NA			NA		
Dibenzofuran	132-64-9	7.80E+00	n	1.00E+02	n	Furan	3.70E-03	n	Furan
Diethylphthalate	84-66-2	4.90E+03	n	4.90E+04	nm		2.90E+00	n	
Di-n-Butylphthalate	84-74-2	6.10E+02	n	6.20E+03	n		3.70E-01	n	
Di-n-Octylphthalate	117-84-0	6.10E+02	n	6.20E+03	n	di-n-Butylphthalate	3.70E-01	n	di-n-Butylphthalate
N-Nitrosodiphenylamine	86-30-6	9.90E+01	c	3.50E+02	c		1.40E-02	c	
Pentachlorophenol	87-86-5	3.00E+00	c	9.00E+00	c		5.60E-04	c	
Phenol	108-95-2	1.80E+03	n	1.80E+04	nm		1.10E+00	n	
Dioxin/Furan Compounds									
1,2,3,4,6,7,8-HpCDD	35822-46-9	4.50E-04	c	1.80E-03	c	Total HpCDD	5.20E-08	c	Total HpCDD
1,2,3,4,6,7,8-HpCDF	67562-39-4	3.70E-04	c	1.30E-03	c	Total HpCDF	5.20E-08	c	Total HpCDF
1,2,3,4,7,8,9-HpCDF	55673-89-7	3.70E-04	c	1.30E-03	c	Total HpCDF	5.20E-08	c	Total HpCDF
1,2,3,4,7,8-HxCDD	39227-28-6	4.50E-05	c	1.80E-04	c	Total HxCDD	5.20E-09	c	Total HxCDD
1,2,3,4,7,8-HxCDF	70648-26-9	3.70E-05	c	1.30E-04	c	Total HxCDF	5.20E-09	c	Total HxCDF
1,2,3,6,7,8-HxCDD	57653-85-7	4.50E-05	c	1.80E-04	c	Total HxCDD	5.20E-09	c	Total HxCDD
1,2,3,6,7,8-HxCDF	57117-44-9	3.70E-05	c	1.30E-04	c	Total HxCDF	5.20E-09	c	Total HxCDF
1,2,3,7,8,9-HxCDD	19408-74-3	4.50E-05	c	1.80E-04	c	Total HxCDD	5.20E-09	c	Total HxCDD
1,2,3,7,8,9-HxCDF	72918-21-9	3.70E-05	c	1.30E-04	c	Total HxCDF	5.20E-09	c	Total HxCDF
1,2,3,7,8-PeCDD	40321-76-4	4.50E-06	c	1.80E-05	c	Total PeCDD	5.20E-10	c	Total PeCDD
1,2,3,7,8-PeCDF	57117-41-6	1.20E-04	c	4.40E-04	c		1.70E-08	c	
2,3,4,6,7,8-HxCDF	60851-34-5	3.70E-05	c	1.30E-04	c	Total HxCDF	5.20E-09	c	Total HxCDF
2,3,4,7,8-PeCDF	57117-31-4	1.20E-05	c	4.40E-05	c		1.70E-09	c	
2,3,7,8-TCDD	1746-01-6	4.50E-06	c*	1.80E-05	c*		5.20E-10	c*	
2,3,7,8-TCDF	51207-31-9	3.70E-05	c	1.30E-04	c		5.20E-09	c	
OCDD	3268-87-9	1.50E-02	c	6.10E-02	c		1.70E-06	c	
OCDF	39001-02-0	1.20E-02	c	4.40E-02	c		1.70E-06	c	

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Explosives									
1,3,5-Trinitrobenzene	99-35-4	2.20E+02	n	2.70E+03	n		1.10E-01	n	
1,3-Dinitrobenzene	99-65-0	6.10E-01	n	6.20E+00	n		3.70E-04	n	
2,4,6-Trinitrotoluene	118-96-7	3.60E+00	c**	4.20E+01	c**		1.80E-03	c**	
4-Amino-2,6-Dinitrotoluene	19406-51-0	1.50E+01	n	1.90E+02	n		7.30E-03	n	
m-Nitrotoluene	99-08-1	1.20E+02	n	1.20E+03	n		7.30E-02	n	
Nitrobenzene	98-95-3	3.10E+00	n	2.80E+01	n		3.40E-04	n	
Nitroglycerine	55-63-0	6.10E-01	n	6.20E+00	n		3.70E-04	n	
Pentaerythritol Tetranitrate	78-11-5	NA		NA			NA		
Perchlorate	14797-73-0	5.50E+00	n	7.20E+01	n		2.60E-03	n	
Herbicides									
2,4,5-T	93-76-5	6.10E+01	n	6.20E+02	n		3.70E-02	n	
2,4,5-TP	93-72-1	4.90E+01	n	4.90E+02	n		2.90E-02	n	
2,4-D	94-75-7	6.90E+01	n	7.70E+02	n		3.70E-02	n	
2,4-DB	94-82-6	4.90E+01	n	4.90E+02	n		2.90E-02	n	
Dalapon	75-99-0	1.80E+02	n	1.80E+03	n		1.10E-01	n	
Dicamba	1918-00-9	1.80E+02	n	1.80E+03	n		1.10E-01	n	
Dichlorprop	120-36-5	NA		NA			NA		
MCPA	94-74-6	3.10E+00	n	3.10E+01	n		1.80E-03	n	
MCPP	93-65-2	6.10E+00	n	6.20E+01	n		3.70E-03	n	
Pesticides									
4,4'-DDD	72-54-8	2.00E+00	c	7.20E+00	c		2.80E-04	c	
4,4'-DDE	72-55-9	1.40E+00	c	5.10E+00	c		2.00E-04	c	
4,4'-DDT	50-29-3	1.70E+00	c*	7.00E+00	c*		2.00E-04	c*	
Alpha-BHC	319-84-6	7.70E-02	c	2.70E-01	c		1.10E-05	c	
Alpha-Chlordane	5103-71-9	1.60E+00	c*	6.50E+00	c*	Chlordane	1.90E-04	c*	Chlordane
Beta-BHC	319-85-7	2.70E-01	c	9.60E-01	c		3.70E-05	c	
Delta-BHC	319-86-8	5.20E-01	c*	2.10E+00	c	gamma-BHC	6.10E-05	c	gamma-BHC
Dieldrin	60-57-1	3.00E-02	c	1.10E-01	c		4.20E-06	c	
Endosulfan I	115-29-7	3.70E+01	n	3.70E+02	n		2.20E-02	n	
Endosulfan II	33213-65-9	3.70E+01	n	3.70E+02	n	Endosulfan	2.20E-02	n	Endosulfan
Endosulfan Sulfate	1031-07-8	3.70E+01	n	3.70E+02	n	Endosulfan	2.20E-02	n	Endosulfan
Endrin	72-20-8	1.80E+00	n	1.80E+01	n		1.10E-03	n	
Endrin Aldehyde	7421-93-4	1.80E+00	n	1.80E+01	n	Endrin	1.10E-03	n	Endrin
Endrin Ketone	53494-70-5	1.80E+00	n	1.80E+01	n	Endrin	1.10E-03	n	Endrin
Gamma-BHC (Lindane)	58-89-9	5.20E-01	c*	2.10E+00	c		6.10E-05	c	
Gamma-Chlordane	5566-34-7	1.60E+00	c*	6.50E+00	c*	Chlordane	1.90E-04	c*	Chlordane
Heptachlor	76-44-8	1.10E-01	c	3.80E-01	c		1.50E-05	c	
Heptachlor Epoxide	1024-57-3	5.30E-02	c*	1.90E-01	c*		7.40E-06	c*	
Methoxychlor	72-43-5	3.10E+01	n	3.10E+02	n		1.80E-02	n	
Polycyclic Aromatic Hydrocarbons									
2-Methylnaphthalene	91-57-6	3.10E+01	n	4.10E+02	ns		1.50E-02	n	
Acenaphthene	83-32-9	3.40E+02	n	3.30E+03	n		2.20E-01	n	
Acenaphthylene	208-96-8	3.40E+02	n	3.30E+03	n	Acenaphthene	2.20E-01	n	Acenaphthene
Anthracene	120-12-7	1.70E+03	n	1.70E+04	nm		1.10E+00	n	
Benzo(a)anthracene	56-55-3	1.50E-01	c	2.10E+00	c		2.90E-05	c	
Benzo(a)pyrene	50-32-8	1.50E-02	c	2.10E-01	c		2.90E-06	c	
Benzo(b)fluoranthene	205-99-2	1.50E-01	c	2.10E+00	c		2.90E-05	c	
Benzo(g,h,i)perylene	191-24-2	1.70E+02	n	1.70E+03	n	Pyrene	1.10E-01	n	Pyrene
Benzo(k)fluoranthene	207-08-9	1.50E+00	c	2.10E+01	c		2.90E-04	c	
Chrysene	218-01-9	1.50E+01	c	2.10E+02	c		2.90E-03	c	
Dibenzo(a,h)anthracene	53-70-3	1.50E-02	c	2.10E-01	c		2.90E-06	c	
Fluoranthene	206-44-0	2.30E+02	n	2.20E+03	n		1.50E-01	n	
Fluorene	86-73-7	2.30E+02	n	2.20E+03	n		1.50E-01	n	
Indeno(1,2,3-cd)pyrene	193-39-5	1.50E-01	c	2.10E+00	c		2.90E-05	c	
Naphthalene	91-20-3	3.90E+00	c*	2.00E+01	c*		1.40E-04	c*	
Phenanthrene	85-01-8	1.70E+03	n	1.70E+04	nm	Anthracene	1.10E+00	n	Anthracene
Pyrene	129-00-0	1.70E+02	n	1.70E+03	n		1.10E-01	n	
Polychlorinated Biphenyls									
Aroclor 1254	11097-69-1	1.10E-01	c**	7.40E-01	c*		3.40E-05	c*	
Aroclor 1260	11096-82-5	2.20E-01	c	7.40E-01	c		3.40E-05	c	

Table A.2-1
Screening Levels for the Protection of Human Health
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Adjusted Soil Risk Screening Level [a,b] Residential Scenario (mg/kg)		Industrial Scenario (mg/kg)		Surrogate	Adjusted Tap Water Regional Screening Level (RSL) [a,c] (mg/L)		Surrogate
Inorganics									
Aluminum	7429-90-5	7.70E+03	n	9.90E+04	nm		3.70E+00	n	
Antimony	7440-36-0	3.10E+00	n	4.10E+01	n		1.50E-03	n	
Arsenic	7440-38-2	3.90E-01	c*	1.60E+00	c		4.50E-05	c	
Barium	7440-39-3	1.50E+03	n	1.90E+04	nm		7.30E-01	n	
Beryllium	7440-41-7	1.60E+01	n	2.00E+02	n		7.30E-03	n	
Cadmium	7440-43-9	7.00E+00	n	8.10E+01	n		1.80E-03	n	
Calcium	7440-70-2	NA		NA			NA		
Chromium	7440-47-3	2.80E+02	c	1.40E+03	c		5.50E+00	n	
Cobalt	7440-48-4	2.30E+00	n	3.00E+01	n		1.10E-03	n	
Copper	7440-50-8	3.10E+02	n	4.10E+03	n		1.50E-01	n	
Iron	7439-89-6	5.50E+03	n	7.20E+04	nm		2.60E+00	n	
Lead	7439-92-1	4.00E+02	n<	8.00E+02	n<		1.50E-02	n<	
Magnesium	7439-95-4	NA		NA			NA		
Manganese	7439-96-5	1.80E+02	n	2.30E+03	n		8.80E-02	n	
Mercury	7439-97-6	2.30E+00	n	3.10E+01	n		6.30E-05	n	
Nickel	7440-02-0	1.60E+02	n	2.00E+03	n		7.30E-02	n	
Potassium	7440-09-7	NA		NA			NA		
Selenium	7782-49-2	3.90E+01	n	5.10E+02	n		1.80E-02	n	
Silver	7440-22-4	3.90E+01	n	5.10E+02	n		1.80E-02	n	
Sodium	7440-23-5	NA		NA			NA		
Thallium	7440-28-0	5.10E-01	n	6.60E+00	n		2.40E-04	n	
Vanadium	7440-62-2	5.50E+01	n	7.20E+02	n		2.60E-02	n	
Zinc	7440-66-6	2.30E+03	n	3.10E+04	nm		1.10E+00	n	

Notes:
COPC = Constituent of Potential Concern
mg/kg = Milligrams per kilogram.
mg/L = Milligrams per liter.

[a] Regional screening levels were from USEPA (2009a).

The screening levels used were risk screening levels for the residential scenario from USEPA (2009a). Screening levels based on non-cancer effects were adjusted downward by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit;
s = Concentration may exceed saturation concentration (Csat).
< The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.

[b] Adjusted soil screening levels were used to assess soil and sediment at the NRU.
[c] Adjusted tap-water screening levels were used to assess surface water and groundwater at the NRU.

Table A.2-2
Metals Background Levels
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Range of Detects (mg/kg)		95% UTL
	Min	Max	
Aluminum	3620	47900	40041
Antimony	–	–	–
Arsenic	1.2	35.9	15.8
Barium	23.4	174	209
Beryllium	0.61	5.4	1.02
Cadmium	0.62	2.5	0.69
Calcium	–	–	–
Chromium	6.3	75.8	65.3
Cobalt	5.9	130	72.3
Copper	1.6	38.7	53.5
Iron	7250	67700	50962
Lead	2.1	256	26.8
Magnesium	–	–	–
Manganese	16.7	2040	2543
Mercury	0.038	1.2	0.13
Nickel	4.6	94.2	62.8
Potassium	–	–	–
Selenium	–	–	–
Silver	–	–	–
Sodium	–	–	–
Thallium	1.3	5	2.11
Vanadium	12.2	114	108
Zinc	4.7	598	202

Notes:
mg/kg = Milligrams per kilogram.

Background levels for inorganics are facility-wide soil background point estimates taken from Facility-Wide Background Study Report (IT Corporation 2001).

Table A.2-3
Physical and Chemical Properties
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Molecular Weight (g/mol)	[ref]	Water Solubility (mg/L 25 °C)	[ref]	Vapor Pressure (mm Hg 25 °C)	[ref]	Henry's Law Constant (atm-m³/mol) (25 °C)	[ref]	Diffusivity in Air (cm²/sec)	[ref]	Diffusivity in Water (cm²/sec)	[ref]	Koc or Kd (mL/g)	[ref]	Log Kow	[ref]
Volatile Organic Compounds													**Koc**			
3-Octanone	1.28E+02	*EPI*	1.19E+03	*EPI*	2.34E+00	*EPI*	3.33E-04	*EPI*	5.39E-01	*L90-calc'd*	6.11E-06	*L90-calc'd*	4.64E+01	*EPI*	2.22E+00	*EPI*
Bromodichloromethane	1.64E+02	*SCDM*	6.74E+03	*SCDM*	5.00E+01	*SCDM*	1.60E-03	*SCDM*	2.98E-02	*J&E*	1.06E-05	*J&E*	5.50E+01	*SCDM*	2.10E+00	*SCDM*
Chloroform	1.19E+02	*SCDM*	7.92E+03	*SCDM*	1.97E+02	*SCDM*	3.67E-03	*SCDM*	1.04E-01	*J&E*	1.00E-05	*J&E*	3.98E+01	*SCDM*	1.97E+00	*CFATE*
Ethanol	4.61E+01	*EPI*	7.92E+05	*EPI*	6.09E+01	*EPI*	4.66E-06	*EPI*	1.35E-01	*L90-calc'd*	1.20E-05	*L90-calc'd*	1.00E+00	*EPI*	-3.10E-01	*EPI*
d-Limonene	1.36E+02	*EPI*	4.58E+00	*EPI*	1.45E+00	*EPI*	5.67E-02	*EPI*	6.44E-02	*L90-calc'd*	5.72E-06	*L90-calc'd*	1.32E+03	*EPI*	4.38E+00	*EPI*
Tetrachloroethene	1.66E+02	*SCDM*	2.00E+02	*SCDM*	1.86E+01	*SCDM*	1.84E-02	*SCDM*	7.20E-02	*J&E*	8.20E-06	*J&E*	1.55E+02	*SCDM*	3.40E+00	*CFATE*
Semi-Volatile Organic Compounds													**Koc**			
2,4-Dinitrotoluene	1.82E+02	*SCDM*	2.70E+02	*SCDM*	1.47E-04	*SCDM*	9.26E-08	*SCDM*	2.03E-01	*J&E*	7.06E-06	*J&E*	9.46E+01	*SCDM*	1.98E+00	*CFATE*
Bis(2-ethylhexyl)phthalate	3.91E+02	*SCDM*	3.40E-01	*SCDM*	6.45E-06	*SCDM*	1.02E-07	*SCDM*	3.51E-02	*J&E*	3.66E-06	*J&E*	8.74E+04	*CFATE*	5.11E+00	*CFATE*
Carbazole	1.67E+02	*SCDM*	7.48E+00	*SCDM*	5.19E-07	*SCDM*	1.53E-08	*SCDM*	3.90E-02	*J&E*	7.03E-06	*J&E*	3.38E+03	*SCDM*	3.72E+00	*CFATE*
Pentachlorophenol	2.66E+02	*SCDM*	1.95E+03	*SCDM*	3.17E-05	*SCDM*	2.44E-08	*SCDM*	5.60E-02	*J&E*	6.10E-06	*J&E*	5.92E+02	*SCDM*	5.09E+00	*SCDM*
Polycyclic Aromatic Hydrocarbons													**Koc**			
Benzo(a)anthracene	2.28E+02	*CFATE*	9.40E-03	*CFATE*	1.05E-07	*CFATE*	3.35E-06	*CFATE*	5.10E-02	*SSG2*	9.00E-06	*SSG2*	3.98E+05	*SSG2*	5.66E+00	*CFATE*
Benzo(a)pyrene	2.52E+02	*CFATE*	1.62E-03	*CFATE*	5.49E-09	*CFATE*	1.13E-06	*CFATE*	4.30E-02	*SSG2*	9.00E-06	*SSG2*	1.02E+06	*SSG2*	5.97E+00	*CFATE*
Benzo(b)fluoranthene	2.52E+02	*CFATE*	1.50E-03	*CFATE*	5.00E-07	*CFATE*	1.11E-04	*CFATE*	2.26E-02	*SSG2*	5.56E-06	*SSG2*	1.23E+06	*SSG2*	6.12E+00	*CFATE*
Benzo(k)fluoranthene	2.52E+02	*SCDM*	8.00E-04	*SCDM*	2.00E-09	*SCDM*	8.29E-07	*SCDM*	2.26E-02	*J&E*	5.56E-06	*J&E*	1.24E+06	*SCDM*	6.20E+00	*SCDM*
Chrysene	2.28E+02	*SCDM*	1.60E-03	*SCDM*	6.23E-09	*SCDM*	9.46E-05	*SCDM*	2.48E-02	*J&E*	6.21E-06	*J&E*	4.01E+05	*SCDM*	5.70E+00	*SCDM*
Dibenzo(a,h)anthracene	2.78E+02	*CFATE*	2.49E-03	*CFATE*	1.00E-10	*CFATE*	1.47E-08	*CFATE*	2.02E-02	*J&E*	5.18E-06	*J&E*	3.80E+06	*SSG2*	6.50E+00	*CFATE*
Indeno(1,2,3-cd)pyrene	2.76E+02	*CFATE*	2.20E-05	*CFATE*	1.00E-10	*CFATE*	1.60E-06	*CFATE*	1.90E-02	*SSG2*	5.66E-06	*SSG2*	3.47E+06	*SSG2*	6.58E+00	*CFATE*
Naphthalene	1.28E+02	*SCDM*	3.10E+01	*SCDM*	8.50E-02	*SCDM*	4.83E-04	*SCDM*	5.90E-02	*J&E*	7.50E-06	*J&E*	2.01E+03	*SCDM*	3.30E+00	*CFATE*
Dioxin/Furan Compounds													**Koc**			
1,2,3,4,7,8-HxCDD	3.91E+02	*EPI*	5.91E-05	*EPI*	6.10E-09	*EPI*	5.31E-05	*EPI*	4.78E-02	*L90-calc'd*	4.58E-06	*L90-calc'd*	4.25E+05	*EPI*	8.21E+00	*EPI*
1,2,3,4,7,8-HxCDF	3.75E+02	*EPI*	5.89E-05	*EPI*	1.12E-07	*EPI*	9.38E-04	*EPI*	4.82E-02	*L90-calc'd*	4.61E-06	*L90-calc'd*	2.31E+05	*EPI*	7.92E+00	*EPI*
1,2,3,6,7,8-HxCDF	3.75E+02	*EPI*	5.89E-05	*EPI*	1.12E-07	*EPI*	9.38E-04	*EPI*	4.82E-02	*L90-calc'd*	4.61E-06	*L90-calc'd*	2.31E+05	*EPI*	7.92E+00	*EPI*
1,2,3,7,8,9-HxCDD	3.91E+02	*SCDM*	2.65E-05	*EPI*	3.60E-11	*EPI*	8.40E-05	*EPI*	4.81E-02	*L90-calc'd*	1.00E-05	*est'd*	4.17E+05	*EPI*	8.21E+00	*RAIS*
1,2,3,7,8,9-HxCDF	3.75E+02	*EPI*	1.14E-04	*EPI*	7.70E-08	*EPI*	3.34E-04	*EPI*	4.82E-02	*L90-calc'd*	4.61E-06	*L90-calc'd*	2.31E+05	*EPI*	7.58E+00	*EPI*
1,2,3,7,8-PeCDD	3.56E+02	*EPI*	9.39E-04	*EPI*	4.44E-08	*EPI*	2.22E-05	*EPI*	4.86E-02	*L90-calc'd*	4.77E-06	*L90-calc'd*	2.47E+05	*EPI*	6.64E+00	*EPI*
1,2,3,7,8-PeCDF	3.40E+02	*EPI*	8.73E-04	*EPI*	5.46E-08	*EPI*	2.80E-05	*EPI*	4.89E-02	*L90-calc'd*	4.81E-06	*L90-calc'd*	1.37E+05	*EPI*	6.94E+00	*EPI*
2,3,4,7,8-PeCDF	3.40E+02	*EPI*	8.73E-04	*EPI*	5.46E-08	*EPI*	2.80E-05	*EPI*	4.89E-02	*L90-calc'd*	4.81E-06	*L90-calc'd*	1.37E+05	*EPI*	6.94E+00	*EPI*
2,3,7,8-TCDD	3.22E+02	*SCDM*	7.91E-06	*SCDM*	1.49E-09	*SCDM*	7.92E-05	*SCDM*	1.43E-02	*RAIS*	5.83E-06	*RAIS*	2.63E+06	*SCDM*	6.53E+00	*SCDM*
2,3,7,8-TCDF	3.06E+02	*EPI*	2.33E-03	*EPI*	1.47E-07	*EPI*	2.54E-05	*EPI*	4.98E-02	*L90-calc'd*	5.04E-06	*L90-calc'd*	8.10E+04	*EPI*	6.29E+00	*EPI*
Herbicides													**Koc**			
MCPA	2.01E+02	*RAIS*	1.17E+03	*CFATE*	2.92E-04	*CFATE*	5.49E-05	*CFATE*	1.00E-01	*est'd*	1.00E-05	*est'd*	2.94E+01	*RAIS*	3.25E+00	*RAIS*
MCPP	2.15E+02	*HSDB*	7.34E+02	*HSDB*	3.00E-06	*RAIS*	1.82E-08	*HSDB*	1.00E-01	*est'd*	5.77E-06	*L90-calc'd*	3.60E+02	*RAIS*	3.13E+00	*HSDB*
Dichlorprop	2.35E+02	*EPI*	8.35E+01	*EPI*	3.39E-05	*EPI*	1.26E-07	*EPI*	5.79E-02	*L90-calc'd*	5.53E-06	*L90-calc'd*	4.86E+01	*EPI*	3.43E+00	*EPI*
Pesticides													**Koc**			
Dieldrin	3.81E+02	*CFATE*	1.95E-01	*CFATE*	5.89E-06	*CFATE*	1.51E-05	*CFATE*	1.25E-02	*SSG2*	4.74E-06	*SSG2*	2.14E+04	*SSG2*	4.55E+00	*CFATE*
Polychlorinated Biphenyls													**Koc**			
Aroclor 1254	3.27E+02	*HSDB*	6.00E-02	*RAIS*	6.53E-06	*EPI*	1.45E-04	*EPI*	1.56E-02	*J&E*	5.00E-06	*J&E*	2.00E+05	*RAIS*	6.79E+00	*EPI*
Aroclor 1260	3.76E+02	*HSDB*	8.00E-02	*RAIS*	4.05E-05	*HSDB*	7.40E-05	*HSDB*	1.38E-02	*J&E*	4.32E-06	*J&E*	2.90E+05	*RAIS*	8.27E+00	*EPI*
Explosives													**Koc**			
Nitroglycerine	2.27E+02	*EPI*	1.31E+03	*EPI*	2.72E-02	*EPI*	6.23E-06	*EPI*	6.40E-02	*L90-calc'd*	6.29E-06	*L90-calc'd*	1.31E+02	*EPI*	1.62E+00	*EPI*
Pentaerythritol Tetranitrate	3.16E+02	*EPI*	9.14E+01	*EPI*	4.21E-06	*EPI*	1.92E-08	*EPI*	5.18E-02	*L90-calc'd*	5.06E-06	*L90-calc'd*	7.58E+02	*EPI*	2.38E+00	*EPI*

Table A.2-3
Physical and Chemical Properties
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Molecular Weight (g/mol)	[ref]	Water Solubility (mg/L 25 °C)	[ref]	Vapor Pressure (mm Hg 25 °C)	[ref]	Henry's Law Constant (atm-m³/mol) (25 °C)	[ref]	Diffusivity in Air (cm²/sec)	[ref]	Diffusivity in Water (cm²/sec)	[ref]	Koc or Kd (mL/g)	[ref]	Log Kow	[ref]
Inorganics													**Kd**			
Aluminum	2.70E+01	*SCDM*	insoluble	*SCDM*	—		—		—		—		1.50E+03	*Kd-SCDM*	3.30E-01	*EPI*
Antimony	1.22E+02	*SCDM*	insoluble	*SCDM*	—		—		—		—		4.50E+01	*Kd-SCDM*	7.30E-01	*EPI*
Arsenic	7.49E+01	*HSDB*	insoluble	*HSDB*	—		—		—		—		2.90E+01	*Kd-SCDM*	6.80E-01	*SCDM*
Barium	1.37E+02	*SCDM*	insoluble	*SCDM*	—		—		—		—		4.10E+01	*Kd-SCDM*	2.30E-01	*EPI*
Beryllium	9.01E+00	*SCDM*	insoluble	*SCDM*	—		—		—		—		7.90E+02	*Kd-SCDM*	-5.70E-01	*EPI*
Cadmium	1.12E+02	*SCDM*	insoluble	*SCDM*	—		—		—		—		7.50E+01	*Kd-SCDM*	-7.00E-02	*EPI*
Chromium	5.20E+01	*SCDM*	insoluble	*SCDM*	—		—		—		—		1.90E+01	*Kd-SCDM*	2.30E-01	*EPI*
Cobalt	5.89E+01	*SCDM*	insoluble	*SCDM*	—		—		—		—		4.50E+01	*Kd-SCDM*	2.30E-01	*EPI*
Copper	6.35E+01	*SCDM*	insoluble	*SCDM*	—		—		—		—		4.28E+02	*Kd-SCDM*	-5.70E-01	*EPI*
Iron	5.58E+01	*SCDM*	insoluble	*SCDM*	—		—		—		—		2.50E+01	*Kd-SCDM*	-7.70E-01	*EPI*
Lead	2.07E+02	*HSDB*	insoluble	*SCDM*	—		—		—		—		9.00E+02	*Kd-SCDM*	7.30E-01	*SCDM*
Manganese	5.49E+01	*SCDM*	insoluble	*SCDM*	—		—		—		—		6.50E+01	*Kd-SCDM*	2.30E-01	*EPI*
Mercury	2.01E+02	*RAIS*	5.60E-02	*HSDB*	1.96E-03	*RAIS*	1.89E-09	*EPI*	3.07E-02	*RAIS*	6.30E-06	*RAIS*	5.20E+01	*Kd-SSG2*	6.20E-01	*RAIS*
Nickel	5.87E+01	*SCDM*	insoluble	*SCDM*	—		—		—		—		6.50E+01	*Kd-SCDM*	-5.70E-01	*EPI*
Selenium	7.90E+01	*SCDM*	insoluble	*SCDM*	—		—		—		—		3.00E+02	*Kd-SCDM*	2.40E-01	*EPI*
Thallium	2.04E+02	*SCDM*	insoluble	*SCDM*	—		—		—		—		1.50E+03	*Kd-SCDM*	2.30E-01	*EPI*
Vanadium	5.09E+01	*SCDM*	insoluble	*SCDM*	—		—		—		—		1.00E+03	*Kd-SCDM*	2.30E-01	*EPI*
Zinc	6.54E+01	*SCDM*	insoluble	*SCDM*	—		—		—		—		6.20E+01	*Kd-SCDM*	-4.70E-01	*EPI*

References: CFATE (SRC 2009); HSDB (NLM 2009); SCDM (USEPA 2004c); EPI (USEPA 2004d); J&E (USEPA 2003i); Lyman, et al. (L90, 1990); RAIS (USDOE 2009); SSG2 (USEPA 2002a).

–	Not applicable.
atm-m³/mol	Atmospheres × cubic meters per mole.
°C	Degrees Celsius.
cm²/sec	Square centimeters per second.
calc'd	Calculated.
est'd	Estimated.
g/mol	Grams per mole.
Kd	Soil-water distribution coefficient (inorganics).
Koc	Organic carbon partition coefficient (organics).
Kow	Octanol-water partition coefficient.
mg/L	Milligrams per liter.
mL/g	Milliliters per gram.
mm Hg	Millimeters of mercury.

Table A.2-4
Noncarcinogenic Toxicity Values for Oral and Dermal Exposure
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

	Oral RfD (mg/kg/day)				Adjustment	Dermal RfD (mg/kg/day)		Target Site/	Confidence Level/
Constituent	Subchronic	*Ref*	Chronic	*Ref*	Factor [a]	Subchronic	Chronic	Critical Effect	Uncertainty Factor
Volatile Organic Compounds									
3-Octanone	NA		NA		1	NA	NA	NA	NA
Bromodichloromethane	2.0E-02	*H*	2.0E-02	*I*	1	2.0E-02	2.0E-02	kidney	medium/1000
Chloroform	1.0E-02	*H*	1.0E-02	*I*	1	1.0E-02	1.0E-02	liver	medium/1000
Ethanol	NA		NA		1	NA	NA	NA	NA
d-Limonene	NA		NA		1	NA	NA	NA	NA
Tetrachloroethene	1.0E-01	*H*	1.0E-02	*I*	1	1.0E-01	1.0E-02	liver	medium/1000
Semi-Volatile Organic Compounds									
2,4-Dinitrotoluene	2.0E-03	*c*	2.0E-03	*I*	1	2.0E-03	2.0E-03	CNS, blood	high/100
Bis(2-ethylhexyl)phthalate	2.0E-02	*cx*	2.0E-02	*I*	1	2.0E-02	2.0E-02	liver	medium/1000
Carbazole	NA		NA		1	NA	NA	NA	NA
Pentachlorophenol	3.0E-02	*H*	3.0E-02	*I*	1	3.0E-02	3.0E-02	liver, kidney	medium/100
Polycyclic Aromatic Hydrocarbons									
Benzo(a)anthracene	NA		NA		1	NA	NA	NR	NA
Benzo(a)pyrene	NA		NA		1	NA	NA	kidney	NA
Benzo(b)fluoranthene	NA		NA		1	NA	NA	liver, kidney, blood	NA
Benzo(k)fluoranthene	NA		NA		1	NA	NA	liver, kidney, blood	NA
Chrysene	NA		NA		1	NA	NA	kidney	NA
Dibenzo(a,h)anthracene	NA		NA		1	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	NA		NA		1	NA	NA	kidney	NA
Naphthalene	2.0E-01	*cx*	2.0E-02	*I*	1	2.0E-01	2.0E-02	WB	low/3000
Dioxin/Furan Compounds									
1,2,3,4,7,8-HxCDD	NA		NA		1	NA	NA	NA	NA
1,2,3,4,7,8-HxCDF	NA		NA		1	NA	NA	NA	NA
1,2,3,6,7,8-HxCDF	NA		NA		1	NA	NA	NA	NA
1,2,3,7,8,9-HxCDD	NA		NA		1	NA	NA	NA	NA
1,2,3,7,8,9-HxCDF	NA		NA		1	NA	NA	NA	NA
1,2,3,7,8-PeCDD	NA		NA		1	NA	NA	NA	NA
1,2,3,7,8-PeCDF	NA		NA		1	NA	NA	NA	NA
2,3,4,7,8-PeCDF	NA		NA		1	NA	NA	NA	NA
2,3,7,8-TCDD	NA		1.0E-09	*A*	1	NA	1.0E-09	NA	NA
2,3,7,8-TCDF	NA		NA		1	NA	NA	NA	NA
Herbicides									
MCPA	5.0E-04	*H*	5.0E-04	*I*	1	5.0E-04	5.0E-04	kidney, liver	medium/300
MCPP	1.0E-02	*H*	1.0E-03	*I*	1	1.0E-02	1.0E-03	kidney	medium/3000
Dichlorprop	NA		NA		1	NA	NA	NA	NA
Pesticides									
Dieldrin	5.0E-05	*H*	5.0E-05	*I*	1	5.0E-05	5.0E-05	liver	medium/100
Polychlorinated Biphenyls									
Aroclor 1254	5.0E-05	*H*	2.0E-05	*I*	1	5.0E-05	2.0E-05	eye, nails, immune system	medium/300
Aroclor 1260	NA		NA		1	NA	NA	NA	NA

Table A.2-4
Noncarcinogenic Toxicity Values for Oral and Dermal Exposure
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent		Oral RfD (mg/kg/day) Subchronic	Ref	Oral RfD (mg/kg/day) Chronic	Ref	Adjustment Factor [a]	Dermal RfD (mg/kg/day) Subchronic	Dermal RfD (mg/kg/day) Chronic	Target Site/ Critical Effect	Confidence Level/ Uncertainty Factor
Explosives										
Nitroglycerine		1.0E-04	*c*	1.0E-04	*P*	1	1.0E-04	1.0E-04	NA	NA
Pentaerythritol Tetranitrate		NA		NA		1	NA	NA	NA	NA
Inorganics										
Aluminum		1.0E+00	*c*	1.0E+00	*P*	1	1.0E+00	1.0E+00	developmental NS	NA
Antimony		4.0E-04	*H*	4.0E-04	*I*	0.15	6.0E-05	6.0E-05	WB, blood	low/1000
Arsenic		3.0E-04	*c*	3.0E-04	*I*	1	3.0E-04	3.0E-04	skin, vascular	medium/3
Barium		2.0E-01	*c*	2.0E-01	*I*	0.07	1.4E-02	1.4E-02	kidney	medium/300
Beryllium		5.0E-03	*H*	2.0E-03	*I*	0.007	3.5E-05	1.4E-05	intestine	low-medium/300
Cadmium	[b]	5E-04 / 1E-03	*c*	5E-04 / 1E-03	*I*	0.05 / 0.025	2.5E-05	2.5E-05	kidney	high/10
Chromium	[c]	2.0E-02	*Hs*	3.0E-03	*Is*	0.025	5.0E-04	7.5E-05	NR	low/300
Cobalt		3.0E-04	*c*	3.0E-04	*P*	1	3.0E-04	3.0E-04	skin	NA
Copper		4.0E-02	*c*	4.0E-02	*H*	1	4.0E-02	4.0E-02	GI	NA
Iron		7.0E-01	*c*	7.0E-01	*P*	1	7.0E-01	7.0E-01	blood, liver, GI	NA
Lead		NA		NA		1	NA	NA	CNS	NA
Manganese	[d]	1.4E-01/2E-02	*c*	1.4E-01/2E-02	*I*	0.04	5.6E-03 / 8E-04	5.6E-03 / 8E-04	CNS	medium/1
Mercury	[e]	3.0E-03	*cx*	3.0E-04	*I*	0.07	2.1E-04	2.1E-05	autoimmune effects	high/1000
Nickel	[f]	2.0E-02	*H*	2.0E-02	*I*	0.04	8.0E-04	8.0E-04	WB	medium/300
Selenium		5.0E-03	*H*	5.0E-03	*I*	1	5.0E-03	5.0E-03	WB	high/3
Thallium	[g]	8.0E-04	*Hs*	8.0E-05	*I*	1	8.0E-04	8.0E-05	liver, blood, hair	low/3000
Vanadium		7.0E-03	*H*	7.0E-03	*H*	0.026	1.8E-04	1.8E-04	liver	low/100
Zinc		3.0E-01	*H*	3.0E-01	*I*	1	3.0E-01	3.0E-01	blood	medium/3

References [ref]: *A* Agency for Toxic Substances Disease Registry (ATSDR), obtained from USEPA Regional Screening Table (USEPA 2008a).
H USEPA (1997b) (Health Effects Assessment Summary Tables [HEAST]).
I USEPA (2008b) Integrated Risk Information System (IRIS).
P Provisional Peer Reviewed Toxicity Values (PPRTV), obtained from USEPA Regional Screening Table (USEPA 2008a).

c = The chronic value is used if available.
CNS = Central nervous system.
GI = Gastrointestinal tract.
mg/kg/day = Milligrams per kilogram per day.
NA = Not available.
NR = None reported.
s = Surrogate.
NS = Nervous system.
RfD = Reference dose.
USEPA = United States Environmental Protection Agency.
WB = Whole body (includes increased mortality and changes to body weight).
x = The uncertainty factor for subchronic to chronic extrapolation was removed. Whole body (includes increased mortality and changes to body weight).

[a] The oral-to-dermal adjustment factor (oral absorption efficiency) (USEPA 2004a) was used to calculate the dermal RfD values:
RfD (dermal) = RfD (oral) × Adjustment Factor (oral absorption efficiency).
[b] RfDs for exposure via water/food consumption. The RfD for food is used to assess soil exposure.
[c] Conservatively assumed to be Chromium VI.
[d] Values for food/non-food (soil or water) exposure.
[e] Oral RfD for mercury is based on mercuric chloride toxicity data.
[f] Data are for nickel (soluble salts).
[g] Thallium chloride used as a surrogate.

Table A.2-5
Noncarcinogenic Toxicity Values for Inhalation Exposure
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent		Inhalation RfD (mg/kg/day) Subchronic	*Ref*	Chronic	*Ref*	Target Site/ Critical Effect	Confidence Level/ Uncertainty Factor
Volatile Organic Compounds							
3-Octanone		NA		NA		NA	NA
Bromodichloromethane		NA		NA		NA	NA
Chloroform		1.4E-02	*c*	2.8E-02	*A*	liver, kidney, CNS	low-med/100
Ethanol		NA		NA		NA	NA
d-Limonene		NA		NA		NA	NA
Tetrachloroethene		8.0E-02	*c*	7.7E-02	*A*	NS	NA
Semi-Volatile Organic Compounds							
2,4-Dinitrotoluene		NA		NA		NA	NA
Bis(2-ethylhexyl)phthalate		NA		NA		NA	NA
Carbazole		NA		NA		NA	NA
Pentachlorophenol		NA		NA		NA	NA
Polycyclic Aromatic Hydrocarbons							
Benzo(a)anthracene		NA		NA		NA	NA
Benzo(a)pyrene		NA		NA		NA	NA
Benzo(b)fluoranthene		NA		NA		NA	NA
Benzo(k)fluoranthene		NA		NA		NA	NA
Chrysene		NA		NA		NA	NA
Dibenzo(a,h)anthracene		NA		NA		NA	NA
Indeno(1,2,3-cd)pyrene		NA		NA		NA	NA
Naphthalene		8.6E-04	*c*	8.6E-04	*I*	nasal	medium/3000
Dioxin/Furan Compounds							
1,2,3,4,7,8-HxCDD		NA		NA		NA	NA
1,2,3,4,7,8-HxCDF		NA		NA		NA	NA
1,2,3,6,7,8-HxCDF		NA		NA		NA	NA
1,2,3,7,8,9-HxCDD		NA		NA		NA	NA
1,2,3,7,8,9-HxCDF		NA		NA		NA	NA
1,2,3,7,8-PeCDD		NA		NA		NA	NA
1,2,3,7,8-PeCDF		NA		NA		NA	NA
2,3,4,7,8-PeCDF		NA		NA		NA	NA
2,3,7,8-TCDD		NA		NA		NA	NA
2,3,7,8-TCDF		NA		NA		NA	NA
Herbicides							
MCPA		NA		NA		NA	NA
MCPP		NA		NA		NA	NA
Dichlorprop		NA		NA		NA	NA
Pesticides							
Dieldrin		NA		NA		NA	NA
Polychlorinated Biphenyls							
Aroclor 1254		NA		NA		NA	NA
Aroclor 1260		NA		NA		NA	NA
Explosives							
Nitroglycerine		NA		NA		NA	NA
Pentaerythritol Tetranitrate		NA		NA		NA	NA
Inorganics							
Aluminum		1.4E-03	*c*	1.4E-03	*P*	NA	NA
Antimony		NA		NA		NA	NA
Arsenic		NA		NA		NA	NA
Barium		1.4E-03	*H*	1.4E-04	*H*	fetus	NA/1000
Beryllium		5.7E-06	*c*	5.7E-06	*I*	lung	medium/10
Cadmium		5.7E-05	*c*	NA		NA	NA
Chromium	[a]	3.0E-05	*c*	1.0E-04		lung	medium/300
Cobalt		5.7E-06	*c*	1.7E-06	*P*	NA	NA
Copper		NA		NA		NA	NA
Iron		NA		NA		NA	NA
Lead		NA		NA		CNS	NA
Manganese		1.4E-05	*c*	1.4E-05	*I*	CNS	medium/1000
Mercury	[b]	8.6E-05	*H*	8.6E-05	*I*	CNS	medium/30
Nickel		NA		NA		NA	NA

Table A.2-5
Noncarcinogenic Toxicity Values for Inhalation Exposure
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Inhalation RfD (mg/kg/day) Subchronic	*Ref*	Chronic	*Ref*	Target Site/ Critical Effect	Confidence Level/ Uncertainty Factor
Selenium	NA		NA		NA	NA
Thallium	NA		NA		NA	NA
Vanadium	NA		NA		NA	NA
Zinc	NA		NA		NA	NA

References [ref]:
A Agency for Toxic Substances Disease Registry (ATDSR), obtained from USEPA Regional Screening Table (USEPA 2008a).
H USEPA (1997b) (Health Effects Assessment Summary Tables [HEAST]).
I USEPA (2008b) Integrated Risk Information System (IRIS).
P Provisional Peer Reviewed Toxicity Values (PPRTV), obtained from USEPA Regional Screening Table (USEPA 2008a).

c = The chronic value is used if available.
CNS = Central nervous system.
mg/kg/day = Milligrams per kilogram per day.
NA = Not available.
RfD = Reference dose.
USEPA = United States Environmental Protection Agency.

[a] Conservatively assumed to be Chromium VI.
[b] Inhalation toxicity value for mercury is based on data for elemental mercury.

Table A.2-6
Carcinogenic Toxicity Values for Oral and Dermal Exposure
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent		Oral CSF (mg/kg/day)$^{-1}$	Ref	TEF	Adjustment Factor [a]	Dermal CSF [a] (mg/kg/day)$^{-1}$	Ref	Tumor Site	Weight of Evidence Classification [b]
Volatile Organic Compounds									
3-Octanone		NA		–	1	NA		NA	NA
Bromodichloromethane		6.2E-02	*I*	–	1	6.2E-02		kidney	B2
Chloroform		NA		–	1	NA		NA	B2
Ethanol		NA		–	1	NA		NA	NA
d-Limonene		NA		–	1	NA		NA	NA
Tetrachloroethene		5.4E-01	*C*	–	1	5.4E-01		liver, kidney	B2
Semi-Volatile Organic Compounds									
2,4-Dinitrotoluene	[c]	6.8E-01	*I*	–	1	6.8E-01		liver, mammary gland	B2
Bis(2-ethylhexyl)phthalate		1.4E-02	*I*	–	1	1.4E-02		liver	B2
Carbazole		NA		–	1	NA		liver	B2
Pentachlorophenol		1.2E-01	*I*	–	1	1.2E-01		liver, adrenal	B2
Polycyclic Aromatic Hydrocarbons									
Benzo(a)anthracene		7.3E-01	*	0.1	1	7.3E-01		stomach	B2
Benzo(a)pyrene		7.3E+00	*I*	1	1	7.3E+00		stomach	B2
Benzo(b)fluoranthene		7.3E-01	*	0.1	1	7.3E-01		stomach	B2
Benzo(k)fluoranthene		7.3E-02	*	0	1	7.3E-02		stomach	B2
Chrysene		7.3E-03	*	0	1	7.3E-03		stomach	B2
Dibenzo(a,h)anthracene		7.3E+00	*	1	1	7.3E+00		stomach	B2
Indeno(1,2,3-cd)pyrene		7.3E-01	*	0.1	1	7.3E-01		stomach	B2
Naphthalene		NA		–	1	NA		NA	C
Dioxin/Furan Compounds									
1,2,3,4,7,8-HxCDD		1.3E+04	*W*	–	1	1.3E+04		NA	NA
1,2,3,4,7,8-HxCDF		1.3E+04	*W*	–	1	1.3E+04		NA	NA
1,2,3,6,7,8-HxCDF		1.3E+04	*W*	–	1	1.3E+04		NA	NA
1,2,3,7,8,9-HxCDD		1.3E+04	*W*	–	1	1.3E+04		liver	B2
1,2,3,7,8,9-HxCDF		1.3E+04	*W*	–	1	1.3E+04		NA	NA
1,2,3,7,8-PeCDD		1.3E+05	*W*	–	1	1.3E+05		NA	NA
1,2,3,7,8-PeCDF		3.9E+03	*W*	–	1	3.9E+03		NA	NA
2,3,4,7,8-PeCDF		3.9E+04	*W*	–	1	3.9E+04		NA	NA
2,3,7,8-TCDD		1.3E+05	*C*	–	1	1.3E+05		liver	B2
2,3,7,8-TCDF		1.3E+04	*W*	–	1	1.3E+04		NA	NA
Herbicides									
MCPA		NA		–	1	NA		–	NA
MCPP		NA		–	1	NA		–	NA
Dichlorprop		NA		–	1	NA		NA	NA
Pesticides									
Dieldrin		1.6E+01	*I*	–	1	1.6E+01		liver	B2
Polychlorinated Biphenyls									
Aroclor 1254		2.0E+00	*I*	–	1	2.0E+00		liver	B2
Aroclor 1260		2.0E+00	*I*	–	1	2.0E+00		liver	B2
Explosives									
Nitroglycerine		1.7E-02	*P*	–	1	1.7E-02		NA	NA
Pentaerythritol Tetranitrate		NA		–	1	NA		NA	NA
Inorganics									
Aluminum		NA		–	1	NA		–	NA
Antimony		NA		–	0.15	NA		–	NA
Arsenic		1.5E+00	*I*	–	1	1.5E+00		skin	A
Barium		NA		–	0.07	NA		–	D
Beryllium		NA		–	0.007	NA		total tumors	B1
Cadmium		NA		–	0.05 / 0.025	NA		–	D/B1
Chromium		NA		–	0.025	NA		–	D/A
Cobalt		NA		–	1	NA		–	NA
Copper		NA		–	1	NA		–	D
Iron		NA		–	1	NA		–	NA
Lead		NA		–	1	NA		NA	B2
Manganese		NA		–	0.04	NA		–	D
Mercury		NA		–	0.07	NA		–	C

Table A.2-6
Carcinogenic Toxicity Values for Oral and Dermal Exposure
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Oral CSF $(mg/kg/day)^{-1}$	*Ref*	TEF	Adjustment Factor [a]	Dermal CSF [a] $(mg/kg/day)^{-1}$	*Ref*	Tumor Site	Weight of Evidence Classification [b]
Nickel	NA		–	0.04	NA		NA	A
Selenium	NA		–	1	NA		–	D
Thallium	NA		–	1	NA		–	NA
Vanadium	NA		–	0.026	NA		–	NA
Zinc	NA		–	1	NA		–	D

References [ref]: *C* California Environmental Protection Agency (CalEPA), obtained from USEPA Regional Screening Table (USEPA 2008a).
I USEPA (2008b) Integrated Risk Information System (IRIS).
P Provisional Peer Reviewed Toxicity Values (PPRTV), obtained from USEPA Regional Screening Table (USEPA 2008a).
W World Health Organization, obtained from USEPA Regional Screening Table (USEPA 2008a).

* = Benzo(a)pyrene used as a surrogate, with the application of the appropriate TEF value.
– = Not applicable.
CSF = Cancer slope factor.
$(mg/kg/day)^{-1}$ = Inverse milligrams per kilogram per day (risk per unit dose).
NA = Not available.
TEF = Benzo(a)pyrene toxicity equivalence factor for carcinogenic polycyclic aromatic hydrocarbons (PAHs).
USEPA = United States Environmental Protection Agency.

[a] The oral-to-dermal adjustment factor (oral absorption efficiency) (USEPA 2004a) was used to calculate the dermal CSF values:
CSF (dermal) = CSF (oral) / Adjustment Factor (oral absorption efficiency)
[b] Weight of evidence classification defined in text.
[c] Value for 2,4-/2,6-dinitrotoluene mixture.

Table A.2-7
Carcinogenic Toxicity Values for Inhalation Exposure
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Inhalation CSF $(mg/kg/day)^{-1}$	*Ref*	Tumor Site	Weight of Evidence Classification [a]
Volatile Organic Compounds				
3-Octanone	NA		NA	NA
Bromodichloromethane	NA		NA	B2
Chloroform	8.1E-02	*I*	liver	B2
Ethanol	NA		NA	NA
d-Limonene	NA		NA	NA
Tetrachloroethene	2.1E-02	*C*	liver, kidney	B2
Semi-Volatile Organic Compounds				
2,4-Dinitrotoluene	NA		NA	B2
Bis(2-ethylhexyl)phthalate	NA		NA	B2
Carbazole	NA		NA	B2
Pentachlorophenol	NA		NA	B2
Polycyclic Aromatic Hydrocarbons				
Benzo(a)anthracene	NA		respiratory	B2
Benzo(a)pyrene	3.1E+00	*R3*	respiratory	B2
Benzo(b)fluoranthene	NA		respiratory	B2
Benzo(k)fluoranthene	NA		respiratory	B2
Chrysene	NA		respiratory	B2
Dibenzo(a,h)anthracene	NA		respiratory	B2
Indeno(1,2,3-cd)pyrene	NA		respiratory	B2
Naphthalene	NA		respiratory	C
Dioxin/Furan Compounds				
1,2,3,4,7,8-HxCDD	1.3E+04	*W*	NA	NA
1,2,3,4,7,8-HxCDF	1.3E+04	*W*	NA	NA
1,2,3,6,7,8-HxCDF	1.3E+04	*W*	NA	NA
1,2,3,7,8,9-HxCDD	1.3E+04	*W*	liver	B2
1,2,3,7,8,9-HxCDF	1.3E+04	*W*	NA	NA
1,2,3,7,8-PeCDD	1.3E+05	*W*	NA	NA
1,2,3,7,8-PeCDF	3.9E+03	*W*	NA	NA
2,3,4,7,8-PeCDF	3.9E+04	*W*	NA	NA
2,3,7,8-TCDD	1.3E+05	*C*	respiratory tract	B2
2,3,7,8-TCDF	1.3E+04	*W*	NA	NA
Herbicides				
MCPA	NA		–	NA
MCPP	NA		–	NA
Dichlorprop	NA		NA	NA
Pesticides				
Dieldrin	1.6E+01	*I*	liver	B2
Polychlorinated Biphenyls				
Aroclor 1254	2.0E+00	*I*	liver	B2
Aroclor 1260	2.0E+00	*I*	liver	B2
Explosives				
Nitroglycerine	NA		NA	NA
Pentaerythritol Tetranitrate	NA		NA	NA
Inorganics				
Aluminum	NA		–	NA
Antimony	NA		–	NA
Arsenic	1.5E+01	*I*	lung	A
Barium	NA		–	D
Beryllium	8.4E+00	*I*	lung	B1
Cadmium	6.3E+00	*I*	respiratory	D/B1
Chromium	4.2E+01	*I*	lung	D/A
Cobalt	3.2E+01	*P*	lung	NA
Copper	NA		–	D
Iron	NA		–	NA
Lead	NA		NA	B2
Manganese	NA		–	D
Mercury	NA		–	C
Nickel	NA		respiratory tract	A
Selenium	NA		–	D

Table A.2-7
Carcinogenic Toxicity Values for Inhalation Exposure
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Inhalation CSF $(mg/kg/day)^{-1}$	*Ref*	Tumor Site	Weight of Evidence Classification [a]
Thallium	NA		–	NA
Vanadium	NA		–	NA
Zinc	NA		–	D

References [ref]:
C California Environmental Protection Agency (CalEPA), obtained from Oak Ridge National Laboratory (USEPA 2008a).
H USEPA (1997b) (Health Effects Assessment Summary Tables [HEAST]).
I USEPA (2008b) Integrated Risk Information System (IRIS).
P Provisional Peer Reviewed Toxicity Values (PPRTV), obtained from USEPA Regional Screening Table (USEPA 2008a).

R3 Provisional value from USEPA's National Center for Environmental Assessment (NCEA), obtained from USEPA Region 3 (2007).

W World Health Organization (WHO 2005).

– = Not applicable.
CSF = Cancer slope factor.
$(mg/kg/day)^{-1}$ = Inverse milligrams per kilogram per day (risk per unit dose).
NA = Not available.
USEPA = United States Environmental Protection Agency.

[a] Weight of evidence classification defined in text.

Table A.2-8
Dermal Absorption Parameters
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern	ABSd (1)	Permeability Constant Kp (cm/hour) (2) Value	Reference	Non-Steady State Dermal Absorption Parameters (3) FA (unitless)	τ (hour)	t* (hour)	B (unitless)	Source	DA (4) (L/cm²/event)
Volatile Organic Compounds									
3-Octanone	0.1	1.2E-02	RAIS	—	—	—	—		1.19E-05
Bromodichloromethane	0	4.6E-03	DRA	1.0	0.88	2.12	0.0229	DRA	1.19E-05
Chloroform	0	6.8E-03	DRA	1.0	0.50	1.19	0.0285	DRA	1.33E-05
Ethanol	0.1	6.0E-04	RAIS	—	—	—	—		6.01E-07
d-Limonene	0.1	2.1E-01	calc	—	—	—	—		2.13E-04
Tetrachloroethene	0	3.3E-02	DRA	1.0	0.91	2.18	0.163	DRA	8.70E-05
Semi-Volatile Organic Compounds									
2,4-Dinitrotoluene	0.1	3.1E-03	DRA	1.0	1.12	2.69	0.0159	DRA	9.07E-06
Bis(2-ethylhexyl)phthalate	0.1	2.5E-02	DRA	0.8	16.64	39.93	0.19	DRA	2.25E-04
Carbazole	0.1	8.0E-02	EPI	1.0	0.91	2.18	0.396	calc	2.10E-04
Pentachlorophenol	0.25	3.9E-01	DRA	0.9	3.33	13.82	2.448	DRA	1.77E-03
Polycyclic Aromatic Hydrocarbons									
Benzo(a)anthracene	0.13	4.7E-01	DRA	1.0	2.03	8.53	2.8	DRA	1.85E-03
Benzo(a)pyrene	0.13	7.0E-01	DRA	1.0	2.69	11.67	4.28	DRA	3.17E-03
Benzo(b)fluoranthene	0.13	7.0E-01	DRA	1.0	2.77	12.03	4.28	DRA	3.22E-03
Benzo(k)fluoranthene	0.13	1.2E+00	EPI	0.8	2.72	12.17	7.331	calc	4.38E-03
Chrysene	0.13	4.7E-01	DRA	1.0	2.03	8.53	2.804	DRA	1.85E-03
Dibenzo(a,h)anthracene	0.13	1.5E+00	DRA	0.6	3.88	17.57	9.7	DRA	4.90E-03
Indeno(1,2,3-cd)pyrene	0.13	1.0E+00	DRA	0.6	3.78	16.83	6.7	DRA	3.22E-03
Naphthalene	0.13	4.7E-02	DRA	1.0	0.56	1.34	0.205	DRA	9.72E-05
Dioxin/Furan Compounds									
1,2,3,4,7,8-HxCDD	0.03	2.7E+00	calc	—	—	—	—		2.69E-03
1,2,3,4,7,8-HxCDF	0.03	2.1E+00	calc	—	—	—	—		0.00E+00
1,2,3,6,7,8-HxCDF	0.03	2.1E+00	calc	—	—	—	—		2.13E-03
1,2,3,7,8,9-HxCDD	0.03	3.2E+00	calc	0.0	16.00	71.00	25	calc	0.00E+00
1,2,3,7,8,9-HxCDF	0.03	3.2E-01	calc	—	—	—	—		3.22E-04
1,2,3,7,8-PeCDD	0.03	3.9E-01	calc	—	—	—	—		3.87E-04
1,2,3,7,8-PeCDF	0.03	7.5E-01	calc	—	—	—	—		7.48E-04
2,3,4,7,8-PeCDF	0.03	7.5E-01	calc	—	—	—	—		7.48E-04
2,3,7,8-TCDD	0.03	9.8E-01	DRA	0.0	6.70	18.00	2.5	calc	0.00E+00
2,3,7,8-TCDF	0.03	4.3E-01	calc	—	—	—	—		4.34E-04
Herbicides									
MCPA	0.1	1.0E-03	calc	0.0	1.40	3.40	0.0056	calc	0.00E+00
MCPP	0.1	1.2E-02	calc	0.0	1.70	4.00	0.07	calc	0.00E+00
Dichlorprop	0.1	1.4E-02	calc	—	—	—	—		1.40E-05
Pesticides									
Dieldrin	0.1	1.2E-02	DRA	0.8	14.62	35.09	0.0882	DRA	0.00E+00

Table A.2-8
Dermal Absorption Parameters
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern	ABSd (1)	Permeability Constant Kp (cm/hour) (2)		Non-Steady State Dermal Absorption Parameters (3)					DA (4) (L/cm²/event)
		Value	Reference	FA (unitless)	τ (hour)	t* (hour)	B (unitless)	Source	
Polychlorinated Biphenyls									
Aroclor 1254	0.14	1.3E+00	EPI	0.6	7.12	32.12	8.97	calc	5.71E-03
Aroclor 1260	0.14	5.5E+00	EPI	0.1	12.39	57.78	40.5	calc	5.33E-03
Explosives									
Nitroglycerine	0.1	1.1E-03	RAIS	—	—	—	—		1.11E-06
Pentaerythritol Tetranitrate	0.1	1.1E-03	RAIS	—	—	—	—		1.10E-06
Inorganics									
Aluminum	0	1.0E-03	W	—	—	—	—		1.00E-06
Antimony	0	1.0E-03	W	—	—	—	—		0.00E+00
Arsenic	0.03	1.0E-03	W	—	—	—	—		1.00E-06
Barium	0	1.0E-03	W	—	—	—	—		0.00E+00
Beryllium	0	1.0E-03	W	—	—	—	—		1.00E-06
Cadmium	0.001	1.0E-03	DRA	—	—	—	—		1.00E-06
Chromium	0	2.0E-03	DRA	—	—	—	—		2.00E-06
Cobalt	0	4.0E-04	DRA	—	—	—	—		4.00E-07
Copper	0	1.0E-03	W	—	—	—	—		1.00E-06
Iron	0	1.0E-03	W	—	—	—	—		1.00E-06
Lead	0	1.0E-04	DRA	—	—	—	—		1.00E-07
Manganese	0	1.0E-03	W	—	—	—	—		1.00E-06
Mercury	0	1.0E-03	DRA	—	—	—	—		1.00E-06
Nickel	0	2.0E-04	DRA	—	—	—	—		2.00E-07
Selenium	0	1.0E-03	W	—	—	—	—		1.00E-06
Thallium	0	1.0E-03	W	—	—	—	—		1.00E-06
Vanadium	0	1.0E-03	W	—	—	—	—		1.00E-06
Zinc	0	6.0E-04	DRA	—	—	—	—		6.00E-07

(1) Dermal absorption efficiency for uptake of constituents from a soil matrix (unitless) (USEPA 2004c).
(2) Permeability coefficient for dermal contact with constituents in water (centimeters per hour).
(3) Absorption parameters for use in the non-steady state model for dermal contact with constituents in water.
τ = Lag time for dermal absorption through the skin.
B = Ratio of the permeability coefficient through the stratus corneum relative to the permeability coefficient across the viable epidermis.
FA = Fraction of absorbed water.
t* = Time required to reach steady state.
(4) Dermal absorption (DA) calculated according to equations presented on Tables 5-11 and 5-12 and based on exposure time (ET) = 1 hour.

References:
calc = Calculated value (USEPA 2004c).
DRA = USEPA (2004c) (Dermal Risk Assessment). The B values are calculated but are consistent with values presented in USEPA (2004c) guidance.
EPI = EPI Suite (USEPA 2000).
RAIS = Risk Assessment Information System (USDOE 2008).
W = Assumed to be equal to the value for water (USEPA 2004c).

cm = Centimeter.
L = Liter.
USEPA = United States Environmental Protection Agency.

Table A.2-9

Calculation of Volatilization and Particulate Emission Factors for Soil Exposure

New River Unit, Radford Army Ammunition Plant, Radford, Virginia.

Volatilization Factors:	(calculated only for volatile organic compounds)								
Constituent	Solubility in Water (mg/L) (S)	Saturation Limit in Soil (mg/kg) (Csat)	Diffusivity in Air (cm^2/sec) (D_{air})	Diffusivity in Water (cm^2/sec) (D_{wat})	Henry's Law Constant (atm-m^3/mol) (H)	Henry's Law Constant (unitless) (H_o)	Partition Coefficient (mL/g) (Koc)	Apparent Diffusivity (cm^2/sec) (D_A)	Volatilization Factor (m^3/kg) (VF)
Volatile Organic Compounds									
3-Octanone	1.19E+03	4.50E+02	5.39E-01	6.11E-06	3.33E-04	1.36E-02	4.64E+01	1.03E-03	3.87E+03
Bromodichloromethane	6.74E+03	3.00E+03	2.98E-02	1.06E-05	1.60E-03	6.54E-02	5.50E+01	2.35E-04	8.10E+03
Chloroform	7.92E+03	2.90E+03	1.04E-01	1.00E-05	3.67E-03	1.50E-01	3.98E+01	2.26E-03	2.61E+03
Ethanol	7.92E+05	8.40E+04	1.35E-01	1.20E-05	4.66E-06	1.90E-04	1.00E+00	1.36E-05	—
d-Limonene	4.58E+00	3.90E+01	6.44E-02	5.72E-06	5.67E-02	2.32E+00	1.32E+03	9.38E-04	4.05E+03
Tetrachloroethene	2.00E+02	2.30E+02	7.20E-02	8.20E-06	1.84E-02	7.52E-01	1.55E+02	2.46E-03	2.50E+03
Semi-Volatile Organic Compounds									
2,4-Dinitrotoluene	2.70E+02	—	2.03E-01	7.06E-06	9.26E-08	3.78E-06	9.46E+01	1.28E-07	—
Bis(2-ethylhexyl)phthalate	3.40E-01	1.80E+02	3.51E-02	3.66E-06	1.02E-07	4.17E-06	8.74E+04	5.91E-11	—
Carbazole	7.48E+00	—	3.90E-02	7.03E-06	1.53E-08	6.25E-07	3.38E+03	2.25E-09	—
Pentachlorophenol	1.95E+03	—	5.60E-02	6.10E-06	2.44E-08	9.97E-07	5.92E+02	1.14E-08	—
Polycyclic Aromatic Hydrocarbons									
Benzo(a)anthracene	9.40E-03	—	5.10E-02	9.00E-06	3.35E-06	1.37E-04	3.98E+05	1.80E-10	—
Benzo(a)pyrene	1.62E-03	—	4.30E-02	9.00E-06	1.13E-06	4.62E-05	1.02E+06	2.66E-11	—
Benzo(b)fluoranthene	1.50E-03	—	2.26E-02	5.56E-06	1.11E-04	4.54E-03	1.23E+06	7.45E-10	—
Benzo(k)fluoranthene	8.00E-04	—	2.26E-02	5.56E-06	8.29E-07	3.39E-05	1.24E+06	1.02E-11	—
Chrysene	1.60E-03	—	2.48E-02	6.21E-06	9.46E-05	3.87E-03	4.01E+05	2.14E-09	—
Dibenzo(a,h)anthracene	2.49E-03	—	2.02E-02	5.18E-06	1.47E-08	6.01E-07	3.80E+06	1.47E-12	—
Indeno(1,2,3-cd)pyrene	2.20E-05	—	1.90E-02	5.66E-06	1.60E-06	6.54E-05	3.47E+06	4.91E-12	—
Naphthalene	3.10E+01	—	5.90E-02	7.50E-06	4.83E-04	1.97E-02	2.01E+03	5.11E-06	5.49E+04
Dioxin/Furan Compounds									
1,2,3,4,7,8-HxCDD	5.91E-05	—	4.78E-02	4.58E-06	5.31E-05	2.17E-03	4.25E+05	2.18E-09	—
1,2,3,4,7,8-HxCDF	5.89E-05	—	4.82E-02	4.61E-06	9.38E-04	3.83E-02	2.31E+05	7.10E-08	—
1,2,3,6,7,8-HxCDF	5.89E-05	—	4.82E-02	4.61E-06	9.38E-04	3.83E-02	2.31E+05	7.10E-08	—
1,2,3,7,8,9-HxCDD	2.65E-05	—	4.81E-02	1.00E-05	8.40E-05	3.43E-03	4.17E+05	3.55E-09	—
1,2,3,7,8,9-HxCDF	1.14E-04	—	4.82E-02	4.61E-06	3.34E-04	1.36E-02	2.31E+05	2.53E-08	—
1,2,3,7,8-PeCDD	9.39E-04	—	4.86E-02	4.77E-06	2.22E-05	9.06E-04	2.47E+05	1.60E-09	—
1,2,3,7,8-PeCDF	8.73E-04	—	4.89E-02	4.81E-06	2.80E-05	1.14E-03	1.37E+05	3.67E-09	—
2,3,4,7,8-PeCDF	8.73E-04	—	4.89E-02	4.81E-06	2.80E-05	1.14E-03	1.37E+05	3.67E-09	—
2,3,7,8-TCDD	7.91E-06	—	1.43E-02	5.83E-06	7.92E-05	3.24E-03	2.63E+06	1.59E-10	—
2,3,7,8-TCDF	2.33E-03	—	4.98E-02	5.04E-06	2.54E-05	1.04E-03	8.10E+04	5.73E-09	—
Herbicides									
MCPA	1.17E+03	—	1.00E-01	1.00E-05	5.49E-05	2.24E-03	2.94E+01	4.34E-05	—
MCPP	7.34E+02	—	1.00E-01	5.77E-06	1.82E-08	7.44E-07	3.60E+02	1.80E-08	—
Dichlorprop	8.35E+01	—	5.79E-02	5.53E-06	1.26E-07	5.13E-06	4.86E+01	1.30E-07	—
Pesticides									
Dieldrin	1.95E-01	—	1.25E-02	4.74E-06	1.51E-05	6.17E-04	2.14E+04	3.43E-09	—
Polychlorinated Biphenyls									
Aroclor 1254	6.00E-02	—	1.56E-02	5.00E-06	1.45E-04	5.93E-03	2.00E+05	4.13E-09	—
Aroclor 1260	8.00E-02	—	1.38E-02	4.32E-06	7.40E-05	3.02E-03	2.90E+05	1.29E-09	—
Explosives									
Nitroglycerine	1.31E+03	—	6.40E-02	6.29E-06	6.23E-06	2.55E-04	1.31E+02	1.03E-06	—
Pentaerythritol Tetranitrate	9.14E+01	—	5.18E-02	5.06E-06	1.92E-08	7.83E-07	7.58E+02	7.38E-09	—

Table A.2-9

Calculation of Volatilization and Particulate Emission Factors for Soil Exposure

New River Unit, Radford Army Ammunition Plant, Radford, Virginia.

Volatilization Factors: (calculated only for volatile organic compounds)

Constituent	Solubility in Water (mg/L) (S)	Saturation Limit in Soil (mg/kg) (Csat)	Diffusivity in Air (cm^2/sec) (D_{air})	Diffusivity in Water (cm^2/sec) (D_{wat})	Henry's Law Constant (atm-m^3/mol) (H)	Henry's Law Constant (unitless) (H_o)	Partition Coefficient (mL/g) (Koc)	Apparent Diffusivity (cm^2/sec) (D_A)	Volatilization Factor (m^3/kg) (VF)
Inorganics									
Aluminum	insoluble	—	—	—	—	—	1.50E+03	—	—
Antimony	insoluble	—	—	—	—	—	4.50E+01	—	—
Arsenic	insoluble	—	—	—	—	—	2.90E+01	—	—
Barium	insoluble	—	—	—	—	—	4.10E+01	—	—
Beryllium	insoluble	—	—	—	—	—	7.90E+02	—	—
Cadmium	insoluble	—	—	—	—	—	7.50E+01	—	—
Chromium	insoluble	—	—	—	—	—	1.90E+01	—	—
Cobalt	insoluble	—	—	—	—	—	4.50E+01	—	—
Copper	insoluble	—	—	—	—	—	4.28E+02	—	—
Iron	insoluble	—	—	—	—	—	2.50E+01	—	—
Lead	insoluble	—	—	—	—	—	9.00E+02	—	—
Manganese	insoluble	—	—	—	—	—	6.50E+01	—	—
Mercury	5.60E-02	—	3.07E-02	6.30E-06	1.89E-09	7.72E-08	5.20E+01	9.74E-08	—
Nickel	insoluble	—	—	—	—	—	6.50E+01	—	—
Selenium	insoluble	—	—	—	—	—	3.00E+02	—	—
Thallium	insoluble	—	—	—	—	—	1.50E+03	—	—
Vanadium	insoluble	—	—	—	—	—	1.00E+03	—	—
Zinc	insoluble	—	—	—	—	—	6.20E+01	—	—

Particulate Emission Factor:

x =	2.138	unitless	Function of Ut/Um; x = 0.886 × (Ut/Um)
Fx =	0.1934	unitless	Function of x; Fx = 0.18 × ($8x^3 + 12x$) × exp($-x^2$)
PEF =	1.36E+09	m^3/kg	Particulate emission factor (m^3/kg)

Model Input Parameters:

Foc =	0.006	unitless	Fraction organic carbon (USEPA 2002a, default)
ρ_b =	1.5	g/cm^3	Soil dry bulk density (USEPA 2002a, default)
θ_T =	0.434	unitless	Total soil porosity (USEPA 2002a, default)
θ_{as} =	0.284	unitless	Air-filled soil porosity [= θ_T - θ_{ws}]
θ_{ws} =	0.15	unitless	Water-filled soil porosity (USEPA 2002a, default)
Q/C_{vol} =	68.18	(g/m^2/sec)/(kg/m^3)	Volatilization flux per unit concentration (USEPA 2002a, default)
Q/C_{wind} =	93.77	(g/m^2/sec)/(kg/m^3)	Wind-related particulate emission flux per unit concentration (USEPA 2002a, default)
RPF =	0.036	g/m^2/hour	Respirable particle fraction (USEPA 2002a).
T =	9.5E+08	sec	Exposure interval (USEPA 2002a)
Um =	4.69	m/sec	Mean annual wind speed for City, State (USDOE 1986)
Ut =	11.32	m/sec	Equivalent threshold value of windspeed at 7 meters (USEPA 2002a)
V =	0.5	unitless	Fraction vegetative cover (USEPA 2002a, default)

—	Not available.	kg	Kilogram.	mL	Milliliter.
atm	Atmosphere.	L	Liter.	mol	Mole.
cm	Centimeter.	m	Meter.	sec	Second.
g	Gram.	mg	Milligram.		

Table A.2-10
Receptor-Specific Exposure Parameters
New River Unit, Radford Army Ammunition Plant, Radford, Virginia.

Parameter	Symbol	units	Residents Child		Residents Adult		Site Worker		Construction Worker	
General Factors										
Averaging Time (cancer)	ATc	days	25,550	[a]	25,550	[a]	25,550	[a]	25,550	[a]
Averaging Time (noncancer)	ATnc	days	2,190	[a]	10,950	[a]	9,125	[a]	182	[a]
Body Weight	BW	kg	15	[2]	70	[1,2]	70	[1,2]	70	[1,2]
Exposure Frequency	EF	days/year	350	[1,2]	350	[1,2]	250	[1,2]	130	PJ
Exposure Frequency - Wading	EFwade	day/syear	48	PJ [b]	48	PJ [b]	26	PJ [b]	–	
Exposure Duration	ED	years	6	[1,2]	24	[1,2]	25	[1,2]	1	PJ
Groundwater - Ingestion (Oral)										
Groundwater Ingestion Rate	IRgw	L/day	1	[1,2]	2	[1,2]	2	[1,2]	–	
Groundwater - Dermal Contact										
Exposed Skin Surface Area	SSAgw	cm²	6,600	[3]	18,000	[3]	2,400	[3,e]	–	
Exposure Time; groundwater contact	ETgw	hours/day	1.0	[3]	0.58	[3]	0.17	PJ [e]	–	
Groundwater - Inhalation of Volatiles										
Breathing Rate	BRgw	m³/day	10	[4]	20	[1,2]	–		–	
Soil - Ingestion (Oral)										
Incidental Soil Ingestion Rate	IRs	mg/day	200	[2]	100	[2]	100	[5]	330	[5]
Fraction Ingested from Souce	FI	unitless	1		1		1		1	
Soil - Dermal Contact										
Exposed Skin Surface Area	SSAs	cm²	2,800	[3,c]	5,700	[3,c]	3,300	[3]	3,300	[3]
Soil-to-Skin Adherence Rate	SAR	mg/cm²/day	0.2	[3]	0.07	[3]	0.2	[3]	0.3	[5]
Soil - Inhalation of Dust and Vapor										
Breathing Rate	BRs	m³/day	10	[4]	20	[2]	20	[1,2]	20	[1,2]
Sediment - Ingestion (Oral)										
Incidental Sediment Ingestion Rate	IRsed	mg/day	100	PJ	50	PJ	50	PJ	–	
Sediment - Dermal Contact										
Exposed Skin Surface Area	SSAsed	cm²	1,900	[4,d]	5,000	[4,d]	5,000	[4,d]	–	
Sediment-to-Skin Adherence Rate	SedAR	mg/cm²/day	0.2	[3]	0.6	[3]	0.6	[3]	–	
Surface Water - Ingestion (Oral) and Dermal Contact										
Surface water Ingestion Rate	IRsw	L/hour	0.05	[1]	0.05	[1]	0.05	[1]	–	
Exposed Skin Surface Area	SSAsw	cm²	1,900	[4,d]	5,000	[4,d]	5,000	[4,d]	–	
Exposure Time	ETsw	hours/day	1	[4]	1	[4]	8	[4]	–	
Surface Water - Inhalation of Volatiles										
Breathing Rate	BRsw	m³/day	2	[4]	2.1	[4]	2.1	[4]	–	
Ingestion of Fish										
Fish Ingestion Rate	IRfish	kg/day	0.054	[6]	0.054	[6]	–		–	

References:

[1] USEPA (1989).
[2] USEPA (1991a).
[3] USEPA (2004a).
[4] USEPA (1997a).
[5] USEPA (2002a).
[6] USEPA (2009a).

[a] The averaging time for cancer risk is the expected lifespan of 70 years expressed in days.
The averaging time for non-cancer hazard is the total exposure duration expressed in days.
[b] EFwade was set at 48 days/year for the resident receptor assuming twice a week during the six warm months of the year.
EFwade was set at 26 days per year for the worker receptor assuming exposure once every two weeks.
[c] SSAs assumes that a receptor is wearing a short-sleeved shirt, shorts, and shoes therefore the
SSAs is the average surface area for the head, hands, forearms, and lower legs.
[d] SSAsed and SSsw assumes that a receptor is wearing a short-sleeved shirt and shorts but not shoes therefore the
SSAed and SSAsw is the average surface area of feet, hands, forearms, and lower legs.
[e] SSAs assumes that a receptor is wearing a short-sleeved shirt, long-pants, and shoes therefore the
SSAs is the average surface area of hands, forearms, and face (average for men and women).
[f] SSAsed and SSsw assumes that a receptor is wearing a short-sleeved shirt and shorts but not shoes therefore the
SSAed and SSAsw is the average surface area of feet, hands, forearms, and lower legs.

cm	Centimeter.	m	Meter.	PJ	Professional judgment (see text).
kg	Kilogram.	mg	Milligram.	yr	Year.
L	Liter.				

Table A.2-11
Risk and Hazard Equations for Exposure to Soil
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

ROUTE-SPECIFIC RISK/HAZARD:

Oral:

$$ELCR_o \text{ or } HQ_o = \frac{EPCs \times FI \times IRs \times EF \times ED}{(10^6 \text{ mg/kg}) \times BW \times (AT_C \text{ or } AT_{NC}) \times ([1/CSF_o] \text{ or } RfD_o)}$$

Dermal:

$$ELCR_d \text{ or } HQ_d = \frac{EPCs \times SSAs \times SAR \times ABSd \times EF \times ED}{(10^6 \text{ mg/kg}) \times BW \times (AT_C \text{ or } AT_{NC}) \times ([1/CSF_a] \text{ or } RfD_a)}$$

Inhalation:

$$ELCR_i \text{ or } HQ_i = \frac{EPC_i \times BRs \times EF \times ED}{(VF \text{ or } PEF) \times BW \times (AT_C \text{ or } AT_{NC}) \times ([1/CSF_i] \text{ or } RfD_i)}$$

$$VF = \frac{Q/C_{vol} \times [3.14 \times D_A \times T]^{1/2}}{2 \times \rho_b \times D_A \times (10{,}000 \text{ cm}^2/\text{m}^2)}$$

used for VOCs

$$PEF = \frac{Q/C_{wind} \times (3{,}600 \text{ sec/hr})}{RPF \times (1-V) \times (Um/Ut)^3 \times Fx}$$

used for non-VOCs

$$D_A = \frac{[(\theta_{as}^{10/3} \times D_{air} \times H_o) + (\theta_{ws}^{10/3} \times D_{wat})] / \theta_T^2}{(\rho_b \times Koc \times Foc) + \theta_{ws} + (\theta_{as} \times H_o)}$$

EPC_i = MINIMUM [EPCs, C_{sat}] OR = EPCs when C_{sat} is not relevant

$$C_{sat} = \frac{S}{\rho_b} \times [(Koc \times Foc \times \rho_b) + \theta_{ws} + (H_o \times \theta_{as})]$$

C_{sat} is relevant only for organic constituents with melting point below 30ºC.

For potentially mutagenic carcinogens (i.e.,PAHs), the ED and ATc of any ELCR equation are removed; 365 days/year replaces ATc; and the equation is adjusted by (4.6*(2/70))+(2.1*(4/70)) for child resident receptors and (2.1*(10/70))+(1*(14/70)) for adult resident receptors.

TOTAL CANCER RISK: $ELCR = ELCR_o + ELCR_d + ELCR_i$

TOTAL NON-CANCER HAZARD: $HI = HQ_o + HQ_d + HQ_i$

Variable Definitions:

θ_{as}	Air-filled porosity of the soil (unitless).
θ_T	Total soil porosity (unitless).
θ_{ws}	Water-filled porosity of the soil (unitless).
ρ_b	Dry soil bulk density (g/cm³).
ABSd	Dermal absorption efficiency (unitless) (Table A.2-8).
AT_C	Averaging time for cancer effects (days) (Table A.2-10).
AT_{NC}	Averaging time for noncancer effects (days) (Table A.2-10).
BRs	Breathing rate for soil exposure (m³/day) (Table A.2-10).
BW	Body weight (kg) (Table A.2-10).
C_{sat}	Constituent saturation limit in soil (mg/kg).
CSF	Cancer slope factor for oral (CSF_o), dermal (adjusted to an absorbed dose, CSF_a), or inhalation (CSF_i) exposure (kg-day/mg [inverse mg/kg/day]) (Tables A.2-6 and A.2-7).
D_A	Apparent diffusivity in soil (cm²/sec).
D_{air}	Constituent diffusivity in air (cm²/sec) (Table A.2-3).
D_{wat}	Constituent diffusivity in water (cm²/sec) (Table A.2-3).
ED	Exposure duration (years) (Table A.2-10).
EF	Exposure frequency (days/year) (Table A.2-10).

Table A.2-11
Risk and Hazard Equations for Exposure to Soil
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

ELCR	Excess lifetime cancer risk (unitless).
EPCs	Exposure point concentration in soil (mg/kg).
EPC_i	Exposure point concentration relevant to inhalation (mg/kg) (minimum of EPCs and C_{sat}).
FI	Fraction ingested from area of concern (unitless) (Table A.2-10).
Foc	Fraction organic carbon in the soil (unitless).
Fx	Function of Ut/Um (unitless); $Fx = 0.18 \times (8x^3 + 12x) \times \exp[-(x^2)]$, where $x = 0.886 \times (Ut/Um)$.
H	Henry's law constant ($atm\text{-}m^3/mol$) (Table A.2-3).
HI	Hazard index for non-cancer effects (unitless); sum of the HQs.
H_o	Dimensionless Henry's law constant (unitless); calculated as $H_o = H / RT$.
HQ	Hazard quotient for non-cancer effects (unitless).
IRs	Ingestion rate of soil (mg/day) (Table A.2-10).
Koc	Organic carbon partition coefficient ($cm^3/g = mL/g = L/kg$) (Table A.2-3).
PEF	Particulate emission factor (m^3/kg).
Q/C_{vol}	Volatile emission flux per unit concentration $[(g/m^2/sec)/(kg/m^3)]$.
Q/C_{wind}	Particulate emission flux per unit concentration $[(g/m^2/sec)/(kg/m^3)]$.
RfD	Reference dose for oral (RfD_o), dermal (adjusted to an absorbed dose, RfD_a), or inhalation (RfD_i) exposure (mg/kg/day) (Tables A.2-4 and A.2-5).
RPF	Respirable particle fraction (0.036 $g/m^2/hr$).
RT	Product of the universal gas constant ($R = 8.206 \times 10^{-5}$ $atm\text{-}m^3/mol/K$) and the relevant Kelvin temperature (T = 298.15 K); RT = 0.02447 $atm\text{-}m^3/mol$.
S	Constituent solubility limit in water (mg/L).
SAR	Soil-to-skin adherence rate ($mg/cm^2/day$) (Table A.2-10).
SSAs	Exposed skin surface area for soil contact (cm^2) (Table A.2-10).
T	Exposure interval (sec).
Um	Mean annual wind speed (m/sec).
Ut	Equivalent threshold value of windspeed at 7 meters (11.32 m/sec).
V	Fraction of vegetative cover (unitless).
VF	Volatilization factor (m^3/kg).
x	Intermediate value in the calculation of PEF; $x = 0.886 \times (Ut/Um)$.

VOCs Volatile organic compounds.

Table A.2-12
Risk and Hazard Equations for Exposure to Sediment
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

ROUTE-SPECIFIC RISK/HAZARD:

Oral:

$$ELCR_o \text{ or } HQ_o = \frac{EPCsed \times IRsed \times EF \times ED}{(10^6 \text{ mg/kg}) \times BW \times (AT_C \text{ or } AT_{NC}) \times ([1/CSF_o] \text{ or } RfD_o)}$$

Dermal:

$$ELCR_d \text{ or } HQ_d = \frac{EPCsed \times SSAsed \times SedAR \times ABSd \times EF \times ED}{(10^6 \text{ mg/kg}) \times BW \times (AT_C \text{ or } AT_{NC}) \times ([1/CSF_a] \text{ or } RfD_a)}$$

For potentially mutagenic carcinogens (i.e.,PAHs), the ED and ATc of any ELCR equation are removed; 365 days/year replaces ATc; and the equation is adjusted by (4.6*(2/70))+(2.1*(4/70)) for child resident receptors and (2.1*(10/70))+(1*(14/70)) for adult resident receptors.

TOTAL CANCER RISK: $ELCR = ELCR_o + ELCR_d$

TOTAL NON-CANCER HAZARD: $HI = HQ_o + HQ_d$

Variable Definitions:

ABSd	Dermal absorption efficiency (unitless) (Table A.2-8).
AT_C	Averaging time for cancer effects (days) (Table A.2-10).
AT_{NC}	Averaging time for non-cancer effects (days) (Table A.2-10).
BW	Body weight (kg) (Table A.2-10).
CSF	Cancer slope factor for oral (CSF_o) or dermal (adjusted to an absorbed dose, CSF_a) exposure (kg-day/mg [inverse mg/kg/day]) (Table A.2-6).
ED	Exposure duration (years) (Table A.2-10).
EF	Exposure frequency (days/year) (Table A.2-10).
ELCR	Excess lifetime cancer risk (unitless).
EPCsed	Exposure point concentration in sediment (mg/kg).
HI	Hazard index for non-cancer effects (unitless); sum of the HQs.
HQ	Hazard quotient for non-cancer effects (unitless).
IRsed	Ingestion rate of sediment (mg/day) (Table A.2-10).
RfD	Reference dose for oral (RfD_o) or dermal (adjusted to an absorbed dose, RfD_a) exposure (mg/kg/day) (Table A.2-4).
SedAR	Sediment-to-skin adherence rate (mg/cm²/day) (Table A.2-10).
SSAsed	Exposed skin surface area for sediment contact (cm²) (Table A.2-10).

Table A.2-13
Risk and Hazard Equations for Wading Exposure to Surface Water
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

ROUTE-SPECIFIC RISK/HAZARD:

Oral:

$$ELCR_o \ \textit{or}\ HQ_o = \frac{EPCsw \times IRsw \times ETsw \times EF \times ED}{BW \times (AT_C \ \textit{or}\ AT_{NC}) \times ([1/CSF_o] \ \textit{or}\ RfD_o)}$$

Dermal:

$$ELCR_d \ \textit{or}\ HQ_d = \frac{EPCsw \times DA \times SSAsw \times EF \times ED}{BW \times (AT_C \ \textit{or}\ AT_{NC}) \times ([1/CSF_a] \ \textit{or}\ RfD_a)}$$

Inorganics:

$$DA\,[0] = \frac{K_p \times ETsw}{1000\ cm^3/L}$$

Organics:

$$DA\,[1] = \frac{2\,FA \times K_p}{1000\ cm^3/L} \times \sqrt{(6\,\tau \times ETsw)/\pi} \qquad \text{if } ETsw \le t^*$$

or

$$DA\,[2] = \frac{FA \times K_p}{1000\ cm^3/L} \times \left(\frac{ETsw}{1+B} + \frac{2\,\tau\,(1 + 3B + 3B^2)}{(1+B)^2} \right) \qquad \text{if } ETsw > t^*$$

Inhalation:

$$ELCR_i \ \textit{or}\ HQ_i = \frac{EPCsw \times VFsw \times BRsw \times EF \times ED}{BW \times (AT_C \ \textit{or}\ AT_{NC}) \times ([1/CSF_i] \ \textit{or}\ RfD_i)}$$

where:

$$VFsw = \frac{(1000\ L/m^3)}{(1/k_l) + [1/(H_o \times k_g)]} \times \frac{SA}{Hb \times Wb \times Um}$$

TOTAL CANCER RISK: $ELCR = ELCR_o + ELCR_d + ELCR_i$

TOTAL NON-CANCER HAZARD: $HI = HQ_o + HQ_d + HQ_i$

Variable Definitions:

τ	(tau) Lag time for dermal absorption through the skin (hour) (Table A.2-8).
AT_C	Averaging time for cancer effects (days) (Table A.2-10).
AT_{NC}	Averaging time for non-cancer effects (days) (Table A.2-10).
B	Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (unitless) (Table A.2-8).
BRsw	Breathing rate for surface water exposure (m^3/day) (Table A.2-10).
BW	Body weight (kg) (Table A.2-10).
CSF	Cancer slope factor for oral (CSF_o), dermal (adjusted to an absorbed dose, CSF_a), or inhalation (CSF_i) exposure (kg-day/mg [inverse mg/kg/day]) (Tables A.2-6 and A.2-7).
DA	Dermal absorption factor (L/cm^2/day), calculated using Equation [0], [1], or [2], as appropriate.
ED	Exposure duration (years) (Table A.2-10).
EF	Exposure frequency (days/year) (Table A.2-10).
ELCR	Excess lifetime cancer risk (unitless).
EPCsw	Exposure point concentration in surface water (mg/L).
ETsw	Exposure time for surface water (hours/day) (Table A.2-10).
FA	Fraction of absorbed water (unitless) (Table A.2-8).
H	Henry's law constant (atm-m^3/mol) (Table A.2-3).
Hb	Height of mixing zone (2 m).
HI	Hazard index for non-cancer effects (unitless); sum of the HQs.

Table A.2-13
Risk and Hazard Equations for Wading Exposure to Surface Water
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

H_o	Dimensionless Henry's law constant (unitless); calculated as H_o = H/RT.
HQ	Hazard quotient for non-cancer effects (unitless).
IRsw	Incidental ingestion rate of surface water (L/day) (Table A.2-10).
k_g	Gas-phase mass transfer coefficient (m/sec) ≈ (8.3 × 10^{-3} m/sec) × [(18 g/mol)/MW]$^{1/2}$.
k_l	Liquid-phase mass transfer coefficient (m/sec) ≈ (5.6 × 10^{-5} m/sec) × [(44 g/mol)/MW]$^{1/2}$.
K_p	Permeability coefficient (cm/hour) (Table A.2-8).
MW	Molecular weight (g/mol) (Table A.2-3).
RfD	Reference dose for oral (RfD_o), dermal (adjusted to an absorbed dose, RfD_a), or inhalation (RfD_i) exposure (mg/kg/day) (Tables A.2-4 and A.2-5).
RT	Product of the universal gas constant (R = 8.206 × 10^{-5} atm-m^3/mol/K) and the relevant Kelvin temperature (T = 298.15 K); RT = 0.02447 atm-m^3/mol.
SA	Source area (1 m^2).
SSAgw	Exposed skin surface area for surface water contact (cm^2) (Table A.2-10).
t*	Time required to reach steady state (hour) (Table A.2-8).
Um	Mean wind speed (m/sec).
VFsw	Volatilization factor from surface water (L/m^3).
Wb	Width of mixing zone (1 m).

Table A.2-14
Risk and Hazard Equations for Exposure to Surface Water by Fish Ingestion
New River Unit, Radford Army Ammunition Plant, Radford, Virginia.

CANCER RISK:

$$ELCR = \frac{EPCsw \times BCF \times IRfish \times EF \times ED \times CSF_o}{BW \times AT_C}$$

NON-CANCER HAZARD:

$$HQ = \frac{EPCsw \times BCF \times IRfish \times EF \times ED}{BW \times AT_{NC} \times RfD_o}$$

Variable Definitions:	
AT_C	Averaging time for cancer effects (days) (Table A.2-10).
AT_{NC}	Averaging time for non-cancer effects (days) (Table A.2-10).
BCF	Fish bioconcentration factor (L/kg) (Table A.2-3).
BW	Body weight (kg) (Table A.2-10).
CSF_o	Cancer slope factor for oral exposure (kg-day/mg [inverse mg/kg/day]) (Table A.2-6).
ED	Exposure duration (years) (Table A.2-10).
EF	Exposure frequency (days/year) (Table A.2-10).
ELCR	Excess lifetime cancer risk (unitless).
EPCsw	Exposure point concentration in surface water (mg/L).
HQ	Hazard quotient for non-cancer hazard (unitless).
IRfish	Ingestion rate of fish (kg/day) (Table A.2-10).
RfD_o	Reference dose for oral exposure (mg/kg/day) (Table A.2-4).

Table A.2-15
Risk and Hazard Equations for Residential and Industrial Exposure to Groundwater
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

ROUTE-SPECIFIC RISK/HAZARD:

Oral:

$$ELCR_o \text{ or } HQ_o = \frac{EPCgw \times IRgw \times EF \times ED}{BW \times (AT_C \text{ or } AT_{NC}) \times ([1/CSF_o] \text{ or } RfD_o)}$$

Dermal:

$$ELCR_d \text{ or } HQ_d = \frac{EPCgw \times DA \times SSAgw \times EF \times ED}{BW \times (AT_C \text{ or } AT_{NC}) \times ([1/CSF_a] \text{ or } RfD_a)}$$

Inorganics:

$$DA\,[0] = \frac{K_p \times ETgw}{1000\ cm^3/L}$$

Organics:

$$DA\,[1] = \frac{2\,FA \times K_p}{1000\ cm^3/L} \times \sqrt{(6\,\tau \times ETgw)/\pi} \qquad \text{if } ETgw \le t^*$$

or

$$DA\,[2] = \frac{FA \times K_p}{1000\ cm^3/L} \times \left(\frac{ETgw}{1+B} + \frac{2\,\tau\,(1 + 3B + 3B^2)}{(1+B)^2} \right) \qquad \text{if } ETgw > t^*$$

Inhalation:

$$ELCR_i \text{ or } HQ_i = \frac{EPCgw \times VFres \times BRgw \times EF \times ED}{BW \times (AT_C \text{ or } AT_{NC}) \times ([1/CSF_i] \text{ or } RfD_i)}$$

** Note: Inhalation pathway only complete for residential exposure to groundwater while showering **

TOTAL CANCER RISK: $ELCR = ELCR_o + ELCR_d + ELCR_i$

TOTAL NON-CANCER HAZARD: $HI = HQ_o + HQ_d + HQ_i$

Variable Definitions:

τ	Lag time for dermal absorption through the skin (hour) (Table A.2-8).
AT_C	Averaging time for cancer effects (days) (Table A.2-10).
AT_{NC}	Averaging time for non-cancer effects (days) (Table A.2-10).
B	Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (unitless) (Table A.2-8).
BRgw	Breathing rate for groundwater exposure (m^3/day) (Table A.2-10).
BW	Body weight (kg) (Table A.2-10).
CSF	Cancer slope factor for oral (CSF_o), dermal (adjusted to an absorbed dose, CSF_a), or inhalation (CSF_i) exposure (kg-day/mg [inverse mg/kg/day]) (Tables A.2-6 and A.2-7).
DA	Dermal absorption factor (L/cm^2/day), calculated using Equation [0], [1], or [2], as appropriate.
ED	Exposure duration (years) (Table A.2-10).
EF	Exposure frequency (days/year) (Table A.2-10).
ELCR	Excess lifetime cancer risk (unitless).
EPCgw	Exposure point concentration in groundwater (mg/L).
ETgw	Exposure time for groundwater contact (hours/day) (Table A.2-10).
FA	Fraction of absorbed water (unitless) (Table A.2-8).
HI	Hazard index for non-cancer effects (unitless); sum of the HQs.
HQ	Hazard quotient for non-cancer effects (unitless).
IRgw	Ingestion rate of groundwater (L/day) (Table A.2-10).
Kp	Permeability coefficient (cm/hour) (Table A.2-8).
RfD	Reference dose for oral (RfD_o), dermal (adjusted to an absorbed dose, RfD_a), or inhalation (RfD_i) exposure (mg/kg/day) (Tables A.2-4 and A.2-5).

Table A.2-15
Risk and Hazard Equations for Residential and Industrial Exposure to Groundwater
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

SSAgw	Exposed skin surface area for groundwater contact (cm^2) (Table A.2-10).
t*	Time required to reach steady state (hour) (Table A.2-8).
VFres	Residential volatilization factor for household tap water (0.5 L/m^3); applicable only for volatile organic compounds (VOCs) (USEPA 1991).

Table A.2-16
Threatened and Endangered Species Potentially Occurring at the Site
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scientific Name Common Name	State Rank [a]	State Status [b]	Federal Status [c]	Habitat	Habitat Present at NRU SWMUs
Upland Forest					
Plants:					
Blephilia hirsuta Hairy woodmint	R	WL	NA	Mesic successional woodlands, sinkholes, and ravines.	NO
Panax quinquifolium American ginseng	C	WL	NA	Rich deciduous forests.	NO
Limestone Barren					
Plants:					
Carex meadii Mead's sedge	R	WL	NA	Dry or seasonally moist basic soils.	NO
Linum sulcatum Grooved yellow flax	R	WL	NA	Glades, prairies, and sometimes in open woods.	NO
Calcareous Fen					
Plants:					
Carex interior Inland sedge	ER	RL	NA	Calcaerous Fen natural communities, along small streams or brooks.	NO
Carex schweinitzii Schweinitz's sedge	ER	RL	NA	Strongly calcareous, perennially wet, seepy habitats often in association with rich fens.	NO
Carex suberecta Prairie straw sedge	R	WL	NA	Moist, low-lying areas, fens and other alkaline wetlands.	YES
Carex tetanica Rigid sedge	R	WL	NA	Open or shrubby calcareous wetlands.	YES
Juncus brachycephalus Small-headed rush	VR	RL	NA	Perennial wet ground with a fresh supply of highly alkaline water.	YES
Grassland					
Plants:					
Carex mesochorea Midland sedge	C	WL	NA	Grassland areas.	YES
Onosmodium hispidissimum Shaggy False Gromwell	C	WL	NA	Dry, open, grassy limestone hills, espeically in the vicinity of the bedrock outcrops.	NO
Invertebrates:					
Speyeria idalia Regal Fritillary	ER	ST	NA	Tall-grass prairies, damp meadows, marshes, wet fields, and mountain pastures.	NO
Birds:					
Ammodramus henslowii Henslow's Sparrow	ER	ST	NA	Wet shrubby fields, marshes and open pine woods.	YES
Lanius ludovicianus Loggerhead Shrike	VR	ST	NA	Pastures, savannah, and open brushland.	YES

Footnotes appear on last page.

Table A.2-16
Threatened and Endangered Species Potentially Occurring at the Site
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scientific Name **Common Name**	**State Rank [a]**	**State Status [b]**	**Federal Status [c]**	**Habitat**	**Habitat Present at NRU SWMUs**
Wet Meadow/Marsh and Ponds					
Plants:					
Carex suberecta Praire straw sedge	R	WL	NA	Moist, low-lying areas, fens and other alkaline wetlands.	YES
Juncus brachycephalus Small-headed rush	VR	RL	NA	Perennial wet ground with a fresh supply of highly alkaline water.	YES
Liparis loeselii Bog Twayblade	VR	RL	NA	Grass and sedge-dominated damp ground along spring branches.	NO
Spiranthes lucida Shining ladies'-tresses	ER	RL	NA	Alluvial or damp rocky shores and slopes, rich damp thickets and meadows.	NO
Sporobolus asper Tall Dropseed	NL	NL	NA	Dry-mesic prairies, savannahs, open-woodlands in upland areas, and along roadsides.	NO

Notes:

[a] PR=Possibly Rare; R=Rare; VR=Very Rare; ER=Extremely Rare; C=Common and secure; NL=Not listed.

[b] WL=Watchlist; RL=Rarelist; ST=State Threatened; NL=Not listed.

[c] FE=Federal Endangered; FT=Federal Threatened; FC=Federal Candidate; SOC=Federal Species of Concern (not a legal status; list maintained by USFWS Virginia Field Office); NL=Not listed.

NRU - New River Unit
SWMU - Solid Waste Management Unit

** Source: Virginia Department of Game and Inland Fisheries (1999).

Table A.2-17

Uncertainties in the Screening-Level and Baseline-Level Ecological Risk Assessments

New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Assumptions	Description And Discussion Related To Uncertainties in ERA	Uncertainty in SLERA	Uncertainty in BERA
Analytical Sampling and Data Analysis			
Limited number of samples	Frequently, there are only a limited number of samples used in ERAs, and very often they are collected in a biased manner (i.e., targeting “hot spots”). This type of sampling often lacks statistical power and does not likely represent the concentrations in the environment in which wildlife exposure occurs. Similarly, limited data used to estimate uptake into organisms may overestimate exposure via the food web.	Overestimate of exposure and risk	Overestimate of exposure and risk
Use of maximum concentrations	Maximum concentrations are used to represent the upper estimate exposures. This practice compensates for uncertainty contributed by limited numbers of samples, but overestimates exposure and risk.	Overestimate of exposure and risk	Overestimate of exposure and risk
Detection limits	Detection limits may exceed ESVs (e.g., PAHs) or thresholds for adverse impacts are well below the analytical methods used in ERA (e.g., compounds that are known or suspected to cause endocrine effects).	May underestimate risk or effect on risk estimate unknown	May underestimate risk or effect on risk unknown
Degradation of chemicals not considered	ERAs are almost exclusively based on concentrations of target compounds, and little if any attention is given to degradation compounds that could be more toxic than the original chemical. Conversely, chemical concentrations may decrease over time due to natural physical processes.	Effect on risk estimate unknown	Effect on risk estimate unknown
Selection of COPCs			
Background concentrations	Chemicals may be identified as COPCs despite the fact that the detected concentrations are less than background concentrations. For the purpose of this assessment, screening against soil background was conducted as part of the initial COPEC screen. However, background data for sediment and surface water were not available, therefore, no consideration of background was given for those media.	Overestimate of risk for aquatic receptors	Not Applicable
Toxicology and ESVs			
Toxicity and exposure data for a limited number of species	Uncertainties exist in many aspects of the toxicology relied upon for conducting ERAs (Newman 1998; Lovett Doust et al. 1993). Toxicity and wildlife exposure data are only available for a limited number of species (most of them laboratory test species) under a strictly defined set of test conditions that deviate from natural conditions (Sample et al. 1996; Suter 1996a; Sample et al. 1997)	Effect on risk estimate unknown	Effect on risk estimate unknown
Laboratory testing	In current practice, more than 95 percent of the resources in toxicology are focused toward the study of single chemicals (Cassee et al. 1998), while wildlife exposures rarely occur on a chemical-specific basis. Simplistic extrapolations from laboratory species to wildlife species and testing conditions to field conditions are not likely accurate, and are rarely, if ever, validated against natural conditions (Power 1996; Tannenbaum 2003).	Effect on risk estimate unknown	Effect on risk estimate unknown
Adaptation and tolerance	There is little consistency and no quantitative methodology for the consideration of the diminished bioavailability (and, thereby, diminished toxicity) even though this process is well documented (e.g., Alexander and Alexander 1999; Alexander 2000). Similarly, tolerance and adaptation are not considered directly (Millward and Klerks 2002; Grant 2002). Furthermore, the white rat often used in toxicological testing is bred to minimize differences between lab animals, thereby diminishing the genetic variability that gives wildlife some capability for adaptation and tolerance (Tannenbaum 2003).	Overestimate of risk	Overestimate of risk
Predator-prey interactions	There are relatively few studies that actually evaluate the effects of toxicity on predator-prey interactions, or on competition for scarce resources (Atchison et al. 1996), the very conditions within which all wildlife exists (Kapustka and Landis 1998).	Effect on risk estimate unknown	Effect on risk estimate unknown

Table A.2-17
Uncertainties in the Screening-Level and Baseline-Level Ecological Risk Assessments
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Assumptions	Description And Discussion Related To Uncertainties in ERA	Uncertainty in SLERA	Uncertainty in BERA
HQs			
HQs based on maximum	The SLERA HQ is based on the maximum detected concentrations and the most conservative ESVs available (USEPA 1997c; 2000b). HQs in the BERA are based on the exposure point concentration (minimum of the 95% upper confidence limit on the mean and the maximum concentration).	Overestimate of risk	Overestimate of risk
Elevated HQs for background concentrations	HQs may exceed a value of 1 for background concentrations of naturally occurring metals (Tannenbaum 2003). This is due to many of the toxicology and ESV uncertainties already discussed.	Overestimate of risk	Overestimate of risk
Interpretation of HQs	An HQ less than or equal to a value of 1 indicates that adverse impacts to wildlife are considered unlikely (USEPA 2001c). However, there is no clear guidance for interpreting the HQs that exceed a value of 1, except that this point of departure indicates that adverse effects of some kind may have occurred or may occur in the future.	Effect on risk estimate unknown	Effect on risk estimate unknown
HQs for individual used to evaluate risks to populations	HQs are based on the types of impacts that could occur to individuals (i.e., those individuals exposed to maximum concentrations) and they completely fail to address ecological exposure and risk at spatial scale of populations (Tannenbaum 2003; Durda and Preziosi 1999).	Overestimate of risk to wildlife populations	Overestimate of risk to wildlife populations
HQs with unrealistic	HQs are seen at magnitudes that suggest that every animal should die upon acute exposure (i.e., in the hundreds or thousands) (Tannenbaum et al. 2003). Often, physical conditions at a site demonstrate that this is not the case.	Overestimate of risk	Overestimate of risk
No evaluation of dermal or inhalation pathways	The dermal and inhalation exposure pathways are generally considered “insignificant” due to protective fur and feathers. Under certain conditions, these exposure pathways may occur, but adequate information is rarely available by which to evaluate them.	Not Applicable	Potentially an underestimate of risk

BERA	Baseline Ecological Risk Assessment.
COPC	Constituent of potential concern.
ERA	Ecological risk assessment.
ESV	Ecological screening value.
HQ	Hazard quotient.
PAH	Polynuclear aromatic hydrocarbon.
RTV	Reference toxicity value.
SLERA	Screening level ecological risk assessment.

Table A.2-18
Ecological Screening Levels
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	TEF [a]	Potential Surrogate [b]	Soil SLs [c] (mg/kg) Value	Soil SLs [c] (mg/kg) *Source*	Sediment SLs [d] (mg/kg) Value	Sediment SLs [d] (mg/kg) *Source*	Surface Water SLs [e] (mg/L) Value	Surface Water SLs [e] (mg/L) *Source*	Bioaccumulation [f] (Yes/no)	Bioaccumulation [f] *Source*
Volatile Organic Compounds										
1,2,3-Trichloropropane	–		3.36E+00	R5	NA		NA		no	PJ
1,2,4-Trimethylbenzene	–	Benzene	2.55E-01	R5s	NA		3.30E-02	R3	YES	R3
1,3,5-Trimethylbenzene	–		NA		NA		7.10E-02	R3	no	R3
2-Butanone	–		8.96E+01	R5	4.24E-02	R5	1.40E+01	R3	no	R3
3-Octanone	–		NA		NA		3.57E+00	R3	no	R3
4-Methyl-2-pentanone	–		4.43E+02	R5	2.51E-02	R5	1.70E-01	R3	no	R3
Acetone	–		2.50E+00	R5	9.90E-03	R5	1.50E+00	R3	no	R3
Bromodichloromethane	–	Chloromethane?	5.40E-01	R5	NA		NA		no	PJ
chloromethane	–		1.04E+01	R5	NA		NA		no	PJ
Carbon Disulfide	–		9.41E-02	R5	8.51E-04	R3	9.20E-04	R3	no	R3
Chloroform	–		1.19E+00	R5	1.21E-01	R5	1.80E-03	R3	no	R3
cis-1,2-Dichloroethene	–	1,2-Dichloroethene mix	7.84E-01	R5s	1.05E+00	R3s	9.70E-01	R3s	YES	R3
1,2-Dichloroethene mix	–		NA		NA		5.90E-01	R3	no	R3
trans-1,2-Dichloroethene	–		7.84E-01	R5	1.05E+00	R3	9.70E-01	R3	no	R3
d-Limonene	–		NA		NA		NA		no	PJ
Ethanol	–		NA		NA		NA		no	PJ
m,p-Xylene	–	Xylenes (total)	1.00E+01	R5s	NA		1.30E+02	R3s	no	R3
Xylene	–		1.00E+01	R5	4.33E-01	R5	1.30E-02	R3	no	R3
Methylene Chloride	–		4.05E+00	R5	1.59E-01	R5	9.81E-02	R3	no	R3
p-Isopropyltoluene	–	p-Isopropylbenzene	NA		8.60E-02	R3s	8.50E-02	R3	no	R3
p-Isopropylbenzene	–		NA		8.60E-02	R3	2.60E-03	R3	no	R3
Tetrachloroethene	–		9.92E+00	R5	4.68E-01	R3	1.11E-01	R3	no	R3
Toluene	–		5.45E+00	R5	1.22E+00	R5	2.00E-03	R3	no	R3
Trichloroethene	–		1.24E+01	R5	9.69E-02	R3	2.10E-02	R3	no	R3
Xylenes (total)	–		1.00E+01	R5	4.33E-01	R5	1.30E-02	R3	no	R3
Semi-Volatile Organic Compounds										
1,2,4-Trichlorobenzene	–		1.11E+01	R5	2.10E+00	R3	2.40E-02	R3	YES	R3
1,2-Dichlorobenzene	–		2.96E+00	R5	1.65E-02	R3	7.00E-04	R3	YES	R3
1,3-Dichlorobenzene	–		3.77E+01	R5	4.43E+00	R3	1.50E-01	R3	YES	R3
1,4-Dichlorobenzene	–		5.46E-01	R5	5.99E-01	R3	2.60E-02	R3	YES	R3
2,4-Dinitrotoluene	–		1.28E+00	R5	4.16E-02	R3	4.40E-02	R3	no	R3
2,6-Dinitrotoluene	–		3.28E-02	R5	3.98E-02	R5	8.10E-02	R3	no	R3
3,3'-Dichlorobenzidine	–		6.46E-01	R5	1.27E-01	R3	4.50E-03	R3	no	R3
4-Methylphenol	–		1.63E+02	R5	6.70E-01	R3	5.43E-01	R3	no	R3
Benzoic Acid	–		NA		6.50E-01	R3	4.20E-02	R3	no	R3
bis(2-Ethylhexyl)phthalate	–		9.26E-01	R5	1.80E-01	R3	1.60E-02	R3	no	R3
Butylbenzylphthalate	–		2.39E-01	R5	1.09E+01	R3	1.90E-02	R3	no	R3
Carbazole	–		NA		NA		NA		no	PJ
Dibenzofuran	–	Furan	NA		4.15E-01	R3	3.70E-03	R3	no	R3
Diethylphthalate	–		2.48E+01	R5	6.03E-01	R3	2.10E-01	R3	no	R3
Di-n-Butylphthalate	–		1.50E-01	R5	6.47E+00	R3	1.90E-02	R3	no	R3
Di-n-Octylphthalate	–		7.09E+02	R5	4.06E+01	R5	2.20E-02	R3	no	R3
N-Nitrosodiphenylamine	–		5.45E-01	R5	2.68E+00	R3	2.10E-01	R3	no	R3
Pentachlorophenol	–		2.10E+00	EcoSSL	5.04E-01	R3	5.00E-04	R3	YES	R3
Phenol	–		1.20E+02	R5	4.20E-01	R3	4.00E-03	R3	YES	R3
Dioxin/Furan Compounds										
1,2,3,4,6,7,8-HpCDD	0.01		NA		NA		NA		YES	R3
1,2,3,4,6,7,8-HpCDF	0.01		NA		NA		NA		YES	R3
1,2,3,4,7,8,9-HpCDF	0.01		NA		NA		NA		YES	R3
1,2,3,4,7,8-HxCDD	0.10		NA		NA		NA		YES	R3
1,2,3,4,7,8-HxCDF	0.10		NA		NA		NA		YES	R3
1,2,3,6,7,8-HxCDD	0.10		NA		NA		NA		YES	R3
1,2,3,6,7,8-HxCDF	0.10		NA		NA		NA		YES	R3
1,2,3,7,8,9-HxCDD	0.10		NA		NA		NA		YES	R3
1,2,3,7,8,9-HxCDF	0.10		NA		NA		NA		YES	R3
1,2,3,7,8-PeCDD	1.00		NA		NA		NA		YES	R3
1,2,3,7,8-PeCDF	0.03		NA		NA		NA		YES	R3
2,3,4,6,7,8-HxCDF	0.10		NA		NA		NA		YES	R3
2,3,4,7,8-PeCDF	0.30		NA		NA		NA		YES	R3
2,3,7,8-TCDD	1.00		1.99E-07	R5	8.50E-07	R3	3.10E-12	R3	YES	R3
2,3,7,8-TCDF	0.10		NA		NA		NA		YES	R3
OCDD	0.0001		NA		NA		NA		YES	R3
OCDF	0.0001		NA		NA		NA		YES	R3
Dioxin Toxicity Equivalents	–	2,3,7,8-TCDD	1.99E-07	R5s	8.50E-07	R3s	3.10E-12	R3s	YES	R3

Table A.2-18
Ecological Screening Levels
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	TEF [a]	Potential Surrogate [b]	Soil SLs [c] (mg/kg) Value	Soil SLs [c] (mg/kg) *Source*	Sediment SLs [d] (mg/kg) Value	Sediment SLs [d] (mg/kg) *Source*	Surface Water SLs [e] (mg/L) Value	Surface Water SLs [e] (mg/L) *Source*	Bioaccumulation [f] (Yes/no)	Bioaccumulation [f] *Source*
Explosives										
1,3,5-Trinitrobenzene	–		3.76E-01	R5	NA		1.40E-02	RAIS	no	PJ
1,3-Dinitrobenzene	–		6.55E-01	R5	8.61E-03	R5	2.20E-02	R5	no	PJ
2,4,6-Trinitrotoluene	–		NA		9.20E-02	R3	1.00E-01	R3	no	R3
4-Amino-2,6-Dinitrotoluene	–		8.00E+01	T	3.98E-02	R5s	8.10E-02	R3s	no	PJ
2,6-Dinitrotoluene	–		3.28E-02	R5	3.98E-02	R5	8.10E-02	R3	no	R3
m-Nitrotoluene	–		NA		NA		7.50E-01	R3	no	R3
Nitrobenzene	–		1.31E+00	R5	1.45E-01	R5	2.20E-01	R5	no	PJ
Nitroglycerine	–		NA		NA		1.38E-01	R3	no	R3
Pentaerythritol Tetranitrate	–		NA		NA		8.50E+01	R3	no	R3
Perchlorate	–		NA		NA		NA		no	PJ
Herbicides										
2,4,5-T	–		5.96E-01	R5	1.23E+01	R3	6.86E-01	R3	no	R3
2,4,5-TP	–		1.09E-01	R5	6.75E-01	R3	3.00E-02	R3	no	R3
2,4-D	–		2.72E-01	R5	1.27E+00	R5	2.20E-01	R5	no	PJ
2,4-DB	–		NA		NA		NA		no	PJ
Dalapon	–		NA		NA		NA		no	PJ
Dicamba	–		NA		NA		NA		no	PJ
Dichlorprop	–		NA		NA		NA		no	PJ
MCPA	–		NA		NA		NA		no	PJ
MCPP	–		NA		NA		NA		no	PJ
Pesticides										
4,4'-DDD	–		2.10E-02	EcoSSL	4.88E-03	R3	1.10E-05	R3	YES	R3
4,4'-DDE	–	DDD	2.10E-02	EcoSSL	3.16E-03	R3	1.10E-05	R3s	YES	R3
4,4'-DDT	–		2.10E-02	EcoSSL	7.00E+00	ORNL	5.00E-07	R3	YES	R3
BHC, alpha-	–	BHC, delta-	9.94E-02	R5	6.00E-03	R3	1.24E-02	R5	YES	R3
BHC, beta-	–		3.98E-03	R5	5.00E-03	R3	4.95E-04	R5	YES	R3
BHC, delta-	–		9.94E+00	R5	6.40E+00	R3	1.41E-01	R3	YES	R3
BHC, gamma- (Lindane)	–		5.00E-03	R5	2.37E-03	R3	1.00E-05	R3	YES	R3
Chlordane, alpha-	–	Chlordane	2.24E-01	R5	3.24E-03	R3s	4.30E-06	R5	YES	USEPA
Chlordane, gamma-	–	Chlordane	2.24E-01	R5s	3.24E-03	R3s	2.20E-06	R3s	YES	USEPA
Chlordane, mixture	–		2.24E-01	R5	3.24E-03	R3	2.20E-06	R3	YES	R3
Dieldrin	–		4.90E-03	EcoSSL	1.90E-03	R3	5.60E-05	R3	YES	R3
Endosulfan	–	Endosulfan I	NA		2.14E-03	R3	2.00E-05	R3	YES	R3
Endosulfan I	–	Endosulfan I	1.19E-01	R5s	2.14E-03	R3	2.00E-05	R3	YES	R3
Endosulfan II	–	Endosulfan I	1.19E-01	R5	1.40E-02	R3	5.10E-05	R3	YES	R3
Endosulfan Sulfate	–	Endosulfan I	3.58E-03	R5	5.40E-03	R3	2.22E-03	R5	no	R3
Endrin	–		1.01E-02	R5	2.22E-03	R3	3.60E-05	R3	YES	R3
Endrin Aldehyde	–	Endrin	1.05E-02	R5	4.80E-01	R5	1.50E-04	R5	YES	R3
Endrin Ketone	–	Endrin	1.01E-02	R5s	2.22E-03	R3s	3.60E-05	R3s	YES	R3
Heptachlor	–		5.98E-03	R5	6.80E-02	R3	1.90E-06	R3	YES	R3
Heptachlor Epoxide	–		1.52E-01	R5	2.47E-03	R3	1.90E-06	R3	YES	R3
Methoxychlor	–		1.99E-02	R5	1.87E-02	R3	1.90E-05	R3	YES	R3
Polycyclic Aromatic Hydrocarbons										
1-Methylnaphthalene	–	2-Methylnaphthalene	3.24E+00	R5s	2.02E-02	R3s	2.10E-03	R3	no	R3
2-Methylnaphthalene	–		3.24E+00	R5	2.02E-02	R3	4.70E-03	R3	no	R3
Acenaphthene	–		6.82E+02	R5	6.70E-03	R3	5.80E-03	R3	YES	R3
Acenaphthylene	–		6.82E+02	R5	5.90E-03	R3	4.84E+00	R5	YES	R3
Anthracene	–		1.48E+03	R5	5.72E-02	R3	1.20E-05	R3	YES	R3
Benzo(a)anthracene	–		5.21E+00	R5	1.08E-01	R3	1.80E-05	R3	YES	R3
Benzo(a)pyrene	–		1.52E+00	R5	1.50E-01	R3	1.50E-05	R3	YES	R3
Benzo(b)fluoranthene	–	Fluoranthene	5.98E+01	R5	1.04E+01	R5	9.07E-03	R5	YES	R3
Benzo(g,h,i)perylene	–	Pyrene	1.19E+02	R5	1.70E-01	R3	7.64E-03	R5	YES	R3
Benzo(k)fluoranthene	–	Fluoranthene	1.48E+02	R5	2.40E-01	R3	4.00E-05	R3s	YES	R3
Chrysene	–	Pyrene	4.73E+00	R5	1.66E-01	R3	2.50E-05	R3s	YES	R3
Dibenzo(a,h)anthracene	–	Anthracene	1.84E+01	R5	3.30E-02	R3	1.20E-05	R3s	YES	R3
Fluoranthene	–		1.22E+02	R5	4.23E-01	R3	4.00E-05	R3	YES	R3
Fluorene	–		1.22E+02	R5	7.74E-02	R3	3.00E-03	R3	YES	R3
Indeno(1,2,3-cd)pyrene	–	Pyrene	1.09E+02	R5	1.70E-02	R3	4.31E-03	R5	YES	R3
Naphthalene	–		9.94E-02	R5	1.76E-01	R3	1.10E-03	R3	no	R3
Phenanthrene	–		4.57E+01	R5	2.04E-01	R3	4.00E-04	R3	YES	R3
Pyrene	–		7.85E+01	R5	1.95E-01	R3	2.50E-05	R3	YES	R3
Polychlorinated Biphenyls										
Aroclor 1254	–		NA		5.98E-02	R3	7.40E-08	R3	YES	R3
Aroclor 1260	–		NA		5.98E-02	R3	7.40E-08	R3	YES	R3

Table A.2-18
Ecological Screening Levels
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	TEF [a]	Potential Surrogate [b]	Soil SLs [c] (mg/kg) Value	Soil SLs [c] (mg/kg) *Source*	Sediment SLs [d] (mg/kg) Value	Sediment SLs [d] (mg/kg) *Source*	Surface Water SLs [e] (mg/L) Value	Surface Water SLs [e] (mg/L) *Source*	Bioaccumulation [f] (Yes/no)	Bioaccumulation [f] *Source*
Inorganics										
Aluminum	–		5.00E+01	ORNL	5.80E+04	ARCS_PEC	8.70E-02	R3	no	R3
Antimony	–		2.70E-01	EcoSSL	2.00E+00	R3	3.00E-02	R3	no	R3
Arsenic	–		1.80E+01	EcoSSL	9.80E+00	R3	5.00E-03	R3	YES	R3
Barium	–		3.30E+02	EcoSSL	NA		4.00E-03	R3	no	R3
Beryllium	–		2.10E+01	EcoSSL	NA		6.60E-04	R3	no	R3
Cadmium	–		3.60E-01	EcoSSL	9.90E-01	R3	2.50E-04	R3	YES	R3
Calcium	–		NA		NA		1.16E+02	R3	no	R3
Chromium	–		2.60E+01	EcoSSL	4.34E+01	R3	8.50E-02	R3	no	R3
Cobalt	–		1.30E+01	EcoSSL	5.00E+01	R3	2.30E-02	R3	no	R3
Copper	–		2.80E+01	EcoSSL	3.16E+01	R3	9.00E-03	R3	YES	R3
Iron	–		NA		2.00E+04	R3	3.00E-01	R3	no	R3
Lead	–		1.10E+01	EcoSSL	3.58E+01	R3	2.50E-03	R3	YES	R3
Magnesium	–		NA		NA		8.20E+01	R3	no	R3
Manganese	–		2.20E+02	EcoSSL	4.60E+02	R3	1.20E-01	R3	no	R3
Mercury	–		1.00E-01	R5	1.80E-01	R3	2.60E-05	R3	no	R3
Nickel	–		3.80E+01	EcoSSL	2.27E+01	R3	5.20E-02	R3	YES	R3
Potassium	–		NA		NA		NA		no	PJ
Selenium	–		5.20E-01	EcoSSL	2.00E+00	R3	1.00E-03	R3	YES	R3
Silver	–		4.20E+00	EcoSSL	1.00E+00	R3	3.20E-03	R3	YES	R3
Sodium	–		NA		NA		6.80E+02	R3	no	R3
Thallium	–		5.69E-02	R5	NA		8.00E-04	R3	no	R3
Vanadium	–		7.80E+00	EcoSSL	NA		2.00E-02	R3	no	R3
Zinc	–		4.60E+01	EcoSSL	1.21E+02	R3	1.20E-01	R3	YES	R3

Notes:
– = Not available or applicable.
mg/kg = Milligrams per kilogram.
mg/L = Milligrams per liter.
NA = Not available or applicable.
s = surrogate was used.

[a] Toxicity Equivalency Factor (TEF); Federal Register Vol. 72, No. 90 (USEPA 2007d).
[b] Surrogates were used were screening values were not available.
[c] Ecological soil screening levels were from the following sources in order of priority:
Region 5 Ecological Screening Levels (USEPA 2003a; R5).
Oak Ridge National Laboratory (Efroymson et. Al. 1997a,b; ORNL).
Nitroaromatic Munition Compounds: Environmental Effects and Screening Values (Talmage et al. 1999; T).
For EcoSSL and ORNL SLs, the lowest value for all available endpoints was selected.
[d] Ecological sediment screening levels were from the following sources in order of priority:
USEPA Ecological Soil Screening Levels (USEPA 2005b; EcoSSL).
Region 3 Sediment Screening Levels (USEPA 2008a, R3).
Oak Ridge National Laboratory (Suter et al. 1997; ORNL); the lowest value for all available endpoints was selected.
Region 5 Sediment Screening Levels (USEPA 2003e; R5).
Sediment screening level for aluminum was from USEPA Assessment and Remediation of Contaminated Sediments Program (ARCS), obtained from Jones et. al. 1997.
[e] Ecological surface water screening levels were from the following sources in order of priority:
Region 3 Fresh Water Screening Levels (USEPA 2008b; R3).
Oak Ridge National Laboratory (Suter et al. 1997; ORNL); the lowest value for all available endpoints was selected.
Region 5 Surafce Water Screening Levels (USEPA 2003e; R5).
USEPA National Ambient Water Quality Criteria (USEPA 2008c).
[f] The following sources were consulted to identify bioaccumulation potential: USEPA Region 3 (USEPA 2008a,b); USEPA (2000c).

Table A.2-19
Exposure Assumptions for Ecological Receptors
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

			Terrestrial Receptors				Aquatic Receptors			
Exposure Parameter	**Acronym**	**Units**	**Short-Tailed Shrew**		**American Robin**		**Mink**		**Great Blue Heron**	
Body Weight (BW)	BW	kg	0.017	[a]	0.078	[a]	0.896	[a]	2.34	[a]
Proportion of Diet (P)	P	unitless								
Maximum Scenario:										
Soil / Sediment		%	7%	[b]	9%	[b]	–	[b]	–	[b]
Invertebrates		%	93%	[a]	91%	[a]	–		–	
Plants and Fungi		%	–		–		–		–	
Fish		%	–		–		100%	[a]	100%	[a]
Small Mammals		%	–		–		–		–	
Refined Scenario:										
Soil / Sediment		%	7%	[b]	9%	[b]	–		–	
Invertebrates		%	78%	[a]	28%	[a]	–		–	
Plants and Fungi		%	11%	[a]	63%	[a]	–		–	
Fish		%	–		–		100%	[a]	100%	[a]
Small Mammals		%	4%	[a]	–		–		–	
Food Ingestion Rate (IRf)	IRf	kg/day	0.0024	[a]	0.011	[a]	0.051	[c]	0.129	[c]
Water Ingestion Rate (IRw)	IRw	L/day	NA		NA		0.11	[a]	0.045	[a]
Home Range	HR	hectare	0.4	[a]	0.32	[a]	14.1	[a]	8.4	[a]
Site Foraging Frequency (SFF)	SFF	unitless	1		1		1		1	
Exposure Frequency (EF)	EF	unitless	1		1		1		1	

Notes:
[a] USEPA 1993a,b.
[b] Beyer et al. 1994.
[c] Nagy 2001.

Table A.2-20
Bioconcentration and Bioaccumulation Factors for Soil
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Surrogate [a]	Soil Bioconcentration and Bioaccumulation Factors (BCFsl and BAFsl)			
		Invertebrates		Vegetation	Mammalian
		$BCFsl_i$ [b]		$BCFsl_v$ [c]	$BAFsl_m$ [d]
Semi-Volatile Organic Compounds					
Pentachlorophenol		5.00E-01	[i]	9.85E-03	3.08E-02
1,2,4-Trichlorobenzene		5.00E-01	[i]	2.93E-02	4.67E-03
1,4-Dichlorobenzene		5.00E-01	[i]	7.96E-02	8.30E-04
Dioxin/Furan Compounds					
Dioxin Toxicity Equivalents		ln(Ci) = 1.182 * ln(Cs) + 3.533	[e]	NA	ln(Cm) = 1.0993 * ln(Cs) + 0.8113 [e]
Pesticides					
4,4'-DDD		1.92E+00	[f]	2.67E-03	2.95E-01
4,4'-DDE		1.92E+00	[f]	3.31E-03	2.04E-01
4,4'-DDT		1.92E+00	[f]	1.63E-03	6.91E-01
BHC, alpha-		1.47E+00	[g]	7.75E-02	8.69E-04
BHC, beta-		1.47E+00	[g]	4.93E-02	1.90E-03
BHC, delta-		1.47E+00	[g]	1.86E-01	1.90E-04
BHC, gamma- (Lindane)	BHC, beta-	1.47E+00	[g]	4.93E-02	1.90E-03
Chlordane, alpha-	Chlordane	1.47E+00	[g]	2.64E-03	3.01E-01
Chlordane, gamma-	Chlordane	1.47E+00	[g]	2.64E-03	3.01E-01
Dieldrin		1.47E+00	[g]	1.63E-03	6.91E-01
Endosulfan		1.47E+00	[g]	6.87E-02	1.07E-03
Endosulfan II	Endosulfan	1.47E+00	[g]	6.87E-02	1.07E-03
Endrin		1.47E+00	[g]	1.79E-02	1.09E-02
Endrin Aldehyde	Endrin	1.47E+00	[g]	1.79E-02	1.09E-02
Heptachlor Epoxide	Heptachlor	1.47E+00	[g]	5.56E-03	8.30E-02
Methoxychlor		6.73E+00	[h]	1.57E+00	6.15E-04
Polycyclic Aromatic Hydrocarbons					
Acenaphthene		5.00E-01	[i]	4.20E-02	2.51E-03
Acenaphthylene		5.00E-01	[i]	3.44E-02	3.54E-03
Anthracene		1.02E-02	[j]	2.07E-02	8.50E-03
Benzo(a)anthracene		2.50E-02	[j]	4.43E-03	1.23E-01
Benzo(a)pyrene		6.84E-02	[j]	2.67E-03	2.95E-01
Benzo(b)fluoranthene		5.06E-02	[j]	1.23E-03	1.12E+00
Benzo(g,h,i)perylene		4.88E-02	[j]	6.10E-04	3.79E+00
Benzo(k)fluoranthene		5.06E-02	[j]	1.23E-03	1.12E+00
Chrysene		3.50E-02	[j]	4.49E-03	1.20E-01
Dibenzo(a,h)anthracene		7.36E-02	[j]	1.63E-03	6.91E-01
Fluoranthene		5.00E-01	[i]	7.45E-03	5.00E-02
Fluorene		5.00E-01	[i]	3.22E-02	3.97E-03
Indeno(1,2,3-cd)pyrene		8.38E-02	[j]	2.74E-04	1.51E+01
Naphthalene		5.00E-01	[i]	8.85E-02	6.91E-04
Phenanthrene		2.44E-02	[j]	1.77E-02	1.12E-02
Pyrene		1.84E-02	[j]	1.17E-02	2.29E-02
Polychlorinated Biphenyls					
Aroclor 1254		1.51E+00	[k]	1.41E-03	8.90E-01
Aroclor 1260		1.51E+00	[k]	7.25E-04	2.81E+00
Inorganics					
Arsenic		3.90E-01	[l]	8.00E-03	1.00E-01
Cadmium		2.84E+00	[m]	1.10E-01	2.75E-02
Copper		6.80E-02	[n]	8.00E-02	5.00E-01
Lead		5.60E-02	[o]	9.00E-03	1.50E-02
Nickel		2.60E-02	[n]	1.20E-02	3.00E-01
Selenium		3.90E-01	[l]	5.00E-03	7.50E-01
Silver		3.90E-01	[l]	8.00E-02	1.50E-01
Zinc		3.90E-01	[n]	3.00E-01	5.00E+00

Table A.2-20
Bioconcentration and Bioaccumulation Factors for Soil
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:

– =	Not applicable.
BAF =	Bioaccumulation Factor (unitless); BAF = (Tissue Concentration)/(Dietary Intake)
BCF =	Bioconcentration Factor (unitless); BCF = (Tissue Concentration)/(Media Concentration)
[a]	Surrogate chemical was used to obtain the BCF or BAF.
[b]	$BCFsl_i$ denotes BCFs for invertebrates. BCFs for earthworms were compiled from available literature sources (Beyer (1990) and Hendriks et al., 1995), and are footnoted accordingly. Factors reported in wet weight.
[c]	$BCFsl_v$ denotes BCF for vegetation. Unless otherwise noted, BCFs for vegetation for organic constituents were calculated using the Travis and Arms (1988) Log K_{ow} equation: Log BCFv = 1.588 - 0.578 Log K_{ow} and BCFs for inorganic constituents were obtained from Baes et al., 1984. Values for uptake into leafy material, stem, and straw were used. Values calculated in dry weight were converted to wet weight by assuming vegetation was 80% moisture (each value was multiplied by 0.2 to dilute BCF representative of hydration).
[d]	$BAFsl_m$ denotes BAF for mammals. Unless otherwise noted, BAFs for small mammals for organic constituents were calculated using the Travis and Arms (1988) Log K_{ow} equation: Log Biotransfer Factor mammal = -7.6 + Log K_{ow}. Biotransfer factors were converted to BAFs by multiplying by an average food ingestion rate (lactating and nonlactating animals) of 12 kg/day. BAFs for small mammals for inorganic constituents were estimated from biotransfer factors (BTFs) presented in Baes et al. (1984). BTFs were converted to BAFs by multiplying by an average food ingestion rate of 50 kg/day. BAF values were assumed to be wet weight.
[e]	Dioxin bioaccumulation for small mammals and invertabates were the general estimates regression models for TCDD presented in Sample et al. 1998a and Sample et al 1998b.
[f]	DDT and metabolite BCFs were estimated using Beyer (1990). A single BCF was calculated as the average of BCFs from the following sources: Beyer and Gish 1980; Davis 1971; Gish 1970; Wheatley and Hardman 1968; and Yadav et. al 1981 (obtained from Beyer 1990). Dry weight BCF was converted to wet weight BCF using a factor of 0.2.
[g]	Organochlorine BCFs were estimated using Beyer, 1990. BCFs from numerous studies were combined and an average BCF was calculated. References used were from the following sources: Beyer and Gish 1980; Davis 1971; Gish 1970; Jeffries and Davis 1968; Korschgen 1971; Venter and Reinecke 1985; Wheatley and Hardman 1968; and Yadav et. al 1981 (obtained from Beyer 1990) (DDT BCFs were included). Dry weight BCF was converted to wet weight BCF using a factor of 0.2.
[h]	Calculated using equation in USEPA (1999); log BCF = 0.819 x logKow - 1.146.
[i]	$BCFsl_i$ were estimated by using the Beyer (1990) BCF for '3,6-Dimethylphenanthrene as a surrogate for selected VOCs, SVOCs, PAHs, pesticides, and explosives. This BCF was selected because it is the greatest BCF presented in Table 25 of Beyer (1990).
[j]	$BCFsl_i$ were estimated using Beyer (1990) PAH specific results presented in Table 25. BCF = (Mean Tissue Concentration)/(Mean Soil Concentration)
[k]	$PCBsl_i$ for PCBs were calculated using Beyer (1990). BCFs from several studies were combined and an average BCF was calculated. References used were from the following sources: Diercxsens et. al. 1985; Kreis et. al. 1987; and Marquenie et. al. 1987 (obtained from Beyer 1990). Dry weight BCF was converted to wet weight BCF using a factor of 0.2.
[l]	$BCFsl_i$ for zinc used as a surrogate.
[m]	$BCFsl_i$ for cadmium was calculated using Beyer (1990) (reference number 41) and two values from Hendriks, et al., 1995 (see Table 1). Dry weight BCF was converted to wet weight BCF using a factor of 0.2.
[n]	$BCFsl_i$ for copper, manganese, nickel, and zinc are average values obtained from Hendriks et al., 1995 (see Table 1). Dry weight BCF was converted to wet weight BCF using a factor of 0.2.
[o]	$BCFsl_i$ for lead is an average of values obtained from Beyer (1990) and Hendriks et al., 1995 (see Table 1). Dry weight BCF was converted to wet weight BCF using a factor of 0.2.

Table A.2-21
Bioconcentration and Bioaccumulation Factors for Sediment
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Surrogate [a]	BSAF [b]		Fish BAFsed$_f$ [c]	
Semi-Volatile Organic Compounds					
Pentachlorophenol		1.03E+03		--	
1,2,4-Trichlorobenzene		1.00E-01		7.67E-03	
1,2-Dichlorobenzene		1.00E-01		7.67E-03	
1,3-Dichlorobenzene		1.00E-01		7.67E-03	
1,4-Dichlorobenzene		1.00E-01		7.67E-03	
Dioxin/Furan Compounds					
Dioxin Toxicity Equivalents		--		--	
Pesticides					
4,4'-DDD		4.47E+00		1.47E+00	
4,4'-DDE		9.50E-01		1.64E+01	
4,4'-DDT		7.90E-01		1.33E+00	
BHC, alpha-		7.00E-01		--	
BHC, beta-	BHC, delta	1.15E+00		--	
BHC, delta-		1.15E+00		--	
BHC, gamma- (Lindane)		6.00E-01		--	
Chlordane, alpha-	Chlordane	1.20E+00		1.45E+00	
Chlordane, gamma-	Chlordane	1.20E+00		1.45E+00	
Dieldrin		3.61E+00		3.90E+00	
Endosulfan		2.70E+00		--	
Endosulfan II	Endosulfan	2.70E+00		--	
Endrin		2.48E-01		--	
Endrin Aldehyde	Endrin	2.48E-01		--	
Heptachlor		1.67E+00		8.30E-01	
Heptachlor Epoxide	Heptachlor	1.67E+00		8.30E-01	
Methoxychlor		1.20E+00		--	
Polycyclic Aromatic Hydrocarbons					
Acenaphthene		1.60E-02	[d]	3.11E-03	[f]
Acenaphthylene		3.70E-02	[d]	3.11E-03	[f]
Anthracene		4.70E-02	[d]	3.11E-03	[f]
Benzo(a)anthracene		1.50E-01	[d]	7.67E-03	[f]
Benzo(a)pyrene		5.00E-02	[d]	7.67E-03	[f]
Benzo(b)fluoranthene		2.06E-01	[d]	7.67E-03	[f]
Benzo(g,h,i)perylene		1.50E-02	[d]	7.67E-03	[f]
Benzo(k)fluoranthene		1.97E-01	[d]	7.67E-03	[f]
Chrysene		8.15E-02	[d]	7.67E-03	[f]
Dibenzo(a,h)anthracene		5.00E-02	[d]	7.67E-03	[f]
Fluoranthene		3.46E-01	[d]	7.67E-03	[f]
Fluorene		5.00E-02	[d]	3.11E-03	[f]
Indeno(1,2,3-cd)pyrene		1.85E-02	[d]	7.67E-03	[f]
Naphthalene		7.10E-02	[d]	3.11E-03	[f]
Phenanthrene		1.06E-01	[d]	3.11E-03	[f]
Pyrene		3.70E-01	[d]	7.67E-03	[f]
Polychlorinated Biphenyls					
Aroclor 1254		5.30E-01		5.00E+00	
Aroclor 1260		2.30E-01		5.00E+00	
Inorganics					
Arsenic		1.27E-01	[e]	1.00E+00	[g]
Cadmium		3.07E+00	[e]	1.00E+00	[g]
Copper		log(Ci) = 0.278 * log(Cs) + 1.089	[e]	1.00E+00	[g]
Lead		6.60E-02	[e]	1.00E+00	[g]
Nickel		1.00E+00	[e]	1.00E+00	[g]
Selenium		9.74E-01	[h]	1.00E+00	[g]
Silver		9.74E-01	[h]	1.00E+00	[g]
Zinc		log(Ci) = 0.126 * log(Cs) + 1.89	[e]	1.00E+00	[g]

Table A.2-21
Bioconcentration and Bioaccumulation Factors for Sediment
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:	
– =	Not applicable.
BAF =	Bioaccumulation Factor (unitless); BAF = (Tissue Concentration)/(Dietary Intake)
BCF =	Bioconcentration Factor (unitless); BCF = (Tissue Concentration)/(Media Concentration)
BSAF	Biota-sediment accumulation factors.
[a]	Surrogate chemical was used to obtain the BCF or BAF.
[b]	BSAF for organic constituents were from the USACE database - BSAF Database (Your Source for Biota Sediment Accumulation Factor and Lipid Data), US Army Corps of Engineers (http://el.erdc.usace.army.mil/bsafnew/)
	BSAF for inorganics were from Bechtel Jacobs (1998).
[c]	$BAFsed_f$ denotes BAF for fish.
[d]	Invertebrate BSAFs based on the median BSAF values from USACE database (USACE, 2(
[e]	From Bechtel Jacobs, 1998b.
[f]	BAF for organics calculated using formula : BAF = BSAF * fl/foc (USEPA, 2000a). The lipid fraction (fl) was set at 0.02 and the fraction organic carbon was set at 0.193.
[g]	Conservatively assumed. (For Metals, mean value for all non-regression sediment BAFs us
[h]	From USEPA (1999); converted to dry weight assuming 84 percent moisture content in earthworms (USEPA 1993a,b).

Table A.2-22
Avian Toxicity Reference Values
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent		Test Species Chronic Toxicity Value (mg/kg BW-day) LOAEL		NOAEL		Test Species	Effect	Body Weight of Test Species	Reference	Toxicity Reference Values (TRV) (unitless) [a] LOAEL	NOAEL
Semi-Volatile Organic Compounds											
Pentachlorophenol		274	[b]	27.4		Chicken	Growth, hepatic and cellular effects	NAP	Prescott et al. 1982	274	27.4
1,2,4-Trichlorobenzene		--		--		--	--	--	--	--	--
1,2-Dichlorobenzene		--		--		--	--	--	--	--	--
1,3-Dichlorobenzene		--		--		--	--	--	--	--	--
1,4-Dichlorobenzene		--		--		--	--	--	--	--	--
Dioxin/Furan Compounds											
Dioxin Toxicity Equivalents		0.00014	[b]	0.000014		Ring-necked Pheasant	NA	NAP	Sample et al. 1996	0.00014	0.000014
Pesticides											
4,4'-DDD	[c]	0.028		0.0028	[b]	Brown Pelican	Reproduction	NAP	Anderson et al. 1975	0.028	0.0028
4,4'-DDE	[c]	0.028		0.0028	[b]	Brown Pelican	Reproduction	NAP	Anderson et al. 1975	0.028	0.0028
4,4'-DDT		0.028		0.0028	[b]	Brown Pelican	Reproduction	NAP	Anderson et al. 1975	0.028	0.0028
BHC, alpha-	[g]	2.25E+00		5.60E-01		Japanese Quail	Reproduction	NAP	Vos et al., 1971	2.25E+00	5.60E-01
BHC, beta-	[g]	2.25E+00		5.60E-01		Japanese Quail	Reproduction	NAP	Vos et al., 1971	2.25E+00	5.60E-01
BHC, delta-	[g]	2.25E+00		5.60E-01		Japanese Quail	Reproduction	NAP	Vos et al., 1971	2.25E+00	5.60E-01
BHC, gamma- (Lindane)		2.00E+01		2.00E+00		Mallard Duck	Reproduction	NAP	Lahiri, 1986;	2.00E+01	2.00E+00
Chlordane, alpha-	[d]	21.4	[b]	2.14		Red-winged Blackbird	Mortality	NAP	Sample et al. 1996	21.4	2.14
Chlordane, gamma-	[d]	21.4	[b]	2.14		Red-winged Blackbird	Mortality	NAP	Sample et al. 1996	21.4	2.14
Dieldrin		0.77	[b]	0.077		Brown Owl	Reproduction	NAP	Mendenhall et al. 1983	0.77	0.077
Endosulfan		100	[b]	10		Gray Partridge	Reproduction	NAP	Abiola 1992	100	10
Endosulfan II	[h]	100	[b]	10		Gray Partridge	Reproduction	NAP	Abiola 1992	100	10
Endrin		3	[b]	0.3		Mallard Duck	Reproduction	NAP	Spann et al. 1986	3	0.3
Endrin Aldehyde	[e]	3	[b]	0.3		Mallard Duck	Reproduction	NAP	Spann et al. 1986	3	0.3
Heptachlor		NA		NA		NA	NA	NAP	NA	NA	NA
Heptachlor Epoxide		NA		NA		NA	NA	NAP	NA	NA	NA
Methoxychlor		NA		NA		NA	NA	NAP	NA	NA	NA
Polycyclic Aromatic Hydrocarbons											
Acenaphthene		100	[b]	10		Unknown	Unknown	NAP	Trust et al. 1994	100	10
Acenaphthylene		100	[b]	10		Unknown	Unknown	NAP	Trust et al. 1994	100	10
Anthracene		100	[b]	10		Unknown	Unknown	NAP	Trust et al. 1994	100	10
Benzo(a)anthracene		100	[b]	10		Unknown	Unknown	NAP	Trust et al. 1994	100	10
Benzo(a)pyrene		100	[b]	10		Unknown	Unknown	NAP	Trust et al. 1994	100	10
Benzo(b)fluoranthene		100	[b]	10		Unknown	Unknown	NAP	Trust et al. 1994	100	10
Benzo(g,h,i)perylene		100	[b]	10		Unknown	Unknown	NAP	Trust et al. 1994	100	10
Benzo(k)fluoranthene		100	[b]	10		Unknown	Unknown	NAP	Trust et al. 1994	100	10
Chrysene		100	[b]	10		Unknown	Unknown	NAP	Trust et al. 1994	100	10
Dibenzo(a,h)anthracene		100	[b]	10		Unknown	Unknown	NAP	Trust et al. 1994	100	10
Fluoranthene		100	[b]	10		Unknown	Unknown	NAP	Trust et al. 1994	100	10
Fluorene		100	[b]	10		Unknown	Unknown	NAP	Trust et al. 1994	100	10
Indeno(1,2,3-cd)pyrene		100	[b]	10		Unknown	Unknown	NAP	Trust et al. 1994	100	10
Phenanthrene		100	[b]	10		Unknown	Unknown	NAP	Trust et al. 1994	NA	NA
Pyrene		100	[b]	10		Unknown	Unknown	NAP	Trust et al. 1994	100	10
Polychlorinated Biphenyls											
Aroclor 1254		1.8		0.18	[b]	Ring-necked Pheasant	Reproduction	NAP	Dahlgren et al. 1972	1.8	0.18
Aroclor 1260	[f]	1.8		0.18	[b]	Ring-necked Pheasant	Reproduction	NAP	Dahlgren et al. 1972	1.8	0.18

Table A.2-22
Avian Toxicity Reference Values
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Test Species Chronic Toxicity Value (mg/kg BW-day) LOAEL		NOAEL	Test Species	Effect	Body Weight of Test Species	Reference	Toxicity Reference Values (TRV) (unitless) [a] LOAEL	NOAEL
Inorganics									
Arsenic	12.8		5.14	Mallard Duck	Mortality	NAP	USFWS 1964	12.8	5.14
Cadmium	14.5	[b]	1.45	Mallard Duck	Reproduction	NAP	Sample et al. 1996	14.5	1.45
Copper	61.7		47	Chicks (1-day old)	Growth	NAP	Mehring et al. 1960	61.7	47
Lead	38.5	[b]	3.85	American Kestrel	Reproduction	NAP	Pattee, 1984	38.5	3.85
Nickel	107.0		77.40	Mallard Duck	Mortality, growth, behavior	NAP	Sample et al. 1996	107.0	77.40
Selenium	1		0.5	Mallard Duck	Reproduction	NAP	Heinz et al. 1987	1	0.5
Silver	1		0.5	Mallard Duck	Reproduction	NAP	Heinz et al. 1987	1	0.5
Zinc	131	[b]	14.5	White leghorn hen	Reproduction	NAP	Stahl et al. 1990	131	14.5

LOAEL Lowest Observed Adverse Effects Level.
mg/kg-BW-day Milligrams per kilogram of body weight per day.
NAP Not applicable because body weight extrapolations are not appropriate for avian species.
NOAEL No Observed Adverse Effects Level.
TRV Toxicity Reference Value (unitless).
[a] Toxicity Reference Values$_{\text{wildlife species}}$ (TRV) = Chronic Toxiity Value for test species x $(BW_{\text{test species}} / BW_{\text{wildlife species}})^{1/4}$
[b] Acute LOAELs and NOAELs were extrapolated (converted) to chronic LOAELs and NOAELs by applying an acute-chronic ratio of 10 (Calabrese and Baldwin 1993).
[c] DDT used as a surrogate.
[d] Chlordane used as a surrogate.
[e] Endrin used as a surrogate.
[f] Aroclor 1254 used as a surrogate.
[g] BHC (mixed isomers) used as a surrogate
[h] Endosulfan used as a surrogate

Table A.2-23
Mammalian Toxicity Reference Values
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent		Test Species Chronic Toxicity Value (mg/kg BW-day) LOAEL		NOAEL		Test Species	Effect	Body Weight of Test Species	Reference	Reference Toxicity Values (RTV) (unitless) [a] Terrestrial LOAEL	Terrestrial NOAEL	Aquatic LOAEL	Aquatic NOAEL
Semi-Volatile Organic Compounds													
Pentachlorophenol		2.4		0.24		Rat	Reproduction	0.35	Schwetz et al. 1978	5.1	0.51	1.9	0.19
1,2,4-Trichlorobenzene		--		--		--	--	--	--	--	--	--	--
1,2-Dichlorobenzene		--		--		--	--	--	--	--	--	--	--
1,3-Dichlorobenzene		--		--		--	--	--	--	--	--	--	--
1,4-Dichlorobenzene		--		--		--	--	--	--	--	--	--	--
Dioxin/Furan Compounds													
Dioxin Toxicity Equivalents		0.00001	[b]	0.000001		Rat	NA	0.35	Sample et al. 1996	2.13E-05	2.13E-06	7.91E-06	7.91E-07
Pesticides													
4,4'-DDD	[c]	4		0.8		Rat	Reproduction	0.35	Fitzhugh 1948	8.5	1.7	3.2	0.63
4,4'-DDE	[c]	4		0.8		Rat	Reproduction	0.35	Fitzhugh 1948	8.5	1.7	3.2	0.63
4,4'-DDT		4		0.8		Rat	Reproduction	0.35	Fitzhugh 1948	8.5	1.7	3.2	0.63
BHC, alpha-	[h]	3	[b]	2		Rat	Reproduction	0.35	Sample et al. 1996	7	3.4	3	1.3
BHC, beta-		2	[b]	0.4		Rat	Growth, blood chemistry, histology	0.35	Sample et al. 1996	4	0.9	2	0.3
BHC, delta-	[h]	3	[b]	2		Rat	Reproduction	0.35	Sample et al. 1996	7	3.4	3	1.3
BHC, gamma- (Lindane)		80	[b]	8		Rat	Reproduction	0.35	Sample et al. 1996	170	17.0	63	6.3
Chlordane, alpha-		45.8	[b]	4.58		Mouse	Reproduction	0.03	Sample et al. 1996	53	5.3	20	2.0
Chlordane, gamma-		45.8	[b]	4.58		Mouse	Reproduction	0.03	Sample et al. 1996	53	5.3	20	2.0
Dieldrin		0.2	[b]	0.02		Rat	Reproduction	0.35	Treon and Cleveland 1955	0.43	0.043	0.16	0.016
Endosulfan		1.5	[b]	0.15		Rat	Reproduction	0.35	Dikshith et al. 1984	3.2	0.32	1.2	0.12
Endosulfan II	[i]	1.5	[b]	0.15		Rat	Reproduction	0.35	Dikshith et al. 1984	3.2	0.32	1.2	0.12
Endrin		0.92	[b]	0.092		Mouse	Reproduction	0.03	Good and Ware 1969	1.1	0.11	0.39	0.039
Endrin Aldehyde	[d]	0.92	[b]	0.092		Mouse	Reproduction	0.03	Good and Ware 1969	1.1	0.11	0.39	0.039
Heptachlor		1		0.1		mouse	- -	0.03	Sample et al. 1996	1.2	0.12	0.43	0.043
Heptachlor Epoxide	[e]	1		0.1		Mink	Reproduction	1.0	Crum et al. 1993	2.8	0.28	1.0	0.10
Methoxychlor		8		4		Rat	Reproduction	0.35	Gray et al. 1988	17	8.5	6.3	3.16
Polycyclic Aromatic Hydrocarbons													
Acenaphthene		17.5		1.75	[b]	Mouse	Decreased body weight and hepatotoxicity	0.03	IRIS 1993	20.2	2.02	7.5	0.75
Acenaphthylene		100	[b]	1000		Mouse	Decreased body weight and mortality	0.03	IRIS 1992	115	1153	43	428
Anthracene		3300		330	[b]	Rodents	Carcinogenicity	0.35	Eisler 1987	7029	703	2609	261
Benzo(a)anthracene		2		0.2	[b]	Rodents	Carcinogenicity	0.35	Eisler 1987	4.3	0.43	1.6	0.16
Benzo(a)pyrene		10		1		Mouse	Reproduction	0.03	Mackenzie and Angevine 1981	12	1.2	4.3	0.43
Benzo(b)fluoranthene	[j]	32.8		1.31		Mouse	Carcinogenicity	0.03	Neal and Rigdon, 1967	37.804	1.510	14.031	0.560
Benzo(g,h,i)perylene		1		0.1	[b]	Mouse	Decreased fertility and litter size	0.03	Mackenzie and Angevine 1981	1.2	0.12	0.4	0.04
Benzo(k)fluoranthene	[j]	32.8		1.31		Mouse	Carcinogenicity	0.03	Neal and Rigdon, 1967	37.804	1.510	14.031	0.560
Chrysene		99		9.9	[b]	Rodents	Carcinogenicity	0.35	Eisler 1987	211	21.1	78	7.83
Dibenzo(a,h)anthracene		0.006		0.0006	[b]	Rodents	Carcinogenicity	0.35	Eisler 1987	0.013	0.0013	0.0047	0.00047
Fluoranthene		40		4	[b]	Rodents	Mortality	0.35	Eisler 1987	85	8.5	31.6	3.16
Fluorene	[k]	150		50		Rat	Developmental	0.35	Navarro et al., 1991	320	106.5	118.6	39.53
Indeno(1,2,3-cd)pyrene	[f]	1		0.1	[b]	Mouse	Decreased fertility and litter size	0.03	Mackenzie and Angevine 1981	1.2	0.12	0.4	0.04
Phenanthrene		14		1.4	[b]	Rodents	Mortality	0.35	Eisler 1987	30	3.0	11.1	1.1
Pyrene		16		1.6	[b]	Mouse	Mortality	0.03	Sax and Lewis 1989	18	1.8	6.8	0.68
Polychlorinated Biphenyls													
Aroclor 1254		0.68	[b]	0.068		Mouse	Reproduction	0.03	McCoy et al. 1995	0.78	0.078	0.3	0.03
Aroclor 1260	[g]	0.68	[b]	0.068		Mouse	Reproduction	0.03	McCoy et al. 1995	0.78	0.078	0.3	0.03
Inorganics													
Arsenic		10	[b]	1		Mouse	Reproduction	0.03	ATSDR 2008	12	1.2	4.3	0.43
Cadmium		2.52	[b]	0.252		Mouse	Mortality	0.03	Sample et al. 1996	2.9	0.29	1.1	0.11
Copper		15.14		11.71		Mink	Reproduction	1.613	Aulerich et al. 1982	47	37	18	14
Lead		80		8		Rat	Reproduction	0.35	Azar et al. 1973	170	17	63	6.32
Nickel		80.0		40.00		Rat	Reproduction	0.35	Sample et al. 1996	170	17	63	31.62
Selenium		0.33		0.2		Rat	Reproduction	0.3	Rosenfeld and Beath 1954	0.68	0.41	0.3	0.15
Silver		168		16.8	[b]	Rat	Mortality	0.35	ATSDR 1990	358	36	133	13.3
Zinc		20.8		2.08	[b]	Mink	Reproduction	1.613	Bleavins et al. 1983	65	6.5	24	2.4

LOAEL Lowest Observed Adverse Effects Level.
mg/kg-BW-day Milligrams per kilogram of body weight per day.
NOAEL No Observed Adverse Effects Level.
TRV Toxicity Reference Value (unitless).

[a] Toxicity Reference Values$_{\text{wildlife species}}$ (TRV) = Chronic Toxiity Value for test species x (BW$_{\text{test species}}$ / BW$_{\text{wildlife species}}$)$^{1/4}$
[b] Acute LOAELs and NOAELs were extrapolated (converted) to chronic LOAELs and NOAELs by applying an acute-chronic ratio of 10 (Calabrese and Baldwin 1993).
[c] 4,4'-DDT used as a surrogate.
[d] Endrin used as a surrogate.
[e] Heptaclor used as a surrogate.
[f] Benzo(a)pyrene used as a surrogate.
[g] Aroclor 1254 used as a surrogate.
[h] BHC (mixed isomers) used as a surrogate

Table A.2-23
Mammalian Toxicity Reference Values
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Test Species Chronic Toxicity Value (mg/kg BW-day)		Test Species	Effect	Body Weight of Test Species	Reference	Reference Toxicity Values (RTV) (unitless) [a]			
							Terrestrial		Aquatic	
	LOAEL	NOAEL					LOAEL	NOAEL	LOAEL	NOAEL

[i] endosulfan used as a surrogate
[j] Benzo(a)pyrene used as a surrogate
[k] Naphthalene used as a surrogate

Table A.2-24

Equations Used to Estimate Risk to Indicator Receptor Foodchain Models

New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Intake Assessment

Terrestrial Foodchain Model

$$\text{Intake (mg/kg - day)} = \left(\frac{\sum_1^f \left(C_{food} \times P_{food}\right) \times \left(\text{IR}_\text{F}\right) \times (\text{SFF}) \times (\text{EF})}{\text{BW}} \right)$$

Where:

C_{food} = Concentration of the constituent in the food (mg/kg)

P_{food} = Proportion of the diet comprised of the food item (unitless)

f = Number of different types of food (e.g., soil/sediment, invertebrates, vegetation (plants and fungi), mammals)

IR_F = Ingestion rate of food (kg/day)

SFF = Site foraging frequency (unitless)

EF = Exposure frequency (unitless)

BW = Body weight of the organism (kg)

Aquatic Foodchain Model

$$\text{Intake (mg/kg - day)} = \left(\frac{\left\{\left(\sum_1^f [C_{food} \times P_{food}] \times IR_f\right) + \left(C_w \times IR_w\right)\right\} \times (\text{SFF}) \times (\text{EF})}{\text{BW}} \right)$$

Where:

C_{food} = Concentration of the constituent in the food (mg/kg)

P_{food} = Proportion of the diet comprised of the food item (unitless)

f = Number of different types of food (e.g., soil/sediment, invertebrates, vegetation (plants and fungi), mammals)

IR_F = Ingestion rate of food (kg/day)

C_w = Concentration of the constituent in the surface water (mg/L)

IR_w = Ingestion rate of water (L/day)

SFF = Site foraging frequency (unitless)

EF = Exposure frequency (unitless)

BW = Body weight of the organism (kg)

$$C_{food} = C_{medium} \times BAF_{food}$$

C_{food} = Concentration in food – primary consumers (e.g., invertebrates, vegetation, mammal…etc)

C_{medium} = Concentration in medium (e.g., soil or sediment)

BAF_{food} = Bioaccumulation factor for food (primary consumer)

Table A.2-24
Equations Used to Estimate Risk to Indicator Receptor Foodchain Models
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Risk Calculations

Risk = Intake / RTV

$$RTV_{\text{Wildlife Species}} = TV_{\text{Test Species}} \times \left[\frac{BW_{\text{TestSpecies}}}{BW_{\text{WildlifeSpecies}}}\right]^{\frac{1}{4}}$$

Where:

$RTV_{\text{Wildlife Species}}$	=	NOAEL or LOAEL for the wildlife species
$TV_{\text{Test Species}}$	=	NOAEL or LOAEL for the laboratory test species (i.e., the toxicological benchmark)
$BW_{\text{Test Species}}$	=	Body weight of the laboratory test species
$BW_{\text{Wildlife Species}}$	=	Body weight of the wildlife species

Table A.3.Data-1
Soil Risk Assessment Dataset
Surface Soil (0-1 foot Depth Interval)
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location	
Volatile Organic Compounds													
1,2,4-Trimethylbenzene	95-63-6	2	-	4	50	0.003	-	0.004	0.002	-	0.002	DTSS1	*
m,p-Xylene	136777612	1	-	5	20	0.003	-	0.003	0.003	-	0.014	DTSS1	*
Xylenes (total)	1330-20-7	1	-	5	20	0.003	-	0.003	0.003	-	0.014	DTSS1	*
Semi-Volatile Organic Compounds													
Carbazole	86-74-8	4	-	4	100	0.17	-	3.5	–	-	–	DTSB35	*r
Dibenzofuran	132-64-9	3	-	4	75	0.28	-	0.8	0.4	-	0.4	DTSB35	*r
Herbicides													
2,4-D	94-75-7	1	-	1	100	0.171	-	0.171	–	-	–	DTSB46	*
Dalapon	75-99-0	1	-	1	100	0.099	-	0.099	–	-	–	DTSB46	*
Dicamba	1918-00-9	1	-	1	100	0.00849	-	0.00849	–	-	–	DTSB46	*
MCPP	93-65-2	1	-	1	100	13.5	-	13.5	–	-	–	DTSB46	*
Pesticides													
4,4'-DDD	72-54-8	1	-	1	100	0.0034	-	0.0034	–	-	–	DTSB46	*
Methoxychlor	72-43-5	1	-	1	100	0.0291	-	0.0291	–	-	–	DTSB46	*
Polycyclic Aromatic Hydrocarbons													
1-Methylnaphthalene	90-12-0	3	-	8	38	0.002	-	0.0036	0.0039	-	0.0045	BDDT-SS001	*
2-Methylnaphthalene	91-57-6	12	-	52	23	0.0025	-	5.1	0.0039	-	0.43	DTSB46	*
Acenaphthene	83-32-9	28	-	52	54	0.011	-	27	0.0039	-	0.011	DTSB46	*
Acenaphthylene	208-96-8	18	-	52	35	0.002	-	0.31	0.0039	-	0.85	DTSB55	*
Anthracene	120-12-7	33	-	52	63	0.015	-	37	0.0039	-	0.011	DTSB46	*
Benzo(a)anthracene	56-55-3	38	-	52	73	0.0093	-	66	0.0039	-	0.011	DTSB46	*
Benzo(a)pyrene	50-32-8	38	-	52	73	0.0089	-	57	0.0039	-	0.011	DTSB46	*
Benzo(b)fluoranthene	205-99-2	43	-	52	83	0.0038	-	81	0.0041	-	0.011	DTSB46	*
Benzo(g,h,i)perylene	191-24-2	37	-	52	71	0.0063	-	38	0.0039	-	0.011	DTSB46	*
Benzo(k)fluoranthene	207-08-9	39	-	52	75	0.0017	-	26	0.0041	-	0.011	DTSB46	*
Chrysene	218-01-9	38	-	52	73	0.0089	-	61	0.0039	-	0.011	DTSB46	*
Dibenzo(a,h)anthracene	53-70-3	23	-	52	44	0.012	-	9.9	0.0039	-	3.4	DTSB46	*
Fluoranthene	206-44-0	46	-	52	88	0.0052	-	180	0.0041	-	0.0088	DTSB46	*
Fluorene	86-73-7	27	-	52	52	0.01	-	28	0.0039	-	0.08	DTSB46	*
Indeno(1,2,3-cd)pyrene	193-39-5	35	-	52	67	0.017	-	47	0.0039	-	0.011	DTSB46	*
Naphthalene	91-20-3	17	-	52	33	0.0025	-	29	0.0039	-	0.43	DTSB46	*
Phenanthrene	85-01-8	42	-	52	81	0.0047	-	160	0.0041	-	0.011	DTSB46	*
Pyrene	129-00-0	44	-	52	85	0.0054	-	130	0.0041	-	0.011	DTSB46	*
Inorganics													
Aluminum	7429-90-5	6	-	6	100	14600	-	20100	–	-	–	DTSS3	*
Antimony	7440-36-0	2	-	6	33	0.22	-	0.33	0.59	-	0.66	DTSB47	*
Arsenic	7440-38-2	6	-	6	100	3.65	-	11.6	–	-	–	DTSS3	*
Barium	7440-39-3	6	-	6	100	58.2	-	78.7	–	-	–	DTSB47	*
Beryllium	7440-41-7	6	-	6	100	0.76	-	1.5	–	-	–	DTSS3	*
Cadmium	7440-43-9	2	-	6	33	0.05	-	0.1	0.12	-	0.13	DTSB46	*

Table A.3.Data-1
Soil Risk Assessment Dataset
Surface Soil (0-1 foot Depth Interval)
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location	
Calcium	7440-70-2	6	-	6	100	850	-	2560	–	-	–	DTSS3	*
Chromium	7440-47-3	6	-	6	100	27.4	-	60.8	–	-	–	DTSS3	*
Cobalt	7440-48-4	6	-	6	100	16.9	-	446	–	-	–	DTSS2	*
Copper	7440-50-8	6	-	6	100	25.9	-	138	–	-	–	DTSS2	*
Iron	7439-89-6	6	-	6	100	23300	-	58100	–	-	–	DTSS3	*
Lead	7439-92-1	6	-	6	100	18.2	-	336	–	-	–	DTSS2	*
Magnesium	7439-95-4	6	-	6	100	4040	-	13500	–	-	–	DTSS3	*
Manganese	7439-96-5	6	-	6	100	746	-	3430	–	-	–	DTSS2	*
Mercury	7439-97-6	2	-	6	33	0.03	-	0.03	0.12	-	0.13	DTSB46,DTSB47	*
Nickel	7440-02-0	6	-	6	100	15.1	-	41.3	–	-	–	DTSS2	*
Potassium	7440-09-7	6	-	6	100	1430	-	3980	–	-	–	DTSS3	*
Selenium	7782-49-2	1	-	6	17	0.43	-	0.43	0.59	-	1.21	DTSB46	*
Sodium	7440-23-5	6	-	6	100	18	-	173	–	-	–	DTSB35	*r
Thallium	7440-28-0	3	-	6	50	0.23	-	0.51	0.24	-	0.26	DTSB35	*r
Vanadium	7440-62-2	6	-	6	100	44.6	-	108	–	-	–	DTSS3	*
Zinc	7440-66-6	6	-	6	100	41.2	-	178	–	-	–	DTSS1	*

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilograms.

PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

* = Surface soil
r = Rip-rap area

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table A.3.Data-2
Soil Risk Assessment Dataset
Surface Soil (0-2 foot Depth Interval)
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location	
Volatile Organic Compounds													
1,2,4-Trimethylbenzene	95-63-6	2	-	4	50	0.003	-	0.004	0.002	-	0.002	DTSS1	*
m,p-Xylene	136777612	1	-	7	14	0.003	-	0.003	0.003	-	0.014	DTSS1	*
Xylenes (total)	1330-20-7	1	-	7	14	0.003	-	0.003	0.003	-	0.014	DTSS1	*
Semi-Volatile Organic Compounds													
Carbazole	86-74-8	4	-	4	100	0.17	-	3.5	–	-	–	DTSB35	*r
Dibenzofuran	132-64-9	3	-	4	75	0.28	-	0.8	0.4	-	0.4	DTSB35	*r
Herbicides													
2,4-D	94-75-7	1	-	1	100	0.171	-	0.171	–	-	–	DTSB46	*
Dalapon	75-99-0	1	-	1	100	0.099	-	0.099	–	-	–	DTSB46	*
Dicamba	1918-00-9	1	-	1	100	0.00849	-	0.00849	–	-	–	DTSB46	*
MCPP	93-65-2	1	-	1	100	13.5	-	13.5	–	-	–	DTSB46	*
Pesticides													
4,4'-DDD	72-54-8	1	-	1	100	0.0034	-	0.0034	–	-	–	DTSB46	*
Methoxychlor	72-43-5	1	-	1	100	0.0291	-	0.0291	–	-	–	DTSB46	*
Polycyclic Aromatic Hydrocarbons													
1-Methylnaphthalene	90-12-0	3	-	8	38	0.002	-	0.0036	0.0039	-	0.0045	BDDT-SS001	*
2-Methylnaphthalene	91-57-6	16	-	59	27	0.00095	-	5.1	0.0039	-	0.43	DTSB46	*
Acenaphthene	83-32-9	32	-	59	54	0.002	-	27	0.0039	-	0.011	DTSB46	*
Acenaphthylene	208-96-8	20	-	59	34	0.00087	-	0.31	0.0039	-	0.85	DTSB55	*
Anthracene	120-12-7	37	-	59	63	0.0036	-	37	0.0039	-	0.011	DTSB46	*
Benzo(a)anthracene	56-55-3	42	-	59	71	0.0093	-	66	0.0039	-	0.011	DTSB46	*
Benzo(a)pyrene	50-32-8	42	-	59	71	0.0089	-	57	0.0039	-	0.011	DTSB46	*
Benzo(b)fluoranthene	205-99-2	47	-	59	80	0.0038	-	81	0.0041	-	0.011	DTSB46	*
Benzo(g,h,i)perylene	191-24-2	41	-	59	69	0.0063	-	38	0.0039	-	0.011	DTSB46	*
Benzo(k)fluoranthene	207-08-9	43	-	59	73	0.0017	-	26	0.0041	-	0.011	DTSB46	*
Chrysene	218-01-9	42	-	59	71	0.0089	-	61	0.0039	-	0.011	DTSB46	*
Dibenzo(a,h)anthracene	53-70-3	26	-	59	44	0.0027	-	9.9	0.0039	-	3.4	DTSB46	*
Fluoranthene	206-44-0	50	-	59	85	0.0052	-	180	0.0041	-	0.0088	DTSB46	*
Fluorene	86-73-7	31	-	59	53	0.002	-	28	0.0039	-	0.08	DTSB46	*
Indeno(1,2,3-cd)pyrene	193-39-5	39	-	59	66	0.013	-	47	0.0039	-	0.011	DTSB46	*
Naphthalene	91-20-3	21	-	59	36	0.0011	-	29	0.0039	-	0.43	DTSB46	*
Phenanthrene	85-01-8	46	-	59	78	0.0047	-	160	0.0041	-	0.011	DTSB46	*
Pyrene	129-00-0	48	-	59	81	0.0054	-	130	0.0041	-	0.011	DTSB46	*
Inorganics													
Aluminum	7429-90-5	8	-	8	100	14600	-	20100	–	-	–	DTSS3	*
Antimony	7440-36-0	2	-	8	25	0.22	-	0.33	0.59	-	0.66	DTSB47	*
Arsenic	7440-38-2	8	-	8	100	2.11	-	11.6	–	-	–	DTSS3	*
Barium	7440-39-3	8	-	8	100	56	-	78.7	–	-	–	DTSB47	*
Beryllium	7440-41-7	8	-	8	100	0.76	-	1.5	–	-	–	DTSS3	*

Table A.3.Data-2
Soil Risk Assessment Dataset
Surface Soil (0-2 foot Depth Interval)
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b]				Detects			Detection Limits			Maximum Location	
		number of detects / number of samples			FOD %	Min (mg/kg)	-	Max (mg/kg)	Min (mg/kg)	-	Max (mg/kg)		
Cadmium	7440-43-9	2	-	8	25	0.05	-	0.1	0.12	-	0.13	DTSB46	*
Calcium	7440-70-2	8	-	8	100	850	-	2560	–	-	–	DTSS3	*
Chromium	7440-47-3	8	-	8	100	23.2	-	60.8	–	-	–	DTSS3	*
Cobalt	7440-48-4	8	-	8	100	10.7	-	446	–	-	–	DTSS2	*
Copper	7440-50-8	8	-	8	100	19.3	-	138	–	-	–	DTSS2	*
Iron	7439-89-6	8	-	8	100	21100	-	58100	–	-	–	DTSS3	*
Lead	7439-92-1	8	-	8	100	14.1	-	336	–	-	–	DTSS2	*
Magnesium	7439-95-4	8	-	8	100	4040	-	13500	–	-	–	DTSS3	*
Manganese	7439-96-5	8	-	8	100	484	-	3430	–	-	–	DTSS2	*
Mercury	7439-97-6	4	-	8	50	0.02	-	0.03	0.12	-	0.13	DTSB46,DTSB46,DTSB47	*
Nickel	7440-02-0	8	-	8	100	15.1	-	41.3	–	-	–	DTSS2	*
Potassium	7440-09-7	8	-	8	100	1370	-	3980	–	-	–	DTSS3	*
Selenium	7782-49-2	1	-	8	12	0.43	-	0.43	0.59	-	1.24	DTSB46	*
Sodium	7440-23-5	8	-	8	100	18	-	173	–	-	–	DTSB35	*r
Thallium	7440-28-0	5	-	8	62	0.2	-	0.51	0.24	-	0.26	DTSB35	*r
Vanadium	7440-62-2	8	-	8	100	38.4	-	108	–	-	–	DTSS3	*
Zinc	7440-66-6	8	-	8	100	39.5	-	178	–	-	–	DTSS1	*

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilograms.

PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

* = Surface soil
r = Rip-rap area

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table A.3.Data-3
Soil Risk Assessment Dataset
Combined Surface and Subsurface Soil
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location	
Volatile Organic Compounds													
1,2,4-Trimethylbenzene	95-63-6	2	-	4	50	0.003	-	0.004	0.002	-	0.002	DTSS1	*
m,p-Xylene	136777612	1	-	7	14	0.003	-	0.003	0.003	-	0.014	DTSS1	*
Xylenes (total)	1330-20-7	1	-	7	14	0.003	-	0.003	0.003	-	0.014	DTSS1	*
Semi-Volatile Organic Compounds													
Carbazole	86-74-8	4	-	4	100	0.17	-	3.5	–	-	–	DTSB35	*r
Dibenzofuran	132-64-9	3	-	4	75	0.28	-	0.8	0.4	-	0.4	DTSB35	*r
Herbicides													
2,4-D	94-75-7	1	-	1	100	0.171	-	0.171	–	-	–	DTSB46	*
Dalapon	75-99-0	1	-	1	100	0.099	-	0.099	–	-	–	DTSB46	*
Dicamba	1918-00-9	1	-	1	100	0.00849	-	0.00849	–	-	–	DTSB46	*
MCPP	93-65-2	1	-	1	100	13.5	-	13.5	–	-	–	DTSB46	*
Pesticides													
4,4'-DDD	72-54-8	1	-	1	100	0.0034	-	0.0034	–	-	–	DTSB46	*
Methoxychlor	72-43-5	1	-	1	100	0.0291	-	0.0291	–	-	–	DTSB46	*
Polycyclic Aromatic Hydrocarbons													
1-Methylnaphthalene	90-12-0	3	-	12	25	0.002	-	0.0036	0.0039	-	0.0045	BDDT-SS001	*
2-Methylnaphthalene	91-57-6	16	-	63	25	0.00095	-	5.1	0.0039	-	0.43	DTSB46	*
Acenaphthene	83-32-9	35	-	63	56	0.002	-	27	0.0039	-	0.011	DTSB46	*
Acenaphthylene	208-96-8	20	-	63	32	0.00087	-	0.31	0.0039	-	0.85	DTSB55	*
Anthracene	120-12-7	40	-	63	63	0.0036	-	37	0.0039	-	0.011	DTSB46	*
Benzo(a)anthracene	56-55-3	45	-	63	71	0.0093	-	66	0.0039	-	0.011	DTSB46	*
Benzo(a)pyrene	50-32-8	45	-	63	71	0.0089	-	57	0.0039	-	0.011	DTSB46	*
Benzo(b)fluoranthene	205-99-2	50	-	63	79	0.0038	-	81	0.0041	-	0.011	DTSB46	*
Benzo(g,h,i)perylene	191-24-2	44	-	63	70	0.0063	-	38	0.0039	-	0.011	DTSB46	*
Benzo(k)fluoranthene	207-08-9	46	-	63	73	0.0017	-	26	0.0041	-	0.011	DTSB46	*
Chrysene	218-01-9	45	-	63	71	0.0089	-	61	0.0039	-	0.011	DTSB46	*
Dibenzo(a,h)anthracene	53-70-3	28	-	63	44	0.0027	-	9.9	0.0039	-	3.4	DTSB46	*
Fluoranthene	206-44-0	53	-	63	84	0.0052	-	180	0.0041	-	0.0088	DTSB46	*
Fluorene	86-73-7	34	-	63	54	0.002	-	28	0.0039	-	0.08	DTSB46	*
Indeno(1,2,3-cd)pyrene	193-39-5	42	-	63	67	0.013	-	47	0.0039	-	0.011	DTSB46	*
Naphthalene	91-20-3	21	-	63	33	0.0011	-	29	0.0039	-	0.43	DTSB46	*
Phenanthrene	85-01-8	49	-	63	78	0.0047	-	160	0.0041	-	0.011	DTSB46	*
Pyrene	129-00-0	51	-	63	81	0.0054	-	130	0.0041	-	0.011	DTSB46	*
Inorganics													
Aluminum	7429-90-5	8	-	8	100	14600	-	20100	–	-	–	DTSS3	*
Antimony	7440-36-0	2	-	8	25	0.22	-	0.33	0.59	-	0.66	DTSB47	*
Arsenic	7440-38-2	8	-	8	100	2.11	-	11.6	–	-	–	DTSS3	*
Barium	7440-39-3	8	-	8	100	56	-	78.7	–	-	–	DTSB47	*
Beryllium	7440-41-7	8	-	8	100	0.76	-	1.5	–	-	–	DTSS3	*

Table A.3.Data-3
Soil Risk Assessment Dataset
Combined Surface and Subsurface Soil
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location	
Cadmium	7440-43-9	2	-	8	25	0.05	-	0.1	0.12	-	0.13	DTSB46	*
Calcium	7440-70-2	8	-	8	100	850	-	2560	–	-	–	DTSS3	*
Chromium	7440-47-3	8	-	8	100	23.2	-	60.8	–	-	–	DTSS3	*
Cobalt	7440-48-4	8	-	8	100	10.7	-	446	–	-	–	DTSS2	*
Copper	7440-50-8	8	-	8	100	19.3	-	138	–	-	–	DTSS2	*
Iron	7439-89-6	8	-	8	100	21100	-	58100	–	-	–	DTSS3	*
Lead	7439-92-1	8	-	8	100	14.1	-	336	–	-	–	DTSS2	*
Magnesium	7439-95-4	8	-	8	100	4040	-	13500	–	-	–	DTSS3	*
Manganese	7439-96-5	8	-	8	100	484	-	3430	–	-	–	DTSS2	*
Mercury	7439-97-6	4	-	8	50	0.02	-	0.03	0.12	-	0.13	DTSB46,DTSB46,DTSB47	*
Nickel	7440-02-0	8	-	8	100	15.1	-	41.3	–	-	–	DTSS2	*
Potassium	7440-09-7	8	-	8	100	1370	-	3980	–	-	–	DTSS3	*
Selenium	7782-49-2	1	-	8	12	0.43	-	0.43	0.59	-	1.24	DTSB46	*
Sodium	7440-23-5	8	-	8	100	18	-	173	–	-	–	DTSB35	*r
Thallium	7440-28-0	5	-	8	62	0.2	-	0.51	0.24	-	0.26	DTSB35	*r
Vanadium	7440-62-2	8	-	8	100	38.4	-	108	–	-	–	DTSS3	*
Zinc	7440-66-6	8	-	8	100	39.5	-	178	–	-	–	DTSS1	*

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilograms.

PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

* = Surface soil
r = Rip-rap area

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table A.3.Data-4
Sediment Risk Assessment Dataset
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Volatile Organic Compounds												
Acetone	67-64-1	5	-	13	38	0.022	-	0.037	0.007	-	0.012	DTSW/SD07
Carbon Disulfide	75-15-0	6	-	13	46	0.00099	-	0.0015	0.007	-	0.009	DTSW/SD07
Methylene Chloride	75-09-2	1	-	13	8	0.005	-	0.005	0.001	-	0.012	DTSD03
p-Isopropyltoluene	99-87-6	1	-	7	14	0.004	-	0.004	0.001	-	0.002	DTSD01
Toluene	108-88-3	3	-	13	23	0.00094	-	0.0027	0.002	-	0.012	DTSW/SD10
Trichloroethene	79-01-6	1	-	13	8	0.003	-	0.003	0.004	-	0.012	DTSD02
Semi-Volatile Organic Compounds										-		
4-Methylphenol	106-44-5	1	-	7	14	0.06	-	0.06	0.46	-	0.58	DTSD03
Di-n-Butylphthalate	84-74-2	2	-	7	29	0.08	-	0.09	0.46	-	0.59	DTSD04
Pesticides										-		
4,4'-DDD	72-54-8	2	-	2	100	0.0011	-	0.00115	–	-	–	DTSW/SD05
4,4'-DDE	72-55-9	2	-	2	100	0.00141	-	0.00212	–	-	–	DTSW/SD05
4,4'-DDT	50-29-3	2	-	2	100	0.00067	-	0.00123	–	-	–	DTSW/SD05
Delta-BHC	319-86-8	1	-	2	50	0.00354	-	0.0065	0.00134	-	0.00134	DTSW/SD07
Alpha-Chlordane	5103-71-9	2	-	2	100	0.00033	-	0.00039	–	-	–	DTSW/SD07
Dieldrin	60-57-1	2	-	2	100	0.00121	-	0.00159	–	-	–	DTSW/SD05
Polycyclic Aromatic Hydrocarbons										-		
1-Methylnaphthalene	90-12-0	1	-	4	25	0.0048	-	0.0048	0.0044	-	0.0048	BDDT-SE004
2-Methylnaphthalene	91-57-6	7	-	17	41	0.0042	-	0.074	0.0044	-	0.59	DTSW/SD10
Acenaphthene	83-32-9	7	-	17	41	0.0018	-	0.24	0.0044	-	0.6	DTSW/SD10
Acenaphthylene	208-96-8	1	-	17	6	0.0017	-	0.0017	0.0032	-	1.2	DTSW/SD06
Anthracene	120-12-7	8	-	17	47	0.0023	-	0.41	0.0026	-	0.06	DTSW/SD10
Benzo(a)anthracene	56-55-3	10	-	17	59	0.0026	-	0.88	0.0026	-	0.04	DTSW/SD10
Benzo(a)pyrene	50-32-8	9	-	17	53	0.012	-	0.71	0.0026	-	0.04	DTSW/SD10
Benzo(b)fluoranthene	205-99-2	8	-	17	47	0.0041	-	1.2	0.0044	-	0.12	DTSW/SD10
Benzo(g,h,i)perylene	191-24-2	8	-	17	47	0.0064	-	0.28	0.0044	-	0.12	DTSW/SD10
Benzo(k)fluoranthene	207-08-9	9	-	17	53	0.0017	-	0.37	0.0026	-	0.06	DTSW/SD10
Chrysene	218-01-9	11	-	17	65	0.004	-	0.8	0.0028	-	0.04	DTSW/SD10
Dibenzo(a,h)anthracene	53-70-3	4	-	17	24	0.0029	-	0.076	0.0032	-	0.12	DTSW/SD10
Fluoranthene	206-44-0	14	-	17	82	0.0082	-	2	0.0044	-	0.09	DTSW/SD10
Fluorene	86-73-7	7	-	17	41	0.0024	-	0.24	0.0044	-	0.12	DTSW/SD10
Indeno(1,2,3-cd)pyrene	193-39-5	8	-	17	47	0.0075	-	0.36	0.0026	-	0.06	DTSW/SD10
Naphthalene	91-20-3	7	-	17	41	0.014	-	0.091	0.0044	-	0.6	DTSW/SD10
Phenanthrene	85-01-8	14	-	17	82	0.0042	-	1.9	0.0044	-	0.04	DTSW/SD10
Pyrene	129-00-0	13	-	17	76	0.006	-	1.7	0.0044	-	0.04	DTSW/SD10

Table A.3.Data-4
Sediment Risk Assessment Dataset
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)		Detects Max (mg/kg)	Detection Limits Min (mg/kg)		Detection Limits Max (mg/kg)	Maximum Location
Inorganics										-		
Aluminum	7429-90-5	13	-	13	100	8690	-	20200	–	-	–	DTSW/SD09
Antimony	7440-36-0	3	-	13	23	0.37	-	0.89	0.69	-	1.19	DTSW/SD05
Arsenic	7440-38-2	13	-	13	100	1.96	-	13.2	–	-	–	DTSD03
Barium	7440-39-3	13	-	13	100	72.5	-	358	–	-	–	DTSD03
Beryllium	7440-41-7	13	-	13	100	0.7	-	1.3	–	-	–	DTSD03
Calcium	7440-70-2	13	-	13	100	46100	-	98600	–	-	–	DTSD04
Chromium	7440-47-3	13	-	13	100	22.3	-	73	–	-	–	DTSD03
Cobalt	7440-48-4	13	-	13	100	8.8	-	27.6	–	-	–	DTSD02
Copper	7440-50-8	13	-	13	100	4.4	-	15	–	-	–	DTSD01
Iron	7439-89-6	13	-	13	100	16400	-	56200	–	-	–	DTSD03
Lead	7439-92-1	13	-	13	100	10.7	-	28.6	–	-	–	DTSD03
Magnesium	7439-95-4	13	-	13	100	3070	-	7720	–	-	–	DTSD02
Manganese	7439-96-5	13	-	13	100	387	-	3340	–	-	–	DTSD03
Mercury	7439-97-6	2	-	13	15	0.03	-	0.04	0.08	-	0.18	DTSW/SD05
Nickel	7440-02-0	13	-	13	100	7.9	-	20.8	–	-	–	DTSD03
Potassium	7440-09-7	13	-	13	100	776	-	2200	–	-	–	DTSW/SD10
Silver	7440-22-4	1	-	13	8	0.86	-	0.86	0.28	-	2.39	DTSD01
Sodium	7440-23-5	13	-	13	100	87.4	-	510	–	-	–	DTSD01
Thallium	7440-28-0	9	-	13	69	0.09	-	1.1	0.28	-	0.35	DTSD01
Vanadium	7440-62-2	13	-	13	100	31.6	-	75.7	–	-	–	DTSD03
Zinc	7440-66-6	13	-	13	100	32.6	-	51.9	–	-	–	DTSD02

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilograms.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.
[c] The exposure point concentration (EPC) was the upper confidence level on the mean (UCL) or the maximum concentration where the UCL was incalculable.
EPCs marked with "m" are based on the maximum detected concentration.
Exposure to lead is evaluated by predicting resultant blood lead levels using the arithmetic average (avg).
The UCLs were calculated using ProUCL 4.0. The UCL used is the one recommended by ProUCL 4.0.

Table A.3.Data-5
Surface Water Risk Assessment Dataset
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)		Detects Max (mg/kg)	Detection Limits Min (mg/kg)		Detection Limits Max (mg/kg)	Maximum Location
Volatile Organic Compounds												
Bromodichloromethane	75-27-4	1	-	13	8	0.023	-	0.023	0.0006	-	0.001	DTSW3
Carbon Disulfide	75-15-0	5	-	13	38	0.00022	-	0.00034	0.001	-	0.005	DTSW/SD08
Chloroform	67-66-3	6	-	13	46	0.00007	-	0.004	0.0008	-	0.001	DTSW3
Semi-Volatile Organic Compounds												
Di-n-Butylphthalate	84-74-2	2	-	7	29	0.002	-	0.003	0.01	-	0.01	DTSW2
Pesticides												
4,4'-DDT	50-29-3	1	-	2	50	5.16E-06	-	5.16E-06	0.00002	-	0.00002	DTSW/SD05
Dieldrin	60-57-1	2	-	2	100	5.48E-06	-	5.91E-06	–	-	–	DTSW/SD07
Endrin Ketone	53494-70-5	2	-	2	100	4.37E-06	-	5.99E-06	–	-	–	DTSW/SD07
Polycyclic Aromatic Hydrocarbons												
2-Methylnaphthalene	91-57-6	4	-	17	24	0.00003	-	0.00013	0.000046	-	0.01	DTSW/SD10
Acenaphthene	83-32-9	1	-	17	6	0.00005	-	0.00005	0.000046	-	0.01	DTSW/SD10
Acenaphthylene	208-96-8	1	-	17	6	0.00004	-	0.00004	0.000046	-	0.01	DTSW/SD10
Fluorene	86-73-7	1	-	17	6	0.00003	-	0.00003	0.000046	-	0.01	DTSW/SD10
Naphthalene	91-20-3	6	-	17	35	0.00003	-	0.00013	0.000046	-	0.01	DTSW/SD10
Inorganics												
Aluminum	7429-90-5	13	-	13	100	0.0498	-	0.603	–	-	–	DTSW/SD09
Antimony	7440-36-0	2	-	13	15	0.00038	-	0.00074	0.005	-	0.005	DTSW/SD06
Barium	7440-39-3	13	-	13	100	0.06	-	0.0825	–	-	–	DTSW/SD08
Calcium	7440-70-2	13	-	13	100	47	-	65	–	-	–	DTSW2
Copper	7440-50-8	7	-	13	54	0.012	-	0.0348	0.02	-	0.02	DTSW1
Iron	7439-89-6	13	-	13	100	0.0763	-	0.507	–	-	–	DTSW/SD09
Lead	7439-92-1	8	-	13	62	0.00015	-	0.0046	0.002	-	0.002	DTSW1
Magnesium	7439-95-4	13	-	13	100	12.7	-	17.4	–	-	–	DTSW/SD08
Manganese	7439-96-5	13	-	13	100	0.0034	-	0.0198	–	-	–	DTSW/SD09
Nickel	7440-02-0	7	-	13	54	0.0027	-	0.0055	0.04	-	0.04	DTSW1
Potassium	7440-09-7	13	-	13	100	1.93	-	3.67	–	-	–	DTSW/SD08
Silver	7440-22-4	1	-	13	8	0.0021	-	0.0021	0.002	-	0.01	DTSW1
Sodium	7440-23-5	13	-	13	100	22.4	-	35.3	–	-	–	DTSW/SD08
Thallium	7440-28-0	4	-	13	31	0.0023	-	0.0072	0.002	-	0.002	DTSW4
Zinc	7440-66-6	7	-	13	54	0.0202	-	0.0462	0.02	-	0.02	DTSW1

Notes:

– =	Not detected/ not analyzed/ not applicable.	PAH =	Polycyclic Aromatic Hydrocarbon.
CASN =	Chemical abstracts registry number.	USEPA =	United States Environmental Protection Agency.
mg/L =	Milligrams per liter.	VOC =	Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.

[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table A.3.HHRA-1
Selection of Constituents of Potential Concern for Surface Soil (0-2 foot Depth Interval)
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b]					Background Level [c]	Does Maximum Exceed RSL?		Is Constituent a Surface Soil COPC? [d]
			Industrial Scenario		Residential Scenario		Surrogate		Industrial	Residential	
		(mg/kg)	(mg/kg)		(mg/kg)			(mg/kg)	(YES, no)	(YES, no)	(YES, no)
Volatile Organic Compounds											
1,2,4-Trimethylbenzene	95-63-6	4.00E-03	2.80E+01	ns	6.70E+00	n		–	no	no	no
m,p-Xylene	136777612	3.00E-03	2.60E+02	ns	6.00E+01	ns	p-Xylene	–	no	no	no
Xylenes (total)	1330-20-7	3.00E-03	2.60E+02	ns	6.00E+01	ns		–	no	no	no
Semi-Volatile Organic Compounds											
Carbazole	86-74-8	3.50E+00	NA		NA			–	NA	NA	**YES**
Dibenzofuran	132-64-9	8.00E-01	1.00E+02	n	7.80E+00	n	Furan	–	no	no	no
Herbicides											
2,4-D	94-75-7	1.71E-01	7.70E+02	n	6.90E+01	n		–	no	no	no
Dalapon	75-99-0	9.90E-02	1.80E+03	n	1.80E+02	n		–	no	no	no
Dicamba	1918-00-9	8.49E-03	1.80E+03	n	1.80E+02	n		–	no	no	no
MCPP	93-65-2	1.35E+01	6.20E+01	n	6.10E+00	n		–	no	**YES**	**YES**
Pesticides											
4,4'-DDD	72-54-8	3.40E-03	7.20E+00	c	2.00E+00	c		–	no	no	no
Methoxychlor	72-43-5	2.91E-02	3.10E+02	n	3.10E+01	n		–	no	no	no
Polycyclic Aromatic Hydrocarbons											
1-Methylnaphthalene	90-12-0	3.60E-03	9.90E+01	c	2.20E+01	c		–	no	no	no
2-Methylnaphthalene	91-57-6	5.10E+00	4.10E+02	ns	3.10E+01	n		–	no	no	no
Acenaphthene	83-32-9	2.70E+01	3.30E+03	n	3.40E+02	n		–	no	no	no
Acenaphthylene	208-96-8	3.10E-01	3.30E+03	n	3.40E+02	n	Acenaphthene	–	no	no	no
Anthracene	120-12-7	3.70E+01	1.70E+04	nm	1.70E+03	n		–	no	no	no
Benzo(a)anthracene	56-55-3	6.60E+01	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Benzo(a)pyrene	50-32-8	5.70E+01	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Benzo(b)fluoranthene	205-99-2	8.10E+01	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Benzo(g,h,i)perylene	191-24-2	3.80E+01	1.70E+03	n	1.70E+02	n	Pyrene	–	no	no	no
Benzo(k)fluoranthene	207-08-9	2.60E+01	2.10E+01	c	1.50E+00	c		–	**YES**	**YES**	**YES**
Chrysene	218-01-9	6.10E+01	2.10E+02	c	1.50E+01	c		–	no	**YES**	**YES**
Dibenzo(a,h)anthracene	53-70-3	9.90E+00	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Fluoranthene	206-44-0	1.80E+02	2.20E+03	n	2.30E+02	n		–	no	no	no
Fluorene	86-73-7	2.80E+01	2.20E+03	n	2.30E+02	n		–	no	no	no
Indeno(1,2,3-cd)pyrene	193-39-5	4.70E+01	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Naphthalene	91-20-3	2.90E+01	2.00E+01	c*	3.90E+00	c*		–	**YES**	**YES**	**YES**
Phenanthrene	85-01-8	1.60E+02	1.70E+04	nm	1.70E+03	n	Anthracene	–	no	no	no
Pyrene	129-00-0	1.30E+02	1.70E+03	n	1.70E+02	n		–	no	no	no
Inorganics											
Aluminum	7429-90-5	2.01E+04	9.90E+04	nm	7.70E+03	n		4.00E+04	no	**YES**	no
Antimony	7440-36-0	3.30E-01	4.10E+01	n	3.10E+00	n		–	no	no	no
Arsenic	7440-38-2	1.16E+01	1.60E+00	c	3.90E-01	c*		1.58E+01	**YES**	**YES**	no
Barium	7440-39-3	7.87E+01	1.90E+04	nm	1.50E+03	n		2.09E+02	no	no	no
Beryllium	7440-41-7	1.50E+00	2.00E+02	n	1.60E+01	n		1.02E+00	no	no	no
Cadmium	7440-43-9	1.00E-01	8.10E+01	n	7.00E+00	n		6.90E-01	no	no	no
Calcium	7440-70-2	2.56E+03	NA		NA			–	NA	NA	no
Chromium	7440-47-3	6.08E+01	1.40E+03	c	2.80E+02	c		6.53E+01	no	no	no
Cobalt	7440-48-4	4.46E+02	3.00E+01	n	2.30E+00	n		7.23E+01	**YES**	**YES**	**YES**
Copper	7440-50-8	1.38E+02	4.10E+03	n	3.10E+02	n		5.35E+01	no	no	no

Table A.3.HHRA-1
Selection of Constituents of Potential Concern for Surface Soil (0-2 foot Depth Interval)
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b]					Background Level [c]	Does Maximum Exceed RSL?		Is Constituent a Surface Soil COPC? [d]
			Industrial Scenario		Residential Scenario		Surrogate		Industrial	Residential	
		(mg/kg)	(mg/kg)		(mg/kg)			(mg/kg)	(YES, no)	(YES, no)	(YES, no)
Iron	7439-89-6	5.81E+04	7.20E+04	nm	5.50E+03	n		5.10E+04	no	**YES**	**YES**
Lead	7439-92-1	3.36E+02	8.00E+02	«	4.00E+02	«		2.68E+01	no	no	no
Magnesium	7439-95-4	1.35E+04	NA		NA			–	NA	NA	no
Manganese	7439-96-5	3.43E+03	2.30E+03	n	1.80E+02	n		2.54E+03	**YES**	**YES**	**YES**
Mercury	7439-97-6	3.00E-02	3.10E+01	n	2.30E+00	n		1.30E-01	no	no	no
Nickel	7440-02-0	4.13E+01	2.00E+03	n	1.60E+02	n		6.28E+01	no	no	no
Potassium	7440-09-7	3.98E+03	NA		NA			–	NA	NA	no
Selenium	7782-49-2	4.30E-01	5.10E+02	n	3.90E+01	n		–	no	no	no
Sodium	7440-23-5	1.73E+02	NA		NA			–	NA	NA	no
Thallium	7440-28-0	5.10E-01	6.60E+00	n	5.10E-01	n		2.11E+00	no	no	no
Vanadium	7440-62-2	1.08E+02	7.20E+02	n	5.50E+01	n		1.08E+02	no	**YES**	no
Zinc	7440-66-6	1.78E+02	3.10E+04	nm	2.30E+03	n		2.02E+02	no	no	no

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
mg/kg = Milligrams per kilogram.
NA = Not available or not applicable.
RSL = Regional Screening Level.
USEPA = United States Environmental Protection Agency.

[a] Maximum concentration in surface soil (0-2 foot depth interval).
[b] The screening levels used were from USEPA (2008a). Screening levels based on non-cancer effects were adjusted downward by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = concentration may exceed ceiling limit; s = Concentration may exceed saturation concentration (Csat).
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.
[c] Background levels for metals are facility-wide soil background point estimates taken from Facility-Wide Background Study Report (IT Corporation, 2001).
[d] Constituents detected with maximum concentrations greater than adjusted residential screening levels were considered COPCs unless they were metals detected at concentrations lower than background, or are essential nutrients (i.e., calcium, magnesium, potassium, sodium), or they were known laboratory contaminants (i.e. acetone).

Table A.3.HHRA-2
Selection of Constituents of Potential Concern for Combined Surface and Subsurface Soil
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b]					Background Level [c]	Does Maximum Exceed RSL?		Is Constituent a Surface/ Subsurface Soil COPC? [d]
			Industrial Scenario		Residential Scenario		Surrogate		Industrial	Residential	
		(mg/kg)	(mg/kg)		(mg/kg)			(mg/kg)	(YES, no)	(YES, no)	(YES, no)
Volatile Organic Compounds											
1,2,4-Trimethylbenzene	95-63-6	4.00E-03	2.80E+01	ns	6.70E+00	n		–	no	no	no
m,p-Xylene	136777612	3.00E-03	2.60E+02	ns	6.00E+01	ns	p-Xylene	–	no	no	no
Xylenes (total)	1330-20-7	3.00E-03	2.60E+02	ns	6.00E+01	ns		–	no	no	no
Semi-Volatile Organic Compounds											
Carbazole	86-74-8	3.50E+00	NA		NA			–	NA	NA	**YES**
Dibenzofuran	132-64-9	8.00E-01	1.00E+02	n	7.80E+00	n	Furan	–	no	no	no
Herbicides											
2,4-D	94-75-7	1.71E-01	7.70E+02	n	6.90E+01	n		–	no	no	no
Dalapon	75-99-0	9.90E-02	1.80E+03	n	1.80E+02	n		–	no	no	no
Dicamba	1918-00-9	8.49E-03	1.80E+03	n	1.80E+02	n		–	no	no	no
MCPP	93-65-2	1.35E+01	6.20E+01	n	6.10E+00	n		–	no	**YES**	**YES**
Pesticides											
4,4'-DDD	72-54-8	3.40E-03	7.20E+00	c	2.00E+00	c		–	no	no	no
Methoxychlor	72-43-5	2.91E-02	3.10E+02	n	3.10E+01	n		–	no	no	no
Polycyclic Aromatic Hydrocarbons											
1-Methylnaphthalene	90-12-0	3.60E-03	9.90E+01	c	2.20E+01	c		–	no	no	no
2-Methylnaphthalene	91-57-6	5.10E+00	4.10E+02	ns	3.10E+01	n		–	no	no	no
Acenaphthene	83-32-9	2.70E+01	3.30E+03	n	3.40E+02	n		–	no	no	no
Acenaphthylene	208-96-8	3.10E-01	3.30E+03	n	3.40E+02	n	Acenaphthene	–	no	no	no
Anthracene	120-12-7	3.70E+01	1.70E+04	nm	1.70E+03	n		–	no	no	no
Benzo(a)anthracene	56-55-3	6.60E+01	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Benzo(a)pyrene	50-32-8	5.70E+01	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Benzo(b)fluoranthene	205-99-2	8.10E+01	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Benzo(g,h,i)perylene	191-24-2	3.80E+01	1.70E+03	n	1.70E+02	n	Pyrene	–	no	no	no
Benzo(k)fluoranthene	207-08-9	2.60E+01	2.10E+01	c	1.50E+00	c		–	**YES**	**YES**	**YES**
Chrysene	218-01-9	6.10E+01	2.10E+02	c	1.50E+01	c		–	no	**YES**	**YES**
Dibenzo(a,h)anthracene	53-70-3	9.90E+00	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Fluoranthene	206-44-0	1.80E+02	2.20E+03	n	2.30E+02	n		–	no	no	no
Fluorene	86-73-7	2.80E+01	2.20E+03	n	2.30E+02	n		–	no	no	no
Indeno(1,2,3-cd)pyrene	193-39-5	4.70E+01	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Naphthalene	91-20-3	2.90E+01	2.00E+01	c*	3.90E+00	c*		–	**YES**	**YES**	**YES**
Phenanthrene	85-01-8	1.60E+02	1.70E+04	nm	1.70E+03	n	Anthracene	–	no	no	no
Pyrene	129-00-0	1.30E+02	1.70E+03	n	1.70E+02	n		–	no	no	no
Inorganics											
Aluminum	7429-90-5	2.01E+04	9.90E+04	nm	7.70E+03	n		4.00E+04	no	**YES**	no
Antimony	7440-36-0	3.30E-01	4.10E+01	n	3.10E+00	n		–	no	no	no
Arsenic	7440-38-2	1.16E+01	1.60E+00	c	3.90E-01	c*		1.58E+01	**YES**	**YES**	no
Barium	7440-39-3	7.87E+01	1.90E+04	nm	1.50E+03	n		2.09E+02	no	no	no
Beryllium	7440-41-7	1.50E+00	2.00E+02	n	1.60E+01	n		1.02E+00	no	no	no
Cadmium	7440-43-9	1.00E-01	8.10E+01	n	7.00E+00	n		6.90E-01	no	no	no
Calcium	7440-70-2	2.56E+03	NA		NA			–	NA	NA	no

Table A.3.HHRA-2
Selection of Constituents of Potential Concern for Combined Surface and Subsurface Soil
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a] (mg/kg)	Adjusted Soil Regional Screening Level (RSL) [b] Industrial Scenario (mg/kg)		Residential Scenario (mg/kg)		Surrogate	Background Level [c] (mg/kg)	Does Maximum Exceed RSL? Industrial (YES, no)	Residential (YES, no)	Is Constituent a Surface/ Subsurface Soil COPC? [d] (YES, no)
Chromium	7440-47-3	6.08E+01	1.40E+03	c	2.80E+02	c		6.53E+01	no	no	no
Cobalt	7440-48-4	4.46E+02	3.00E+01	n	2.30E+00	n		7.23E+01	**YES**	**YES**	**YES**
Copper	7440-50-8	1.38E+02	4.10E+03	n	3.10E+02	n		5.35E+01	no	no	no
Iron	7439-89-6	5.81E+04	7.20E+04	nm	5.50E+03	n		5.10E+04	no	**YES**	**YES**
Lead	7439-92-1	3.36E+02	8.00E+02	«	4.00E+02	«		2.68E+01	no	no	no
Magnesium	7439-95-4	1.35E+04	NA		NA			–	NA	NA	no
Manganese	7439-96-5	3.43E+03	2.30E+03	n	1.80E+02	n		2.54E+03	**YES**	**YES**	**YES**
Mercury	7439-97-6	3.00E-02	3.10E+01	n	2.30E+00	n		1.30E-01	no	no	no
Nickel	7440-02-0	4.13E+01	2.00E+03	n	1.60E+02	n		6.28E+01	no	no	no
Potassium	7440-09-7	3.98E+03	NA		NA			–	NA	NA	no
Selenium	7782-49-2	4.30E-01	5.10E+02	n	3.90E+01	n		–	no	no	no
Sodium	7440-23-5	1.73E+02	NA		NA			–	NA	NA	no
Thallium	7440-28-0	5.10E-01	6.60E+00	n	5.10E-01	n		2.11E+00	no	no	no
Vanadium	7440-62-2	1.08E+02	7.20E+02	n	5.50E+01	n		1.08E+02	no	**YES**	no
Zinc	7440-66-6	1.78E+02	3.10E+04	nm	2.30E+03	n		2.02E+02	no	no	no

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
mg/kg = Milligrams per kilogram.
NA = Not available or not applicable.
RSL = Regional Screening Level.
USEPA = United States Environmental Protection Agency.

[a] Maximum concentration in combined surface and subsurface soil.

[b] The screening levels used were from USEPA (2008a). Screening levels based on non-cancer effects were adjusted downward by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = Concentration may exceed ceiling limit; s = Concentration may exceed saturation concentration (Csat).
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.

[c] Background levels for metals are facility-wide soil background point estimates taken from Facility-Wide Background Study Report (IT Corporation, 2001).

[d] Constituents detected with maximum concentrations greater than adjusted residential screening levels were considered COPCs unless they were metals detected at concentrations lower than background, or are essential nutrients (i.e., calcium, magnesium, potassium, sodium), or they were known laboratory contaminants (i.e. acetone).

Table A.3.HHRA-3
Selection of Constituents of Potential Concern for Sediment
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b]			Is Constituent a Sediment COPC? [c]
			Residential Scenario		Surrogate	
		(mg/kg)	(mg/kg)			(YES, no)
Volatile Organic Compounds						
Acetone	67-64-1	3.70E-02	6.10E+03	n		no
Carbon Disulfide	75-15-0	1.50E-03	6.70E+01	ns		no
Methylene Chloride	75-09-2	5.00E-03	1.10E+01	c		no
p-Isopropyltoluene	99-87-6	4.00E-03	2.20E+02	ns	Isopropylbenzene	no
Toluene	108-88-3	2.70E-03	5.00E+02	ns		no
Trichloroethene	79-01-6	3.00E-03	2.80E+00	c		no
Semi-Volatile Organic Compounds						
4-Methylphenol	106-44-5	6.00E-02	3.10E+01	n		no
Di-n-Butylphthalate	84-74-2	9.00E-02	6.10E+02	n		no
Pesticides						
4,4'-DDD	72-54-8	1.15E-03	2.00E+00	c		no
4,4'-DDE	72-55-9	2.12E-03	1.40E+00	c		no
4,4'-DDT	50-29-3	1.23E-03	1.70E+00	c*		no
Delta-BHC	319-86-8	6.50E-03	5.20E-01	c*	gamma-BHC	no
Alpha-Chlordane	5103-71-9	3.90E-04	1.60E+00	c*	Chlordane	no
Dieldrin	60-57-1	1.59E-03	3.00E-02	c		no
Polycyclic Aromatic Hydrocarbons						
1-Methylnaphthalene	90-12-0	4.80E-03	2.20E+01	c		no
2-Methylnaphthalene	91-57-6	7.40E-02	3.10E+01	n		no
Acenaphthene	83-32-9	2.40E-01	3.40E+02	n		no
Acenaphthylene	208-96-8	1.70E-03	3.40E+02	n	Acenaphthene	no
Anthracene	120-12-7	4.10E-01	1.70E+03	n		no
Benzo(a)anthracene	56-55-3	8.80E-01	1.50E-01	c		**YES**
Benzo(a)pyrene	50-32-8	7.10E-01	1.50E-02	c		**YES**
Benzo(b)fluoranthene	205-99-2	1.20E+00	1.50E-01	c		**YES**
Benzo(g,h,i)perylene	191-24-2	2.80E-01	1.70E+02	n	Pyrene	no
Benzo(k)fluoranthene	207-08-9	3.70E-01	1.50E+00	c		no
Chrysene	218-01-9	8.00E-01	1.50E+01	c		no
Dibenzo(a,h)anthracene	53-70-3	7.60E-02	1.50E-02	c		**YES**
Fluoranthene	206-44-0	2.00E+00	2.30E+02	n		no
Fluorene	86-73-7	2.40E-01	2.30E+02	n		no
Indeno(1,2,3-cd)pyrene	193-39-5	3.60E-01	1.50E-01	c		**YES**
Naphthalene	91-20-3	9.10E-02	3.90E+00	c*		no
Phenanthrene	85-01-8	1.90E+00	1.70E+03	n	Anthracene	no
Pyrene	129-00-0	1.70E+00	1.70E+02	n		no
Inorganics						
Aluminum	7429-90-5	2.02E+04	7.70E+03	n		**YES**
Antimony	7440-36-0	8.90E-01	3.10E+00	n		no

Table A.3.HHRA-3
Selection of Constituents of Potential Concern for Sediment
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a] (mg/kg)	Adjusted Soil Regional Screening Level (RSL) [b] Residential Scenario (mg/kg)		Surrogate	Is Constituent a Sediment COPC? [c] (YES, no)
Arsenic	7440-38-2	1.32E+01	3.90E-01	c*		**YES**
Barium	7440-39-3	3.58E+02	1.50E+03	n		no
Beryllium	7440-41-7	1.30E+00	1.60E+01	n		no
Calcium	7440-70-2	9.86E+04	NA			no
Chromium	7440-47-3	7.30E+01	2.80E+02	c		no
Cobalt	7440-48-4	2.76E+01	2.30E+00	n		**YES**
Copper	7440-50-8	1.50E+01	3.10E+02	n		no
Iron	7439-89-6	5.62E+04	5.50E+03	n		**YES**
Lead	7439-92-1	2.86E+01	4.00E+02	«		no
Magnesium	7439-95-4	7.72E+03	NA			no
Manganese	7439-96-5	3.34E+03	1.80E+02	n		**YES**
Mercury	7439-97-6	4.00E-02	2.30E+00	n		no
Nickel	7440-02-0	2.08E+01	1.60E+02	n		no
Potassium	7440-09-7	2.20E+03	NA			no
Silver	7440-22-4	8.60E-01	3.90E+01	n		no
Sodium	7440-23-5	5.10E+02	NA			no
Thallium	7440-28-0	1.10E+00	5.10E-01	n		**YES**
Vanadium	7440-62-2	7.57E+01	5.50E+01	n		**YES**
Zinc	7440-66-6	5.19E+01	2.30E+03	n		no

Notes:

CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
mg/kg = Milligrams per kilogram.
NA = Not available or not applicable.
RSL = Regional Screening Level.
USEPA = United States Environmental Protection Agency.

[a] Maximum concentration in sediment.

[b] The screening levels used were risk screening levels for the residential scenario from USEPA (2008a). Screening levels based on non-cancer effects were adjusted downward by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = Concentration may exceed ceiling limit; s = Concentration may exceed saturation concentration (Csat).
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.

[c] Constituents detected with maximum concentrations greater than adjusted residential screening levels were considered COPCs unless they were metals detected at concentrations lower than background, or are essential nutrients (i.e., calcium, magnesium, potassium, sodium), or they were known laboratory contaminants (i.e. acetone).

Table A.3.HHRA-4
Selection Constituents of Potential Concern for Surface Water
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Tap Water Regional Screening Level (RSL) [b]			Is Constituent a Surface Water COPC? [c]
		(mg/L)	(mg/L)		Surrogate	(YES, no)
Volatile Organic Compounds						
Bromodichloromethane	75-27-4	2.30E-02	1.10E-03	c		**YES**
Carbon Disulfide	75-15-0	3.40E-04	1.00E-01	n		no
Chloroform	67-66-3	4.00E-03	1.90E-04	c		**YES**
Semi-Volatile Organic Compounds						
Di-n-Butylphthalate	84-74-2	3.00E-03	3.70E-01	n		no
Pesticides						
4,4'-DDT	50-29-3	5.16E-06	2.00E-04	c*		no
Dieldrin	60-57-1	5.91E-06	4.20E-06	c		**YES**
Endrin Ketone	53494-70-5	5.99E-06	1.10E-03	n	Endrin	no
Polycyclic Aromatic Hydrocarbons						
2-Methylnaphthalene	91-57-6	1.30E-04	1.50E-02	n		no
Acenaphthene	83-32-9	5.00E-05	2.20E-01	n		no
Acenaphthylene	208-96-8	4.00E-05	2.20E-01	n	Acenaphthene	no
Fluorene	86-73-7	3.00E-05	1.50E-01	n		no
Naphthalene	91-20-3	1.30E-04	1.40E-04	c*		no
Inorganics						
Aluminum	7429-90-5	6.03E-01	3.70E+00	n		no
Antimony	7440-36-0	7.40E-04	1.50E-03	n		no
Barium	7440-39-3	8.25E-02	7.30E-01	n		no
Calcium	7440-70-2	6.50E+01	NA			no
Copper	7440-50-8	3.48E-02	1.50E-01	n		no
Iron	7439-89-6	5.07E-01	2.60E+00	n		no
Lead	7439-92-1	4.60E-03	1.50E-02	**		no
Magnesium	7439-95-4	1.74E+01	NA			no
Manganese	7439-96-5	1.98E-02	8.80E-02	n		no
Nickel	7440-02-0	5.50E-03	7.30E-02	n		no
Potassium	7440-09-7	3.67E+00	NA			no
Silver	7440-22-4	2.10E-03	1.80E-02	n		no
Sodium	7440-23-5	3.53E+01	NA			no
Thallium	7440-28-0	7.20E-03	2.40E-04	n		**YES**
Zinc	7440-66-6	4.62E-02	1.10E+00	n		no

Table A.3.HHRA-4
Selection Constituents of Potential Concern for Surface Water
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:

CASN =	Chemical abstracts registry number.	NA =	Not available or not applicable.
COPC =	Constituent of Potential Concern.	RSL =	Regional Screening Level.
mg/L =	Milligrams per liter.	USEPA =	United States Environmental Protection Agency.

[a] Maximum concentration in surface water.

[b] The screening levels used were risk screening levels for tap water from USEPA (2008a). Screening levels based on non-cancer effects were adjusted downward by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = Concentration may exceed ceiling limit;
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.

[c] Constituents detected with maximum concentrations greater than screening levels were considered COPCs unless they were essential nutrients (i.e., calcium, magnesium, potassium, sodium), or were known laboratory contaminants (i.e. acetone).

Table A.3.HHRA-5
Exposure Point Concentrations
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

		COPC? [a]				Exposure Point Concentrations [b]					
Constituent of Potential Concern (COPC)	**CASN**	**Surface Soil**	**Combined Surface and Subsurface Soil**	**Sediment**	**Surface Water**	**Surface Soil (mg/kg)**	**Surface Soil - Rip Rap (mg/kg)**	**Combined Surface and Subsurface Soil (mg/kg)**	**Combined Surface and Subsurface Soil - Rip Rap (mg/kg)**	**Sediment (mg/kg)**	**Surface Water (mg/L)**
Volatile Organic Compounds											
1,2,3-Trichloropropane	96-18-4	no	no	no	no	–	–	–	–	–	–
1,2,4-Trimethylbenzene	95-63-6	no	no	no	no	–	–	–	–	–	–
2-Butanone	78-93-3	no	no	no	no	–	–	–	–	–	–
3-Octanone	106-68-3	no	no	no	no	–	–	–	–	–	–
4-Methyl-2-pentanone	108-10-1	no	no	no	no	–	–	–	–	–	–
Acetone	67-64-1	no	no	no	no	–	–	–	–	–	–
Bromodichloromethane	75-27-4	no	no	no	**YES**	–	–	–	–	–	2.30E-02 m
Carbon Disulfide	75-15-0	no	no	no	no	–	–	–	–	–	–
Chloroform	67-66-3	no	no	no	**YES**	–	–	–	–	–	2.37E-03
cis-1,2-Dichloroethene	156-59-2	no	no	no	no	–	–	–	–	–	–
d-Limonene	5989-27-5	no	no	no	no	–	–	–	–	–	–
Ethanol	64-17-5	no	no	no	no	–	–	–	–	–	–
m,p-Xylene	136777612	no	no	no	no	–	–	–	–	–	–
Methylene Chloride	75-09-2	no	no	no	no	–	–	–	–	–	–
p-Isopropyltoluene	99-87-6	no	no	no	no	–	–	–	–	–	–
Tetrachloroethene	127-18-4	no	no	no	no	–	–	–	–	–	–
Toluene	108-88-3	no	no	no	no	–	–	–	–	–	–
Trichloroethene	79-01-6	no	no	no	no	–	–	–	–	–	–
Xylenes (total)	1330-20-7	no	no	no	no	–	–	–	–	–	–
Semi-Volatile Organic Compounds											
1,2,4-Trichlorobenzene	120-82-1	no	no	no	no	–	–	–	–	–	–
1,2-Dichlorobenzene	95-50-1	no	no	no	no	–	–	–	–	–	–
1,3-Dichlorobenzene	541-73-1	no	no	no	no	–	–	–	–	–	–
1,4-Dichlorobenzene	106-46-7	no	no	no	no	–	–	–	–	–	–
2,4-Dinitrotoluene	121-14-2	no	no	no	no	–	–	–	–	–	–
2,6-Dinitrotoluene	606-20-2	no	no	no	no	–	–	–	–	–	–
3,3'-Dichlorobenzidine	91-94-1	no	no	no	no	–	–	–	–	–	–
4-Methylphenol	106-44-5	no	no	no	no	–	–	–	–	–	–
Benzoic Acid	65-85-0	no	no	no	no	–	–	–	–	–	–
bis(2-Ethylhexyl)phthalate	117-81-7	no	no	no	no	–	–	–	–	–	–
Butylbenzylphthalate	85-68-7	no	no	no	no	–	–	–	–	–	–
Carbazole	86-74-8	**YES**	**YES**	no	no	1.20E+00	1.20E+00	8.20E-01	7.70E-01	–	–
Dibenzofuran	132-64-9	no	no	no	no	–	–	–	–	–	–
Diethylphthalate	84-66-2	no	no	no	no	–	–	–	–	–	–
Di-n-Butylphthalate	84-74-2	no	no	no	no	–	–	–	–	–	–
Di-n-Octylphthalate	117-84-0	no	no	no	no	–	–	–	–	–	–
N-Nitrosodiphenylamine	86-30-6	no	no	no	no	–	–	–	–	–	–
Pentachlorophenol	87-86-5	no	no	no	no	–	–	–	–	–	–
Phenol	108-95-2	no	no	no	no	–	–	–	–	–	–
Dioxin/Furan Compounds											
1,2,3,4,6,7,8-HpCDD	35822-46-9	no	no	no	no	–	–	–	–	–	–
1,2,3,4,6,7,8-HpCDF	67562-39-4	no	no	no	no	–	–	–	–	–	–
1,2,3,4,7,8,9-HpCDF	55673-89-7	no	no	no	no	–	–	–	–	–	–
1,2,3,4,7,8-HxCDD	39227-28-6	no	no	no	no	–	–	–	–	–	–
1,2,3,4,7,8-HxCDF	70648-26-9	no	no	no	no	–	–	–	–	–	–
1,2,3,6,7,8-HxCDD	57653-85-7	no	no	no	no	–	–	–	–	–	–
1,2,3,6,7,8-HxCDF	57117-44-9	no	no	no	no	–	–	–	–	–	–
1,2,3,7,8,9-HxCDD	19408-74-3	no	no	no	no	–	–	–	–	–	–
1,2,3,7,8,9-HxCDF	72918-21-9	no	no	no	no	–	–	–	–	–	–
1,2,3,7,8-PeCDD	40321-76-4	no	no	no	no	–	–	–	–	–	–
1,2,3,7,8-PeCDF	57117-41-6	no	no	no	no	–	–	–	–	–	–
2,3,4,6,7,8-HxCDF	60851-34-5	no	no	no	no	–	–	–	–	–	–

Table A.3.HHRA-5
Exposure Point Concentrations
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a]				Exposure Point Concentrations [b]					
		Surface Soil	Combined Surface and Subsurface Soil	Sediment	Surface Water	Surface Soil (mg/kg)	Surface Soil - Rip Rap (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Combined Surface and Subsurface Soil - Rip Rap (mg/kg)	Sediment (mg/kg)	Surface Water (mg/L)
2,3,4,7,8-PeCDF	57117-31-4	no	no	no	no	–	–	–	–	–	–
2,3,7,8-TCDD	1746-01-6	no	no	no	no	–	–	–	–	–	–
2,3,7,8-TCDF	51207-31-9	no	no	no	no	–	–	–	–	–	–
OCDD	3268-87-9	no	no	no	no	–	–	–	–	–	–
OCDF	39001-02-0	no	no	no	no	–	–	–	–	–	–
Explosives											
1,3,5-Trinitrobenzene	99-35-4	no	no	no	no	–	–	–	–	–	–
1,3-Dinitrobenzene	99-65-0	no	no	no	no	–	–	–	–	–	–
2,4,6-Trinitrotoluene	118-96-7	no	no	no	no	–	–	–	–	–	–
4-Amino-2,6-Dinitrotoluene	19406-51-0	no	no	no	no	–	–	–	–	–	–
m-Nitrotoluene	99-08-1	no	no	no	no	–	–	–	–	–	–
Nitrobenzene	98-95-3	no	no	no	no	–	–	–	–	–	–
Nitroglycerine	55-63-0	no	no	no	no	–	–	–	–	–	–
Pentaerythritol Tetranitrate	78-11-5	no	no	no	no	–	–	–	–	–	–
Perchlorate	14797-73-0	no	no	no	no	–	–	–	–	–	–
Herbicides											
2,4,5-T	93-76-5	no	no	no	no	–	–	–	–	–	–
2,4,5-TP	93-72-1	no	no	no	no	–	–	–	–	–	–
2,4-D	94-75-7	no	no	no	no	–	–	–	–	–	–
2,4-DB	94-82-6	no	no	no	no	–	–	–	–	–	–
Dalapon	75-99-0	no	no	no	no	–	–	–	–	–	–
Dicamba	1918-00-9	no	no	no	no	–	–	–	–	–	–
Dichlorprop	120-36-5	no	no	no	no	–	–	–	–	–	–
MCPA	94-74-6	no	no	no	no	–	–	–	–	–	–
MCPP	93-65-2	**YES**	**YES**	no	no	*	NA	*	NA	–	–
Pesticides											
4,4'-DDD	72-54-8	no	no	no	no	–	–	–	–	–	–
4,4'-DDE	72-55-9	no	no	no	no	–	–	–	–	–	–
4,4'-DDT	50-29-3	no	no	no	no	–	–	–	–	–	–
Alpha-BHC	319-84-6	no	no	no	no	–	–	–	–	–	–
Beta-BHC	319-85-7	no	no	no	no	–	–	–	–	–	–
Delta-BHC	319-86-8	no	no	no	no	–	–	–	–	–	–
Gamma-BHC (Lindane)	58-89-9	no	no	no	no	–	–	–	–	–	–
Alpha-Chlordane	5103-71-9	no	no	no	no	–	–	–	–	–	–
Gamma-Chlordane	5566-34-7	no	no	no	no	–	–	–	–	–	–
Dieldrin	60-57-1	no	no	no	**YES**	–	–	–	–	–	5.91E-06 m
Endosulfan I	115-29-7	no	no	no	no	–	–	–	–	–	–
Endosulfan II	33213-65-9	no	no	no	no	–	–	–	–	–	–
Endosulfan Sulfate	1031-07-8	no	no	no	no	–	–	–	–	–	–
Endrin	72-20-8	no	no	no	no	–	–	–	–	–	–
Endrin Aldehyde	7421-93-4	no	no	no	no	–	–	–	–	–	–
Endrin Ketone	53494-70-5	no	no	no	no	–	–	–	–	–	–
Heptachlor	76-44-8	no	no	no	no	–	–	–	–	–	–
Heptachlor Epoxide	1024-57-3	no	no	no	no	–	–	–	–	–	–
Methoxychlor	72-43-5	no	no	no	no	–	–	–	–	–	–

Table A.3.HHRA-5
Exposure Point Concentrations
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

		COPC? [a]				Exposure Point Concentrations [b]					
Constituent of Potential Concern (COPC)	CASN	Surface Soil	Combined Surface and Subsurface Soil	Sediment	Surface Water	Surface Soil (mg/kg)	Surface Soil - Rip Rap (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Combined Surface and Subsurface Soil - Rip Rap (mg/kg)	Sediment (mg/kg)	Surface Water (mg/L)
Polycyclic Aromatic Hydrocarbons											
1-Methylnaphthalene	90-12-0	no	no	no	no	–	–	–	–	–	–
2-Methylnaphthalene	91-57-6	no	no	no	no	–	–	–	–	–	–
Acenaphthene	83-32-9	no	no	no	no	–	–	–	–	–	–
Acenaphthylene	208-96-8	no	no	no	no	–	–	–	–	–	–
Anthracene	120-12-7	no	no	no	no	–	–	–	–	–	–
Benzo(a)anthracene	56-55-3	**YES**	**YES**	**YES**	no	9.50E+00	2.50E+00	8.00E+00	4.99E+00	6.54E-01	–
Benzo(a)pyrene	50-32-8	**YES**	**YES**	**YES**	no	7.90E+00	2.59E+00	6.92E+00	5.35E+00	5.35E-01	–
Benzo(b)fluoranthene	205-99-2	**YES**	**YES**	**YES**	no	1.20E+01	3.43E+00	1.01E+01	6.59E+00	2.66E-01	–
Benzo(g,h,i)perylene	191-24-2	no	no	no	no	–	–	–	–	–	–
Benzo(k)fluoranthene	207-08-9	**YES**	**YES**	no	no	3.80E+00	1.61E+00	3.34E+00	2.64E+00	–	–
Chrysene	218-01-9	**YES**	**YES**	no	no	9.10E+00	2.89E+00	7.94E+00	6.15E+00	–	–
Dibenzo(a,h)anthracene	53-70-3	**YES**	**YES**	**YES**	no	8.70E-01	3.25E-01	7.01E-01	1.89E-01	7.60E-02 m	–
Fluoranthene	206-44-0	no	no	no	no	–	–	–	–	–	–
Fluorene	86-73-7	no	no	no	no	–	–	–	–	–	–
Indeno(1,2,3-cd)pyrene	193-39-5	**YES**	**YES**	**YES**	no	5.60E+00	1.30E+00	4.68E+00	2.88E+00	8.91E-02	–
Naphthalene	91-20-3	**YES**	**YES**	no	no	3.20E+00	ND	2.64E+00	7.80E+00 m	–	–
Phenanthrene	85-01-8	no	no	no	no	–	–	–	–	–	–
Pyrene	129-00-0	no	no	no	no	–	–	–	–	–	–
Polychlorinated Biphenyls											
Aroclor 1254	11097-69-1	no	no	no	no	–	–	–	–	–	–
Aroclor 1260	11096-82-5	no	no	no	no	–	–	–	–	–	–

Table A.3.HHRA-5
Exposure Point Concentrations
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

		COPC? [a]				Exposure Point Concentrations [b]					
Constituent of Potential Concern (COPC)	**CASN**	**Surface Soil**	**Combined Surface and Subsurface Soil**	**Sediment**	**Surface Water**	**Surface Soil (mg/kg)**	**Surface Soil - Rip Rap (mg/kg)**	**Combined Surface and Subsurface Soil (mg/kg)**	**Combined Surface and Subsurface Soil - Rip Rap (mg/kg)**	**Sediment (mg/kg)**	**Surface Water (mg/L)**
Inorganics											
Aluminum	7429-90-5	no	no	**YES**	no	–	–	–	–	1.57E+04	–
Antimony	7440-36-0	no	no	no	no	–	–	–	–	–	–
Arsenic	7440-38-2	no	no	**YES**	no	–	–	–	–	7.58E+00	–
Barium	7440-39-3	no	no	no	no	–	–	–	–	–	–
Beryllium	7440-41-7	no	no	no	no	–	–	–	–	–	–
Cadmium	7440-43-9	no	no	no	no	–	–	–	–	–	–
Calcium	7440-70-2	no	no	no	no	–	–	–	–	–	–
Chromium	7440-47-3	no	no	no	no	–	–	–	–	–	–
Cobalt	7440-48-4	**YES**	**YES**	**YES**	no	1.20E+02	2.03E+01	7.40E+01	1.78E+01	1.71E+01	–
Copper	7440-50-8	no	no	no	no	–	–	–	–	–	–
Iron	7439-89-6	**YES**	**YES**	**YES**	no	3.72E+04	3.70E+04	3.46E+04	3.40E+04	3.29E+04	–
Lead	7439-92-1	no	no	no	no	–	–	–	–	–	–
Magnesium	7439-95-4	no	no	no	no	–	–	–	–	–	–
Manganese	7439-96-5	**YES**	**YES**	**YES**	no	1.32E+03	1.04E+03	1.03E+03	8.57E+02	1.86E+03	–
Mercury	7439-97-6	no	no	no	no	–	–	–	–	–	–
Nickel	7440-02-0	no	no	no	no	–	–	–	–	–	–
Potassium	7440-09-7	no	no	no	no	–	–	–	–	–	–
Selenium	7782-49-2	no	no	no	no	–	–	–	–	–	–
Silver	7440-22-4	no	no	no	no	–	–	–	–	–	–
Sodium	7440-23-5	no	no	no	no	–	–	–	–	–	–
Thallium	7440-28-0	no	no	**YES**	**YES**	–	–	–	–	4.50E-01	7.20E-03 m
Vanadium	7440-62-2	no	no	**YES**	no	–	–	–	–	5.33E+01	–
Zinc	7440-66-6	no	no	no	no	–	–	–	–	–	–

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilogram.
mg/L = Milligrams per liter.

[a] Constituent of Potential Concern.
[b] The exposure point concentration (EPC) was the upper confidence level on the mean (UCL) or the maximum concentration where the UCL was incalculable.
EPCs marked with "m" are based on the maximum detected concentration.
Exposure to lead is evaluated by predicting resultant blood lead levels using the arithmetic average (avg).
The UCLs were calculated using ProUCL 4.0. The UCL used is the one recommended by ProUCL 4.0.

Table A.3.HHRA-6
Risk and Hazard Calculations for Site Worker Exposure to Surface Soil (0-2 foot Depth Interval)
BUILDING DEBRIS DISPOSAL TRENCH
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Current / Future
Receptor Population: Site Worker
Receptor Age: Adult

Constituent	EPCs (mg/kg)	VF *or* PEF [a] (m^3/kg)		CANCER RISK – Route-Specific Risk – Oral	Dermal	Inhalation	Calculated Risk	Percent Total ELCR	NON-CANCER HAZARD – Route-Specific Hazard – Oral	Dermal	Inhalation	Calculated Hazard	Percent Total HI
				ELCRo	ELCRd	ELCRi	ELCR		HQo	HQd	HQi	HI	
Semi-Volatile Organic Compounds													
Carbazole	1.20E+00	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Polycyclic Aromatic Hydrocarbons													
Benzo(a)anthracene	9.50E+00	1.36E+09	P	2.4E-06	2.1E-06	NA	4.5E-06	8%	NA	NA	NA	NA	–
Benzo(a)pyrene	7.90E+00	1.36E+09	P	2.0E-05	1.7E-05	1.3E-09	3.7E-05	68%	NA	NA	NA	NA	–
Benzo(b)fluoranthene	1.20E+01	1.36E+09	P	3.1E-06	2.6E-06	NA	5.7E-06	10%	NA	NA	NA	NA	–
Benzo(k)fluoranthene	3.80E+00	1.36E+09	P	9.7E-08	8.3E-08	NA	1.8E-07	0%	NA	NA	NA	NA	–
Chrysene	9.10E+00	1.36E+09	P	2.3E-08	2.0E-08	NA	4.3E-08	0%	NA	NA	NA	NA	–
Dibenzo(a,h)anthracene	8.70E-01	1.36E+09	P	2.2E-06	1.9E-06	NA	4.1E-06	8%	NA	NA	NA	NA	–
Indeno(1,2,3-cd)pyrene	5.60E+00	1.36E+09	P	1.4E-06	1.2E-06	NA	2.7E-06	5%	NA	NA	NA	NA	–
Naphthalene	3.20E+00	5.49E+04	V	NA	NA	NA	NA	–	1.6E-04	1.3E-04	1.3E-02	1.4E-02	3%
Herbicides								–					–
MCPP	1.35E+01	1.36E+09	P	NA	NA	NA	NA	–	1.3E-02	8.7E-03	NA	2.2E-02	4%
Inorganics													
Cobalt	1.20E+02	1.36E+09	P	NA	NA	1.9E-07	1.9E-07	0%	3.9E-01	0.0E+00	1.0E-02	4.0E-01	78%
Iron	3.72E+04	1.36E+09	P	NA	NA	NA	NA	–	5.2E-02	0.0E+00	NA	5.2E-02	10%
Lead	–	–		–	–	–	–	–	–	–	–	–	–
Manganese	1.32E+03	1.36E+09	P	NA	NA	NA	NA	–	9.2E-03	0.0E+00	1.3E-02	2.3E-02	4%
					Total ELCR		5E-05	100%		Total HI		0.5	100%

[a] Minimum of the volatilization factor (identified with "V") and the particulate emission factor (PEF) (identified with "P"), both derived on Table A.2-11.

–	Not applicable.	HQ	Hazard quotient.	PEF	Particulate emission factor.
ELCR	Excess lifetime cancer risk.	m^3/kg	Cubic meters per kilogram.	VF	Volatilization factor.
EPCs	Exposure point concentration in surface soil (mg/kg).	mg/kg	Milligrams per kilogram.		
HI	Hazard index (sum of the HQs).	NA	Not available.		

Equations: (see Table A.2-11)

ELCRo = (EPCs × 1 × 100 × 250 × 25 × CSFo) / (1,000,000 × 70 × 25,550)
ELCRd = (EPCs × 3,300 × 0.2 × ABSd × 250 × 25 × CSFa) / (1,000,000 × 70 × 25,550)
ELCRi = (EPCs × 20 × 250 × 25 × CSFi) / ([VF or PEF] × 70 × 25,550)

HQo = (EPCs × 1 × 100 × 250 × 25) / (1,000,000 × 70 × 9,125 × RfDo)
HQd = (EPCs × 3,300 × 0.2 × ABSd × 250 × 25) / (1,000,000 × 70 × 9,125 × RfDa)
HQi = (EPCs × 20 × 250 × 25) / ([VF or PEF] × 70 × 9,125 × RfDi)

Table A.3.HHRA-7
Risk and Hazard Calculations for Site Worker Exposure to Vapors in Indoor Air from Combined Surface and Subsurface Soil
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

SL-SCREEN
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (µg/kg)	Chemical
91203	2.64E+03	Naphthalene

MORE ê

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Average soil temperature, T_S (^oC)	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
200	400	10	L		

MORE ê

ENTER Vandose zone SCS soil type (Lookup Soil Parameters)	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	ENTER Vadose zone soil organic carbon fraction, f_{oc}^V (unitless)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
L	1.59	0.399	0.148	0.002	

MORE ê

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-06	1

Used to calculate risk-based soil concentration.

END

Table A.3.HHRA-7
Risk and Hazard Calculations for Site Worker Exposure to Vapors in Indoor Air from Combined Surface and Subsurface Soil
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen (µg/kg)	Indoor exposure soil conc., noncarcinogen (µg/kg)	Risk-based indoor exposure soil conc., (µg/kg)	Soil saturation conc., C_{sat} (µg/kg)	Final indoor exposure soil conc., (µg/kg)
NA	NA	NA	1.27E+05	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	4E-02

MESSAGE SUMMARY BELOW:

Table A.3.HHRA-8
Risk and Hazard Calculations for Site Worker Wading Exposure to Sediment
BUILDING DEBRIS DISPOSAL TRENCH
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Current / Future
Receptor Population: Site Worker
Receptor Age: Adult

		CANCER RISK			Percent	NON-CANCER RISK			Percent
	EPCsed	Route-Specific Risks		Calculated	Total	Route-Specific Risks		Calculated	Total
Constituent	(mg/kg)	Oral	Dermal	Risk	ELCR	Oral	Dermal	Hazard	HI
		ELCRo	ELCRd	ELCR		HQo	HQd	HI	
Polycyclic Aromatic Hydrocarbons									
Benzo(a)anthracene	8.00E+00	1.1E-07	8.3E-07	9.3E-07	8%	NA	NA	NA	–
Benzo(a)pyrene	6.92E+00	9.2E-07	7.2E-06	8.1E-06	70%	NA	NA	NA	–
Benzo(b)fluoranthene	1.01E+01	1.3E-07	1.0E-06	1.2E-06	10%	NA	NA	NA	–
Dibenzo(a,h)anthracene	7.01E-01	9.3E-08	7.3E-07	8.2E-07	7%	NA	NA	NA	–
Indeno(1,2,3-cd)pyrene	4.68E+00	6.2E-08	4.8E-07	5.5E-07	5%	NA	NA	NA	–
Inorganics									
Aluminum	–	–	–	–	–	–	–	–	–
Arsenic	–	–	–	–	–	–	–	–	–
Cobalt	7.40E+01	NA	NA	NA	–	1.3E-02	0.0E+00	1.3E-02	62%
Iron	3.46E+04	NA	NA	NA	–	2.5E-03	0.0E+00	2.5E-03	12%
Manganese	1.03E+03	NA	NA	NA	–	3.7E-04	0.0E+00	3.7E-04	2%
Thallium	–	–	–	–	–	–	–	–	–
Vanadium	–	–	–	–	–	–	–	–	–
		Total ELCR		1E-05	100%	Total HI		0.02	100%

– Not applicable.
ELCR Excess lifetime cancer risk.
EPCsed Exposure point concentration in sediment (mg/kg).
HI Hazard index (sum of the HQs).
HQ Hazard quotient.
mg/kg Milligrams per kilogram.
NA Not available.

Equations: (see Table A.2-12)

ELCRo = (EPCsed × 50 × 26 × 25 × CSFo) / (1,000,000 × 70 × 25,550)
ELCRd = (EPCsed × 5,000 × 1 × ABSd × 26 × 25 × CSFa) / (1,000,000 × 70 × 25,550)
HQo = (EPCsed × 50 × 26 × 25) / (1,000,000 × 70 × 9,125 × RfDo)
HQd = (EPCsed × 5,000 × 1 × ABSd × 26 × 25) / (1,000,000 × 70 × 9,125 × RfDa)

Table A.3.HHRA-9
Risk and Hazard Calculations for Site Worker Wading Exposure to Surface Water
BUILDING DEBRIS DISPOSAL TRENCH
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Current / Future
Receptor Population: Site Worker
Receptor Age: Adult

Constituent	EPCsw (mg/L)	DA [a] (L/cm²/day)	VFsw (L/m³)	CANCER RISK: Route-Specific Risk: Oral	Dermal	Inhalation	Calculated Risk	Percent Total ELCR	NON-CANCER HAZARD: Route-Specific Hazard: Oral	Dermal	Inhalation	Calculated Hazard	Percent Total HI
				ELCRo	ELCRd	ELCRi	ELCR		HQo	HQd	HQi	HI	
Volatile Organic Compounds													
Bromodichloromethane	2.30E-02	4.43E-05	3.33E-03	2.1E-07	1.1E-07	NA	3.2E-07	83%	4.7E-04	2.6E-04	NA	7.3E-04	2%
Chloroform	2.37E-03	5.99E-05	4.24E-03	NA	NA	6.2E-10	6.2E-10	0.2%	9.6E-05	7.2E-05	7.7E-07	1.7E-04	0.4%
Pesticides													
Dieldrin	5.91E-06	2.87E-04	1.40E-04	1.4E-08	4.9E-08	1.0E-11	6.3E-08	16%	4.8E-05	1.7E-04	NA	2.2E-04	0.5%
Inorganics													
Thallium	7.20E-03	8.00E-06	NA	NA	NA	NA	NA	–	3.7E-02	3.7E-03	NA	4.0E-02	97%
				Total ELCR			4E-07	100%	Total HI			0.04	100%

[a] The dermal absorption factor (DA) was calculated using Equation [0], [1], or [2], as indicated, from Table A.2-13.

–	Not applicable.	HQ	Hazard quotient.	NA	Not available.
ELCR	Excess lifetime cancer risk.	L/cm²/day	Liters per square centimeter per day.	VFsw	Volatilization factor for surface water.
EPCsw	Exposure point concentration in surface water (mg/L).	L/m^3	Liters per cubic meter.		
HI	Hazard index (sum of the HQs).	mg/L	Milligrams per liter.		

Equations: (see Table A.2-13)

3.75 = Um = Mean annual wind speed (m/sec) for Roanoke, Virginia (USDOE 1986).

ELCRo = (EPCsw × 0.05 × 8 × 26 × 25 × CSFo) / (70 × 25,550)
ELCRd = (EPCsw × DA × 5,000 × 26 × 25 × CSFa) / (70 × 25,550)
ELCRi = (EPCsw × VFsw × 2 × 26 × 25 × CSFi) / (70 × 25,550)

HQo = (EPCsw × 0.05 × 8 × 26 × 25) / (70 × 9,125 × RfDo)
HQd = (EPCsw × DA × 5,000 × 26 × 25) / (70 × 9,125 × RfDa)
HQi = (EPCsw × VFsw × 2 × 26 × 25) / (70 × 9,125 × RfDi)

Table A.3.HHRA-10
Risk and Hazard Calculations for Hypothetical Future Construction Worker Exposure to Combined Surface and Subsurface Soil
BUILDING DEBRIS DISPOSAL TRENCH
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Constituent	EPCs (mg/kg)	VF *or* PEF [a] (m^3/kg)		CANCER RISK Route-Specific Risk Oral ELCRo	Dermal ELCRd	Inhalation ELCRi	Calculated Risk ELCR	Percent Total ELCR	NON-CANCER HAZARD Route-Specific Hazard Oral HQo	Dermal HQd	Inhalation HQi	Calculated Hazard HI	Percent Total HI
Semi-Volatile Organic Compounds													
Carbazole	8.20E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Polycyclic Aromatic Hydrocarbons													
Benzo(a)anthracene	8.00E+00	1.36E+09	P	1.4E-07	5.5E-08	NA	1.9E-07	8%	NA	NA	NA	NA	–
Benzo(a)pyrene	6.92E+00	1.36E+09	P	1.2E-06	4.7E-07	2.3E-11	1.7E-06	70%	NA	NA	NA	NA	–
Benzo(b)fluoranthene	1.01E+01	1.36E+09	P	1.8E-07	6.9E-08	NA	2.5E-07	10%	NA	NA	NA	NA	–
Benzo(k)fluoranthene	3.34E+00	1.36E+09	P	5.8E-09	2.3E-09	NA	8.1E-09	0%	NA	NA	NA	NA	–
Chrysene	7.94E+00	1.36E+09	P	1.4E-09	5.4E-10	NA	1.9E-09	0%	NA	NA	NA	NA	–
Dibenzo(a,h)anthracene	7.01E-01	1.36E+09	P	1.2E-07	4.8E-08	NA	1.7E-07	7%	NA	NA	NA	NA	–
Indeno(1,2,3-cd)pyrene	4.68E+00	1.36E+09	P	8.2E-08	3.2E-08	NA	1.1E-07	5%	NA	NA	NA	NA	–
Naphthalene	2.64E+00	5.49E+04	V	NA	NA	NA	NA	–	4.4E-05	1.7E-05	1.1E-02	1.1E-02	1%
Herbicides													
MCPP	1.35E+01	1.36E+09	P	NA	NA	NA	NA	–	4.5E-03	1.4E-03	NA	5.9E-03	1%
Inorganics													
Cobalt	7.40E+01	1.36E+09	P	NA	NA	2.5E-09	2.5E-09	0%	8.3E-01	0.0E+00	1.9E-03	8.3E-01	79%
Iron	3.46E+04	1.36E+09	P	NA	NA	NA	NA	–	1.7E-01	0.0E+00	NA	1.7E-01	16%
Lead	–	–		–	–	–	–	–	–	–	–	–	–
Manganese	1.03E+03	1.36E+09	P	NA	NA	NA	NA	–	2.5E-02	0.0E+00	1.1E-02	3.5E-02	3%
				Total ELCR			2E-06	100%	Total HI			1	100%

** HI Segregated by Target Site/Critical Effect:	HI (liver, kidney) = 0.2	HI (gastrointestinal tract) = 0.2	
CNS - Central nervous system	HI (CNS, whole body, immune system) = 0.04	HI (nasal, lung) = 0.01	
NA - Not available	HI (blood) = 0.2	HI (eyes, nails, hair, skin) = 0.8	
NR - None reported	HI (fetus, developmental) = 0	HI (NA, NR) = 0	

[a] Minimum of the volatilization factor (identified with "V") and the particulate emission factor (PEF) (identified with "P"), both derived on Table A.2-11.

–	Not applicable.	HQ	Hazard quotient.	PEF	Particulate emission factor.
ELCR	Excess lifetime cancer risk.	m^3/kg	Cubic meters per kilogram.	VF	Volatilization factor.
EPCs	Exposure point concentration in soil (mg/kg).	mg/kg	Milligrams per kilogram.		
HI	Hazard index (sum of the HQs).	NA	Not available.		

Equations: (see Table A.2-11)

ELCRo = (EPCs × 1 × 330 × 130 × 1 × CSFo) / (1,000,000 × 70 × 25,550)
ELCRd = (EPCs × 3,300 × 0.3 × ABSd × 130 × 1 × CSFa) / (1,000,000 × 70 × 25,550)
ELCRi = (EPCs × 20 × 130 × 1 × CSFi) / ([VF or PEF] × 70 × 25,550)

HQo = (EPCs × 1 × 330 × 130 × 1) / (1,000,000 × 70 × 182 × RfDo)
HQd = (EPCs × 3,300 × 0.3 × ABSd × 130 × 1) / (1,000,000 × 70 × 182 × RfDa)
HQi = (EPCs × 20 × 130 × 1) / ([VF or PEF] × 70 × 182 × RfDi)

Table A.3.HHRA-11
Risk and Hazard Calculations for Hypothetical Future Adult Resident Exposure to Combined Surface and Subsurface Soil
BUILDING DEBRIS DISPOSAL TRENCH
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Adult Resident
Receptor Age: Adult

Constituent	EPCs (mg/kg)	VF *or* PEF [a] (m^3/kg)		CANCER RISK Route-Specific Risk Oral ELCRo	Dermal ELCRd	Inhalation ELCRi	Calculated Risk ELCR	Percent Total ELCR	NON-CANCER HAZARD Route-Specific Hazard Oral HQo	Dermal HQd	Inhalation HQi	Calculated Hazard HI	Percent Total HI
Semi-Volatile Organic Compounds													
Carbazole	8.20E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Polycyclic Aromatic Hydrocarbons													
Benzo(a)anthracene	8.00E+00	1.36E+09	P	4.0E-06	2.1E-06	NA	6.1E-06	8%	NA	NA	NA	NA	–
Benzo(a)pyrene	6.92E+00	1.36E+09	P	3.5E-05	1.8E-05	2.2E-09	5.3E-05	69%	NA	NA	NA	NA	–
Benzo(b)fluoranthene	1.01E+01	1.36E+09	P	5.1E-06	2.6E-06	NA	7.7E-06	10%	NA	NA	NA	NA	–
Benzo(k)fluoranthene	3.34E+00	1.36E+09	P	1.7E-07	8.7E-08	NA	2.5E-07	0.3%	NA	NA	NA	NA	–
Chrysene	7.94E+00	1.36E+09	P	4.0E-08	2.1E-08	NA	6.0E-08	0.1%	NA	NA	NA	NA	–
Dibenzo(a,h)anthracene	7.01E-01	1.36E+09	P	3.5E-06	1.8E-06	NA	5.3E-06	7%	NA	NA	NA	NA	–
Indeno(1,2,3-cd)pyrene	4.68E+00	1.36E+09	P	2.3E-06	1.2E-06	NA	3.6E-06	5%	NA	NA	NA	NA	–
Naphthalene	2.64E+00	5.49E+04	V	NA	NA	NA	NA	–	1.8E-04	9.4E-05	1.5E-02	1.6E-02	3%
Herbicides													
MCPP	1.35E+01	1.36E+09	P	NA	NA	NA	NA	–	1.8E-02	7.4E-03	NA	2.6E-02	5%
Inorganics													
Cobalt	7.40E+01	1.36E+09	P	NA	NA	1.6E-07	1.6E-07	0.2%	3.4E-01	0.0E+00	8.7E-03	3.5E-01	72%
Iron	3.46E+04	1.36E+09	P	NA	NA	NA	NA	–	6.8E-02	0.0E+00	NA	6.8E-02	14%
Lead	–	–		–	–	–	–	–	–	–	–	–	–
Manganese	1.03E+03	1.36E+09	P	NA	NA	NA	NA	–	1.0E-02	0.0E+00	1.4E-02	2.4E-02	5%
				Total ELCR			8E-05	100%	Total HI			0.5	100%

** HI Segregated by Target Site/Critical Effect:
CNS - Central nervous system
NA - Not available
NR - None reported

HI (liver, kidney) =	0.1	HI (gastrointestinal tract) =	0.07
HI (CNS, whole body, immune system) =	0.02	HI (nasal, lung) =	0.02
HI (blood) =	0.07	HI (skin) =	0
HI (fetus, developmental) =	0	HI (NA, NR) =	0

[a] Minimum of the volatilization factor (identified with "V") and the particulate emission factor (PEF) (identified with "P"), both derived on Table A.2-11.

–	Not applicable.	HQ	Hazard quotient.	PEF	Particulate emission factor.
ELCR	Excess lifetime cancer risk.	m^3/kg	Cubic meters per kilogram.	VF	Volatilization factor.
EPCs	Exposure point concentration in soil (mg/kg).	mg/kg	Milligrams per kilogram.		
HI	Hazard index (sum of the HQs).	NA	Not available.		

Equations: (see Table A.2-11. Potentially mutagenic carcinogens (i.e., PAHs) adjusted to incorporate ADAFs of 2.1 for 10 years (ages 6 to 16) and 1 for the remaining 14 years as an adult. Oral example: (EPC x 1 x 100 x 350 x CSF/(1,000,000 x 365 x 70)) x ((2.1 x 10/70) + (1 x 14/70)).

ELCRo = (EPCs × 1 × 100 × 350 × 24 × CSFo) / (1,000,000 × 70 × 25,550)
ELCRd = (EPCs × 5,700 × 0.07 × ABSd × 350 × 24 × CSFa) / (1,000,000 × 70 × 25,550)
ELCRi = (EPCs × 20 × 350 × 24 × CSFi) / ([VF or PEF] × 70 × 25,550)

HQo = (EPCs × 1 × 100 × 350 × 24) / (1,000,000 × 70 × 8,760 × RfDo)
HQd = (EPCs × 5,700 × 0.07 × ABSd × 350 × 24) / (1,000,000 × 70 × 8,760 × RfDa)
HQi = (EPCs × 20 × 350 × 24) / ([VF or PEF] × 70 × 8,760 × RfDi)

Table A.3.HHRA-12
Risk and Hazard Calculations for Adult Resident Exposure to Vapors in Indoor Air from Combined Surface and Subsurface Soil
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

SL-SCREEN
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES X

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (µg/kg)	Chemical
91203	2.64E+00	Naphthalene

MORE ê

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Average soil temperature, T_S (^oC)	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
200	400	10	L		

MORE ê

ENTER Vandose zone SCS soil type (Lookup Soil Parameters)	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	ENTER Vadose zone soil organic carbon fraction, f_{oc}^V (unitless)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
L	1.59	0.399	0.148	0.002	

MORE ê

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	24	24	350	1.0E-06	1

Used to calculate risk-based soil concentration.

END

Table A.3.HHRA-12
Risk and Hazard Calculations for Adult Resident Exposure to Vapors in Indoor Air from Combined Surface and Subsurface Soil
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen (µg/kg)	Indoor exposure soil conc., noncarcinogen (µg/kg)	Risk-based indoor exposure soil conc., (µg/kg)	Soil saturation conc., C_{sat} (µg/kg)	Final indoor exposure soil conc., (µg/kg)
NA	NA	NA	1.27E+05	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	6E-02

MESSAGE SUMMARY BELOW:

Table A.3.HHRA-13
Risk and Hazard Calculations for Hypothetical Future Adult Resident Wading Exposure to Sediment
BUILDING DEBRIS DISPOSAL TRENCH
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Adult Resident
Receptor Age: Adult

Constituent	EPCsed (mg/kg)	CANCER RISK Route-Specific Risks Oral	Dermal	Calculated Risk	Percent Total ELCR	NON-CANCER RISK Route-Specific Risks Oral	Dermal	Calculated Hazard	Percent Total HI
		ELCRo	ELCRd	ELCR		HQo	HQd	HI	
Polycyclic Aromatic Hydrocarbons									
Benzo(a)anthracene	8.00E+00	2.7E-07	2.1E-06	2.4E-06	8%	NA	NA	NA	–
Benzo(a)pyrene	6.92E+00	2.4E-06	1.8E-05	2.1E-05	70%	NA	NA	NA	–
Benzo(b)fluoranthene	1.01E+01	3.5E-07	2.7E-06	3.1E-06	10%	NA	NA	NA	–
Dibenzo(a,h)anthracene	7.01E-01	2.4E-07	1.9E-06	2.1E-06	7%	NA	NA	NA	–
Indeno(1,2,3-cd)pyrene	4.68E+00	1.6E-07	1.3E-06	1.4E-06	5%	NA	NA	NA	–
Inorganics									
Aluminum	–	–	–	–	–	–	–	–	–
Arsenic	–	–	–	–	–	–	–	–	–
Cobalt	7.40E+01	NA	NA	NA	–	2.3E-02	0.0E+00	2.3E-02	62%
Iron	3.46E+04	NA	NA	NA	–	4.6E-03	0.0E+00	4.6E-03	12%
Manganese	1.03E+03	NA	NA	NA	–	6.9E-04	0.0E+00	6.9E-04	2%
Thallium	–	–	–	–	–	–	–	–	–
Vanadium	–	–	–	–	–	–	–	–	–
		Total ELCR		3E-05	100%	Total HI		0.04	100%

– Not applicable.
ELCR Excess lifetime cancer risk.
EPCsed Exposure point concentration in sediment (mg/kg).
HI Hazard index (sum of the HQs).
HQ Hazard quotient.
mg/kg Milligrams per kilogram.
NA Not available.

Equations: (see Table A.2-12. Potentially mutagenic carcinogens (i.e., PAHs) adjusted to incorporate ADAFs of 2.1 for 10 years (ages 6 to 16) and 1 for the remaining 14 years as an adult.
Oral example: (EPC x 50 x 48 x CSF/(1,000,000 x 365 x 70)) x ((2.1 x 10/70) + (1 x 14/70)).
ELCRo = (EPCsed × 50 × 48 × 24 × CSFo) / (1,000,000 × 70 × 25,550)
ELCRd = (EPCsed × 5,000 × 1 × ABSd × 48 × 24 × CSFa) / (1,000,000 × 70 × 25,550)
HQo = (EPCsed × 50 × 48 × 24) / (1,000,000 × 70 × 8,760 × RfDo)
HQd = (EPCsed × 5,000 × 1 × ABSd × 48 × 24) / (1,000,000 × 70 × 8,760 × RfDa)

Table A.3.HHRA-14
Risk and Hazard Calculations for Hypothetical Future Adult Resident Wading Exposure to Surface Water
BUILDING DEBRIS DISPOSAL TRENCH
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Adult Resident
Receptor Age: Adult

Constituent	EPCsw (mg/L)	DA [a] (L/cm²/day)	VFsw (L/m³)	CANCER RISK Route-Specific Risk Oral	Dermal	Inhalation	Calculated Risk	Percent Total ELCR	NON-CANCER HAZARD Route-Specific Hazard Oral	Dermal	Inhalation	Calculated Hazard	Percent Total HI
				ELCRo	ELCRd	ELCRi	ELCR		HQo	HQd	HQi	HI	
Volatile Organic Compounds													
Bromodichloromethane	2.30E-02	1.19E-05	3.33E-03	4.6E-08	5.5E-08	NA	1.0E-07	74%	1.1E-04	1.3E-04	NA	2.4E-04	2%
Chloroform	2.37E-03	1.33E-05	4.24E-03	NA	NA	1.1E-09	1.1E-09	1%	2.2E-05	3.0E-05	1.4E-06	5.3E-05	1%
Pesticides													
Dieldrin	5.91E-06	1.01E-04	1.40E-04	3.0E-09	3.1E-08	1.8E-11	3.4E-08	25%	1.1E-05	1.1E-04	NA	1.2E-04	1%
Inorganics													
Thallium	7.20E-03	1.00E-06	NA	NA	NA	NA	NA	–	8.5E-03	8.5E-04	NA	9.3E-03	96%
				Total ELCR			1E-07	100%	Total HI			0.01	100%

[a] The dermal absorption factor (DA) was calculated using Equation [0], [1], or [2], as indicated, from Table A.2-13.

–	Not applicable.
ELCR	Excess lifetime cancer risk.
EPCsw	Exposure point concentration in surface water (mg/L).
HI	Hazard index (sum of the HQs).
HQ	Hazard quotient.
L/cm²/day	Liters per square centimeter per day.
L/m^3	Liters per cubic meter.
mg/L	Milligrams per liter.
NA	Not available.
VFsw	Volatilization factor for surface water.

Equations: (see Table A.2-13)

3.75 = Um = Mean annual wind speed (m/sec) for Roanoke, Virginia (USDOE 1986).

ELCRo = (EPCsw × 0.05 × 1 × 48 × 24 × CSFo) / (70 × 25,550)
ELCRd = (EPCsw × DA × 5,000 × 48 × 24 × CSFa) / (70 × 25,550)
ELCRi = (EPCsw × VFsw × 2 × 48 × 24 × CSFi) / (70 × 25,550)

HQo = (EPCsw × 0.05 × 1 × 48 × 24) / (70 × 8,760 × RfDo)
HQd = (EPCsw × DA × 5,000 × 48 × 24) / (70 × 8,760 × RfDa)
HQi = (EPCsw × VFsw × 2 × 48 × 24) / (70 × 8,760 × RfDi)

Table A.3.HHRA-15
Risk and Hazard Calculations for Hypothetical Future Child Resident Exposure to Combined Surface and Subsurface Soil
BUILDING DEBRIS DISPOSAL TRENCH
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Child Resident
Receptor Age: Child

Constituent	EPCs (mg/kg)	VF *or* PEF [a] (m^3/kg)		CANCER RISK Route-Specific Risk Oral ELCRo	Dermal ELCRd	Inhalation ELCRi	Calculated Risk ELCR	Percent Total ELCR	NON-CANCER HAZARD Route-Specific Hazard Oral HQo	Dermal HQd	Inhalation HQi	Calculated Hazard HI	Percent Total HI
Semi-Volatile Organic Compounds													
Carbazole	8.20E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Polycyclic Aromatic Hydrocarbons													
Benzo(a)anthracene	8.00E+00	1.36E+09	P	1.9E-05	6.8E-06	NA	2.6E-05	8%	NA	NA	NA	NA	–
Benzo(a)pyrene	6.92E+00	1.36E+09	P	1.6E-04	5.9E-05	2.5E-09	2.2E-04	70%	NA	NA	NA	NA	–
Benzo(b)fluoranthene	1.01E+01	1.36E+09	P	2.4E-05	8.7E-06	NA	3.2E-05	10%	NA	NA	NA	NA	–
Benzo(k)fluoranthene	3.34E+00	1.36E+09	P	7.8E-07	2.8E-07	NA	1.1E-06	0%	NA	NA	NA	NA	–
Chrysene	7.94E+00	1.36E+09	P	1.9E-07	6.8E-08	NA	2.5E-07	0%	NA	NA	NA	NA	–
Dibenzo(a,h)anthracene	7.01E-01	1.36E+09	P	1.6E-05	6.0E-06	NA	2.2E-05	7%	NA	NA	NA	NA	–
Indeno(1,2,3-cd)pyrene	4.68E+00	1.36E+09	P	1.1E-05	4.0E-06	NA	1.5E-05	5%	NA	NA	NA	NA	–
Naphthalene	2.64E+00	5.49E+04	V	NA	NA	NA	NA	–	1.7E-03	6.1E-04	3.6E-02	3.8E-02	1%
Herbicides													
MCPP	1.35E+01	1.36E+09	P	NA	NA	NA	NA	–	1.7E-01	4.8E-02	NA	2.2E-01	5%
Inorganics													
Cobalt	7.40E+01	1.36E+09	P	NA	NA	9.4E-08	9.4E-08	0%	3.2E+00	0.0E+00	2.0E-02	3.2E+00	76%
Iron	3.46E+04	1.36E+09	P	NA	NA	NA	NA	–	6.3E-01	0.0E+00	NA	6.3E-01	15%
Lead	–	–		–	–	–	–	–	–	–	–	–	–
Manganese	1.03E+03	1.36E+09	P	NA	NA	NA	NA	–	9.4E-02	0.0E+00	3.4E-02	1.3E-01	3%
				Total ELCR			3E-04	100%	Total HI **			4	100%

** HI Segregated by Target Site/Critical Effect:
CNS - Central nervous system
NA - Not available
NR - None reported

HI (liver, kidney) =	1	HI (gastrointestinal tract) =	0.6
HI (CNS, whole body, immune system) =	0.1	HI (nasal, lung) =	0.04
HI (blood) =	0.6	HI (skin) =	3
HI (fetus, developmental) =	0	HI (NA, NR) =	0

[a] Minimum of the volatilization factor (identified with "V") and the particulate emission factor (PEF) (identified with "P"), both derived on Table A.2-11.

–	Not applicable.	HQ	Hazard quotient.	PEF	Particulate emission factor.
ELCR	Excess lifetime cancer risk.	m^3/kg	Cubic meters per kilogram.	VF	Volatilization factor.
EPCs	Exposure point concentration in soil (mg/kg).	mg/kg	Milligrams per kilogram.		
HI	Hazard index (sum of the HQs).	NA	Not available.		

Equations: (see Table A.2-11. Potentially mutagenic carcinogens (i.e., PAHs) adjusted to incorporate ADAFs of 4.6 for 2 years (ages 0 to 2) and 2.1 for 4 years (ages 2 to 6). Oral example: (EPC x 1 x 200 x 350 x CSF/(1,000,000 x 365 x 15)) x ((4.6 x 2/70) + (2.1 x 4/70)).

ELCRo = (EPCs × 1 × 200 × 350 × 6 × CSFo) / (1,000,000 × 15 × 25,550)
ELCRd = (EPCs × 2,800 × 0.2 × ABSd × 350 × 6 × CSFa) / (1,000,000 × 15 × 25,550)
ELCRi = (EPCs × 10 × 350 × 6 × CSFi) / ([VF or PEF] × 15 × 25,550)

HQo = (EPCs × 1 × 200 × 350 × 6) / (1,000,000 × 15 × 2,190 × RfDo)
HQd = (EPCs × 2,800 × 0.2 × ABSd × 350 × 6) / (1,000,000 × 15 × 2,190 × RfDa)
HQi = (EPCs × 10 × 350 × 6) / ([VF or PEF] × 15 × 2,190 × RfDi)

Table A.3.HHRA-16
Risk and Hazard Calculations for Child Resident Exposure to Vapors in Indoor Air from Combined Surface and Subsurface Soil
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

SL-SCREEN
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (µg/kg)	Chemical
91203	2.64E+03	Naphthalene

MORE ê

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
200	400	10	L		

MORE ê

ENTER Vandose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	ENTER Vadose zone soil organic carbon fraction, f_{oc}^V (unitless)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
L	1.59	0.399	0.148	0.002	

Lookup Soil Parameters

MORE ê

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	6	350	1.0E-06	1

Used to calculate risk-based soil concentration.

END

Table A.3.HHRA-16
Risk and Hazard Calculations for Child Resident Exposure to Vapors in Indoor Air from Combined Surface and Subsurface Soil
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen (µg/kg)	Indoor exposure soil conc., noncarcinogen (µg/kg)	Risk-based indoor exposure soil conc., (µg/kg)	Soil saturation conc., C_{sat} (µg/kg)	Final indoor exposure soil conc., (µg/kg)
NA	NA	NA	1.27E+05	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	6E-02

MESSAGE SUMMARY BELOW:

Table A.3.HHRA-17
Risk and Hazard Calculations for Hypothetical Future Child Resident Wading Exposure to Sediment
BUILDING DEBRIS DISPOSAL TRENCH
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Child Resident
Receptor Age: Child

		CANCER RISK			Percent	NON-CANCER RISK			Percent
	EPCsed	Route-Specific Risks		Calculated	Total	Route-Specific Risks		Calculated	Total
Constituent	(mg/kg)	Oral	Dermal	Risk	ELCR	Oral	Dermal	Hazard	HI
		ELCRo	ELCRd	ELCR		HQo	HQd	HI	
Polycyclic Aromatic Hydrocarbons									
Benzo(a)anthracene	8.00E+00	1.3E-06	6.4E-07	1.9E-06	8%	NA	NA	NA	–
Benzo(a)pyrene	6.92E+00	1.1E-05	5.5E-06	1.7E-05	70%	NA	NA	NA	–
Benzo(b)fluoranthene	1.01E+01	1.6E-06	8.1E-07	2.4E-06	10%	NA	NA	NA	–
Dibenzo(a,h)anthracene	7.01E-01	1.1E-06	5.6E-07	1.7E-06	7%	NA	NA	NA	–
Indeno(1,2,3-cd)pyrene	4.68E+00	7.5E-07	3.7E-07	1.1E-06	5%	NA	NA	NA	–
Inorganics									
Aluminum	–	–	–	–	–	–	–	–	–
Arsenic	–	–	–	–	–	–	–	–	–
Cobalt	7.40E+01	NA	NA	NA	–	2.2E-01	0.0E+00	2.2E-01	77%
Iron	3.46E+04	NA	NA	NA	–	4.3E-02	0.0E+00	4.3E-02	15%
Manganese	1.03E+03	NA	NA	NA	–	6.4E-03	0.0E+00	6.4E-03	2%
Thallium	–	–	–	–	–	–	–	–	–
Vanadium	–	–	–	–	–	–	–	–	–
		Total ELCR		2E-05	100%	Total HI		0.3	100%

–	Not applicable.	HQ	Hazard quotient.
ELCR	Excess lifetime cancer risk.	mg/kg	Milligrams per kilogram.
EPCsed	Exposure point concentration in sediment (mg/kg).	NA	Not available.
HI	Hazard index (sum of the HQs).		

Equations: (see Table A.2-12. Potentially mutagenic carcinogens (i.e., PAHs) adjusted to incorporate ADAFs of 4.6 for 2 years (ages 0 to 2) and 2.1 for 4 years (ages 2 to 6). Oral example: (EPC x 100 x 48 x CSF/(1,000,000 x 365 x 15)) x ((4.6 x 2/70) + (2.1 x 4/70)).

ELCRo = (EPCsed × 100 × 48 × 6 × CSFo) / (1,000,000 × 15 × 25,550)

ELCRd = (EPCsed × 1,900 × 0.2 × ABSd × 48 × 6 × CSFa) / (1,000,000 × 15 × 25,550)

HQo = (EPCsed × 100 × 48 × 6) / (1,000,000 × 15 × 2,190 × RfDo)

HQd = (EPCsed × 1,900 × 0.2 × ABSd × 48 × 6) / (1,000,000 × 15 × 2,190 × RfDa)

Table A.3.HHRA-18
Risk and Hazard Calculations for Hypothetical Future Child Resident Wading Exposure to Surface Water
BUILDING DEBRIS DISPOSAL TRENCH
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Child Resident
Receptor Age: Child

Constituent	EPCsw (mg/L)	DA [a] (L/cm²/day)	VFsw (L/m³)	CANCER RISK: Route-Specific Risk: Oral	Dermal	Inhalation	Calculated Risk	Percent Total ELCR	NON-CANCER HAZARD: Route-Specific Hazard: Oral	Dermal	Inhalation	Calculated Hazard	Percent Total HI
				ELCRo	ELCRd	ELCRi	ELCR		HQo	HQd	HQi	HI	
Volatile Organic Compounds													
Bromodichloromethane	2.30E-02	1.19E-05	3.33E-03	5.4E-08	2.4E-08	NA	7.8E-08	81%	5.0E-04	2.3E-04	NA	7.3E-04	2%
Chloroform	2.37E-03	1.33E-05	4.24E-03	NA	NA	1.2E-09	1.2E-09	1%	1.0E-04	5.2E-05	6.3E-06	1.6E-04	0.4%
Pesticides													
Dieldrin	5.91E-06	1.01E-04	1.40E-04	3.6E-09	1.4E-08	2.0E-11	1.7E-08	18%	5.2E-05	2.0E-04	NA	2.5E-04	0.6%
Inorganics													
Thallium	7.20E-03	1.00E-06	NA	NA	NA	NA	NA	–	3.9E-02	1.5E-03	NA	4.1E-02	97%
				Total ELCR			1E-07	100%	Total HI			0.04	100%

[a] The dermal absorption factor (DA) was calculated using Equation [0], [1], or [2], as indicated, from Table A.2-13.

–	Not applicable.
ELCR	Excess lifetime cancer risk.
EPCsw	Exposure point concentration in surface water (mg/L).
HI	Hazard index (sum of the HQs).
HQ	Hazard quotient.
L/cm²/day	Liters per square centimeter per day.
L/m^3	Liters per cubic meter.
mg/L	Milligrams per liter.
NA	Not available.
VFsw	Volatilization factor for surface water.

Equations: (see Table A.2-13)

3.75 = Um = Mean annual wind speed (m/sec) for Roanoke, Virginia (USDOE 1986).

ELCRo = (EPCsw × 0.05 × 1 × 48 × 6 × CSFo) / (15 × 25,550)
ELCRd = (EPCsw × DA × 1,900 × 48 × 6 × CSFa) / (15 × 25,550)
ELCRi = (EPCsw × VFsw × 2 × 48 × 6 × CSFi) / (15 × 25,550)

HQo = (EPCsw × 0.05 × 1 × 48 × 6) / (15 × 2,190 × RfDo)
HQd = (EPCsw × DA × 1,900 × 48 × 6) / (15 × 2,190 × RfDa)
HQi = (EPCsw × VFsw × 2 × 48 × 6) / (15 × 2,190 × RfDi)

Table A.3.HHRA-19
Summary of Calculated Human Health Risks and Hazards
BUILDING DEBRIS DISPOSAL TRENCH
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

RECEPTOR Exposure Medium - Scenario	Calculation Table	Total Excess Lifetime Cancer Risk	Total Non-Cancer Hazard
Site Worker			
Surface Soil - Direct Contact	Table A.3.HHRA-6	5E-05	0.5
Combined Surface and Subsurface Soil - Vapor Migration to Indoor Air	Table A.3.HHRA-7	NA	0.04
Sediment - Wading	Table A.3.HHRA-8	1E-05	0.02
Surface Water - Wading	Table A.3.HHRA-9	4E-07	0.04
TOTAL SITE RISKS (Site Worker):		7E-05	0.6
Hypothetical Future Construction Worker			
Combined Surface and Subsurface Soil - Direct Contact	Table A.3.HHRA-10	2E-06	1
TOTAL SITE RISKS (Construction Worker):		2E-06	1
Hypothetical Future Adult Resident			
Combined Surface and Subsurface Soil - Direct Contact	Table A.3.HHRA-11	8E-05	0.5
Combined Surface and Subsurface Soil - Vapor Migration to Indoor Air	Table A.3.HHRA-12	NA	0.06
Sediment - Wading	Table A.3.HHRA-13	3E-05	0.04
Surface Water - Wading	Table A.3.HHRA-14	1E-07	0.01
TOTAL SITE RISKS (Adult Resident):		1E-04	0.6
Hypothetical Future Child Resident			
Combined Surface and Subsurface Soil - Direct Contact	Table A.3.HHRA-15	3E-04	4
Combined Surface and Subsurface Soil - Vapor Migration to Indoor Air	Table A.3.HHRA-16	NA	0.06
Sediment - Wading	Table A.3.HHRA-17	2E-05	0.3
Surface Water - Wading	Table A.3.HHRA-18	1E-07	0.04
TOTAL SITE RISKS (Child Resident):		3E-04	5
Hypothetical Future Aggregate Resident (Adult + Child)			
Combined Surface and Subsurface Soil - Direct Contact		4E-04	--
Combined Surface and Subsurface Soil - Vapor Migration to Indoor Air		NA	--
Sediment - Wading		5E-05	--
Surface Water - Wading		2E-07	--
TOTAL SITE RISKS (Aggregate Resident):		4E-04	--

Table A.3.HHRA-20
Risk and Hazard Calculations for Site Worker Exposure to Rip Rap Surface Soil (0-2 foot Depth Interval)
BUILDING DEBRIS DISPOSAL TRENCH - RIP RAP AREA
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Current / Future
Receptor Population: Site Worker
Receptor Age: Adult

Constituent	EPCs (mg/kg)	VF *or* PEF [a] (m^3/kg)		CANCER RISK Route-Specific Risk Oral	Dermal	Inhalation	Calculated Risk	Percent Total ELCR	NON-CANCER HAZARD Route-Specific Hazard Oral	Dermal	Inhalation	Calculated Hazard	Percent Total HI
				ELCRo	ELCRd	ELCRi	ELCR		HQo	HQd	HQi	HI	
Semi-Volatile Organic Compounds													
Carbazole	1.20E+00	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Polycyclic Aromatic Hydrocarbons													
Benzo(a)anthracene	2.50E+00	1.36E+09	P	6.4E-07	5.5E-07	NA	1.2E-06	7%	NA	NA	NA	NA	–
Benzo(a)pyrene	2.59E+00	1.36E+09	P	6.6E-06	5.7E-06	4.1E-10	1.2E-05	71%	NA	NA	NA	NA	–
Benzo(b)fluoranthene	3.43E+00	1.36E+09	P	8.8E-07	7.5E-07	NA	1.6E-06	9%	NA	NA	NA	NA	–
Benzo(k)fluoranthene	1.61E+00	1.36E+09	P	4.1E-08	3.5E-08	NA	7.6E-08	0%	NA	NA	NA	NA	–
Chrysene	2.89E+00	1.36E+09	P	7.4E-09	6.3E-09	NA	1.4E-08	0%	NA	NA	NA	NA	–
Dibenzo(a,h)anthracene	3.25E-01	1.36E+09	P	8.3E-07	7.1E-07	NA	1.5E-06	9%	NA	NA	NA	NA	–
Indeno(1,2,3-cd)pyrene	1.30E+00	1.36E+09	P	3.3E-07	2.8E-07	NA	6.2E-07	4%	NA	NA	NA	NA	–
Naphthalene	ND	–		ND	ND	–	ND	–	ND	ND	–	ND	–
Herbicides								–					–
MCPP	NA	–		NA	NA	–	NA	–	NA	NA	–	NA	–
Inorganics													
Cobalt	2.03E+01	1.36E+09	P	NA	NA	3.3E-08	3.3E-08	0%	6.6E-02	0.0E+00	1.7E-03	6.8E-02	49%
Iron	3.70E+04	1.36E+09	P	NA	NA	NA	NA	–	5.2E-02	0.0E+00	NA	5.2E-02	38%
Lead	–	–		–	–	–	–	–	–	–	–	–	–
Manganese	1.04E+03	1.36E+09	P	NA	NA	NA	NA	–	7.3E-03	0.0E+00	1.0E-02	1.8E-02	13%
					Total ELCR		2E-05	100%		Total HI		0.1	100%

[a] Minimum of the volatilization factor (identified with "V") and the particulate emission factor (PEF) (identified with "P"), both derived on Table A.2-11.

–	Not applicable.	HQ	Hazard quotient.	PEF	Particulate emission factor.
ELCR	Excess lifetime cancer risk.	m^3/kg	Cubic meters per kilogram.	VF	Volatilization factor.
EPCs	Exposure point concentration in surface soil (mg/kg).	mg/kg	Milligrams per kilogram.		
HI	Hazard index (sum of the HQs).	NA	Not available.		

Equations: (see Table A.2-11)

ELCRo = (EPCs × 1 × 100 × 250 × 25 × CSFo) / (1,000,000 × 70 × 25,550)
ELCRd = (EPCs × 3,300 × 0.2 × ABSd × 250 × 25 × CSFa) / (1,000,000 × 70 × 25,550)
ELCRi = (EPCs × 20 × 250 × 25 × CSFi) / ([VF or PEF] × 70 × 25,550)

HQo = (EPCs × 1 × 100 × 250 × 25) / (1,000,000 × 70 × 9,125 × RfDo)
HQd = (EPCs × 3,300 × 0.2 × ABSd × 250 × 25) / (1,000,000 × 70 × 9,125 × RfDa)
HQi = (EPCs × 20 × 250 × 25) / ([VF or PEF] × 70 × 9,125 × RfDi)

Table A.3.HHRA-21
Risk and Hazard Calculations for Site Worker Exposure to Vapors in Indoor Air from Rip Rap Surface and Subsurface Soil
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

SL-SCREEN
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (µg/kg)	Chemical
91203	7.80E+03	Naphthalene

MORE ê

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
200	400	10	L		

MORE ê

ENTER Vandose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	ENTER Vadose zone soil organic carbon fraction, f_{oc}^V (unitless)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
L	1.59	0.399	0.148	0.002	

Lookup Soil Parameters

MORE ê

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-06	1

Used to calculate risk-based soil concentration.

END

Table A.3.HHRA-21
Risk and Hazard Calculations for Site Worker Exposure to Vapors in Indoor Air from Rip Rap Surface and Subsurface Soil
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen (µg/kg)	Indoor exposure soil conc., noncarcinogen (µg/kg)	Risk-based indoor exposure soil conc., (µg/kg)	Soil saturation conc., C_{sat} (µg/kg)	Final indoor exposure soil conc., (µg/kg)
NA	NA	NA	1.27E+05	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	1E-01

MESSAGE SUMMARY BELOW:

Table A.3.HHRA-22
Risk and Hazard Calculations for Hypothetical Future Construction Worker Exposure to Combined Rip Rap Surface and Subsurface Soil
BUILDING DEBRIS DISPOSAL TRENCH - RIP RAP AREA
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

				CANCER RISK				Percent	NON-CANCER HAZARD				Percent
		VF *or*		Route-Specific Risk			Calculated	Total	Route-Specific Hazard			Calculated	Total
Constituent	EPCs (mg/kg)	PEF [a] (m^3/kg)		Oral	Dermal	Inhalation	Risk	ELCR	Oral	Dermal	Inhalation	Hazard	HI
				ELCRo	ELCRd	ELCRi	ELCR		HQo	HQd	HQi	HI	
Semi-Volatile Organic Compounds													
Carbazole	7.70E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Polycyclic Aromatic Hydrocarbons													
Benzo(a)anthracene	4.99E+00	1.36E+09	P	8.7E-08	3.4E-08	NA	1.2E-07	7%	NA	NA	NA	NA	–
Benzo(a)pyrene	5.35E+00	1.36E+09	P	9.4E-07	3.7E-07	1.8E-11	1.3E-06	76%	NA	NA	NA	NA	–
Benzo(b)fluoranthene	6.59E+00	1.36E+09	P	1.2E-07	4.5E-08	NA	1.6E-07	9%	NA	NA	NA	NA	–
Benzo(k)fluoranthene	2.64E+00	1.36E+09	P	4.6E-09	1.8E-09	NA	6.4E-09	0%	NA	NA	NA	NA	–
Chrysene	6.15E+00	1.36E+09	P	1.1E-09	4.2E-10	NA	1.5E-09	0%	NA	NA	NA	NA	–
Dibenzo(a,h)anthracene	1.89E-01	1.36E+09	P	3.3E-08	1.3E-08	NA	4.6E-08	3%	NA	NA	NA	NA	–
Indeno(1,2,3-cd)pyrene	2.88E+00	1.36E+09	P	5.0E-08	2.0E-08	NA	7.0E-08	4%	NA	NA	NA	NA	–
Naphthalene	7.80E+00	5.49E+04	V	NA	NA	NA	NA	–	1.3E-04	5.1E-05	3.4E-02	3.4E-02	8%
Herbicides													
MCPP	NA	–		NA	NA	–	NA	–	NA	NA	–	NA	–
Inorganics													
Cobalt	1.78E+01	1.36E+09	P	NA	NA	6.0E-10	6.0E-10	0%	2.0E-01	0.0E+00	4.7E-04	2.0E-01	47%
Iron	3.40E+04	1.36E+09	P	NA	NA	NA	NA	–	1.6E-01	0.0E+00	NA	1.6E-01	38%
Lead	–	–		–	–	–	–	–	–	–	–	–	–
Manganese	8.57E+02	1.36E+09	P	NA	NA	NA	NA	–	2.1E-02	0.0E+00	9.0E-03	3.0E-02	7%
				Total ELCR			2E-06	100%	Total HI			0.4	100%

** HI Segregated by Target Site/Critical Effect:	HI (liver, kidney) =	0.2		HI (gastrointestinal tract) =	0.2
CNS - Central nervous system	HI (CNS, whole body, immune system) =	0.03		HI (nasal, lung) =	0.03
NA - Not available	HI (blood) =	0.2		HI (eyes, nails, hair, skin) =	0
NR - None reported	HI (fetus, developmental) =	0		HI (NA, NR) =	0

[a] Minimum of the volatilization factor (identified with "V") and the particulate emission factor (PEF) (identified with "P"), both derived on Table A.2-11.

–	Not applicable.	HQ	Hazard quotient.	PEF	Particulate emission factor.
ELCR	Excess lifetime cancer risk.	m^3/kg	Cubic meters per kilogram.	VF	Volatilization factor.
EPCs	Exposure point concentration in soil (mg/kg).	mg/kg	Milligrams per kilogram.		
HI	Hazard index (sum of the HQs).	NA	Not available.		

Equations: (see Table A.2-11)

ELCRo = (EPCs × 1 × 330 × 130 × 1 × CSFo) / (1,000,000 × 70 × 25,550)
ELCRd = (EPCs × 3,300 × 0.3 × ABSd × 130 × 1 × CSFa) / (1,000,000 × 70 × 25,550)
ELCRi = (EPCs × 20 × 130 × 1 × CSFi) / ([VF or PEF] × 70 × 25,550)

HQo = (EPCs × 1 × 330 × 130 × 1) / (1,000,000 × 70 × 182 × RfDo)
HQd = (EPCs × 3,300 × 0.3 × ABSd × 130 × 1) / (1,000,000 × 70 × 182 × RfDa)
HQi = (EPCs × 20 × 130 × 1) / ([VF or PEF] × 70 × 182 × RfDi)

Table A.3.HHRA-23
Risk and Hazard Calculations for Hypothetical Future Adult Resident Exposure to Combined Rip Rap Surface and Subsurface Soil
BUILDING DEBRIS DISPOSAL TRENCH - RIP RAP AREA
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Adult Resident
Receptor Age: Adult

Constituent	EPCs (mg/kg)	VF *or* PEF [a] (m^3/kg)		CANCER RISK Route-Specific Risk Oral	Dermal	Inhalation	Calculated Risk	Percent Total ELCR	NON-CANCER HAZARD Route-Specific Hazard Oral	Dermal	Inhalation	Calculated Hazard	Percent Total HI
				ELCRo	ELCRd	ELCRi	ELCR		HQo	HQd	HQi	HI	
Semi-Volatile Organic Compounds													
Carbazole	7.70E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Polycyclic Aromatic Hydrocarbons													
Benzo(a)anthracene	4.99E+00	1.36E+09	P	2.5E-06	1.3E-06	NA	3.8E-06	7%	NA	NA	NA	NA	–
Benzo(a)pyrene	5.35E+00	1.36E+09	P	2.7E-05	1.4E-05	1.7E-09	4.1E-05	76%	NA	NA	NA	NA	–
Benzo(b)fluoranthene	6.59E+00	1.36E+09	P	3.3E-06	1.7E-06	NA	5.0E-06	9%	NA	NA	NA	NA	–
Benzo(k)fluoranthene	2.64E+00	1.36E+09	P	1.3E-07	6.8E-08	NA	2.0E-07	0.4%	NA	NA	NA	NA	–
Chrysene	6.15E+00	1.36E+09	P	3.1E-08	1.6E-08	NA	4.7E-08	0.1%	NA	NA	NA	NA	–
Dibenzo(a,h)anthracene	1.89E-01	1.36E+09	P	9.5E-07	4.9E-07	NA	1.4E-06	3%	NA	NA	NA	NA	–
Indeno(1,2,3-cd)pyrene	2.88E+00	1.36E+09	P	1.4E-06	7.5E-07	NA	2.2E-06	4%	NA	NA	NA	NA	–
Naphthalene	7.80E+00	5.49E+04	V	NA	NA	NA	NA	–	5.3E-04	2.8E-04	4.5E-02	4.6E-02	21%
Herbicides													
MCPP	NA	–		NA	NA	–	NA	–	NA	NA	–	NA	–
Inorganics													
Cobalt	1.78E+01	1.36E+09	P	NA	NA	3.9E-08	3.9E-08	0.1%	8.1E-02	0.0E+00	2.1E-03	8.3E-02	38%
Iron	3.40E+04	1.36E+09	P	NA	NA	NA	NA	–	6.7E-02	0.0E+00	NA	6.7E-02	31%
Lead	–	–		–	–	–	–	–	–	–	–	–	–
Manganese	8.57E+02	1.36E+09	P	NA	NA	NA	NA	–	8.4E-03	0.0E+00	1.2E-02	2.0E-02	9%
				Total ELCR			5E-05	100%	Total HI			0.2	100%

** HI Segregated by Target Site/Critical Effect:	HI (liver, kidney) =	0.1	HI (gastrointestinal tract) =	0.07
CNS - Central nervous system	HI (CNS, whole body, immune system) =	0.02	HI (nasal, lung) =	0.05
NA - Not available	HI (blood) =	0.07	HI (skin) =	0
NR - None reported	HI (fetus, developmental) =	0	HI (NA, NR) =	0

[a] Minimum of the volatilization factor (identified with "V") and the particulate emission factor (PEF) (identified with "P"), both derived on Table A.2-11.

–	Not applicable.	HQ	Hazard quotient.	PEF	Particulate emission factor.
ELCR	Excess lifetime cancer risk.	m^3/kg	Cubic meters per kilogram.	VF	Volatilization factor.
EPCs	Exposure point concentration in soil (mg/kg).	mg/kg	Milligrams per kilogram.		
HI	Hazard index (sum of the HQs).	NA	Not available.		

Equations: (see Table A.2-11. Potentially mutagenic carcinogens (i.e., PAHs) adjusted to incorporate ADAFs of 2.1 for 10 years (ages 6 to 16) and 1 for the remaining 14 years as an adult. Oral example: (EPC x 1 x 100 x 350 x CSF/(1,000,000 x 365 x 70)) x ((2.1 x 10/70) + (1 x 14/70)).

ELCRo = (EPCs × 1 × 100 × 350 × 24 × CSFo) / (1,000,000 × 70 × 25,550)
ELCRd = (EPCs × 5,700 × 0.07 × ABSd × 350 × 24 × CSFa) / (1,000,000 × 70 × 25,550)
ELCRi = (EPCs × 20 × 350 × 24 × CSFi) / ([VF or PEF] × 70 × 25,550)

HQo = (EPCs × 1 × 100 × 350 × 24) / (1,000,000 × 70 × 8,760 × RfDo)
HQd = (EPCs × 5,700 × 0.07 × ABSd × 350 × 24) / (1,000,000 × 70 × 8,760 × RfDa)
HQi = (EPCs × 20 × 350 × 24) / ([VF or PEF] × 70 × 8,760 × RfDi)

Table A.3.HHRA-24
Risk and Hazard Calculations for Adult Resident Exposure to Vapors in Indoor Air from Rip Rap Surface and Subsurface Soil
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

SL-SCREEN
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (µg/kg)	Chemical
91203	7.80E+03	Naphthalene

MORE ê

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Average soil temperature, T_S (^oC)	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
200	400	10	L		

MORE ê

ENTER Vandose zone SCS soil type (Lookup Soil Parameters)	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	ENTER Vadose zone soil organic carbon fraction, f_{oc}^V (unitless)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
L	1.59	0.399	0.148	0.002	

MORE ê

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	24	24	350	1.0E-06	1

Used to calculate risk-based soil concentration.

END

Table A.3.HHRA-24
Risk and Hazard Calculations for Adult Resident Exposure to Vapors in Indoor Air from Rip Rap Surface and Subsurface Soil
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen (µg/kg)	Indoor exposure soil conc., noncarcinogen (µg/kg)	Risk-based indoor exposure soil conc., (µg/kg)	Soil saturation conc., C_{sat} (µg/kg)	Final indoor exposure soil conc., (µg/kg)
NA	NA	NA	1.27E+05	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	2E-01

MESSAGE SUMMARY BELOW:

Table A.3.HHRA-25
Risk and Hazard Calculations for Hypothetical Future Child Resident Exposure to Combined Rip Rap Surface and Subsurface Soil
BUILDING DEBRIS DISPOSAL TRENCH - RIP RAP AREA
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Child Resident
Receptor Age: Child

				CANCER RISK				Percent	NON-CANCER HAZARD				Percent
		VF *or*		Route-Specific Risk			Calculated	Total	Route-Specific Hazard			Calculated	Total
Constituent	EPCs (mg/kg)	PEF [a] (m^3/kg)		Oral	Dermal	Inhalation	Risk	ELCR	Oral	Dermal	Inhalation	Hazard	HI
				ELCRo	ELCRd	ELCRi	ELCR		HQo	HQd	HQi	HI	
Semi-Volatile Organic Compounds													
Carbazole	7.70E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Polycyclic Aromatic Hydrocarbons													
Benzo(a)anthracene	4.99E+00	1.36E+09	P	1.2E-05	4.3E-06	NA	1.6E-05	7%	NA	NA	NA	NA	–
Benzo(a)pyrene	5.35E+00	1.36E+09	P	1.3E-04	4.6E-05	6.6E-09	1.7E-04	76%	NA	NA	NA	NA	–
Benzo(b)fluoranthene	6.59E+00	1.36E+09	P	1.5E-05	5.6E-06	NA	2.1E-05	9%	NA	NA	NA	NA	–
Benzo(k)fluoranthene	2.64E+00	1.36E+09	P	6.2E-07	2.3E-07	NA	8.4E-07	0%	NA	NA	NA	NA	–
Chrysene	1.89E-01	1.36E+09	P	4.4E-09	1.6E-09	NA	6.0E-09	0%	NA	NA	NA	NA	–
Dibenzo(a,h)anthracene	1.89E-01	1.36E+09	P	4.4E-06	1.6E-06	NA	6.0E-06	3%	NA	NA	NA	NA	–
Indeno(1,2,3-cd)pyrene	2.88E+00	1.36E+09	P	6.8E-06	2.5E-06	NA	9.2E-06	4%	NA	NA	NA	NA	–
Naphthalene	7.80E+00	5.49E+04	V	NA	NA	NA	NA	–	5.0E-03	1.8E-03	1.1E-01	1.1E-01	7%
Herbicides													
MCPP	NA	–		NA	NA	–	NA	–	NA	NA	–	NA	–
Inorganics													
Cobalt	1.78E+01	1.36E+09	P	NA	NA	2.3E-08	2.3E-08	0%	7.6E-01	0.0E+00	4.9E-03	7.6E-01	48%
Iron	3.40E+04	1.36E+09	P	NA	NA	NA	NA	–	6.2E-01	0.0E+00	NA	6.2E-01	39%
Lead	–	–		–	–	–	–	–	–	–	–	–	–
Manganese	8.57E+02	1.36E+09	P	NA	NA	NA	NA	–	7.8E-02	0.0E+00	2.8E-02	1.1E-01	7%
				Total ELCR			2E-04	100%	Total HI **			2	100%

** HI Segregated by Target Site/Critical Effect:
CNS - Central nervous system
NA - Not available
NR - None reported

HI (liver, kidney) =	0.6	HI (gastrointestinal tract) =	0.6
HI (CNS, whole body, immune system) =	0.1	HI (nasal, lung) =	0.1
HI (blood) =	0.6	HI (skin) =	0.8
HI (fetus, developmental) =	0	HI (NA, NR) =	0

[a] Minimum of the volatilization factor (identified with "V") and the particulate emission factor (PEF) (identified with "P"), both derived on Table A.2-11.

–	Not applicable.	HQ	Hazard quotient.	PEF	Particulate emission factor.
ELCR	Excess lifetime cancer risk.	m^3/kg	Cubic meters per kilogram.	VF	Volatilization factor.
EPCs	Exposure point concentration in soil (mg/kg).	mg/kg	Milligrams per kilogram.		
HI	Hazard index (sum of the HQs).	NA	Not available.		

Equations: (see Table A.2-11. Potentially mutagenic carcinogens (i.e., PAHs) adjusted to incorporate ADAFs of 4.6 for 2 years (ages 0 to 2) and 2.1 for 4 years (ages 2 to 6). Oral example: (EPC x 1 x 200 x 350 x CSF/(1,000,000 x 365 x 15)) x ((4.6 x 2/70) + (2.1 x 4/70)).

ELCRo = (EPCs × 1 × 200 × 350 × 6 × CSFo) / (1,000,000 × 15 × 25,550)
ELCRd = (EPCs × 2,800 × 0.2 × ABSd × 350 × 6 × CSFa) / (1,000,000 × 15 × 25,550)
ELCRi = (EPCs × 10 × 350 × 6 × CSFi) / ([VF or PEF] × 15 × 25,550)

HQo = (EPCs × 1 × 200 × 350 × 6) / (1,000,000 × 15 × 2,190 × RfDo)
HQd = (EPCs × 2,800 × 0.2 × ABSd × 350 × 6) / (1,000,000 × 15 × 2,190 × RfDa)
HQi = (EPCs × 10 × 350 × 6) / ([VF or PEF] × 15 × 2,190 × RfDi)

Table A.3.HHRA-26
Risk and Hazard Calculations for Child Resident Exposure to Vapors in Indoor Air from Rip Rap Surface and Subsurface Soil
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

SL-SCREEN
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (µg/kg)	Chemical
91203	7.80E+03	Naphthalene

MORE ê

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Average soil temperature, T_S (^oC)	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
200	400	10	L		

MORE ê

ENTER Vandose zone SCS soil type (Lookup Soil Parameters)	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	ENTER Vadose zone soil organic carbon fraction, f_{oc}^V (unitless)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
L	1.59	0.399	0.148	0.002	

MORE ê

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	6	350	1.0E-06	1

Used to calculate risk-based soil concentration.

END

Table A.3.HHRA-26
Risk and Hazard Calculations for Child Resident Exposure to Vapors in Indoor Air from Rip Rap Surface and Subsurface Soil
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen (µg/kg)	Indoor exposure soil conc., noncarcinogen (µg/kg)	Risk-based indoor exposure soil conc., (µg/kg)	Soil saturation conc., C_{sat} (µg/kg)	Final indoor exposure soil conc., (µg/kg)
NA	NA	NA	1.27E+05	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	2E-01

MESSAGE SUMMARY BELOW:

Table A.3.HHRA-27
Summary of Calculated Human Health Risks and Hazards
BUILDING DEBRIS DISPOSAL TRENCH - RIP RAP AREA
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

RECEPTOR Exposure Medium - Scenario	Calculation Table	Total Excess Lifetime Cancer Risk	Total Non-Cancer Hazard
Site Worker			
Surface Soil - Direct Contact	Table A.3.HHRA-20	2E-05	0.1
Combined Surface and Subsurface Soil - Vapor Migration to Indoor Air	Table A.3.HHRA-21	NA	0.1
Sediment - Wading	NA	NA	NA
Surface Water - Wading	NA	NA	NA
TOTAL SITE RISKS (Site Worker):		2E-05	0.3
Hypothetical Future Construction Worker			
Combined Surface and Subsurface Soil - Direct Contact	Table A.3.HHRA-22	2E-06	0.4
TOTAL SITE RISKS (Construction Worker):		2E-06	0.4
Hypothetical Future Adult Resident			
Combined Surface and Subsurface Soil - Direct Contact	Table A.3.HHRA-23	5E-05	0.2
Combined Surface and Subsurface Soil - Vapor Migration to Indoor Air	Table A.3.HHRA-24	NA	0.2
Sediment - Wading	NA	NA	NA
Surface Water - Wading	NA	NA	NA
TOTAL SITE RISKS (Adult Resident):		5E-05	0.4
Hypothetical Future Child Resident			
Combined Surface and Subsurface Soil - Direct Contact	Table A.3.HHRA-25	2E-04	2
Combined Surface and Subsurface Soil - Vapor Migration to Indoor Air	Table A.3.HHRA-26	NA	0.2
Sediment - Wading	NA	NA	NA
Surface Water - Wading	NA	NA	NA
TOTAL SITE RISKS (Child Resident):		2E-04	2
Hypothetical Future Aggregate Resident (Adult + Child)			
Combined Surface and Subsurface Soil - Direct Contact		3E-04	--
Combined Surface and Subsurface Soil - Vapor Migration to Indoor Air		NA	--
Sediment - Wading		NA	--
Surface Water - Wading		NA	--
TOTAL SITE RISKS (Aggregate Resident):		3E-04	--

Table A.3.ERA-1
Screening Level -Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Background Concentration [a] (mg/kg)	Ecological Screening Level (ESLs) [b] (mg/kg)		Maximum HQ [c] (unitless)	Bioaccumulative Chemical?[d] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [e]	
			Value	*Source*			(YES/no)	Rationale
Volatile Organic Compounds								
1,2,4-Trimethylbenzene	0.004	–	0.25462	*R5s*	0.02	no	no	HQ • 1
m,p-Xylene	0.003	–	10	*R5s*	0.0003	no	no	HQ • 1
Xylene	0.003	–	10	*R5*	0.0003	no	no	HQ • 1
Semi-Volatile Organic Compounds								
Carbazole	3.5	–	NA		NA	no	**YES**	**NSL**
Dibenzofuran	0.8	–	NA		NA	no	**YES**	**NSL**
Herbicides								
2,4-D	0.171	–	0.272	*R5*	0.6	no	no	HQ • 1
Dalapon	0.099	–	NA		NA	no	**YES**	**NSL**
Dicamba	0.00849	–	NA		NA	no	**YES**	**NSL**
MCPP	13.5	–	NA		NA	no	**YES**	**NSL**
Pesticides								
4,4'-DDD	0.0034	–	0.021	*EcoSSL*	0.2	YES	**YES**	**Bioaccumulative**
Methoxychlor	0.0291	–	0.0199	*R5*	1	YES	**YES**	**Bioaccumulative**
Polycyclic Aromatic Hydrocarbons								
1-Methylnaphthalene	0.0036	–	3.24	*R5s*	0.001	no	no	HQ • 1
2-Methylnaphthalene	5.1	–	3.24	*R5*	2	no	**YES**	**HQ > 1**
Acenaphthene	27	–	682	*R5*	0.04	YES	**YES**	**Bioaccumulative**
Acenaphthylene	0.31	–	682	*R5*	0.0005	YES	**YES**	**Bioaccumulative**
Anthracene	37	–	1,480	*R5*	0.03	YES	**YES**	**Bioaccumulative**
Benzo(a)anthracene	66	–	5.21	*R5*	10	YES	**YES**	**HQ > 1**
Benzo(a)pyrene	57	–	1.52	*R5*	40	YES	**YES**	**HQ > 1**
Benzo(b)fluoranthene	81	–	59.8	*R5*	1	YES	**YES**	**Bioaccumulative**
Benzo(g,h,i)perylene	38	–	119	*R5*	0.3	YES	**YES**	**Bioaccumulative**
Benzo(k)fluoranthene	26	–	148	*R5*	0.2	YES	**YES**	**Bioaccumulative**
Chrysene	61	–	4.73	*R5*	10	YES	**YES**	**HQ > 1**
Dibenzo(a,h)anthracene	9.9	–	18.4	*R5*	0.5	YES	**YES**	**Bioaccumulative**
Fluoranthene	180	–	122	*R5*	1	YES	**YES**	**Bioaccumulative**
Fluorene	28	–	122	*R5*	0.2	YES	**YES**	**Bioaccumulative**
Indeno(1,2,3-cd)pyrene	47	–	109	*R5*	0.4	YES	**YES**	**Bioaccumulative**
Naphthalene	29	–	0.0994	*R5*	300	no	**YES**	**HQ > 1**
Phenanthrene	160	–	45.7	*R5*	4	YES	**YES**	**HQ > 1**
Pyrene	130	–	78.5	*R5*	2	YES	**YES**	**HQ > 1**
Inorganics								
Aluminum	20,100	40,041	50	*ORNL*	400	no	no	max • BKGD
Antimony	0.33	NA	0.27	*EcoSSL*	1	no	no	HQ • 1
Arsenic	11.6	15.8	18	*EcoSSL*	0.6	YES	no	max • BKGD
Barium	78.7	209	330	*EcoSSL*	0.2	no	no	max • BKGD
Beryllium	1.5	1.02	21	*EcoSSL*	0.07	no	no	HQ • 1
Cadmium	0.1	0.69	0.36	*EcoSSL*	0.3	YES	no	max • BKGD
Calcium	2,560	NA	NA		NA	no	no	NT
Chromium	60.8	65.3	26	*EcoSSL*	2	YES	no	max • BKGD
Cobalt	446	72.3	13	*EcoSSL*	30	no	**YES**	**HQ > 1**
Copper	138	53.5	28	*EcoSSL*	5	YES	**YES**	**HQ > 1**

Table A.3.ERA-1
Screening Level -Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Background Concentration [a] (mg/kg)	Ecological Screening Level (ESLs) [b] (mg/kg)		Maximum HQ [c] (unitless)	Bioaccumulative Chemical?[d] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [e]	
			Value	*Source*			(YES/no)	Rationale
Iron	58,100	50,962	NA		NA	no	**YES**	**NSL**
Lead	336	26.8	11	*EcoSSL*	30	YES	**YES**	**HQ > 1**
Magnesium	13,500	NA	NA		NA	no	no	NT
Manganese	3,430	2,543	220	*EcoSSL*	20	no	**YES**	**HQ > 1**
Mercury	0.03	0.13	0.1	*R5*	0.3	no	no	max • BKGD
Nickel	41.3	62.8	38	*EcoSSL*	1	YES	no	max • BKGD
Potassium	3,980	NA	NA		NA	no	no	NT
Selenium	0.43	NA	0.52	*EcoSSL*	0.8	YES	**YES**	**Bioaccumulative**
Sodium	173	NA	NA		NA	no	no	NT
Thallium	0.51	2.11	0.05692	*R5*	9	no	no	max • BKGD
Vanadium	108	108	7.8	*EcoSSL*	10	no	no	max • BKGD
Zinc	178	202	46	*EcoSSL*	4	YES	no	max • BKGD

Notes:

– = Not available or applicable.
mg/kg = Milligrams per kilogram.
NA = Not available or applicable.

[a] Background levels for inorganics are facility-wide soil background point estimates taken from Facility-Wide Background Study Report (IT Corporation 2001).
[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[c] The maximum hazard quotient (HQ) is the ratio of the maximum constituent concentration to the surface soil screening level. HQs are rounded to one significant figure.
[d] Constituent was considered at bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment quality Assessment, Status and Needs, February 2000.
[e] Constituents with a hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for screening level assessment unless they were essential nutrients and thus considered non-toxic (NT), or were metals present at concentrations below background (max • BKGD).

Table A.3.ERA-2
Screening Level - Constituents of Potential Ecological Concern in Sediment
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Ecological Screening Level (ESLs) [a] (mg/kg)		Maximum HQ [b] (unitless)	Bioaccumulative Chemical?[c] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [d]	
		Value	*Source*			(YES/no)	Rationale
Volatile Organic Compounds							
Acetone	0.037	0.0099	*R5*	4	no	**YES**	**HQ > 1**
Carbon Disulfide	0.0015	0.000851	*R3*	2	no	**YES**	**HQ > 1**
Methylene Chloride	0.005	0.159	*R5*	0.03	no	no	HQ • 1
p-Isopropyltoluene	0.004	0.086	*R3s*	0.05	no	no	HQ • 1
Toluene	0.0027	1.22	*R5*	0.002	no	no	HQ • 1
Trichloroethene	0.003	0.0969	*R3*	0.03	no	no	HQ • 1
Semi-Volatile Organic Compounds							
4-Methylphenol	0.06	0.67	*R3*	0.09	no	no	HQ • 1
Di-n-Butylphthalate	0.09	6.47	*R3*	0.01	no	no	HQ • 1
Pesticides							
4,4'-DDD	0.00115	0.00488	*R3*	0.2	YES	**YES**	**Bioaccumulative**
4,4'-DDE	0.00212	0.00316	*R3*	0.7	YES	**YES**	**Bioaccumulative**
4,4'-DDT	0.00123	7	*ORNL*	0.0002	YES	**YES**	**Bioaccumulative**
BHC, delta-	0.0065	6.4	*R3*	0.001	YES	**YES**	**Bioaccumulative**
Chlordane, alpha-	0.00039	0.00324	*R3s*	0.1	YES	**YES**	**Bioaccumulative**
Dieldrin	0.00159	0.0019	*R3*	0.8	YES	**YES**	**Bioaccumulative**
Polycyclic Aromatic Hydrocarbons							
1-Methylnaphthalene	0.0048	0.0202	*R3s*	0.2	no	no	HQ • 1
2-Methylnaphthalene	0.074	0.0202	*R3*	4	no	**YES**	**HQ > 1**
Acenaphthene	0.24	0.0067	*R3*	40	YES	**YES**	**HQ > 1**
Acenaphthylene	0.0017	0.0059	*R3*	0.3	YES	**YES**	**Bioaccumulative**
Anthracene	0.41	0.0572	*R3*	7	YES	**YES**	**HQ > 1**
Benzo(a)anthracene	0.88	0.108	*R3*	8	YES	**YES**	**HQ > 1**
Benzo(a)pyrene	0.71	0.15	*R3*	5	YES	**YES**	**HQ > 1**
Benzo(b)fluoranthene	1.2	10.4	*R5*	0.1	YES	**YES**	**Bioaccumulative**
Benzo(g,h,i)perylene	0.28	0.17	*R3*	2	YES	**YES**	**HQ > 1**
Benzo(k)fluoranthene	0.37	0.24	*R3*	2	YES	**YES**	**HQ > 1**
Chrysene	0.8	0.166	*R3*	5	YES	**YES**	**HQ > 1**
Dibenzo(a,h)anthracene	0.076	0.033	*R3*	2	YES	**YES**	**HQ > 1**
Fluoranthene	2	0.423	*R3*	5	YES	**YES**	**HQ > 1**
Fluorene	0.24	0.0774	*R3*	3	YES	**YES**	**HQ > 1**
Indeno(1,2,3-cd)pyrene	0.36	0.017	*R3*	20	YES	**YES**	**HQ > 1**
Naphthalene	0.091	0.176	*R3*	0.5	no	no	HQ • 1
Phenanthrene	1.9	0.204	*R3*	9	YES	**YES**	**HQ > 1**
Pyrene	1.7	0.195	*R3*	9	YES	**YES**	**HQ > 1**
Inorganics							
Aluminum	20,200	58,000	*ARCS_PEC*	0.3	no	no	HQ • 1
Antimony	0.89	2	*R3*	0.4	no	no	HQ • 1
Arsenic	13.2	9.8	*R3*	1	YES	**YES**	**Bioaccumulative**
Barium	358	NA		NA	no	**YES**	**NSL**
Beryllium	1.3	NA		NA	no	**YES**	**NSL**
Calcium	98,600	NA		NA	no	no	NT
Chromium	73	43.4	*R3*	2	YES	**YES**	**HQ > 1**
Cobalt	27.6	50	*R3*	0.6	no	no	HQ • 1
Copper	15	31.6	*R3*	0.5	YES	**YES**	**Bioaccumulative**
Iron	56,200	20,000	*R3*	3	no	**YES**	**HQ > 1**

Table A.3.ERA-2
Screening Level - Constituents of Potential Ecological Concern in Sediment
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Ecological Screening Level (ESLs) [a] (mg/kg) Value	*Source*	Maximum HQ [b] (unitless)	Bioaccumulative Chemical?[c] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rationale
Lead	28.6	35.8	*R3*	0.8	YES	**YES**	**Bioaccumulative**
Magnesium	7,720	NA		NA	no	no	NT
Manganese	3,340	460	*R3*	7	no	**YES**	**HQ > 1**
Mercury	0.04	0.18	*R3*	0.2	no	no	HQ • 1
Nickel	20.8	22.7	*R3*	0.9	YES	**YES**	**Bioaccumulative**
Potassium	2,200	NA		NA	no	no	NT
Silver	0.86	1	*R3*	0.9	YES	**YES**	**Bioaccumulative**
Sodium	510	NA		NA	no	no	NT
Thallium	1.1	NA		NA	no	**YES**	**NSL**
Vanadium	75.7	NA		NA	no	**YES**	**NSL**
Zinc	51.9	121	*R3*	0.4	YES	**YES**	**Bioaccumulative**

Notes:
– = Not available or applicable.
mg/kg = Milligrams per kilogram.
NA = Not available or applicable.

[a] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[b] The maximum hazard quotient (HQ) is the ratio of the maximum constituent concentration to the sediment screening level. HQs are rounded to one significant figure.
[c] Constituent was considered at bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment quality Assessment, Statu: and Needs, February 2000.
[d] Constituents with a hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) f screening level assessment unless they were essential nutrients and thus considered non-toxic (NT), or were metals present at concentrations below background (max • BKGD).

Table A.3.ERA-3
Screening Level - Constituents of Potential Ecological Concern in Surface Water
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/L)	Ecological Screening Level (ESLs) [a] (mg/L)		Maximum HQ [b] (unitless)	Bioaccumulative Chemical?[c] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [d]	
		Value	*Source*			(YES/no)	Rationale
Volatile Organic Compounds							
Bromodichloromethane	0.023	NA		NA	no	**YES**	**NSL**
Carbon Disulfide	0.00034	0.00092	*R3*	0.4	no	no	HQ • 1
Chloroform	0.004	0.0018	*R3*	2	no	**YES**	**HQ > 1**
Semi-Volatile Organic Compounds							
Di-n-Butylphthalate	0.003	0.019	*R3*	0.2	no	no	HQ • 1
Pesticides							
4,4'-DDT	0.00000516	0.0000005	*R3*	10	YES	**YES**	**HQ > 1**
Dieldrin	0.00000591	0.000056	*R3*	0.1	YES	**YES**	**Bioaccumulative**
Endrin Ketone	0.00000599	0.000036	*R3s*	0.2	no	no	HQ • 1
Polycyclic Aromatic Hydrocarbons							
2-Methylnaphthalene	0.00013	0.0047	*R3*	0.03	no	no	HQ • 1
Acenaphthene	0.00005	0.0058	*R3*	0.009	YES	**YES**	**Bioaccumulative**
Acenaphthylene	0.00004	4.84	*R5*	0.000008	YES	**YES**	**Bioaccumulative**
Fluorene	0.00003	0.003	*R3*	0.01	YES	**YES**	**Bioaccumulative**
Naphthalene	0.00013	0.0011	*R3*	0.1	no	no	HQ • 1
Inorganics							
Aluminum	0.603	0.087	*R3*	7	no	**YES**	**HQ > 1**
Antimony	0.00074	0.03	*R3*	0.02	no	no	HQ • 1
Barium	0.0825	0.004	*R3*	20	no	**YES**	**HQ > 1**
Calcium	65	116	*R3*	NA	no	no	NT
Copper	0.0348	0.009	*R3*	4	YES	**YES**	**HQ > 1**
Iron	0.507	0.3	*R3*	2	no	**YES**	**HQ > 1**
Lead	0.0046	0.0025	*R3*	2	YES	**YES**	**HQ > 1**
Magnesium	17.4	82	*R3*	NA	no	no	NT
Manganese	0.0198	0.12	*R3*	0.2	no	no	HQ • 1
Nickel	0.0055	0.052	*R3*	0.1	YES	**YES**	**Bioaccumulative**
Potassium	3.67	NA		NA	no	no	NT
Silver	0.0021	0.0032	*R3*	0.7	YES	**YES**	**Bioaccumulative**
Sodium	35.3	680	*R3*	NA	no	no	NT
Thallium	0.0072	0.0008	*R3*	9	no	**YES**	**HQ > 1**
Zinc	0.0462	0.12	*R3*	0.4	YES	**YES**	**Bioaccumulative**

Notes:

– = Not available or applicable.
mg/L = Milligrams per liter.
NA = Not available or applicable.

[a] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.

[b] The maximum hazard quotient (HQ) is the ratio of the maximum constituent concentration to the surface water screening level. HQs are rounded to one significant figure.

[c] Constituent was considered at bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.

[d] Constituents with a hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for screening level assessment unless they were essential nutrients and thus considered non-toxic (NT), or were metals present at concentrations below background (max • BKGD).

Table A.3.ERA-4
Baseline Level - Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)		Ecological Screening Level (ESLs) [b] (mg/kg) Value	*Source*	Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rationale	Bioaccumulative ? [e] (YES/no)
Semi-Volatile Organic Compounds								
Carbazole	3.5	m	NA		NA	**YES**	**NSL**	no
Dibenzofuran	0.8	m	NA		NA	**YES**	**NSL**	no
Herbicides								
Dalapon	0.099	m	NA		NA	**YES**	**NSL**	no
Dicamba	0.00849	m	NA		NA	**YES**	**NSL**	no
MCPP	13.5	m	NA		NA	**YES**	**NSL**	no
Pesticides								
4,4'-DDD	0.0034	m	0.021	*EcoSSL*	0.2	**YES**	**Bioaccumulative**	**YES**
Methoxychlor	0.0291	m	0.0199	*R5*	1	**YES**	**Bioaccumulative**	**YES**
Polycyclic Aromatic Hydrocarbons								
2-Methylnaphthalene	1.233		3.24	*R5*	0.4	no	HQ • 1	no
Acenaphthene	7.14		682	*R5*	0.01	**YES**	**Bioaccumulative**	**YES**
Acenaphthylene	0.0469		682	*R5*	0.00007	**YES**	**Bioaccumulative**	**YES**
Anthracene	10.67		1,480	*R5*	0.007	**YES**	**Bioaccumulative**	**YES**
Benzo(a)anthracene	19.04		5.21	*R5*	4	**YES**	**HQ > 1**	**YES**
Benzo(a)pyrene	15.79		1.52	*R5*	10	**YES**	**HQ > 1**	**YES**
Benzo(b)fluoranthene	23.81		59.8	*R5*	0.4	**YES**	**Bioaccumulative**	**YES**
Benzo(g,h,i)perylene	9.622		119	*R5*	0.08	**YES**	**Bioaccumulative**	**YES**
Benzo(k)fluoranthene	7.473		148	*R5*	0.05	**YES**	**Bioaccumulative**	**YES**
Chrysene	18.1		4.73	*R5*	4	**YES**	**HQ > 1**	**YES**
Dibenzo(a,h)anthracene	1.235		18.4	*R5*	0.07	**YES**	**Bioaccumulative**	**YES**
Fluoranthene	53.96		122	*R5*	0.4	**YES**	**Bioaccumulative**	**YES**
Fluorene	7.328		122	*R5*	0.06	**YES**	**Bioaccumulative**	**YES**
Indeno(1,2,3-cd)pyrene	7.795		109	*R5*	0.07	**YES**	**Bioaccumulative**	**YES**
Naphthalene	6.839		0.0994	*R5*	70	**YES**	**HQ > 1**	no
Phenanthrene	47.5		45.7	*R5*	1	**YES**	**Bioaccumulative**	**YES**
Pyrene	39.71		78.5	*R5*	0.5	**YES**	**Bioaccumulative**	**YES**
Inorganics								
Cobalt	446	m	13	*EcoSSL*	30	**YES**	**HQ > 1**	no
Copper	138	m	28	*EcoSSL*	5	**YES**	**HQ > 1**	**YES**
Iron	58,100	m	NA		NA	**YES**	**NSL**	no
Lead	336	m	11	*EcoSSL*	30	**YES**	**HQ > 1**	**YES**
Manganese	3,430	m	220	*EcoSSL*	20	**YES**	**HQ > 1**	no
Selenium	0.43	m	0.52	*EcoSSL*	0.8	**YES**	**Bioaccumulative**	**YES**

Notes:

– =	Not available or applicable.
mg/kg =	Milligrams per kilogram.
NA =	Not available or applicable.
[a]	Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
[b]	See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[c]	The refined hazard quotient (HQ) is the ratio of the EPC to the surface soil screening level. HQs are rounded to one significant figure.
[d]	Constituents with a refined hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for baseline risk assessment.
[e]	Constituent was considered at bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment quality Assessment, Status and Needs, February 2000.

Table A.3.ERA-5
Baseline Level - Constituents of Potential Ecological Concern in Sediment
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)		Ecological Screening Level (ESLs) [b] (mg/kg) Value	*Source*	Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rationale	Bioaccumulative ? [e] (YES/no)
Volatile Organic Compounds								
Acetone	0.037	m	0.0099	*R5*	4	**YES**	**HQ > 1**	no
Carbon Disulfide	0.00142		0.000851	*R3*	2	**YES**	**HQ > 1**	no
Pesticides								
4,4'-DDD	0.00115	m	0.00488	*R3*	0.2	**YES**	**Bioaccumulative**	**YES**
4,4'-DDE	0.00212	m	0.00316	*R3*	0.7	**YES**	**Bioaccumulative**	**YES**
4,4'-DDT	0.00123	m	7	*ORNL*	0.0002	**YES**	**Bioaccumulative**	**YES**
BHC, delta-	0.0065	m	6.4	*R3*	0.001	**YES**	**Bioaccumulative**	**YES**
Chlordane, alpha-	0.00039	m	0.00324	*R3s*	0.1	**YES**	**Bioaccumulative**	**YES**
Dieldrin	0.00159	m	0.0019	*R3*	0.8	**YES**	**Bioaccumulative**	**YES**
Polycyclic Aromatic Hydrocarbons								
2-Methylnaphthalene	0.0303		0.0202	*R3*	2	**YES**	**HQ > 1**	no
Acenaphthene	0.0708		0.0067	*R3*	10	**YES**	**HQ > 1**	**YES**
Acenaphthylene	0.0017	m	0.0059	*R3*	0.3	**YES**	**Bioaccumulative**	**YES**
Anthracene	0.0911		0.0572	*R3*	2	**YES**	**HQ > 1**	**YES**
Benzo(a)anthracene	0.654		0.108	*R3*	6	**YES**	**HQ > 1**	**YES**
Benzo(a)pyrene	0.535		0.15	*R3*	4	**YES**	**HQ > 1**	**YES**
Benzo(b)fluoranthene	0.266		10.4	*R5*	0.03	**YES**	**Bioaccumulative**	**YES**
Benzo(g,h,i)perylene	0.0747		0.17	*R3*	0.4	**YES**	**Bioaccumulative**	**YES**
Benzo(k)fluoranthene	0.277		0.24	*R3*	1	**YES**	**Bioaccumulative**	**YES**
Chrysene	0.606		0.166	*R3*	4	**YES**	**HQ > 1**	**YES**
Dibenzo(a,h)anthracene	0.076	m	0.033	*R3*	2	**YES**	**HQ > 1**	**YES**
Fluoranthene	1.514		0.423	*R3*	4	**YES**	**HQ > 1**	**YES**
Fluorene	0.058		0.0774	*R3*	0.7	**YES**	**Bioaccumulative**	**YES**
Indeno(1,2,3-cd)pyrene	0.0891		0.017	*R3*	5	**YES**	**HQ > 1**	**YES**
Phenanthrene	1.443		0.204	*R3*	7	**YES**	**HQ > 1**	**YES**
Pyrene	1.293		0.195	*R3*	7	**YES**	**HQ > 1**	**YES**
Inorganics								
Arsenic	7.577		9.8	*R3*	0.8	**YES**	**Bioaccumulative**	**YES**
Barium	150.2		NA		NA	**YES**	**NSL**	no
Beryllium	1.073		NA		NA	**YES**	**NSL**	no
Chromium	46.05		43.4	*R3*	1	no	HQ • 1	no
Copper	12.93		31.6	*R3*	0.4	**YES**	**Bioaccumulative**	**YES**
Iron	32,855		20,000	*R3*	2	**YES**	**HQ > 1**	no
Lead	19	avg	35.8	*R3*	0.5	**YES**	**Bioaccumulative**	**YES**
Manganese	1,863		460	*R3*	4	**YES**	**HQ > 1**	no
Nickel	14.89		22.7	*R3*	0.7	**YES**	**Bioaccumulative**	**YES**
Silver	0.86	m	1	*R3*	0.9	**YES**	**Bioaccumulative**	**YES**
Thallium	0.45		NA		NA	**YES**	**NSL**	no
Vanadium	53.28		NA		NA	**YES**	**NSL**	no
Zinc	44.62		121	*R3*	0.4	**YES**	**Bioaccumulative**	**YES**

Table A.3.ERA-5
Baseline Level - Constituents of Potential Ecological Concern in Sediment
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:

– =	Not available or applicable.
mg/kg =	Milligrams per kilogram.
NA =	Not available or applicable.
[a]	Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
[b]	See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[c]	The refined hazard quotient (HQ) is the ratio of the EPC to the sediment screening level. HQs are rounded to one significant figure.
[d]	Constituents with a refined hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for baseline risk assessment.
[e]	Constituent was considered at bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment quality Assessment, Status and Needs, February 2000.

Table A.3.ERA-6
Sediment Polycyclic Aromatic Hydrocarbon Toxic Units
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant
Radford, Virginia

Location ID: **Sample Depth(Feet):** **Date Collected:**		**Final Chronic Value (FCV) [a]**	**BDDT-SE001 0 - 0.5 07/28/08**			**BDDT-SE002 0 - 0.5 07/28/08**			**BDDT-SE003 0 - 0.5 07/28/08**			**BDDT-SE004 0 - 0.5 07/28/08**		
			mg/kg_{sed}	**mg/kg_{TOC}**	**TU**	**mg/kg_{sed}**	**mg/kg_{TOC}**	**TU**	**mg/kg_{sed}**	**mg/kg_{TOC}**	**TU**	**mg/kg_{sed}**	**mg/kg_{TOC}**	**TU**
TOC [b]	**3.40%**													
2-Methylnaphthalene		446	<0.0044	6.5E-02	1.5E-04	<0.0045	6.6E-02	1.5E-04	<0.0048	7.1E-02	1.6E-04	0.0075	2.2E-01	4.9E-04
Acenaphthene		491	<0.0044	6.5E-02	1.3E-04	<0.0045	6.6E-02	1.3E-04	<0.0048	7.1E-02	1.4E-04	0.055	1.6E+00	3.3E-03
Acenaphthylene		452	<0.0044	6.5E-02	1.4E-04	<0.0045	6.6E-02	1.5E-04	<0.0048	7.1E-02	1.6E-04	<0.0062	9.1E-02	2.0E-04
Anthracene		594	<0.0044	6.5E-02	1.1E-04	<0.0045	6.6E-02	1.1E-04	<0.0048	7.1E-02	1.2E-04	0.083	2.4E+00	4.1E-03
Benzo(a)anthracene		841	<0.0044	6.5E-02	7.7E-05	<0.0045	6.6E-02	7.9E-05	0.0026	7.6E-02	9.1E-05	0.17	5.0E+00	5.9E-03
Benzo(a)pyrene		965	<0.0044	6.5E-02	6.7E-05	<0.0045	6.6E-02	6.9E-05	<0.0048	7.1E-02	7.3E-05	0.13	3.8E+00	4.0E-03
Benzo(b)fluoranthene		979	<0.0044	6.5E-02	6.6E-05	<0.0045	6.6E-02	6.8E-05	0.0041	1.2E-01	1.2E-04	0.17	5.0E+00	5.1E-03
Benzo(g,h,i)perylene		1095	<0.0044	6.5E-02	5.9E-05	<0.0045	6.6E-02	6.0E-05	<0.0048	7.1E-02	6.4E-05	0.086	2.5E+00	2.3E-03
Benzo(k)fluoranthene		981	<0.0044	6.5E-02	6.6E-05	<0.0045	6.6E-02	6.7E-05	0.0017	5.0E-02	5.1E-05	0.085	2.5E+00	2.5E-03
Chrysene		844	<0.0044	6.5E-02	7.7E-05	<0.0045	6.6E-02	7.8E-05	0.004	1.2E-01	1.4E-04	0.19	5.6E+00	6.6E-03
Dibenzo(a,h)anthracene		1123	<0.0044	6.5E-02	5.8E-05	<0.0045	6.6E-02	5.9E-05	<0.0048	7.1E-02	6.3E-05	0.026	7.6E-01	6.8E-04
Fluoranthene		707	<0.0044	6.5E-02	9.2E-05	<0.0045	6.6E-02	9.4E-05	0.0082	2.4E-01	3.4E-04	0.57	1.7E+01	2.4E-02
Fluorene		538	<0.0044	6.5E-02	1.2E-04	<0.0045	6.6E-02	1.2E-04	<0.0048	7.1E-02	1.3E-04	0.063	1.9E+00	3.4E-03
Indeno(1,2,3-cd)pyrene		1115	<0.0044	6.5E-02	5.8E-05	<0.0045	6.6E-02	5.9E-05	<0.0048	7.1E-02	6.3E-05	0.093	2.7E+00	2.5E-03
Naphthalene		385	<0.0044	6.5E-02	1.7E-04	<0.0045	6.6E-02	1.7E-04	<0.0048	7.1E-02	1.8E-04	0.021	6.2E-01	1.6E-03
Phenanthrene		596	<0.0044	6.5E-02	1.1E-04	<0.0045	6.6E-02	1.1E-04	0.0056	1.6E-01	2.8E-04	0.47	1.4E+01	2.3E-02
Pyrene		697	<0.0044	6.5E-02	9.3E-05	<0.0045	6.6E-02	9.5E-05	0.006	1.8E-01	2.5E-04	0.32	9.4E+00	1.4E-02
sum TU					0.002			0.002			0.002			0.103
Total TU [c]					0.005			0.005			0.007			0.3

Table A.3.ERA-6
Sediment Polycyclic Aromatic Hydrocarbon Toxic Units
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant
Radford, Virginia

Location ID: Sample Depth(Feet): Date Collected:	Final Chronic Value (FCV) [a]	DTSD01 0 - 0.5 07/17/98			DTSD01 0 - 0.5 08/17/98			DTSD02 0 - 0.5 07/17/98			DTSD02 0 - 0.5 08/17/98		
		mg/kg_{sed}	mg/kg_{TOC}	TU	mg/kg_{sed}	mg/kg_{TOC}	TU	mg/kg_{sed}	mg/kg_{TOC}	TU	mg/kg_{sed}	mg/kg_{TOC}	TU
TOC [b] 3.40%													
2-Methylnaphthalene	446	<0.50	7.4E+00	1.6E-02	<0.57	8.4E+00	1.9E-02	<0.58	8.5E+00	1.9E-02	<0.46	6.8E+00	1.5E-02
Acenaphthene	491	<0.030	4.4E-01	9.0E-04	<0.60	8.8E+00	1.8E-02	<0.020	2.9E-01	6.0E-04	<0.49	7.2E+00	1.5E-02
Acenaphthylene	452	<0.060	8.8E-01	2.0E-03	<1.2	1.8E+01	3.9E-02	<0.050	7.4E-01	1.6E-03	<0.97	1.4E+01	3.2E-02
Anthracene	594	<0.0031	4.6E-02	7.7E-05	<0.060	8.8E-01	1.5E-03	<0.0026	3.8E-02	6.4E-05	<0.040	5.9E-01	9.9E-04
Benzo(a)anthracene	841	<0.0031	4.6E-02	5.4E-05	0.01	2.9E-01	3.5E-04	<0.0026	3.8E-02	4.5E-05	<0.040	5.9E-01	7.0E-04
Benzo(a)pyrene	965	<0.0031	4.6E-02	4.7E-05	0.03	8.8E-01	9.1E-04	<0.0026	3.8E-02	4.0E-05	<0.040	5.9E-01	6.1E-04
Benzo(b)fluoranthene	979	<0.0061	9.0E-02	9.2E-05	<0.12	1.8E+00	1.8E-03	<0.0052	7.6E-02	7.8E-05	<0.090	1.3E+00	1.4E-03
Benzo(g,h,i)perylene	1095	<0.0061	9.0E-02	8.2E-05	<0.12	1.8E+00	1.6E-03	<0.0052	7.6E-02	7.0E-05	<0.090	1.3E+00	1.2E-03
Benzo(k)fluoranthene	981	<0.0031	4.6E-02	4.6E-05	<0.060	8.8E-01	9.0E-04	<0.0026	3.8E-02	3.9E-05	<0.040	5.9E-01	6.0E-04
Chrysene	844	<0.0031	4.6E-02	5.4E-05	0.02	5.9E-01	7.0E-04	0.0044	1.3E-01	1.5E-04	<0.040	5.9E-01	7.0E-04
Dibenzo(a,h)anthracene	1123	<0.0061	9.0E-02	8.0E-05	<0.12	1.8E+00	1.6E-03	<0.0052	7.6E-02	6.8E-05	<0.090	1.3E+00	1.2E-03
Fluoranthene	707	0.01	2.9E-01	4.2E-04	0.03	8.8E-01	1.2E-03	0.01	2.9E-01	4.2E-04	<0.090	1.3E+00	1.9E-03
Fluorene	538	<0.0061	9.0E-02	1.7E-04	<0.12	1.8E+00	3.3E-03	<0.0052	7.6E-02	1.4E-04	<0.090	1.3E+00	2.5E-03
Indeno(1,2,3-cd)pyrene	1115	<0.0031	4.6E-02	4.1E-05	<0.060	8.8E-01	7.9E-04	<0.0026	3.8E-02	3.4E-05	<0.040	5.9E-01	5.3E-04
Naphthalene	385	<0.030	4.4E-01	1.1E-03	<0.60	8.8E+00	2.3E-02	<0.020	2.9E-01	7.6E-04	<0.49	7.2E+00	1.9E-02
Phenanthrene	596	0.0049	1.4E-01	2.4E-04	0.04	1.2E+00	2.0E-03	0.0042	1.2E-01	2.1E-04	<0.040	5.9E-01	9.9E-04
Pyrene	697	0.01	2.9E-01	4.2E-04	0.02	5.9E-01	8.4E-04	0.01	2.9E-01	4.2E-04	<0.040	5.9E-01	8.4E-04
sum TU				0.022			0.116			0.024			0.094
Total TU [c]				0.06			0.3			0.07			0.3

Table A.3.ERA-6
Sediment Polycyclic Aromatic Hydrocarbon Toxic Units
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant
Radford, Virginia

Location ID: **Sample Depth(Feet):** **Date Collected:**		**Final Chronic Value (FCV) [a]**	**DTSD03 0 - 0.5 07/17/98**			**DTSD03 0 - 0.5 08/17/98**			**DTSD04 0 - 0.5 08/17/98**			**DTSW/SD05 0 - 0.5 06/20/02**		
			mg/kg_{sed}	**mg/kg_{TOC}**	**TU**	**mg/kg_{sed}**	**mg/kg_{TOC}**	**TU**	**mg/kg_{sed}**	**mg/kg_{TOC}**	**TU**	**mg/kg_{sed}**	**mg/kg_{TOC}**	**TU**
TOC [b]	**3.40%**													
2-Methylnaphthalene		446	<0.59	8.7E+00	1.9E-02	<0.47	6.9E+00	1.5E-02	<0.52	7.6E+00	1.7E-02	0.03	8.8E-01	2.0E-03
Acenaphthene		491	<0.020	2.9E-01	6.0E-04	<0.47	6.9E+00	1.4E-02	<0.50	7.4E+00	1.5E-02	0.13	3.8E+00	7.8E-03
Acenaphthylene		452	<0.050	7.4E-01	1.6E-03	<0.94	1.4E+01	3.1E-02	<1.0	1.5E+01	3.3E-02	<0.0068	1.0E-01	2.2E-04
Anthracene		594	<0.0028	4.1E-02	6.9E-05	<0.040	5.9E-01	9.9E-04	0.03	8.8E-01	1.5E-03	0.19	5.6E+00	9.4E-03
Benzo(a)anthracene		841	<0.0028	4.1E-02	4.9E-05	<0.040	5.9E-01	7.0E-04	0.03	8.8E-01	1.0E-03	0.41	1.2E+01	1.4E-02
Benzo(a)pyrene		965	<0.0028	4.1E-02	4.3E-05	<0.040	5.9E-01	6.1E-04	0.02	5.9E-01	6.1E-04	0.35	1.0E+01	1.1E-02
Benzo(b)fluoranthene		979	<0.0056	8.2E-02	8.4E-05	<0.090	1.3E+00	1.4E-03	<0.10	1.5E+00	1.5E-03	0.62	1.8E+01	1.9E-02
Benzo(g,h,i)perylene		1095	<0.0056	8.2E-02	7.5E-05	<0.090	1.3E+00	1.2E-03	0.04	1.2E+00	1.1E-03	0.17	5.0E+00	4.6E-03
Benzo(k)fluoranthene		981	<0.0028	4.1E-02	4.2E-05	<0.040	5.9E-01	6.0E-04	0.01	2.9E-01	3.0E-04	0.17	5.0E+00	5.1E-03
Chrysene		844	<0.0028	4.1E-02	4.9E-05	<0.040	5.9E-01	7.0E-04	0.09	2.6E+00	3.1E-03	0.4	1.2E+01	1.4E-02
Dibenzo(a,h)anthracene		1123	<0.0056	8.2E-02	7.3E-05	<0.090	1.3E+00	1.2E-03	<0.10	1.5E+00	1.3E-03	0.041	1.2E+00	1.1E-03
Fluoranthene		707	0.01	2.9E-01	4.2E-04	0.01	2.9E-01	4.2E-04	0.2	5.9E+00	8.3E-03	1	2.9E+01	4.2E-02
Fluorene		538	<0.0056	8.2E-02	1.5E-04	<0.090	1.3E+00	2.5E-03	<0.10	1.5E+00	2.7E-03	0.13	3.8E+00	7.1E-03
Indeno(1,2,3-cd)pyrene		1115	<0.0028	4.1E-02	3.7E-05	<0.040	5.9E-01	5.3E-04	0.04	1.2E+00	1.1E-03	0.2	5.9E+00	5.3E-03
Naphthalene		385	<0.020	2.9E-01	7.6E-04	<0.47	6.9E+00	1.8E-02	<0.50	7.4E+00	1.9E-02	0.053	1.6E+00	4.0E-03
Phenanthrene		596	0.0048	1.4E-01	2.4E-04	0.02	5.9E-01	9.9E-04	0.21	6.2E+00	1.0E-02	1	2.9E+01	4.9E-02
Pyrene		697	0.01	2.9E-01	4.2E-04	<0.040	5.9E-01	8.4E-04	0.1	2.9E+00	4.2E-03	0.94	2.8E+01	4.0E-02
sum TU					0.024			0.091			0.121			0.235
Total TU [c]					0.07			0.2			0.3			0.6

Table A.3.ERA-6
Sediment Polycyclic Aromatic Hydrocarbon Toxic Units
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant
Radford, Virginia

Location ID: Sample Depth(Feet): Date Collected:	**Final Chronic Value (FCV) [a]**	**DTSW/SD06 0 - 0.5 06/20/02**			**DTSW/SD07 0 - 0.5 06/20/02**			**DTSW/SD08 0 - 0.5 06/20/02**			**DTSW/SD09 0 - 0.5 06/20/02**		
		mg/kg_{sed}	**mg/kg_{TOC}**	**TU**	**mg/kg_{sed}**	**mg/kg_{TOC}**	**TU**	**mg/kg_{sed}**	**mg/kg_{TOC}**	**TU**	**mg/kg_{sed}**	**mg/kg_{TOC}**	**TU**
TOC [b] 3.40%													
2-Methylnaphthalene	446	0.025	7.4E-01	1.6E-03	0.019	5.6E-01	1.3E-03	0.0042	1.2E-01	2.8E-04	0.006	1.8E-01	4.0E-04
Acenaphthene	491	0.0025	7.4E-02	1.5E-04	0.0036	1.1E-01	2.2E-04	0.0018	5.3E-02	1.1E-04	0.0023	6.8E-02	1.4E-04
Acenaphthylene	452	0.0017	5.0E-02	1.1E-04	<0.0034	5.0E-02	1.1E-04	<0.0032	4.7E-02	1.0E-04	<0.0041	6.0E-02	1.3E-04
Anthracene	594	0.0044	1.3E-01	2.2E-04	0.0053	1.6E-01	2.6E-04	0.0023	6.8E-02	1.1E-04	0.0029	8.5E-02	1.4E-04
Benzo(a)anthracene	841	0.02	5.9E-01	7.0E-04	0.015	4.4E-01	5.2E-04	0.013	3.8E-01	4.5E-04	0.015	4.4E-01	5.2E-04
Benzo(a)pyrene	965	0.017	5.0E-01	5.2E-04	0.013	3.8E-01	4.0E-04	0.013	3.8E-01	4.0E-04	0.014	4.1E-01	4.3E-04
Benzo(b)fluoranthene	979	0.034	1.0E+00	1.0E-03	0.024	7.1E-01	7.2E-04	0.026	7.6E-01	7.8E-04	0.025	7.4E-01	7.5E-04
Benzo(g,h,i)perylene	1095	0.011	3.2E-01	3.0E-04	0.0069	2.0E-01	1.9E-04	0.0082	2.4E-01	2.2E-04	0.0088	2.6E-01	2.4E-04
Benzo(k)fluoranthene	981	0.013	3.8E-01	3.9E-04	0.008	2.4E-01	2.4E-04	0.0076	2.2E-01	2.3E-04	0.009	2.6E-01	2.7E-04
Chrysene	844	0.022	6.5E-01	7.7E-04	0.014	4.1E-01	4.9E-04	0.015	4.4E-01	5.2E-04	0.015	4.4E-01	5.2E-04
Dibenzo(a,h)anthracene	1123	0.0029	8.5E-02	7.6E-05	<0.0034	5.0E-02	4.5E-05	<0.0032	4.7E-02	4.2E-05	<0.0041	6.0E-02	5.4E-05
Fluoranthene	707	0.034	1.0E+00	1.4E-03	0.024	7.1E-01	1.0E-03	0.024	7.1E-01	1.0E-03	0.024	7.1E-01	1.0E-03
Fluorene	538	0.003	8.8E-02	1.6E-04	0.0038	1.1E-01	2.1E-04	0.0024	7.1E-02	1.3E-04	0.0028	8.2E-02	1.5E-04
Indeno(1,2,3-cd)pyrene	1115	0.012	3.5E-01	3.2E-04	0.008	2.4E-01	2.1E-04	0.0099	2.9E-01	2.6E-04	0.011	3.2E-01	2.9E-04
Naphthalene	385	0.024	7.1E-01	1.8E-03	0.024	7.1E-01	1.8E-03	0.014	4.1E-01	1.1E-03	0.014	4.1E-01	1.1E-03
Phenanthrene	596	0.034	1.0E+00	1.7E-03	0.022	6.5E-01	1.1E-03	0.012	3.5E-01	5.9E-04	0.013	3.8E-01	6.4E-04
Pyrene	697	0.035	1.0E+00	1.5E-03	0.027	7.9E-01	1.1E-03	0.025	7.4E-01	1.1E-03	0.025	7.4E-01	1.1E-03
sum TU				0.013			0.010			0.007			0.008
Total TU [c]				0.04			0.03			0.02			0.02

Table A.3.ERA-6
Sediment Polycyclic Aromatic Hydrocarbon Toxic Units
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant
Radford, Virginia

Location ID:		Final Chronic	DTSW/SD10		
Sample Depth(Feet):		Value	0 - 0.5		
Date Collected:		(FCV) [a]	06/20/02		
			mg/kg_{sed}	mg/kg_{TOC}	TU
TOC [b]	**3.40%**				
2-Methylnaphthalene		446	0.074	2.2E+00	4.9E-03
Acenaphthene		491	0.24	7.1E+00	1.4E-02
Acenaphthylene		452	<0.0061	9.0E-02	2.0E-04
Anthracene		594	0.41	1.2E+01	2.0E-02
Benzo(a)anthracene		841	0.88	2.6E+01	3.1E-02
Benzo(a)pyrene		965	0.71	2.1E+01	2.2E-02
Benzo(b)fluoranthene		979	1.2	3.5E+01	3.6E-02
Benzo(g,h,i)perylene		1095	0.28	8.2E+00	7.5E-03
Benzo(k)fluoranthene		981	0.37	1.1E+01	1.1E-02
Chrysene		844	0.8	2.4E+01	2.8E-02
Dibenzo(a,h)anthracene		1123	0.076	2.2E+00	2.0E-03
Fluoranthene		707	2	5.9E+01	8.3E-02
Fluorene		538	0.24	7.1E+00	1.3E-02
Indeno(1,2,3-cd)pyrene		1115	0.36	1.1E+01	9.5E-03
Naphthalene		385	0.091	2.7E+00	7.0E-03
Phenanthrene		596	1.9	5.6E+01	9.4E-02
Pyrene		697	1.7	5.0E+01	7.2E-02
sum TU					0.455
Total TU [c]					1

Notes:
mg/kg Milligrams per kilogram.
PAH Polycyclic aromatic hydrocarbons.
TU Toxic unit.
TOC Total organic carbon.

TU = (concentration (mg/kg_{sed}) / TOC / FCV) x UF (2.75).
An uncertainty factor (UF) of 2.75 was used. TUs > 1 are in bold font.

[a] Final chronic value from USEPA (2003f).
Sediment Benchmarks for the Protection of Benthic Organisms: PAHs)
[b] Total organic carbon ranged between 2.2% to 5.4% at the site with an average TOC of 3.4%.
TOC here was assumed equal to the average site TOC.
[c] Sum of Toxic Units (TU) based on the Final Chronic Value, including an uncertainty factor of 2.75. Sediments containing less than or equal to 1 total TUs are acceptable for the protection of benthic organisms. If the total TU is greater than 1, sensitive benthic organisms may be unacceptably affected.

Table A.3.ERA-7
Baseline Level - Constituents of Potential Ecological Concern in Surface Water
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	**Exposure Point Concentration [a] (mg/L)**		**Ecological Screening Level (ESLs) [b] (mg/L) Value**	***Source***	**Refined HQ [c] (unitless)**	**Baseline Level Constituent of Potential Ecological Concern? [d] (YES/no)**	**Rationale**	**Bioaccumulative ? [e] (YES/no)**
Volatile Organic Compounds								
Bromodichloromethane	0.023	m	NA		NA	**YES**	**NSL**	no
Chloroform	0.00237		0.0018	*R3*	1	no	HQ • 1	no
Pesticides								
4,4'-DDT	0.00000516	m	0.0000005	*R3*	10	**YES**	**HQ > 1**	**YES**
Dieldrin	0.00000591	m	0.000056	*R3*	0.1	**YES**	**Bioaccumulative**	**YES**
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	0.00005	m	0.0058	*R3*	0.009	**YES**	**Bioaccumulative**	**YES**
Acenaphthylene	0.00004	m	4.84	*R5*	0.000008	**YES**	**Bioaccumulative**	**YES**
Fluorene	0.00003	m	0.003	*R3*	0.01	**YES**	**Bioaccumulative**	**YES**
Inorganics								
Aluminum	0.391		0.087	*R3*	4	**YES**	**HQ > 1**	no
Barium	0.0733		0.004	*R3*	20	**YES**	**HQ > 1**	no
Copper	0.0239		0.009	*R3*	3	**YES**	**HQ > 1**	**YES**
Iron	0.278		0.3	*R3*	0.9	no	HQ • 1	no
Lead	0.00119	avg	0.0025	*R3*	0.5	**YES**	**Bioaccumulative**	**YES**
Nickel	0.0044		0.052	*R3*	0.08	**YES**	**Bioaccumulative**	**YES**
Silver	0.0021	m	0.0032	*R3*	0.7	**YES**	**Bioaccumulative**	**YES**
Thallium	0.0072	m	0.0008	*R3*	9	**YES**	**HQ > 1**	no
Zinc	0.0295		0.12	*R3*	0.2	**YES**	**Bioaccumulative**	**YES**

Notes:
– = Not available or applicable.
mg/L = Milligrams per liter.
NA = Not available or applicable.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[c] The refined hazard quotient (HQ) is the ratio of the EPC to the surface water screening level. HQs are rounded to one significant figure.
[d] Constituents with a refined hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for baseline risk assessment.
[e] Constituent was considered at bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment quality Assessment, Status and Needs, February 2000.

Table A.3.ERA-8
Maximum Scenario Food Chain Modeling for the Short-Tailed Shrew
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration [a] (mg/kg)	Soil Bioaccumulation Factors [b]	Estimated Dietary Tissue Concentrations [c] (mg/kg)	Maximum Estimated Dietary Ingestion [d]	Toxicity Reference Values [e] mg/kg-BW-day		Maximum Scenario HQ [f]	
		Invertebrate	Invertebrate	mg/kg-BW-day	LOAEL	NOAEL	LOAEL	NOAEL
Pesticides								
4,4'-DDD	3.4E-03	1.9E+00	6.5E-03	8.9E-04	8.52E+00	1.70E+00	0.0001	0.0005
Methoxychlor	2.9E-02	6.7E+00	2.0E-01	2.6E-02	1.70E+01	8.52E+00	0.002	0.003
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	2.7E+01	5.0E-01	1.4E+01	2.0E+00	2.02E+01	2.02E+00	0.1	1
Acenaphthylene	3.1E-01	5.0E-01	1.6E-01	2.3E-02	1.15E+02	1.15E+03	0.0002	0.00002
Anthracene	3.7E+01	1.0E-02	3.8E-01	4.2E-01	7.03E+03	7.03E+02	0.00006	0.0006
Benzo(a)anthracene	6.6E+01	2.5E-02	1.7E+00	8.7E-01	4.26E+00	4.26E-01	0.2	2
Benzo(a)pyrene	5.7E+01	6.8E-02	3.9E+00	1.1E+00	1.15E+01	1.15E+00	0.09	0.9
Benzo(b)fluoranthene	8.1E+01	5.1E-02	4.1E+00	1.3E+00	3.78E+01	1.51E+00	0.04	0.9
Benzo(g,h,i)perylene	3.8E+01	4.9E-02	1.9E+00	6.2E-01	1.15E+00	1.15E-01	0.5	5
Benzo(k)fluoranthene	2.6E+01	5.1E-02	1.3E+00	4.3E-01	3.78E+01	1.51E+00	0.01	0.3
Chrysene	6.1E+01	3.5E-02	2.1E+00	8.8E-01	2.11E+02	2.11E+01	0.004	0.04
Dibenzo(a,h)anthracene	9.9E+00	7.4E-02	7.3E-01	1.9E-01	1.28E-02	1.28E-03	20	200
Fluoranthene	1.8E+02	5.0E-01	9.0E+01	1.4E+01	8.52E+01	8.52E+00	0.2	2
Fluorene	2.8E+01	5.0E-01	1.4E+01	2.1E+00	3.20E+02	1.07E+02	0.007	0
Indeno(1,2,3-cd)pyrene	4.7E+01	8.4E-02	3.9E+00	9.8E-01	1.15E+00	1.15E-01	0.9	9
Phenanthrene	1.6E+02	2.4E-02	3.9E+00	2.1E+00	2.98E+01	2.98E+00	0.07	0.7
Pyrene	1.3E+02	1.8E-02	2.4E+00	1.6E+00	1.84E+01	1.84E+00	0.09	0.9
Inorganics								
Copper	1.4E+02	6.8E-02	9.4E+00	2.6E+00	4.73E+01	3.65E+01	0.05	0.07
Lead	3.4E+02	5.6E-02	1.9E+01	5.8E+00	1.70E+02	1.70E+01	0.03	0.3
Selenium	4.3E-01	3.9E-01	1.7E-01	2.6E-02	6.76E-01	4.10E-01	0.04	0.06

Notes:

HQ = Hazard Quotient.
LOAEL = Lowest observed adverse effect level.
mg/kg = Milligrams per kilogram.
mg/kg-BW-day = Milligrams per kilogram of body weight per day.
NOAEL = No observed adverse effect level.

[a] Maximum concentration detected in surface soil (mg/kg).
[b] See Table A.2-20 for sources of soil bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.
[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.
[e] See Table A.2-23 for sources of mammalian toxicity reference values.
[f] Maximum hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.3.ERA-9
Refined Scenario Food Chain Modeling for the Short-Tailed Shrew
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)		Soil Bioaccumulation Factors [b] Invertebrate	Vegetation	Mammal	Estimated Dietary Tissue Concentrations [c] (mg/kg) Invertebrate	Vegetation	Mammal	Refined Estimated Dietary Ingestion [d] mg/kg-BW-day	Toxicity Reference Values [e] mg/kg-BW-day LOAEL	NOAEL	Refined Scenario HQ [f] LOAEL	NOAEL
Pesticides													
4,4'-DDD	3.4E-03	m	1.9E+00	2.7E-03	2.9E-01	6.5E-03	9.1E-06	1.0E-03	7.6E-04	8.52E+00	1.70E+00	0.00009	0.0004
Methoxychlor	2.9E-02	m	6.7E+00	1.6E+00	6.2E-04	2.0E-01	4.6E-02	1.8E-05	2.3E-02	1.70E+01	8.52E+00	0.001	0.003
Polycyclic Aromatic Hydrocarbons													
Acenaphthene	7.1E+00		5.0E-01	4.2E-02	2.5E-03	3.6E+00	3.0E-01	1.8E-02	4.7E-01	2.02E+01	2.02E+00	0.02	0.2
Acenaphthylene	4.7E-02		5.0E-01	3.4E-02	3.5E-03	2.3E-02	1.6E-03	1.7E-04	3.1E-03	1.15E+02	1.15E+03	0.00003	0.000003
Anthracene	1.1E+01		1.0E-02	2.1E-02	8.5E-03	1.1E-01	2.2E-01	9.1E-02	1.2E-01	7.03E+03	7.03E+02	0.00002	0.0002
Benzo(a)anthracene	1.9E+01		2.5E-02	4.4E-03	1.2E-01	4.8E-01	8.4E-02	2.3E+00	2.6E-01	4.26E+00	4.26E-01	0.06	0.6
Benzo(a)pyrene	1.6E+01		6.8E-02	2.7E-03	2.9E-01	1.1E+00	4.2E-02	4.7E+00	3.0E-01	1.15E+01	1.15E+00	0.03	0.3
Benzo(b)fluoranthene	2.4E+01		5.1E-02	1.2E-03	1.1E+00	1.2E+00	2.9E-02	2.7E+01	5.2E-01	3.78E+01	1.51E+00	0.01	0.3
Benzo(g,h,i)perylene	9.6E+00		4.9E-02	6.1E-04	3.8E+00	4.7E-01	5.9E-03	3.7E+01	3.5E-01	1.15E+00	1.15E-01	0.3	3
Benzo(k)fluoranthene	7.5E+00		5.1E-02	1.2E-03	1.1E+00	3.8E-01	9.2E-03	8.4E+00	1.6E-01	3.78E+01	1.51E+00	0.004	0.1
Chrysene	1.8E+01		3.5E-02	4.5E-03	1.2E-01	6.3E-01	8.1E-02	2.2E+00	2.6E-01	2.11E+02	2.11E+01	0.001	0.01
Dibenzo(a,h)anthracene	1.2E+00		7.4E-02	1.6E-03	6.9E-01	9.1E-02	2.0E-03	8.5E-01	2.7E-02	1.28E-02	1.28E-03	2	20
Fluoranthene	5.4E+01		5.0E-01	7.4E-03	5.0E-02	2.7E+01	4.0E-01	2.7E+00	3.5E+00	8.52E+01	8.52E+00	0.04	0.4
Fluorene	7.3E+00		5.0E-01	3.2E-02	4.0E-03	3.7E+00	2.4E-01	2.9E-02	4.8E-01	3.20E+02	1.07E+02	0.002	0.005
Indeno(1,2,3-cd)pyrene	7.8E+00		8.4E-02	2.7E-04	1.5E+01	6.5E-01	2.1E-03	1.2E+02	8.1E-01	1.15E+00	1.15E-01	0.7	7
Phenanthrene	4.8E+01		2.4E-02	1.8E-02	1.1E-02	1.2E+00	8.4E-01	5.3E-01	6.1E-01	2.98E+01	2.98E+00	0.02	0.2
Pyrene	4.0E+01		1.8E-02	1.2E-02	2.3E-02	7.3E-01	4.6E-01	9.1E-01	4.9E-01	1.84E+01	1.84E+00	0.03	0.3
Inorganics													
Copper	1.4E+02	m	6.8E-02	8.0E-02	5.0E-01	9.4E+00	1.1E+01	6.9E+01	3.0E+00	4.73E+01	3.65E+01	0.06	0.08
Lead	3.4E+02	m	5.6E-02	9.0E-03	1.5E-02	1.9E+01	3.0E+00	5.0E+00	5.5E+00	1.70E+02	1.70E+01	0.03	0.3
Selenium	4.3E-01	m	3.9E-01	5.0E-03	7.5E-01	1.7E-01	2.2E-03	3.2E-01	2.5E-02	6.76E-01	4.10E-01	0.04	0.06

Notes:

HQ = Hazard Quotient.
LOAEL = Lowest observed adverse effect level.
mg/kg = Milligrams per kilogram.
mg/kg-BW-day = Milligrams per kilogram of body weight per day.
NOAEL = No observed adverse effect level.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
[b] See Table A.2-20 for sources of soil bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.
[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.
[e] See Table A.2-23 for sources of mammalian toxicity reference values.
[f] Refined hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.3.ERA-10
Maximum Scenario Food Chain Modeling for the American Robin
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration [a] (mg/kg)	Soil Bioaccumulation Factors [b] Invertebrate	Estimated Dietary Tissue Concentrations [c] (mg/kg) Invertebrate	Maximum Estimated Dietary Ingestion [d] mg/kg-BW-day	Toxicity Reference Values [e] mg/kg-BW-day LOAEL	Toxicity Reference Values [e] mg/kg-BW-day NOAEL	Maximum Scenario HQ [f] LOAEL	Maximum Scenario HQ [f] NOAEL
Pesticides								
4,4'-DDD	3.4E-03	1.9E+00	6.5E-03	8.8E-04	2.80E-02	2.80E-03	0.03	0.3
Methoxychlor	2.9E-02	6.7E+00	2.0E-01	2.6E-02	NA	NA	NA	NA
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	2.7E+01	5.0E-01	1.4E+01	2.1E+00	1.00E+02	1.00E+01	0.02	0.2
Acenaphthylene	3.1E-01	5.0E-01	1.6E-01	2.4E-02	1.00E+02	1.00E+01	0.0002	0.002
Anthracene	3.7E+01	1.0E-02	3.8E-01	5.2E-01	1.00E+02	1.00E+01	0.005	0.05
Benzo(a)anthracene	6.6E+01	2.5E-02	1.7E+00	1.0E+00	1.00E+02	1.00E+01	0.01	0.1
Benzo(a)pyrene	5.7E+01	6.8E-02	3.9E+00	1.2E+00	1.00E+02	1.00E+01	0.01	0.1
Benzo(b)fluoranthene	8.1E+01	5.1E-02	4.1E+00	1.6E+00	1.00E+02	1.00E+01	0.02	0.2
Benzo(g,h,i)perylene	3.8E+01	4.9E-02	1.9E+00	7.2E-01	1.00E+02	1.00E+01	0.007	0.07
Benzo(k)fluoranthene	2.6E+01	5.1E-02	1.3E+00	5.0E-01	1.00E+02	1.00E+01	0.005	0.05
Chrysene	6.1E+01	3.5E-02	2.1E+00	1.0E+00	1.00E+02	1.00E+01	0.01	0.1
Dibenzo(a,h)anthracene	9.9E+00	7.4E-02	7.3E-01	2.2E-01	1.00E+02	1.00E+01	0.002	0.02
Fluoranthene	1.8E+02	5.0E-01	9.0E+01	1.4E+01	1.00E+02	1.00E+01	0.1	1
Fluorene	2.8E+01	5.0E-01	1.4E+01	2.2E+00	1.00E+02	1.00E+01	0.02	0.2
Indeno(1,2,3-cd)pyrene	4.7E+01	8.4E-02	3.9E+00	1.1E+00	1.00E+02	1.00E+01	0.01	0.1
Phenanthrene	1.6E+02	2.4E-02	3.9E+00	2.5E+00	1.00E+02	1.00E+01	0.03	0.3
Pyrene	1.3E+02	1.8E-02	2.4E+00	2.0E+00	1.00E+02	1.00E+01	0.02	0.2
Inorganics								
Copper	1.4E+02	6.8E-02	9.4E+00	3.0E+00	6.17E+01	4.70E+01	0.05	0.06
Lead	3.4E+02	5.6E-02	1.9E+01	6.7E+00	3.85E+01	3.85E+00	0.2	2
Selenium	4.3E-01	3.9E-01	1.7E-01	2.7E-02	1.00E+00	5.00E-01	0.03	0.05

Notes:

HQ = Hazard Quotient.
LOAEL = Lowest observed adverse effect level.
mg/kg = Milligrams per kilogram.
mg/kg-BW-day = Milligrams per kilogram of body weight per day.
NOAEL = No observed adverse effect level.

[a] Maximum concentration detected in surface soil (mg/kg).
[b] See Table A.2-20 for sources of soil bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.
[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.
[e] See Table A.2-22 for sources of avian toxicity reference values.
[f] Maximum hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.3.ERA-11
Refined Scenario Food Chain Modeling for the American Robin
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)		Soil Bioaccumulation Factors [b]		Estimated Dietary Tissue Concentrations [c] (mg/kg)		Refined Estimated Dietary Ingestion [d]	Toxicity Reference Values [e] mg/kg-BW-day		Refined Scenario HQ [f]	
			Invertebrate	Vegetation	Invertebrate	Vegetation	mg/kg-BW-day	LOAEL	NOAEL	LOAEL	NOAEL
Pesticides											
4,4'-DDD	3.4E-03	m	1.9E+00	2.7E-03	6.5E-03	9.1E-06	3.0E-04	2.80E-02	2.80E-03	0.01	0.1
Methoxychlor	2.9E-02	m	6.7E+00	1.6E+00	2.0E-01	4.6E-02	1.2E-02	NA	NA	NA	NA
Polycyclic Aromatic Hydrocarbons											
Acenaphthene	7.1E+00		5.0E-01	4.2E-02	3.6E+00	3.0E-01	2.6E-01	1.00E+02	1.00E+01	0.003	0.03
Acenaphthylene	4.7E-02		5.0E-01	3.4E-02	2.3E-02	1.6E-03	1.7E-03	1.00E+02	1.00E+01	0.00002	0.0002
Anthracene	1.1E+01		1.0E-02	2.1E-02	1.1E-01	2.2E-01	1.6E-01	1.00E+02	1.00E+01	0.002	0.02
Benzo(a)anthracene	1.9E+01		2.5E-02	4.4E-03	4.8E-01	8.4E-02	2.7E-01	1.00E+02	1.00E+01	0.003	0.03
Benzo(a)pyrene	1.6E+01		6.8E-02	2.7E-03	1.1E+00	4.2E-02	2.5E-01	1.00E+02	1.00E+01	0.002	0.02
Benzo(b)fluoranthene	2.4E+01		5.1E-02	1.2E-03	1.2E+00	2.9E-02	3.5E-01	1.00E+02	1.00E+01	0.004	0.04
Benzo(g,h,i)perylene	9.6E+00		4.9E-02	6.1E-04	4.7E-01	5.9E-03	1.4E-01	1.00E+02	1.00E+01	0.001	0.01
Benzo(k)fluoranthene	7.5E+00		5.1E-02	1.2E-03	3.8E-01	9.2E-03	1.1E-01	1.00E+02	1.00E+01	0.001	0.01
Chrysene	1.8E+01		3.5E-02	4.5E-03	6.3E-01	8.1E-02	2.6E-01	1.00E+02	1.00E+01	0.003	0.03
Dibenzo(a,h)anthracene	1.2E+00		7.4E-02	1.6E-03	9.1E-02	2.0E-03	1.9E-02	1.00E+02	1.00E+01	0.0002	0.002
Fluoranthene	5.4E+01		5.0E-01	7.4E-03	2.7E+01	4.0E-01	1.8E+00	1.00E+02	1.00E+01	0.02	0.2
Fluorene	7.3E+00		5.0E-01	3.2E-02	3.7E+00	2.4E-01	2.6E-01	1.00E+02	1.00E+01	0.003	0.03
Indeno(1,2,3-cd)pyrene	7.8E+00		8.4E-02	2.7E-04	6.5E-01	2.1E-03	1.2E-01	1.00E+02	1.00E+01	0.001	0.01
Phenanthrene	4.8E+01		2.4E-02	1.8E-02	1.2E+00	8.4E-01	7.2E-01	1.00E+02	1.00E+01	0.007	0.07
Pyrene	4.0E+01		1.8E-02	1.2E-02	7.3E-01	4.6E-01	5.7E-01	1.00E+02	1.00E+01	0.006	0.06
Inorganics											
Copper	1.4E+02	m	6.8E-02	8.0E-02	9.4E+00	1.1E+01	3.1E+00	6.17E+01	4.70E+01	0.05	0.07
Lead	3.4E+02	m	5.6E-02	9.0E-03	1.9E+01	3.0E+00	5.3E+00	3.85E+01	3.85E+00	0.1	1
Selenium	4.3E-01	m	3.9E-01	5.0E-03	1.7E-01	2.2E-03	1.2E-02	1.00E+00	5.00E-01	0.01	0.02

Notes:

HQ = Hazard Quotient.
LOAEL = Lowest observed adverse effect level.
mg/kg = Milligrams per kilogram.
mg/kg-BW-day = Milligrams per kilogram of body weight per day.
NOAEL = No observed adverse effect level.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
[b] See Table A.2-20 for sources of soil bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.
[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.
[e] See Table A.2-22 for sources of avian toxicity reference values.
[f] Refined hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.3.ERA-12
Maximum Scenario Food Chain Modeling for the Mink
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration [a] Surface Water (mg/L)	Maximum Concentration [a] Sediment (mg/kg)	Sediment Bioaccumulation Factors (BAFsed) [b] Fish	Estimated Dietary Tissue Concentrations [c] (mg/kg) Fish	Maximum Estimated Dietary Ingestion [d] mg/kg-BW-day	Toxicity Reference Values [e] mg/kg-BW-day LOAEL	Toxicity Reference Values [e] mg/kg-BW-day NOAEL	Maximum Scenario HQ [f] LOAEL	Maximum Scenario HQ [f] NOAEL
Pesticides									
4,4'-DDT	5.2E-06	1.2E-03	1.3E+00	1.6E-03	9.0E-05	3.16E+00	6.32E-01	0.00003	0.0001
Dieldrin	5.9E-06	1.6E-03	3.9E+00	6.2E-03	4.0E-04	1.58E-01	1.58E-02	0.003	0.03
Polycyclic Aromatic Hydrocarbons									
Acenaphthene	5.0E-05	2.4E-01	3.1E-03	7.5E-04	5.0E-05	7.49E+00	7.49E-01	0.000007	0.00007
Acenaphthylene	4.0E-05	1.7E-03	3.1E-03	5.3E-06	5.0E-06	4.28E+01	4.28E+02	0.0000001	0.00000001
Fluorene	3.0E-05	2.4E-01	3.1E-03	7.5E-04	5.0E-05	1.19E+02	3.95E+01	0.0000004	0.000001
Inorganics									
Copper	3.5E-02	1.5E+01	1.0E+00	1.5E+01	9.0E-01	1.75E+01	1.36E+01	0.05	0.07
Lead	4.6E-03	2.9E+01	1.0E+00	2.9E+01	2.0E+00	6.32E+01	6.32E+00	0.03	0.3
Nickel	5.5E-03	2.1E+01	1.0E+00	2.1E+01	1.0E+00	6.32E+01	3.16E+01	0.02	0.03
Silver	2.1E-03	8.6E-01	1.0E+00	8.6E-01	5.0E-02	1.33E+02	1.33E+01	0.0004	0.004
Zinc	4.6E-02	5.2E+01	1.0E+00	5.2E+01	3.0E+00	2.41E+01	2.41E+00	0.1	1

Notes:

– = Not applicable.
HQ = Hazard Quotient.
LOAEL = Lowest observed adverse effect level.
mg/kg = Milligrams per kilogram.
mg/kg-BW-day = Milligrams per kilogram of body weight per day.
mg/L = Milligrams per liter.
NOAEL = No observed adverse effect level.

[a] Maximum concentrations detected in surface water (mg/L) and sediment (mg/kg).
[b] See Table A.2-21 for sources of sediment bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.
[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.
[e] See Table A.2-23 for sources of mammalian toxicity reference values.
[f] Maximum hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.3.ERA-13
Refined Scenario Food Chain Modeling for the Mink
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] Surface Water (mg/L)	Exposure Point Concentration [a] Sediment (mg/kg)	Sediment Bioaccumulation Factors (BAFsed) [b] Fish	Estimated Dietary Tissue Concentrations [c] (mg/kg) Fish	Refined Estimated Dietary Ingestion [d] mg/kg-BW-day	Toxicity Reference Values [e] mg/kg-BW-day LOAEL	Toxicity Reference Values [e] mg/kg-BW-day NOAEL	Refined Scenario HQ [f] LOAEL	Refined Scenario HQ [f] NOAEL
Pesticides									
4,4'-DDD	–	1.2E-03 m	1.5E+00	1.7E-03	1.0E-04	3.16E+00	6.32E-01	0.00003	0.0002
4,4'-DDE	–	2.1E-03 m	1.6E+01	3.5E-02	2.0E-03	3.16E+00	6.32E-01	0.0006	0.003
4,4'-DDT	5.2E-06 m	1.2E-03 m	1.3E+00	1.6E-03	9.0E-05	3.16E+00	6.32E-01	0.00003	0.0001
BHC, delta-	–	6.5E-03 m	NA	NA	NA	2.53E+00	1.26E+00	NA	NA
Chlordane, alpha-	–	3.9E-04 m	1.5E+00	5.7E-04	3.0E-05	1.96E+01	1.96E+00	0.000002	0.00002
Dieldrin	5.9E-06 m	1.6E-03 m	3.9E+00	6.2E-03	4.0E-04	1.58E-01	1.58E-02	0.003	0.03
Polycyclic Aromatic Hydrocarbons									
Acenaphthene	5.0E-05 m	7.1E-02	3.1E-03	2.2E-04	2.0E-05	7.49E+00	7.49E-01	0.000003	0.00003
Acenaphthylene	4.0E-05 m	1.7E-03 m	3.1E-03	5.3E-06	5.0E-06	4.28E+01	4.28E+02	0.0000001	0.00000001
Anthracene	–	9.1E-02	3.1E-03	2.8E-04	2.0E-05	2.61E+03	2.61E+02	0.000000008	0.00000008
Benzo(a)anthracene	–	6.5E-01	7.7E-03	5.0E-03	3.0E-04	1.58E+00	1.58E-01	0.0002	0.002
Benzo(a)pyrene	–	5.4E-01	7.7E-03	4.1E-03	2.0E-04	4.28E+00	4.28E-01	0.00005	0.0005
Benzo(b)fluoranthene	–	2.7E-01	7.7E-03	2.0E-03	1.0E-04	1.40E+01	5.60E-01	0.000007	0.0002
Benzo(g,h,i)perylene	–	7.5E-02	7.7E-03	5.7E-04	3.0E-05	4.28E-01	4.28E-02	0.00007	0.0007
Benzo(k)fluoranthene	–	2.8E-01	7.7E-03	2.1E-03	1.0E-04	1.40E+01	5.60E-01	0.000007	0.0002
Chrysene	–	6.1E-01	7.7E-03	4.6E-03	3.0E-04	7.83E+01	7.83E+00	0.000004	0.00004
Dibenzo(a,h)anthracene	–	7.6E-02 m	7.7E-03	5.8E-04	3.0E-05	4.74E-03	4.74E-04	0.006	0.06
Fluoranthene	–	1.5E+00	7.7E-03	1.2E-02	7.0E-04	3.16E+01	3.16E+00	0.00002	0.0002
Fluorene	3.0E-05 m	5.8E-02	3.1E-03	1.8E-04	1.0E-05	1.19E+02	3.95E+01	0.00000008	0.0000003
Indeno(1,2,3-cd)pyrene	–	8.9E-02	7.7E-03	6.8E-04	4.0E-05	4.28E-01	4.28E-02	0.00009	0.0009
Phenanthrene	–	1.4E+00	3.1E-03	4.5E-03	3.0E-04	1.11E+01	1.11E+00	0.00003	0.0003
Pyrene	–	1.3E+00	7.7E-03	9.9E-03	6.0E-04	6.84E+00	6.84E-01	0.00009	0.0009
Inorganics									
Arsenic	–	7.6E+00	1.0E+00	7.6E+00	4.0E-01	4.28E+00	4.28E-01	0.09	0.9
Copper	2.4E-02	1.3E+01	1.0E+00	1.3E+01	7.0E-01	1.75E+01	1.36E+01	0.04	0.05
Lead	1.2E-03 avg	1.9E+01 avg	1.0E+00	1.9E+01	1.0E+00	6.32E+01	6.32E+00	0.02	0.2
Nickel	4.4E-03	1.5E+01	1.0E+00	1.5E+01	9.0E-01	6.32E+01	3.16E+01	0.01	0.03
Silver	2.1E-03 m	8.6E-01 m	1.0E+00	8.6E-01	5.0E-02	1.33E+02	1.33E+01	0.0004	0.004
Zinc	3.0E-02	4.5E+01	1.0E+00	4.5E+01	3.0E+00	2.41E+01	2.41E+00	0.1	1

Table A.3.ERA-13
Refined Scenario Food Chain Modeling for the Mink
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:

– =	Not applicable.
HQ =	Hazard Quotient.
LOAEL =	Lowest observed adverse effect level.
mg/kg =	Milligrams per kilogram.
mg/kg-BW-day =	Milligrams per kilogram of body weight per day.
mg/L =	Milligrams per liter.
NOAEL =	No observed adverse effect level.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the refined concentration. EPCs marked with "m" are the maximum concentration.

[b] See Table A.2-21 for sources of sediment bioaccumulation factors.

[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.

[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.

[e] See Table A.2-23 for sources of mammalian toxicity reference values.

[f] Refined hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.3.ERA-14
Maximum Scenario Food Chain Modeling for the Great Blue Heron
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration [a] Surface Water (mg/L)	Maximum Concentration [a] Sediment (mg/kg)	Sediment Bioaccumulation Factors (BAFsed) [b] Fish	Estimated Dietary Tissue Concentrations [c] (mg/kg) Fish	Maximum Estimated Dietary Ingestion [d] mg/kg-BW-day	Toxicity Reference Values [e] mg/kg-BW-day LOAEL	Toxicity Reference Values [e] mg/kg-BW-day NOAEL	Maximum Scenario HQ [f] LOAEL	Maximum Scenario HQ [f] NOAEL
Pesticides									
4,4'-DDD	–	1.2E-03	1.5E+00	1.7E-03	9.0E-05	2.80E-02	2.80E-03	0.003	0.03
4,4'-DDE	–	2.1E-03	1.6E+01	3.5E-02	2.0E-03	2.80E-02	2.80E-03	0.07	0.7
4,4'-DDT	5.2E-06	1.2E-03	1.3E+00	1.6E-03	9.0E-05	2.80E-02	2.80E-03	0.003	0.03
BHC, delta-	–	6.5E-03	NA	NA	NA	2.25E+00	5.60E-01	NA	NA
Chlordane, alpha-	–	3.9E-04	1.5E+00	5.7E-04	3.0E-05	2.14E+01	2.14E+00	0.000001	0.00001
Dieldrin	5.9E-06	1.6E-03	3.9E+00	6.2E-03	3.0E-04	7.70E-01	7.70E-02	0.0004	0.004
Polycyclic Aromatic Hydrocarbons									
Acenaphthene	5.0E-05	2.4E-01	3.1E-03	7.5E-04	4.0E-05	1.00E+02	1.00E+01	0.0000004	0.000004
Acenaphthylene	4.0E-05	1.7E-03	3.1E-03	5.3E-06	1.0E-06	1.00E+02	1.00E+01	0.00000001	0.0000001
Anthracene	–	4.1E-01	3.1E-03	1.3E-03	7.0E-05	1.00E+02	1.00E+01	0.0000007	0.000007
Benzo(a)anthracene	–	8.8E-01	7.7E-03	6.7E-03	4.0E-04	1.00E+02	1.00E+01	0.000004	0.00004
Benzo(a)pyrene	–	7.1E-01	7.7E-03	5.4E-03	3.0E-04	1.00E+02	1.00E+01	0.000003	0.00003
Benzo(b)fluoranthene	–	1.2E+00	7.7E-03	9.2E-03	5.0E-04	1.00E+02	1.00E+01	0.000005	0.00005
Benzo(g,h,i)perylene	–	2.8E-01	7.7E-03	2.1E-03	1.0E-04	1.00E+02	1.00E+01	0.000001	0.00001
Benzo(k)fluoranthene	–	3.7E-01	7.7E-03	2.8E-03	2.0E-04	1.00E+02	1.00E+01	0.000002	0.00002
Chrysene	–	8.0E-01	7.7E-03	6.1E-03	3.0E-04	1.00E+02	1.00E+01	0.000003	0.00003
Dibenzo(a,h)anthracene	–	7.6E-02	7.7E-03	5.8E-04	3.0E-05	1.00E+02	1.00E+01	0.0000003	0.000003
Fluoranthene	–	2.0E+00	7.7E-03	1.5E-02	8.0E-04	1.00E+02	1.00E+01	0.000008	0.00008
Fluorene	3.0E-05	2.4E-01	3.1E-03	7.5E-04	4.0E-05	1.00E+02	1.00E+01	0.0000004	0.000004
Indeno(1,2,3-cd)pyrene	–	3.6E-01	7.7E-03	2.8E-03	2.0E-04	1.00E+02	1.00E+01	0.000002	0.00002
Phenanthrene	–	1.9E+00	3.1E-03	5.9E-03	3.0E-04	1.00E+02	1.00E+01	0.000003	0.00003
Pyrene	–	1.7E+00	7.7E-03	1.3E-02	7.0E-04	1.00E+02	1.00E+01	0.000007	0.00007
Inorganics									
Arsenic	–	1.3E+01	1.0E+00	1.3E+01	7.0E-01	1.28E+01	5.14E+00	0.05	0.1
Copper	3.5E-02	1.5E+01	1.0E+00	1.5E+01	8.0E-01	6.17E+01	4.70E+01	0.01	0.02
Lead	4.6E-03	2.9E+01	1.0E+00	2.9E+01	2.0E+00	3.85E+01	3.85E+00	0.05	0.5
Nickel	5.5E-03	2.1E+01	1.0E+00	2.1E+01	1.0E+00	1.07E+02	7.74E+01	0.009	0.01
Silver	2.1E-03	8.6E-01	1.0E+00	8.6E-01	5.0E-02	1.00E+00	5.00E-01	0.05	0.1
Zinc	4.6E-02	5.2E+01	1.0E+00	5.2E+01	3.0E+00	1.31E+02	1.45E+01	0.02	0.2

Table A.3.ERA-14
Maximum Scenario Food Chain Modeling for the Great Blue Heron
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:

– =	Not applicable.
HQ =	Hazard Quotient.
LOAEL =	Lowest observed adverse effect level.
mg/kg =	Milligrams per kilogram.
mg/kg-BW-day =	Milligrams per kilogram of body weight per day.
mg/L =	Milligrams per liter.
NA =	Not available.
NOAEL =	No observed adverse effect level.

[a] Maximum concentrations detected in surface water (mg/L) and sediment (mg/kg).
[b] See Table A.2-21 for sources of sediment bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.
[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.
[e] See Table A.2-22 for sources of avian toxicity reference values.
[f] Maximum hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.3.ERA-15
Refined Scenario Food Chain Modeling for the Great Blue Heron
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] Surface Water (mg/L)		Exposure Point Concentration [a] Sediment (mg/kg)		Sediment Bioaccumulation Factors (BAFsed) [b] Fish	Estimated Dietary Tissue Concentrations [c] (mg/kg) Fish	Refined Estimated Dietary Ingestion [d] mg/kg-BW-day	Toxicity Reference Values [e] mg/kg-BW-day LOAEL	Toxicity Reference Values [e] mg/kg-BW-day NOAEL	Refined Scenario HQ [f] LOAEL	Refined Scenario HQ [f] NOAEL
Pesticides											
4,4'-DDD	–		1.2E-03	m	1.5E+00	1.7E-03	9.0E-05	2.80E-02	2.80E-03	0.003	0.03
4,4'-DDE	–		2.1E-03	m	1.6E+01	3.5E-02	2.0E-03	2.80E-02	2.80E-03	0.07	0.7
4,4'-DDT	5.2E-06	m	1.2E-03	m	1.3E+00	1.6E-03	9.0E-05	2.80E-02	2.80E-03	0.003	0.03
BHC, delta-	–		6.5E-03	m	NA	NA	NA	2.25E+00	5.60E-01	NA	NA
Chlordane, alpha-	–		3.9E-04	m	1.5E+00	5.7E-04	3.0E-05	2.14E+01	2.14E+00	0.000001	0.00001
Dieldrin	5.9E-06	m	1.6E-03	m	3.9E+00	6.2E-03	3.0E-04	7.70E-01	7.70E-02	0.0004	0.004
Polycyclic Aromatic Hydrocarbons											
Acenaphthene	5.0E-05	m	7.1E-02		3.1E-03	2.2E-04	1.0E-05	1.00E+02	1.00E+01	0.0000001	0.000001
Acenaphthylene	4.0E-05	m	1.7E-03	m	3.1E-03	5.3E-06	1.0E-06	1.00E+02	1.00E+01	0.00000001	0.0000001
Anthracene	–		9.1E-02		3.1E-03	2.8E-04	2.0E-05	1.00E+02	1.00E+01	0.0000002	0.000002
Benzo(a)anthracene	–		6.5E-01		7.7E-03	5.0E-03	3.0E-04	1.00E+02	1.00E+01	0.000003	0.00003
Benzo(a)pyrene	–		5.4E-01		7.7E-03	4.1E-03	2.0E-04	1.00E+02	1.00E+01	0.000002	0.00002
Benzo(b)fluoranthene	–		2.7E-01		7.7E-03	2.0E-03	1.0E-04	1.00E+02	1.00E+01	0.000001	0.00001
Benzo(g,h,i)perylene	–		7.5E-02		7.7E-03	5.7E-04	3.0E-05	1.00E+02	1.00E+01	0.0000003	0.000003
Benzo(k)fluoranthene	–		2.8E-01		7.7E-03	2.1E-03	1.0E-04	1.00E+02	1.00E+01	0.000001	0.00001
Chrysene	–		6.1E-01		7.7E-03	4.6E-03	3.0E-04	1.00E+02	1.00E+01	0.000003	0.00003
Dibenzo(a,h)anthracene	–		7.6E-02	m	7.7E-03	5.8E-04	3.0E-05	1.00E+02	1.00E+01	0.0000003	0.000003
Fluoranthene	–		1.5E+00		7.7E-03	1.2E-02	7.0E-04	1.00E+02	1.00E+01	0.000007	0.00007
Fluorene	3.0E-05	m	5.8E-02		3.1E-03	1.8E-04	1.0E-05	1.00E+02	1.00E+01	0.0000001	0.000001
Indeno(1,2,3-cd)pyrene	–		8.9E-02		7.7E-03	6.8E-04	4.0E-05	1.00E+02	1.00E+01	0.0000004	0.000004
Phenanthrene	–		1.4E+00		3.1E-03	4.5E-03	2.0E-04	1.00E+02	1.00E+01	0.000002	0.00002
Pyrene	–		1.3E+00		7.7E-03	9.9E-03	5.0E-04	1.00E+02	1.00E+01	0.000005	0.00005
Inorganics											
Arsenic	–		7.6E+00		1.0E+00	7.6E+00	4.0E-01	1.28E+01	5.14E+00	0.03	0.08
Copper	2.4E-02		1.3E+01		1.0E+00	1.3E+01	7.0E-01	6.17E+01	4.70E+01	0.01	0.01
Lead	1.2E-03	avg	1.9E+01	avg	1.0E+00	1.9E+01	1.0E+00	3.85E+01	3.85E+00	0.03	0.3
Nickel	4.4E-03		1.5E+01		1.0E+00	1.5E+01	8.0E-01	1.07E+02	7.74E+01	0.007	0.01
Silver	2.1E-03	m	8.6E-01	m	1.0E+00	8.6E-01	5.0E-02	1.00E+00	5.00E-01	0.05	0.1
Zinc	3.0E-02		4.5E+01		1.0E+00	4.5E+01	2.0E+00	1.31E+02	1.45E+01	0.02	0.1

Table A.3.ERA-15
Refined Scenario Food Chain Modeling for the Great Blue Heron
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:

– =	Not applicable.
HQ =	Hazard Quotient.
LOAEL =	Lowest observed adverse effect level.
mg/kg =	Milligrams per kilogram.
mg/kg-BW-day =	Milligrams per kilogram of body weight per day.
mg/L =	Milligrams per liter.
NA =	Not available.
NOAEL =	No observed adverse effect level.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.

[b] See Table A.2-21 for sources of sediment bioaccumulation factors.

[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.

[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.

[e] See Table A.2-22 for sources of avian toxicity reference values.

[f] Refined hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.3.ERA-16
Summary of Ecological Risk Characterization Results - Terrestrial Habitat
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Soil Frequency of Detection # detects / n samples			Soil Frequency of Detection %	Soil EPC (mg/kg)		Baseline Level Assessment Hazard Quotient [a]	Baseline Level Assessment Ecological Screening Level [b] Source	Baseline Level Assessment Ecological Screening Level [b] Basis	Bioaccum-ulative ? (YES/no)	Results of Refined Food Chain Models [c] Short-tailed Shrew LOAEL HQ	Short-tailed Shrew NOAEL HQ	American Robin LOAEL HQ	American Robin NOAEL HQ
Semi-Volatile Organic Compounds														
Carbazole	4	-	4	100%	3.5	m	NA			no	–	–	–	–
Dibenzofuran	3	-	4	75%	0.8	m	NA			no	–	–	–	–
Herbicides														
Dalapon	1	-	1	100%	0.099	m	NA			no	–	–	–	–
Dicamba	1	-	1	100%	0.0085	m	NA			no	–	–	–	–
MCPP	1	-	1	100%	13.5	m	NA			no	–	–	–	–
Pesticides														
4,4'-DDD	1	-	1	100%	0.0034	m	0.2	EcoSSL	mam	YES	0.00009	0.0004	0.01	0.1
Methoxychlor	1	-	1	100%	0.0291	m	1	R5		YES	0.001	0.003	–	–
Polycyclic Aromatic Hydrocarbons														
Acenaphthene	35	-	63	56%	7.14		0.01	R5		YES	0.02	0.2	0.003	0.03
Acenaphthylene	20	-	63	32%	0.0469		0.00007	R5		YES	0.00003	0.000003	0.00002	0.0002
Anthracene	40	-	63	63%	10.67		0.007	R5		YES	0.00002	0.0002	0.002	0.02
Benzo(a)anthracene	45	-	63	71%	19.04		**4**	R5		YES	0.06	0.6	0.003	0.03
Benzo(a)pyrene	45	-	63	71%	15.79		**10**	R5		YES	0.03	0.3	0.002	0.02
Benzo(b)fluoranthene	50	-	63	79%	23.81		0.4	R5		YES	0.01	0.3	0.004	0.04
Benzo(g,h,i)perylene	44	-	63	70%	9.622		0.08	R5		YES	0.3	**3**	0.001	0.01
Benzo(k)fluoranthene	46	-	63	73%	7.473		0.05	R5		YES	0.004	0.1	0.001	0.01
Chrysene	45	-	63	71%	18.1		**4**	R5		YES	0.001	0.01	0.003	0.03
Dibenzo(a,h)anthracene	28	-	63	44%	1.235		0.07	R5		YES	**2**	**20**	0.0002	0.002
Fluoranthene	53	-	63	84%	53.96		0.4	R5		YES	0.04	0.4	0.02	0.2
Fluorene	34	-	63	54%	7.328		0.06	R5		YES	0.002	0.005	0.003	0.03
Indeno(1,2,3-cd)pyrene	42	-	63	67%	7.795		0.07	R5		YES	0.7	**7**	0.001	0.01
Naphthalene	21	-	63	33%	6.839		**70**	R5		no	–	–	–	–
Phenanthrene	49	-	63	78%	47.5		1	R5		YES	0.02	0.2	0.007	0.07
Pyrene	51	-	63	81%	39.71		0.5	R5		YES	0.03	0.3	0.006	0.06
Inorganics														
Cobalt	8	-	8	100%	446	m	**30**	EcoSSL	veg	no	–	–	–	–
Copper	8	-	8	100%	138	m	**5**	EcoSSL	avi	YES	0.06	0.08	0.05	0.07
Iron	8	-	8	100%	58,100	m	NA			no	–	–	–	–
Lead	8	-	8	100%	336	m	**30**	EcoSSL	avi	YES	0.03	0.3	0.1	1
Manganese	8	-	8	100%	3,430	m	**20**	EcoSSL	veg	no	–	–	–	–
Selenium	1	-	8	13%	0.43	m	0.8	EcoSSL	veg	YES	0.04	0.06	0.01	0.02

Table A.3.ERA-16
Summary of Ecological Risk Characterization Results - Terrestrial Habitat
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:

– =	Not applicable.
COPEC =	Constituent of Potential Ecological Concern.
EPC =	Exposure point concentrations - the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
LOAEL HQ =	Lowest observed adverse effect level hazard quotient.
mg/kg =	Milligrams per kilogram.
NA =	Not available.
NOAEL HQ =	No observed adverse effect level hazard quotient.
[a]	Hazard quotients (HQs) greater than one are presented in bold font. HQs are rounded to one significant figure (unitless).
[b]	See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate. R5: Region 5 Ecological Screening Levels (USEPA 2003e; R5). EcoSSL: USEPA Ecological Soil Screening Levels (USEPA 2005b; EcoSSL). Where readily available (i.e., EcoSSLs), the basis of the ESL is presented.
[c]	Foodchain modeling was conducted for bioaccumulative COPECs.

Table A.3.ERA-17

Summary of Ecological Risk Characterization Results - Aquatic Habitat

BUILDING DEBRIS DISPOSAL TRENCH

New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Sediment				Surface Water				Baseline Level Assessment			Results of Refined Food Chain Models [b]			
	Frequency of Detection		EPC		Frequency of Detection		EPC		Sediment Hazard Quotient	Surface Water Hazard Quotient	Bioaccum-ulative ?	Mink		Great Blue Heron	
	# detects / n samples	%	(mg/kg)		# detects / n samples	%	(mg/L)		[a]	[a]	(YES/no)	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ
Volatile Organic Compounds															
Acetone	5 - 13	38%	3.7E-02	m	0 - 13	0%	–		**4**	NA	no	–	–	–	–
Bromodichloromethane	0 - 13	0%	–		1 - 13	8%	2.3E-02	m	NA	NA	no	–	–	–	–
Carbon Disulfide	6 - 13	46%	1.4E-03		5 - 13	38%	–		**2**	NA	no	–	–	–	–
Pesticides															
4,4'-DDD	2 - 2	100%	1.2E-03	m	0 - 2	0%	–		0.2	NA	YES	0.00003	0.0002	0.003	0.03
4,4'-DDE	2 - 2	100%	2.1E-03	m	0 - 2	0%	–		0.7	NA	YES	0.0006	0.003	0.07	0.7
4,4'-DDT	2 - 2	100%	1.2E-03	m	1 - 2	50%	5.2E-06	m	0.0002	**10**	YES	0.00003	0.0001	0.003	0.03
BHC, delta-	1 - 2	50%	6.5E-03	m	0 - 2	0%	–		0.001	NA	YES	–	–	–	–
Chlordane, alpha-	2 - 2	100%	3.9E-04	m	0 - 2	0%	–		0.1	NA	YES	0.000002	0.00002	0.000001	0.00001
Dieldrin	2 - 2	100%	1.6E-03	m	2 - 2	100%	5.9E-06	m	0.8	0.1	YES	0.003	0.03	0.0004	0.004
Polycyclic Aromatic Hydrocarbons															
2-Methylnaphthalene	7 - 17	41%	3.0E-02		4 - 17	24%	–		**2**	NA	no	–	–	–	–
Acenaphthene	7 - 17	41%	7.1E-02		1 - 17	6%	5.0E-05	m	**10**	0.009	YES	0.000003	0.00003	0.0000001	0.000001
Acenaphthylene	1 - 17	6%	1.7E-03	m	1 - 17	6%	4.0E-05	m	0.3	0.000008	YES	0.0000001	1E-08	0.00000001	1E-07
Anthracene	8 - 17	47%	9.1E-02		0 - 17	0%	–		**2**	NA	YES	0.000000008	8E-08	0.0000002	0.000002
Benzo(a)anthracene	10 - 17	59%	6.5E-01		0 - 17	0%	–		**6**	NA	YES	0.0002	0.002	0.000003	0.00003
Benzo(a)pyrene	9 - 17	53%	5.4E-01		0 - 17	0%	–		**4**	NA	YES	0.00005	0.0005	0.000002	0.00002
Benzo(b)fluoranthene	8 - 17	47%	2.7E-01		0 - 17	0%	–		0.03	NA	YES	0.000007	0.0002	0.000001	0.00001
Benzo(g,h,i)perylene	8 - 17	47%	7.5E-02		0 - 17	0%	–		0.4	NA	YES	0.00007	0.0007	0.0000003	0.000003
Benzo(k)fluoranthene	9 - 17	53%	2.8E-01		0 - 17	0%	–		1	NA	YES	0.000007	0.0002	0.000001	0.00001
Chrysene	11 - 17	65%	6.1E-01		0 - 17	0%	–		**4**	NA	YES	0.000004	0.00004	0.000003	0.00003
Dibenzo(a,h)anthracene	4 - 17	24%	7.6E-02	m	0 - 17	0%	–		**2**	NA	YES	0.006	0.06	0.0000003	0.000003
Fluoranthene	14 - 17	82%	1.5E+00		0 - 17	0%	–		**4**	NA	YES	0.00002	0.0002	0.000007	0.00007
Fluorene	7 - 17	41%	5.8E-02		1 - 17	6%	3.0E-05	m	0.7	0.01	YES	0.00000008	0.0000003	0.0000001	0.000001
Indeno(1,2,3-cd)pyrene	8 - 17	47%	8.9E-02		0 - 17	0%	–		**5**	NA	YES	0.00009	0.0009	0.0000004	0.000004
Phenanthrene	14 - 17	82%	1.4E+00		0 - 17	0%	–		**7**	NA	YES	0.00003	0.0003	0.000002	0.00002
Pyrene	13 - 17	76%	1.3E+00		0 - 17	0%	–		**7**	NA	YES	0.00009	0.0009	0.000005	0.00005
Inorganics															
Aluminum	13 - 13	100%	–		13 - 13	100%	3.9E-01		NA	**4**	no	–	–	–	–
Arsenic	13 - 13	100%	7.6E+00		0 - 13	0%	–		0.8	NA	YES	0.09	0.9	0.03	0.08
Barium	13 - 13	100%	1.5E+02		13 - 13	100%	7.3E-02		NA	**20**	no	–	–	–	–
Beryllium	13 - 13	100%	1.1E+00		0 - 13	0%	–		NA	NA	no	–	–	–	–
Copper	13 - 13	100%	1.3E+01		7 - 13	54%	2.4E-02		0.4	**3**	YES	0.04	0.05	0.01	0.01
Iron	13 - 13	100%	3.3E+04		13 - 13	100%	–		**2**	NA	no	–	–	–	–
Lead	13 - 13	100%	1.9E+01	avg	8 - 13	62%	1.2E-03	avg	0.5	0.5	YES	0.02	0.2	0.03	0.3
Manganese	13 - 13	100%	1.9E+03		13 - 13	100%	–		**4**	NA	no	–	–	–	–
Nickel	13 - 13	100%	1.5E+01		7 - 13	54%	4.4E-03		0.7	0.08	YES	0.01	0.03	0.007	0.01
Silver	1 - 13	8%	8.6E-01	m	1 - 13	8%	2.1E-03	m	0.9	0.7	YES	0.0004	0.004	0.05	0.1
Thallium	9 - 13	69%	4.5E-01		4 - 13	31%	7.2E-03	m	NA	**9**	no	–	–	–	–
Vanadium	13 - 13	100%	5.3E+01		0 - 13	0%	–		NA	NA	no	–	–	–	–
Zinc	13 - 13	100%	4.5E+01		7 - 13	54%	3.0E-02		0.4	0.2	YES	0.1	1	0.02	0.1

Notes:

– =	Not applicable.
EPC =	Exposure point concentrations - the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration.
	EPCs marked with "m" are the maximum concentration.
LOAEL HQ =	Lowest observed adverse effect level hazard quotient.
mg/kg =	Milligrams per kilogram.
mg/L =	Milligrams per liter.
NOAEL HQ =	No observed adverse effect level hazard quotient.
[a]	Hazard quotients (HQs) greater than one are presented in bold font. HQs are rounded to one significant figure (unitless).
[b]	Foodchain modeling was conducted for bioaccumulative COPECs.

Table A.3.ERA-18
Summary of Ecological Risk Characterization Results - Terrestrial Habitat (Rip Rap)
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Compared Results of Refined Food Chain Models for BDDT Area and Rip-Rap BDDT Area [a]												
	EPC (mg/kg)				Short-tailed Shrew				American Robin			
	BDDT		Rip Rap Area		BDDT		Rip Rap Area		BDDT		Rip Rap Area	
Constituent					LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ
Semi-Volatile Organic Compounds												
Carbazole	3.5	m	6.3	m	–	–	–	–	–	–	–	–
Dibenzofuran	0.8	m	–		–	–	–	–	–	–	–	–
Herbicides												
Dalapon	0.099	m	–		–	–	–	–	–	–	–	–
Dicamba	0.0085	m	–		–	–	–	–	–	–	–	–
MCPP	13.5	m	–		–	–	–	–	–	–	–	–
Pesticides												
4,4'-DDD	0.0034	m	–		0.00009	0.0004	–	–	0.01	0.1	–	–
Methoxychlor	0.0291	m	–		0.001	0.003	–	–	–	–	–	–
Polycyclic Aromatic Hydrocarbons												
Acenaphthene	7.14		–		0.02	0.2	–	–	0.003	0.03	–	–
Acenaphthylene	0.0469		–		0.00003	0.000003	–	–	0.00002	0.0002	–	–
Anthracene	10.67		–		0.00002	0.0002	–	–	0.002	0.02	–	–
Benzo(a)anthracene	19.04		9.6	m	0.06	0.6	0.02	0.2	0.003	0.03	0.003	0.03
Benzo(a)pyrene	15.79		10		0.03	0.3	0.01	0.1	0.002	0.02	0.003	0.03
Benzo(b)fluoranthene	23.81		13		0.01	0.3	0.01	0.3	0.004	0.04	0.0007	0.02
Benzo(g,h,i)perylene	9.622		–		0.3	3	–	–	0.001	0.01	–	–
Benzo(k)fluoranthene	7.473		6		0.004	0.1	0.003	0.08	0.001	0.01	0.0003	0.008
Chrysene	18.1		11		0.001	0.01	0.0004	0.004	0.003	0.03	0.00009	0.0009
Dibenzo(a,h)anthracene	1.235		0.7		**2**	**20**	1	**10**	0.0002	0.002	0.2	**2**
Fluoranthene	53.96		–		0.04	0.4	–	–	0.02	0.2	–	–
Fluorene	7.328		–		0.002	0.005	–	–	0.003	0.03	–	–
Indeno(1,2,3-cd)pyrene	7.795		4.9		0.7	**7**	1	**10**	0.001	0.01	0.01	0.1
Naphthalene	6.839		–		–	–	–	–	–	–	–	–
Phenanthrene	47.5		–		0.02	0.2	–	–	0.007	0.07	–	–
Pyrene	39.71		–		0.03	0.3	–	–	0.006	0.06	–	–
Polychlorinated Biphenyls												
Inorganics												
Cobalt	446	m	–		–	–	–	–	–	–	–	–
Copper	138	m	–		0.06	0.08	–	–	0.05	0.07	–	–
Iron	58,100	m	–		–	–	–	–	–	–	–	–
Lead	336	m	–		0.03	0.3	–	–	0.1	1	–	–
Manganese	3430	m	–		–	–	–	–	–	–	–	–
Selenium	0.43	m	–		0.04	0.06	–	–	0.01	0.02	–	–

Table A.3.ERA-18
Summary of Ecological Risk Characterization Results - Terrestrial Habitat (Rip Rap)
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:

– =	Not applicable.
COPEC =	Constituent of Potential Ecological Concern.
EPC =	Exposure point concentrations - the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration.
	EPCs marked with "m" are the maximum concentration.
ESL	Ecological Screening Critiera.
FOD	Frequency of Detection.
LOAEL HQ =	Lowest observed adverse effect level hazard quotient.
mg/kg =	Milligrams per kilogram.
NA =	Not available.
NOAEL HQ =	No observed adverse effect level hazard quotient.
[a]	Foodchain modeling was conducted for bioaccumulative COPECs.

Table A.4.ERA-1
Screening Level -Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Background Concentration [a] (mg/kg)	Ecological Screening Level (ESLs) [b] (mg/kg) Value	*Source*	Maximum HQ [c] (unitless)	Bioaccumulative Chemical?[d] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [e] (YES/no)	Rationale
Volatile Organic Compounds								
2-Butanone	0.011	–	89.6	*R5*	0.0001	no	no	HQ • 1
3-Octanone	0.011	–	NA		NA	no	**YES**	**NSL**
4-Methyl-2-pentanone	0.0016	–	443	*R5*	0.000004	no	no	HQ • 1
Acetone	0.043	–	2.5	*R5*	0.02	no	no	HQ • 1
Carbon Disulfide	0.0031	–	0.09412	*R5*	0.03	no	no	HQ • 1
d-Limonene	0.057	–	NA		NA	no	**YES**	**NSL**
Methylene Chloride	0.0028	–	4.05	*R5*	0.0007	no	no	HQ • 1
Tetrachloroethene	0.00092	–	9.92	*R5*	0.00009	no	no	HQ • 1
Toluene	0.007	–	5.45	*R5*	0.001	no	no	HQ • 1
Semi-Volatile Organic Compounds								
2,4-Dinitrotoluene	3	–	1.28	*R5*	2	no	**YES**	**HQ > 1**
2,6-Dinitrotoluene	1.9	–	0.0328	*R5*	60	no	**YES**	**HQ > 1**
Benzoic Acid	0.3	–	NA		NA	no	**YES**	**NSL**
bis(2-Ethylhexyl)phthalate	0.57	–	0.92594	*R5*	0.6	no	no	HQ • 1
Carbazole	13	–	NA		NA	no	**YES**	**NSL**
Dibenzofuran	2.8	–	NA		NA	no	**YES**	**NSL**
Di-n-Butylphthalate	120	–	0.15	*R5*	800	no	**YES**	**HQ > 1**
N-Nitrosodiphenylamine	8.3	–	0.545	*R5*	20	no	**YES**	**HQ > 1**
Phenol	0.08	–	120	*R5*	0.0007	no	no	HQ • 1
Explosives								
1,3,5-Trinitrobenzene	0.07	–	0.376	*R5*	0.2	no	no	HQ • 1
1,3-Dinitrobenzene	0.05	–	0.655	*R5*	0.08	no	no	HQ • 1
2,4,6-Trinitrotoluene	0.06	–	NA		NA	no	**YES**	**NSL**
4-Amino-2,6-Dinitrotoluene	0.07	–	80	*T*	0.0009	no	no	HQ • 1
m-Nitrotoluene	2.86	–	NA		NA	no	**YES**	**NSL**
Nitroglycerine	0.21	–	NA		NA	no	**YES**	**NSL**
Pentaerythritol Tetranitrate	0.16	–	NA		NA	no	**YES**	**NSL**
Pesticides								
4,4'-DDD	0.043	–	0.021	*EcoSSL*	2	YES	**YES**	**HQ > 1**
4,4'-DDE	0.00086	–	0.021	*EcoSSL*	0.04	YES	**YES**	**Bioaccumulative**
BHC, beta-	0.00028	–	0.00398	*R5*	0.07	YES	**YES**	**Bioaccumulative**

Table A.4.ERA-1
Screening Level -Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Background Concentration [a] (mg/kg)	Ecological Screening Level (ESLs) [b] (mg/kg)		Maximum HQ [c] (unitless)	Bioaccumulative Chemical?[d] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [e]	
			Value	*Source*			(YES/no)	Rationale
Chlordane, alpha-	0.089	–	0.224	*R5*	0.4	YES	**YES**	**Bioaccumulative**
Chlordane, gamma-	0.01	–	0.224	*R5s*	0.04	no	no	HQ • 1
Endosulfan	0.022	–	NA		NA	no	**YES**	**NSL**
Endrin	0.00035	–	0.0101	*R5*	0.03	YES	**YES**	**Bioaccumulative**
Heptachlor Epoxide	0.015	–	0.152	*R5*	0.1	YES	**YES**	**Bioaccumulative**
Methoxychlor	0.0674	–	0.0199	*R5*	3	YES	**YES**	**HQ > 1**
Polycyclic Aromatic Hydrocarbons								
1-Methylnaphthalene	0.4	–	3.24	*R5s*	0.1	no	no	HQ • 1
2-Methylnaphthalene	0.58	–	3.24	*R5*	0.2	no	no	HQ • 1
Acenaphthene	12	–	682	*R5*	0.02	YES	**YES**	**Bioaccumulative**
Acenaphthylene	0.31	–	682	*R5*	0.0005	YES	**YES**	**Bioaccumulative**
Anthracene	22	–	1,480	*R5*	0.01	YES	**YES**	**Bioaccumulative**
Benzo(a)anthracene	46	–	5.21	*R5*	9	YES	**YES**	**HQ > 1**
Benzo(a)pyrene	39	–	1.52	*R5*	30	YES	**YES**	**HQ > 1**
Benzo(b)fluoranthene	68	–	59.8	*R5*	1	YES	**YES**	**Bioaccumulative**
Benzo(g,h,i)perylene	21	–	119	*R5*	0.2	YES	**YES**	**Bioaccumulative**
Benzo(k)fluoranthene	31	–	148	*R5*	0.2	YES	**YES**	**Bioaccumulative**
Chrysene	54	–	4.73	*R5*	10	YES	**YES**	**HQ > 1**
Dibenzo(a,h)anthracene	6.9	–	18.4	*R5*	0.4	YES	**YES**	**Bioaccumulative**
Fluoranthene	160	–	122	*R5*	1	YES	**YES**	**Bioaccumulative**
Fluorene	12	–	122	*R5*	0.1	YES	**YES**	**Bioaccumulative**
Indeno(1,2,3-cd)pyrene	25	–	109	*R5*	0.2	YES	**YES**	**Bioaccumulative**
Naphthalene	1.4	–	0.0994	*R5*	10	no	**YES**	**HQ > 1**
Phenanthrene	100	–	45.7	*R5*	2	YES	**YES**	**HQ > 1**
Pyrene	88	–	78.5	*R5*	1	YES	**YES**	**Bioaccumulative**
Polychlorinated Biphenyls								
Aroclor 1254	8.3	–	NA		NA	YES	**YES**	**Bioaccumulative**
Inorganics								
Aluminum	36,000	40,041	50	*ORNL*	700	no	no	max • BKGD
Antimony	8.1	NA	0.27	*EcoSSL*	30	no	**YES**	**HQ > 1**
Arsenic	58.4	15.8	18	*EcoSSL*	3	YES	**YES**	**HQ > 1**
Barium	11,100	209	330	*EcoSSL*	30	no	**YES**	**HQ > 1**
Beryllium	2.2	1.02	21	*EcoSSL*	0.1	no	no	HQ • 1
Cadmium	44.8	0.69	0.36	*EcoSSL*	100	YES	**YES**	**HQ > 1**
Calcium	191,000	NA	NA		NA	no	no	NT
Chromium	106	65.3	26	*EcoSSL*	4	YES	**YES**	**HQ > 1**
Cobalt	149	72.3	13	*EcoSSL*	10	no	**YES**	**HQ > 1**
Copper	72,000	53.5	28	*EcoSSL*	3000	YES	**YES**	**HQ > 1**
Iron	61,500	50,962	NA		NA	no	**YES**	**NSL**
Lead	58,000	26.8	11	*EcoSSL*	5000	YES	**YES**	**HQ > 1**
Magnesium	105,000	NA	NA		NA	no	no	NT
Manganese	3,080	2,543	220	*EcoSSL*	10	no	**YES**	**HQ > 1**

Table A.4.ERA-1
Screening Level -Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Background Concentration [a] (mg/kg)	Ecological Screening Level (ESLs) [b] (mg/kg)		Maximum HQ [c] (unitless)	Bioaccumulative Chemical?[d] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [e]	
			Value	*Source*			(YES/no)	Rationale
Mercury	16.8	0.13	0.1	*R5*	200	no	**YES**	**HQ > 1**
Nickel	148	62.8	38	*EcoSSL*	4	YES	**YES**	**HQ > 1**
Potassium	5,000	NA	NA		NA	no	no	NT
Selenium	1.9	NA	0.52	*EcoSSL*	4	YES	**YES**	**HQ > 1**
Silver	2.3	NA	4.2	*EcoSSL*	0.5	YES	**YES**	**Bioaccumulative**
Sodium	118	NA	NA		NA	no	no	NT
Thallium	0.78	2.11	0.05692	*R5*	10	no	no	max • BKGD
Vanadium	102	108	7.8	*EcoSSL*	10	no	no	max • BKGD
Zinc	12,500	202	46	*EcoSSL*	300	YES	**YES**	**HQ > 1**

Notes:

– = Not available or applicable.
mg/kg = Milligrams per kilogram.
NA = Not available or applicable.

[a] Background levels for inorganics are facility-wide soil background point estimates taken from Facility-Wide Background Study Report (IT Corporation 2001).
[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[c] The maximum hazard quotient (HQ) is the ratio of the maximum constituent concentration to the surface soil screening level. HQs are rounded to one significant figure.
[d] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment quality Assessment, Status and Needs, February 2000.
[e] (COPECs) for screening level assessment unless they were essential nutrients and thus considered non-toxic (NT), or were inorganics present at concentrations below background (max • BKGD).

Table A.4.ERA-2
Screening Level - Constituents of Potential Ecological Concern in Sediment
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Ecological Screening Level (ESLs) [a] (mg/kg) Value	*Source*	Maximum HQ [b] (unitless)	Bioaccumulative Chemical?[c] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rationale
Volatile Organic Compounds							
Acetone	0.028	0.0099	*R5*	3	no	**YES**	**HQ > 1**
Toluene	0.00096	1.22	*R5*	0.0008	no	no	HQ • 1
Semi-Volatile Organic Compounds							
bis(2-Ethylhexyl)phthalate	0.058	0.18	*R3*	0.3	no	no	HQ • 1
Pesticides							
4,4'-DDD	0.00073	0.00488	*R3*	0.1	YES	**YES**	**Bioaccumulative**
4,4'-DDE	0.00182	0.00316	*R3*	0.6	YES	**YES**	**Bioaccumulative**
4,4'-DDT	0.00077	7	*ORNL*	0.0001	YES	**YES**	**Bioaccumulative**
BHC, beta-	0.00029	0.005	*R3*	0.06	YES	**YES**	**Bioaccumulative**
Chlordane, alpha-	0.00038	0.00324	*R3s*	0.1	YES	**YES**	**Bioaccumulative**
Chlordane, gamma-	0.00041	0.00324	*R3s*	0.1	no	no	HQ • 1
Dieldrin	0.00094	0.0019	*R3*	0.5	YES	**YES**	**Bioaccumulative**
Polycyclic Aromatic Hydrocarbons							
2-Methylnaphthalene	0.0018	0.0202	*R3*	0.09	no	no	HQ • 1
Anthracene	0.0017	0.0572	*R3*	0.03	YES	**YES**	**Bioaccumulative**
Benzo(a)anthracene	0.013	0.108	*R3*	0.1	YES	**YES**	**Bioaccumulative**
Benzo(a)pyrene	0.012	0.15	*R3*	0.08	YES	**YES**	**Bioaccumulative**
Benzo(b)fluoranthene	0.019	10.4	*R5*	0.002	YES	**YES**	**Bioaccumulative**
Benzo(g,h,i)perylene	0.0071	0.17	*R3*	0.04	YES	**YES**	**Bioaccumulative**
Benzo(k)fluoranthene	0.0071	0.24	*R3*	0.03	YES	**YES**	**Bioaccumulative**
Chrysene	0.013	0.166	*R3*	0.08	YES	**YES**	**Bioaccumulative**
Dibenzo(a,h)anthracene	0.0021	0.033	*R3*	0.06	YES	**YES**	**Bioaccumulative**
Fluoranthene	0.019	0.423	*R3*	0.04	YES	**YES**	**Bioaccumulative**
Fluorene	0.0012	0.0774	*R3*	0.02	YES	**YES**	**Bioaccumulative**
Indeno(1,2,3-cd)pyrene	0.0081	0.017	*R3*	0.5	YES	**YES**	**Bioaccumulative**
Naphthalene	0.0021	0.176	*R3*	0.01	no	no	HQ • 1
Phenanthrene	0.009	0.204	*R3*	0.04	YES	**YES**	**Bioaccumulative**
Pyrene	0.019	0.195	*R3*	0.1	YES	**YES**	**Bioaccumulative**
Inorganics							
Aluminum	13,300	58,000	*ARCS_PEC*	0.2	no	no	HQ • 1
Antimony	0.37	2	*R3*	0.2	no	no	HQ • 1
Arsenic	4.6	9.8	*R3*	0.5	YES	**YES**	**Bioaccumulative**
Barium	77.2	NA		NA	no	**YES**	**NSL**
Beryllium	0.92	NA		NA	no	**YES**	**NSL**
Calcium	102,000	NA		NA	no	no	NT
Chromium	28.5	43.4	*R3*	0.7	YES	**YES**	**Bioaccumulative**
Cobalt	10.5	50	*R3*	0.2	no	no	HQ • 1
Copper	8.89	31.6	*R3*	0.3	YES	**YES**	**Bioaccumulative**
Iron	23,300	20,000	*R3*	1	no	no	HQ • 1
Lead	19.3	35.8	*R3*	0.5	YES	**YES**	**Bioaccumulative**

Table A.4.ERA-2
Screening Level - Constituents of Potential Ecological Concern in Sediment
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Ecological Screening Level (ESLs) [a] (mg/kg)		Maximum HQ [b] (unitless)	Bioaccumulative Chemical?[c] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [d]	
		Value	***Source***			**(YES/no)**	**Rationale**
Magnesium	9,810	NA		NA	no	no	NT
Manganese	681	460	*R3*	1	no	no	HQ • 1
Nickel	11.5	22.7	*R3*	0.5	YES	**YES**	**Bioaccumulative**
Potassium	1,310	NA		NA	no	no	NT
Sodium	83.6	NA		NA	no	no	NT
Thallium	0.29	NA		NA	no	**YES**	**NSL**
Vanadium	37.8	NA		NA	no	**YES**	**NSL**
Zinc	36	121	*R3*	0.3	YES	**YES**	**Bioaccumulative**

Notes:
– = Not available or applicable.
mg/kg = Milligrams per kilogram.
NA = Not available or applicable.

[a] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[b] The maximum hazard quotient (HQ) is the ratio of the maximum constituent concentration to the sediment screening level. HQs are rounded to one significant figure.
[c] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment quality Assessment, Status and Needs, February 2000.
[d] Constituents with a hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for screening level assessment unless they were essential nutrients and thus considered non-toxic (NT), or were inorganics present at concentrations below background (max • BKGD).

Table A.4.ERA-3
Screening Level - Constituents of Potential Ecological Concern in Surface Water
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	**Maximum Concentration (mg/L)**	**Ecological Screening Level (ESLs) [a] (mg/L)**		**Maximum HQ [b] (unitless)**	**Bioaccumulative Chemical?[c] (YES/no)**	**Screening Level Constituent of Potential Ecological Concern? [d]**	
		Value	***Source***			**(YES/no)**	**Rationale**
Volatile Organic Compounds							
Carbon Disulfide	0.00012	0.00092	*R3*	0.1	no	no	HQ • 1
Chloroform	0.00018	0.0018	*R3*	0.1	no	no	HQ • 1
Semi-Volatile Organic Compounds							
Butylbenzylphthalate	0.00044	0.019	*R3*	0.02	no	no	HQ • 1
Di-n-Butylphthalate	0.0009	0.019	*R3*	0.05	no	no	HQ • 1
Explosives							
m-Nitrotoluene	0.00043	0.75	*R3*	0.0006	no	no	HQ • 1
Herbicides							
2,4-D	0.00326	0.22	*R5*	0.01	no	no	HQ • 1
Pesticides							
Dieldrin	0.00000582	0.000056	*R3*	0.1	YES	**YES**	**Bioaccumulative**
Polycyclic Aromatic Hydrocarbons							
Benzo(a)anthracene	0.000024	0.000018	*R3*	1	YES	**YES**	**Bioaccumulative**
Benzo(b)fluoranthene	0.000025	0.00907	*R5*	0.003	YES	**YES**	**Bioaccumulative**
Chrysene	0.00003	0.000025	*R3s*	1	YES	**YES**	**Bioaccumulative**
Fluoranthene	0.000066	0.00004	*R3*	2	YES	**YES**	**HQ > 1**
Phenanthrene	0.000036	0.0004	*R3*	0.09	YES	**YES**	**Bioaccumulative**
Pyrene	0.000041	0.000025	*R3*	2	YES	**YES**	**HQ > 1**
Inorganics							
Aluminum	0.549	0.087	*R3*	6	no	**YES**	**HQ > 1**
Antimony	0.00077	0.03	*R3*	0.03	no	no	HQ • 1
Arsenic	0.01	0.005	*R3*	2	YES	**YES**	**HQ > 1**
Barium	0.0981	0.004	*R3*	20	no	**YES**	**HQ > 1**
Calcium	86.5	116	*R3*	NA	no	no	NT
Chromium	0.0027	0.085	*R3*	0.03	YES	**YES**	**Bioaccumulative**
Copper	0.828	0.009	*R3*	90	YES	**YES**	**HQ > 1**
Iron	0.742	0.3	*R3*	2	no	**YES**	**HQ > 1**
Lead	0.247	0.0025	*R3*	100	YES	**YES**	**HQ > 1**
Magnesium	496	82	*R3*	NA	no	no	NT
Manganese	0.377	0.12	*R3*	3	no	**YES**	**HQ > 1**
Mercury	0.0002	0.000026	*R3*	8	no	**YES**	**HQ > 1**
Potassium	146	NA		NA	no	no	NT
Selenium	0.00051	0.001	*R3*	0.5	YES	**YES**	**Bioaccumulative**
Sodium	107	680	*R3*	NA	no	no	NT
Zinc	0.116	0.12	*R3*	1	YES	**YES**	**Bioaccumulative**

Table A.4.ERA-3
Screening Level - Constituents of Potential Ecological Concern in Surface Water
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:

– = Not available or applicable.
mg/L = Milligrams per liter.
NA = Not available or applicable.

[a] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.

[b] The maximum hazard quotient (HQ) is the ratio of the maximum constituent concentration to the surface soil screening level. HQs are rounded to one significant figure.

[c] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment quality Assessment, Status and Needs, February 2000.

[d] Constituents with a hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for screening level assessment unless they were essential nutrients and thus considered non-toxic (NT), or were inorganics present at concentrations below background (max • BKGD).

Table A.4.ERA-4
Baseline Level - Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)		Ecological Screening Level (ESLs) [b] (mg/kg) Value	*Source*	Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rationale	Bioaccumulative ? [e] (YES/no)
Volatile Organic Compounds								
3-Octanone	0.011	m	NA		NA	**YES**	**NSL**	no
d-Limonene	0.057	m	NA		NA	**YES**	**NSL**	no
Semi-Volatile Organic Compounds								
2,4-Dinitrotoluene	0.648		1.28	*R5*	0.5	no	HQ • 1	no
2,6-Dinitrotoluene	1.9	m	0.0328	*R5*	60	**YES**	**HQ > 1**	no
Benzoic Acid	0.3	m	NA		NA	**YES**	**NSL**	no
Carbazole	11.99		NA		NA	**YES**	**NSL**	no
Dibenzofuran	2.604		NA		NA	**YES**	**NSL**	no
Di-n-Butylphthalate	29.36		0.15	*R5*	200	**YES**	**HQ > 1**	no
N-Nitrosodiphenylamine	8.3	m	0.545	*R5*	20	**YES**	**HQ > 1**	no
Explosives								
2,4,6-Trinitrotoluene	0.06	m	NA		NA	**YES**	**NSL**	no
m-Nitrotoluene	2.86	m	NA		NA	**YES**	**NSL**	no
Nitroglycerine	0.21	m	NA		NA	**YES**	**NSL**	no
Pentaerythritol Tetranitrate	0.16	m	NA		NA	**YES**	**NSL**	no
Pesticides								
4,4'-DDD	0.043	m	0.021	*EcoSSL*	2	**YES**	**HQ > 1**	**YES**
4,4'-DDE	0.00086	m	0.021	*EcoSSL*	0.04	**YES**	**Bioaccumulative**	**YES**
BHC, beta-	0.00028	m	0.00398	*R5*	0.07	**YES**	**Bioaccumulative**	**YES**
Chlordane, alpha-	0.089	m	0.224	*R5*	0.4	**YES**	**Bioaccumulative**	**YES**
Endosulfan	0.022	m	NA		NA	**YES**	**NSL**	**YES**
Endrin	0.00035	m	0.0101	*R5*	0.03	**YES**	**Bioaccumulative**	**YES**
Heptachlor Epoxide	0.015	m	0.152	*R5*	0.1	**YES**	**Bioaccumulative**	**YES**
Methoxychlor	0.0674	m	0.0199	*R5*	3	**YES**	**HQ > 1**	**YES**
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	4.763		682	*R5*	0.007	**YES**	**Bioaccumulative**	**YES**
Acenaphthylene	0.0728		682	*R5*	0.0001	**YES**	**Bioaccumulative**	**YES**
Anthracene	9.003		1,480	*R5*	0.006	**YES**	**Bioaccumulative**	**YES**
Benzo(a)anthracene	24.65		5.21	*R5*	5	**YES**	**HQ > 1**	**YES**
Benzo(a)pyrene	17.26		1.52	*R5*	10	**YES**	**HQ > 1**	**YES**
Benzo(b)fluoranthene	33.31		59.8	*R5*	0.6	**YES**	**Bioaccumulative**	**YES**
Benzo(g,h,i)perylene	13.05		119	*R5*	0.1	**YES**	**Bioaccumulative**	**YES**
Benzo(k)fluoranthene	14.82		148	*R5*	0.1	**YES**	**Bioaccumulative**	**YES**
Chrysene	29.95		4.73	*R5*	6	**YES**	**HQ > 1**	**YES**
Dibenzo(a,h)anthracene	3.297		18.4	*R5*	0.2	**YES**	**Bioaccumulative**	**YES**
Fluoranthene	92.29		122	*R5*	0.8	**YES**	**Bioaccumulative**	**YES**
Fluorene	4.686		122	*R5*	0.04	**YES**	**Bioaccumulative**	**YES**
Indeno(1,2,3-cd)pyrene	11.79		109	*R5*	0.1	**YES**	**Bioaccumulative**	**YES**
Naphthalene	0.194		0.0994	*R5*	2	**YES**	**HQ > 1**	no
Phenanthrene	53.49		45.7	*R5*	1	**YES**	**Bioaccumulative**	**YES**

Table A.4.ERA-4
Baseline Level - Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)	Ecological Screening Level (ESLs) [b] (mg/kg) Value	*Source*	Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rationale	Bioaccumulative ? [e] (YES/no)
Pyrene	56.42	78.5	*R5*	0.7	**YES**	**Bioaccumulative**	**YES**
Polychlorinated Biphenyls							
Aroclor 1254	2.155	NA		NA	**YES**	**NSL**	**YES**
Inorganics							
Antimony	1.236	0.27	*EcoSSL*	5	**YES**	**HQ > 1**	no
Arsenic	12.33	18	*EcoSSL*	0.7	**YES**	**Bioaccumulative**	**YES**
Barium	6,101	330	*EcoSSL*	20	**YES**	**HQ > 1**	no
Cadmium	14.42	0.36	*EcoSSL*	40	**YES**	**HQ > 1**	**YES**
Chromium	53.69	26	*EcoSSL*	2	**YES**	**HQ > 1**	no
Cobalt	34.68	13	*EcoSSL*	3	**YES**	**HQ > 1**	no
Copper	21,230	28	*EcoSSL*	800	**YES**	**HQ > 1**	**YES**
Iron	39,125	NA		NA	**YES**	**NSL**	no
Lead	15,706	11	*EcoSSL*	1,000	**YES**	**HQ > 1**	**YES**
Manganese	545.9	220	*EcoSSL*	2	**YES**	**HQ > 1**	no
Mercury	7.271	0.1	*R5*	70	**YES**	**HQ > 1**	no
Nickel	45.55	38	*EcoSSL*	1	**YES**	**Bioaccumulative**	**YES**
Selenium	0.857	0.52	*EcoSSL*	2	**YES**	**HQ > 1**	**YES**
Silver	0.971	4.2	*EcoSSL*	0.2	**YES**	**Bioaccumulative**	**YES**
Zinc	5,351	46	*EcoSSL*	100	**YES**	**HQ > 1**	**YES**

Notes:
– = Not available or applicable.
mg/kg = Milligrams per kilogram.
NA = Not available or applicable.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[c] The refined hazard quotient (HQ) is the ratio of the EPC to the surface soil screening level. HQs are rounded to one significant figure.
[d] Constituents with a refined hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for baseline risk assessment.
[e] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment quality Assessment, Status and Needs, February 2000.

Table A.4.ERA-5
Baseline Level - Constituents of Potential Ecological Concern in Sediment
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)		Ecological Screening Level (ESLs) [b] (mg/kg) Value	*Source*	Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rationale	Bioaccumulative ? [e] (YES/no)
Volatile Organic Compounds								
Acetone	0.028	m	0.0099	*R5*	3	**YES**	**HQ > 1**	no
Pesticides								
4,4'-DDD	0.00073	m	0.00488	*R3*	0.1	**YES**	**Bioaccumulative**	**YES**
4,4'-DDE	0.00182	m	0.00316	*R3*	0.6	**YES**	**Bioaccumulative**	**YES**
4,4'-DDT	0.00077	m	7	*ORNL*	0.0001	**YES**	**Bioaccumulative**	**YES**
BHC, beta-	0.00029	m	0.005	*R3*	0.06	**YES**	**Bioaccumulative**	**YES**
Chlordane, alpha-	0.00038	m	0.00324	*R3s*	0.1	**YES**	**Bioaccumulative**	**YES**
Dieldrin	0.00094	m	0.0019	*R3*	0.5	**YES**	**Bioaccumulative**	**YES**
Polycyclic Aromatic Hydrocarbons								
Anthracene	0.0017	m	0.0572	*R3*	0.03	**YES**	**Bioaccumulative**	**YES**
Benzo(a)anthracene	0.013	m	0.108	*R3*	0.1	**YES**	**Bioaccumulative**	**YES**
Benzo(a)pyrene	0.012	m	0.15	*R3*	0.08	**YES**	**Bioaccumulative**	**YES**
Benzo(b)fluoranthene	0.019	m	10.4	*R5*	0.002	**YES**	**Bioaccumulative**	**YES**
Benzo(g,h,i)perylene	0.0071	m	0.17	*R3*	0.04	**YES**	**Bioaccumulative**	**YES**
Benzo(k)fluoranthene	0.0071	m	0.24	*R3*	0.03	**YES**	**Bioaccumulative**	**YES**
Chrysene	0.013	m	0.166	*R3*	0.08	**YES**	**Bioaccumulative**	**YES**
Dibenzo(a,h)anthracene	0.0021	m	0.033	*R3*	0.06	**YES**	**Bioaccumulative**	**YES**
Fluoranthene	0.019	m	0.423	*R3*	0.04	**YES**	**Bioaccumulative**	**YES**
Fluorene	0.0012	m	0.0774	*R3*	0.02	**YES**	**Bioaccumulative**	**YES**
Indeno(1,2,3-cd)pyrene	0.0081	m	0.017	*R3*	0.5	**YES**	**Bioaccumulative**	**YES**
Phenanthrene	0.009	m	0.204	*R3*	0.04	**YES**	**Bioaccumulative**	**YES**
Pyrene	0.019	m	0.195	*R3*	0.1	**YES**	**Bioaccumulative**	**YES**
Inorganics								
Arsenic	4.6	m	9.8	*R3*	0.5	**YES**	**Bioaccumulative**	**YES**
Barium	77.2	m	NA		NA	**YES**	**NSL**	no
Beryllium	0.92	m	NA		NA	**YES**	**NSL**	no
Chromium	28.5	m	43.4	*R3*	0.7	no	HQ • 1	no
Copper	8.89	m	31.6	*R3*	0.3	**YES**	**Bioaccumulative**	**YES**
Lead	17	avg	35.8	*R3*	0.5	**YES**	**Bioaccumulative**	**YES**
Nickel	11.5	m	22.7	*R3*	0.5	**YES**	**Bioaccumulative**	**YES**
Thallium	0.29	m	NA		NA	**YES**	**NSL**	no
Vanadium	37.8	m	NA		NA	**YES**	**NSL**	no
Zinc	36	m	121	*R3*	0.3	**YES**	**Bioaccumulative**	**YES**

Table A.4.ERA-5
Baseline Level - Constituents of Potential Ecological Concern in Sediment
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:

– =	Not available or applicable.
mg/kg =	Milligrams per kilogram.
NA =	Not available or applicable.
[a]	Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
[b]	See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[c]	The refined hazard quotient (HQ) is the ratio of the EPC to the sediment screening level. HQs are rounded to one significant figure.
[d]	Constituents with a refined hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for baseline risk assessment.
[e]	Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment quality Assessment, Status and Needs, February 2000.

Table A.4.ERA-6
Baseline Level - Constituents of Potential Ecological Concern in Surface Water
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/L)		Ecological Screening Level (ESLs) [b] (mg/L) Value	*Source*	Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rationale	Bioaccumulative ? [e] (YES/no)
Pesticides								
Dieldrin	0.00000582	m	0.000056	*R3*	0.1	**YES**	**Bioaccumulative**	**YES**
Polycyclic Aromatic Hydrocarbons								
Benzo(a)anthracene	0.000024	m	0.000018	*R3*	1	**YES**	**Bioaccumulative**	**YES**
Benzo(b)fluoranthene	0.000025	m	0.00907	*R5*	0.003	**YES**	**Bioaccumulative**	**YES**
Chrysene	0.00003	m	0.000025	*R3s*	1	**YES**	**Bioaccumulative**	**YES**
Fluoranthene	0.000066	m	0.00004	*R3*	2	**YES**	**HQ > 1**	**YES**
Phenanthrene	0.000036	m	0.0004	*R3*	0.09	**YES**	**Bioaccumulative**	**YES**
Pyrene	0.000041	m	0.000025	*R3*	2	**YES**	**HQ > 1**	**YES**
Inorganics								
Aluminum	0.549	m	0.087	*R3*	6	**YES**	**HQ > 1**	no
Arsenic	0.01	m	0.005	*R3*	2	**YES**	**HQ > 1**	**YES**
Barium	0.0981	m	0.004	*R3*	20	**YES**	**HQ > 1**	no
Chromium	0.0027	m	0.085	*R3*	0.03	no	HQ • 1	no
Copper	0.828	m	0.009	*R3*	90	**YES**	**HQ > 1**	**YES**
Iron	0.742	m	0.3	*R3*	2	**YES**	**HQ > 1**	no
Lead	0.247	m	0.0025	*R3*	100	**YES**	**HQ > 1**	**YES**
Manganese	0.377	m	0.12	*R3*	3	**YES**	**HQ > 1**	no
Mercury	0.0002	m	0.000026	*R3*	8	**YES**	**HQ > 1**	no
Selenium	0.00051	m	0.001	*R3*	0.5	**YES**	**Bioaccumulative**	**YES**
Zinc	0.116	m	0.12	*R3*	1	**YES**	**Bioaccumulative**	**YES**

Notes:
– = Not available or applicable.
mg/L = Milligrams per liter.
NA = Not available or applicable.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[c] The refined hazard quotient (HQ) is the ratio of the EPC to the surface water screening level. HQs are rounded to one significant figure.
[d] Constituents with a refined hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for baseline risk assessment.
[e] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment quality Assessment, Status and Needs, February 2000.

Table A.4.ERA-7
Maximum Scenario Food Chain Modeling for the Short-Tailed Shrew
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration [a] (mg/kg)	Soil Bioconcentration Factors [b] Invertebrate	Estimated Dietary Tissue Concentrations [c] (mg/kg) Invertebrate	Maximum Estimated Dietary Ingestion [d] mg/kg-BW-day	Toxicity Reference Values [e] mg/kg-BW-day LOAEL	Toxicity Reference Values [e] mg/kg-BW-day NOAEL	Maximum Scenario HQ [f] LOAEL	Maximum Scenario HQ [f] NOAEL
Pesticides								
4,4'-DDD	4.3E-02	1.9E+00	8.3E-02	1.1E-02	8.52E+00	1.70E+00	0.001	0.006
4,4'-DDE	8.6E-04	1.9E+00	1.7E-03	2.3E-04	8.52E+00	1.70E+00	0.00003	0.0001
Chlordane, alpha-	8.9E-02	1.5E+00	1.3E-01	1.8E-02	5.28E+01	5.28E+00	0.0003	0.003
BHC, beta-	2.8E-04	1.5E+00	4.1E-04	5.7E-05	4.26E+00	8.52E-01	0.00001	0.00007
Endosulfan	2.2E-02	1.5E+00	3.2E-02	4.4E-03	3.20E+00	3.20E-01	0.001	0.01
Endrin	3.5E-04	1.5E+00	5.1E-04	7.0E-05	1.06E+00	1.06E-01	0.00007	0.0007
Heptachlor Epoxide	1.5E-02	1.5E+00	2.2E-02	3.0E-03	2.77E+00	2.77E-01	0.001	0.01
Methoxychlor	6.7E-02	6.7E+00	4.5E-01	6.0E-02	1.70E+01	8.52E+00	0.004	0.007
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	1.2E+01	5.0E-01	6.0E+00	9.1E-01	2.02E+01	2.02E+00	0.05	0.5
Acenaphthylene	3.1E-01	5.0E-01	1.6E-01	2.4E-02	1.15E+02	1.15E+03	0.0002	0.00002
Anthracene	2.2E+01	1.0E-02	2.2E-01	2.5E-01	7.03E+03	7.03E+02	0.00004	0.0004
Benzo(a)anthracene	4.6E+01	2.5E-02	1.2E+00	6.1E-01	4.26E+00	4.26E-01	0.1	1
Benzo(a)pyrene	3.9E+01	6.8E-02	2.7E+00	7.4E-01	1.15E+01	1.15E+00	0.06	0.6
Benzo(b)fluoranthene	6.8E+01	5.1E-02	3.4E+00	1.1E+00	3.78E+01	1.51E+00	0.03	0.7
Benzo(g,h,i)perylene	2.1E+01	4.9E-02	1.0E+00	3.4E-01	1.15E+00	1.15E-01	0.3	3
Benzo(k)fluoranthene	3.1E+01	5.1E-02	1.6E+00	5.2E-01	3.78E+01	1.51E+00	0.01	0.3
Chrysene	5.4E+01	3.5E-02	1.9E+00	7.8E-01	2.11E+02	2.11E+01	0.004	0.04
Dibenzo(a,h)anthracene	6.9E+00	7.4E-02	5.1E-01	1.4E-01	1.28E-02	1.28E-03	10	100
Fluoranthene	1.6E+02	5.0E-01	8.0E+01	1.2E+01	8.52E+01	8.52E+00	0.1	1
Fluorene	1.2E+01	5.0E-01	6.0E+00	9.1E-01	3.20E+02	1.07E+02	0.003	0.009
Indeno(1,2,3-cd)pyrene	2.5E+01	8.4E-02	2.1E+00	5.2E-01	1.15E+00	1.15E-01	0.5	5
Phenanthrene	1.0E+02	2.4E-02	2.4E+00	1.3E+00	2.98E+01	2.98E+00	0.04	0.4
Pyrene	8.8E+01	1.8E-02	1.6E+00	1.1E+00	1.84E+01	1.84E+00	0.06	0.6
Polychlorinated Biphenyls								
Aroclor 1254	8.3E+00	1.5E+00	1.3E+01	1.8E+00	7.84E-01	7.84E-02	2	20
Inorganics								
Arsenic	5.8E+01	3.9E-01	2.3E+01	3.6E+00	1.15E+01	1.15E+00	0.3	3
Cadmium	4.5E+01	2.8E+00	1.3E+02	1.8E+01	2.90E+00	2.90E-01	6	60
Copper	7.2E+04	6.8E-02	4.9E+03	1.4E+03	4.73E+01	3.65E+01	30	40
Lead	5.8E+04	5.6E-02	3.2E+03	9.9E+02	1.70E+02	1.70E+01	6	60
Nickel	1.5E+02	2.6E-02	3.8E+00	2.0E+00	1.70E+02	1.70E+01	0.01	0.1
Selenium	1.9E+00	3.9E-01	7.4E-01	1.2E-01	6.76E-01	4.10E-01	0.2	0.3
Silver	2.3E+00	3.9E-01	9.0E-01	1.4E-01	3.58E+02	3.58E+01	0.0004	0.004
Zinc	1.3E+04	3.9E-01	4.9E+03	7.7E+02	6.49E+01	6.49E+00	10	100

Notes:

HQ =	Hazard Quotient.
LOAEL =	Lowest observed adverse effect level.
mg/kg =	Milligrams per kilogram.
mg/kg-BW-day =	Milligrams per kilogram of body weight per day.
NOAEL =	No observed adverse effect level.

[a] Maximum concentration detected in surface soil (mg/kg).
[b] See Table A.2-20 for sources of soil bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.
[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.
[e] See Table A.2-23 for sources of mammalian toxicity reference values.
[f] Maximum hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.4.ERA-8
Refined Scenario Food Chain Modeling for the Short-Tailed Shrew
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)		Soil Bioconcentration Factors [b]			Estimated Dietary Tissue Concentrations [c] (mg/kg)			Refined Estimated Dietary Ingestion [d]	Toxicity Reference Values [e] mg/kg-BW-day		Refined Scenario HQ [f]	
			Invertebrate	Vegetation	Mammal	Invertebrate	Vegetation	Mammal	mg/kg-BW-day	LOAEL	NOAEL	LOAEL	NOAEL
Pesticides													
4,4'-DDD	4.3E-02	m	1.9E+00	2.7E-03	2.9E-01	8.3E-02	1.1E-04	1.3E-02	9.6E-03	8.52E+00	1.70E+00	0.001	0.006
4,4'-DDE	8.6E-04	m	1.9E+00	3.3E-03	2.0E-01	1.7E-03	2.8E-06	1.8E-04	2.0E-04	8.52E+00	1.70E+00	0.00002	0.0001
Chlordane, alpha-	8.9E-02	m	1.5E+00	2.6E-03	3.0E-01	1.3E-01	2.3E-04	2.7E-02	1.5E-02	5.28E+01	5.28E+00	0.0003	0.003
BHC, beta-	2.8E-04	m	1.5E+00	4.9E-02	1.9E-03	4.1E-04	1.4E-05	5.3E-07	4.8E-05	4.26E+00	8.52E-01	0.00001	0.00006
Endosulfan	2.2E-02	m	1.5E+00	6.9E-02	1.1E-03	3.2E-02	1.5E-03	2.4E-05	3.8E-03	3.20E+00	3.20E-01	0.001	0.01
Endrin	3.5E-04	m	1.5E+00	1.8E-02	1.1E-02	5.1E-04	6.3E-06	3.8E-06	6.0E-05	1.06E+00	1.06E-01	0.00006	0.0006
Heptachlor Epoxide	1.5E-02	m	1.5E+00	5.6E-03	8.3E-02	2.2E-02	8.3E-05	1.2E-03	2.6E-03	2.77E+00	2.77E-01	0.0009	0.009
Methoxychlor	6.7E-02	m	6.7E+00	1.6E+00	6.2E-04	4.5E-01	1.1E-01	4.1E-05	5.2E-02	1.70E+01	8.52E+00	0.003	0.006
Polycyclic Aromatic Hydrocarbons													
Acenaphthene	4.8E+00		5.0E-01	4.2E-02	2.5E-03	2.4E+00	2.0E-01	1.2E-02	3.1E-01	2.02E+01	2.02E+00	0.02	0.2
Acenaphthylene	7.3E-02		5.0E-01	3.4E-02	3.5E-03	3.6E-02	2.5E-03	2.6E-04	4.7E-03	1.15E+02	1.15E+03	0.00004	0.000004
Anthracene	9.0E+00		1.0E-02	2.1E-02	8.5E-03	9.2E-02	1.9E-01	7.6E-02	1.0E-01	7.03E+03	7.03E+02	0.00001	0.0001
Benzo(a)anthracene	2.5E+01		2.5E-02	4.4E-03	1.2E-01	6.2E-01	1.1E-01	3.0E+00	3.3E-01	4.26E+00	4.26E-01	0.08	0.8
Benzo(a)pyrene	1.7E+01		6.8E-02	2.7E-03	2.9E-01	1.2E+00	4.6E-02	5.1E+00	3.3E-01	1.15E+01	1.15E+00	0.03	0.3
Benzo(b)fluoranthene	3.3E+01		5.1E-02	1.2E-03	1.1E+00	1.7E+00	4.1E-02	3.7E+01	7.3E-01	3.78E+01	1.51E+00	0.02	0.5
Benzo(g,h,i)perylene	1.3E+01		4.9E-02	6.1E-04	3.8E+00	6.4E-01	8.0E-03	5.0E+01	4.8E-01	1.15E+00	1.15E-01	0.4	4
Benzo(k)fluoranthene	1.5E+01		5.1E-02	1.2E-03	1.1E+00	7.5E-01	1.8E-02	1.7E+01	3.3E-01	3.78E+01	1.51E+00	0.009	0.2
Chrysene	3.0E+01		3.5E-02	4.5E-03	1.2E-01	1.0E+00	1.3E-01	3.6E+00	4.3E-01	2.11E+02	2.11E+01	0.002	0.02
Dibenzo(a,h)anthracene	3.3E+00		7.4E-02	1.6E-03	6.9E-01	2.4E-01	5.4E-03	2.3E+00	7.2E-02	1.28E-02	1.28E-03	6	60
Fluoranthene	9.2E+01		5.0E-01	7.4E-03	5.0E-02	4.6E+01	6.9E-01	4.6E+00	6.0E+00	8.52E+01	8.52E+00	0.07	0.7
Fluorene	4.7E+00		5.0E-01	3.2E-02	4.0E-03	2.3E+00	1.5E-01	1.9E-02	3.0E-01	3.20E+02	1.07E+02	0.0009	0.003
Indeno(1,2,3-cd)pyrene	1.2E+01		8.4E-02	2.7E-04	1.5E+01	9.9E-01	3.2E-03	1.8E+02	1.2E+00	1.15E+00	1.15E-01	1	10
Phenanthrene	5.3E+01		2.4E-02	1.8E-02	1.1E-02	1.3E+00	9.5E-01	6.0E-01	6.9E-01	2.98E+01	2.98E+00	0.02	0.2
Pyrene	5.6E+01		1.8E-02	1.2E-02	2.3E-02	1.0E+00	6.6E-01	1.3E+00	6.9E-01	1.84E+01	1.84E+00	0.04	0.4
Polychlorinated Biphenyls													
Aroclor 1254	2.2E+00		1.5E+00	1.4E-03	8.9E-01	3.3E+00	3.0E-03	1.9E+00	4.0E-01	7.84E-01	7.84E-02	0.5	5
Inorganics													
Arsenic	1.2E+01		3.9E-01	8.0E-03	1.0E-01	4.8E+00	9.9E-02	1.2E+00	6.6E-01	1.15E+01	1.15E+00	0.06	0.6
Cadmium	1.4E+01		2.8E+00	1.1E-01	2.8E-02	4.1E+01	1.6E+00	4.0E-01	4.7E+00	2.90E+00	2.90E-01	2	20
Copper	2.1E+04		6.8E-02	8.0E-02	5.0E-01	1.4E+03	1.7E+03	1.1E+04	4.5E+02	4.73E+01	3.65E+01	10	10
Lead	1.6E+04		5.6E-02	9.0E-03	1.5E-02	8.8E+02	1.4E+02	2.4E+02	2.6E+02	1.70E+02	1.70E+01	2	20
Nickel	4.6E+01		2.6E-02	1.2E-02	3.0E-01	1.2E+00	5.5E-01	1.4E+01	6.7E-01	1.70E+02	1.70E+01	0.004	0.04
Selenium	8.6E-01		3.9E-01	5.0E-03	7.5E-01	3.3E-01	4.3E-03	6.4E-01	4.8E-02	6.76E-01	4.10E-01	0.07	0.1
Silver	9.7E-01		3.9E-01	8.0E-02	1.5E-01	3.8E-01	7.8E-02	1.5E-01	5.3E-02	3.58E+02	3.58E+01	0.0001	0.001
Zinc	5.4E+03		3.9E-01	3.0E-01	5.0E+00	2.1E+03	1.6E+03	2.7E+04	4.6E+02	6.49E+01	6.49E+00	7	70

Table A.4.ERA-8
Refined Scenario Food Chain Modeling for the Short-Tailed Shrew
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:

HQ =	Hazard Quotient.
LOAEL =	Lowest observed adverse effect level.
mg/kg =	Milligrams per kilogram.
NA =	Not applicable.
NOAEL =	No observed adverse effect level.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.

[b] See Table A.2-20 for sources of soil bioaccumulation factors.

[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.

[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.

[e] See Table A.2-23 for sources of mammalian toxicity reference values.

[f] Refined hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.4.ERA-9
Maximum Scenario Food Chain Modeling for the American Robin
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration [a] (mg/kg)	Soil Bioconcentration Factors [b] Invertebrate	Estimated Dietary Tissue Concentrations [c] (mg/kg) Invertebrate	Maximum Estimated Dietary Ingestion [d] mg/kg-BW-day	Toxicity Reference Values [e] mg/kg-BW-day LOAEL	Toxicity Reference Values [e] mg/kg-BW-day NOAEL	Maximum Scenario HQ [f] LOAEL	Maximum Scenario HQ [f] NOAEL
Pesticides								
4,4'-DDD	4.3E-02	1.9E+00	8.3E-02	1.1E-02	2.80E-02	2.80E-03	0.4	4
4,4'-DDE	8.6E-04	1.9E+00	1.7E-03	2.3E-04	2.80E-02	2.80E-03	0.008	0.08
Chlordane, alpha-	8.9E-02	1.5E+00	1.3E-01	1.8E-02	2.14E+01	2.14E+00	0.0008	0.008
BHC, beta-	2.8E-04	1.5E+00	4.1E-04	5.6E-05	2.25E+00	5.60E-01	0.00002	0.0001
Endosulfan	2.2E-02	1.5E+00	3.2E-02	4.4E-03	1.00E+02	1.00E+01	0.00004	0.0004
Endrin	3.5E-04	1.5E+00	5.1E-04	7.0E-05	3.00E+00	3.00E-01	0.00002	0.0002
Heptachlor Epoxide	1.5E-02	1.5E+00	2.2E-02	3.0E-03	NA	NA	NA	NA
Methoxychlor	6.7E-02	6.7E+00	4.5E-01	5.9E-02	NA	NA	NA	NA
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	1.2E+01	5.0E-01	6.0E+00	9.2E-01	1.00E+02	1.00E+01	0.009	0.09
Acenaphthylene	3.1E-01	5.0E-01	1.6E-01	2.4E-02	1.00E+02	1.00E+01	0.0002	0.002
Anthracene	2.2E+01	1.0E-02	2.2E-01	3.1E-01	1.00E+02	1.00E+01	0.003	0.03
Benzo(a)anthracene	4.6E+01	2.5E-02	1.2E+00	7.4E-01	1.00E+02	1.00E+01	0.007	0.07
Benzo(a)pyrene	3.9E+01	6.8E-02	2.7E+00	8.4E-01	1.00E+02	1.00E+01	0.008	0.08
Benzo(b)fluoranthene	6.8E+01	5.1E-02	3.4E+00	1.3E+00	1.00E+02	1.00E+01	0.01	0.1
Benzo(g,h,i)perylene	2.1E+01	4.9E-02	1.0E+00	3.9E-01	1.00E+02	1.00E+01	0.004	0.04
Benzo(k)fluoranthene	3.1E+01	5.1E-02	1.6E+00	6.0E-01	1.00E+02	1.00E+01	0.006	0.06
Chrysene	5.4E+01	3.5E-02	1.9E+00	9.3E-01	1.00E+02	1.00E+01	0.009	0.09
Dibenzo(a,h)anthracene	6.9E+00	7.4E-02	5.1E-01	1.5E-01	1.00E+02	1.00E+01	0.002	0.02
Fluoranthene	1.6E+02	5.0E-01	8.0E+01	1.2E+01	1.00E+02	1.00E+01	0.1	1
Fluorene	1.2E+01	5.0E-01	6.0E+00	9.2E-01	1.00E+02	1.00E+01	0.009	0.09
Indeno(1,2,3-cd)pyrene	2.5E+01	8.4E-02	2.1E+00	5.9E-01	1.00E+02	1.00E+01	0.006	0.06
Phenanthrene	1.0E+02	2.4E-02	2.4E+00	1.6E+00	1.00E+02	1.00E+01	0.02	0.2
Pyrene	8.8E+01	1.8E-02	1.6E+00	1.3E+00	1.00E+02	1.00E+01	0.01	0.1
Polychlorinated Biphenyls								
Aroclor 1254	8.3E+00	1.5E+00	1.3E+01	1.8E+00	1.80E+00	1.80E-01	1	10
Inorganics								
Arsenic	5.8E+01	3.9E-01	2.3E+01	3.7E+00	1.28E+01	5.14E+00	0.3	0.7
Cadmium	4.5E+01	2.8E+00	1.3E+02	1.7E+01	1.45E+01	1.45E+00	1	10
Copper	7.2E+04	6.8E-02	4.9E+03	1.5E+03	6.17E+01	4.70E+01	20	30
Lead	5.8E+04	5.6E-02	3.2E+03	1.1E+03	3.85E+01	3.85E+00	30	300
Nickel	1.5E+02	2.6E-02	3.8E+00	2.4E+00	1.07E+02	7.74E+01	0.02	0.03
Selenium	1.9E+00	3.9E-01	7.4E-01	1.2E-01	1.00E+00	5.00E-01	0.1	0.2
Silver	2.3E+00	3.9E-01	9.0E-01	1.4E-01	1.00E+00	5.00E-01	0.1	0.3
Zinc	1.3E+04	3.9E-01	4.9E+03	7.9E+02	1.31E+02	1.45E+01	6	50

Notes:

HQ =	Hazard Quotient.
LOAEL =	Lowest observed adverse effect level.
mg/kg =	Milligrams per kilogram.
mg/kg-BW-day =	Milligrams per kilogram of body weight per day.
NA =	Not applicable.
NOAEL =	No observed adverse effect level.
TRV	Toxicity reference value.

[a] Maximum concentration detected in surface soil (mg/kg).
[b] See Table A.2-20 for sources of soil bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.
[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.
[e] See Table A.2-22 for sources of avian toxicity reference values.
[f] Maximum hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.4.ERA-10
Refined Scenario Food Chain Modeling for the American Robin
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)		Soil Bioconcentration Factors [b] Invertebrate	Vegetation	Estimated Dietary Tissue Concentrations [c] (mg/kg) Invertebrate	Vegetation	Refined Estimated Dietary Ingestion [d] mg/kg-BW-day	Toxicity Reference Values [e] mg/kg-BW-day LOAEL	NOAEL	Refined Scenario HQ [f] LOAEL	NOAEL
Pesticides											
4,4'-DDD	4.3E-02	m	1.9E+00	2.7E-03	8.3E-02	1.1E-04	3.8E-03	2.80E-02	2.80E-03	0.1	1
4,4'-DDE	8.6E-04	m	1.9E+00	3.3E-03	1.7E-03	2.8E-06	7.8E-05	2.80E-02	2.80E-03	0.003	0.03
Chlordane, alpha-	8.9E-02	m	1.5E+00	2.6E-03	1.3E-01	2.3E-04	6.3E-03	2.14E+01	2.14E+00	0.0003	0.003
BHC, beta-	2.8E-04	m	1.5E+00	4.9E-02	4.1E-04	1.4E-05	2.1E-05	2.25E+00	5.60E-01	0.000009	0.00004
Endosulfan	2.2E-02	m	1.5E+00	6.9E-02	3.2E-02	1.5E-03	1.7E-03	1.00E+02	1.00E+01	0.00002	0.0002
Endrin	3.5E-04	m	1.5E+00	1.8E-02	5.1E-04	6.3E-06	2.5E-05	3.00E+00	3.00E-01	0.000008	0.00008
Heptachlor Epoxide	1.5E-02	m	1.5E+00	5.6E-03	2.2E-02	8.3E-05	1.1E-03	NA	NA	NA	NA
Methoxychlor	6.7E-02	m	6.7E+00	1.6E+00	4.5E-01	1.1E-01	2.8E-02	NA	NA	NA	NA
Polycyclic Aromatic Hydrocarbons											
Acenaphthene	4.8E+00		5.0E-01	4.2E-02	2.4E+00	2.0E-01	1.7E-01	1.00E+02	1.00E+01	0.002	0.02
Acenaphthylene	7.3E-02		5.0E-01	3.4E-02	3.6E-02	2.5E-03	2.6E-03	1.00E+02	1.00E+01	0.00003	0.0003
Anthracene	9.0E+00		1.0E-02	2.1E-02	9.2E-02	1.9E-01	1.3E-01	1.00E+02	1.00E+01	0.001	0.01
Benzo(a)anthracene	2.5E+01		2.5E-02	4.4E-03	6.2E-01	1.1E-01	3.5E-01	1.00E+02	1.00E+01	0.004	0.04
Benzo(a)pyrene	1.7E+01		6.8E-02	2.7E-03	1.2E+00	4.6E-02	2.7E-01	1.00E+02	1.00E+01	0.003	0.03
Benzo(b)fluoranthene	3.3E+01		5.1E-02	1.2E-03	1.7E+00	4.1E-02	4.9E-01	1.00E+02	1.00E+01	0.005	0.05
Benzo(g,h,i)perylene	1.3E+01		4.9E-02	6.1E-04	6.4E-01	8.0E-03	1.9E-01	1.00E+02	1.00E+01	0.002	0.02
Benzo(k)fluoranthene	1.5E+01		5.1E-02	1.2E-03	7.5E-01	1.8E-02	2.2E-01	1.00E+02	1.00E+01	0.002	0.02
Chrysene	3.0E+01		3.5E-02	4.5E-03	1.0E+00	1.3E-01	4.3E-01	1.00E+02	1.00E+01	0.004	0.04
Dibenzo(a,h)anthracene	3.3E+00		7.4E-02	1.6E-03	2.4E-01	5.4E-03	5.2E-02	1.00E+02	1.00E+01	0.0005	0.005
Fluoranthene	9.2E+01		5.0E-01	7.4E-03	4.6E+01	6.9E-01	3.0E+00	1.00E+02	1.00E+01	0.03	0.3
Fluorene	4.7E+00		5.0E-01	3.2E-02	2.3E+00	1.5E-01	1.6E-01	1.00E+02	1.00E+01	0.002	0.02
Indeno(1,2,3-cd)pyrene	1.2E+01		8.4E-02	2.7E-04	9.9E-01	3.2E-03	1.9E-01	1.00E+02	1.00E+01	0.002	0.02
Phenanthrene	5.3E+01		2.4E-02	1.8E-02	1.3E+00	9.5E-01	8.1E-01	1.00E+02	1.00E+01	0.008	0.08
Pyrene	5.6E+01		1.8E-02	1.2E-02	1.0E+00	6.6E-01	8.1E-01	1.00E+02	1.00E+01	0.008	0.08
Polychlorinated Biphenyls											
Aroclor 1254	2.2E+00		1.5E+00	1.4E-03	3.3E+00	3.0E-03	1.6E-01	1.80E+00	1.80E-01	0.09	0.9
Inorganics											
Arsenic	1.2E+01		3.9E-01	8.0E-03	4.8E+00	9.9E-02	3.5E-01	1.28E+01	5.14E+00	0.03	0.07
Cadmium	1.4E+01		2.8E+00	1.1E-01	4.1E+01	1.6E+00	1.9E+00	1.45E+01	1.45E+00	0.1	1
Copper	2.1E+04		6.8E-02	8.0E-02	1.4E+03	1.7E+03	4.8E+02	6.17E+01	4.70E+01	8	10
Lead	1.6E+04		5.6E-02	9.0E-03	8.8E+02	1.4E+02	2.5E+02	3.85E+01	3.85E+00	6	60
Nickel	4.6E+01		2.6E-02	1.2E-02	1.2E+00	5.5E-01	6.7E-01	1.07E+02	7.74E+01	0.006	0.009
Selenium	8.6E-01		3.9E-01	5.0E-03	3.3E-01	4.3E-03	2.4E-02	1.00E+00	5.00E-01	0.02	0.05
Silver	9.7E-01		3.9E-01	8.0E-02	3.8E-01	7.8E-02	3.4E-02	1.00E+00	5.00E-01	0.03	0.07
Zinc	5.4E+03		3.9E-01	3.0E-01	2.1E+03	1.6E+03	2.9E+02	1.31E+02	1.45E+01	2	20

Table A.4.ERA-10
Refined Scenario Food Chain Modeling for the American Robin
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:

HQ =	Hazard Quotient.
LOAEL =	Lowest observed adverse effect level.
mg/kg =	Milligrams per kilogram.
mg/kg-BW-day =	Milligrams per kilogram of body weight per day.
NA =	Not applicable.
NOAEL =	No observed adverse effect level.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.

[b] See Table A.2-20 for sources of soil bioaccumulation factors.

[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.

[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.

[e] See Table A.2-22 for sources of avian toxicity reference values.

[f] Refined hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.4.ERA-11
Maximum Scenario Food Chain Modeling for the Mink
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration [a] Surface Water (mg/L)	Maximum Concentration [a] Sediment (mg/kg)	Sediment Bioaccumulation Factors (BAFsed) [b] Fish	Estimated Dietary Tissue Concentrations [c] (mg/kg) Fish	Maximum Estimated Dietary Ingestion [d] mg/kg-BW-day	Toxicity Reference Values [e] mg/kg-BW-day LOAEL	Toxicity Reference Values [e] mg/kg-BW-day NOAEL	Maximum Scenario HQ [f] LOAEL	Maximum Scenario HQ [f] NOAEL
Pesticides									
4,4'-DDD	–	7.3E-04	1.5E+00	1.1E-03	6.0E-05	3.16E+00	6.32E-01	0.00002	0.00009
4,4'-DDE	–	1.8E-03	1.6E+01	3.0E-02	2.0E-03	3.16E+00	6.32E-01	0.0006	0.003
4,4'-DDT	–	7.7E-04	1.3E+00	1.0E-03	6.0E-05	3.16E+00	6.32E-01	0.00002	0.00009
Chlordane, alpha-	–	3.8E-04	1.5E+00	5.5E-04	3.0E-05	1.96E+01	1.96E+00	0.000002	0.00002
BHC, beta-	–	2.9E-04	NA	NA	NA	1.58E+00	3.16E-01	NA	NA
Dieldrin	5.8E-06	9.4E-04	3.9E+00	3.7E-03	2.0E-04	1.58E-01	1.58E-02	0.001	0.01
Polycyclic Aromatic Hydrocarbons									
Anthracene	–	1.7E-03	3.1E-03	5.3E-06	3.0E-07	2.61E+03	2.61E+02	1E-10	0.000000001
Benzo(a)anthracene	2.4E-05	1.3E-02	7.7E-03	1.0E-04	9.0E-06	1.58E+00	1.58E-01	0.000006	0.00006
Benzo(a)pyrene	–	1.2E-02	7.7E-03	9.2E-05	5.0E-06	4.28E+00	4.28E-01	0.000001	0.00001
Benzo(b)fluoranthene	2.5E-05	1.9E-02	7.7E-03	1.5E-04	1.0E-05	1.40E+01	5.60E-01	0.0000007	0.00002
Benzo(g,h,i)perylene	–	7.1E-03	7.7E-03	5.4E-05	3.0E-06	4.28E-01	4.28E-02	0.000007	0.00007
Benzo(k)fluoranthene	–	7.1E-03	7.7E-03	5.4E-05	3.0E-06	1.40E+01	5.60E-01	0.0000002	0.000005
Chrysene	3.0E-05	1.3E-02	7.7E-03	1.0E-04	9.0E-06	7.83E+01	7.83E+00	0.0000001	0.000001
Dibenzo(a,h)anthracene	–	2.1E-03	7.7E-03	1.6E-05	9.0E-07	4.74E-03	4.74E-04	0.0002	0.002
Fluoranthene	6.6E-05	1.9E-02	7.7E-03	1.5E-04	2.0E-05	3.16E+01	3.16E+00	0.0000006	0.000006
Fluorene	–	1.2E-03	3.1E-03	3.7E-06	2.0E-07	1.19E+02	3.95E+01	0.000000002	0.000000005
Indeno(1,2,3-cd)pyrene	–	8.1E-03	7.7E-03	6.2E-05	4.0E-06	4.28E-01	4.28E-02	0.000009	0.00009
Phenanthrene	3.6E-05	9.0E-03	3.1E-03	2.8E-05	6.0E-06	1.11E+01	1.11E+00	0.0000005	0.000005
Pyrene	4.1E-05	1.9E-02	7.7E-03	1.5E-04	1.0E-05	6.84E+00	6.84E-01	0.000001	0.00001
Inorganics									
Arsenic	1.0E-02	4.6E+00	1.0E+00	4.6E+00	3.0E-01	4.28E+00	4.28E-01	0.07	0.7
Copper	8.3E-01	8.9E+00	1.0E+00	8.9E+00	6.0E-01	1.75E+01	1.36E+01	0.03	0.04
Lead	2.5E-01	1.9E+01	1.0E+00	1.9E+01	1.0E+00	6.32E+01	6.32E+00	0.02	0.2
Nickel	–	1.2E+01	1.0E+00	1.2E+01	7.0E-01	6.32E+01	3.16E+01	0.01	0.02
Selenium	5.1E-04	–	1.0E+00	NA	NA	2.51E-01	1.52E-01	NA	NA
Zinc	1.2E-01	3.6E+01	1.0E+00	3.6E+01	2.0E+00	2.41E+01	2.41E+00	0.08	0.8

Table A.4.ERA-11
Maximum Scenario Food Chain Modeling for the Mink
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:

HQ =	Hazard Quotient.
LOAEL =	Lowest observed adverse effect level.
mg/kg =	Milligrams per kilogram.
mg/kg-BW-day =	Milligrams per kilogram of body weight per day.
mg/L =	Milligrams per liter.
NOAEL =	No observed adverse effect level.

[a] Maximum concentrations detected in surface water (mg/L) and sediment (mg/kg).
[b] See Table A.2-21 for sources of sediment bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.
[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.
[e] See Table A.2-23 for sources of mammalian toxicity reference values.
[f] Maximum hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.4.ERA-12
Refined Scenario Food Chain Modeling for the Mink
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] Surface Water (mg/L)		Exposure Point Concentration [a] Sediment (mg/kg)		Sediment Bioaccumulation Factors (BAFsed) [b] Fish	Estimated Dietary Tissue Concentrations [c] (mg/kg) Fish	Refined Estimated Dietary Ingestion [d] mg/kg-BW-day	Toxicity Reference Values [e] mg/kg-BW-day LOAEL	Toxicity Reference Values [e] mg/kg-BW-day NOAEL	Refined Scenario HQ [f] LOAEL	Refined Scenario HQ [f] NOAEL
Pesticides											
4,4'-DDD	–		7.3E-04	m	1.5E+00	1.1E-03	6.0E-05	3.16E+00	6.32E-01	0.00002	0.00009
4,4'-DDE	–		1.8E-03	m	1.6E+01	3.0E-02	2.0E-03	3.16E+00	6.32E-01	0.0006	0.003
4,4'-DDT	–		7.7E-04	m	1.3E+00	1.0E-03	6.0E-05	3.16E+00	6.32E-01	0.00002	0.00009
Chlordane, alpha-	–		3.8E-04	m	1.5E+00	5.5E-04	3.0E-05	1.96E+01	1.96E+00	0.000002	0.00002
BHC, beta-	–		2.9E-04	m	NA	NA	NA	1.58E+00	3.16E-01	NA	NA
Dieldrin	5.8E-06	m	9.4E-04	m	3.9E+00	3.7E-03	2.0E-04	1.58E-01	1.58E-02	0.001	0.01
Polycyclic Aromatic Hydrocarbons											
Anthracene	–		1.7E-03	m	3.1E-03	5.3E-06	3.0E-07	2.61E+03	2.61E+02	1E-10	0.000000001
Benzo(a)anthracene	2.4E-05	m	1.3E-02	m	7.7E-03	1.0E-04	9.0E-06	1.58E+00	1.58E-01	0.000006	0.00006
Benzo(a)pyrene	–		1.2E-02	m	7.7E-03	9.2E-05	5.0E-06	4.28E+00	4.28E-01	0.000001	0.00001
Benzo(b)fluoranthene	2.5E-05	m	1.9E-02	m	7.7E-03	1.5E-04	1.0E-05	1.40E+01	5.60E-01	0.0000007	0.00002
Benzo(g,h,i)perylene	–		7.1E-03	m	7.7E-03	5.4E-05	3.0E-06	4.28E-01	4.28E-02	0.000007	0.00007
Benzo(k)fluoranthene	–		7.1E-03	m	7.7E-03	5.4E-05	3.0E-06	1.40E+01	5.60E-01	0.0000002	0.000005
Chrysene	3.0E-05	m	1.3E-02	m	7.7E-03	1.0E-04	9.0E-06	7.83E+01	7.83E+00	0.0000001	0.000001
Dibenzo(a,h)anthracene	–		2.1E-03	m	7.7E-03	1.6E-05	9.0E-07	4.74E-03	4.74E-04	0.0002	0.002
Fluoranthene	6.6E-05	m	1.9E-02	m	7.7E-03	1.5E-04	2.0E-05	3.16E+01	3.16E+00	0.0000006	0.000006
Fluorene	–		1.2E-03	m	3.1E-03	3.7E-06	2.0E-07	1.19E+02	3.95E+01	0.000000002	0.000000005
Indeno(1,2,3-cd)pyrene	–		8.1E-03	m	7.7E-03	6.2E-05	4.0E-06	4.28E-01	4.28E-02	0.000009	0.00009
Phenanthrene	3.6E-05	m	9.0E-03	m	3.1E-03	2.8E-05	6.0E-06	1.11E+01	1.11E+00	0.0000005	0.000005
Pyrene	4.1E-05	m	1.9E-02	m	7.7E-03	1.5E-04	1.0E-05	6.84E+00	6.84E-01	0.000001	0.00001
Inorganics											
Arsenic	1.0E-02	m	4.6E+00	m	1.0E+00	4.6E+00	3.0E-01	4.28E+00	4.28E-01	0.07	0.7
Copper	8.3E-01	m	8.9E+00	m	1.0E+00	8.9E+00	6.0E-01	1.75E+01	1.36E+01	0.03	0.04
Lead	2.5E-01	m	1.9E+01	m	1.0E+00	1.9E+01	1.0E+00	6.32E+01	6.32E+00	0.02	0.2
Nickel	–		1.2E+01	m	1.0E+00	1.2E+01	7.0E-01	6.32E+01	3.16E+01	0.01	0.02
Selenium	5.1E-04	m	–		1.0E+00	NA	NA	2.51E-01	1.52E-01	NA	NA
Zinc	1.2E-01	m	3.6E+01	m	1.0E+00	3.6E+01	2.0E+00	2.41E+01	2.41E+00	0.08	0.8

Notes:

HQ =	Hazard Quotient.
LOAEL =	Lowest observed adverse effect level.
mg/kg =	Milligrams per kilogram.
mg/kg-BW-day =	Milligrams per kilogram of body weight per day.
mg/L =	Milligrams per liter.
NOAEL =	No observed adverse effect level.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the refined concentration. EPCs marked with "m" are the maximum concentration.

[b] See Table A.2-21 for sources of sediment bioaccumulation factors.

[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.

[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.

[e] See Table A.2-23 for sources of mammalian toxicity reference values.

[f] Refined hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.4.ERA-13
Maximum Scenario Food Chain Modeling for the Great Blue Heron
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration [a] Surface Water (mg/L)	Maximum Concentration [a] Sediment (mg/kg)	Sediment Bioaccumulation Factors (BAFsed) [b] Fish	Estimated Dietary Tissue Concentrations [c] (mg/kg) Fish	Maximum Estimated Dietary Ingestion [d] mg/kg-BW-day	Toxicity Reference Values [e] mg/kg-BW-day LOAEL	Toxicity Reference Values [e] mg/kg-BW-day NOAEL	Maximum Scenario HQ [f] LOAEL	Maximum Scenario HQ [f] NOAEL
Pesticides									
4,4'-DDD	–	7.3E-04	1.5E+00	1.1E-03	6.0E-05	2.80E-02	2.80E-03	0.002	0.02
4,4'-DDE	–	1.8E-03	1.6E+01	3.0E-02	2.0E-03	2.80E-02	2.80E-03	0.07	0.7
4,4'-DDT	–	7.7E-04	1.3E+00	1.0E-03	6.0E-05	2.80E-02	2.80E-03	0.002	0.02
Chlordane, alpha-	–	3.8E-04	1.5E+00	5.5E-04	3.0E-05	2.14E+01	2.14E+00	0.000001	0.00001
BHC, beta-	–	2.9E-04	NA	NA	NA	2.25E+00	5.60E-01	NA	NA
Dieldrin	5.8E-06	9.4E-04	3.9E+00	3.7E-03	2.0E-04	7.70E-01	7.70E-02	0.0003	0.003
Polycyclic Aromatic Hydrocarbons									
Anthracene	–	1.7E-03	3.1E-03	5.3E-06	3.0E-07	1.00E+02	1.00E+01	0.000000003	0.00000003
Benzo(a)anthracene	2.4E-05	1.3E-02	7.7E-03	1.0E-04	6.0E-06	1.00E+02	1.00E+01	0.00000006	0.0000006
Benzo(a)pyrene	–	1.2E-02	7.7E-03	9.2E-05	5.0E-06	1.00E+02	1.00E+01	0.00000005	0.0000005
Benzo(b)fluoranthene	2.5E-05	1.9E-02	7.7E-03	1.5E-04	9.0E-06	1.00E+02	1.00E+01	0.00000009	0.0000009
Benzo(g,h,i)perylene	–	7.1E-03	7.7E-03	5.4E-05	3.0E-06	1.00E+02	1.00E+01	0.00000003	0.0000003
Benzo(k)fluoranthene	–	7.1E-03	7.7E-03	5.4E-05	3.0E-06	1.00E+02	1.00E+01	0.00000003	0.0000003
Chrysene	3.0E-05	1.3E-02	7.7E-03	1.0E-04	6.0E-06	1.00E+02	1.00E+01	0.00000006	0.0000006
Dibenzo(a,h)anthracene	–	2.1E-03	7.7E-03	1.6E-05	9.0E-07	1.00E+02	1.00E+01	0.000000009	0.00000009
Fluoranthene	6.6E-05	1.9E-02	7.7E-03	1.5E-04	1.0E-05	1.00E+02	1.00E+01	0.0000001	0.000001
Fluorene	–	1.2E-03	3.1E-03	3.7E-06	2.0E-07	1.00E+02	1.00E+01	0.000000002	0.00000002
Indeno(1,2,3-cd)pyrene	–	8.1E-03	7.7E-03	6.2E-05	3.0E-06	1.00E+02	1.00E+01	0.00000003	0.0000003
Phenanthrene	3.6E-05	9.0E-03	3.1E-03	2.8E-05	2.0E-06	1.00E+02	1.00E+01	0.00000002	0.0000002
Pyrene	4.1E-05	1.9E-02	7.7E-03	1.5E-04	9.0E-06	1.00E+02	1.00E+01	0.00000009	0.0000009
Inorganics									
Arsenic	1.0E-02	4.6E+00	1.0E+00	4.6E+00	3.0E-01	1.28E+01	5.14E+00	0.02	0.06
Copper	8.3E-01	8.9E+00	1.0E+00	8.9E+00	5.0E-01	6.17E+01	4.70E+01	0.008	0.01
Lead	2.5E-01	1.9E+01	1.0E+00	1.9E+01	1.0E+00	3.85E+01	3.85E+00	0.03	0.3
Nickel	–	1.2E+01	1.0E+00	1.2E+01	7.0E-01	1.07E+02	7.74E+01	0.007	0.009
Selenium	5.1E-04	–	1.0E+00	NA	NA	1.00E+00	5.00E-01	NA	NA
Zinc	1.2E-01	3.6E+01	1.0E+00	3.6E+01	2.0E+00	1.31E+02	1.45E+01	0.02	0.1

Table A.4.ERA-13
Maximum Scenario Food Chain Modeling for the Great Blue Heron
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:

HQ =	Hazard Quotient.
LOAEL =	Lowest observed adverse effect level.
mg/kg =	Milligrams per kilogram.
mg/kg-BW-day =	Milligrams per kilogram of body weight per day.
mg/L =	Milligrams per liter.
NOAEL =	No observed adverse effect level.

[a] Maximum concentrations detected in surface water (mg/L) and sediment (mg/kg).
[b] See Table A.2-21 for sources of sediment bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.
[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.
[e] See Table A.2-22 for sources of avian toxicity reference values.
[f] Maximum hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.4.ERA-14
Refined Scenario Food Chain Modeling for the Great Blue Heron
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] Surface Water (mg/L)		Exposure Point Concentration [a] Sediment (mg/kg)		Sediment Bioaccumulation Factors (BAFsed) [b] Fish	Estimated Dietary Tissue Concentrations [c] (mg/kg) Fish	Refined Estimated Dietary Ingestion [d] mg/kg-BW-day	Toxicity Reference Values [e] mg/kg-BW-day LOAEL	Toxicity Reference Values [e] mg/kg-BW-day NOAEL	Refined Scenario HQ [f] LOAEL	Refined Scenario HQ [f] NOAEL
Pesticides											
4,4'-DDD	–		7.3E-04	m	1.5E+00	1.1E-03	6.0E-05	2.80E-02	2.80E-03	0.002	0.02
4,4'-DDE	–		1.8E-03	m	1.6E+01	3.0E-02	2.0E-03	2.80E-02	2.80E-03	0.07	0.7
4,4'-DDT	–		7.7E-04	m	1.3E+00	1.0E-03	6.0E-05	2.80E-02	2.80E-03	0.002	0.02
Chlordane, alpha-	–		3.8E-04	m	1.5E+00	5.5E-04	3.0E-05	2.14E+01	2.14E+00	0.000001	0.00001
BHC, beta-	–		2.9E-04	m	NA	NA	NA	2.25E+00	5.60E-01	NA	NA
Dieldrin	5.8E-06	m	9.4E-04	m	3.9E+00	3.7E-03	2.0E-04	7.70E-01	7.70E-02	0.0003	0.003
Polycyclic Aromatic Hydrocarbons											
Anthracene	–		1.7E-03	m	3.1E-03	5.3E-06	3.0E-07	1.00E+02	1.00E+01	0.000000003	0.00000003
Benzo(a)anthracene	2.4E-05	m	1.3E-02	m	7.7E-03	1.0E-04	6.0E-06	1.00E+02	1.00E+01	0.00000006	0.0000006
Benzo(a)pyrene	–		1.2E-02	m	7.7E-03	9.2E-05	5.0E-06	1.00E+02	1.00E+01	0.00000005	0.0000005
Benzo(b)fluoranthene	2.5E-05	m	1.9E-02	m	7.7E-03	1.5E-04	9.0E-06	1.00E+02	1.00E+01	0.00000009	0.0000009
Benzo(g,h,i)perylene	–		7.1E-03	m	7.7E-03	5.4E-05	3.0E-06	1.00E+02	1.00E+01	0.00000003	0.0000003
Benzo(k)fluoranthene	–		7.1E-03	m	7.7E-03	5.4E-05	3.0E-06	1.00E+02	1.00E+01	0.00000003	0.0000003
Chrysene	3.0E-05	m	1.3E-02	m	7.7E-03	1.0E-04	6.0E-06	1.00E+02	1.00E+01	0.00000006	0.0000006
Dibenzo(a,h)anthracene	–		2.1E-03	m	7.7E-03	1.6E-05	9.0E-07	1.00E+02	1.00E+01	0.000000009	0.00000009
Fluoranthene	6.6E-05	m	1.9E-02	m	7.7E-03	1.5E-04	1.0E-05	1.00E+02	1.00E+01	0.0000001	0.000001
Fluorene	–		1.2E-03	m	3.1E-03	3.7E-06	2.0E-07	1.00E+02	1.00E+01	0.000000002	0.00000002
Indeno(1,2,3-cd)pyrene	–		8.1E-03	m	7.7E-03	6.2E-05	3.0E-06	1.00E+02	1.00E+01	0.00000003	0.0000003
Phenanthrene	3.6E-05	m	9.0E-03	m	3.1E-03	2.8E-05	2.0E-06	1.00E+02	1.00E+01	0.00000002	0.0000002
Pyrene	4.1E-05	m	1.9E-02	m	7.7E-03	1.5E-04	9.0E-06	1.00E+02	1.00E+01	0.00000009	0.0000009
Inorganics											
Arsenic	1.0E-02	m	4.6E+00	m	1.0E+00	4.6E+00	3.0E-01	1.28E+01	5.14E+00	0.02	0.06
Copper	8.3E-01	m	8.9E+00	m	1.0E+00	8.9E+00	5.0E-01	6.17E+01	4.70E+01	0.008	0.01
Lead	2.5E-01	m	1.9E+01	m	1.0E+00	1.9E+01	1.0E+00	3.85E+01	3.85E+00	0.03	0.3
Nickel	–		1.2E+01	m	1.0E+00	1.2E+01	7.0E-01	1.07E+02	7.74E+01	0.007	0.009
Selenium	5.1E-04	m	–		1.0E+00	NA	NA	1.00E+00	5.00E-01	NA	NA
Zinc	1.2E-01	m	3.6E+01	m	1.0E+00	3.6E+01	2.0E+00	1.31E+02	1.45E+01	0.02	0.1

Table A.4.ERA-14
Refined Scenario Food Chain Modeling for the Great Blue Heron
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:

HQ =	Hazard Quotient.
LOAEL =	Lowest observed adverse effect level.
mg/kg =	Milligrams per kilogram.
mg/kg-BW-day =	Milligrams per kilogram of body weight per day.
mg/L =	Milligrams per liter.
NOAEL =	No observed adverse effect level.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.

[b] See Table A.2-21 for sources of sediment bioaccumulation factors.

[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.

[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.

[e] See Table A.2-22 for sources of avian toxicity reference values.

[f] Refined hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.4.ERA-15

Summary of Ecological Risk Characterization Results - Terrestrial Habitat

BAG LOADING AREA

New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Soil Frequency of Detection # detects / n samples			%	EPC (mg/kg)		Baseline Level Assessment Hazard Quotient [a]	Ecological Screening Level [b] Source	Basis	Bioaccum-ulative ? (YES/no)	Short-tailed Shrew LOAEL HQ	Short-tailed Shrew NOAEL HQ	American Robin LOAEL HQ	American Robin NOAEL HQ
Volatile Organic Compounds														
3-Octanone	1	-	1	100%	0.011	m	NA			no	–	–	–	–
d-Limonene	1	-	1	100%	0.057	m	NA			no	–	–	–	–
Semi-Volatile Organic Compounds														
2,6-Dinitrotoluene	3	-	20	15%	1.9	m	**60**	R5		no	–	–	–	–
Benzoic Acid	4	-	15	27%	0.3	m	NA			no	–	–	–	–
Carbazole	10	-	14	71%	11.99		NA			no	–	–	–	–
Dibenzofuran	9	-	14	64%	2.604		NA			no	–	–	–	–
Di-n-Butylphthalate	6	-	14	43%	29.36		**200**	R5		no	–	–	–	–
N-Nitrosodiphenylamine	2	-	13	15%	8.3	m	**20**	R5		no	–	–	–	–
Explosives														
2,4,6-Trinitrotoluene	1	-	19	5%	0.06	m	NA			no	–	–	–	–
m-Nitrotoluene	1	-	19	5%	2.86	m	NA			no	–	–	–	–
Nitroglycerine	1	-	19	5%	0.21	m	NA			no	–	–	–	–
Pentaerythritol Tetranitrate	1	-	19	5%	0.16	m	NA			no	–	–	–	–
Pesticides														
4,4'-DDD	4	-	5	80%	0.043	m	**2**	EcoSSL	mam	YES	0.001	0.006	0.1	1
4,4'-DDE	2	-	4	50%	0.0009	m	0.04	EcoSSL	mam	YES	0.00002	0.0001	0.003	0.03
BHC, beta-	1	-	4	25%	0.0003	m	0.07	R5		YES	0.00001	0.00006	0.000009	0.00004
Chlordane, alpha-	1	-	5	20%	0.089	m	0.4	R5		YES	0.0003	0.003	0.0003	0.003
Endosulfan	1	-	5	20%	0.022	m	NA			YES	0.001	0.01	0.00002	0.0002
Endrin	1	-	4	25%	0.0004	m	0.03	R5		YES	0.00006	0.0006	0.000008	0.00008
Heptachlor Epoxide	2	-	5	40%	0.015	m	0.1	R5		YES	0.0009	0.009	–	–
Methoxychlor	2	-	4	50%	0.0674	m	**3**	R5		YES	0.003	0.006	–	–
Polycyclic Aromatic Hydrocarbons														
Acenaphthene	32	-	42	76%	4.763		0.007	R5		YES	0.02	0.2	0.002	0.02
Acenaphthylene	26	-	42	62%	0.0728		0.0001	R5		YES	0.00004	0.000004	0.00003	0.0003
Anthracene	36	-	42	86%	9.003		0.006	R5		YES	0.00001	0.0001	0.001	0.01
Benzo(a)anthracene	42	-	44	95%	24.65		**5**	R5		YES	0.08	0.8	0.004	0.04
Benzo(a)pyrene	39	-	44	89%	17.26		**10**	R5		YES	0.03	0.3	0.003	0.03
Benzo(b)fluoranthene	41	-	44	93%	33.31		0.6	R5		YES	0.02	0.5	0.005	0.05
Benzo(g,h,i)perylene	39	-	42	93%	13.05		0.1	R5		YES	0.4	**4**	0.002	0.02
Benzo(k)fluoranthene	41	-	44	93%	14.82		0.1	R5		YES	0.009	0.2	0.002	0.02
Chrysene	41	-	44	93%	29.95		**6**	R5		YES	0.002	0.02	0.004	0.04
Dibenzo(a,h)anthracene	30	-	42	71%	3.297		0.2	R5		YES	**6**	**60**	0.0005	0.005
Fluoranthene	41	-	44	93%	92.29		0.8	R5		YES	0.07	0.7	0.03	0.3
Fluorene	31	-	42	74%	4.686		0.04	R5		YES	0.0009	0.003	0.002	0.02
Indeno(1,2,3-cd)pyrene	38	-	42	90%	11.79		0.1	R5		YES	1	**10**	0.002	0.02
Naphthalene	25	-	42	60%	0.194		**2**	R5		no	–	–	–	–
Phenanthrene	41	-	44	93%	53.49		1	R5		YES	0.02	0.2	0.008	0.08
Pyrene	41	-	44	93%	56.42		0.7	R5		YES	0.04	0.4	0.008	0.08

Table A.4.ERA-15
Summary of Ecological Risk Characterization Results - Terrestrial Habitat
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Soil Frequency of Detection # detects / n samples			Soil Frequency of Detection %	Soil EPC (mg/kg)	Baseline Level Assessment Hazard Quotient [a]	Baseline Level Assessment Ecological Screening Level [b] Source	Baseline Level Assessment Ecological Screening Level [b] Basis	Bioaccum-ulative ? (YES/no)	Results of Refined Food Chain Models [c] Short-tailed Shrew LOAEL HQ	Short-tailed Shrew NOAEL HQ	American Robin LOAEL HQ	American Robin NOAEL HQ
Polychlorinated Biphenyls													
Aroclor 1254	9	-	20	45%	2.155	NA			YES	0.5	**5**	0.09	0.9
Inorganics													
Antimony	20	-	45	44%	1.236	**5**	EcoSSL	mam	no	–	–	–	–
Arsenic	46	-	47	98%	12.33	0.7	EcoSSL	veg	YES	0.06	0.6	0.03	0.07
Barium	47	-	47	100%	6,101	**20**	EcoSSL	inv	no	–	–	–	–
Cadmium	30	-	38	79%	14.42	**40**	EcoSSL	mam	YES	**2**	**20**	0.1	1
Chromium	47	-	47	100%	53.69	**2**	EcoSSL	avi	no	–	–	–	–
Cobalt	44	-	47	94%	34.68	**3**	EcoSSL	veg	no	–	–	–	–
Copper	47	-	47	100%	21,230	**800**	EcoSSL	avi	YES	**10**	**10**	**8**	**10**
Iron	47	-	47	100%	39,125	NA			no	–	–	–	–
Lead	47	-	47	100%	15,706	**1,000**	EcoSSL	avi	YES	**2**	**20**	**6**	**60**
Manganese	47	-	47	100%	545.9	**2**	EcoSSL	veg	no	–	–	–	–
Mercury	36	-	38	95%	7.271	**70**	R5		no	–	–	–	–
Nickel	47	-	47	100%	45.55	1	EcoSSL	veg	YES	0.004	0.04	0.006	0.009
Selenium	12	-	46	26%	0.857	**2**	EcoSSL	veg	YES	0.07	0.1	0.02	0.05
Silver	12	-	38	32%	0.971	0.2	EcoSSL	avi	YES	0.0001	0.001	0.03	0.07
Zinc	47	-	47	100%	5,351	**100**	EcoSSL	avi	YES	**7**	**70**	**2**	**20**

Notes:

– = Not applicable.
COPEC = Constituent of Potential Ecological Concern.
EPC = Exposure point concentrations - the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
LOAEL HQ = Lowest observed adverse effect level hazard quotient.
mg/kg = Milligrams per kilogram.
NA = Not available.
NOAEL HQ = No observed adverse effect level hazard quotient.

[a] Hazard quotients (HQs) greater than one are presented in bold font. HQs are rounded to one significant figure (unitless).
[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
R5: Region 5 Ecological Screening Levels (USEPA 2003e; R5).
EcoSSL: USEPA Ecological Soil Screening Levels (USEPA 2005b, EcoSSL).
Where readily available (i.e., EcoSSLs), the basis of the ESL is presented.
[c] Foodchain modeling was conducted for bioaccumulative COPECs.

Table A.4.ERA-16
Summary of Ecological Risk Characterization Results - Aquatic Habitat
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

	Sediment				Surface Water				Baseline Level Assessment			Results of Refined Food Chain Models [b]			
	Frequency of Detection		EPC		Frequency of Detection		EPC		Sediment Hazard Quotient	Surface Water Hazard Quotient	Bioaccum-ulative ?	Mink		Great Blue Heron	
Constituent	**# detects / n samples**	**%**	**(mg/kg)**		**# detects / n samples**	**%**	**(mg/L)**		**[a]**	**[a]**	**(YES/no)**	**LOAEL HQ**	**NOAEL HQ**	**LOAEL HQ**	**NOAEL HQ**
Volatile Organic Compounds															
Acetone	1 - 2	50%	0.028	m	0 - 3	0%	–		**3**	NA	no	–	–	–	–
Pesticides					-										
4,4'-DDD	2 - 2	100%	0.00073	m	0 - 2	0%	–		0.1	NA	YES	0.00002	0.00009	0.002	0.02
4,4'-DDE	2 - 2	100%	0.00182	m	0 - 2	0%	–		0.6	NA	YES	0.0006	0.003	0.07	0.7
4,4'-DDT	2 - 2	100%	0.00077	m	0 - 2	0%	–		0.0001	NA	YES	0.00002	0.00009	0.002	0.02
BHC, beta-	1 - 2	50%	0.00029	m	0 - 2	0%	–		0.06	NA	YES	–	–	–	–
Chlordane, alpha-	2 - 2	100%	0.00038	m	0 - 2	0%	–		0.1	NA	YES	0.000002	0.00002	0.000001	0.00001
Dieldrin	1 - 2	50%	0.00094	m	2 - 2	100%	0.00000582	m	0.5	0.1	YES	0.001	0.01	0.0003	0.003
Polycyclic Aromatic Hydrocarbons					-										
Anthracene	1 - 2	50%	0.0017	m	0 - 4	0%	–		0.03	NA	YES	1E-10	0.000000001	0.000000003	0.00000003
Benzo(a)anthracene	2 - 2	100%	0.013	m	1 - 4	25%	0.000024	m	0.1	1	YES	0.000006	0.00006	0.00000006	0.0000006
Benzo(a)pyrene	2 - 2	100%	0.012	m	0 - 4	0%	–		0.08	NA	YES	0.000001	0.00001	0.00000005	0.0000005
Benzo(b)fluoranthene	2 - 2	100%	0.019	m	1 - 4	25%	0.000025	m	0.002	0.003	YES	0.0000007	0.00002	0.00000009	0.0000009
Benzo(g,h,i)perylene	2 - 2	100%	0.0071	m	0 - 4	0%	–		0.04	NA	YES	0.000007	0.00007	0.00000003	0.0000003
Benzo(k)fluoranthene	2 - 2	100%	0.0071	m	0 - 4	0%	–		0.03	NA	YES	0.0000002	0.000005	0.00000003	0.0000003
Chrysene	2 - 2	100%	0.013	m	1 - 4	25%	0.00003	m	0.08	1	YES	0.0000001	0.000001	0.00000006	0.0000006
Dibenzo(a,h)anthracene	2 - 2	100%	0.0021	m	0 - 4	0%	–		0.06	NA	YES	0.0002	0.002	0.000000009	0.00000009
Fluoranthene	2 - 2	100%	0.019	m	1 - 4	25%	0.000066	m	0.04	**2**	YES	0.0000006	0.000006	0.0000001	0.000001
Fluorene	1 - 2	50%	0.0012	m	0 - 4	0%	–		0.02	NA	YES	0.000000002	0.000000005	0.000000002	0.00000002
Indeno(1,2,3-cd)pyrene	2 - 2	100%	0.0081	m	0 - 4	0%	–		0.5	NA	YES	0.000009	0.00009	0.00000003	0.0000003
Phenanthrene	2 - 2	100%	0.009	m	1 - 4	25%	0.000036	m	0.04	0.09	YES	0.0000005	0.000005	0.00000002	0.0000002
Pyrene	2 - 2	100%	0.019	m	1 - 4	25%	0.000041	m	0.1	**2**	YES	0.000001	0.00001	0.00000009	0.0000009
Inorganics					-										
Aluminum	2 - 2	100%	–		4 - 4	100%	0.549	m	NA	**6**	no	–	–	–	–
Arsenic	2 - 2	100%	4.6	m	2 - 4	50%	0.01	m	0.5	**2**	YES	0.07	0.7	0.02	0.06
Barium	2 - 2	100%	77.2	m	4 - 4	100%	0.0981	m	NA	**20**	no	–	–	–	–
Beryllium	2 - 2	100%	0.92	m	0 - 4	0%	–		NA	NA	no	–	–	–	–
Copper	2 - 2	100%	8.89	m	2 - 4	50%	0.828	m	0.3	**90**	YES	0.03	0.04	0.008	0.01
Iron	2 - 2	100%	–		4 - 4	100%	0.742	m	NA	**2**	no	–	–	–	–
Lead	2 - 2	100%	17	avg	4 - 4	100%	0.247	m	0.5	**100**	YES	0.02	0.2	0.03	0.3
Manganese	2 - 2	100%	–		4 - 4	100%	0.377	m	NA	**3**	no	–	–	–	–
Mercury	0 - 2	0%	–		1 - 4	25%	0.0002	m	NA	**8**	no	–	–	–	–
Nickel	2 - 2	100%	11.5	m	0 - 4	0%	–		0.5	NA	YES	0.01	0.02	0.007	0.009
Selenium	0 - 2	0%	–		1 - 4	25%	0.00051	m	NA	0.5	YES	–	–	–	–
Thallium	2 - 2	100%	0.29	m	0 - 4	0%	–		NA	NA	no	–	–	–	–
Vanadium	2 - 2	100%	37.8	m	0 - 4	0%	–		NA	NA	no	–	–	–	–
Zinc	2 - 2	100%	36	m	2 - 4	50%	0.116	m	0.3	1	YES	0.08	0.8	0.02	0.1

Table A.4.ERA-16
Summary of Ecological Risk Characterization Results - Aquatic Habitat
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:

– =	Not applicable.
EPC =	Exposure point concentrations - the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration.
	EPCs marked with "m" are the maximum concentration.
LOAEL HQ =	Lowest observed adverse effect level hazard quotient.
mg/kg =	Milligrams per kilogram.
mg/L =	Milligrams per liter.
NOAEL HQ =	No observed adverse effect level hazard quotient.
[a]	Hazard quotients (HQs) greater than one are presented in bold font. HQs are rounded to one significant figure (unitless).
[b]	Foodchain modeling was conducted for bioaccumulative COPECs.

Table A.4.Data-1
Surface Soil Risk Assessment Dataset
Surface Soil (0-1 foot Depth Interval)
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects /		number of samples	FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Volatile Organic Compounds												
2-Butanone	78-93-3	1	-	15	7	0.011	-	0.011	0.0055	-	0.0088	BLA-SPSD01
3-Octanone	106-68-3	1	-	1	100	0.011	-	0.011	–	-	–	BLASS07
4-Methyl-2-pentanone	108-10-1	1	-	15	7	0.0016	-	0.0016	0.0055	-	0.0088	BLA-SPSD01
Acetone	67-64-1	2	-	15	13	0.023	-	0.043	0.0055	-	0.0088	BLA-SPSD01
Carbon Disulfide	75-15-0	1	-	15	7	0.0031	-	0.0031	0.0055	-	0.0088	BLA-SPSD01
d-Limonene	5989-27-5	1	-	1	100	0.057	-	0.057	–	-	–	BLASS07
Methylene Chloride	75-09-2	3	-	17	18	0.001	-	0.0028	0.0055	-	0.0088	BLA-SPSD01
Tetrachloroethene	127-18-4	2	-	15	13	0.0009	-	0.00092	0.0055	-	0.0094	BLASS07
Toluene	108-88-3	5	-	15	33	0.00071	-	0.007	0.0055	-	0.0094	BLASS07
Semi-Volatile Organic Compounds												
2,4-Dinitrotoluene	121-14-2	9	-	17	53	0.04	-	3	0.2	-	0.2	BLASS03
2,6-Dinitrotoluene	606-20-2	3	-	17	18	0.07	-	1.9	0.2	-	0.4	SS-09
Benzoic Acid	65-85-0	2	-	13	15	0.14	-	0.3	0.86	-	3.8	TR-03E
bis(2-Ethylhexyl)phthalate	117-81-7	11	-	14	79	0.05	-	0.57	0.2	-	0.21	SS-09
Carbazole	86-74-8	10	-	12	83	0.045	-	13	0.2	-	0.21	BLASB02
Dibenzofuran	132-64-9	9	-	12	75	0.016	-	2.8	0.2	-	0.21	BLASB02
Di-n-Butylphthalate	84-74-2	6	-	12	50	0.061	-	120	0.2	-	0.39	BLASS03
N-Nitrosodiphenylamine	86-30-6	2	-	11	18	0.1	-	8.3	0.2	-	0.78	BLASS03
Phenol	108-95-2	1	-	12	8	0.08	-	0.08	0.2	-	0.78	SS-14
Explosives												
1,3,5-Trinitrobenzene	99-35-4	1	-	16	6	0.07	-	0.07	0.1	-	0.2	BLASS06
1,3-Dinitrobenzene	99-65-0	1	-	16	6	0.05	-	0.05	0.1	-	0.2	BLASS02
2,4,6-Trinitrotoluene	118-96-7	1	-	16	6	0.06	-	0.06	0.2	-	0.4	BLASS03
4-Amino-2,6-Dinitrotoluene	19406-51-0	3	-	16	19	0.04	-	0.07	0.2	-	0.4	BLASS03
m-Nitrotoluene	99-08-1	1	-	16	6	2.86	-	2.86	0.4	-	0.8	BLASS04
Nitroglycerine	55-63-0	1	-	16	6	0.21	-	0.21	0.31	-	0.72	BLASS11
Pentaerythritol Tetranitrate	78-11-5	1	-	16	6	0.16	-	0.16	0.31	-	0.72	BLASD01
Pesticides												
4,4'-DDD	72-54-8	4	-	5	80	0.00064	-	0.043	0.00798	-	0.00798	SS-09
4,4'-DDE	72-55-9	2	-	4	50	0.00058	-	0.00086	0.00798	-	0.00809	BLASD01
Beta-BHC	319-85-7	1	-	4	25	0.00028	-	0.00028	0.00082	-	0.00809	BLASD01
Alpha-Chlordane	5103-71-9	1	-	5	20	0.089	-	0.089	0.00079	-	0.00809	SS-09
Gamma-Chlordane	5566-34-7	1	-	5	20	0.01	-	0.01	0.00079	-	0.00809	SS-09
Endosulfan I	115-29-7	1	-	5	20	0.022	-	0.022	0.00079	-	0.00809	SS-09
Endrin	72-20-8	1	-	4	25	0.00035	-	0.00035	0.00079	-	0.00809	BLASD02
Heptachlor Epoxide	1024-57-3	2	-	5	40	0.00094	-	0.015	0.00082	-	0.00809	SS-09
Methoxychlor	72-43-5	2	-	4	50	0.00442	-	0.0674	0.00082	-	0.00809	BLASB02

Table A.4.Data-1
Surface Soil Risk Assessment Dataset
Surface Soil (0-1 foot Depth Interval)
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)		Detects Max (mg/kg)	Detection Limits Min (mg/kg)		Detection Limits Max (mg/kg)	Maximum Location
Polycyclic Aromatic Hydrocarbons												
1-Methylnaphthalene	90-12-0	15	-	24	62	0.0056	-	0.4	0.0054	-	0.027	BLA-SS005
2-Methylnaphthalene	91-57-6	25	-	39	64	0.0022	-	0.58	0.0054	-	0.39	BLA-SS005
Acenaphthene	83-32-9	32	-	39	82	0.0015	-	12	0.0018	-	0.21	BLA-SS005
Acenaphthylene	208-96-8	26	-	39	67	0.00076	-	0.31	0.0026	-	0.39	BLA-SS007
Anthracene	120-12-7	36	-	39	92	0.00099	-	22	0.0024	-	0.011	BLA-SS005
Benzo(a)anthracene	56-55-3	40	-	41	98	0.0054	-	46	–	-	–	BLA-SS005
Benzo(a)pyrene	50-32-8	39	-	41	95	0.0049	-	39	0.0085	-	0.0085	BLA-SS005
Benzo(b)fluoranthene	205-99-2	40	-	41	98	0.0098	-	68	–	-	–	BLASB02
Benzo(g,h,i)perylene	191-24-2	39	-	39	100	0.0068	-	21	–	-	–	BLA-SS005
Benzo(k)fluoranthene	207-08-9	40	-	41	98	0.0028	-	31	–	-	–	BLA-SS005
Chrysene	218-01-9	40	-	41	98	0.0065	-	54	–	-	–	BLA-SS005
Dibenzo(a,h)anthracene	53-70-3	30	-	39	77	0.0019	-	6.9	0.0054	-	0.21	BLA-SS005
Fluoranthene	206-44-0	40	-	41	98	0.0089	-	160	–	-	–	BLA-SS005
Fluorene	86-73-7	30	-	39	77	0.00095	-	12	0.0054	-	0.21	BLA-SS005
Indeno(1,2,3-cd)pyrene	193-39-5	38	-	39	97	0.0052	-	25	0.0085	-	0.0085	BLA-SS005
Naphthalene	91-20-3	24	-	39	62	0.0019	-	1.4	0.0054	-	0.21	BLA-SS005
Phenanthrene	85-01-8	40	-	41	98	0.0058	-	100	–	-	–	BLA-SS005
Pyrene	129-00-0	40	-	41	98	0.0071	-	88	–	-	–	BLA-SS005
Polychlorinated Biphenyls												
Aroclor 1254	11097-69-1	9	-	17	53	0.0066	-	8.3	0.02	-	0.04	SS-09
Inorganics												
Aluminum	7429-90-5	40	-	40	100	5530	-	36000	–	-	–	407712
Antimony	7440-36-0	17	-	38	45	0.2	-	8.1	0.59	-	5.6	BLA-SS014
Arsenic	7440-38-2	39	-	40	98	1.29	-	58.4	0.51	-	0.51	BLA-SS014
Barium	7440-39-3	40	-	40	100	45.4	-	11100	–	-	–	BLA-SS008
Beryllium	7440-41-7	40	-	40	100	0.36	-	2.2	–	-	–	BLASD02,BLA-SS005
Cadmium	7440-43-9	30	-	35	86	0.09	-	44.8	0.12	-	1.5	BLA-SS013
Calcium	7440-70-2	40	-	40	100	483	-	191000	–	-	–	BLA-SS007
Chromium	7440-47-3	40	-	40	100	11.2	-	106	–	-	–	BLA-SS016
Cobalt	7440-48-4	37	-	40	92	3.9	-	149	40.6	-	47	BLASS11
Copper	7440-50-8	40	-	40	100	23.5	-	72000	–	-	–	BLA-SS013
Iron	7439-89-6	40	-	40	100	8500	-	61500	–	-	–	BLA-SS012
Lead	7439-92-1	40	-	40	100	14.7	-	58000	–	-	–	BLA-SS013
Magnesium	7439-95-4	40	-	40	100	4500	-	105000	–	-	–	BLA-SS003
Manganese	7439-96-5	40	-	40	100	88	-	3080	–	-	–	BLASS11
Mercury	7439-97-6	33	-	35	94	0.02	-	16.8	0.047	-	0.05	BLA-SS009
Nickel	7440-02-0	40	-	40	100	5.99	-	148	–	-	–	BLA-SS013
Potassium	7440-09-7	40	-	40	100	752	-	5000	–	-	–	BLA-SS005
Selenium	7782-49-2	8	-	39	21	0.39	-	1.9	1.03	-	1.9	BLA-SS013

Table A.4.Data-1
Surface Soil Risk Assessment Dataset
Surface Soil (0-1 foot Depth Interval)
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Silver	7440-22-4	12	-	35	34	0.39	-	2.3	1.03	-	3.7	BLA-SS013
Sodium	7440-23-5	18	-	38	47	23.8	-	118	1190	-	2330	BLASS03
Thallium	7440-28-0	16	-	38	42	0.04	-	0.78	2.4	-	4.7	407712
Vanadium	7440-62-2	40	-	40	100	14.4	-	102	–	-	–	BLA-SS002
Zinc	7440-66-6	40	-	40	100	37.2	-	12500	–	-	–	BLA-SS013

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilograms.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table A.3.Data-2
Soil Risk Assessment Dataset
Surface Soil (0-2 foot Depth Interval)
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b]: number of detects / number of samples	FOD %	Detects Min - Max (mg/kg) - (mg/kg)	Detection Limits Min - Max (mg/kg) - (mg/kg)	Maximum Location	
Volatile Organic Compounds							
1,2,4-Trimethylbenzene	95-63-6	2 - 4	50	0.003 - 0.004	0.002 - 0.002	DTSS1	*
m,p-Xylene	136777612	1 - 7	14	0.003 - 0.003	0.003 - 0.014	DTSS1	*
Xylenes (total)	1330-20-7	1 - 7	14	0.003 - 0.003	0.003 - 0.014	DTSS1	*
Semi-Volatile Organic Compounds							
Carbazole	86-74-8	4 - 4	100	0.17 - 3.5	– - –	DTSB35	*r
Dibenzofuran	132-64-9	3 - 4	75	0.28 - 0.8	0.4 - 0.4	DTSB35	*r
Herbicides							
2,4-D	94-75-7	1 - 1	100	0.171 - 0.171	– - –	DTSB46	*
Dalapon	75-99-0	1 - 1	100	0.099 - 0.099	– - –	DTSB46	*
Dicamba	1918-00-9	1 - 1	100	0.00849 - 0.00849	– - –	DTSB46	*
MCPP	93-65-2	1 - 1	100	13.5 - 13.5	– - –	DTSB46	*
Pesticides							
4,4'-DDD	72-54-8	1 - 1	100	0.0034 - 0.0034	– - –	DTSB46	*
Methoxychlor	72-43-5	1 - 1	100	0.0291 - 0.0291	– - –	DTSB46	*
Polycyclic Aromatic Hydrocarbons							
1-Methylnaphthalene	90-12-0	3 - 8	38	0.002 - 0.0036	0.0039 - 0.0045	BDDT-SS001	*
2-Methylnaphthalene	91-57-6	16 - 59	27	0.00095 - 5.1	0.0039 - 0.43	DTSB46	*
Acenaphthene	83-32-9	32 - 59	54	0.002 - 27	0.0039 - 0.011	DTSB46	*
Acenaphthylene	208-96-8	20 - 59	34	0.00087 - 0.31	0.0039 - 0.85	DTSB55	*
Anthracene	120-12-7	37 - 59	63	0.0036 - 37	0.0039 - 0.011	DTSB46	*
Benzo(a)anthracene	56-55-3	42 - 59	71	0.0093 - 66	0.0039 - 0.011	DTSB46	*
Benzo(a)pyrene	50-32-8	42 - 59	71	0.0089 - 57	0.0039 - 0.011	DTSB46	*
Benzo(b)fluoranthene	205-99-2	47 - 59	80	0.0038 - 81	0.0041 - 0.011	DTSB46	*
Benzo(g,h,i)perylene	191-24-2	41 - 59	69	0.0063 - 38	0.0039 - 0.011	DTSB46	*
Benzo(k)fluoranthene	207-08-9	43 - 59	73	0.0017 - 26	0.0041 - 0.011	DTSB46	*
Chrysene	218-01-9	42 - 59	71	0.0089 - 61	0.0039 - 0.011	DTSB46	*
Dibenzo(a,h)anthracene	53-70-3	26 - 59	44	0.0027 - 9.9	0.0039 - 3.4	DTSB46	*
Fluoranthene	206-44-0	50 - 59	85	0.0052 - 180	0.0041 - 0.0088	DTSB46	*
Fluorene	86-73-7	31 - 59	53	0.002 - 28	0.0039 - 0.08	DTSB46	*
Indeno(1,2,3-cd)pyrene	193-39-5	39 - 59	66	0.013 - 47	0.0039 - 0.011	DTSB46	*
Naphthalene	91-20-3	21 - 59	36	0.0011 - 29	0.0039 - 0.43	DTSB46	*
Phenanthrene	85-01-8	46 - 59	78	0.0047 - 160	0.0041 - 0.011	DTSB46	*
Pyrene	129-00-0	48 - 59	81	0.0054 - 130	0.0041 - 0.011	DTSB46	*
Inorganics							
Aluminum	7429-90-5	8 - 8	100	14600 - 20100	– - –	DTSS3	*
Antimony	7440-36-0	2 - 8	25	0.22 - 0.33	0.59 - 0.66	DTSB47	*
Arsenic	7440-38-2	8 - 8	100	2.11 - 11.6	– - –	DTSS3	*
Barium	7440-39-3	8 - 8	100	56 - 78.7	– - –	DTSB47	*
Beryllium	7440-41-7	8 - 8	100	0.76 - 1.5	– - –	DTSS3	*

Table A.3.Data-2
Soil Risk Assessment Dataset
Surface Soil (0-2 foot Depth Interval)
BUILDING DEBRIS DISPOSAL TRENCH
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b]				Detects			Detection Limits			Maximum Location	
		number of detects / number of samples			FOD %	Min (mg/kg)	-	Max (mg/kg)	Min (mg/kg)	-	Max (mg/kg)		
Cadmium	7440-43-9	2	-	8	25	0.05	-	0.1	0.12	-	0.13	DTSB46	*
Calcium	7440-70-2	8	-	8	100	850	-	2560	–	-	–	DTSS3	*
Chromium	7440-47-3	8	-	8	100	23.2	-	60.8	–	-	–	DTSS3	*
Cobalt	7440-48-4	8	-	8	100	10.7	-	446	–	-	–	DTSS2	*
Copper	7440-50-8	8	-	8	100	19.3	-	138	–	-	–	DTSS2	*
Iron	7439-89-6	8	-	8	100	21100	-	58100	–	-	–	DTSS3	*
Lead	7439-92-1	8	-	8	100	14.1	-	336	–	-	–	DTSS2	*
Magnesium	7439-95-4	8	-	8	100	4040	-	13500	–	-	–	DTSS3	*
Manganese	7439-96-5	8	-	8	100	484	-	3430	–	-	–	DTSS2	*
Mercury	7439-97-6	4	-	8	50	0.02	-	0.03	0.12	-	0.13	DTSB46,DTSB46,DTSB47	*
Nickel	7440-02-0	8	-	8	100	15.1	-	41.3	–	-	–	DTSS2	*
Potassium	7440-09-7	8	-	8	100	1370	-	3980	–	-	–	DTSS3	*
Selenium	7782-49-2	1	-	8	12	0.43	-	0.43	0.59	-	1.24	DTSB46	*
Sodium	7440-23-5	8	-	8	100	18	-	173	–	-	–	DTSB35	*r
Thallium	7440-28-0	5	-	8	62	0.2	-	0.51	0.24	-	0.26	DTSB35	*r
Vanadium	7440-62-2	8	-	8	100	38.4	-	108	–	-	–	DTSS3	*
Zinc	7440-66-6	8	-	8	100	39.5	-	178	–	-	–	DTSS1	*

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilograms.

PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

* = Surface soil
r = Rip-rap area

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table A.4.Data-3
Soil Risk Assessment Dataset
Combined Surface and Subsurface Soil
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects /		number of samples	FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Volatile Organic Compounds												
2-Butanone	78-93-3	1	-	18	6	0.011	-	0.011	0.0055	-	0.0088	BLA-SPSD01
3-Octanone	106-68-3	1	-	1	100	0.011	-	0.011	–	-	–	BLASS07
4-Methyl-2-pentanone	108-10-1	1	-	18	6	0.0016	-	0.0016	0.0055	-	0.0088	BLA-SPSD01
Acetone	67-64-1	2	-	18	11	0.023	-	0.043	0.0055	-	0.0088	BLA-SPSD01
Carbon Disulfide	75-15-0	3	-	18	17	0.00043	-	0.0031	0.0055	-	0.0088	BLA-SPSD01
d-Limonene	5989-27-5	1	-	1	100	0.057	-	0.057	–	-	–	BLASS07
Methylene Chloride	75-09-2	3	-	20	15	0.001	-	0.0028	0.0055	-	0.0088	BLA-SPSD01
Tetrachloroethene	127-18-4	2	-	18	11	0.0009	-	0.00092	0.0055	-	0.0094	BLASS07
Toluene	108-88-3	5	-	18	28	0.00071	-	0.007	0.0055	-	0.0094	BLASS07
Semi-Volatile Organic Compounds												
2,4-Dinitrotoluene	121-14-2	9	-	20	45	0.04	-	3	0.2	-	0.2	BLASS03
2,6-Dinitrotoluene	606-20-2	3	-	20	15	0.07	-	1.9	0.2	-	0.4	SS-09
Benzoic Acid	65-85-0	4	-	15	27	0.14	-	0.3	0.86	-	3.8	TR-03E
bis(2-Ethylhexyl)phthalate	117-81-7	13	-	16	81	0.03	-	0.57	0.2	-	0.21	SS-09
Carbazole	86-74-8	10	-	14	71	0.045	-	13	0.2	-	0.26	BLASB02
Dibenzofuran	132-64-9	9	-	14	64	0.016	-	2.8	0.2	-	0.26	BLASB02
Di-n-Butylphthalate	84-74-2	6	-	14	43	0.061	-	120	0.2	-	0.39	BLASS03
N-Nitrosodiphenylamine	86-30-6	2	-	13	15	0.1	-	8.3	0.2	-	0.78	BLASS03
Phenol	108-95-2	1	-	14	7	0.08	-	0.08	0.2	-	0.78	SS-14
Explosives												
1,3,5-Trinitrobenzene	99-35-4	1	-	19	5	0.07	-	0.07	0.1	-	0.2	BLASS06
1,3-Dinitrobenzene	99-65-0	1	-	19	5	0.05	-	0.05	0.1	-	0.2	BLASS02
2,4,6-Trinitrotoluene	118-96-7	1	-	19	5	0.06	-	0.06	0.2	-	0.4	BLASS03
4-Amino-2,6-Dinitrotoluene	19406-51-0	3	-	19	16	0.04	-	0.07	0.2	-	0.4	BLASS03
m-Nitrotoluene	99-08-1	1	-	19	5	2.86	-	2.86	0.4	-	0.8	BLASS04
Nitroglycerine	55-63-0	1	-	19	5	0.21	-	0.21	0.31	-	0.72	BLASS11
Pentaerythritol Tetranitrate	78-11-5	1	-	19	5	0.16	-	0.16	0.31	-	0.72	BLASD01
Pesticides												
4,4'-DDD	72-54-8	4	-	5	80	0.00064	-	0.043	0.00798	-	0.00798	SS-09
4,4'-DDE	72-55-9	2	-	4	50	0.00058	-	0.00086	0.00798	-	0.00809	BLASD01
Beta-BHC	319-85-7	1	-	4	25	0.00028	-	0.00028	0.00082	-	0.00809	BLASD01
Alpha-Chlordane	5103-71-9	1	-	5	20	0.089	-	0.089	0.00079	-	0.00809	SS-09
Gamma-Chlordane	5566-34-7	1	-	5	20	0.01	-	0.01	0.00079	-	0.00809	SS-09
Endosulfan I	115-29-7	1	-	5	20	0.022	-	0.022	0.00079	-	0.00809	SS-09
Endrin	72-20-8	1	-	4	25	0.00035	-	0.00035	0.00079	-	0.00809	BLASD02
Heptachlor Epoxide	1024-57-3	2	-	5	40	0.00094	-	0.015	0.00082	-	0.00809	SS-09
Methoxychlor	72-43-5	2	-	4	50	0.00442	-	0.0674	0.00082	-	0.00809	BLASB02

Table A.4.Data-3
Soil Risk Assessment Dataset
Combined Surface and Subsurface Soil
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)		Detects Max (mg/kg)	Detection Limits Min (mg/kg)		Detection Limits Max (mg/kg)	Maximum Location
Polycyclic Aromatic Hydrocarbons												
1-Methylnaphthalene	90-12-0	15	-	24	62	0.0056	-	0.4	0.0054	-	0.027	BLA-SS005
2-Methylnaphthalene	91-57-6	26	-	42	62	0.0013	-	0.58	0.0054	-	0.39	BLA-SS005
Acenaphthene	83-32-9	32	-	42	76	0.0015	-	12	0.0018	-	0.26	BLA-SS005
Acenaphthylene	208-96-8	26	-	42	62	0.00076	-	0.31	0.0022	-	0.39	BLA-SS007
Anthracene	120-12-7	36	-	42	86	0.00099	-	22	0.0022	-	0.26	BLA-SS005
Benzo(a)anthracene	56-55-3	42	-	44	95	0.0054	-	46	0.0022	-	0.0022	BLA-SS005
Benzo(a)pyrene	50-32-8	39	-	44	89	0.0049	-	39	0.0022	-	0.26	BLA-SS005
Benzo(b)fluoranthene	205-99-2	41	-	44	93	0.0098	-	68	0.0022	-	0.26	BLASB02
Benzo(g,h,i)perylene	191-24-2	39	-	42	93	0.0068	-	21	0.0022	-	0.26	BLA-SS005
Benzo(k)fluoranthene	207-08-9	41	-	44	93	0.0028	-	31	0.0022	-	0.26	BLA-SS005
Chrysene	218-01-9	41	-	44	93	0.0065	-	54	0.0022	-	0.26	BLA-SS005
Dibenzo(a,h)anthracene	53-70-3	30	-	42	71	0.0019	-	6.9	0.0022	-	0.26	BLA-SS005
Fluoranthene	206-44-0	41	-	44	93	0.0089	-	160	0.0022	-	0.26	BLA-SS005
Fluorene	86-73-7	31	-	42	74	0.00085	-	12	0.0054	-	0.26	BLA-SS005
Indeno(1,2,3-cd)pyrene	193-39-5	38	-	42	90	0.0052	-	25	0.0022	-	0.26	BLA-SS005
Naphthalene	91-20-3	25	-	42	60	0.0019	-	1.4	0.0054	-	0.26	BLA-SS005
Phenanthrene	85-01-8	41	-	44	93	0.0058	-	100	0.0022	-	0.26	BLA-SS005
Pyrene	129-00-0	41	-	44	93	0.0071	-	88	0.0022	-	0.26	BLA-SS005
Polychlorinated Biphenyls												
Aroclor 1254	11097-69-1	9	-	20	45	0.0066	-	8.3	0.02	-	0.04	SS-09
Inorganics												
Aluminum	7429-90-5	47	-	47	100	5530	-	43700	–	-	–	BLASB01
Antimony	7440-36-0	20	-	45	44	0.2	-	8.1	0.59	-	5.6	BLA-SS014
Arsenic	7440-38-2	46	-	47	98	1.29	-	58.4	0.51	-	0.51	BLA-SS014
Barium	7440-39-3	47	-	47	100	37.2	-	11100	–	-	–	BLA-SS008
Beryllium	7440-41-7	47	-	47	100	0.36	-	2.97	–	-	–	BLASB02
Cadmium	7440-43-9	30	-	38	79	0.09	-	44.8	0.12	-	1.5	BLA-SS013
Calcium	7440-70-2	47	-	47	100	483	-	191000	–	-	–	BLA-SS007
Chromium	7440-47-3	47	-	47	100	11.2	-	106	–	-	–	BLA-SS016
Cobalt	7440-48-4	44	-	47	94	3.9	-	149	40.6	-	47	BLASS11
Copper	7440-50-8	47	-	47	100	21	-	72000	–	-	–	BLA-SS013
Iron	7439-89-6	47	-	47	100	8500	-	61500	–	-	–	BLA-SS012
Lead	7439-92-1	47	-	47	100	9.82	-	58000	–	-	–	BLA-SS013
Magnesium	7439-95-4	47	-	47	100	3470	-	105000	–	-	–	BLA-SS003
Manganese	7439-96-5	47	-	47	100	71	-	3080	–	-	–	BLASS11
Mercury	7439-97-6	36	-	38	95	0.02	-	16.8	0.047	-	0.05	BLA-SS009
Nickel	7440-02-0	47	-	47	100	5.99	-	148	–	-	–	BLA-SS013
Potassium	7440-09-7	47	-	47	100	752	-	9590	–	-	–	BLASB02

Table A.4.Data-3
Soil Risk Assessment Dataset
Combined Surface and Subsurface Soil
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Max (mg/kg)	Detection Limits Min (mg/kg)	-	Max (mg/kg)	Maximum Location
Selenium	7782-49-2	12	-	46	26	0.39	-	1.9	1.03	-	1.9	BLA-SS013
Silver	7440-22-4	12	-	38	32	0.39	-	2.3	1.03	-	3.7	BLA-SS013
Sodium	7440-23-5	25	-	45	56	23.8	-	118	1190	-	2330	BLASS03
Thallium	7440-28-0	20	-	45	44	0.04	-	0.78	2.4	-	4.7	407712
Vanadium	7440-62-2	47	-	47	100	14.4	-	102	–	-	–	BLA-SS002
Zinc	7440-66-6	47	-	47	100	30.4	-	12500	–	-	–	BLA-SS013

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilograms.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table A.4.Data-4
Sediment Risk Assessment Dataset
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Volatile Organic Compounds												
Acetone	67-64-1	1	-	2	50	0.028	-	0.028	0.008	-	0.008	BLASD05
Toluene	108-88-3	1	-	2	50	0.00096	-	0.00096	0.008	-	0.008	BLASD05
Semi-Volatile Organic Compounds										-		
bis(2-Ethylhexyl)phthalate	117-81-7	1	-	2	50	0.058	-	0.058	0.25	-	0.25	BLASD04
Pesticides										-		
4,4'-DDD	72-54-8	2	-	2	100	0.00059	-	0.00073	–	-	–	BLASD04
4,4'-DDE	72-55-9	2	-	2	100	0.00102	-	0.00182	–	-	–	BLASD04
4,4'-DDT	50-29-3	2	-	2	100	0.00062	-	0.00077	–	-	–	BLASD04
Beta-BHC	319-85-7	1	-	2	50	0.00029	-	0.00029	0.00099	-	0.00099	BLASD04
Alpha-Chlordane	5103-71-9	2	-	2	100	0.00025	-	0.00038	–	-	–	BLASD04
Gamma-Chlordane	5566-34-7	1	-	2	50	0.00041	-	0.00041	0.00099	-	0.00099	BLASD04
Dieldrin	60-57-1	1	-	2	50	0.00094	-	0.00094	0.00099	-	0.00099	BLASD04
Polycyclic Aromatic Hydrocarbons										-		
2-Methylnaphthalene	91-57-6	2	-	2	100	0.0013	-	0.0018	–	-	–	BLASD04
Anthracene	120-12-7	1	-	2	50	0.0017	-	0.0017	0.0025	-	0.0025	BLASD04
Benzo(a)anthracene	56-55-3	2	-	2	100	0.0059	-	0.013	–	-	–	BLASD04
Benzo(a)pyrene	50-32-8	2	-	2	100	0.005	-	0.012	–	-	–	BLASD04
Benzo(b)fluoranthene	205-99-2	2	-	2	100	0.013	-	0.019	–	-	–	BLASD04
Benzo(g,h,i)perylene	191-24-2	2	-	2	100	0.0031	-	0.0071	–	-	–	BLASD04
Benzo(k)fluoranthene	207-08-9	2	-	2	100	0.0033	-	0.0071	–	-	–	BLASD04
Chrysene	218-01-9	2	-	2	100	0.0073	-	0.013	–	-	–	BLASD04
Dibenzo(a,h)anthracene	53-70-3	2	-	2	100	0.0013	-	0.0021	–	-	–	BLASD04
Fluoranthene	206-44-0	2	-	2	100	0.0078	-	0.019	–	-	–	BLASD04
Fluorene	86-73-7	1	-	2	50	0.0012	-	0.0012	0.0025	-	0.0025	BLASD04
Indeno(1,2,3-cd)pyrene	193-39-5	2	-	2	100	0.0039	-	0.0081	–	-	–	BLASD04
Naphthalene	91-20-3	2	-	2	100	0.002	-	0.0021	–	-	–	BLASD04
Phenanthrene	85-01-8	2	-	2	100	0.0037	-	0.009	–	-	–	BLASD04
Pyrene	129-00-0	2	-	2	100	0.0091	-	0.019	–	-	–	BLASD04
Inorganics										-		
Aluminum	7429-90-5	2	-	2	100	7900	-	13300	–	-	–	BLASD04
Antimony	7440-36-0	2	-	2	100	0.28	-	0.37	–	-	–	BLASD05
Arsenic	7440-38-2	2	-	2	100	2.1	-	4.6	–	-	–	BLASD05
Barium	7440-39-3	2	-	2	100	74.8	-	77.2	–	-	–	BLASD04
Beryllium	7440-41-7	2	-	2	100	0.89	-	0.92	–	-	–	BLASD05
Calcium	7440-70-2	2	-	2	100	61200	-	102000	–	-	–	BLASD05
Chromium	7440-47-3	2	-	2	100	26.8	-	28.5	–	-	–	BLASD05

Table A.4.Data-4
Sediment Risk Assessment Dataset
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Cobalt	7440-48-4	2	-	2	100	7.3	-	10.5	–	-	–	BLASD05
Copper	7440-50-8	2	-	2	100	6.06	-	8.89	–	-	–	BLASD04
Iron	7439-89-6	2	-	2	100	17600	-	23300	–	-	–	BLASD05
Lead	7439-92-1	2	-	2	100	14.6	-	19.3	–	-	–	BLASD05
Magnesium	7439-95-4	2	-	2	100	3200	-	9810	–	-	–	BLASD05
Manganese	7439-96-5	2	-	2	100	649	-	681	–	-	–	BLASD04
Nickel	7440-02-0	2	-	2	100	10.9	-	11.5	–	-	–	BLASD04
Potassium	7440-09-7	2	-	2	100	1240	-	1310	–	-	–	BLASD05
Sodium	7440-23-5	2	-	2	100	81.9	-	83.6	–	-	–	BLASD05
Thallium	7440-28-0	2	-	2	100	0.18	-	0.29	–	-	–	BLASD05
Vanadium	7440-62-2	2	-	2	100	31.7	-	37.8	–	-	–	BLASD05
Zinc	7440-66-6	2	-	2	100	25.8	-	36	–	-	–	BLASD04

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilograms.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table A.4.Data-5
Surface Water Risk Assessment Dataset
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/L)	-	Detects Max (mg/L)	Detection Limits Min (mg/L)	-	Detection Limits Max (mg/L)	Maximum Location
Volatile Organic Compounds												
Carbon Disulfide	75-15-0	2	-	3	67	0.00007	-	0.00012	0.001	-	0.001	BLASW/SD04
Chloroform	67-66-3	2	-	3	67	0.00013	-	0.00018	0.001	-	0.001	BLASW/SD04
Semi-Volatile Organic Compounds												
Butylbenzylphthalate	85-68-7	1	-	2	50	0.00044	-	0.00044	0.005	-	0.005	BLASW/SD04
Di-n-Butylphthalate	84-74-2	1	-	2	50	0.0009	-	0.0009	0.005	-	0.005	BLASW/SD04
Explosives												
m-Nitrotoluene	99-08-1	2	-	2	100	0.00042	-	0.00043	–	-	–	BLASW/SD04
Herbicides												
2,4-D	94-75-7	1	-	2	50	0.00326	-	0.00326	0.0005	-	0.0005	BLASW/SD04
Pesticides												
Dieldrin	60-57-1	2	-	2	100	0.0000041	-	5.82E-06	–	-	–	BLASW/SD05
Polycyclic Aromatic Hydrocarbons												
Benzo(a)anthracene	56-55-3	1	-	4	25	0.000024	-	0.000024	0.00005	-	0.00047	BLA-VLTW01
Benzo(b)fluoranthene	205-99-2	1	-	4	25	0.000025	-	0.000025	0.00005	-	0.00047	BLA-VLTW01
Chrysene	218-01-9	1	-	4	25	0.00003	-	0.00003	0.00005	-	0.00047	BLA-VLTW01
Fluoranthene	206-44-0	1	-	4	25	0.000066	-	0.000066	0.000047	-	0.00005	BLA-VLTW01
Phenanthrene	85-01-8	1	-	4	25	0.000036	-	0.000036	0.000047	-	0.00005	BLA-VLTW01
Pyrene	129-00-0	1	-	4	25	0.000041	-	0.000041	0.00005	-	0.00047	BLA-VLTW01
Inorganics												
Aluminum	7429-90-5	4	-	4	100	0.14	-	0.549	–	-	–	BLA-SPSW01
Antimony	7440-36-0	1	-	4	25	0.00077	-	0.00077	0.005	-	0.015	BLASW/SD05
Arsenic	7440-38-2	2	-	4	50	0.0034	-	0.01	0.003	-	0.003	BLA-SPSW01
Barium	7440-39-3	4	-	4	100	0.0588	-	0.0981	–	-	–	BLA-VLTW01
Calcium	7440-70-2	4	-	4	100	25.6	-	86.5	–	-	–	BLA-SPSW01
Chromium	7440-47-3	1	-	4	25	0.0027	-	0.0027	0.01	-	0.01	BLA-VLTW01
Copper	7440-50-8	2	-	4	50	0.646	-	0.828	0.02	-	0.02	BLA-SPSW01
Iron	7439-89-6	4	-	4	100	0.274	-	0.742	–	-	–	BLA-VLTW01
Lead	7439-92-1	4	-	4	100	0.00034	-	0.247	–	-	–	BLA-VLTW01
Magnesium	7439-95-4	4	-	4	100	16.4	-	496	–	-	–	BLA-SPSW01
Manganese	7439-96-5	4	-	4	100	0.0184	-	0.377	–	-	–	BLA-SPSW01
Mercury	7439-97-6	1	-	4	25	0.0002	-	0.0002	0.0001	-	0.0002	BLA-VLTW01
Potassium	7440-09-7	4	-	4	100	3.3	-	146	–	-	–	BLA-SPSW01
Selenium	7782-49-2	1	-	4	25	0.00051	-	0.00051	0.005	-	0.005	BLASW/SD04
Sodium	7440-23-5	4	-	4	100	22.1	-	107	–	-	–	BLA-SPSW01
Zinc	7440-66-6	2	-	4	50	0.0263	-	0.116	0.02	-	0.02	BLA-VLTW01

Notes:

– =	Not detected/ not analyzed/ not applicable.	PAH =	Polycyclic Aromatic Hydrocarbon.
CASN =	Chemical abstracts registry number.	USEPA =	United States Environmental Protection Agency.
mg/L =	Milligrams per liter.	VOC =	Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.

[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table A.4.HHRA-1
Selection of Constituents of Potential Concern for Surface Soil
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a] (mg/kg)	Adjusted Soil Regional Screening Level (RSL) [b] Industrial Scenario (mg/kg)		Residential Scenario (mg/kg)		Surrogate	Background Level [c] (mg/kg)	Does Maximum Exceed RSL? Industrial (YES, no)	Residential (YES, no)	Is Constituent a Surface Soil COPC? [d] (YES, no)
Volatile Organic Compounds											
2-Butanone	78-93-3	1.10E-02	1.90E+04	nms	1.90E+04	ns		–	no	no	no
3-Octanone	106-68-3	1.10E-02	NA		NA			–	NA	NA	**YES**
4-Methyl-2-pentanone	108-10-1	1.60E-03	5.20E+03	ns	5.20E+03	ns		–	no	no	no
Acetone	67-64-1	4.30E-02	6.10E+04	nms	6.10E+04	n		–	no	no	no
Carbon Disulfide	75-15-0	3.10E-03	3.00E+02	ns	3.00E+02	ns		–	no	no	no
d-Limonene	5989-27-5	5.70E-02	NA		NA			–	NA	NA	**YES**
Methylene Chloride	75-09-2	2.80E-03	5.40E+01	c	1.10E+01	c		–	no	no	no
Tetrachloroethene	127-18-4	9.20E-04	2.70E+00	c	5.70E-01	c		–	no	no	no
Toluene	108-88-3	7.00E-03	6.10E+04	ns	4.60E+03	ns		–	no	no	no
Semi-Volatile Organic Compounds											
2,4-Dinitrotoluene	121-14-2	3.00E+00	1.20E+02	n	1.20E+02	n		–	no	no	no
2,6-Dinitrotoluene	606-20-2	1.90E+00	6.20E+01	n	6.20E+01	n		–	no	no	no
Benzoic Acid	65-85-0	3.00E-01	2.50E+05	nm	2.50E+05	nm		–	no	no	no
bis(2-Ethylhexyl)phthalate	117-81-7	5.70E-01	1.20E+02	c*	3.50E+01	c*		–	no	no	no
Carbazole	86-74-8	1.30E+01	NA		NA			–	NA	NA	**YES**
Dibenzofuran	132-64-9	2.80E+00	3.70E+02	n	1.00E+02	n	Furan	–	no	no	no
Di-n-Butylphthalate	84-74-2	1.20E+02	6.20E+03	n	6.20E+03	n		–	no	no	no
N-Nitrosodiphenylamine	86-30-6	8.30E+00	3.50E+02	c	9.90E+01	c		–	no	no	no
Phenol	108-95-2	8.00E-02	1.80E+04	nm	1.80E+04	n		–	no	no	no
Explosives											
1,3,5-Trinitrobenzene	99-35-4	7.00E-02	2.00E+01	n	2.70E+03	n		–	no	no	no
1,3-Dinitrobenzene	99-65-0	5.00E-02	6.20E+00	n	6.20E+00	n		–	no	no	no
2,4,6-Trinitrotoluene	118-96-7	6.00E-02	2.70E+03	c**	4.20E+01	c**		–	no	no	no
4-Amino-2,6-Dinitrotoluene	19406-51-0	7.00E-02	1.90E+02	n	1.90E+02	n		–	no	no	no
m-Nitrotoluene	99-08-1	2.86E+00	1.20E+03	n	1.20E+03	n		–	no	no	no
Nitroglycerine	55-63-0	2.10E-01	6.20E+00	n	6.20E+00	n		–	no	no	no
Pentaerythritol Tetranitrate	78-11-5	1.60E-01	NA		NA			–	NA	NA	**YES**
Pesticides											
4,4'-DDD	72-54-8	4.30E-02	7.20E+00	c	2.00E+00	c		–	no	no	no
4,4'-DDE	72-55-9	8.60E-04	5.10E+00	c	1.40E+00	c		–	no	no	no
Beta-BHC	319-85-7	2.80E-04	9.60E-01	c	2.70E-01	c		–	no	no	no
Alpha-Chlordane	5103-71-9	8.90E-02	6.50E+00	c*	1.60E+00	c*	Chlordane	–	no	no	no
Gamma-Chlordane	5566-34-7	1.00E-02	6.50E+00	c*	1.60E+00	c*	Chlordane	–	no	no	no
Endosulfan I	115-29-7	2.20E-02	3.70E+02	n	3.70E+02	n		–	no	no	no
Endrin	72-20-8	3.50E-04	1.80E+01	n	1.80E+01	n		–	no	no	no
Heptachlor Epoxide	1024-57-3	1.50E-02	1.90E-01	c*	5.30E-02	c*		–	no	no	no
Methoxychlor	72-43-5	6.74E-02	3.10E+02	n	3.10E+02	n		–	no	no	no
Polycyclic Aromatic Hydrocarbons											
1-Methylnaphthalene	90-12-0	4.00E-01	9.90E+01	c	2.20E+01	c		–	no	no	no

Table A.4.HHRA-1
Selection of Constituents of Potential Concern for Surface Soil
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b]					Background Level [c]	Does Maximum Exceed RSL?		Is Constituent a Surface Soil COPC? [d]
			Industrial Scenario		Residential Scenario		Surrogate		Industrial	Residential	
		(mg/kg)	(mg/kg)		(mg/kg)			(mg/kg)	(YES, no)	(YES, no)	(YES, no)
2-Methylnaphthalene	91-57-6	5.80E-01	#VALUE!		4.10E+02	n		–	NA	no	no
Acenaphthene	83-32-9	1.20E+01	#VALUE!		3.30E+03	n		–	NA	no	no
Acenaphthylene	208-96-8	3.10E-01	1.70E+03	n	3.30E+03	n	Acenaphthene	–	no	no	no
Anthracene	120-12-7	2.20E+01	3.30E+03	nm	1.70E+04	n		–	no	no	no
Benzo(a)anthracene	56-55-3	4.60E+01	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Benzo(a)pyrene	50-32-8	3.90E+01	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Benzo(b)fluoranthene	205-99-2	6.80E+01	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Benzo(g,h,i)perylene	191-24-2	2.10E+01	3.30E+01	n	1.70E+03	n	Pyrene	–	no	no	no
Benzo(k)fluoranthene	207-08-9	3.10E+01	2.10E+01	c	1.50E+00	c		–	**YES**	**YES**	**YES**
Chrysene	218-01-9	5.40E+01	2.10E+02	c	1.50E+01	c		–	no	**YES**	**YES**
Dibenzo(a,h)anthracene	53-70-3	6.90E+00	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Fluoranthene	206-44-0	1.60E+02	#VALUE!		2.20E+03	n		–	NA	no	no
Fluorene	86-73-7	1.20E+01	2.20E+03	n	2.20E+03	n		–	no	no	no
Indeno(1,2,3-cd)pyrene	193-39-5	2.50E+01	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Naphthalene	91-20-3	1.40E+00	2.00E+01	c*	3.90E+00	c*		–	no	no	no
Phenanthrene	85-01-8	1.00E+02	#VALUE!		1.70E+04	n	Anthracene	–	NA	no	no
Pyrene	129-00-0	8.80E+01	6.70E+01	n	1.70E+03	n		–	**YES**	no	no
Polychlorinated Biphenyls											
Aroclor 1254	11097-69-1	8.30E+00	7.40E-01	c*	1.10E+00	n		–	**YES**	**YES**	**YES**
Inorganics											
Aluminum	7429-90-5	3.91E+04	9.90E+04	nm	9.90E+04	n		4.00E+04	no	no	no
Antimony	7440-36-0	8.10E+00	4.10E+01	n	4.10E+01	n		–	no	no	no
Arsenic	7440-38-2	5.84E+01	1.60E+00	c	3.90E-01	c*		1.58E+01	**YES**	**YES**	**YES**
Barium	7440-39-3	1.11E+04	1.90E+04	nm	1.90E+04	n		2.09E+02	no	no	no
Beryllium	7440-41-7	2.20E+00	2.00E+02	n	2.00E+02	n		1.02E+00	no	no	no
Cadmium	7440-43-9	4.48E+01	8.10E+01	n	8.10E+01	n		6.90E-01	no	no	no
Calcium	7440-70-2	1.91E+05	NA		NA			–	NA	NA	no
Chromium	7440-47-3	1.06E+02	1.40E+03	c	2.80E+02	c		6.53E+01	no	no	no
Cobalt	7440-48-4	1.49E+02	3.00E+01	n	3.00E+01	n		7.23E+01	**YES**	**YES**	**YES**
Copper	7440-50-8	7.20E+04	4.10E+03	n	4.10E+03	n		5.35E+01	**YES**	**YES**	**YES**
Iron	7439-89-6	6.15E+04	7.20E+04	nm	7.20E+04	n		5.10E+04	no	no	no
Lead	7439-92-1	5.80E+04	8.00E+02	«	4.00E+02	«		2.68E+01	**YES**	**YES**	**YES**
Magnesium	7439-95-4	1.05E+05	NA		NA			–	NA	NA	no
Manganese	7439-96-5	3.08E+03	2.30E+03	n	2.30E+03	n		2.54E+03	**YES**	**YES**	**YES**
Mercury	7439-97-6	1.68E+01	2.80E+00	ns	2.80E+00	ns		1.30E-01	**YES**	**YES**	**YES**
Nickel	7440-02-0	1.48E+02	2.00E+03	n	2.00E+03	n		6.28E+01	no	no	no
Potassium	7440-09-7	5.61E+03	NA		NA			–	NA	NA	no
Selenium	7782-49-2	1.90E+00	5.10E+02	n	5.10E+02	n		–	no	no	no
Silver	7440-22-4	2.30E+00	5.50E+03	n	5.10E+02	n		–	no	no	no
Sodium	7440-23-5	1.18E+02	NA		NA			–	NA	NA	no

Table A.4.HHRA-1
Selection of Constituents of Potential Concern for Surface Soil
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b]					Background Level [c]	Does Maximum Exceed RSL?		Is Constituent a Surface Soil COPC? [d]
			Industrial Scenario		Residential Scenario		Surrogate		Industrial	Residential	
		(mg/kg)	(mg/kg)		(mg/kg)			(mg/kg)	(YES, no)	(YES, no)	(YES, no)
Thallium	7440-28-0	7.80E-01	9.20E+00	n	6.60E+00	n		2.11E+00	no	no	no
Vanadium	7440-62-2	1.02E+02	5.20E+02	n	7.20E+02	n		1.08E+02	no	no	no
Zinc	7440-66-6	1.25E+04	2.30E+03	nm	3.10E+04	n		2.02E+02	**YES**	no	no

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
mg/kg = Milligrams per kilogram.
NA = Not available or not applicable.
RSL = Regional Screening Level.
USEPA = United States Environmental Protection Agency.

[a] Maximum concentration in surface soil.

[b] The screening levels used were from USEPA (2008a). Screening levels based on non-cancer effects were adjusted by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = concentration may exceed ceiling limit; s = Concentration may exceed saturation concentration (Csat).
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.

[c] Background levels for metals are facility-wide soil background point estimates taken from Facility-Wide Background Study Report (IT Corporation, 2001).

[d] Constituents detected with maximum concentrations greater than adjusted residential screening levels were considered COPCs unless they were metals detected at concentrations lower than background, or are essential nutrients (i.e., calcium, magnesium, potassium, sodium), or they were known laboratory contaminants (i.e. acetone).

Table A.4.HHRA-2
Selection of Constituents of Potential Concern for Combined Surface and Subsurface Soil
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b]					Background Level [c]	Does Maximum Exceed RSL?		Is Constituent a Surface/ Subsurface Soil COPC? [d]
			Industrial Scenario		Residential Scenario		Surrogate		Industrial	Residential	
		(mg/kg)	(mg/kg)		(mg/kg)			(mg/kg)	(YES, no)	(YES, no)	(YES, no)
Volatile Organic Compounds											
2-Butanone	78-93-3	1.10E-02	1.90E+04	nms	1.90E+04	ns		–	no	no	no
3-Octanone	106-68-3	1.10E-02	NA		NA			–	NA	NA	**YES**
4-Methyl-2-pentanone	108-10-1	1.60E-03	5.20E+03	ns	5.20E+03	ns		–	no	no	no
Acetone	67-64-1	4.30E-02	6.10E+04	nms	6.10E+04	n		–	no	no	no
Carbon Disulfide	75-15-0	3.10E-03	3.00E+02	ns	3.00E+02	ns		–	no	no	no
d-Limonene	5989-27-5	5.70E-02	NA		NA			–	NA	NA	**YES**
Methylene Chloride	75-09-2	2.80E-03	5.40E+01	c	1.10E+01	c		–	no	no	no
Tetrachloroethene	127-18-4	9.20E-04	2.70E+00	c	5.70E-01	c		–	no	no	no
Toluene	108-88-3	7.00E-03	6.10E+04	ns	4.60E+03	ns		–	no	no	no
Semi-Volatile Organic Compounds											
2,4-Dinitrotoluene	121-14-2	3.00E+00	1.20E+02	n	1.20E+02	n		–	no	no	no
2,6-Dinitrotoluene	606-20-2	1.90E+00	6.20E+01	n	6.20E+01	n		–	no	no	no
Benzoic Acid	65-85-0	3.00E-01	2.50E+05	nm	2.50E+05	nm		–	no	no	no
bis(2-Ethylhexyl)phthalate	117-81-7	5.70E-01	1.20E+02	c*	3.50E+01	c*		–	no	no	no
Carbazole	86-74-8	1.30E+01	NA		NA			–	NA	NA	**YES**
Dibenzofuran	132-64-9	2.80E+00	3.70E+02	n	1.00E+02	n	Furan	–	no	no	no
Di-n-Butylphthalate	84-74-2	1.20E+02	6.20E+03	n	6.20E+03	n		–	no	no	no
N-Nitrosodiphenylamine	86-30-6	8.30E+00	3.50E+02	c	9.90E+01	c		–	no	no	no
Phenol	108-95-2	8.00E-02	1.80E+04	nm	1.80E+04	n		–	no	no	no
Explosives											
1,3,5-Trinitrobenzene	99-35-4	7.00E-02	2.00E+01	n	2.70E+03	n		–	no	no	no
1,3-Dinitrobenzene	99-65-0	5.00E-02	6.20E+00	n	6.20E+00	n		–	no	no	no
2,4,6-Trinitrotoluene	118-96-7	6.00E-02	2.70E+03	c**	4.20E+01	c**		–	no	no	no
4-Amino-2,6-Dinitrotoluene	19406-51-0	7.00E-02	1.90E+02	n	1.90E+02	n		–	no	no	no
m-Nitrotoluene	99-08-1	2.86E+00	1.20E+03	n	1.20E+03	n		–	no	no	no
Nitroglycerine	55-63-0	2.10E-01	6.20E+00	n	6.20E+00	n		–	no	no	no
Pentaerythritol Tetranitrate	78-11-5	1.60E-01	NA		NA			–	NA	NA	**YES**
Pesticides											
4,4'-DDD	72-54-8	4.30E-02	7.20E+00	c	2.00E+00	c		–	no	no	no
4,4'-DDE	72-55-9	8.60E-04	5.10E+00	c	1.40E+00	c		–	no	no	no
Beta-BHC	319-85-7	2.80E-04	9.60E-01	c	2.70E-01	c		–	no	no	no
Alpha-Chlordane	5103-71-9	8.90E-02	6.50E+00	c*	1.60E+00	c*	Chlordane	–	no	no	no
Gamma-Chlordane	5566-34-7	1.00E-02	6.50E+00	c*	1.60E+00	c*	Chlordane	–	no	no	no
Endosulfan I	115-29-7	2.20E-02	3.70E+02	n	3.70E+02	n		–	no	no	no
Endrin	72-20-8	3.50E-04	1.80E+01	n	1.80E+01	n		–	no	no	no
Heptachlor Epoxide	1024-57-3	1.50E-02	1.90E-01	c*	5.30E-02	c*		–	no	no	no
Methoxychlor	72-43-5	6.74E-02	3.10E+02	n	3.10E+02	n		–	no	no	no
Polycyclic Aromatic Hydrocarbons											
1-Methylnaphthalene	90-12-0	4.00E-01	9.90E+01	c	2.20E+01	c		–	no	no	no
2-Methylnaphthalene	91-57-6	5.80E-01	#VALUE!		4.10E+02	n		–	NA	no	no
Acenaphthene	83-32-9	1.20E+01	#VALUE!		3.30E+03	n		–	NA	no	no

Table A.4.HHRA-2
Selection of Constituents of Potential Concern for Combined Surface and Subsurface Soil
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a] (mg/kg)	Adjusted Soil Regional Screening Level (RSL) [b] Industrial Scenario (mg/kg)		Residential Scenario (mg/kg)		Surrogate	Background Level [c] (mg/kg)	Does Maximum Exceed RSL? Industrial (YES, no)	Residential (YES, no)	Is Constituent a Surface/ Subsurface Soil COPC? [d] (YES, no)
Acenaphthylene	208-96-8	3.10E-01	1.70E+03	n	3.30E+03	n	Acenaphthene	–	no	no	no
Anthracene	120-12-7	2.20E+01	3.30E+03	nm	1.70E+04	n		–	no	no	no
Benzo(a)anthracene	56-55-3	4.60E+01	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Benzo(a)pyrene	50-32-8	3.90E+01	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Benzo(b)fluoranthene	205-99-2	6.80E+01	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Benzo(g,h,i)perylene	191-24-2	2.10E+01	3.30E+01	n	1.70E+03	n	Pyrene	–	no	no	no
Benzo(k)fluoranthene	207-08-9	3.10E+01	2.10E+01	c	1.50E+00	c		–	**YES**	**YES**	**YES**
Chrysene	218-01-9	5.40E+01	2.10E+02	c	1.50E+01	c		–	no	**YES**	**YES**
Dibenzo(a,h)anthracene	53-70-3	6.90E+00	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Fluoranthene	206-44-0	1.60E+02	#VALUE!		2.20E+03	n		–	NA	no	no
Fluorene	86-73-7	1.20E+01	2.20E+03	n	2.20E+03	n		–	no	no	no
Indeno(1,2,3-cd)pyrene	193-39-5	2.50E+01	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Naphthalene	91-20-3	1.40E+00	2.00E+01	c*	3.90E+00	c*		–	no	no	no
Phenanthrene	85-01-8	1.00E+02	#VALUE!		1.70E+04	n	Anthracene	–	NA	no	no
Pyrene	129-00-0	8.80E+01	6.70E+01	n	1.70E+03	n		–	**YES**	no	no
Polychlorinated Biphenyls											
Aroclor 1254	11097-69-1	8.30E+00	7.40E-01	c*	1.10E+00	n		–	**YES**	**YES**	**YES**
Inorganics											
Aluminum	7429-90-5	4.37E+04	9.90E+04	nm	9.90E+04	n		4.00E+04	no	no	no
Antimony	7440-36-0	8.10E+00	4.10E+01	n	4.10E+01	n		–	no	no	no
Arsenic	7440-38-2	5.84E+01	1.60E+00	c	3.90E-01	c*		1.58E+01	**YES**	**YES**	**YES**
Barium	7440-39-3	1.11E+04	1.90E+04	nm	1.90E+04	n		2.09E+02	no	no	no
Beryllium	7440-41-7	2.97E+00	2.00E+02	n	2.00E+02	n		1.02E+00	no	no	no
Cadmium	7440-43-9	4.48E+01	8.10E+01	n	8.10E+01	n		6.90E-01	no	no	no
Calcium	7440-70-2	1.91E+05	NA		NA			–	NA	NA	no
Chromium	7440-47-3	1.06E+02	1.40E+03	c	2.80E+02	c		6.53E+01	no	no	no
Cobalt	7440-48-4	1.49E+02	3.00E+01	n	3.00E+01	n		7.23E+01	**YES**	**YES**	**YES**
Copper	7440-50-8	7.20E+04	4.10E+03	n	4.10E+03	n		5.35E+01	**YES**	**YES**	**YES**
Iron	7439-89-6	6.15E+04	7.20E+04	nm	7.20E+04	n		5.10E+04	no	no	no
Lead	7439-92-1	5.80E+04	8.00E+02	«	4.00E+02	«		2.68E+01	**YES**	**YES**	**YES**
Magnesium	7439-95-4	1.05E+05	NA		NA			–	NA	NA	no
Manganese	7439-96-5	3.08E+03	2.30E+03	n	2.30E+03	n		2.54E+03	**YES**	**YES**	**YES**
Mercury	7439-97-6	1.68E+01	2.80E+00	ns	2.80E+00	ns		1.30E-01	**YES**	**YES**	**YES**
Nickel	7440-02-0	1.48E+02	2.00E+03	n	2.00E+03	n		6.28E+01	no	no	no
Potassium	7440-09-7	9.59E+03	NA		NA			–	NA	NA	no
Selenium	7782-49-2	1.90E+00	5.10E+02	n	5.10E+02	n		–	no	no	no
Silver	7440-22-4	2.30E+00	5.50E+03	n	5.10E+02	n		–	no	no	no
Sodium	7440-23-5	1.18E+02	NA		NA			–	NA	NA	no
Thallium	7440-28-0	7.80E-01	9.20E+00	n	6.60E+00	n		2.11E+00	no	no	no
Vanadium	7440-62-2	1.02E+02	5.20E+02	n	7.20E+02	n		1.08E+02	no	no	no
Zinc	7440-66-6	1.25E+04	2.30E+03	nm	3.10E+04	n		2.02E+02	**YES**	no	no

Table A.4.HHRA-2
Selection of Constituents of Potential Concern for Combined Surface and Subsurface Soil
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b]			Background Level [c]	Does Maximum Exceed RSL?		Is Constituent a Surface/ Subsurface Soil COPC? [d]
			Industrial Scenario	Residential Scenario	Surrogate		Industrial	Residential	
		(mg/kg)	(mg/kg)	(mg/kg)		(mg/kg)	(YES, no)	(YES, no)	(YES, no)

Notes:

– =	Not detected/ not analyzed/ not applicable.	NA =	Not available or not applicable.
CASN =	Chemical abstracts registry number.	RSL =	Regional Screening Level.
COPC =	Constituent of Potential Concern.	USEPA =	United States Environmental Protection Agency.
mg/kg =	Milligrams per kilogram.		

[a] Maximum concentration in combined surface and subsurface soil.

[b] The screening levels used were from USEPA (2008a). Screening levels based on non-cancer effects were adjusted by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = Concentration may exceed ceiling limit; s = Concentration may exceed saturation concentration (Csat).
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.

[c] Background levels for metals are facility-wide soil background point estimates taken from Facility-Wide Background Study Report (IT Corporation, 2001).

[d] Constituents detected with maximum concentrations greater than adjusted residential screening levels were considered COPCs unless they were metals detected at concentrations lower than background, or are essential nutrients (i.e., calcium, magnesium, potassium, sodium), or they were known laboratory contaminants (i.e. acetone).

Table A.4.HHRA-3
Selection of Constituents of Potential Concern for Sediment
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a] (mg/kg)	Adjusted Soil Regional Screening Level (RSL) [b] Residential Scenario (mg/kg)		Surrogate	Is Constituent a Sediment COPC? [c] (YES, no)
Volatile Organic Compounds						
Acetone	67-64-1	2.80E-02	6.10E+04	n		no
Toluene	108-88-3	9.60E-04	4.60E+03	ns		no
Semi-Volatile Organic Compounds						
bis(2-Ethylhexyl)phthalate	117-81-7	5.80E-02	3.50E+01	c*		no
Pesticides						
4,4'-DDD	72-54-8	7.30E-04	2.00E+00	c		no
4,4'-DDE	72-55-9	1.82E-03	1.40E+00	c		no
4,4'-DDT	50-29-3	7.70E-04	1.70E+00	c*		no
Beta-BHC	319-85-7	2.90E-04	2.70E-01	c		no
Alpha-Chlordane	5103-71-9	3.80E-04	1.60E+00	c*	Chlordane	no
Gamma-Chlordane	5566-34-7	4.10E-04	1.60E+00	c*	Chlordane	no
Dieldrin	60-57-1	9.40E-04	3.00E-02	c		no
Polycyclic Aromatic Hydrocarbons						
2-Methylnaphthalene	91-57-6	1.80E-03	4.10E+02	n		no
Anthracene	120-12-7	1.70E-03	1.70E+04	n		no
Benzo(a)anthracene	56-55-3	1.30E-02	1.50E-01	c		no
Benzo(a)pyrene	50-32-8	1.20E-02	1.50E-02	c		no
Benzo(b)fluoranthene	205-99-2	1.90E-02	1.50E-01	c		no
Benzo(g,h,i)perylene	191-24-2	7.10E-03	1.70E+03	n	Pyrene	no
Benzo(k)fluoranthene	207-08-9	7.10E-03	1.50E+00	c		no
Chrysene	218-01-9	1.30E-02	1.50E+01	c		no
Dibenzo(a,h)anthracene	53-70-3	2.10E-03	1.50E-02	c		no
Fluoranthene	206-44-0	1.90E-02	2.20E+03	n		no
Fluorene	86-73-7	1.20E-03	2.20E+03	n		no
Indeno(1,2,3-cd)pyrene	193-39-5	8.10E-03	1.50E-01	c		no
Naphthalene	91-20-3	2.10E-03	3.90E+00	c*		no
Phenanthrene	85-01-8	9.00E-03	1.70E+04	n	Anthracene	no
Pyrene	129-00-0	1.90E-02	1.70E+03	n		no
Inorganics						
Aluminum	7429-90-5	1.33E+04	9.90E+04	n		no
Antimony	7440-36-0	3.70E-01	4.10E+01	n		no
Arsenic	7440-38-2	4.60E+00	3.90E-01	c*		**YES**
Barium	7440-39-3	7.72E+01	1.90E+04	n		no
Beryllium	7440-41-7	9.20E-01	2.00E+02	n		no
Calcium	7440-70-2	1.02E+05	NA			no
Chromium	7440-47-3	2.85E+01	2.80E+02	c		no
Cobalt	7440-48-4	1.05E+01	3.00E+01	n		no
Copper	7440-50-8	8.89E+00	4.10E+03	n		no

Table A.4.HHRA-3
Selection of Constituents of Potential Concern for Sediment
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a] (mg/kg)	Adjusted Soil Regional Screening Level (RSL) [b] Residential Scenario (mg/kg)		Surrogate	Is Constituent a Sediment COPC? [c] (YES, no)
Iron	7439-89-6	2.33E+04	7.20E+04	n		no
Lead	7439-92-1	1.93E+01	4.00E+02	«		no
Magnesium	7439-95-4	9.81E+03	NA			no
Manganese	7439-96-5	6.81E+02	2.30E+03	n		no
Nickel	7440-02-0	1.15E+01	2.00E+03	n		no
Potassium	7440-09-7	1.31E+03	NA			no
Sodium	7440-23-5	8.36E+01	NA			no
Thallium	7440-28-0	2.90E-01	6.60E+00	n		no
Vanadium	7440-62-2	3.78E+01	7.20E+02	n		no
Zinc	7440-66-6	3.60E+01	3.10E+04	n		no

Notes:

CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
mg/kg = Milligrams per kilogram.
NA = Not available or not applicable.
RSL = Regional Screening Level.
USEPA = United States Environmental Protection Agency.

[a] Maximum concentration in sediment.

[b] The screening levels used were risk screening levels for the residential scenario from USEPA (2008a). Screening levels based on non-cancer effects were adjusted by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = Concentration may exceed ceiling limit; s = Concentration may exceed saturation concentration (Csat).
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.

[c] Constituents detected with maximum concentrations greater than adjusted residential screening levels were considered COPCs unless they were metals detected at concentrations lower than background, or are essential nutrients (i.e., calcium, magnesium, potassium, sodium), or they were known laboratory contaminants (i.e. acetone).

Table A.4.HHRA-4
Selection Constituents of Potential Concern for Surface Water
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Tap Water Regional Screening Level (RSL) [b]			Is Constituent a Surface Water COPC? [c]
		(mg/L)	(mg/L)		Surrogate	(YES, no)
Volatile Organic Compounds						
Carbon Disulfide	75-15-0	1.20E-04	1.00E-01	n		no
Chloroform	67-66-3	1.80E-04	1.90E-04	c		no
Semi-Volatile Organic Compounds						
Butylbenzylphthalate	85-68-7	4.40E-04	3.50E-02	c		no
Di-n-Butylphthalate	84-74-2	9.00E-04	3.70E-01	n		no
Explosives						
m-Nitrotoluene	99-08-1	4.30E-04	7.30E-02	n		no
Herbicides						
2,4-D	94-75-7	3.26E-03	3.70E-02	n		no
Pesticides						
Dieldrin	60-57-1	5.82E-06	4.20E-06	c		**YES**
Polycyclic Aromatic Hydrocarbons						
Benzo(a)anthracene	56-55-3	2.40E-05	2.90E-05	c		no
Benzo(b)fluoranthene	205-99-2	2.50E-05	2.90E-05	c		no
Chrysene	218-01-9	3.00E-05	2.90E-03	c		no
Fluoranthene	206-44-0	6.60E-05	1.50E-01	n		no
Phenanthrene	85-01-8	3.60E-05	1.10E+00	n	Anthracene	no
Pyrene	129-00-0	4.10E-05	1.10E-01	n		no
Inorganics						
Aluminum	7429-90-5	5.49E-01	3.70E+00	n		no
Antimony	7440-36-0	7.70E-04	1.50E-03	n		no
Arsenic	7440-38-2	1.00E-02	4.50E-05	c		**YES**
Barium	7440-39-3	9.81E-02	7.30E-01	n		no
Calcium	7440-70-2	8.65E+01	NA			no
Chromium	7440-47-3	2.70E-03	5.50E+00	n		no
Copper	7440-50-8	8.28E-01	1.50E-01	n		**YES**
Iron	7439-89-6	7.42E-01	2.60E+00	n		no
Lead	7439-92-1	2.47E-01	1.50E-02	**		**YES**
Magnesium	7439-95-4	4.96E+02	NA			no
Manganese	7439-96-5	3.77E-01	8.80E-02	n		**YES**
Mercury	7439-97-6	2.00E-04	6.30E-05	n		**YES**
Potassium	7440-09-7	1.46E+02	NA			no
Selenium	7782-49-2	5.10E-04	1.80E-02	n		no
Sodium	7440-23-5	1.07E+02	NA			no
Zinc	7440-66-6	1.16E-01	1.10E+00	n		no

Table A.4.HHRA-4
Selection Constituents of Potential Concern for Surface Water
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:

CASN =	Chemical abstracts registry number.	NA =	Not available or not applicable.
COPC =	Constituent of Potential Concern.	RSL =	Regional Screening Level.
mg/L =	Milligrams per liter.	USEPA =	United States Environmental Protection Agency.

[a] Maximum concentration in surface water.

[b] The screening levels used were risk screening levels for tap water from USEPA (2008a). Screening levels based on non-cancer effects were adjusted by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.

c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = Concentration may exceed ceiling limit;

« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.

Some RSL values were based on surrogates as identified next to each value.

[c] Constituents detected with maximum concentrations greater than screening levels were considered COPCs unless they were essential nutrients (i.e., calcium, magnesium, potassium, sodium), or were known laboratory contaminants (i.e. acetone).

Table A.4.HHRA-5
Exposure Point Concentrations
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a]				Exposure Point Concentrations [b]			
		Surface Soil	Combined Surface and Subsurface Soil	Sediment	Surface Water	Surface Soil (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Sediment (mg/kg)	Surface Water (mg/L)
Volatile Organic Compounds									
1,2,3-Trichloropropane	96-18-4	no	no	no	no	–	–	–	–
1,2,4-Trimethylbenzene	95-63-6	no	no	no	no	–	–	–	–
2-Butanone	78-93-3	no	no	no	no	–	–	–	–
3-Octanone	106-68-3	**YES**	**YES**	no	no	1.10E-02 m	1.10E-02 m	–	–
4-Methyl-2-pentanone	108-10-1	no	no	no	no	–	–	–	–
Acetone	67-64-1	no	no	no	no	–	–	–	–
Bromodichloromethane	75-27-4	no	no	no	no	–	–	–	–
Carbon Disulfide	75-15-0	no	no	no	no	–	–	–	–
Chloroform	67-66-3	no	no	no	no	–	–	–	–
cis-1,2-Dichloroethene	156-59-2	no	no	no	no	–	–	–	–
d-Limonene	5989-27-5	**YES**	**YES**	no	no	5.70E-02 m	5.70E-02 m	–	–
Ethanol	64-17-5	no	no	no	no	–	–	–	–
m,p-Xylene	136777612	no	no	no	no	–	–	–	–
Methylene Chloride	75-09-2	no	no	no	no	–	–	–	–
p-Isopropyltoluene	99-87-6	no	no	no	no	–	–	–	–
Tetrachloroethene	127-18-4	no	no	no	no	–	–	–	–
Toluene	108-88-3	no	no	no	no	–	–	–	–
Trichloroethene	79-01-6	no	no	no	no	–	–	–	–
Xylenes (total)	1330-20-7	no	no	no	no	–	–	–	–
Semi-Volatile Organic Compounds									
1,2,4-Trichlorobenzene	120-82-1	no	no	no	no	–	–	–	–
1,2-Dichlorobenzene	95-50-1	no	no	no	no	–	–	–	–
1,3-Dichlorobenzene	541-73-1	no	no	no	no	–	–	–	–
1,4-Dichlorobenzene	106-46-7	no	no	no	no	–	–	–	–
2,4-Dinitrotoluene	121-14-2	no	no	no	no	–	–	–	–
2,6-Dinitrotoluene	606-20-2	no	no	no	no	–	–	–	–
3,3'-Dichlorobenzidine	91-94-1	no	no	no	no	–	–	–	–
4-Methylphenol	106-44-5	no	no	no	no	–	–	–	–
Benzoic Acid	65-85-0	no	no	no	no	–	–	–	–
bis(2-Ethylhexyl)phthalate	117-81-7	no	no	no	no	–	–	–	–
Butylbenzylphthalate	85-68-7	no	no	no	no	–	–	–	–
Carbazole	86-74-8	**YES**	**YES**	no	no	1.20E+01	1.04E+01	–	–
Dibenzofuran	132-64-9	no	no	no	no	–	–	–	–
Diethylphthalate	84-66-2	no	no	no	no	–	–	–	–
Di-n-Butylphthalate	84-74-2	no	no	no	no	–	–	–	–
Di-n-Octylphthalate	117-84-0	no	no	no	no	–	–	–	–
N-Nitrosodiphenylamine	86-30-6	no	no	no	no	–	–	–	–
Pentachlorophenol	87-86-5	no	no	no	no	–	–	–	–
Phenol	108-95-2	no	no	no	no	–	–	–	–
Dioxin/Furan Compounds									
1,2,3,4,6,7,8-HpCDD	35822-46-9	no	no	no	no	–	–	–	–

Table A.4.HHRA-5
Exposure Point Concentrations
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a]				Exposure Point Concentrations [b]			
		Surface Soil	Combined Surface and Subsurface Soil	Sediment	Surface Water	Surface Soil (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Sediment (mg/kg)	Surface Water (mg/L)
1,2,3,4,6,7,8-HpCDF	67562-39-4	no	no	no	no	–	–	–	–
1,2,3,4,7,8,9-HpCDF	55673-89-7	no	no	no	no	–	–	–	–
1,2,3,4,7,8-HxCDD	39227-28-6	no	no	no	no	–	–	–	–
1,2,3,4,7,8-HxCDF	70648-26-9	no	no	no	no	–	–	–	–
1,2,3,6,7,8-HxCDD	57653-85-7	no	no	no	no	–	–	–	–
1,2,3,6,7,8-HxCDF	57117-44-9	no	no	no	no	–	–	–	–
1,2,3,7,8,9-HxCDD	19408-74-3	no	no	no	no	–	–	–	–
1,2,3,7,8,9-HxCDF	72918-21-9	no	no	no	no	–	–	–	–
1,2,3,7,8-PeCDD	40321-76-4	no	no	no	no	–	–	–	–
1,2,3,7,8-PeCDF	57117-41-6	no	no	no	no	–	–	–	–
2,3,4,6,7,8-HxCDF	60851-34-5	no	no	no	no	–	–	–	–
2,3,4,7,8-PeCDF	57117-31-4	no	no	no	no	–	–	–	–
2,3,7,8-TCDD	1746-01-6	no	no	no	no	–	–	–	–
2,3,7,8-TCDF	51207-31-9	no	no	no	no	–	–	–	–
OCDD	3268-87-9	no	no	no	no	–	–	–	–
OCDF	39001-02-0	no	no	no	no	–	–	–	–
Explosives									
1,3,5-Trinitrobenzene	99-35-4	no	no	no	no	–	–	–	–
1,3-Dinitrobenzene	99-65-0	no	no	no	no	–	–	–	–
2,4,6-Trinitrotoluene	118-96-7	no	no	no	no	–	–	–	–
4-Amino-2,6-Dinitrotoluene	19406-51-0	no	no	no	no	–	–	–	–
m-Nitrotoluene	99-08-1	no	no	no	no	–	–	–	–
Nitrobenzene	98-95-3	no	no	no	no	–	–	–	–
Nitroglycerine	55-63-0	no	no	no	no	–	–	–	–
Pentaerythritol Tetranitrate	78-11-5	**YES**	**YES**	no	no	1.60E-01 m	1.60E-01 m	–	–
Perchlorate	14797-73-0	no	no	no	no	–	–	–	–
Herbicides									
2,4,5-T	93-76-5	no	no	no	no	–	–	–	–
2,4,5-TP	93-72-1	no	no	no	no	–	–	–	–
2,4-D	94-75-7	no	no	no	no	–	–	–	–
2,4-DB	94-82-6	no	no	no	no	–	–	–	–
Dalapon	75-99-0	no	no	no	no	–	–	–	–
Dicamba	1918-00-9	no	no	no	no	–	–	–	–
Dichlorprop	120-36-5	no	no	no	no	–	–	–	–
MCPA	94-74-6	no	no	no	no	–	–	–	–
MCPP	93-65-2	no	no	no	no	–	–	–	–
Pesticides									
4,4'-DDD	72-54-8	no	no	no	no	–	–	–	–
4,4'-DDE	72-55-9	no	no	no	no	–	–	–	–
4,4'-DDT	50-29-3	no	no	no	no	–	–	–	–
Alpha-BHC	319-84-6	no	no	no	no	–	–	–	–
Beta-BHC	319-85-7	no	no	no	no	–	–	–	–

Table A.4.HHRA-5
Exposure Point Concentrations
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a]				Exposure Point Concentrations [b]			
		Surface Soil	Combined Surface and Subsurface Soil	Sediment	Surface Water	Surface Soil (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Sediment (mg/kg)	Surface Water (mg/L)
Delta-BHC	319-86-8	no	no	no	no	–	–	–	–
Gamma-BHC (Lindane)	58-89-9	no	no	no	no	–	–	–	–
Alpha-Chlordane	5103-71-9	no	no	no	no	–	–	–	–
Gamma-Chlordane	5566-34-7	no	no	no	no	–	–	–	–
Dieldrin	60-57-1	no	no	no	**YES**	–	–	–	5.82E-06 m
Endosulfan I	115-29-7	no	no	no	no	–	–	–	–
Endosulfan II	33213-65-9	no	no	no	no	–	–	–	–
Endosulfan Sulfate	1031-07-8	no	no	no	no	–	–	–	–
Endrin	72-20-8	no	no	no	no	–	–	–	–
Endrin Aldehyde	7421-93-4	no	no	no	no	–	–	–	–
Endrin Ketone	53494-70-5	no	no	no	no	–	–	–	–
Heptachlor	76-44-8	no	no	no	no	–	–	–	–
Heptachlor Epoxide	1024-57-3	no	no	no	no	–	–	–	–
Methoxychlor	72-43-5	no	no	no	no	–	–	–	–
Polycyclic Aromatic Hydrocarbons									
1-Methylnaphthalene	90-12-0	no	no	no	no	–	–	–	–
2-Methylnaphthalene	91-57-6	no	no	no	no	–	–	–	–
Acenaphthene	83-32-9	no	no	no	no	–	–	–	–
Acenaphthylene	208-96-8	no	no	no	no	–	–	–	–
Anthracene	120-12-7	no	no	no	no	–	–	–	–
Benzo(a)anthracene	56-55-3	**YES**	**YES**	no	no	2.47E+01	1.87E+01	–	–
Benzo(a)pyrene	50-32-8	**YES**	**YES**	no	no	1.73E+01	1.61E+01	–	–
Benzo(b)fluoranthene	205-99-2	**YES**	**YES**	no	no	3.33E+01	2.64E+01	–	–
Benzo(g,h,i)perylene	191-24-2	no	no	no	no	–	–	–	–
Benzo(k)fluoranthene	207-08-9	**YES**	**YES**	no	no	1.48E+01	1.06E+01	–	–
Chrysene	218-01-9	**YES**	**YES**	no	no	3.00E+01	2.21E+01	–	–
Dibenzo(a,h)anthracene	53-70-3	**YES**	**YES**	no	no	3.30E+00	3.08E+00	–	–
Fluoranthene	206-44-0	no	no	no	no	–	–	–	–
Fluorene	86-73-7	no	no	no	no	–	–	–	–
Indeno(1,2,3-cd)pyrene	193-39-5	**YES**	**YES**	no	no	1.18E+01	1.10E+01	–	–
Naphthalene	91-20-3	no	no	no	no	–	–	–	–
Phenanthrene	85-01-8	no	no	no	no	–	–	–	–
Pyrene	129-00-0	no	no	no	no	–	–	–	–
Polychlorinated Biphenyls									
Aroclor 1254	11097-69-1	**YES**	**YES**	no	no	2.19E+00	1.87E+00	–	–
Aroclor 1260	11096-82-5	no	no	no	no	–	–	–	–

Table A.4.HHRA-5
Exposure Point Concentrations
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a]				Exposure Point Concentrations [b]			
		Surface Soil	Combined Surface and Subsurface Soil	Sediment	Surface Water	Surface Soil (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Sediment (mg/kg)	Surface Water (mg/L)
Inorganics									
Aluminum	7429-90-5	no	no	no	no	–	–	–	–
Antimony	7440-36-0	no	no	no	no	–	–	–	–
Arsenic	7440-38-2	**YES**	**YES**	**YES**	**YES**	1.26E+01	1.16E+01	4.60E+00 m	1.00E-02 m
Barium	7440-39-3	no	no	no	no	–	–	–	–
Beryllium	7440-41-7	no	no	no	no	–	–	–	–
Cadmium	7440-43-9	no	no	no	no	–	–	–	–
Calcium	7440-70-2	no	no	no	no	–	–	–	–
Chromium	7440-47-3	no	no	no	no	–	–	–	–
Cobalt	7440-48-4	**YES**	**YES**	no	no	3.62E+01	3.80E+01	–	–
Copper	7440-50-8	**YES**	**YES**	no	**YES**	7.31E+03	1.95E+04	–	8.28E-01 m
Iron	7439-89-6	no	no	no	no	–	–	–	–
Lead	7439-92-1	**YES**	**YES**	no	**YES**	2.21E+03 avg	2.02E+03 avg	–	6.25E-02 avg
Magnesium	7439-95-4	no	no	no	no	–	–	–	–
Manganese	7439-96-5	**YES**	**YES**	no	**YES**	5.76E+02	5.46E+02	–	3.77E-01 m
Mercury	7439-97-6	**YES**	**YES**	no	**YES**	7.27E+00	6.72E+00	–	2.00E-04 m
Nickel	7440-02-0	no	no	no	no	–	–	–	–
Potassium	7440-09-7	no	no	no	no	–	–	–	–
Selenium	7782-49-2	no	no	no	no	–	–	–	–
Silver	7440-22-4	no	no	no	no	–	–	–	–
Sodium	7440-23-5	no	no	no	no	–	–	–	–
Thallium	7440-28-0	no	no	no	no	–	–	–	–
Vanadium	7440-62-2	no	no	no	no	–	–	–	–
Zinc	7440-66-6	no	no	no	no	–	–	–	–

Notes:
– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilogram.
mg/L = Milligrams per liter.

[a] Constituent of Potential Concern.
[b] The exposure point concentration (EPC) was the upper confidence level on the mean (UCL) or the maximum concentration where the UCL was incalculable.
EPCs marked with "m" are based on the maximum detected concentration.
Exposure to lead is evaluated by predicting resultant blood lead levels using the arithmetic average (avg).
The UCLs were calculated using ProUCL 4.0. The UCL used is the one recommended by ProUCL 4.0.

Table A.4.HHRA-6
Risk and Hazard Calculations for Site Worker Exposure to Surface Soil (0-2 foot Depth Interval)
BAG LOADING AREA
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Current / Future
Receptor Population: Site Worker
Receptor Age: Adult

Constituent	EPCs (mg/kg)	VF *or* PEF [a] (m^3/kg)		CANCER RISK Route-Specific Risk Oral ELCRo	Dermal ELCRd	Inhalation ELCRi	Calculated Risk ELCR	Percent Total ELCR	NON-CANCER HAZARD Route-Specific Hazard Oral HQo	Dermal HQd	Inhalation HQi	Calculated Hazard HI	Percent Total HI
Volatile Organic Compounds													
3-Octanone	1.10E-02	3.87E+03	V	NA	NA	NA	NA	–	NA	NA	NA	NA	–
d-Limonene	5.70E-02	4.05E+03	V	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Semi-Volatile Organic Compounds													
Carbazole	1.20E+01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Polycyclic Aromatic Hydrocarbons													
Benzo(a)anthracene	2.47E+01	1.36E+09	P	6.3E-06	5.4E-06	NA	1.2E-05	8%	NA	NA	NA	NA	–
Benzo(a)pyrene	1.73E+01	1.36E+09	P	4.4E-05	3.8E-05	2.7E-09	8.2E-05	58%	NA	NA	NA	NA	–
Benzo(b)fluoranthene	3.33E+01	1.36E+09	P	8.5E-06	7.3E-06	NA	1.6E-05	11%	NA	NA	NA	NA	–
Benzo(k)fluoranthene	1.48E+01	1.36E+09	P	3.8E-07	3.2E-07	NA	7.0E-07	0%	NA	NA	NA	NA	–
Chrysene	3.00E+01	1.36E+09	P	7.6E-08	6.6E-08	NA	1.4E-07	0%	NA	NA	NA	NA	–
Dibenzo(a,h)anthracene	3.30E+00	1.36E+09	P	8.4E-06	7.2E-06	NA	1.6E-05	11%	NA	NA	NA	NA	–
Indeno(1,2,3-cd)pyrene	1.18E+01	1.36E+09	P	3.0E-06	2.6E-06	NA	5.6E-06	4%	NA	NA	NA	NA	–
Polychlorinated Biphenyls													
Aroclor 1254	2.19E+00	1.36E+09	P	1.5E-06	1.4E-06	2.2E-10	2.9E-06	2%	1.1E-01	9.9E-02	NA	2.1E-01	29%
Explosives													
Pentaerythritol Tetranitrate	1.60E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Inorganics													
Antimony	1.24E+00	1.36E+09	P	NA	NA	NA	NA	–	3.0E-03	0.0E+00	NA	3.0E-03	0%
Arsenic	1.26E+01	1.36E+09	P	6.6E-06	1.3E-06	9.7E-09	7.9E-06	6%	4.1E-02	8.1E-03	NA	4.9E-02	7%
Barium	6.51E+03	1.36E+09	P	NA	NA	NA	NA	–	3.2E-02	0.0E+00	6.5E-03	3.8E-02	5%
Cadmium	1.44E+01	1.36E+09	P	NA	NA	4.7E-09	4.7E-09	0%	1.4E-02	3.7E-03	NA	1.8E-02	2%
Cobalt	3.62E+01	1.36E+09	P	NA	NA	5.8E-08	5.8E-08	0%	1.2E-01	0.0E+00	3.0E-03	1.2E-01	17%
Copper	7.31E+03	1.36E+09	P	NA	NA	NA	NA	–	1.8E-01	0.0E+00	NA	1.8E-01	25%
Iron	3.90E+04	1.36E+09	P	NA	NA	NA	NA	–	5.5E-02	0.0E+00	NA	5.5E-02	8%
Lead	2.21E+03	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Manganese	5.76E+02	1.36E+09	P	NA	NA	NA	NA	–	4.0E-03	0.0E+00	5.8E-03	9.8E-03	1%
Mercury	7.27E+00	1.36E+09	P	NA	NA	NA	NA	–	2.4E-02	0.0E+00	1.2E-05	2.4E-02	3%
Zinc	5.70E+03	1.36E+09	P	NA	NA	NA	NA	–	1.9E-02	0.0E+00	NA	1.9E-02	3%
				Total ELCR			1E-04	100%	Total HI			0.7	100%

[a] Minimum of the volatilization factor (identified with "V") and the particulate emission factor (PEF) (identified with "P"), both derived on Table A.2-11.

–	Not applicable.	HQ	Hazard quotient.	PEF	Particulate emission factor.
ELCR	Excess lifetime cancer risk.	m^3/kg	Cubic meters per kilogram.	VF	Volatilization factor.
EPCs	Exposure point concentration in surface soil (mg/kg).	mg/kg	Milligrams per kilogram.		
HI	Hazard index (sum of the HQs).	NA	Not available.		

Table A.4.HHRA-6
Risk and Hazard Calculations for Site Worker Exposure to Surface Soil (0-2 foot Depth Interval)
BAG LOADING AREA
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Current / Future
Receptor Population: Site Worker
Receptor Age: Adult

Equations: (see Table A.2-11)

ELCRo = (EPCs × 1 × 100 × 250 × 25 × CSFo) / (1,000,000 × 70 × 25,550)
ELCRd = (EPCs × 3,300 × 0.2 × ABSd × 250 × 25 × CSFa) / (1,000,000 × 70 × 25,550)
ELCRi = (EPCs × 20 × 250 × 25 × CSFi) / ([VF or PEF] × 70 × 25,550)

HQo = (EPCs × 1 × 100 × 250 × 25) / (1,000,000 × 70 × 9,125 × RfDo)
HQd = (EPCs × 3,300 × 0.2 × ABSd × 250 × 25) / (1,000,000 × 70 × 9,125 × RfDa)
HQi = (EPCs × 20 × 250 × 25) / ([VF or PEF] × 70 × 9,125 × RfDi)

Table A.4.HHRA-7
Risk and Hazard Calculations for Site Worker Wading Exposure to Sediment
BAG LOADING AREA
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Current / Future
Receptor Population: Site Worker
Receptor Age: Adult

Constituent	EPCsed (mg/kg)	CANCER RISK Route-Specific Risks Oral	Dermal	Calculated Risk	Percent Total ELCR	NON-CANCER RISK Route-Specific Risks Oral	Dermal	Calculated Hazard	Percent Total HI
		ELCRo	ELCRd	ELCR		HQo	HQd	HI	
Inorganics									
Aluminum	1.33E+04	NA	NA	NA	–	6.8E-04	0.0E+00	6.8E-04	10%
Arsenic	4.60E+00	1.3E-07	2.3E-07	3.5E-07	100%	7.8E-04	1.4E-03	2.2E-03	33%
Cobalt	1.05E+01	NA	NA	NA	–	1.8E-03	0.0E+00	1.8E-03	27%
Iron	2.33E+04	NA	NA	NA	–	1.7E-03	0.0E+00	1.7E-03	26%
Manganese	6.81E+02	NA	NA	NA	–	2.5E-04	0.0E+00	2.5E-04	4%
		Total ELCR		4E-07	100%	Total HI		0.007	100%

– Not applicable.
ELCR Excess lifetime cancer risk.
EPCsed Exposure point concentration in sediment (mg/kg).
HI Hazard index (sum of the HQs).
HQ Hazard quotient.
mg/kg Milligrams per kilogram.
NA Not available.

Equations: (see Table A.2-12)

ELCRo = (EPCsed × 50 × 26 × 25 × CSFo) / (1,000,000 × 70 × 25,550)
ELCRd = (EPCsed × 5,000 × 1 × ABSd × 26 × 25 × CSFa) / (1,000,000 × 70 × 25,550)
HQo = (EPCsed × 50 × 26 × 25) / (1,000,000 × 70 × 9,125 × RfDo)
HQd = (EPCsed × 5,000 × 1 × ABSd × 26 × 25) / (1,000,000 × 70 × 9,125 × RfDa)

Table A.4.HHRA-8
Risk and Hazard Calculations for Site Worker Wading Exposure to Surface Water
BAG LOADING AREA
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Current / Future
Receptor Population: Site Worker
Receptor Age: Adult

Constituent	EPCsw (mg/L)	DA [a] (L/cm²/day)	VFsw (L/m³)	CANCER RISK Route-Specific Risk Oral	Dermal	Inhalation	Calculated Risk	Percent Total ELCR	NON-CANCER HAZARD Route-Specific Hazard Oral	Dermal	Inhalation	Calculated Hazard	Percent Total HI
				ELCRo	ELCRd	ELCRi	ELCR		HQo	HQd	HQi	HI	
Pesticides													
Dieldrin	5.82E-06	2.87E-04	1.40E-04	1.4E-08	4.9E-08	1.0E-11	6.2E-08	3%	4.7E-05	1.7E-04	NA	2.2E-04	0%
Inorganics													
Arsenic	1.00E-02	8.00E-06	NA	2.2E-06	2.2E-07	NA	2.4E-06	97%	1.4E-02	1.4E-03	NA	1.5E-02	29%
Copper	8.28E-01	8.00E-06	NA	NA	NA	NA	NA	–	8.4E-03	8.4E-04	NA	9.3E-03	18%
Lead	6.25E-02	8.00E-07	NA	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Manganese	3.77E-01	8.00E-06	NA	NA	NA	NA	NA	–	7.7E-03	1.9E-02	NA	2.7E-02	52%
Mercury	2.00E-04	8.00E-06	2.56E-08	NA	NA	NA	NA	–	2.7E-04	3.9E-04	1.3E-10	6.6E-04	1%
				Total ELCR			2E-06	100%	Total HI			0.05	100%

[a] The dermal absorption factor (DA) was calculated using Equation [0], [1], or [2], as indicated, from Table A.2-13.

–	Not applicable.
ELCR	Excess lifetime cancer risk.
EPCsw	Exposure point concentration in surface water.
HI	Hazard index (sum of the HQs).
HQ	Hazard quotient.
L/cm²/day	Liters per square centimeter per day.
L/m^3	Liters per cubic meter.
mg/L	Milligrams per liter.
NA	Not available.
VFsw	Volatilization factor for surface water.

Equations: (see Table A.2-13)

ELCRo = (EPCsw × 0.05 × 8 × 26 × 25 × CSFo) / (70 × 25,550)
ELCRd = (EPCsw × DA × 5,000 × 26 × 25 × CSFa) / (70 × 25,550)
ELCRi = (EPCsw × VFsw × 2 × 26 × 25 × CSFi) / (70 × 25,550)

3.75 = Um = Mean annual wind speed (m/sec) for Roanoke, Virginia (USDOE 1986).

HQo = (EPCsw × 0.05 × 8 × 26 × 25) / (70 × 9,125 × RfDo)
HQd = (EPCsw × DA × 5,000 × 26 × 25) / (70 × 9,125 × RfDa)
HQi = (EPCsw × VFsw × 2 × 26 × 25) / (70 × 9,125 × RfDi)

Table A.4.HHRA-9
Risk and Hazard Calculations for Hypothetical Future Construction Worker Exposure to Combined Surface and Subsurface Soil
BAG LOADING AREA
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Constituent	EPCs (mg/kg)	VF *or* PEF [a] (m^3/kg)		CANCER RISK: Route-Specific Risk: Oral	Dermal	Inhalation	Calculated Risk	Percent Total ELCR	NON-CANCER HAZARD: Route-Specific Hazard: Oral	Dermal	Inhalation	Calculated Hazard	Percent Total HI
				ELCRo	ELCRd	ELCRi	ELCR		HQo	HQd	HQi	HI	
Volatile Organic Compounds													
3-Octanone	1.10E-02	3.87E+03	V	NA	NA	NA	NA	–	NA	NA	NA	NA	–
d-Limonene	5.70E-02	4.05E+03	V	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Semi-Volatile Organic Compounds													
Carbazole	1.04E+01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Polycyclic Aromatic Hydrocarbons													
Benzo(a)anthracene	1.87E+01	1.36E+09	P	3.3E-07	1.3E-07	NA	4.5E-07	7%	NA	NA	NA	NA	–
Benzo(a)pyrene	1.61E+01	1.36E+09	P	2.8E-06	1.1E-06	5.3E-11	3.9E-06	59%	NA	NA	NA	NA	–
Benzo(b)fluoranthene	2.64E+01	1.36E+09	P	4.6E-07	1.8E-07	NA	6.4E-07	10%	NA	NA	NA	NA	–
Benzo(k)fluoranthene	1.06E+01	1.36E+09	P	1.9E-08	7.2E-09	NA	2.6E-08	0%	NA	NA	NA	NA	–
Chrysene	2.21E+01	1.36E+09	P	3.9E-09	1.5E-09	NA	5.4E-09	0%	NA	NA	NA	NA	–
Dibenzo(a,h)anthracene	3.08E+00	1.36E+09	P	5.4E-07	2.1E-07	NA	7.5E-07	11%	NA	NA	NA	NA	–
Indeno(1,2,3-cd)pyrene	1.10E+01	1.36E+09	P	1.9E-07	7.5E-08	NA	2.7E-07	4%	NA	NA	NA	NA	–
Polychlorinated Biphenyls													
Aroclor 1254	1.87E+00	1.36E+09	P	9.0E-08	3.8E-08	4.0E-12	1.3E-07	2%	1.3E-01	5.3E-02	NA	1.8E-01	6%
Explosives													
Pentaerythritol Tetranitrate	1.60E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Inorganics													
Aluminum	2.63E+04	1.36E+09	P	NA	NA	NA	NA	–	8.8E-02	0.0E+00	2.8E-03	9.1E-02	3%
Antimony	1.18E+00	1.36E+09	P	NA	NA	NA	NA	–	9.9E-03	0.0E+00	NA	9.9E-03	0%
Arsenic	1.16E+01	1.36E+09	P	4.2E-07	3.8E-08	1.9E-10	4.6E-07	7%	1.3E-01	1.2E-02	NA	1.4E-01	5%
Barium	5.63E+03	1.36E+09	P	NA	NA	NA	NA	–	9.5E-02	0.0E+00	6.0E-04	9.5E-02	3%
Cadmium	1.34E+01	1.36E+09	P	NA	NA	9.0E-11	9.0E-11	0%	4.5E-02	5.4E-03	3.5E-05	5.1E-02	2%
Cobalt	3.80E+01	1.36E+09	P	NA	NA	1.3E-09	1.3E-09	0%	4.3E-01	0.0E+00	1.0E-03	4.3E-01	15%
Copper	1.95E+04	1.36E+09	P	NA	NA	NA	NA	–	1.6E+00	0.0E+00	NA	1.6E+00	56%
Iron	3.98E+04	1.36E+09	P	NA	NA	NA	NA	–	1.9E-01	0.0E+00	NA	1.9E-01	7%
Lead	2.02E+03	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Manganese	5.46E+02	1.36E+09	P	NA	NA	NA	NA	–	1.3E-02	0.0E+00	5.7E-03	1.9E-02	1%
Mercury	6.72E+00	1.36E+09	P	NA	NA	NA	NA	–	7.5E-03	0.0E+00	1.2E-05	7.6E-03	0%
Zinc	4.94E+03	1.36E+09	P	NA	NA	NA	NA	–	5.5E-02	0.0E+00	NA	5.5E-02	2%
				Total ELCR			7E-06	100%	Total HI **			3	100%

** HI Segregated by Target Site/Critical Effect:

CNS - Central nervous system	HI (liver, kidney) = 0.3	HI (gastrointestinal tract) = 2
NA - Not available	HI (CNS, whole body, immune system) = 0.2	HI (nasal, lung) = 0
NR - None reported	HI (blood) = 0.3	HI (eyes, nails, hair, skin) = 0.7
	HI (fetus, developmental) = 0.09	HI (NA, NR) = 0

[a] Minimum of the volatilization factor (identified with "V") and the particulate emission factor (PEF) (identified with "P"), both derived on Table A.2-11.

Table A.4.HHRA-9
Risk and Hazard Calculations for Hypothetical Future Construction Worker Exposure to Combined Surface and Subsurface Soil
BAG LOADING AREA
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

–	Not applicable.	HQ	Hazard quotient.	PEF	Particulate emission factor.
ELCR	Excess lifetime cancer risk.	m^3/kg	Cubic meters per kilogram.	VF	Volatilization factor.
EPCs	Exposure point concentration in soil (mg/kg).	mg/kg	Milligrams per kilogram.		
HI	Hazard index (sum of the HQs).	NA	Not available.		

Equations: (see Table A.2-11)

ELCRo = (EPCs × 1 × 330 × 130 × 1 × CSFo) / (1,000,000 × 70 × 25,550)
ELCRd = (EPCs × 3,300 × 0.3 × ABSd × 130 × 1 × CSFa) / (1,000,000 × 70 × 25,550)
ELCRi = (EPCs × 20 × 130 × 1 × CSFi) / ([VF or PEF] × 70 × 25,550)

HQo = (EPCs × 1 × 330 × 130 × 1) / (1,000,000 × 70 × 182 × RfDo)
HQd = (EPCs × 3,300 × 0.3 × ABSd × 130 × 1) / (1,000,000 × 70 × 182 × RfDa)
HQi = (EPCs × 20 × 130 × 1) / ([VF or PEF] × 70 × 182 × RfDi)

Table A.4.HHRA-10
Risk and Hazard Calculations for Hypothetical Future Adult Resident Exposure to Combined Surface and Subsurface Soil
BAG LOADING AREA
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Adult Resident
Receptor Age: Adult

Constituent	EPCs (mg/kg)	VF *or* PEF [a] (m^3/kg)		CANCER RISK Route-Specific Risk Oral ELCRo	Dermal ELCRd	Inhalation ELCRi	Calculated Risk ELCR	Percent Total ELCR	NON-CANCER HAZARD Route-Specific Hazard Oral HQo	Dermal HQd	Inhalation HQi	Calculated Hazard HI	Percent Total HI
Volatile Organic Compounds													
3-Octanone	1.10E-02	3.87E+03	V	NA	NA	NA	NA	–	NA	NA	NA	NA	–
d-Limonene	5.70E-02	4.05E+03	V	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Semi-Volatile Organic Compounds													
Carbazole	1.04E+01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Polycyclic Aromatic Hydrocarbons													
Benzo(a)anthracene	1.87E+01	1.36E+09	P	9.3E-06	4.8E-06	NA	1.4E-05	7%	NA	NA	NA	NA	–
Benzo(a)pyrene	1.61E+01	1.36E+09	P	8.1E-05	4.2E-05	5.0E-09	1.2E-04	61%	NA	NA	NA	NA	–
Benzo(b)fluoranthene	2.64E+01	1.36E+09	P	1.3E-05	6.9E-06	NA	2.0E-05	10%	NA	NA	NA	NA	–
Benzo(k)fluoranthene	1.06E+01	1.36E+09	P	5.3E-07	2.7E-07	NA	8.0E-07	0%	NA	NA	NA	NA	–
Chrysene	2.21E+01	1.36E+09	P	1.1E-07	5.7E-08	NA	1.7E-07	0%	NA	NA	NA	NA	–
Dibenzo(a,h)anthracene	3.08E+00	1.36E+09	P	1.5E-05	8.0E-06	NA	2.3E-05	12%	NA	NA	NA	NA	–
Indeno(1,2,3-cd)pyrene	1.10E+01	1.36E+09	P	5.5E-06	2.9E-06	NA	8.4E-06	4%	NA	NA	NA	NA	–
Polychlorinated Biphenyls													
Aroclor 1254	1.87E+00	1.36E+09	P	1.8E-06	9.8E-07	2.6E-10	2.7E-06	1%	1.3E-01	7.2E-02	NA	2.0E-01	15%
Explosives													
Pentaerythritol Tetranitrate	1.60E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Inorganics													
Aluminum	2.63E+04	1.36E+09	P	NA	NA	NA	NA	–	3.6E-02	0.0E+00	3.7E-03	4.0E-02	3%
Antimony	1.18E+00	1.36E+09	P	NA	NA	NA	NA	–	4.0E-03	0.0E+00	NA	4.0E-03	0%
Arsenic	1.16E+01	1.36E+09	P	8.2E-06	9.8E-07	1.2E-08	9.2E-06	5%	5.3E-02	6.3E-03	NA	5.9E-02	4%
Barium	5.63E+03	1.36E+09	P	NA	NA	NA	NA	–	3.9E-02	0.0E+00	7.9E-03	4.6E-02	3%
Cadmium	1.34E+01	1.36E+09	P	NA	NA	5.8E-09	5.8E-09	0%	1.8E-02	2.9E-03	NA	2.1E-02	2%
Cobalt	3.80E+01	1.36E+09	P	NA	NA	8.2E-08	8.2E-08	0%	1.7E-01	0.0E+00	4.5E-03	1.8E-01	13%
Copper	1.95E+04	1.36E+09	P	NA	NA	NA	NA	–	6.7E-01	0.0E+00	NA	6.7E-01	49%
Iron	3.98E+04	1.36E+09	P	NA	NA	NA	NA	–	7.8E-02	0.0E+00	NA	7.8E-02	6%
Lead	2.02E+03	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Manganese	5.46E+02	1.36E+09	P	NA	NA	NA	NA	–	5.3E-03	0.0E+00	7.7E-03	1.3E-02	1%
Mercury	6.72E+00	1.36E+09	P	NA	NA	NA	NA	–	3.1E-02	0.0E+00	1.6E-05	3.1E-02	2%
Zinc	4.94E+03	1.36E+09	P	NA	NA	NA	NA	–	2.3E-02	0.0E+00	NA	2.3E-02	2%
					Total ELCR		2E-04	100%		Total HI		1	100%

[a] Minimum of the volatilization factor (identified with "V") and the particulate emission factor (PEF) (identified with "P"), both derived on Table A.2-11.

–	Not applicable.	HQ	Hazard quotient.	PEF	Particulate emission factor.
ELCR	Excess lifetime cancer risk.	m^3/kg	Cubic meters per kilogram.	VF	Volatilization factor.
EPCs	Exposure point concentration in soil (mg/kg).	mg/kg	Milligrams per kilogram.		
HI	Hazard index (sum of the HQs).	NA	Not available.		

Table A.4.HHRA-10
Risk and Hazard Calculations for Hypothetical Future Adult Resident Exposure to Combined Surface and Subsurface Soil
BAG LOADING AREA
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Adult Resident
Receptor Age: Adult

Equations: (see Table A.2-11. Potentially mutagenic carcinogens (i.e., PAHs) adjusted to incorporate ADAFs of 2.1 for 10 years (ages 6 to 16) and 1 for the remaining 14 years as an adult. Oral example: (EPC x 1 x 100 x 350 x CSF/(1,000,000 x 365 x 70)) x ((2.1 x 10/70) + (1 x 14/70)).

ELCRo = (EPCs × 1 × 100 × 350 × 24 × CSFo) / (1,000,000 × 70 × 25,550)
ELCRd = (EPCs × 5,700 × 0.07 × ABSd × 350 × 24 × CSFa) / (1,000,000 × 70 × 25,550)
ELCRi = (EPCs × 20 × 350 × 24 × CSFi) / ([VF or PEF] × 70 × 25,550)

HQo = (EPCs × 1 × 100 × 350 × 24) / (1,000,000 × 70 × 8,760 × RfDo)
HQd = (EPCs × 5,700 × 0.07 × ABSd × 350 × 24) / (1,000,000 × 70 × 8,760 × RfDa)
HQi = (EPCs × 20 × 350 × 24) / ([VF or PEF] × 70 × 8,760 × RfDi)

Table A.4.HHRA-11
Risk and Hazard Calculations for Hypothetical Future Adult Resident Wading Exposure to Sediment
BAG LOADING AREA
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Adult Resident
Receptor Age: Adult

Constituent	EPCsed (mg/kg)	CANCER RISK Route-Specific Risks Oral	Dermal	Calculated Risk	Percent Total ELCR	NON-CANCER RISK Route-Specific Risks Oral	Dermal	Calculated Hazard	Percent Total HI
		ELCRo	ELCRd	ELCR		HQo	HQd	HI	
Inorganics									
Aluminum	1.33E+04	NA	NA	NA	–	1.2E-03	0.0E+00	1.2E-03	10%
Arsenic	4.60E+00	2.2E-07	4.0E-07	6.2E-07	100%	1.4E-03	2.6E-03	4.0E-03	33%
Cobalt	1.05E+01	NA	NA	NA	–	3.3E-03	0.0E+00	3.3E-03	27%
Iron	2.33E+04	NA	NA	NA	–	3.1E-03	0.0E+00	3.1E-03	26%
Manganese	6.81E+02	NA	NA	NA	–	4.6E-04	0.0E+00	4.6E-04	4%
		Total ELCR		6E-07	100%	Total HI		0.01	100%

– Not applicable.
ELCR Excess lifetime cancer risk.
EPCsed Exposure point concentration in sediment (mg/kg).
HI Hazard index (sum of the HQs).
HQ Hazard quotient.
mg/kg Milligrams per kilogram.
NA Not available.

Equations: (see Table A.2-12)

ELCRo = (EPCsed × 50 × 48 × 24 × CSFo) / (1,000,000 × 70 × 25,550)
ELCRd = (EPCsed × 5,000 × 1 × ABSd × 48 × 24 × CSFa) / (1,000,000 × 70 × 25,550)

HQo = (EPCsed × 50 × 48 × 24) / (1,000,000 × 70 × 8,760 × RfDo)
HQd = (EPCsed × 5,000 × 1 × ABSd × 48 × 24) / (1,000,000 × 70 × 8,760 × RfDa)

Table A.4.HHRA-12
Risk and Hazard Calculations for Hypothetical Future Adult Resident Wading Exposure to Surface Water
BAG LOADING AREA
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Adult Resident
Receptor Age: Adult

Constituent	EPCsw (mg/L)	DA [a] (L/cm²/day)	VFsw (L/m³)	CANCER RISK: Route-Specific Risk: Oral	Dermal	Inhalation	Calculated Risk	Percent Total ELCR	NON-CANCER HAZARD: Route-Specific Hazard: Oral	Dermal	Inhalation	Calculated Hazard	Percent Total HI
				ELCRo	ELCRd	ELCRi	ELCR		HQo	HQd	HQi	HI	
Pesticides													
Dieldrin	5.82E-06	1.01E-04	1.40E-04	3.0E-09	3.0E-08	1.8E-11	3.3E-08	6%	1.1E-05	1.1E-04	NA	1.2E-04	1%
Inorganics													
Arsenic	1.00E-02	1.00E-06	NA	4.8E-07	4.8E-08	NA	5.3E-07	94%	3.1E-03	3.1E-04	NA	3.4E-03	29%
Copper	8.28E-01	1.00E-06	NA	NA	NA	NA	NA	–	1.9E-03	1.9E-04	NA	2.1E-03	18%
Lead	6.25E-02	1.00E-07	NA	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Manganese	3.77E-01	1.00E-06	NA	NA	NA	NA	NA	–	1.8E-03	4.4E-03	NA	6.2E-03	51%
Mercury	2.00E-04	1.00E-06	2.56E-08	NA	NA	NA	NA	–	6.3E-05	8.9E-05	2.4E-10	1.5E-04	1%
				Total ELCR			6E-07	100%	Total HI			0.01	100%

[a] The dermal absorption factor (DA) was calculated using Equation [0], [1], or [2], as indicated, from Table A.2-13.

–	Not applicable.
ELCR	Excess lifetime cancer risk.
EPCsw	Exposure point concentration in surface water.
HI	Hazard index (sum of the HQs).
HQ	Hazard quotient.
L/cm²/day	Liters per square centimeter per day.
L/m^3	Liters per cubic meter.
mg/L	Milligrams per liter.
NA	Not available.
VFsw	Volatilization factor for surface water.

Equations: (see Table A.2-13)

3.75 = Um = Mean annual wind speed (m/sec) for Roanoke, Virginia (USDOE 1986).

ELCRo = (EPCsw × 0.05 × 1 × 48 × 24 × CSFo) / (70 × 25,550)
ELCRd = (EPCsw × DA × 5,000 × 48 × 24 × CSFa) / (70 × 25,550)
ELCRi = (EPCsw × VFsw × 2 × 48 × 24 × CSFi) / (70 × 25,550)

HQo = (EPCsw × 0.05 × 1 × 48 × 24) / (70 × 8,760 × RfDo)
HQd = (EPCsw × DA × 5,000 × 48 × 24) / (70 × 8,760 × RfDa)
HQi = (EPCsw × VFsw × 2 × 48 × 24) / (70 × 8,760 × RfDi)

Table A.4.HHRA-13
Risk and Hazard Calculations for Hypothetical Future Child Resident Exposure to Combined Surface and Subsurface Soil
BAG LOADING AREA
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Child Resident
Receptor Age: Child

Constituent	EPCs (mg/kg)	VF *or* PEF [a] (m^3/kg)		CANCER RISK Route-Specific Risk Oral ELCRo	Dermal ELCRd	Inhalation ELCRi	Calculated Risk ELCR	Percent Total ELCR	NON-CANCER HAZARD Route-Specific Hazard Oral HQo	Dermal HQd	Inhalation HQi	Calculated Hazard HI	Percent Total HI
Volatile Organic Compounds													
3-Octanone	1.10E-02	3.87E+03	V	NA	NA	NA	NA	–	NA	NA	NA	NA	–
d-Limonene	5.70E-02	4.05E+03	V	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Semi-Volatile Organic Compounds													
Carbazole	1.04E+01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Polycyclic Aromatic Hydrocarbons													
Benzo(a)anthracene	1.87E+01	1.36E+09	P	4.4E-05	1.6E-05	NA	6.0E-05	7%	NA	NA	NA	NA	–
Benzo(a)pyrene	1.61E+01	1.36E+09	P	3.8E-04	1.4E-04	5.9E-09	5.2E-04	63%	NA	NA	NA	NA	–
Benzo(b)fluoranthene	2.64E+01	1.36E+09	P	6.2E-05	2.3E-05	NA	8.5E-05	10%	NA	NA	NA	NA	–
Benzo(k)fluoranthene	1.06E+01	1.36E+09	P	2.5E-06	9.0E-07	NA	3.4E-06	0%	NA	NA	NA	NA	–
Chrysene	2.21E+01	1.36E+09	P	5.2E-07	1.9E-07	NA	7.1E-07	0%	NA	NA	NA	NA	–
Dibenzo(a,h)anthracene	3.08E+00	1.36E+09	P	7.2E-05	2.6E-05	NA	9.9E-05	12%	NA	NA	NA	NA	–
Indeno(1,2,3-cd)pyrene	1.10E+01	1.36E+09	P	2.6E-05	9.4E-06	NA	3.5E-05	4%	NA	NA	NA	NA	–
Polychlorinated Biphenyls													
Aroclor 1254	1.87E+00	1.36E+09	P	4.1E-06	1.6E-06	1.5E-10	5.7E-06	1%	1.2E+00	4.7E-01	NA	1.7E+00	14%
Explosives													
Pentaerythritol Tetranitrate	1.60E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Inorganics													
Aluminum	2.63E+04	1.36E+09	P	NA	NA	NA	NA	–	3.4E-01	0.0E+00	8.6E-03	3.4E-01	3%
Antimony	1.18E+00	1.36E+09	P	NA	NA	NA	NA	–	3.8E-02	0.0E+00	NA	3.8E-02	0%
Arsenic	1.16E+01	1.36E+09	P	1.9E-05	1.6E-06	7.0E-09	2.1E-05	3%	4.9E-01	4.2E-02	NA	5.4E-01	4%
Barium	5.63E+03	1.36E+09	P	NA	NA	NA	NA	–	3.6E-01	0.0E+00	1.8E-02	3.8E-01	3%
Cadmium	1.34E+01	1.36E+09	P	NA	NA	3.4E-09	3.4E-09	0%	1.7E-01	1.9E-02	NA	1.9E-01	2%
Cobalt	3.80E+01	1.36E+09	P	NA	NA	4.8E-08	4.8E-08	0%	1.6E+00	0.0E+00	1.0E-02	1.6E+00	13%
Copper	1.95E+04	1.36E+09	P	NA	NA	NA	NA	–	6.2E+00	0.0E+00	NA	6.2E+00	51%
Iron	3.98E+04	1.36E+09	P	NA	NA	NA	NA	–	7.3E-01	0.0E+00	NA	7.3E-01	6%
Lead	2.02E+03	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Manganese	5.46E+02	1.36E+09	P	NA	NA	NA	NA	–	5.0E-02	0.0E+00	1.8E-02	6.8E-02	1%
Mercury	6.72E+00	1.36E+09	P	NA	NA	NA	NA	–	2.9E-01	0.0E+00	3.7E-05	2.9E-01	2%
Zinc	4.94E+03	1.36E+09	P	NA	NA	NA	NA	–	2.1E-01	0.0E+00	NA	2.1E-01	2%
				Total ELCR			8E-04	100%	Total HI **			12	100%

** HI Segregated by Target Site/Critical Effect:
CNS - Central nervous system
NA - Not available
NR - None reported

HI (liver, kidney) =	1	HI (gastrointestinal tract) =	7
HI (CNS, whole body, immune system) =	2	HI (nasal, lung) =	0
HI (blood) =	1	HI (eyes, nails, hair, skin) =	4
HI (fetus, developmental) =	0.4	HI (NA, NR) =	0

Table A.4.HHRA-13
Risk and Hazard Calculations for Hypothetical Future Child Resident Exposure to Combined Surface and Subsurface Soil
BAG LOADING AREA
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Child Resident
Receptor Age: Child

[a] Minimum of the volatilization factor (identified with "V") and the particulate emission factor (PEF) (identified with "P"), both derived on Table A.2-11.

–	Not applicable.	HQ	Hazard quotient.	PEF	Particulate emission factor.
ELCR	Excess lifetime cancer risk.	m^3/kg	Cubic meters per kilogram.	VF	Volatilization factor.
EPCs	Exposure point concentration in soil (mg/kg).	mg/kg	Milligrams per kilogram.		
HI	Hazard index (sum of the HQs).	NA	Not available.		

Equations: (see Table A.2-11. Potentially mutagenic carcinogens (i.e., PAHs) adjusted to incorporate ADAFs of 4.6 for 2 years (ages 0 to 2) and 2.1 for 4 years (ages 2 to 6). Oral example: (EPC x 1 x 200 x 350 x CSF/(1,000,000 x 365 x 15)) x ((4.6 x 2/70) + (2.1 x 4/70)).

ELCRo = (EPCs × 1 × 200 × 350 × 6 × CSFo) / (1,000,000 × 15 × 25,550)
ELCRd = (EPCs × 2,800 × 0.2 × ABSd × 350 × 6 × CSFa) / (1,000,000 × 15 × 25,550)
ELCRi = (EPCs × 10 × 350 × 6 × CSFi) / ([VF or PEF] × 15 × 25,550)

HQo = (EPCs × 1 × 200 × 350 × 6) / (1,000,000 × 15 × 2,190 × RfDo)
HQd = (EPCs × 2,800 × 0.2 × ABSd × 350 × 6) / (1,000,000 × 15 × 2,190 × RfDa)
HQi = (EPCs × 10 × 350 × 6) / ([VF or PEF] × 15 × 2,190 × RfDi)

Table A.4.HHRA-14
Risk and Hazard Calculations for Hypothetical Future Child Resident Wading Exposure to Sediment
BAG LOADING AREA
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Child Resident
Receptor Age: Child

Constituent	EPCsed (mg/kg)	CANCER RISK Route-Specific Risks Oral	Dermal	Calculated Risk	Percent Total ELCR	NON-CANCER RISK Route-Specific Risks Oral	Dermal	Calculated Hazard	Percent Total HI
		ELCRo	ELCRd	ELCR		HQo	HQd	HI	
Inorganics									
Aluminum	1.33E+04	NA	NA	NA	–	1.2E-02	0.0E+00	1.2E-02	13%
Arsenic	4.60E+00	5.2E-07	5.9E-08	5.8E-07	100%	1.3E-02	1.5E-03	1.5E-02	16%
Cobalt	1.05E+01	NA	NA	NA	–	3.1E-02	0.0E+00	3.1E-02	34%
Iron	2.33E+04	NA	NA	NA	–	2.9E-02	0.0E+00	2.9E-02	32%
Manganese	6.81E+02	NA	NA	NA	–	4.3E-03	0.0E+00	4.3E-03	5%
		Total ELCR		6E-07	100%	Total HI		0.09	100%

–	Not applicable.
ELCR	Excess lifetime cancer risk.
EPCsed	Exposure point concentration in sediment (mg/kg).
HI	Hazard index (sum of the HQs).
HQ	Hazard quotient.
mg/kg	Milligrams per kilogram.
NA	Not available.

Equations: (see Table A.2-12)

ELCRo = (EPCsed × 100 × 48 × 6 × CSFo) / (1,000,000 × 15 × 25,550)

ELCRd = (EPCsed × 1,900 × 0.2 × ABSd × 48 × 6 × CSFa) / (1,000,000 × 15 × 25,550)

HQo = (EPCsed × 100 × 48 × 6) / (1,000,000 × 15 × 2,190 × RfDo)

HQd = (EPCsed × 1,900 × 0.2 × ABSd × 48 × 6) / (1,000,000 × 15 × 2,190 × RfDa)

Table A.4.HHRA-15
Risk and Hazard Calculations for Hypothetical Future Child Resident Wading Exposure to Surface Water
BAG LOADING AREA
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Child Resident
Receptor Age: Child

Constituent	EPCsw (mg/L)	DA [a] (L/cm²/day)	VFsw (L/m³)	CANCER RISK: Route-Specific Risk: Oral	Dermal	Inhalation	Calculated Risk	Percent Total ELCR	NON-CANCER HAZARD: Route-Specific Hazard: Oral	Dermal	Inhalation	Calculated Hazard	Percent Total HI
				ELCRo	ELCRd	ELCRi	ELCR		HQo	HQd	HQi	HI	
Pesticides													
Dieldrin	5.82E-06	1.01E-04	1.40E-04	3.5E-09	1.3E-08	2.0E-11	1.7E-08	3%	5.1E-05	2.0E-04	NA	2.5E-04	1%
Inorganics													
Arsenic	1.00E-02	1.00E-06	NA	5.6E-07	2.1E-08	NA	5.9E-07	97%	1.5E-02	5.6E-04	NA	1.5E-02	37%
Copper	8.28E-01	1.00E-06	NA	NA	NA	NA	NA	–	9.1E-03	3.4E-04	NA	9.4E-03	23%
Lead	6.25E-02	1.00E-07	NA	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Manganese	3.77E-01	1.00E-06	NA	NA	NA	NA	NA	–	8.3E-03	7.8E-03	NA	1.6E-02	39%
Mercury	2.00E-04	1.00E-06	2.56E-08	NA	NA	NA	NA	–	2.9E-04	1.6E-04	1.0E-09	4.5E-04	1%
				Total ELCR			6E-07	100%	Total HI			0.04	100%

[a] The dermal absorption factor (DA) was calculated using Equation [0], [1], or [2], as indicated, from Table A.2-13.

–	Not applicable.	HQ	Hazard quotient.	NA	Not available.
ELCR	Excess lifetime cancer risk.	L/cm²/day	Liters per square centimeter per day.	VFsw	Volatilization factor for surface water.
EPCsw	Exposure point concentration in surface water.	L/m^3	Liters per cubic meter.		
HI	Hazard index (sum of the HQs).	mg/L	Milligrams per liter.		

Equations: (see Table A.2-13)

3.75 = Um = Mean annual wind speed (m/sec) for Roanoke, Virginia (USDOE 1986).

ELCRo = (EPCsw × 0.050 × 1 × 48 × 6 × CSFo) / (15 × 25,550)
ELCRd = (EPCsw × DA × 1,900 × 48 × 6 × CSFa) / (15 × 25,550)
ELCRi = (EPCsw × VFsw × 2 × 48 × 6 × CSFi) / (15 × 25,550)

HQo = (EPCsw × 0.050 × 1 × 48 × 6) / (15 × 2,190 × RfDo)
HQd = (EPCsw × DA × 1,900 × 48 × 6) / (15 × 2,190 × RfDa)
HQi = (EPCsw × VFsw × 2 × 48 × 6) / (15 × 2,190 × RfDi)

Table A.4.HHRA-16
Summary of Calculated Human Health Risks and Hazards
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

RECEPTOR / Exposure Medium - Scenario	Calculation Table	Total Excess Lifetime Cancer Risk	Total Non-Cancer Hazard
Site Worker			
Surface Soil - Direct Contact	Table A.4.HHRA-6	1E-04	0.7
Sediment - Wading	Table A.4.HHRA-7	4E-07	0.007
Surface Water - Wading	Table A.4.HHRA-8	2E-06	0.05
TOTAL SITE RISKS (Site Worker):		1E-04	0.8
Hypothetical Future Construction Worker			
Combined Surface and Subsurface Soil - Direct Contact	Table A.4.HHRA-9	7E-06	3
TOTAL SITE RISKS (Construction Worker):		7E-06	3
Hypothetical Future Adult Resident			
Combined Surface and Subsurface Soil - Direct Contact	Table A.4.HHRA-10	2E-04	1
Sediment - Wading	Table A.4.HHRA-11	6E-07	0.01
Surface Water - Wading	Table A.4.HHRA-12	6E-07	0.01
TOTAL SITE RISKS (Adult Resident):		2E-04	1
Hypothetical Future Child Resident			
Combined Surface and Subsurface Soil - Direct Contact	Table A.4.HHRA-13	8E-04	12
Sediment - Wading	Table A.4.HHRA-14	6E-07	0.09
Surface Water - Wading	Table A.4.HHRA-15	6E-07	0.04
TOTAL SITE RISKS (Child Resident):		8E-04	12
Hypothetical Future Aggregate Resident (Adult + Child)			
Combined Surface and Subsurface Soil - Direct Contact		1E-03	--
Sediment - Wading		1E-06	--
Surface Water - Wading		1E-06	--
TOTAL SITE RISKS (Aggregate Resident):		1E-03	--

Table A.4.HHRA-17
Blood Lead Level Estimates for a Hypothetical Current Commercial/Industrial Worker Receptor
from Exposure to Surface Soil (0-1 feet below ground surface)
BAG LOADING AREA
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Exposure Variable	PbB Equation1		Description of Exposure Variable	Units	Values for Non-Residential Exposure Scenario			
					Using Equation 1		Using Equation 2	
	1*	2**			GSDi = Hom	GSDi = Het	GSDi = Hom	GSDi = Het
PbS	X	X	Soil lead concentration	ug/g or ppm	**2210**	**2210**	**2210**	**2210**
Rfetal/maternal	X	X	Fetal/maternal PbB ratio	--	0.9	0.9	0.9	0.9
BKSF	X	X	Biokinetic Slope Factor	ug/dL per ug/day	0.4	0.4	0.4	0.4
GSDi	X	X	Geometric standard deviation PbB	--	2.1	2.3	2.1	2.3
PbB0	X	X	Baseline PbB	ug/dL	1.5	1.7	1.5	1.7
IRS	X		Soil ingestion rate (including soil-derived indoor dust)	g/day	0.05	0.05	--	--
IRS+D		X	Total ingestion rate of outdoor soil and indoor dust	g/day	--	--	0.05	0.05
WS		X	Weighting factor; fraction of IRS+D ingested as outdoor soil	--	--	--	1.0	1.0
KSD		X	Mass fraction of soil in dust	--	--	--	0.7	0.7
AFS, D	X	X	Absorption fraction (same for soil and dust)	--	0.12	0.12	0.12	0.12
EFS, D	X	X	Exposure frequency (same for soil and dust)	days/yr	**219**	**219**	**219**	**219**
ATS, D	X	X	Averaging time (same for soil and dust)	days/yr	365	365	365	365
PbBadult	**PbB of adult worker, geometric mean**			**ug/dL**	**4.7**	**4.9**	**4.7**	**4.9**
PbBfetal, 0.95	**95th percentile PbB among fetuses of adult workers**			**ug/dL**	**14.3**	**17.3**	**14.3**	**17.3**
PbBt	**Target PbB level of concern (e.g., 10 ug/dL)**			**ug/dL**	**10.0**	**10.0**	**10.0**	**10.0**
P(PbBfetal > PbBt)	**Probability that fetal PbB > PbBt, assuming lognormal distribution**			**%**	**12.2%**	**16.2%**	**12.2%**	**16.2%**

Calculations of Blood Lead Concentrations (PbBs)
U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee
Version date 05/19/03

Table A.4.HHRA-17
Blood Lead Level Estimates for a Hypothetical Current Commercial/Industrial Worker Receptor
from Exposure to Surface Soil (0-1 feet below ground surface)
BAG LOADING AREA
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

1 Equation 1 does not apportion exposure between soil and dust ingestion (excludes WS, KSD).
When IRS = IRS+D and WS = 1.0, the equations yield the same PbBfetal,0.95.

***Equation 1, based on Eq. 1, 2 in USEPA (1996).**

PbB adult =	(PbS*BKSF*IRS+D*AFS,D*EFS/ATS.D) + PbB0
PbB fetal, 0.95 =	PbBadult * (GSDi1.645 * R)

****Equation 2, alternate approach based on Eq. 1, 2, and A-19 in USEPA (1996).**

PbB adult =	PbS*BKSF*([(IRS+D)*AFS*EFS*WS]+[KSD*(IRS+D)*(1-WS)*AFD*EFD])/365+PbB0
PbB fetal, 0.95 =	PbBadult * (GSDi1.645 * R)

References:
USEPA 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risk Associated with Adult Exposure to Lead in Soil. Technical Review Workgroup for Lead. December.
USEPA 2003b. Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risk Associated with Adult Exposure to Lead in Soil. Adult Lead Model (ALM). Technical Review Workgroup for Lead. January.

Notes:

g/day =	Gram(s) per day.	ppm =	Part(s) per million.
GSDi =	Individual Geometric Standard Deviations.	µg/day =	Microgram(s) per day.
Het =	Heterogeneous population.	µg/dL =	Microgram(s) per deciliter.
Hom =	Homogeneous population.	µg/g =	Microgram(s) per gram.
PbB =	Blood lead.	yr =	Year.

USEPA Adult Lead Model (2003b) was used to assess exposure to lead.
Input values in bold font were receptor- and site-specific.

Table A.4.HHRA-18
Blood Lead Level Estimates for a Hypothetical Future Child and Adult Resident Receptor
from Exposure to Surface and Subsurface Soil
BAG LOADING AREA
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

ADULT RESIDENT

Exposure Variable	PbB Equation1 1*	PbB Equation1 2**	Description of Exposure Variable	Units	Values for Non-Residential Exposure Scenario – Using Equation 1 – GSDi = Hom	Using Equation 1 – GSDi = Het	Using Equation 2 – GSDi = Hom	Using Equation 2 – GSDi = Het
PbS	X	X	Soil lead concentration	ug/g or ppm	**2020**	**2020**	**2020**	**2020**
Rfetal/maternal	X	X	Fetal/maternal PbB ratio	--	0.9	0.9	0.9	0.9
BKSF	X	X	Biokinetic Slope Factor	ug/dL per ug/day	0.4	0.4	0.4	0.4
GSDi	X	X	Geometric standard deviation PbB	--	2.1	2.3	2.1	2.3
PbB0	X	X	Baseline PbB	ug/dL	1.5	1.7	1.5	1.7
IRS	X		Soil ingestion rate (including soil-derived indoor dust)	g/day	0.05	0.05	--	--
IRS+D		X	Total ingestion rate of outdoor soil and indoor dust	g/day	--	--	0.05	0.05
WS		X	Weighting factor; fraction of IRS+D ingested as outdoor soil	--	--	--	1.0	1.0
KSD		X	Mass fraction of soil in dust	--	--	--	0.7	0.7
AFS, D	X	X	Absorption fraction (same for soil and dust)	--	0.12	0.12	0.12	0.12
EFS, D	X	X	Exposure frequency (same for soil and dust)	days/yr	**365**	**365**	**365**	**365**
ATS, D	X	X	Averaging time (same for soil and dust)	days/yr	365	365	365	365
PbBadult			**PbB of adult worker, geometric mean**	**ug/dL**	**6.3**	**6.5**	**6.3**	**6.5**
PbBfetal, 0.95			**95th percentile PbB among fetuses of adult workers**	**ug/dL**	**19.4**	**23.2**	**19.4**	**23.2**
PbBt			**Target PbB level of concern (e.g., 10 ug/dL)**	**ug/dL**	**10.0**	**10.0**	**10.0**	**10.0**
P(PbBfetal > PbBt)			**Probability that fetal PbB > PbBt, assuming lognormal distribution**	**%**	**22.5%**	**26.3%**	**22.5%**	**26.3%**

Calculations of Blood Lead Concentrations (PbBs)
U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee
Version date 05/19/03

Table A.4.HHRA-18
Blood Lead Level Estimates for a Hypothetical Future Child and Adult Resident Receptor
from Exposure to Surface and Subsurface Soil
BAG LOADING AREA
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

1 Equation 1 does not apportion exposure between soil and dust ingestion (excludes WS, KSD).
When IRS = IRS+D and WS = 1.0, the equations yield the same PbBfetal,0.95.

***Equation 1, based on Eq. 1, 2 in USEPA (1996).**

PbB adult =	(PbS*BKSF*IRS+D*AFS,D*EFS/ATS.D) + PbB0
PbB fetal, 0.95 =	PbBadult * (GSDi1.645 * R)

****Equation 2, alternate approach based on Eq. 1, 2, and A-19 in USEPA (1996).**

PbB adult =	PbS*BKSF*([(IRS+D)*AFS*EFS*WS]+[KSD*(IRS+D)*(1-WS)*AFD*EFD])/365+PbB0
PbB fetal, 0.95 =	PbBadult * (GSDi1.645 * R)

References:
USEPA 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risk Associated with Adult Exposure to Lead in Soil. Technical Review Workgroup for Lead. December.
USEPA 2003b. Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risk Associated with Adult Exposure to Lead in Soil. Adult Lead Model (ALM). Technical Review Workgroup for Lead. January.

Notes:

g/day =	Gram(s) per day.	ppm =	Part(s) per million.
GSDi =	Individual Geometric Standard Deviations.	µg/day =	Microgram(s) per day.
Het =	Heterogeneous population.	µg/dL =	Microgram(s) per deciliter.
Hom =	Homogeneous population.	µg/g =	Microgram(s) per gram.
PbB =	Blood lead.	yr =	Year.

USEPA Adult Lead Model (2003b) was used to assess exposure to lead.
Input values in bold font were receptor- and site-specific.

Table A.4.HHRA-18
Blood Lead Level Estimates for a Hypothetical Future Child and Adult Resident Receptor
from Exposure to Surface and Subsurface Soil
BAG LOADING AREA
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

CHILD RESIDENT

Description of Result	Units	Result
Geometric Mean PbB	ug/dL	14.9
Percent Above 10 ug/dL	%	80.1

LEAD MODEL FOR WINDOWS Version 1.1 [a]

==
Model Version: 1.1 Build9
User Name:
Date:
Site Name: Bag Loading Area
Operable Unit:
Run Mode: Research
==

****** Air ******

Indoor Air Pb Concentration: 30.000 percent of outdoor.
Other Air Parameters:

Age	Time Outdoors (hours)	Ventilation Rate (m3/day)	Lung Absorption (%)	Outdoor Air Pb Conc (ug Pb/m3)
.5-1	1.000	2.000	32.000	0.100
1-2	2.000	3.000	32.000	0.100
2-3	3.000	5.000	32.000	0.100
3-4	4.000	5.000	32.000	0.100
4-5	4.000	5.000	32.000	0.100
5-6	4.000	7.000	32.000	0.100
6-7	4.000	7.000	32.000	0.100

Table A.4.HHRA-18
Blood Lead Level Estimates for a Hypothetical Future Child and Adult Resident Receptor
from Exposure to Surface and Subsurface Soil
BAG LOADING AREA
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

****** Diet ******

Age	Diet Intake(ug/day)
.5-1	2.260
1-2	1.960
2-3	2.130
3-4	2.040
4-5	1.950
5-6	2.050
6-7	2.220

****** Drinking Water ******

Water Consumption:

Age	Water (L/day)
.5-1	0.200
1-2	0.500
2-3	0.520
3-4	0.530
4-5	0.550
5-6	0.580
6-7	0.590

Drinking Water Concentration: 4.000 ug Pb/L

Table A.4.HHRA-18
Blood Lead Level Estimates for a Hypothetical Future Child and Adult Resident Receptor
from Exposure to Surface and Subsurface Soil
BAG LOADING AREA
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

****** Soil & Dust ******

Multiple Source Analysis Used
Average multiple source concentration: 1424.000 ug/g

Mass fraction of outdoor soil to indoor dust conversion factor: 0.700
Outdoor airborne lead to indoor household dust lead concentration: 100.000
Use alternate indoor dust Pb sources? No

Age	Soil (ug Pb/g)[b]	House Dust (ug Pb/g)
.5-1	2020.000	1424.000
1-2	2020.000	1424.000
2-3	2020.000	1424.000
3-4	2020.000	1424.000
4-5	2020.000	1424.000
5-6	2020.000	1424.000
6-7	2020.000	1424.000

****** Alternate Intake ******

Age	Alternate (ug Pb/day)
.5-1	0.000
1-2	0.000
2-3	0.000
3-4	0.000
4-5	0.000
5-6	0.000
6-7	0.000

****** Maternal Contribution: Infant Model ******

Maternal Blood Concentration: 1.000 ug Pb/dL

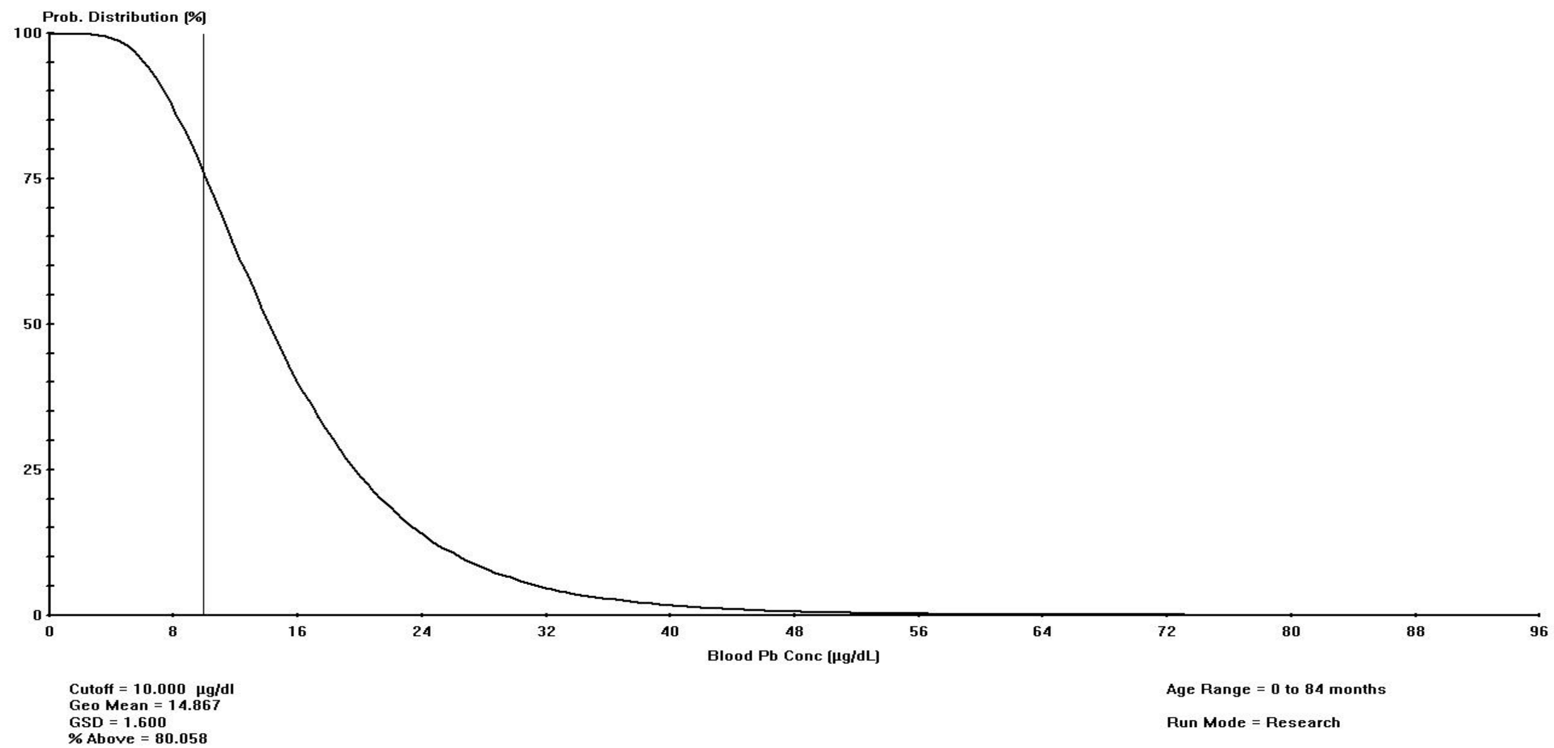
Table A.4.HHRA-18
Blood Lead Level Estimates for a Hypothetical Future Child and Adult Resident Receptor
from Exposure to Surface and Subsurface Soil
BAG LOADING AREA
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
****

Year	Air (ug/day)	Diet (ug/day)	Alternate (ug/day)	Water (ug/day)
.5-1	0.021	0.782	0.000	0.277
1-2	0.034	0.641	0.000	0.654
2-3	0.062	0.730	0.000	0.713
3-4	0.067	0.729	0.000	0.758
4-5	0.067	0.770	0.000	0.868
5-6	0.093	0.842	0.000	0.953
6-7	0.093	0.932	0.000	0.991

Year	Soil+Dust (ug/day)	Total (ug/day)	Blood (ug/dL)
.5-1	29.879	30.959	15.9
1-2	44.854	46.185	18.4
2-3	46.981	48.486	17.4
3-4	49.001	50.555	17.0
4-5	40.066	41.770	14.4
5-6	37.523	39.411	12.3
6-7	36.234	38.250	10.9

Table A.4.HHRA-18
Blood Lead Level Estimates for a Hypothetical Future Child and Adult Resident Receptor
from Exposure to Surface and Subsurface Soil
BAG LOADING AREA
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia



Notes:
[a] Model parameters are defaults, except where noted.
[b] Arithmetic mean

Table A.4.HHRA-19
Blood Lead Level Estimates for a Hypothetical Construction Worker Receptor
from Exposure to Surface and Subsurface Soil
BAG LOADING AREA
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Exposure Variable	PbB Equation1		Description of Exposure Variable	Units	Values for Non-Residential Exposure Scenario			
					Using Equation 1		Using Equation 2	
	1*	2**			GSDi = Hom	GSDi = Het	GSDi = Hom	GSDi = Het
PbS	X	X	Soil lead concentration	ug/g or ppm	**2020**	**2020**	**2020**	**2020**
Rfetal/maternal	X	X	Fetal/maternal PbB ratio	--	0.9	0.9	0.9	0.9
BKSF	X	X	Biokinetic Slope Factor	ug/dL per ug/day	0.4	0.4	0.4	0.4
GSDi	X	X	Geometric standard deviation PbB	--	2.1	2.3	2.1	2.3
PbB0	X	X	Baseline PbB	ug/dL	1.5	1.7	1.5	1.7
IRS	X		Soil ingestion rate (including soil-derived indoor dust)	g/day	0.10	0.10	--	--
IRS+D		X	Total ingestion rate of outdoor soil and indoor dust	g/day	--	--	0.05	0.05
WS		X	Weighting factor; fraction of IRS+D ingested as outdoor soil	--	--	--	1.0	1.0
KSD		X	Mass fraction of soil in dust	--	--	--	0.7	0.7
AFS, D	X	X	Absorption fraction (same for soil and dust)	--	0.12	0.12	0.12	0.12
EFS, D	X	X	Exposure frequency (same for soil and dust)	days/yr	**130**	**130**	**130**	**130**
ATS, D	X	X	Averaging time (same for soil and dust)	days/yr	365	365	365	365
PbBadult	**PbB of adult worker, geometric mean**			**ug/dL**	**5.0**	**5.2**	**3.2**	**3.4**
PbBfetal, 0.95	**95th percentile PbB among fetuses of adult workers**			**ug/dL**	**15.1**	**18.3**	**9.8**	**12.1**
PbBt	**Target PbB level of concern (e.g., 10 ug/dL)**			**ug/dL**	**10.0**	**10.0**	**10.0**	**10.0**
P(PbBfetal > PbBt)	**Probability that fetal PbB > PbBt, assuming lognormal distribution**			**%**	**13.8%**	**17.8%**	**4.8%**	**7.9%**

Calculations of Blood Lead Concentrations (PbBs)
U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee
Version date 05/19/03

Table A.4.HHRA-19
Blood Lead Level Estimates for a Hypothetical Construction Worker Receptor
from Exposure to Surface and Subsurface Soil
BAG LOADING AREA
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

1 Equation 1 does not apportion exposure between soil and dust ingestion (excludes WS, KSD).
When IRS = IRS+D and WS = 1.0, the equations yield the same PbBfetal,0.95.

***Equation 1, based on Eq. 1, 2 in USEPA (1996).**

PbB adult =	(PbS*BKSF*IRS+D*AFS,D*EFS/ATS.D) + PbB0
PbB fetal, 0.95 =	PbBadult * (GSDi1.645 * R)

****Equation 2, alternate approach based on Eq. 1, 2, and A-19 in USEPA (1996).**

PbB adult =	PbS*BKSF*([(IRS+D)*AFS*EFS*WS]+[KSD*(IRS+D)*(1-WS)*AFD*EFD])/365+PbB0
PbB fetal, 0.95 =	PbBadult * (GSDi1.645 * R)

References:

USEPA 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risk Associated with Adult Exposure to Lead in Soil. Technical Review Workgroup for Lead. December.

USEPA 2003b. Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risk Associated with Adult Exposure to Lead in Soil. Adult Lead Model (ALM). Technical Review Workgroup for Lead. January.

Notes:

g/day =	Gram(s) per day.	ppm =	Part(s) per million.
GSDi =	Individual Geometric Standard Deviations.	µg/day =	Microgram(s) per day.
Het =	Heterogeneous population.	µg/dL =	Microgram(s) per deciliter.
Hom =	Homogeneous population.	µg/g =	Microgram(s) per gram.
PbB =	Blood lead.	yr =	Year.

USEPA Adult Lead Model (2003b) was used to assess exposure to lead.
Input values in bold font were receptor- and site-specific.

Table A.4.HHRA-20
Summary of Calculated Blood Lead Level Estimates
BAG LOADING AREA
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Exposure Medium/Receptor	Model Used [a]	Receptor Blood Lead Level[b] Adult 50th Percentile/ Geometric Mean (µg/dL)	Receptor Blood Lead Level[b] Child range in seven years (µg/dL)	Fetus Blood Level [b] 95th Percentile (µg/dL)
BAG LOADING AREA				
Surface Soil (0-1 feet below ground surface)				
Hypothetical Current Commercial/Industrial Worker Receptor	USEPA ALM	4.9	–	17
Surface and Subsurface Soil				
Hypothetical Construction Worker Receptor	USEPA ALM	5.2	–	18
Hypothetical Future Child Resident Receptor	IEUBK	–	10.9 - 18.4	–
Hypothetical Future Adult Resident Receptor	USEPA ALM	6.5	–	23

Notes:
– = Not applicable.
µg/dL = Microgram(s) per deciliter.
[a] USEPA ALM: USEPA Adult Lead Methodology Spreadsheet.
USEPA Technical Review Workgroup for Lead, Adult Lead Committee (USEPA 2003b).
USEPA IEUBK: USEPA Integrated Exposure Uptake Biogenetic Model for Lead in Children (USEPA 2005).
[b] Compare to a target blood lead level of 10 mg/dL.

Table A.5.Data-1
Soil Risk Assessment Dataset
Surface Soil (0-1 foot Depth Interval)
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)		Detects Max (mg/kg)	Detection Limits Min (mg/kg)		Detection Limits Max (mg/kg)	Maximum Location
Volatile Organic Compounds												
3-Octanone	106-68-3	4	-	4	100	0.006	-	0.015	–	-	–	IASD12
Acetone	67-64-1	8	-	14	57	0.009	-	0.16	0.0055	-	0.0062	IASD12
d-Limonene	5989-27-5	3	-	3	100	0.031	-	0.084	–	-	–	IASD08
Methylene Chloride	75-09-2	2	-	14	14	0.002	-	0.004	0.0054	-	0.0074	SS-11
Semi-Volatile Organic Compounds												
2,4-Dinitrotoluene	121-14-2	1	-	27	4	48	-	48	0.2	-	0.46	504360
Benzoic Acid	65-85-0	7	-	22	32	0.1	-	0.3	1	-	8.2	TR-01A
bis(2-Ethylhexyl)phthalate	117-81-7	23	-	31	74	0.03	-	750	0.38	-	0.49	504312
Butylbenzylphthalate	85-68-7	1	-	22	5	0.13	-	0.13	0.19	-	1.7	SS-11
Carbazole	86-74-8	5	-	22	23	0.016	-	2.4	0.2	-	0.49	IASD09
Dibenzofuran	132-64-9	4	-	20	20	0.018	-	0.74	0.19	-	0.49	IASD09
Diethylphthalate	84-66-2	4	-	25	16	0.07	-	250	0.19	-	1.7	504360
Di-n-Butylphthalate	84-74-2	2	-	22	9	0.07	-	0.31	0.19	-	1.7	IASS05
Di-n-Octylphthalate	117-84-0	1	-	20	5	0.04	-	0.04	0.19	-	1.7	IATP2A/C
Explosives												
1,3,5-Trinitrobenzene	99-35-4	1	-	19	5	0.07	-	0.07	0.1	-	0.3	IASD11
4-Amino-2,6-Dinitrotoluene	19406-51-0	2	-	19	11	0.04	-	0.05	0.2	-	0.3	IASS05
Nitroglycerine	55-63-0	1	-	19	5	0.57	-	0.57	0.32	-	1.3	IASS05
Pesticides												
4,4'-DDD	72-54-8	6	-	9	67	0.00068	-	0.00248	0.00082	-	0.00755	IASD08
4,4'-DDE	72-55-9	5	-	9	56	0.00066	-	0.00301	0.00072	-	0.00755	IASD05
4,4'-DDT	50-29-3	11	-	14	79	0.00062	-	0.0067	0.00755	-	0.00755	IASD08
Beta-BHC	319-85-7	1	-	9	11	0.00017	-	0.00017	0.00072	-	0.00755	IASD07
Delta-BHC	319-86-8	1	-	9	11	0.00104	-	0.00104	0.0008	-	0.00755	IASD10
Alpha-Chlordane	5103-71-9	3	-	9	33	0.00038	-	0.00301	0.00072	-	0.00755	IASD05
Gamma-Chlordane	5566-34-7	4	-	9	44	0.00062	-	0.00408	0.0008	-	0.00755	IASD05
Dieldrin	60-57-1	7	-	9	78	0.00061	-	0.00909	0.00082	-	0.00755	IASD10
Endosulfan II	33213-65-9	7	-	13	54	0.00038	-	0.00378	0.0008	-	0.00755	IASD08
Endrin	72-20-8	5	-	15	33	0.00062	-	0.02	0.00072	-	0.00755	TR-01A
Endrin Ketone	53494-70-5	3	-	9	33	0.00148	-	0.00424	0.0008	-	0.00755	IASD05
Heptachlor Epoxide	1024-57-3	1	-	9	11	0.00101	-	0.00101	0.00072	-	0.00755	IASD08
Methoxychlor	72-43-5	7	-	10	70	0.00107	-	0.0122	0.00082	-	0.00755	IASD10
Polycyclic Aromatic Hydrocarbons												
1-Methylnaphthalene	90-12-0	1	-	2	50	0.037	-	0.037	0.0044	-	0.0044	IAA-SS002
2-Methylnaphthalene	91-57-6	12	-	27	44	0.00092	-	0.36	0.0044	-	0.49	IASD11
Acenaphthene	83-32-9	5	-	27	19	0.0014	-	1	0.0019	-	0.49	IASD09
Acenaphthylene	208-96-8	5	-	29	17	0.0012	-	0.3	0.0019	-	0.49	TR-01A
Anthracene	120-12-7	8	-	29	28	0.0013	-	2.1	0.0019	-	0.49	IASD09
Benzo(a)anthracene	56-55-3	18	-	31	58	0.0018	-	6.9	0.0044	-	0.49	IASD09

Table A.5.Data-1
Soil Risk Assessment Dataset
Surface Soil (0-1 foot Depth Interval)
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)		Detects Max (mg/kg)	Detection Limits Min (mg/kg)		Detection Limits Max (mg/kg)	Maximum Location
Benzo(a)pyrene	50-32-8	17	-	31	55	0.002	-	5.9	0.0044	-	0.49	IASD09
Benzo(b)fluoranthene	205-99-2	17	-	31	55	0.0049	-	13	0.0044	-	0.49	TR-01A
Benzo(g,h,i)perylene	191-24-2	14	-	32	44	0.0023	-	3.5	0.0044	-	0.49	IASD09
Benzo(k)fluoranthene	207-08-9	17	-	31	55	0.0014	-	6.5	0.0044	-	0.49	TR-01A
Chrysene	218-01-9	19	-	34	56	0.0026	-	7.7	0.0044	-	0.49	IASD09,TR-01A
Dibenzo(a,h)anthracene	53-70-3	7	-	29	24	0.0024	-	0.97	0.0019	-	0.49	IASD09
Fluoranthene	206-44-0	20	-	34	59	0.0047	-	22	0.0044	-	0.49	IASD09
Fluorene	86-73-7	7	-	27	26	0.00097	-	1.3	0.0019	-	0.49	IASD09
Indeno(1,2,3-cd)pyrene	193-39-5	13	-	29	45	0.0017	-	6.1	0.0044	-	0.49	TR-01A
Naphthalene	91-20-3	13	-	29	45	0.00088	-	0.75	0.0021	-	0.49	IASD09
Phenanthrene	85-01-8	19	-	31	61	0.0034	-	16	0.0044	-	0.49	IASD09
Pyrene	129-00-0	20	-	34	59	0.0033	-	16	0.0044	-	0.49	IASD09
Polychlorinated Biphenyls												
Aroclor 1254	11097-69-1	12	-	35	34	0.0049	-	12	0.022	-	0.04	IASS05
Aroclor 1260	11096-82-5	3	-	27	11	0.37	-	1	0.02	-	0.04	SS-11
Inorganics												
Aluminum	7429-90-5	99	-	99	100	881	-	39000	–	-	–	50240
Antimony	7440-36-0	30	-	96	31	0.21	-	16.9	0.54	-	5.6	IAA-SS028
Arsenic	7440-38-2	98	-	99	99	0.55	-	164	–	-	–	SS-12
Barium	7440-39-3	99	-	99	100	12.3	-	11800	–	-	–	SS-11a
Beryllium	7440-41-7	87	-	99	88	0.36	-	2.3	0.11	-	1.2	IASB4
Cadmium	7440-43-9	52	-	90	58	0.08	-	15.2	0.11	-	6.2	IAA-SS015
Calcium	7440-70-2	99	-	99	100	508	-	197000	–	-	–	IAA-SS006
Chromium	7440-47-3	99	-	99	100	11.9	-	1110	–	-	–	IAA-SS026
Cobalt	7440-48-4	97	-	99	98	0.26	-	422	4.6	-	27.8	IASB07
Copper	7440-50-8	99	-	99	100	9.1	-	56500	–	-	–	SS-12
Iron	7439-89-6	99	-	99	100	9450	-	328000	–	-	–	IAA-SS028
Lead	7439-92-1	99	-	99	100	6.4	-	14400	–	-	–	IAA-SS012
Magnesium	7439-95-4	99	-	99	100	296	-	86100	–	-	–	IAA-SS033
Manganese	7439-96-5	99	-	99	100	8.6	-	2510	–	-	–	IASB07
Mercury	7439-97-6	75	-	94	80	0.015	-	79.5	0.05	-	0.14	IAA-SS022
Nickel	7440-02-0	98	-	99	99	0.47	-	213	0.12	-	0.12	IAA-SS028
Potassium	7440-09-7	98	-	99	99	173	-	5570	1250	-	1250	IATP2B/D
Selenium	7782-49-2	18	-	96	19	0.41	-	1.9	0.55	-	6.2	50240

Table A.5.Data-1
Soil Risk Assessment Dataset
Surface Soil (0-1 foot Depth Interval)
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b]				Detects			Detection Limits			Maximum Location
		number of detects / number of samples			FOD %	Min - Max			Min - Max			
						(mg/kg)		(mg/kg)	(mg/kg)		(mg/kg)	
Silver	7440-22-4	15	-	87	17	0.3	-	22.5	0.22	-	3.7	SS-12
Sodium	7440-23-5	54	-	97	56	7.5	-	1350	972	-	1850	IATP2B/D
Thallium	7440-28-0	36	-	99	36	0.12	-	1	0.22	-	12.5	SS-03,SS-11
Vanadium	7440-62-2	99	-	99	100	10.8	-	98.4	–	-	–	50240
Zinc	7440-66-6	99	-	99	100	6	-	21800	–	-	–	SS-11

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilogram.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table A.4.Data-2
Surface Soil Risk Assessment Dataset
Surface Soil (0-2 foot Depth Interval)
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Volatile Organic Compounds												
2-Butanone	78-93-3	1	-	15	7	0.011	-	0.011	0.0055	-	0.0088	BLA-SPSD01
3-Octanone	106-68-3	1	-	1	100	0.011	-	0.011	–	-	–	BLASS07
4-Methyl-2-pentanone	108-10-1	1	-	15	7	0.0016	-	0.0016	0.0055	-	0.0088	BLA-SPSD01
Acetone	67-64-1	2	-	15	13	0.023	-	0.043	0.0055	-	0.0088	BLA-SPSD01
Carbon Disulfide	75-15-0	1	-	15	7	0.0031	-	0.0031	0.0055	-	0.0088	BLA-SPSD01
d-Limonene	5989-27-5	1	-	1	100	0.057	-	0.057	–	-	–	BLASS07
Methylene Chloride	75-09-2	3	-	17	18	0.001	-	0.0028	0.0055	-	0.0088	BLA-SPSD01
Tetrachloroethene	127-18-4	2	-	15	13	0.0009	-	0.00092	0.0055	-	0.0094	BLASS07
Toluene	108-88-3	5	-	15	33	0.00071	-	0.007	0.0055	-	0.0094	BLASS07
Semi-Volatile Organic Compounds												
2,4-Dinitrotoluene	121-14-2	9	-	17	53	0.04	-	3	0.2	-	0.2	BLASS03
2,6-Dinitrotoluene	606-20-2	3	-	17	18	0.07	-	1.9	0.2	-	0.4	SS-09
Benzoic Acid	65-85-0	2	-	13	15	0.14	-	0.3	0.86	-	3.8	TR-03E
bis(2-Ethylhexyl)phthalate	117-81-7	11	-	14	79	0.05	-	0.57	0.2	-	0.21	SS-09
Carbazole	86-74-8	10	-	12	83	0.045	-	13	0.2	-	0.21	BLASB02
Dibenzofuran	132-64-9	9	-	12	75	0.016	-	2.8	0.2	-	0.21	BLASB02
Di-n-Butylphthalate	84-74-2	6	-	12	50	0.061	-	120	0.2	-	0.39	BLASS03
N-Nitrosodiphenylamine	86-30-6	2	-	11	18	0.1	-	8.3	0.2	-	0.78	BLASS03
Phenol	108-95-2	1	-	12	8	0.08	-	0.08	0.2	-	0.78	SS-14
Explosives												
1,3,5-Trinitrobenzene	99-35-4	1	-	16	6	0.07	-	0.07	0.1	-	0.2	BLASS06
1,3-Dinitrobenzene	99-65-0	1	-	16	6	0.05	-	0.05	0.1	-	0.2	BLASS02
2,4,6-Trinitrotoluene	118-96-7	1	-	16	6	0.06	-	0.06	0.2	-	0.4	BLASS03
4-Amino-2,6-Dinitrotoluene	19406-51-0	3	-	16	19	0.04	-	0.07	0.2	-	0.4	BLASS03
m-Nitrotoluene	99-08-1	1	-	16	6	2.86	-	2.86	0.4	-	0.8	BLASS04
Nitroglycerine	55-63-0	1	-	16	6	0.21	-	0.21	0.31	-	0.72	BLASS11
Pentaerythritol Tetranitrate	78-11-5	1	-	16	6	0.16	-	0.16	0.31	-	0.72	BLASD01
Pesticides												
4,4'-DDD	72-54-8	4	-	5	80	0.00064	-	0.043	0.00798	-	0.00798	SS-09
4,4'-DDE	72-55-9	2	-	4	50	0.00058	-	0.00086	0.00798	-	0.00809	BLASD01
Beta-BHC	319-85-7	1	-	4	25	0.00028	-	0.00028	0.00082	-	0.00809	BLASD01
Alpha-Chlordane	5103-71-9	1	-	5	20	0.089	-	0.089	0.00079	-	0.00809	SS-09
Gamma-Chlordane	5566-34-7	1	-	5	20	0.01	-	0.01	0.00079	-	0.00809	SS-09
Endosulfan I	115-29-7	1	-	5	20	0.022	-	0.022	0.00079	-	0.00809	SS-09
Endrin	72-20-8	1	-	4	25	0.00035	-	0.00035	0.00079	-	0.00809	BLASD02
Heptachlor Epoxide	1024-57-3	2	-	5	40	0.00094	-	0.015	0.00082	-	0.00809	SS-09
Methoxychlor	72-43-5	2	-	4	50	0.00442	-	0.0674	0.00082	-	0.00809	BLASB02
Polycyclic Aromatic Hydrocarbons												

Table A.4.Data-2
Surface Soil Risk Assessment Dataset
Surface Soil (0-2 foot Depth Interval)
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
1-Methylnaphthalene	90-12-0	15	-	24	62	0.0056	-	0.4	0.0054	-	0.027	BLA-SS005
2-Methylnaphthalene	91-57-6	25	-	39	64	0.0022	-	0.58	0.0054	-	0.39	BLA-SS005
Acenaphthene	83-32-9	32	-	39	82	0.0015	-	12	0.0018	-	0.21	BLA-SS005
Acenaphthylene	208-96-8	26	-	39	67	0.00076	-	0.31	0.0026	-	0.39	BLA-SS007
Anthracene	120-12-7	36	-	39	92	0.00099	-	22	0.0024	-	0.011	BLA-SS005
Benzo(a)anthracene	56-55-3	40	-	41	98	0.0054	-	46	–	-	–	BLA-SS005
Benzo(a)pyrene	50-32-8	39	-	41	95	0.0049	-	39	0.0085	-	0.0085	BLA-SS005
Benzo(b)fluoranthene	205-99-2	40	-	41	98	0.0098	-	68	–	-	–	BLASB02
Benzo(g,h,i)perylene	191-24-2	39	-	39	100	0.0068	-	21	–	-	–	BLA-SS005
Benzo(k)fluoranthene	207-08-9	40	-	41	98	0.0028	-	31	–	-	–	BLA-SS005
Chrysene	218-01-9	40	-	41	98	0.0065	-	54	–	-	–	BLA-SS005
Dibenzo(a,h)anthracene	53-70-3	30	-	39	77	0.0019	-	6.9	0.0054	-	0.21	BLA-SS005
Fluoranthene	206-44-0	40	-	41	98	0.0089	-	160	–	-	–	BLA-SS005
Fluorene	86-73-7	30	-	39	77	0.00095	-	12	0.0054	-	0.21	BLA-SS005
Indeno(1,2,3-cd)pyrene	193-39-5	38	-	39	97	0.0052	-	25	0.0085	-	0.0085	BLA-SS005
Naphthalene	91-20-3	24	-	39	62	0.0019	-	1.4	0.0054	-	0.21	BLA-SS005
Phenanthrene	85-01-8	40	-	41	98	0.0058	-	100	–	-	–	BLA-SS005
Pyrene	129-00-0	40	-	41	98	0.0071	-	88	–	-	–	BLA-SS005
Polychlorinated Biphenyls												
Aroclor 1254	11097-69-1	9	-	18	50	0.0066	-	8.3	0.02	-	0.04	SS-09
Inorganics												
Aluminum	7429-90-5	43	-	43	100	5530	-	39100	–	-	–	407760
Antimony	7440-36-0	17	-	41	41	0.2	-	8.1	0.59	-	5.6	BLA-SS014
Arsenic	7440-38-2	42	-	43	98	1.29	-	58.4	0.51	-	0.51	BLA-SS014
Barium	7440-39-3	43	-	43	100	45.4	-	11100	–	-	–	BLA-SS008
Beryllium	7440-41-7	43	-	43	100	0.36	-	2.2	–	-	–	BLASD02,BLA-SS005
Cadmium	7440-43-9	30	-	35	86	0.09	-	44.8	0.12	-	1.5	BLA-SS013
Calcium	7440-70-2	43	-	43	100	483	-	191000	–	-	–	BLA-SS007
Chromium	7440-47-3	43	-	43	100	11.2	-	106	–	-	–	BLA-SS016
Cobalt	7440-48-4	40	-	43	93	3.9	-	149	40.6	-	47	BLASS11
Copper	7440-50-8	43	-	43	100	23.5	-	72000	–	-	–	BLA-SS013
Iron	7439-89-6	43	-	43	100	8500	-	61500	–	-	–	BLA-SS012
Lead	7439-92-1	43	-	43	100	13.8	-	58000	–	-	–	BLA-SS013
Magnesium	7439-95-4	43	-	43	100	4500	-	105000	–	-	–	BLA-SS003
Manganese	7439-96-5	43	-	43	100	88	-	3080	–	-	–	BLASS11
Mercury	7439-97-6	33	-	35	94	0.02	-	16.8	0.047	-	0.05	BLA-SS009
Nickel	7440-02-0	43	-	43	100	5.99	-	148	–	-	–	BLA-SS013
Potassium	7440-09-7	43	-	43	100	752	-	5610	–	-	–	407760
Selenium	7782-49-2	11	-	42	26	0.39	-	1.9	1.03	-	1.9	BLA-SS013
Silver	7440-22-4	12	-	35	34	0.39	-	2.3	1.03	-	3.7	BLA-SS013

Table A.4.Data-2
Surface Soil Risk Assessment Dataset
Surface Soil (0-2 foot Depth Interval)
BAG LOADING AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)		Detects Max (mg/kg)	Detection Limits Min (mg/kg)		Detection Limits Max (mg/kg)	Maximum Location
Sodium	7440-23-5	21	-	41	51	23.8	-	118	1190	-	2330	BLASS03
Thallium	7440-28-0	17	-	41	41	0.04	-	0.78	2.4	-	4.7	407712
Vanadium	7440-62-2	43	-	43	100	14.4	-	102	–	-	–	BLA-SS002
Zinc	7440-66-6	43	-	43	100	33.8	-	12500	–	-	–	BLA-SS013

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilograms.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table A.5.Data-3
Soil Risk Assessment Dataset
Combined Surface and Subsurface Soil
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)		Detects Max (mg/kg)	Detection Limits Min (mg/kg)		Detection Limits Max (mg/kg)	Maximum Location
Volatile Organic Compounds												
3-Octanone	106-68-3	4	-	4	100	0.006	-	0.015	–	-	–	IASD12
Acetone	67-64-1	8	-	18	44	0.009	-	0.16	0.0052	-	0.0071	IASD12
d-Limonene	5989-27-5	3	-	3	100	0.031	-	0.084	–	-	–	IASD08
Methylene Chloride	75-09-2	2	-	18	11	0.002	-	0.004	0.0052	-	0.0074	SS-11
Toluene	108-88-3	3	-	16	19	0.00066	-	0.00083	0.0054	-	0.0074	IASB12
Semi-Volatile Organic Compounds												
2,4-Dinitrotoluene	121-14-2	2	-	36	6	48	-	210	0.2	-	0.49	504360
Benzoic Acid	65-85-0	7	-	27	26	0.1	-	0.3	1	-	8.2	TR-01A
bis(2-Ethylhexyl)phthalate	117-81-7	28	-	47	60	0.03	-	750	0.38	-	0.49	504312
Butylbenzylphthalate	85-68-7	1	-	27	4	0.13	-	0.13	0.19	-	1.7	SS-11
Carbazole	86-74-8	5	-	27	19	0.016	-	2.4	0.2	-	0.49	IASD09
Dibenzofuran	132-64-9	4	-	25	16	0.018	-	0.74	0.19	-	0.49	IASD09
Diethylphthalate	84-66-2	4	-	34	12	0.07	-	250	0.19	-	1.7	504360
Di-n-Butylphthalate	84-74-2	4	-	27	15	0.07	-	0.31	0.19	-	1.7	IASS05
Di-n-Octylphthalate	117-84-0	1	-	25	4	0.04	-	0.04	0.19	-	1.7	IATP2A/C
Explosives												
1,3,5-Trinitrobenzene	99-35-4	1	-	19	5	0.07	-	0.07	0.1	-	0.3	IASD11
4-Amino-2,6-Dinitrotoluene	19406-51-0	2	-	19	11	0.04	-	0.05	0.2	-	0.3	IASS05
Nitroglycerine	55-63-0	1	-	19	5	0.57	-	0.57	0.32	-	1.3	IASS05
Pesticides												
4,4'-DDD	72-54-8	6	-	9	67	0.00068	-	0.00248	0.00082	-	0.00755	IASD08
4,4'-DDE	72-55-9	5	-	9	56	0.00066	-	0.00301	0.00072	-	0.00755	IASD05
4,4'-DDT	50-29-3	14	-	21	67	0.00042	-	0.0067	0.00755	-	0.00755	IASD08
Beta-BHC	319-85-7	1	-	9	11	0.00017	-	0.00017	0.00072	-	0.00755	IASD07
Delta-BHC	319-86-8	1	-	9	11	0.00104	-	0.00104	0.0008	-	0.00755	IASD10
Alpha-Chlordane	5103-71-9	3	-	9	33	0.00038	-	0.00301	0.00072	-	0.00755	IASD05
Gamma-Chlordane	5566-34-7	4	-	9	44	0.00062	-	0.00408	0.0008	-	0.00755	IASD05
Dieldrin	60-57-1	7	-	9	78	0.00061	-	0.00909	0.00082	-	0.00755	IASD10
Endosulfan II	33213-65-9	8	-	20	40	0.0003	-	0.00378	0.0008	-	0.00755	IASD08
Endrin	72-20-8	8	-	22	36	0.00024	-	0.02	0.00072	-	0.00755	TR-01A
Endrin Ketone	53494-70-5	3	-	9	33	0.00148	-	0.00424	0.0008	-	0.00755	IASD05
Heptachlor Epoxide	1024-57-3	1	-	9	11	0.00101	-	0.00101	0.00072	-	0.00755	IASD08
Methoxychlor	72-43-5	7	-	10	70	0.00107	-	0.0122	0.00082	-	0.00755	IASD10
Polycyclic Aromatic Hydrocarbons												
1-Methylnaphthalene	90-12-0	1	-	3	33	0.037	-	0.037	0.0044	-	0.006	IAA-SS002
2-Methylnaphthalene	91-57-6	13	-	38	34	0.00092	-	0.36	0.0019	-	0.49	IASD11
Acenaphthene	83-32-9	6	-	38	16	0.0014	-	1	0.0019	-	0.49	IASD09

Table A.5.Data-3
Soil Risk Assessment Dataset
Combined Surface and Subsurface Soil
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Acenaphthylene	208-96-8	6	-	40	15	0.0012	-	0.3	0.0019	-	0.49	TR-01A
Anthracene	120-12-7	9	-	40	22	0.0011	-	2.1	0.0019	-	0.49	IASD09
Benzo(a)anthracene	56-55-3	18	-	42	43	0.0018	-	6.9	0.0019	-	0.49	IASD09
Benzo(a)pyrene	50-32-8	17	-	42	40	0.002	-	5.9	0.0019	-	0.49	IASD09
Benzo(b)fluoranthene	205-99-2	17	-	42	40	0.0049	-	13	0.0019	-	0.49	TR-01A
Benzo(g,h,i)perylene	191-24-2	15	-	47	32	0.0023	-	41	0.0019	-	0.49	504360
Benzo(k)fluoranthene	207-08-9	18	-	42	43	0.0014	-	6.5	0.0019	-	0.49	TR-01A
Chrysene	218-01-9	20	-	49	41	0.0026	-	44	0.0019	-	0.49	504360
Dibenzo(a,h)anthracene	53-70-3	7	-	40	18	0.0024	-	0.97	0.0019	-	0.49	IASD09
Fluoranthene	206-44-0	22	-	49	45	0.0047	-	59	0.0019	-	0.49	504360
Fluorene	86-73-7	8	-	38	21	0.00097	-	1.3	0.0019	-	0.49	IASD09
Indeno(1,2,3-cd)pyrene	193-39-5	13	-	40	32	0.0017	-	6.1	0.0019	-	0.49	TR-01A
Naphthalene	91-20-3	14	-	40	35	0.00088	-	0.75	0.0019	-	0.49	IASD09
Phenanthrene	85-01-8	23	-	42	55	0.00084	-	16	0.0022	-	0.49	IASD09
Pyrene	129-00-0	22	-	49	45	0.0033	-	48	0.0019	-	0.49	504360
Polychlorinated Biphenyls												
Aroclor 1254	11097-69-1	18	-	61	30	0.0049	-	12	0.022	-	0.04	IASS05
Aroclor 1260	11096-82-5	3	-	38	8	0.37	-	1	0.02	-	0.04	SS-11
Inorganics												
Aluminum	7429-90-5	139	-	139	100	881	-	46900	–	-	–	81027160
Antimony	7440-36-0	39	-	136	29	0.21	-	16.9	0.54	-	5.6	IAA-SS028
Arsenic	7440-38-2	138	-	139	99	0.55	-	164	–	-	–	SS-12
Barium	7440-39-3	139	-	139	100	8.5	-	11800	–	-	–	SS-11a
Beryllium	7440-41-7	118	-	139	85	0.28	-	4.3	0.11	-	1.2	IASB4
Cadmium	7440-43-9	55	-	118	47	0.06	-	15.2	0.11	-	6.2	IAA-SS015
Calcium	7440-70-2	139	-	139	100	33.7	-	197000	–	-	–	IAA-SS006
Chromium	7440-47-3	139	-	139	100	10.1	-	1920	–	-	–	504360
Cobalt	7440-48-4	137	-	139	99	0.26	-	422	4.6	-	27.8	IASB07
Copper	7440-50-8	139	-	139	100	5.13	-	56500	–	-	–	SS-12
Iron	7439-89-6	139	-	139	100	9450	-	328000	–	-	–	IAA-SS028
Lead	7439-92-1	139	-	139	100	6.4	-	16200	–	-	–	504360
Magnesium	7439-95-4	139	-	139	100	120	-	86100	–	-	–	IAA-SS033
Manganese	7439-96-5	139	-	139	100	8.6	-	2510	–	-	–	IASB07
Mercury	7439-97-6	92	-	130	71	0.015	-	79.5	0.05	-	0.15	IAA-SS022
Nickel	7440-02-0	138	-	139	99	0.47	-	213	0.12	-	0.12	IAA-SS028
Potassium	7440-09-7	138	-	139	99	173	-	5570	1250	-	1250	IATP2B/D
Selenium	7782-49-2	45	-	136	33	0.41	-	1.9	0.55	-	6.2	50240,81022636
Silver	7440-22-4	17	-	111	15	0.18	-	22.5	0.22	-	3.7	SS-12
Sodium	7440-23-5	94	-	137	69	6.28	-	1350	972	-	1850	IATP2B/D
Thallium	7440-28-0	59	-	139	42	0.11	-	1	0.22	-	12.5	SS-03,SS-11

Table A.5.Data-3
Soil Risk Assessment Dataset
Combined Surface and Subsurface Soil
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b]				Detects			Detection Limits			Maximum Location
		number of detects / number of samples			FOD %	Min - Max			Min - Max			
						(mg/kg)		(mg/kg)	(mg/kg)		(mg/kg)	
Vanadium	7440-62-2	137	-	139	99	10.8	-	98.4	–	-	–	50240
Zinc	7440-66-6	137	-	139	99	6	-	21800	–	-	–	SS-11

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilogram.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table A.5.Data-4
Sediment Risk Assessment Dataset
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Inorganics										-		
Aluminum	7429-90-5	4	-	4	100	16600	-	21200	–	-	–	IAA-SE003
Arsenic	7440-38-2	4	-	4	100	8.4	-	10.3	–	-	–	IAA-SE001
Barium	7440-39-3	4	-	4	100	36.8	-	48.9	–	-	–	IAA-SE004
Beryllium	7440-41-7	4	-	4	100	0.61	-	1.2	–	-	–	IAA-SE003
Cadmium	7440-43-9	2	-	4	50	0.42	-	0.47	1.3	-	1.4	IAA-SE004
Calcium	7440-70-2	4	-	4	100	1350	-	8650	–	-	–	IAA-SE001
Chromium	7440-47-3	4	-	4	100	25.1	-	32.7	–	-	–	IAA-SE001
Cobalt	7440-48-4	4	-	4	100	4	-	13	–	-	–	IAA-SE003
Copper	7440-50-8	4	-	4	100	19	-	24.8	–	-	–	IAA-SE003
Iron	7439-89-6	4	-	4	100	27900	-	32300	–	-	–	IAA-SE001
Lead	7439-92-1	4	-	4	100	31.8	-	44.4	–	-	–	IAA-SE003
Magnesium	7439-95-4	4	-	4	100	1800	-	4580	–	-	–	IAA-SE001
Manganese	7439-96-5	4	-	4	100	186	-	369	–	-	–	IAA-SE003
Mercury	7439-97-6	4	-	4	100	0.054	-	0.093	–	-	–	IAA-SE002
Nickel	7440-02-0	4	-	4	100	7.7	-	15.2	–	-	–	IAA-SE003
Potassium	7440-09-7	4	-	4	100	643	-	880	–	-	–	IAA-SE003
Vanadium	7440-62-2	4	-	4	100	50.7	-	62.6	–	-	–	IAA-SE001
Zinc	7440-66-6	4	-	4	100	54.5	-	107	–	-	–	IAA-SE003

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilograms.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.

[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table A.5.HHRA-1
Selection of Constituents of Potential Concern for Surface Soil (0-2 foot Depth Interval)
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b]					Background Level [c]	Does Maximum Exceed RSL?		Is Constituent a Surface Soil COPC? [d]
			Industrial Scenario		Residential Scenario		Surrogate		Industrial	Residential	
		(mg/kg)	(mg/kg)		(mg/kg)			(mg/kg)	(YES, no)	(YES, no)	(YES, no)
Volatile Organic Compounds											
3-Octanone	106-68-3	1.50E-02	NA		NA			–	NA	NA	**YES**
Acetone	67-64-1	1.60E-01	6.10E+04	nms	6.10E+03	n		–	no	no	no
d-Limonene	5989-27-5	8.40E-02	NA		NA			–	NA	NA	**YES**
Methylene Chloride	75-09-2	4.00E-03	5.40E+01	c	1.10E+01	c		–	no	no	no
Semi-Volatile Organic Compounds											
2,4-Dinitrotoluene	121-14-2	2.10E+02	1.20E+02	n	1.20E+01	n		–	**YES**	**YES**	**YES**
Benzoic Acid	65-85-0	3.00E-01	2.50E+05	nm	2.40E+04	nm		–	no	no	no
bis(2-Ethylhexyl)phthalate	117-81-7	7.50E+02	1.20E+02	c*	3.50E+01	c*		–	**YES**	**YES**	**YES**
Butylbenzylphthalate	85-68-7	1.30E-01	9.10E+02	c	2.60E+02	c*		–	no	no	no
Carbazole	86-74-8	2.40E+00	NA		NA			–	NA	NA	**YES**
Dibenzofuran	132-64-9	7.40E-01	1.00E+02	n	7.80E+00	n	Furan	–	no	no	no
Diethylphthalate	84-66-2	2.50E+02	4.90E+04	nm	4.90E+03	n		–	no	no	no
Di-n-Butylphthalate	84-74-2	3.10E-01	6.20E+03	n	6.10E+02	n		–	no	no	no
Di-n-Octylphthalate	117-84-0	4.00E-02	6.20E+03	n	6.10E+02	n	di-n-Butylphthalate	–	no	no	no
Explosives											
1,3,5-Trinitrobenzene	99-35-4	7.00E-02	2.70E+03	n	2.20E+02	n		–	no	no	no
4-Amino-2,6-Dinitrotoluene	19406-51-0	5.00E-02	1.90E+02	n	1.50E+01	n		–	no	no	no
Nitroglycerine	55-63-0	5.70E-01	6.20E+00	n	6.10E-01	n		–	no	no	no
Pesticides											
4,4'-DDD	72-54-8	2.48E-03	7.20E+00	c	2.00E+00	c		–	no	no	no
4,4'-DDE	72-55-9	3.01E-03	5.10E+00	c	1.40E+00	c		–	no	no	no
4,4'-DDT	50-29-3	6.70E-03	7.00E+00	c*	1.70E+00	c*		–	no	no	no
Beta-BHC	319-85-7	1.70E-04	9.60E-01	c	2.70E-01	c		–	no	no	no
Delta-BHC	319-86-8	1.04E-03	2.10E+00	c	5.20E-01	c*	gamma-BHC	–	no	no	no
Alpha-Chlordane	5103-71-9	3.01E-03	6.50E+00	c*	1.60E+00	c*	Chlordane	–	no	no	no
Gamma-Chlordane	5566-34-7	4.08E-03	6.50E+00	c*	1.60E+00	c*	Chlordane	–	no	no	no
Dieldrin	60-57-1	9.09E-03	1.10E-01	c	3.00E-02	c		–	no	no	no
Endosulfan II	33213-65-9	3.78E-03	3.70E+02	n	3.70E+01	n	Endosulfan	–	no	no	no
Endrin	72-20-8	2.00E-02	1.80E+01	n	1.80E+00	n		–	no	no	no
Endrin Ketone	53494-70-5	4.24E-03	1.80E+01	n	1.80E+00	n	Endrin	–	no	no	no
Heptachlor Epoxide	1024-57-3	1.01E-03	1.90E-01	c*	5.30E-02	c*		–	no	no	no
Methoxychlor	72-43-5	1.22E-02	3.10E+02	n	3.10E+01	n		–	no	no	no
Polycyclic Aromatic Hydrocarbons											
1-Methylnaphthalene	90-12-0	3.70E-02	9.90E+01	c	2.20E+01	c		–	no	no	no
2-Methylnaphthalene	91-57-6	3.60E-01	4.10E+02	ns	3.10E+01	n		–	no	no	no
Acenaphthene	83-32-9	1.00E+00	3.30E+03	n	3.40E+02	n		–	no	no	no
Acenaphthylene	208-96-8	3.00E-01	3.30E+03	n	3.40E+02	n	Acenaphthene	–	no	no	no
Anthracene	120-12-7	2.10E+00	1.70E+04	nm	1.70E+03	n		–	no	no	no
Benzo(a)anthracene	56-55-3	6.90E+00	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Benzo(a)pyrene	50-32-8	5.90E+00	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Benzo(b)fluoranthene	205-99-2	1.30E+01	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Benzo(g,h,i)perylene	191-24-2	4.10E+01	1.70E+03	n	1.70E+02	n	Pyrene	–	no	no	no
Benzo(k)fluoranthene	207-08-9	6.50E+00	2.10E+01	c	1.50E+00	c		–	no	**YES**	**YES**
Chrysene	218-01-9	4.40E+01	2.10E+02	c	1.50E+01	c		–	no	**YES**	**YES**

Table A.5.HHRA-1
Selection of Constituents of Potential Concern for Surface Soil (0-2 foot Depth Interval)
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a] (mg/kg)	Adjusted Soil Regional Screening Level (RSL) [b] Industrial Scenario (mg/kg)		Residential Scenario (mg/kg)		Surrogate	Background Level [c] (mg/kg)	Does Maximum Exceed RSL? Industrial (YES, no)	Residential (YES, no)	Is Constituent a Surface Soil COPC? [d] (YES, no)
Dibenzo(a,h)anthracene	53-70-3	9.70E-01	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Fluoranthene	206-44-0	5.90E+01	2.20E+03	n	2.30E+02	n		–	no	no	no
Fluorene	86-73-7	1.30E+00	2.20E+03	n	2.30E+02	n		–	no	no	no
Indeno(1,2,3-cd)pyrene	193-39-5	6.10E+00	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Naphthalene	91-20-3	7.50E-01	2.00E+01	c*	3.90E+00	c*		–	no	no	no
Phenanthrene	85-01-8	1.60E+01	1.70E+04	nm	1.70E+03	n	Anthracene	–	no	no	no
Pyrene	129-00-0	4.80E+01	1.70E+03	n	1.70E+02	n		–	no	no	no
Polychlorinated Biphenyls											
Aroclor 1254	11097-69-1	1.20E+01	7.40E-01	c*	1.10E-01	n		–	**YES**	**YES**	**YES**
Aroclor 1260	11096-82-5	1.00E+00	7.40E-01	c	2.20E-01	c		–	**YES**	**YES**	**YES**
Inorganics											
Aluminum	7429-90-5	4.69E+04	9.90E+04	nm	7.70E+03	n		4.00E+04	no	**YES**	**YES**
Antimony	7440-36-0	1.69E+01	4.10E+01	n	3.10E+00	n		–	no	**YES**	**YES**
Arsenic	7440-38-2	1.64E+02	1.60E+00	c	3.90E-01	c*		1.58E+01	**YES**	**YES**	**YES**
Barium	7440-39-3	1.18E+04	1.90E+04	nm	1.50E+03	n		2.09E+02	no	**YES**	**YES**
Beryllium	7440-41-7	3.80E+00	2.00E+02	n	1.60E+01	n		1.02E+00	no	no	no
Cadmium	7440-43-9	1.52E+01	8.10E+01	n	7.00E+00	n		6.90E-01	no	**YES**	**YES**
Calcium	7440-70-2	1.97E+05	NA		NA			–	NA	NA	no
Chromium	7440-47-3	1.92E+03	1.40E+03	c	2.80E+02	c		6.53E+01	**YES**	**YES**	**YES**
Cobalt	7440-48-4	4.22E+02	3.00E+01	n	2.30E+00	n		7.23E+01	**YES**	**YES**	**YES**
Copper	7440-50-8	5.65E+04	4.10E+03	n	3.10E+02	n		5.35E+01	**YES**	**YES**	**YES**
Iron	7439-89-6	3.28E+05	7.20E+04	nm	5.50E+03	n		5.10E+04	**YES**	**YES**	**YES**
Lead	7439-92-1	1.62E+04	8.00E+02	«	4.00E+02	«		2.68E+01	**YES**	**YES**	**YES**
Magnesium	7439-95-4	8.61E+04	NA		NA			–	NA	NA	no
Manganese	7439-96-5	2.51E+03	2.30E+03	n	1.80E+02	n		2.54E+03	**YES**	**YES**	no
Mercury	7439-97-6	7.95E+01	3.10E+01	n	2.30E+00	n		1.30E-01	**YES**	**YES**	**YES**
Nickel	7440-02-0	2.13E+02	2.00E+03	n	1.60E+02	n		6.28E+01	no	**YES**	**YES**
Potassium	7440-09-7	5.57E+03	NA		NA			–	NA	NA	no
Selenium	7782-49-2	1.90E+00	5.10E+02	n	3.90E+01	n		–	no	no	no
Silver	7440-22-4	2.25E+01	5.10E+02	n	3.90E+01	n		–	no	no	no
Sodium	7440-23-5	1.35E+03	NA		NA			–	NA	NA	no
Thallium	7440-28-0	1.00E+00	6.60E+00	n	5.10E-01	n		2.11E+00	no	**YES**	no
Vanadium	7440-62-2	9.84E+01	7.20E+02	n	5.50E+01	n		1.08E+02	no	**YES**	no
Zinc	7440-66-6	2.18E+04	3.10E+04	nm	2.30E+03	n		2.02E+02	no	**YES**	**YES**

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
mg/kg = Milligrams per kilogram.
NA = Not available or not applicable.
RSL = Regional Screening Level.
USEPA = United States Environmental Protection Agency.

[a] Maximum concentration in surface soil (0-2 foot depth interval).

[b] The screening levels used were from USEPA (2008a). Screening levels based on non-cancer effects were adjusted downward by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = concentration may exceed ceiling limit; s = Concentration may exceed saturation concentration (Csat).
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.

[c] Background levels for metals are facility-wide soil background point estimates taken from Facility-Wide Background Study Report (IT Corporation, 2001).

[d] Constituents detected with maximum concentrations greater than adjusted residential screening levels were considered COPCs unless they were metals detected at concentrations lower than background, or are essential nutrients (i.e., calcium, magnesium, potassium, sodium), or they were known laboratory contaminants (i.e. acetone).

Table A.5.HHRA-2
Selection of Constituents of Potential Concern for Combined Surface and Subsurface Soil
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a] (mg/kg)	Adjusted Soil Regional Screening Level (RSL) [b] Industrial Scenario (mg/kg)		Residential Scenario (mg/kg)		Surrogate	Background Level [c] (mg/kg)	Does Maximum Exceed RSL? Industrial (YES, no)	Residential (YES, no)	Is Constituent a Surface/ Subsurface Soil COPC? [d] (YES, no)
Volatile Organic Compounds											
3-Octanone	106-68-3	1.50E-02	NA		NA			–	NA	NA	**YES**
Acetone	67-64-1	1.60E-01	6.10E+04	nms	6.10E+03	n		–	no	no	no
d-Limonene	5989-27-5	8.40E-02	NA		NA			–	NA	NA	**YES**
Methylene Chloride	75-09-2	4.00E-03	5.40E+01	c	1.10E+01	c		–	no	no	no
Toluene	108-88-3	8.30E-04	4.60E+03	ns	5.00E+02	ns		–	no	no	no
Semi-Volatile Organic Compounds											
2,4-Dinitrotoluene	121-14-2	2.10E+02	1.20E+02	n	1.20E+01	n		–	**YES**	**YES**	**YES**
Benzoic Acid	65-85-0	3.00E-01	2.50E+05	nm	2.40E+04	nm		–	no	no	no
bis(2-Ethylhexyl)phthalate	117-81-7	7.50E+02	1.20E+02	c*	3.50E+01	c*		–	**YES**	**YES**	**YES**
Butylbenzylphthalate	85-68-7	1.30E-01	9.10E+02	c	2.60E+02	c*		–	no	no	no
Carbazole	86-74-8	2.40E+00	NA		NA			–	NA	NA	**YES**
Dibenzofuran	132-64-9	7.40E-01	1.00E+02	n	7.80E+00	n	Furan	–	no	no	no
Diethylphthalate	84-66-2	2.50E+02	4.90E+04	nm	4.90E+03	n		–	no	no	no
Di-n-Butylphthalate	84-74-2	3.10E-01	6.20E+03	n	6.10E+02	n		–	no	no	no
Di-n-Octylphthalate	117-84-0	4.00E-02	6.20E+03	n	6.10E+02	n	di-n-Butylphthalate	–	no	no	no
Explosives											
1,3,5-Trinitrobenzene	99-35-4	7.00E-02	2.70E+03	n	2.20E+02	n		–	no	no	no
4-Amino-2,6-Dinitrotoluene	19406-51-0	5.00E-02	1.90E+02	n	1.50E+01	n		–	no	no	no
Nitroglycerine	55-63-0	5.70E-01	6.20E+00	n	6.10E-01	n		–	no	no	no
Pesticides											
4,4'-DDD	72-54-8	2.48E-03	7.20E+00	c	2.00E+00	c		–	no	no	no
4,4'-DDE	72-55-9	3.01E-03	5.10E+00	c	1.40E+00	c		–	no	no	no
4,4'-DDT	50-29-3	6.70E-03	7.00E+00	c*	1.70E+00	c*		–	no	no	no
Beta-BHC	319-85-7	1.70E-04	9.60E-01	c	2.70E-01	c		–	no	no	no
Delta-BHC	319-86-8	1.04E-03	2.10E+00	c	5.20E-01	c*	gamma-BHC	–	no	no	no
Alpha-Chlordane	5103-71-9	3.01E-03	6.50E+00	c*	1.60E+00	c*	Chlordane	–	no	no	no
Gamma-Chlordane	5566-34-7	4.08E-03	6.50E+00	c*	1.60E+00	c*	Chlordane	–	no	no	no
Dieldrin	60-57-1	9.09E-03	1.10E-01	c	3.00E-02	c		–	no	no	no
Endosulfan II	33213-65-9	3.78E-03	3.70E+02	n	3.70E+01	n	Endosulfan	–	no	no	no
Endrin	72-20-8	2.00E-02	1.80E+01	n	1.80E+00	n		–	no	no	no
Endrin Ketone	53494-70-5	4.24E-03	1.80E+01	n	1.80E+00	n	Endrin	–	no	no	no
Heptachlor Epoxide	1024-57-3	1.01E-03	1.90E-01	c*	5.30E-02	c*		–	no	no	no
Methoxychlor	72-43-5	1.22E-02	3.10E+02	n	3.10E+01	n		–	no	no	no
Polycyclic Aromatic Hydrocarbons											
1-Methylnaphthalene	90-12-0	3.70E-02	9.90E+01	c	2.20E+01	c		–	no	no	no
2-Methylnaphthalene	91-57-6	3.60E-01	4.10E+02	ns	3.10E+01	n		–	no	no	no
Acenaphthene	83-32-9	1.00E+00	3.30E+03	n	3.40E+02	n		–	no	no	no
Acenaphthylene	208-96-8	3.00E-01	3.30E+03	n	3.40E+02	n	Acenaphthene	–	no	no	no
Anthracene	120-12-7	2.10E+00	1.70E+04	nm	1.70E+03	n		–	no	no	no
Benzo(a)anthracene	56-55-3	6.90E+00	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Benzo(a)pyrene	50-32-8	5.90E+00	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Benzo(b)fluoranthene	205-99-2	1.30E+01	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**
Benzo(g,h,i)perylene	191-24-2	4.10E+01	1.70E+03	n	1.70E+02	n	Pyrene	–	no	no	no
Benzo(k)fluoranthene	207-08-9	6.50E+00	2.10E+01	c	1.50E+00	c		–	no	**YES**	**YES**
Chrysene	218-01-9	4.40E+01	2.10E+02	c	1.50E+01	c		–	no	**YES**	**YES**
Dibenzo(a,h)anthracene	53-70-3	9.70E-01	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Fluoranthene	206-44-0	5.90E+01	2.20E+03	n	2.30E+02	n		–	no	no	no
Fluorene	86-73-7	1.30E+00	2.20E+03	n	2.30E+02	n		–	no	no	no
Indeno(1,2,3-cd)pyrene	193-39-5	6.10E+00	2.10E+00	c	1.50E-01	c		–	**YES**	**YES**	**YES**

Table A.5.HHRA-2
Selection of Constituents of Potential Concern for Combined Surface and Subsurface Soil
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b] Industrial Scenario		Residential Scenario		Surrogate	Background Level [c]	Does Maximum Exceed RSL? Industrial	Residential	Is Constituent a Surface/ Subsurface Soil COPC? [d]
		(mg/kg)	(mg/kg)		(mg/kg)			(mg/kg)	(YES, no)	(YES, no)	(YES, no)
Naphthalene	91-20-3	7.50E-01	2.00E+01	c*	3.90E+00	c*		–	no	no	no
Phenanthrene	85-01-8	1.60E+01	1.70E+04	nm	1.70E+03	n	Anthracene	–	no	no	no
Pyrene	129-00-0	4.80E+01	1.70E+03	n	1.70E+02	n		–	no	no	no
Polychlorinated Biphenyls											
Aroclor 1254	11097-69-1	1.20E+01	7.40E-01	c*	1.10E-01	n		–	**YES**	**YES**	**YES**
Aroclor 1260	11096-82-5	1.00E+00	7.40E-01	c	2.20E-01	c		–	**YES**	**YES**	**YES**
Inorganics											
Aluminum	7429-90-5	4.69E+04	9.90E+04	nm	7.70E+03	n		4.00E+04	no	**YES**	**YES**
Antimony	7440-36-0	1.69E+01	4.10E+01	n	3.10E+00	n		–	no	**YES**	**YES**
Arsenic	7440-38-2	1.64E+02	1.60E+00	c	3.90E-01	c*		1.58E+01	**YES**	**YES**	**YES**
Barium	7440-39-3	1.18E+04	1.90E+04	nm	1.50E+03	n		2.09E+02	no	**YES**	**YES**
Beryllium	7440-41-7	4.30E+00	2.00E+02	n	1.60E+01	n		1.02E+00	no	no	no
Cadmium	7440-43-9	1.52E+01	8.10E+01	n	7.00E+00	n		6.90E-01	no	**YES**	**YES**
Calcium	7440-70-2	1.97E+05	NA		NA			–	NA	NA	no
Chromium	7440-47-3	1.92E+03	1.40E+03	c	2.80E+02	c		6.53E+01	**YES**	**YES**	**YES**
Cobalt	7440-48-4	4.22E+02	3.00E+01	n	2.30E+00	n		7.23E+01	**YES**	**YES**	**YES**
Copper	7440-50-8	5.65E+04	4.10E+03	n	3.10E+02	n		5.35E+01	**YES**	**YES**	**YES**
Iron	7439-89-6	3.28E+05	7.20E+04	nm	5.50E+03	n		5.10E+04	**YES**	**YES**	**YES**
Lead	7439-92-1	1.62E+04	8.00E+02	«	4.00E+02	«		2.68E+01	**YES**	**YES**	**YES**
Magnesium	7439-95-4	8.61E+04	NA		NA			–	NA	NA	no
Manganese	7439-96-5	2.51E+03	2.30E+03	n	1.80E+02	n		2.54E+03	**YES**	**YES**	no
Mercury	7439-97-6	7.95E+01	3.10E+01	n	2.30E+00	n		1.30E-01	**YES**	**YES**	**YES**
Nickel	7440-02-0	2.13E+02	2.00E+03	n	1.60E+02	n		6.28E+01	no	**YES**	**YES**
Potassium	7440-09-7	5.57E+03	NA		NA			–	NA	NA	no
Selenium	7782-49-2	1.90E+00	5.10E+02	n	3.90E+01	n		–	no	no	no
Silver	7440-22-4	2.25E+01	5.10E+02	n	3.90E+01	n		–	no	no	no
Sodium	7440-23-5	1.35E+03	NA		NA			–	NA	NA	no
Thallium	7440-28-0	1.00E+00	6.60E+00	n	5.10E-01	n		2.11E+00	no	**YES**	no
Vanadium	7440-62-2	9.84E+01	7.20E+02	n	5.50E+01	n		1.08E+02	no	**YES**	no
Zinc	7440-66-6	2.18E+04	3.10E+04	nm	2.30E+03	n		2.02E+02	no	**YES**	**YES**

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
mg/kg = Milligrams per kilogram.
NA = Not available or not applicable.
RSL = Regional Screening Level.
USEPA = United States Environmental Protection Agency.

[a] Maximum concentration in combined surface and subsurface soil.
[b] The screening levels used were from USEPA (2008a). Screening levels based on non-cancer effects were adjusted downward by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = Concentration may exceed ceiling limit; s = Concentration may exceed saturation concentration (Csat).
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.
[c] Background levels for metals are facility-wide soil background point estimates taken from Facility-Wide Background Study Report (IT Corporation, 2001).
[d] Constituents detected with maximum concentrations greater than adjusted residential screening levels were considered COPCs unless they were metals detected at concentrations lower than background, or are essential nutrients (i.e., calcium, magnesium, potassium, sodium), or they were known laboratory contaminants (i.e. acetone).

Table A.5.HHRA-3
Selection of Constituents of Potential Concern for Sediment
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a] (mg/kg)	Adjusted Soil Regional Screening Level (RSL) [b] Residential Scenario (mg/kg)		Surrogate	Is Constituent a Sediment COPC? [c] (YES, no)
Inorganics						
Aluminum	7429-90-5	2.12E+04	7.70E+03	n		**YES**
Arsenic	7440-38-2	1.03E+01	3.90E-01	c*		**YES**
Barium	7440-39-3	4.89E+01	1.50E+03	n		no
Beryllium	7440-41-7	1.20E+00	1.60E+01	n		no
Cadmium	7440-43-9	4.70E-01	7.00E+00	n		no
Calcium	7440-70-2	8.65E+03	NA			no
Chromium	7440-47-3	3.27E+01	2.80E+02	c		no
Cobalt	7440-48-4	1.30E+01	2.30E+00	n		**YES**
Copper	7440-50-8	2.48E+01	3.10E+02	n		no
Iron	7439-89-6	3.23E+04	5.50E+03	n		**YES**
Lead	7439-92-1	4.44E+01	4.00E+02	«		no
Magnesium	7439-95-4	4.58E+03	NA			no
Manganese	7439-96-5	3.69E+02	1.80E+02	n		**YES**
Mercury	7439-97-6	9.30E-02	2.30E+00	n		no
Nickel	7440-02-0	1.52E+01	1.60E+02	n		no
Potassium	7440-09-7	8.80E+02	NA			no
Vanadium	7440-62-2	6.26E+01	5.50E+01	n		**YES**
Zinc	7440-66-6	1.07E+02	2.30E+03	n		no

Notes:

CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
mg/kg = Milligrams per kilogram.
NA = Not available or not applicable.
RSL = Regional Screening Level.
USEPA = United States Environmental Protection Agency.

[a] Maximum concentration in sediment.

[b] The screening levels used were risk screening levels for the residential scenario from USEPA (2008a). Screening levels based on non-cancer effects were adjusted downward by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = Concentration may exceed ceiling limit; s = Concentration may exceed saturation concentration (Csat).
Some RSL values were based on surrogates as identified next to each value.
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.

[c] Constituents detected with maximum concentrations greater than adjusted residential screening levels were considered COPCs unless they were metals detected at concentrations lower than background, or are essential nutrients (i.e., calcium, magnesium, potassium, sodium), or they were known laboratory contaminants (i.e. acetone).

Table A.5.HHRA-4
Exposure Point Concentrations
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a]			Exposure Point Concentrations [b]		
		Surface Soil	Combined Surface and Subsurface Soil	Sediment	Surface Soil (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Sediment (mg/kg)
Volatile Organic Compounds							
1,2,3-Trichloropropane	96-18-4	no	no	no	–	–	–
1,2,4-Trimethylbenzene	95-63-6	no	no	no	–	–	–
2-Butanone	78-93-3	no	no	no	–	–	–
3-Octanone	106-68-3	**YES**	**YES**	no	1.50E-02 m	1.50E-02 m	–
4-Methyl-2-pentanone	108-10-1	no	no	no	–	–	–
Acetone	67-64-1	no	no	no	–	–	–
Bromodichloromethane	75-27-4	no	no	no	–	–	–
Carbon Disulfide	75-15-0	no	no	no	–	–	–
Chloroform	67-66-3	no	no	no	–	–	–
cis-1,2-Dichloroethene	156-59-2	no	no	no	–	–	–
d-Limonene	5989-27-5	**YES**	**YES**	no	8.40E-02 m	8.40E-02 m	–
Ethanol	64-17-5	no	no	no	–	–	–
m,p-Xylene	136777612	no	no	no	–	–	–
Methylene Chloride	75-09-2	no	no	no	–	–	–
p-Isopropyltoluene	99-87-6	no	no	no	–	–	–
Tetrachloroethene	127-18-4	no	no	no	–	–	–
Toluene	108-88-3	no	no	no	–	–	–
Trichloroethene	79-01-6	no	no	no	–	–	–
Xylenes (total)	1330-20-7	no	no	no	–	–	–
Semi-Volatile Organic Compounds							
1,2,4-Trichlorobenzene	120-82-1	no	no	no	–	–	–
1,2-Dichlorobenzene	95-50-1	no	no	no	–	–	–
1,3-Dichlorobenzene	541-73-1	no	no	no	–	–	–
1,4-Dichlorobenzene	106-46-7	no	no	no	–	–	–
2,4-Dinitrotoluene	121-14-2	**YES**	**YES**	no	2.10E+02 m	2.10E+02 m	–
2,6-Dinitrotoluene	606-20-2	no	no	no	–	–	–
3,3'-Dichlorobenzidine	91-94-1	no	no	no	–	–	–
4-Methylphenol	106-44-5	no	no	no	–	–	–
Benzoic Acid	65-85-0	no	no	no	–	–	–
bis(2-Ethylhexyl)phthalate	117-81-7	**YES**	**YES**	no	2.84E+02	2.44E+02	–
Butylbenzylphthalate	85-68-7	no	no	no	–	–	–
Carbazole	86-74-8	**YES**	**YES**	no	4.02E-01	3.36E-01	–
Dibenzofuran	132-64-9	no	no	no	–	–	–
Diethylphthalate	84-66-2	no	no	no	–	–	–
Di-n-Butylphthalate	84-74-2	no	no	no	–	–	–
Di-n-Octylphthalate	117-84-0	no	no	no	–	–	–
N-Nitrosodiphenylamine	86-30-6	no	no	no	–	–	–
Pentachlorophenol	87-86-5	no	no	no	–	–	–
Phenol	108-95-2	no	no	no	–	–	–
Dioxin/Furan Compounds							
1,2,3,4,6,7,8-HpCDD	35822-46-9	no	no	no	–	–	–

Table A.5.HHRA-4
Exposure Point Concentrations
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a]			Exposure Point Concentrations [b]		
		Surface Soil	Combined Surface and Subsurface Soil	Sediment	Surface Soil (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Sediment (mg/kg)
1,2,3,4,6,7,8-HpCDF	67562-39-4	no	no	no	–	–	–
1,2,3,4,7,8,9-HpCDF	55673-89-7	no	no	no	–	–	–
1,2,3,4,7,8-HxCDD	39227-28-6	no	no	no	–	–	–
1,2,3,4,7,8-HxCDF	70648-26-9	no	no	no	–	–	–
1,2,3,6,7,8-HxCDD	57653-85-7	no	no	no	–	–	–
1,2,3,6,7,8-HxCDF	57117-44-9	no	no	no	–	–	–
1,2,3,7,8,9-HxCDD	19408-74-3	no	no	no	–	–	–
1,2,3,7,8,9-HxCDF	72918-21-9	no	no	no	–	–	–
1,2,3,7,8-PeCDD	40321-76-4	no	no	no	–	–	–
1,2,3,7,8-PeCDF	57117-41-6	no	no	no	–	–	–
2,3,4,6,7,8-HxCDF	60851-34-5	no	no	no	–	–	–
2,3,4,7,8-PeCDF	57117-31-4	no	no	no	–	–	–
2,3,7,8-TCDD	1746-01-6	no	no	no	–	–	–
2,3,7,8-TCDF	51207-31-9	no	no	no	–	–	–
OCDD	3268-87-9	no	no	no	–	–	–
OCDF	39001-02-0	no	no	no	–	–	–
Explosives							
1,3,5-Trinitrobenzene	99-35-4	no	no	no	–	–	–
1,3-Dinitrobenzene	99-65-0	no	no	no	–	–	–
2,4,6-Trinitrotoluene	118-96-7	no	no	no	–	–	–
4-Amino-2,6-Dinitrotoluene	19406-51-0	no	no	no	–	–	–
m-Nitrotoluene	99-08-1	no	no	no	–	–	–
Nitrobenzene	98-95-3	no	no	no	–	–	–
Nitroglycerine	55-63-0	no	no	no	–	–	–
Pentaerythritol Tetranitrate	78-11-5	no	no	no	–	–	–
Perchlorate	14797-73-0	no	no	no	–	–	–
Herbicides							
2,4,5-T	93-76-5	no	no	no	–	–	–
2,4,5-TP	93-72-1	no	no	no	–	–	–
2,4-D	94-75-7	no	no	no	–	–	–
2,4-DB	94-82-6	no	no	no	–	–	–
Dalapon	75-99-0	no	no	no	–	–	–
Dicamba	1918-00-9	no	no	no	–	–	–
Dichlorprop	120-36-5	no	no	no	–	–	–
MCPA	94-74-6	no	no	no	–	–	–
MCPP	93-65-2	no	no	no	–	–	–
Pesticides							
4,4'-DDD	72-54-8	no	no	no	–	–	–
4,4'-DDE	72-55-9	no	no	no	–	–	–
4,4'-DDT	50-29-3	no	no	no	–	–	–
Alpha-BHC	319-84-6	no	no	no	–	–	–
Beta-BHC	319-85-7	no	no	no	–	–	–

Table A.5.HHRA-4
Exposure Point Concentrations
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a]			Exposure Point Concentrations [b]		
		Surface Soil	Combined Surface and Subsurface Soil	Sediment	Surface Soil (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Sediment (mg/kg)
Delta-BHC	319-86-8	no	no	no	–	–	–
Gamma-BHC (Lindane)	58-89-9	no	no	no	–	–	–
Alpha-Chlordane	5103-71-9	no	no	no	–	–	–
Gamma-Chlordane	5566-34-7	no	no	no	–	–	–
Dieldrin	60-57-1	no	no	no	–	–	–
Endosulfan I	115-29-7	no	no	no	–	–	–
Endosulfan II	33213-65-9	no	no	no	–	–	–
Endosulfan Sulfate	1031-07-8	no	no	no	–	–	–
Endrin	72-20-8	no	no	no	–	–	–
Endrin Aldehyde	7421-93-4	no	no	no	–	–	–
Endrin Ketone	53494-70-5	no	no	no	–	–	–
Heptachlor	76-44-8	no	no	no	–	–	–
Heptachlor Epoxide	1024-57-3	no	no	no	–	–	–
Methoxychlor	72-43-5	no	no	no	–	–	–
Polycyclic Aromatic Hydrocarbons							
1-Methylnaphthalene	90-12-0	no	no	no	–	–	–
2-Methylnaphthalene	91-57-6	no	no	no	–	–	–
Acenaphthene	83-32-9	no	no	no	–	–	–
Acenaphthylene	208-96-8	no	no	no	–	–	–
Anthracene	120-12-7	no	no	no	–	–	–
Benzo(a)anthracene	56-55-3	**YES**	**YES**	no	2.94E+00	2.17E+00	–
Benzo(a)pyrene	50-32-8	**YES**	**YES**	no	3.00E+00	2.22E+00	–
Benzo(b)fluoranthene	205-99-2	**YES**	**YES**	no	6.47E+00	4.78E+00	–
Benzo(g,h,i)perylene	191-24-2	no	no	no	–	–	–
Benzo(k)fluoranthene	207-08-9	**YES**	**YES**	no	2.65E+00	1.96E+00	–
Chrysene	218-01-9	**YES**	**YES**	no	1.60E+01	1.20E+01	–
Dibenzo(a,h)anthracene	53-70-3	**YES**	**YES**	no	1.62E-01	1.17E-01	–
Fluoranthene	206-44-0	no	no	no	–	–	–
Fluorene	86-73-7	no	no	no	–	–	–
Indeno(1,2,3-cd)pyrene	193-39-5	**YES**	**YES**	no	3.04E+00	2.20E+00	–
Naphthalene	91-20-3	no	no	no	–	–	–
Phenanthrene	85-01-8	no	no	no	–	–	–
Pyrene	129-00-0	no	no	no	–	–	–
Polychlorinated Biphenyls							
Aroclor 1254	11097-69-1	**YES**	**YES**	no	4.63E+00	3.70E+00	–
Aroclor 1260	11096-82-5	**YES**	**YES**	no	1.00E+00 m	1.00E+00 m	–
Inorganics							
Aluminum	7429-90-5	**YES**	**YES**	**YES**	1.97E+04	2.05E+04	2.12E+04 m
Antimony	7440-36-0	**YES**	**YES**	no	1.20E+00	1.07E+00	–
Arsenic	7440-38-2	**YES**	**YES**	**YES**	2.15E+01	1.94E+01	1.03E+01 m
Barium	7440-39-3	**YES**	**YES**	no	1.48E+03	1.26E+03	–
Beryllium	7440-41-7	no	no	no	–	–	–

Table A.5.HHRA-4
Exposure Point Concentrations
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a]			Exposure Point Concentrations [b]		
		Surface Soil	Combined Surface and Subsurface Soil	Sediment	Surface Soil (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Sediment (mg/kg)
Cadmium	7440-43-9	**YES**	**YES**	no	2.12E+00	1.81E+00	–
Calcium	7440-70-2	no	no	no	–	–	–
Chromium	7440-47-3	**YES**	**YES**	no	1.86E+02	1.64E+02	–
Cobalt	7440-48-4	**YES**	**YES**	**YES**	3.40E+01	3.08E+01	1.30E+01 m
Copper	7440-50-8	**YES**	**YES**	no	1.13E+04	9.52E+03	–
Iron	7439-89-6	**YES**	**YES**	**YES**	4.04E+04	4.03E+04	3.23E+04 m
Lead	7439-92-1	**YES**	**YES**	no	7.57E+02 avg	6.42E+02 avg	–
Magnesium	7439-95-4	no	no	no	–	–	–
Manganese	7439-96-5	no	no	**YES**	–	–	3.69E+02 m
Mercury	7439-97-6	**YES**	**YES**	no	4.90E+00	4.14E+00	–
Nickel	7440-02-0	**YES**	**YES**	no	2.82E+01	2.62E+01	–
Potassium	7440-09-7	no	no	no	–	–	–
Selenium	7782-49-2	no	no	no	–	–	–
Silver	7440-22-4	no	no	no	–	–	–
Sodium	7440-23-5	no	no	no	–	–	–
Thallium	7440-28-0	no	no	no	–	–	–
Vanadium	7440-62-2	no	no	**YES**	–	–	6.26E+01 m
Zinc	7440-66-6	**YES**	**YES**	no	2.55E+03	2.17E+03	–

Notes:
– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilogram.
mg/L = Milligrams per liter.

[a] Constituent of Potential Concern.
[b] The exposure point concentration (EPC) was the upper confidence level on the mean (UCL) or the maximum concentration where the UCL was incalculable.
EPCs marked with "m" are based on the maximum detected concentration.
Exposure to lead is evaluated by predicting resultant blood lead levels using the arithmetic average (avg).
The UCLs were calculated using ProUCL 4.0. The UCL used is the one recommended by ProUCL 4.0.

Table A.5.HHRA-5
Risk and Hazard Calculations for Site Worker Exposure to Surface Soil (0-2 foot Depth Interval)
IGNITER ASSEMBLY AREA
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Current / Future
Receptor Population: Site Worker
Receptor Age: Adult

Constituent	EPCs (mg/kg)	VF *or* PEF [a] (m^3/kg)		CANCER RISK Route-Specific Risk Oral	Dermal	Inhalation	Calculated Risk	Percent Total ELCR	NON-CANCER HAZARD Route-Specific Hazard Oral	Dermal	Inhalation	Calculated Hazard	Percent Total HI
				ELCRo	ELCRd	ELCRi	ELCR		HQo	HQd	HQi	HI	
Volatile Organic Compounds													
3-Octanone	1.50E-02	3.87E+03	V	NA	NA	NA	NA	–	NA	NA	NA	NA	–
d-Limonene	8.40E-02	4.05E+03	V	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Semi-Volatile Organic Compounds													
2,4-Dinitrotoluene	2.10E+02	1.36E+09	P	5.0E-05	3.3E-05	NA	8.3E-05	65%	1.0E-01	6.8E-02	NA	1.7E-01	13%
Bis(2-ethylhexyl)phthalate	2.84E+02	1.36E+09	P	1.4E-06	9.2E-07	NA	2.3E-06	2%	1.4E-02	9.2E-03	NA	2.3E-02	2%
Carbazole	4.02E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Polycyclic Aromatic Hydrocarbons													
Benzo(a)anthracene	2.94E+00	1.36E+09	P	7.5E-07	6.4E-07	NA	1.4E-06	1%	NA	NA	NA	NA	–
Benzo(a)pyrene	3.00E+00	1.36E+09	P	7.6E-06	6.6E-06	4.8E-10	1.4E-05	11%	NA	NA	NA	NA	–
Benzo(b)fluoranthene	6.47E+00	1.36E+09	P	1.7E-06	1.4E-06	NA	3.1E-06	2%	NA	NA	NA	NA	–
Benzo(k)fluoranthene	2.65E+00	1.36E+09	P	6.8E-08	5.8E-08	NA	1.3E-07	0%	NA	NA	NA	NA	–
Chrysene	1.60E+01	1.36E+09	P	4.1E-08	3.5E-08	NA	7.6E-08	0%	NA	NA	NA	NA	–
Dibenzo(a,h)anthracene	1.62E-01	1.36E+09	P	4.1E-07	3.5E-07	NA	7.7E-07	1%	NA	NA	NA	NA	–
Indeno(1,2,3-cd)pyrene	3.04E+00	1.36E+09	P	7.7E-07	6.6E-07	NA	1.4E-06	1%	NA	NA	NA	NA	–
Polychlorinated Biphenyls													
Aroclor 1254	4.63E+00	1.36E+09	P	3.2E-06	3.0E-06	4.7E-10	6.2E-06	5%	2.3E-01	2.1E-01	NA	4.4E-01	34%
Aroclor 1260	1.00E+00	1.36E+09	P	7.0E-07	6.5E-07	1.0E-10	1.3E-06	1%	NA	NA	NA	NA	–
Inorganics													
Aluminum	1.97E+04	1.36E+09	P	NA	NA	NA	NA	–	1.9E-02	0.0E+00	2.0E-03	2.1E-02	2%
Antimony	1.20E+00	1.36E+09	P	NA	NA	NA	NA	–	2.9E-03	0.0E+00	NA	2.9E-03	0%
Arsenic	2.15E+01	1.36E+09	P	1.1E-05	2.2E-06	1.7E-08	1.3E-05	11%	7.0E-02	1.4E-02	NA	8.4E-02	7%
Barium	1.48E+03	1.36E+09	P	NA	NA	NA	NA	–	7.2E-03	0.0E+00	1.5E-03	8.7E-03	1%
Cadmium	2.12E+00	1.36E+09	P	NA	NA	6.9E-10	6.9E-10	0%	2.1E-03	5.5E-04	NA	2.6E-03	0%
Chromium	1.86E+02	1.36E+09	P	NA	NA	4.0E-07	4.0E-07	0%	6.1E-02	0.0E+00	2.7E-04	6.1E-02	5%
Cobalt	3.40E+01	1.36E+09	P	NA	NA	5.5E-08	5.5E-08	0%	1.1E-01	0.0E+00	2.8E-03	1.1E-01	9%
Copper	1.13E+04	1.36E+09	P	NA	NA	NA	NA	–	2.8E-01	0.0E+00	NA	2.8E-01	21%
Iron	4.04E+04	1.36E+09	P	NA	NA	NA	NA	–	5.7E-02	0.0E+00	NA	5.7E-02	4%
Lead	7.57E+02	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Mercury	4.90E+00	1.36E+09	P	NA	NA	NA	NA	–	1.6E-02	0.0E+00	8.2E-06	1.6E-02	1%
Nickel	2.82E+01	1.36E+09	P	NA	NA	NA	NA	–	1.4E-03	0.0E+00	NA	1.4E-03	0%
Zinc	2.55E+03	1.36E+09	P	NA	NA	NA	NA	–	8.3E-03	0.0E+00	NA	8.3E-03	1%
				Total ELCR			1E-04	100%	Total HI			1	100%

Table A.5.HHRA-5
Risk and Hazard Calculations for Site Worker Exposure to Surface Soil (0-2 foot Depth Interval)
IGNITER ASSEMBLY AREA
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Current / Future
Receptor Population: Site Worker
Receptor Age: Adult

** HI Segregated by Target Site/Critical Effect:	HI (liver, kidney) =	0.09	HI (gastrointestinal tract) =	0.3
CNS - Central nervous system	HI (CNS, whole body, immune system) =	0.6	HI (nasal, lung) =	0.06
NA - Not available	HI (blood) =	0.2	HI (eyes, nails, hair, skin) =	0.6
NR - None reported	HI (fetus, developmental) =	0.02	HI (NA, NR) =	0

[a] Minimum of the volatilization factor (identified with "V") and the particulate emission factor (PEF) (identified with "P"), both derived on Table A.2-11.

–	Not applicable.	HQ	Hazard quotient.	PEF	Particulate emission factor.
ELCR	Excess lifetime cancer risk.	m^3/kg	Cubic meters per kilogram.	VF	Volatilization factor.
EPCs	Exposure point concentration in surface soil (mg/kg).	mg/kg	Milligrams per kilogram.		
HI	Hazard index (sum of the HQs).	NA	Not available.		

Equations: (see Table A.2-11)

ELCRo = (EPCs × 1 × 100 × 250 × 25 × CSFo) / (1,000,000 × 70 × 25,550)
ELCRd = (EPCs × 3,300 × 0.2 × ABSd × 250 × 25 × CSFa) / (1,000,000 × 70 × 25,550)
ELCRi = (EPCs × 20 × 250 × 25 × CSFi) / ([VF or PEF] × 70 × 25,550)

HQo = (EPCs × 1 × 100 × 250 × 25) / (1,000,000 × 70 × 9,125 × RfDo)
HQd = (EPCs × 3,300 × 0.2 × ABSd × 250 × 25) / (1,000,000 × 70 × 9,125 × RfDa)
HQi = (EPCs × 20 × 250 × 25) / ([VF or PEF] × 70 × 9,125 × RfDi)

Table A.5.HHRA-6
Risk and Hazard Calculations for Site Worker Wading Exposure to Sediment
IGNITER ASSEMBLY AREA
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Current / Future
Receptor Population: Site Worker
Receptor Age: Adult

		CANCER RISK			Percent	NON-CANCER RISK			Percent
	EPCsed	Route-Specific Risks		Calculated	Total	Route-Specific Risks		Calculated	Total
Constituent	(mg/kg)	Oral	Dermal	Risk	ELCR	Oral	Dermal	Hazard	HI
		ELCRo	ELCRd	ELCR		HQo	HQd	HI	
Inorganics									
Aluminum	2.12E+04	NA	NA	NA	–	1.1E-03	0.0E+00	1.1E-03	10%
Arsenic	1.03E+01	2.8E-07	5.1E-07	7.9E-07	100%	1.7E-03	3.1E-03	4.9E-03	44%
Cobalt	1.30E+01	NA	NA	NA	–	2.2E-03	0.0E+00	2.2E-03	20%
Iron	3.23E+04	NA	NA	NA	–	2.3E-03	0.0E+00	2.3E-03	21%
Lead	–	–	–	–	–	–	–	–	–
Manganese	3.69E+02	NA	NA	NA	–	1.3E-04	0.0E+00	1.3E-04	1%
Vanadium	6.26E+01	NA	NA	NA	–	4.6E-04	0.0E+00	4.6E-04	4%
		Total ELCR		8E-07	100%	Total HI		0.01	100%

– Not applicable.
ELCR Excess lifetime cancer risk.
EPCsed Exposure point concentration in sediment (mg/kg).
HI Hazard index (sum of the HQs).
HQ Hazard quotient.
mg/kg Milligrams per kilogram.
NA Not available.

Equations: (see Table A.2-12)

ELCRo = (EPCsed × 50 × 26 × 25 × CSFo) / (1,000,000 × 70 × 25,550)
ELCRd = (EPCsed × 5,000 × 1 × ABSd × 26 × 25 × CSFa) / (1,000,000 × 70 × 25,550)

HQo = (EPCsed × 50 × 26 × 25) / (1,000,000 × 70 × 9,125 × RfDo)
HQd = (EPCsed × 5,000 × 1 × ABSd × 26 × 25) / (1,000,000 × 70 × 9,125 × RfDa)

Table A.5.HHRA-7
Risk and Hazard Calculations for Hypothetical Future Construction Worker Exposure to Combined Surface and Subsurface Soil
IGNITER ASSEMBLY AREA
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Constituent	EPCs (mg/kg)	VF *or* PEF [a] (m^3/kg)		CANCER RISK Route-Specific Risk Oral ELCRo	Dermal ELCRd	Inhalation ELCRi	Calculated Risk ELCR	Percent Total ELCR	NON-CANCER HAZARD Route-Specific Hazard Oral HQo	Dermal HQd	Inhalation HQi	Calculated Hazard HI	Percent Total HI
Volatile Organic Compounds													
3-Octanone	1.50E-02	3.87E+03	V	NA	NA	NA	NA	–	NA	NA	NA	NA	–
d-Limonene	8.40E-02	4.05E+03	V	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Semi-Volatile Organic Compounds													
2,4-Dinitrotoluene	2.10E+02	1.36E+09	P	3.4E-06	1.0E-06	NA	4.5E-06	69%	3.5E-01	1.1E-01	NA	4.6E-01	18%
Bis(2-ethylhexyl)phthalate	2.44E+02	1.36E+09	P	8.2E-08	2.5E-08	NA	1.1E-07	2%	4.1E-02	1.2E-02	NA	5.3E-02	2%
Carbazole	3.36E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Polycyclic Aromatic Hydrocarbons													
Benzo(a)anthracene	2.17E+00	1.36E+09	P	3.8E-08	1.5E-08	NA	5.3E-08	1%	NA	NA	NA	NA	–
Benzo(a)pyrene	2.22E+00	1.36E+09	P	3.9E-07	1.5E-07	7.3E-12	5.4E-07	8%	NA	NA	NA	NA	–
Benzo(b)fluoranthene	4.78E+00	1.36E+09	P	8.4E-08	3.3E-08	NA	1.2E-07	2%	NA	NA	NA	NA	–
Benzo(k)fluoranthene	1.96E+00	1.36E+09	P	3.4E-09	1.3E-09	NA	4.8E-09	0%	NA	NA	NA	NA	–
Chrysene	1.20E+01	1.36E+09	P	2.1E-09	8.2E-10	NA	2.9E-09	0%	NA	NA	NA	NA	–
Dibenzo(a,h)anthracene	1.17E-01	1.36E+09	P	2.0E-08	8.0E-09	NA	2.8E-08	0%	NA	NA	NA	NA	–
Indeno(1,2,3-cd)pyrene	2.20E+00	1.36E+09	P	3.9E-08	1.5E-08	NA	5.4E-08	1%	NA	NA	NA	NA	–
Polychlorinated Biphenyls													
Aroclor 1254	3.70E+00	1.36E+09	P	1.8E-07	7.4E-08	7.9E-12	2.5E-07	4%	2.5E-01	1.0E-01	NA	3.5E-01	14%
Aroclor 1260	1.00E+00	1.36E+09	P	4.8E-08	2.0E-08	2.1E-12	6.8E-08	1%	NA	NA	NA	NA	–
Inorganics													
Aluminum	2.05E+04	1.36E+09	P	NA	NA	NA	NA	–	6.9E-02	0.0E+00	2.2E-03	7.1E-02	3%
Antimony	1.07E+00	1.36E+09	P	NA	NA	NA	NA	–	9.0E-03	0.0E+00	NA	9.0E-03	0%
Arsenic	1.94E+01	1.36E+09	P	7.0E-07	6.3E-08	3.1E-10	7.6E-07	12%	2.2E-01	2.0E-02	NA	2.4E-01	9%
Barium	1.26E+03	1.36E+09	P	NA	NA	NA	NA	–	2.1E-02	0.0E+00	1.3E-04	2.1E-02	1%
Cadmium	1.81E+00	1.36E+09	P	NA	NA	1.2E-11	1.2E-11	0%	6.1E-03	7.3E-04	4.8E-06	6.8E-03	0%
Chromium	1.64E+02	1.36E+09	P	NA	NA	7.3E-09	7.3E-09	0%	2.8E-02	0.0E+00	8.2E-04	2.8E-02	1%
Cobalt	3.08E+01	1.36E+09	P	NA	NA	1.0E-09	1.0E-09	0%	3.5E-01	0.0E+00	8.1E-04	3.5E-01	13%
Copper	9.52E+03	1.36E+09	P	NA	NA	NA	NA	–	8.0E-01	0.0E+00	NA	8.0E-01	31%
Iron	4.03E+04	1.36E+09	P	NA	NA	NA	NA	–	1.9E-01	0.0E+00	NA	1.9E-01	7%
Lead	6.42E+02	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Mercury	4.14E+00	1.36E+09	P	NA	NA	NA	NA	–	4.6E-03	0.0E+00	7.2E-06	4.7E-03	0%
Nickel	2.62E+01	1.36E+09	P	NA	NA	NA	NA	–	4.4E-03	0.0E+00	NA	4.4E-03	0%
Zinc	2.17E+03	1.36E+09	P	NA	NA	NA	NA	–	2.4E-02	0.0E+00	NA	2.4E-02	1%
				Total ELCR			6E-06	100%	Total HI **			3	100%

** HI Segregated by Target Site/Critical Effect:
CNS - Central nervous system
NA - Not available
NR - None reported

HI (liver, kidney) =	0.3	HI (gastrointestinal tract) =	1
HI (CNS, whole body, immune system) =	0.8	HI (nasal, lung) =	0.03
HI (blood) =	0.7	HI (eyes, nails, hair, skin) =	0.9
HI (fetus, developmental) =	0.07	HI (NA, NR) =	0

Table A.5.HHRA-7
Risk and Hazard Calculations for Hypothetical Future Construction Worker Exposure to Combined Surface and Subsurface Soil
IGNITER ASSEMBLY AREA
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

[a] Minimum of the volatilization factor (identified with "V") and the particulate emission factor (PEF) (identified with "P"), both derived on Table A.2-11.

–	Not applicable.	HQ	Hazard quotient.	PEF	Particulate emission factor.
ELCR	Excess lifetime cancer risk.	m^3/kg	Cubic meters per kilogram.	VF	Volatilization factor.
EPCs	Exposure point concentration in soil (mg/kg).	mg/kg	Milligrams per kilogram.		
HI	Hazard index (sum of the HQs).	NA	Not available.		

Equations: (see Table A.2-11)

ELCRo = (EPCs × 1 × 330 × 130 × 1 × CSFo) / (1,000,000 × 70 × 25,550)
ELCRd = (EPCs × 3,300 × 0.3 × ABSd × 130 × 1 × CSFa) / (1,000,000 × 70 × 25,550)
ELCRi = (EPCs × 20 × 130 × 1 × CSFi) / ([VF or PEF] × 70 × 25,550)

HQo = (EPCs × 1 × 330 × 130 × 1) / (1,000,000 × 70 × 182 × RfDo)
HQd = (EPCs × 3,300 × 0.3 × ABSd × 130 × 1) / (1,000,000 × 70 × 182 × RfDa)
HQi = (EPCs × 20 × 130 × 1) / ([VF or PEF] × 70 × 182 × RfDi)

Table A.5.HHRA-8
Risk and Hazard Calculations for Hypothetical Future Adult Resident Exposure to Combined Surface and Subsurface Soil
IGNITER ASSEMBLY AREA
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Adult Resident
Receptor Age: Adult

Constituent	EPCs (mg/kg)	VF *or* PEF [a] (m^3/kg)		CANCER RISK: Route-Specific Risk: Oral ELCRo	Dermal ELCRd	Inhalation ELCRi	Calculated Risk ELCR	Percent Total ELCR	NON-CANCER HAZARD: Route-Specific Hazard: Oral HQo	Dermal HQd	Inhalation HQi	Calculated Hazard HI	Percent Total HI
Volatile Organic Compounds													
3-Octanone	1.50E-02	3.87E+03	V	NA	NA	NA	NA	–	NA	NA	NA	NA	–
d-Limonene	8.40E-02	4.05E+03	V	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Semi-Volatile Organic Compounds													
2,4-Dinitrotoluene	2.10E+02	1.36E+09	P	6.7E-05	2.7E-05	NA	9.4E-05	65%	1.4E-01	5.7E-02	NA	2.0E-01	14%
Bis(2-ethylhexyl)phthalate	2.44E+02	1.36E+09	P	1.6E-06	6.4E-07	NA	2.2E-06	2%	1.7E-02	6.7E-03	NA	2.3E-02	2%
Carbazole	3.36E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Polycyclic Aromatic Hydrocarbons													
Benzo(a)anthracene	2.17E+00	1.36E+09	P	1.1E-06	5.6E-07	NA	1.7E-06	1%	NA	NA	NA	NA	–
Benzo(a)pyrene	2.22E+00	1.36E+09	P	1.1E-05	5.8E-06	6.9E-10	1.7E-05	12%	NA	NA	NA	NA	–
Benzo(b)fluoranthene	4.78E+00	1.36E+09	P	2.4E-06	1.2E-06	NA	3.6E-06	3%	NA	NA	NA	NA	–
Benzo(k)fluoranthene	1.96E+00	1.36E+09	P	9.8E-08	5.1E-08	NA	1.5E-07	0%	NA	NA	NA	NA	–
Chrysene	1.20E+01	1.36E+09	P	6.0E-08	3.1E-08	NA	9.1E-08	0%	NA	NA	NA	NA	–
Dibenzo(a,h)anthracene	1.17E-01	1.36E+09	P	5.9E-07	3.0E-07	NA	8.9E-07	1%	NA	NA	NA	NA	–
Indeno(1,2,3-cd)pyrene	2.20E+00	1.36E+09	P	1.1E-06	5.7E-07	NA	1.7E-06	1%	NA	NA	NA	NA	–
Polychlorinated Biphenyls													
Aroclor 1254	3.70E+00	1.36E+09	P	3.5E-06	1.9E-06	5.1E-10	5.4E-06	4%	2.5E-01	1.4E-01	NA	3.9E-01	28%
Aroclor 1260	1.00E+00	1.36E+09	P	9.4E-07	5.2E-07	1.4E-10	1.5E-06	1%	NA	NA	NA	NA	–
Inorganics													
Aluminum	2.05E+04	1.36E+09	P	NA	NA	NA	NA	–	2.8E-02	0.0E+00	2.9E-03	3.1E-02	2%
Antimony	1.07E+00	1.36E+09	P	NA	NA	NA	NA	–	3.7E-03	0.0E+00	NA	3.7E-03	0%
Arsenic	1.94E+01	1.36E+09	P	1.4E-05	1.6E-06	2.0E-08	1.5E-05	11%	8.8E-02	1.1E-02	NA	9.9E-02	7%
Barium	1.26E+03	1.36E+09	P	NA	NA	NA	NA	–	8.6E-03	0.0E+00	1.8E-03	1.0E-02	1%
Cadmium	1.81E+00	1.36E+09	P	NA	NA	7.9E-10	7.9E-10	0%	2.5E-03	4.0E-04	NA	2.9E-03	0%
Chromium	1.64E+02	1.36E+09	P	NA	NA	4.7E-07	4.7E-07	0%	7.5E-02	0.0E+00	3.3E-04	7.5E-02	5%
Cobalt	3.08E+01	1.36E+09	P	NA	NA	6.7E-08	6.7E-08	0%	1.4E-01	0.0E+00	3.6E-03	1.4E-01	10%
Copper	9.52E+03	1.36E+09	P	NA	NA	NA	NA	–	3.3E-01	0.0E+00	NA	3.3E-01	23%
Iron	4.03E+04	1.36E+09	P	NA	NA	NA	NA	–	7.9E-02	0.0E+00	NA	7.9E-02	6%
Lead	6.42E+02	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Mercury	4.14E+00	1.36E+09	P	NA	NA	NA	NA	–	1.9E-02	0.0E+00	9.7E-06	1.9E-02	1%
Nickel	2.62E+01	1.36E+09	P	NA	NA	NA	NA	–	1.8E-03	0.0E+00	NA	1.8E-03	0%
Zinc	2.17E+03	1.36E+09	P	NA	NA	NA	NA	–	9.9E-03	0.0E+00	NA	9.9E-03	1%
				Total ELCR			1E-04	100%	Total HI			1	100%

** HI Segregated by Target Site/Critical Effect:
CNS - Central nervous system
NA - Not available
NR - None reported

HI (liver, kidney) =	0.1	HI (gastrointestinal tract) =	0.4
HI (CNS, whole body, immune system) =	0.6	HI (nasal, lung) =	0.08
HI (blood) =	0.3	HI (eyes, nails, hair, skin) =	0.6
HI (fetus, developmental) =	0.03	HI (NA, NR) =	0

Table A.5.HHRA-8
Risk and Hazard Calculations for Hypothetical Future Adult Resident Exposure to Combined Surface and Subsurface Soil
IGNITER ASSEMBLY AREA
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Adult Resident
Receptor Age: Adult

[a] Minimum of the volatilization factor (identified with "V") and the particulate emission factor (PEF) (identified with "P"), both derived on Table A.2-11.

–	Not applicable.	HQ	Hazard quotient.	PEF	Particulate emission factor.
ELCR	Excess lifetime cancer risk.	m^3/kg	Cubic meters per kilogram.	VF	Volatilization factor.
EPCs	Exposure point concentration in soil (mg/kg).	mg/kg	Milligrams per kilogram.		
HI	Hazard index (sum of the HQs).	NA	Not available.		

Equations: (see Table A.2-11. Potentially mutagenic carcinogens (i.e., PAHs) adjusted to incorporate ADAFs of 2.1 for 10 years (ages 6 to 16) and 1 for the remaining 14 years as an adult. Oral example: (EPC x 1 x 100 x 350 x CSF/(1,000,000 x 365 x 70)) x ((2.1 x 10/70) + (1 x 14/70)).

ELCRo = (EPCs × 1 × 100 × 350 × 24 × CSFo) / (1,000,000 × 70 × 25,550)
ELCRd = (EPCs × 5,700 × 0.07 × ABSd × 350 × 24 × CSFa) / (1,000,000 × 70 × 25,550)
ELCRi = (EPCs × 20 × 350 × 24 × CSFi) / ([VF or PEF] × 70 × 25,550)

HQo = (EPCs × 1 × 100 × 350 × 24) / (1,000,000 × 70 × 8,760 × RfDo)
HQd = (EPCs × 5,700 × 0.07 × ABSd × 350 × 24) / (1,000,000 × 70 × 8,760 × RfDa)
HQi = (EPCs × 20 × 350 × 24) / ([VF or PEF] × 70 × 8,760 × RfDi)

Table A.5.HHRA-9
Risk and Hazard Calculations for Hypothetical Future Adult Resident Wading Exposure to Sediment
IGNITER ASSEMBLY AREA
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Adult Resident
Receptor Age: Adult

Constituent	EPCsed (mg/kg)	CANCER RISK Route-Specific Risks Oral	Dermal	Calculated Risk	Percent Total ELCR	NON-CANCER RISK Route-Specific Risks Oral	Dermal	Calculated Hazard	Percent Total HI
		ELCRo	ELCRd	ELCR		HQo	HQd	HI	
Inorganics									
Aluminum	2.12E+04	NA	NA	NA	–	2.0E-03	0.0E+00	2.0E-03	10%
Arsenic	1.03E+01	5.0E-07	9.0E-07	1.4E-06	100%	3.2E-03	5.8E-03	9.0E-03	44%
Cobalt	1.30E+01	NA	NA	NA	–	4.1E-03	0.0E+00	4.1E-03	20%
Iron	3.23E+04	NA	NA	NA	–	4.3E-03	0.0E+00	4.3E-03	21%
Lead	–	–	–	–	–	–	–	–	–
Manganese	3.69E+02	NA	NA	NA	–	2.5E-04	0.0E+00	2.5E-04	1%
Vanadium	6.26E+01	NA	NA	NA	–	8.4E-04	0.0E+00	8.4E-04	4%
		Total ELCR		1E-06	100%	Total HI		0.02	100%

– Not applicable.
ELCR Excess lifetime cancer risk.
EPCsed Exposure point concentration in sediment (mg/kg).
HI Hazard index (sum of the HQs).
HQ Hazard quotient.
mg/kg Milligrams per kilogram.
NA Not available.

Equations: (see Table A.2-12)

ELCRo = (EPCsed × 50 × 48 × 24 × CSFo) / (1,000,000 × 70 × 25,550)
ELCRd = (EPCsed × 5,000 × 1 × ABSd × 48 × 24 × CSFa) / (1,000,000 × 70 × 25,550)
HQo = (EPCsed × 50 × 48 × 24) / (1,000,000 × 70 × 8,760 × RfDo)
HQd = (EPCsed × 5,000 × 1 × ABSd × 48 × 24) / (1,000,000 × 70 × 8,760 × RfDa)

Table A.5.HHRA-10
Risk and Hazard Calculations for Hypothetical Future Child Resident Exposure to Combined Surface and Subsurface Soil
IGNITER ASSEMBLY AREA
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Child Resident
Receptor Age: Child

				CANCER RISK				Percent	NON-CANCER HAZARD				Percent
		VF *or*		Route-Specific Risk			Calculated	Total	Route-Specific Hazard			Calculated	Total
Constituent	EPCs (mg/kg)	PEF [a] (m^3/kg)		Oral	Dermal	Inhalation	Risk	ELCR	Oral	Dermal	Inhalation	Hazard	HI
				ELCRo	ELCRd	ELCRi	ELCR		HQo	HQd	HQi	HI	
Volatile Organic Compounds													
3-Octanone	1.50E-02	3.87E+03	V	NA	NA	NA	NA	–	NA	NA	NA	NA	–
d-Limonene	8.40E-02	4.05E+03	V	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Semi-Volatile Organic Compounds													
2,4-Dinitrotoluene	2.10E+02	1.36E+09	P	1.6E-04	4.4E-05	NA	2.0E-04	56%	1.3E+00	3.8E-01	NA	1.7E+00	14%
Bis(2-ethylhexyl)phthalate	2.44E+02	1.36E+09	P	3.7E-06	1.0E-06	NA	4.8E-06	1%	1.6E-01	4.4E-02	NA	2.0E-01	2%
Carbazole	3.36E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Polycyclic Aromatic Hydrocarbons													
Benzo(a)anthracene	2.17E+00	1.36E+09	P	5.1E-06	1.9E-06	NA	7.0E-06	2%	NA	NA	NA	NA	–
Benzo(a)pyrene	2.22E+00	1.36E+09	P	5.2E-05	1.9E-05	8.1E-10	7.1E-05	20%	NA	NA	NA	NA	–
Benzo(b)fluoranthene	4.78E+00	1.36E+09	P	1.1E-05	4.1E-06	NA	1.5E-05	4%	NA	NA	NA	NA	–
Benzo(k)fluoranthene	1.96E+00	1.36E+09	P	4.6E-07	1.7E-07	NA	6.3E-07	0%	NA	NA	NA	NA	–
Chrysene	1.20E+01	1.36E+09	P	2.8E-07	1.0E-07	NA	3.8E-07	0%	NA	NA	NA	NA	–
Dibenzo(a,h)anthracene	1.17E-01	1.36E+09	P	2.7E-06	1.0E-06	NA	3.7E-06	1%	NA	NA	NA	NA	–
Indeno(1,2,3-cd)pyrene	2.20E+00	1.36E+09	P	5.2E-06	1.9E-06	NA	7.1E-06	2%	NA	NA	NA	NA	–
Polychlorinated Biphenyls													
Aroclor 1254	3.70E+00	1.36E+09	P	8.1E-06	3.2E-06	3.0E-10	1.1E-05	3%	2.4E+00	9.3E-01	NA	3.3E+00	26%
Aroclor 1260	1.00E+00	1.36E+09	P	2.2E-06	8.6E-07	8.0E-11	3.1E-06	1%	NA	NA	NA	NA	–
Inorganics													
Aluminum	2.05E+04	1.36E+09	P	NA	NA	NA	NA	–	2.6E-01	0.0E+00	6.7E-03	2.7E-01	2%
Antimony	1.07E+00	1.36E+09	P	NA	NA	NA	NA	–	3.4E-02	0.0E+00	NA	3.4E-02	0%
Arsenic	1.94E+01	1.36E+09	P	3.2E-05	2.7E-06	1.2E-08	3.5E-05	10%	8.3E-01	6.9E-02	NA	8.9E-01	7%
Barium	1.26E+03	1.36E+09	P	NA	NA	NA	NA	–	8.0E-02	0.0E+00	4.1E-03	8.4E-02	1%
Cadmium	1.81E+00	1.36E+09	P	NA	NA	4.6E-10	4.6E-10	0%	2.3E-02	2.6E-03	NA	2.6E-02	0%
Chromium	1.64E+02	1.36E+09	P	NA	NA	2.8E-07	2.8E-07	0%	7.0E-01	0.0E+00	7.7E-04	7.0E-01	6%
Cobalt	3.08E+01	1.36E+09	P	NA	NA	3.9E-08	3.9E-08	0%	1.3E+00	0.0E+00	8.4E-03	1.3E+00	10%
Copper	9.52E+03	1.36E+09	P	NA	NA	NA	NA	–	3.0E+00	0.0E+00	NA	3.0E+00	24%
Iron	4.03E+04	1.36E+09	P	NA	NA	NA	NA	–	7.4E-01	0.0E+00	NA	7.4E-01	6%
Lead	6.42E+02	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Mercury	4.14E+00	1.36E+09	P	NA	NA	NA	NA	–	1.8E-01	0.0E+00	2.3E-05	1.8E-01	1%
Nickel	2.62E+01	1.36E+09	P	NA	NA	NA	NA	–	1.7E-02	0.0E+00	NA	1.7E-02	0%
Zinc	2.17E+03	1.36E+09	P	NA	NA	NA	NA	–	9.3E-02	0.0E+00	NA	9.3E-02	1%
				Total ELCR			4E-04	100%	Total HI **			13	100%

** HI Segregated by Target Site/Critical Effect:	HI (liver, kidney) = 1		HI (gastrointestinal tract) = 4
CNS - Central nervous system	HI (CNS, whole body, immune system) = 5		HI (nasal, lung) = 0.7
NA - Not available	HI (blood) = 3		HI (eyes, nails, hair, skin) = 6
NR - None reported	HI (fetus, developmental) = 0.3		HI (NA, NR) = 0

Table A.5.HHRA-10
Risk and Hazard Calculations for Hypothetical Future Child Resident Exposure to Combined Surface and Subsurface Soil
IGNITER ASSEMBLY AREA
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Child Resident
Receptor Age: Child

[a] Minimum of the volatilization factor (identified with "V") and the particulate emission factor (PEF) (identified with "P"), both derived on Table A.2-11.

–	Not applicable.	HQ	Hazard quotient.	PEF	Particulate emission factor.
ELCR	Excess lifetime cancer risk.	m^3/kg	Cubic meters per kilogram.	VF	Volatilization factor.
EPCs	Exposure point concentration in soil (mg/kg).	mg/kg	Milligrams per kilogram.		
HI	Hazard index (sum of the HQs).	NA	Not available.		

Equations: (see Table A.2-11. Potentially mutagenic carcinogens (i.e., PAHs) adjusted to incorporate ADAFs of 4.6 for 2 years (ages 0 to 2) and 2.1 for 4 years (ages 2 to 6). Oral example: (EPC x 1 x 200 x 350 x CSF/(1,000,000 x 365 x 15)) x ((4.6 x 2/70) + (2.1 x 4/70)).

ELCRo = (EPCs × 1 × 200 × 350 × 6 × CSFo) / (1,000,000 × 15 × 25,550)
ELCRd = (EPCs × 2,800 × 0.2 × ABSd × 350 × 6 × CSFa) / (1,000,000 × 15 × 25,550)
ELCRi = (EPCs × 10 × 350 × 6 × CSFi) / ([VF or PEF] × 15 × 25,550)

HQo = (EPCs × 1 × 200 × 350 × 6) / (1,000,000 × 15 × 2,190 × RfDo)
HQd = (EPCs × 2,800 × 0.2 × ABSd × 350 × 6) / (1,000,000 × 15 × 2,190 × RfDa)
HQi = (EPCs × 10 × 350 × 6) / ([VF or PEF] × 15 × 2,190 × RfDi)

Table A.5.HHRA-11
Risk and Hazard Calculations for Hypothetical Future Child Resident Wading Exposure to Sediment
IGNITER ASSEMBLY AREA
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Child Resident
Receptor Age: Child

Constituent	EPCsed (mg/kg)	CANCER RISK Route-Specific Risks Oral	Dermal	Calculated Risk	Percent Total ELCR	NON-CANCER RISK Route-Specific Risks Oral	Dermal	Calculated Hazard	Percent Total HI
		ELCRo	ELCRd	ELCR		HQo	HQd	HI	
Inorganics									
Aluminum	2.12E+04	NA	NA	NA	–	1.9E-02	0.0E+00	1.9E-02	13%
Arsenic	1.03E+01	1.2E-06	1.3E-07	1.3E-06	100%	3.0E-02	3.4E-03	3.4E-02	24%
Cobalt	1.30E+01	NA	NA	NA	–	3.8E-02	0.0E+00	3.8E-02	27%
Iron	3.23E+04	NA	NA	NA	–	4.0E-02	0.0E+00	4.0E-02	29%
Lead	–	–	–	–	–	–	–	–	–
Manganese	3.69E+02	NA	NA	NA	–	2.3E-03	0.0E+00	2.3E-03	2%
Vanadium	6.26E+01	NA	NA	NA	–	7.8E-03	0.0E+00	7.8E-03	6%
		Total ELCR		1E-06	100%	Total HI		0.1	100%

– Not applicable.
ELCR Excess lifetime cancer risk.
EPCsed Exposure point concentration in sediment (mg/kg).
HI Hazard index (sum of the HQs).
HQ Hazard quotient.
mg/kg Milligrams per kilogram.
NA Not available.

Equations: (see Table A.2-12)

ELCRo = (EPCsed × 100 × 48 × 6 × CSFo) / (1,000,000 × 15 × 25,550)
ELCRd = (EPCsed × 1,900 × 0.2 × ABSd × 48 × 6 × CSFa) / (1,000,000 × 15 × 25,550)
HQo = (EPCsed × 100 × 48 × 6) / (1,000,000 × 15 × 2,190 × RfDo)
HQd = (EPCsed × 1,900 × 0.2 × ABSd × 48 × 6) / (1,000,000 × 15 × 2,190 × RfDa)

Table A.5.HHRA-12
Summary of Calculated Human Health Risks and Hazards
IGNITER ASSEMBLY AREA
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

RECEPTOR Exposure Medium - Scenario	Calculation Table	Total Excess Lifetime Cancer Risk	Total Non-Cancer Hazard
Site Worker			
Surface Soil - Direct Contact	Table A.5.HHRA-5	1E-04	1
Sediment - Wading	Table A.5.HHRA-6	8E-07	0.01
TOTAL SITE RISKS (Site Worker):		1E-04	1
Hypothetical Future Construction Worker			
Combined Surface and Subsurface Soil - Direct Contact	Table A.5.HHRA-7	6E-06	3
TOTAL SITE RISKS (Construction Worker):		6E-06	3
Hypothetical Future Adult Resident			
Combined Surface and Subsurface Soil - Direct Contact	Table A.5.HHRA-8	1E-04	1
Sediment - Wading	Table A.5.HHRA-9	1E-06	0.02
TOTAL SITE RISKS (Adult Resident):		1E-04	1
Hypothetical Future Child Resident			
Combined Surface and Subsurface Soil - Direct Contact	Table A.5.HHRA-10	4E-04	13
Sediment - Wading	Table A.5.HHRA-11	1E-06	0.1
TOTAL SITE RISKS (Child Resident):		4E-04	13
Hypothetical Future Aggregate Resident (Adult + Child)			
Combined Surface and Subsurface Soil - Direct Contact		5E-04	--
Sediment - Wading		3E-06	--
TOTAL SITE RISKS (Aggregate Resident):		5E-04	--

Table A.5.HHRA-13
Blood Lead Level Estimates for a Hypothetical Current Commercial/Industrial Worker Receptor from Exposure to Surface Soil (0-1 feet below ground surface)
IGNITER ASSEMBLY AREA
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Calculations of Blood Lead Concentrations (PbBs)
U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee
Version date 05/19/03

Exposure Variable	PbB Equation[1]		Description of Exposure Variable	Units	Values for Non-Residential Exposure Scenario			
					Using Equation 1		Using Equation 2	
	1*	2**			GSDi = Hom	GSDi = Het	GSDi = Hom	GSDi = Het
PbS	X	X	Soil lead concentration	ug/g or ppm	**757**	**757**	**757**	**757**
$R_{fetal/maternal}$	X	X	Fetal/maternal PbB ratio	--	0.9	0.9	0.9	0.9
BKSF	X	X	Biokinetic Slope Factor	ug/dL per ug/day	0.4	0.4	0.4	0.4
GSD_i	X	X	Geometric standard deviation PbB	--	2.1	2.3	2.1	2.3
PbB_0	X	X	Baseline PbB	ug/dL	1.5	1.7	1.5	1.7
IR_S	X		Soil ingestion rate (including soil-derived indoor dust)	g/day	0.05	0.05	--	--
IR_{S+D}		X	Total ingestion rate of outdoor soil and indoor dust	g/day	--	--	0.05	0.05
W_S		X	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--	--	1.0	1.0
K_{SD}		X	Mass fraction of soil in dust	--	--	--	0.7	0.7
$AF_{S, D}$	X	X	Absorption fraction (same for soil and dust)	--	0.12	0.12	0.12	0.12
$EF_{S, D}$	X	X	Exposure frequency (same for soil and dust)	days/yr	**219**	**219**	**219**	**219**
$AT_{S, D}$	X	X	Averaging time (same for soil and dust)	days/yr	365	365	365	365
PbB_{adult}	**PbB of adult worker, geometric mean**			**ug/dL**	**2.6**	**2.8**	**2.6**	**2.8**
$PbB_{fetal, 0.95}$	**95th percentile PbB among fetuses of adult workers**			**ug/dL**	**7.9**	**9.9**	**7.9**	**9.9**
PbB_t	**Target PbB level of concern (e.g., 10 ug/dL)**			**ug/dL**	**10.0**	**10.0**	**10.0**	**10.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**			**%**	**2.5%**	**4.9%**	**2.5%**	**4.9%**

Table A.5.HHRA-13
Blood Lead Level Estimates for a Hypothetical Current Commercial/Industrial Worker Receptor
from Exposure to Surface Soil (0-1 feet below ground surface)
IGNITER ASSEMBLY AREA
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

[1] Equation 1 does not apportion exposure between soil and dust ingestion (excludes W_S, K_{SD}).
When $IR_S = IR_{S+D}$ and $W_S = 1.0$, the equations yield the same $PbB_{fetal,0.95}$.

***Equation 1, based on Eq. 1, 2 in USEPA (1996).**

PbB_{adult} =	$(PbS*BKSF*IR_{S+D}*AF_{S,D}*EF_S/AT_{S,D}) + PbB_0$
$PbB_{fetal,\,0.95}$ =	$PbB_{adult} * (GSD_i^{1.645} * R)$

****Equation 2, alternate approach based on Eq. 1, 2, and A-19 in USEPA (1996).**

PbB_{adult} =	$PbS*BKSF*([(IR_{S+D})*AF_S*EF_S*W_S]+[K_{SD}*(IR_{S+D})*(1-W_S)*AF_D*EF_D])/365+PbB_0$
$PbB_{fetal,\,0.95}$ =	$PbB_{adult} * (GSD_i^{1.645} * R)$

References:
USEPA 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risk Associated with Adult Exposure to Lead in Soil. Technical Review Workgroup for Lead. December.
USEPA 2003b. Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risk Associated with Adult Exposure to Lead in Soil. Adult Lead Model (ALM). Technical Review Workgroup for Lead. January.

Notes:

g/day =	Gram(s) per day.	ppm =	Part(s) per million.
GSDi =	Individual Geometric Standard Deviations.	µg/day =	Microgram(s) per day.
Het =	Heterogeneous population.	µg/dL =	Microgram(s) per deciliter.
Hom =	Homogeneous population.	µg/g =	Microgram(s) per gram.
PbB =	Blood lead.	yr =	Year.

USEPA Adult Lead Model (2003b) was used to assess exposure to lead.
Input values in bold font were receptor- and site-specific.

Table A.5.HHRA-14
Blood Lead Level Estimates for a Hypothetical Future Child and Adult Resident Receptor
from Exposure to Surface and Subsurface Soil
IGNITER ASSEMBLY AREA
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Calculations of Blood Lead Concentrations (PbBs)
U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee
Version date 05/19/03

ADULT RESIDENT

Exposure Variable	PbB Equation[1]		Description of Exposure Variable	Units	Values for Non-Residential Exposure Scenario			
					Using Equation 1		Using Equation 2	
	1*	2**			GSDi = Hom	GSDi = Het	GSDi = Hom	GSDi = Het
PbS	X	X	Soil lead concentration	ug/g or ppm	**642**	**642**	**642**	**642**
$R_{fetal/maternal}$	X	X	Fetal/maternal PbB ratio	--	0.9	0.9	0.9	0.9
BKSF	X	X	Biokinetic Slope Factor	ug/dL per ug/day	0.4	0.4	0.4	0.4
GSD_i	X	X	Geometric standard deviation PbB	--	2.1	2.3	2.1	2.3
PbB_0	X	X	Baseline PbB	ug/dL	1.5	1.7	1.5	1.7
IR_S	X		Soil ingestion rate (including soil-derived indoor dust)	g/day	0.05	0.05	--	--
IR_{S+D}		X	Total ingestion rate of outdoor soil and indoor dust	g/day	--	--	0.05	0.05
W_S		X	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--	--	1.0	1.0
K_{SD}		X	Mass fraction of soil in dust	--	--	--	0.7	0.7
$AF_{S, D}$	X	X	Absorption fraction (same for soil and dust)	--	0.12	0.12	0.12	0.12
$EF_{S, D}$	X	X	Exposure frequency (same for soil and dust)	days/yr	**365**	**365**	**365**	**365**
$AT_{S, D}$	X	X	Averaging time (same for soil and dust)	days/yr	365	365	365	365
PbB_{adult}	**PbB of adult worker, geometric mean**			**ug/dL**	**3.0**	**3.2**	**3.0**	**3.2**
$PbB_{fetal, 0.95}$	**95th percentile PbB among fetuses of adult workers**			**ug/dL**	**9.3**	**11.5**	**9.3**	**11.5**
PbB_t	**Target PbB level of concern (e.g., 10 ug/dL)**			**ug/dL**	**10.0**	**10.0**	**10.0**	**10.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**			**%**	**4.0%**	**7.0%**	**4.0%**	**7.0%**

Table A.5.HHRA-14
Blood Lead Level Estimates for a Hypothetical Future Child and Adult Resident Receptor
from Exposure to Surface and Subsurface Soil
IGNITER ASSEMBLY AREA
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

[1] Equation 1 does not apportion exposure between soil and dust ingestion (excludes W_S, K_{SD}).
When $IR_S = IR_{S+D}$ and W_S = 1.0, the equations yield the same $PbB_{fetal,0.95}$.

***Equation 1, based on Eq. 1, 2 in USEPA (1996).**

PbB_{adult} =	$(PbS*BKSF*IR_{S+D}*AF_{S,D}*EF_S/AT_{S,D}) + PbB_0$
$PbB_{fetal,\,0.95}$ =	$PbB_{adult} * (GSD_i^{1.645} * R)$

****Equation 2, alternate approach based on Eq. 1, 2, and A-19 in USEPA (1996).**

PbB_{adult} =	$PbS*BKSF*([(IR_{S+D})*AF_S*EF_S*W_S]+[K_{SD}*(IR_{S+D})*(1-W_S)*AF_D*EF_D])/365+PbB_0$
$PbB_{fetal,\,0.95}$ =	$PbB_{adult} * (GSD_i^{1.645} * R)$

References:
USEPA 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risk Associated with Adult Exposure to Lead in Soil. Technical Review Workgroup for Lead. December.
USEPA 2003b. Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risk Associated with Adult Exposure to Lead in Soil. Adult Lead Model (ALM). Technical Review Workgroup for Lead. January.

Notes:

g/day =	Gram(s) per day.	ppm =	Part(s) per million.
GSDi =	Individual Geometric Standard Deviations.	µg/day =	Microgram(s) per day.
Het =	Heterogeneous population.	µg/dL =	Microgram(s) per deciliter.
Hom =	Homogeneous population.	µg/g =	Microgram(s) per gram.
PbB =	Blood lead.	yr =	Year.

USEPA Adult Lead Model (2003b) was used to assess exposure to lead.
Input values in bold font were receptor- and site-specific.

Table A.5.HHRA-14
Blood Lead Level Estimates for a Hypothetical Future Child and Adult Resident Receptor
from Exposure to Surface and Subsurface Soil
IGNITER ASSEMBLY AREA
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

CHILD RESIDENT

Description of Result	Units	Result
Geometric Mean PbB	ug/dL	6.4
Percent Above 10 ug/dL	%	17.0

LEAD MODEL FOR WINDOWS Version 1.1 [a]

==
Model Version: 1.1 Build9
User Name:
Date:
Site Name: Igniter Assembly Area
Operable Unit:
Run Mode: Research
==

****** Air ******

Indoor Air Pb Concentration: 30.000 percent of outdoor.
Other Air Parameters:

Age	Time Outdoors (hours)	Ventilation Rate (m3/day)	Lung Absorption (%)	Outdoor Air Pb Conc (ug Pb/m3)
.5-1	1.000	2.000	32.000	0.100
1-2	2.000	3.000	32.000	0.100
2-3	3.000	5.000	32.000	0.100
3-4	4.000	5.000	32.000	0.100
4-5	4.000	5.000	32.000	0.100
5-6	4.000	7.000	32.000	0.100
6-7	4.000	7.000	32.000	0.100

Table A.5.HHRA-14
Blood Lead Level Estimates for a Hypothetical Future Child and Adult Resident Receptor
from Exposure to Surface and Subsurface Soil
IGNITER ASSEMBLY AREA
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

****** Diet ******

Age	Diet Intake (ug/day)
.5-1	2.260
1-2	1.960
2-3	2.130
3-4	2.040
4-5	1.950
5-6	2.050
6-7	2.220

****** Drinking Water ******

Water Consumption:

Age	Water (L/day)
.5-1	0.200
1-2	0.500
2-3	0.520
3-4	0.530
4-5	0.550
5-6	0.580
6-7	0.590

Drinking Water Concentration: 4.000 ug Pb/L

Table A.5.HHRA-14
Blood Lead Level Estimates for a Hypothetical Future Child and Adult Resident Receptor
from Exposure to Surface and Subsurface Soil
IGNITER ASSEMBLY AREA
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

****** Soil & Dust ******

Multiple Source Analysis Used
Average multiple source concentration: 459.400 ug/g

Mass fraction of outdoor soil to indoor dust conversion factor: 0.700
Outdoor airborne lead to indoor household dust lead concentration: 100.000
Use alternate indoor dust Pb sources? No

Age	Soil (ug Pb/g)[b]	House Dust (ug Pb/g)
.5-1	642.000	459.400
1-2	642.000	459.400
2-3	642.000	459.400
3-4	642.000	459.400
4-5	642.000	459.400
5-6	642.000	459.400
6-7	642.000	459.400

****** Alternate Intake ******

Age	Alternate (ug Pb/day)
.5-1	0.000
1-2	0.000
2-3	0.000
3-4	0.000
4-5	0.000
5-6	0.000
6-7	0.000

****** Maternal Contribution: Infant Model ******

Maternal Blood Concentration: 1.000 ug Pb/dL

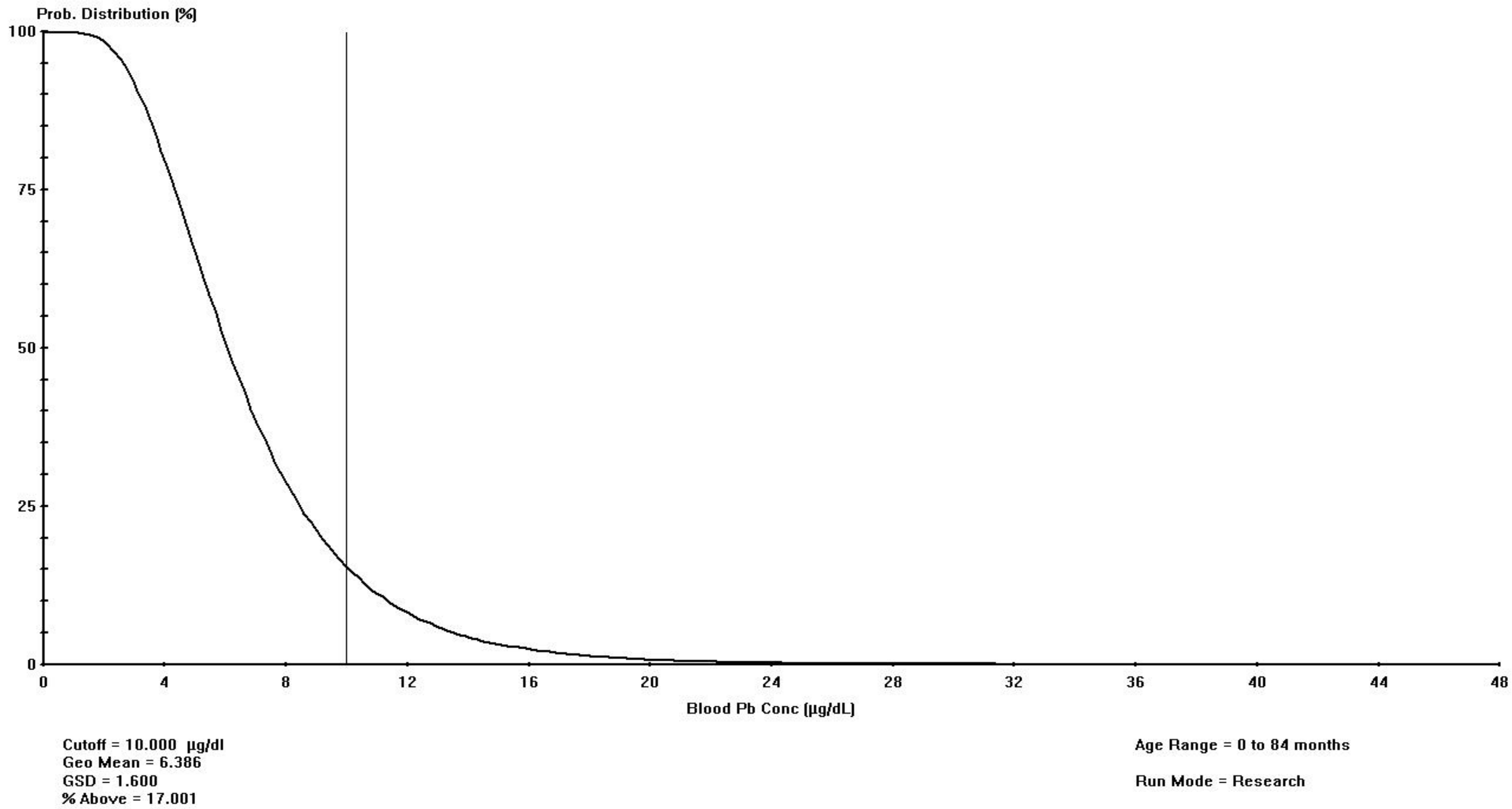
Table A.5.HHRA-14
Blood Lead Level Estimates for a Hypothetical Future Child and Adult Resident Receptor
from Exposure to Surface and Subsurface Soil
IGNITER ASSEMBLY AREA
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
****

Year	Air (ug/day)	Diet (ug/day)	Alternate (ug/day)	Water (ug/day)
.5-1	0.021	0.970	0.000	0.343
1-2	0.034	0.819	0.000	0.836
2-3	0.062	0.911	0.000	0.890
3-4	0.067	0.891	0.000	0.926
4-5	0.067	0.889	0.000	1.003
5-6	0.093	0.950	0.000	1.075
6-7	0.093	1.038	0.000	1.103

Year	Soil+Dust (ug/day)	Total (ug/day)	Blood (ug/dL)
.5-1	11.855	13.190	7.0
1-2	18.335	20.025	8.2
2-3	18.763	20.626	7.6
3-4	19.153	21.036	7.3
4-5	14.813	16.771	6.0
5-6	13.549	15.667	5.0
6-7	12.909	15.143	4.4

Table A.5.HHRA-14
Blood Lead Level Estimates for a Hypothetical Future Child and Adult Resident Receptor
from Exposure to Surface and Subsurface Soil
IGNITER ASSEMBLY AREA
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia



Notes:
[a] Model parameters are defaults, except where noted.
[b] Arithmetic mean

Table A.5.HHRA-15
Blood Lead Level Estimates for a Hypothetical Construction Worker Receptor
from Exposure to Surface and Subsurface Soil
IGNITER ASSEMBLY AREA
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Calculations of Blood Lead Concentrations (PbBs)
U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee
Version date 05/19/03

Exposure Variable	PbB Equation[1] 1*	PbB Equation[1] 2**	Description of Exposure Variable	Units	Values for Non-Residential Exposure Scenario: Using Equation 1, GSDi = Hom	Using Equation 1, GSDi = Het	Using Equation 2, GSDi = Hom	Using Equation 2, GSDi = Het
PbS	X	X	Soil lead concentration	ug/g or ppm	**642**	**642**	**642**	**642**
$R_{fetal/maternal}$	X	X	Fetal/maternal PbB ratio	--	0.9	0.9	0.9	0.9
BKSF	X	X	Biokinetic Slope Factor	ug/dL per ug/day	0.4	0.4	0.4	0.4
GSD_i	X	X	Geometric standard deviation PbB	--	2.1	2.3	2.1	2.3
PbB_0	X	X	Baseline PbB	ug/dL	1.5	1.7	1.5	1.7
IR_S	X		Soil ingestion rate (including soil-derived indoor dust)	g/day	0.10	0.10	--	--
IR_{S+D}		X	Total ingestion rate of outdoor soil and indoor dust	g/day	--	--	0.10	0.10
W_S		X	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--	--	1.0	1.0
K_{SD}		X	Mass fraction of soil in dust	--	--	--	0.7	0.7
$AF_{S,D}$	X	X	Absorption fraction (same for soil and dust)	--	0.12	0.12	0.12	0.12
$EF_{S,D}$	X	X	Exposure frequency (same for soil and dust)	days/yr	**130**	**130**	**130**	**130**
$AT_{S,D}$	X	X	Averaging time (same for soil and dust)	days/yr	365	365	365	365
PbB_{adult}			**PbB of adult worker, geometric mean**	**ug/dL**	**2.6**	**2.8**	**2.6**	**2.8**
$PbB_{fetal, 0.95}$			**95th percentile PbB among fetuses of adult workers**	**ug/dL**	**7.9**	**9.9**	**7.9**	**9.9**
PbB_t			**Target PbB level of concern (e.g., 10 ug/dL)**	**ug/dL**	**10.0**	**10.0**	**10.0**	**10.0**
$P(PbB_{fetal} > PbB_t)$			**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**2.5%**	**4.9%**	**2.5%**	**4.9%**

Table A.5.HHRA-15
Blood Lead Level Estimates for a Hypothetical Construction Worker Receptor
from Exposure to Surface and Subsurface Soil
IGNITER ASSEMBLY AREA
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

[1] Equation 1 does not apportion exposure between soil and dust ingestion (excludes W_S, K_{SD}).
When $IR_S = IR_{S+D}$ and $W_S = 1.0$, the equations yield the same $PbB_{fetal,0.95}$.

***Equation 1, based on Eq. 1, 2 in USEPA (1996).**

PbB_{adult} =	$(PbS*BKSF*IR_{S+D}*AF_{S,D}*EF_S/AT_{S,D}) + PbB_0$
$PbB_{fetal,\,0.95}$ =	$PbB_{adult} * (GSD_i^{1.645} * R)$

****Equation 2, alternate approach based on Eq. 1, 2, and A-19 in USEPA (1996).**

PbB_{adult} =	$PbS*BKSF*([(IR_{S+D})*AF_S*EF_S*W_S]+[K_{SD}*(IR_{S+D})*(1-W_S)*AF_D*EF_D])/365+PbB_0$
$PbB_{fetal,\,0.95}$ =	$PbB_{adult} * (GSD_i^{1.645} * R)$

References:

USEPA 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risk Associated with Adult Exposure to Lead in Soil. Technical Review Workgroup for Lead. December.
USEPA 2003b. Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risk Associated with Adult Exposure to Lead in Soil. Adult Lead Model (ALM). Technical Review Workgroup for Lead. January.

Notes:

g/day =	Gram(s) per day.	ppm =	Part(s) per million.
GSDi =	Individual Geometric Standard Deviations.	µg/day =	Microgram(s) per day.
Het =	Heterogeneous population.	µg/dL =	Microgram(s) per deciliter.
Hom =	Homogeneous population.	µg/g =	Microgram(s) per gram.
PbB =	Blood lead.	yr =	Year.

USEPA Adult Lead Model (2003b) was used to assess exposure to lead.
Input values in bold font were receptor- and site-specific.

Table A.5.HHRA-16
Summary of Calculated Blood Lead Level Estimates
IGNITER ASSEMBLY AREA
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Exposure Medium/Receptor	Model Used [a]	Receptor Blood Lead Level[b]		Fetus Blood Level [b]
		Adult	Child	
		50th Percentile/ Geometric Mean (µg/dL)	range in seven years (µg/dL)	95th Percentile (µg/dL)
IGNITER ASSEMBLY AREA				
Surface Soil (0-1 feet below ground surface)				
Hypothetical Current Commercial/Industrial Worker Receptor	USEPA ALM	2.8	–	9.9
Surface and Subsurface Soil				
Hypothetical Construction Worker Receptor	USEPA ALM	2.8	–	9.9
Hypothetical Future Child Resident Receptor	IEUBK	–	4.4 - 8.2	–
Hypothetical Future Adult Resident Receptor	USEPA ALM	3.2	–	11

Notes:
– = Not applicable.
µg/dL = Microgram(s) per deciliter.

[a] USEPA ALM: USEPA Adult Lead Methodology Spreadsheet.
USEPA Technical Review Workgroup for Lead, Adult Lead Committee (USEPA, 2003b).
USEPA IEUBK: USEPA Integrated Exposure Uptake Biogenetic Model for Lead in Children (USEPA 2005).
[b] Compare to a target blood lead level of 10 mg/dL.

Table A.5.ERA-1
Screening Level -Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Background Concentration [a] (mg/kg)	Ecological Screening Level (ESLs) [b] (mg/kg)		Maximum HQ [c] (unitless)	Bioaccumulative Chemical?[d] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [e]	
			Value	*Source*			(YES/no)	Rationale
Volatile Organic Compounds								
3-Octanone	0.015	–	NA		NA	no	**YES**	**NSL**
Acetone	0.16	–	2.5	*R5*	0.06	no	no	HQ • 1
d-Limonene	0.084	–	NA		NA	no	**YES**	**NSL**
Methylene Chloride	0.004	–	4.05	*R5*	0.001	no	no	HQ • 1
Semi-Volatile Organic Compounds								
2,4-Dinitrotoluene	48	–	1.28	*R5*	40	no	**YES**	**HQ > 1**
Benzoic Acid	0.3	–	NA		NA	no	**YES**	**NSL**
bis(2-Ethylhexyl)phthalate	750	–	0.92594	*R5*	800	no	**YES**	**HQ > 1**
Butylbenzylphthalate	0.13	–	0.23889	*R5*	0.5	no	no	HQ • 1
Carbazole	2.4	–	NA		NA	no	**YES**	**NSL**
Dibenzofuran	0.74	–	NA		NA	no	**YES**	**NSL**
Diethylphthalate	250	–	24.8	*R5*	10	no	**YES**	**HQ > 1**
Di-n-Butylphthalate	0.31	–	0.15	*R5*	2	no	**YES**	**HQ > 1**
Di-n-Octylphthalate	0.04	–	709	*R5*	0.00006	no	no	HQ • 1
Explosives								
1,3,5-Trinitrobenzene	0.07	–	0.376	*R5*	0.2	no	no	HQ • 1
4-Amino-2,6-Dinitrotoluene	0.05	–	80	*T*	0.0006	no	no	HQ • 1
Nitroglycerine	0.57	–	NA		NA	no	**YES**	**NSL**
Pesticides								
4,4'-DDD	0.00248	–	0.021	*EcoSSL*	0.1	YES	**YES**	**Bioaccumulative**
4,4'-DDE	0.00301	–	0.021	*EcoSSL*	0.1	YES	**YES**	**Bioaccumulative**
4,4'-DDT	0.0067	–	0.021	*EcoSSL*	0.3	YES	**YES**	**Bioaccumulative**
BHC, beta-	0.00017	–	0.00398	*R5*	0.04	YES	**YES**	**Bioaccumulative**
BHC, delta-	0.00104	–	9.94	*R5*	0.0001	YES	**YES**	**Bioaccumulative**
BHC, gamma- (Lindane)	–	–	0.005	*R5*	NA	YES	no	HQ • 1
Chlordane, alpha-	0.00301	–	0.224	*R5*	0.01	YES	**YES**	**Bioaccumulative**
Chlordane, gamma-	0.00408	–	0.224	*R5s*	0.02	no	no	HQ • 1
Dieldrin	0.00909	–	0.0049	*EcoSSL*	2	YES	**YES**	**HQ > 1**
Endosulfan II	0.00378	–	0.119	*R5*	0.03	YES	**YES**	**Bioaccumulative**
Endrin	0.02	–	0.0101	*R5*	2	YES	**YES**	**HQ > 1**
Endrin Ketone	0.00424	–	0.0101	*R5s*	0.4	no	no	HQ • 1
Heptachlor Epoxide	0.00101	–	0.152	*R5*	0.007	YES	**YES**	**Bioaccumulative**
Methoxychlor	0.0122	–	0.0199	*R5*	0.6	YES	**YES**	**Bioaccumulative**

Table A.5.ERA-1
Screening Level -Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Background Concentration [a] (mg/kg)	Ecological Screening Level (ESLs) [b] (mg/kg)		Maximum HQ [c] (unitless)	Bioaccumulative Chemical?[d] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [e]	
			Value	*Source*			(YES/no)	Rationale
Polycyclic Aromatic Hydrocarbons								
1-Methylnaphthalene	0.037	–	3.24	*R5s*	0.01	no	no	HQ • 1
2-Methylnaphthalene	0.36	–	3.24	*R5*	0.1	no	no	HQ • 1
Acenaphthene	1	–	682	*R5*	0.001	YES	**YES**	**Bioaccumulative**
Acenaphthylene	0.3	–	682	*R5*	0.0004	YES	**YES**	**Bioaccumulative**
Anthracene	2.1	–	1,480	*R5*	0.001	YES	**YES**	**Bioaccumulative**
Benzo(a)anthracene	6.9	–	5.21	*R5*	1	YES	**YES**	**Bioaccumulative**
Benzo(a)pyrene	5.9	–	1.52	*R5*	4	YES	**YES**	**HQ > 1**
Benzo(b)fluoranthene	13	–	59.8	*R5*	0.2	YES	**YES**	**Bioaccumulative**
Benzo(g,h,i)perylene	3.5	–	119	*R5*	0.03	YES	**YES**	**Bioaccumulative**
Benzo(k)fluoranthene	6.5	–	148	*R5*	0.04	YES	**YES**	**Bioaccumulative**
Chrysene	7.7	–	4.73	*R5*	2	YES	**YES**	**HQ > 1**
Dibenzo(a,h)anthracene	0.97	–	18.4	*R5*	0.05	YES	**YES**	**Bioaccumulative**
Fluoranthene	22	–	122	*R5*	0.2	YES	**YES**	**Bioaccumulative**
Fluorene	1.3	–	122	*R5*	0.01	YES	**YES**	**Bioaccumulative**
Indeno(1,2,3-cd)pyrene	6.1	–	109	*R5*	0.06	YES	**YES**	**Bioaccumulative**
Naphthalene	0.75	–	0.0994	*R5*	8	no	**YES**	**HQ > 1**
Phenanthrene	16	–	45.7	*R5*	0.4	YES	**YES**	**Bioaccumulative**
Pyrene	16	–	78.5	*R5*	0.2	YES	**YES**	**Bioaccumulative**
Polychlorinated Biphenyls								
Aroclor 1254	12	–	NA		NA	YES	**YES**	**Bioaccumulative**
Aroclor 1260	1	–	NA		NA	YES	**YES**	**Bioaccumulative**
Inorganics								
Aluminum	39,000	40,041	50	*ORNL*	800	no	no	max • BKGD
Antimony	16.9	NA	0.27	*EcoSSL*	60	no	**YES**	**HQ > 1**
Arsenic	164	15.8	18	*EcoSSL*	9	YES	**YES**	**HQ > 1**
Barium	11,800	209	330	*EcoSSL*	40	no	**YES**	**HQ > 1**
Beryllium	2.3	1.02	21	*EcoSSL*	0.1	no	no	HQ • 1
Cadmium	15.2	0.69	0.36	*EcoSSL*	40	YES	**YES**	**HQ > 1**
Calcium	197,000	NA	NA		NA	no	no	NT
Chromium	1,110	65.3	26	*EcoSSL*	40	YES	**YES**	**HQ > 1**
Cobalt	422	72.3	13	*EcoSSL*	30	no	**YES**	**HQ > 1**
Copper	56,500	53.5	28	*EcoSSL*	2000	YES	**YES**	**HQ > 1**
Iron	328,000	50,962	NA		NA	no	**YES**	**NSL**
Lead	14,400	26.8	11	*EcoSSL*	1000	YES	**YES**	**HQ > 1**
Magnesium	86,100	NA	NA		NA	no	no	NT
Manganese	2,510	2,543	220	*EcoSSL*	10	no	no	max • BKGD
Mercury	79.5	0.13	0.1	*R5*	800	no	**YES**	**HQ > 1**
Nickel	213	62.8	38	*EcoSSL*	6	YES	**YES**	**HQ > 1**

Table A.5.ERA-1
Screening Level -Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Background Concentration [a] (mg/kg)	Ecological Screening Level (ESLs) [b] (mg/kg)		Maximum HQ [c] (unitless)	Bioaccumulative Chemical?[d] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [e]	
			Value	***Source***			**(YES/no)**	**Rationale**
Potassium	5,570	NA	NA		NA	no	no	NT
Selenium	1.9	NA	0.52	*EcoSSL*	4	YES	**YES**	**HQ > 1**
Silver	22.5	NA	4.2	*EcoSSL*	5	YES	**YES**	**HQ > 1**
Sodium	1,350	NA	NA		NA	no	no	NT
Thallium	1	2.11	0.05692	*R5*	20	no	no	max • BKGD
Vanadium	98.4	108	7.8	*EcoSSL*	10	no	no	max • BKGD
Zinc	21,800	202	46	*EcoSSL*	500	YES	**YES**	**HQ > 1**

Notes:
– = Not available or applicable.
mg/kg = Milligrams per kilogram.
NA = Not available or applicable.

[a] Background levels for inorganics are facility-wide soil background point estimates taken from Facility-Wide Background Study Report (IT Corporation 2001).
[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[c] The maximum hazard quotient (HQ) is the ratio of the maximum constituent concentration to the surface soil screening level. HQs are rounded to one significant figure.
[d] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.
[e] Constituents with a hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for screening level assessment unless they were essential nutrients and thus considered non-toxic (NT), or were inorganics present at concentrations below background (max • BKGD).

Table A.5.ERA-2
Screening Level - Constituents of Potential Ecological Concern in Sediment
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Ecological Screening Level (ESLs) [a] (mg/kg)		Maximum HQ [b] (unitless)	Bioaccumulative Chemical? [c] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [d]	
		Value	*Source*			(YES/no)	Rationale
Inorganics							
Aluminum	21,200	58,000	*ARCS_PEC*	0.4	no	no	HQ • 1
Arsenic	10.3	9.8	*R3*	1	YES	**YES**	**Bioaccumulative**
Barium	48.9	NA		NA	no	**YES**	**NSL**
Beryllium	1.2	NA		NA	no	**YES**	**NSL**
Cadmium	0.47	0.99	*R3*	0.5	YES	**YES**	**Bioaccumulative**
Calcium	8,650	NA		NA	no	no	NT
Chromium	32.7	43.4	*R3*	0.8	YES	**YES**	**Bioaccumulative**
Cobalt	13	50	*R3*	0.3	no	no	HQ • 1
Copper	24.8	31.6	*R3*	0.8	YES	**YES**	**Bioaccumulative**
Iron	32,300	20,000	*R3*	2	no	**YES**	**HQ > 1**
Lead	44.4	35.8	*R3*	1	YES	**YES**	**Bioaccumulative**
Magnesium	4,580	NA		NA	no	no	NT
Manganese	369	460	*R3*	0.8	no	no	HQ • 1
Mercury	0.093	0.18	*R3*	0.5	no	no	HQ • 1
Nickel	15.2	22.7	*R3*	0.7	YES	**YES**	**Bioaccumulative**
Potassium	880	NA		NA	no	no	NT
Vanadium	62.6	NA		NA	no	**YES**	**NSL**
Zinc	107	121	*R3*	0.9	YES	**YES**	**Bioaccumulative**

Notes:
– = Not available or applicable.
mg/kg = Milligrams per kilogram.
NA = Not available or applicable.

[a] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.

[b] The maximum hazard quotient (HQ) is the ratio of the maximum constituent concentration to the sediment screening level. HQs are rounded to one significant figure.

[c] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.

[d] Constituents with a hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for screening level assessment unless they were essential nutrients and thus considered non-toxic (NT), or were inorganics present at concentrations below background (max • BKGD).

Table A.5.ERA-3
Baseline Level - Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)		Ecological Screening Level (ESLs) [b] (mg/kg) Value	Source	Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rationale	Bioaccumulative ? [e] (YES/no)
Volatile Organic Compounds								
3-Octanone	0.015	m	NA		NA	**YES**	**NSL**	no
d-Limonene	0.084	m	NA		NA	**YES**	**NSL**	no
Semi-Volatile Organic Compounds								
2,4-Dinitrotoluene	48	m	1.28	*R5*	40	**YES**	**HQ > 1**	no
Benzoic Acid	0.233		NA		NA	**YES**	**NSL**	no
bis(2-Ethylhexyl)phthalate	303.3		0.92594	*R5*	300	**YES**	**HQ > 1**	no
Carbazole	0.402		NA		NA	**YES**	**NSL**	no
Dibenzofuran	0.74	m	NA		NA	**YES**	**NSL**	no
Diethylphthalate	250	m	24.8	*R5*	10	**YES**	**HQ > 1**	no
Di-n-Butylphthalate	0.31	m	0.15	*R5*	2	**YES**	**HQ > 1**	no
Explosives								
Nitroglycerine	0.57	m	NA		NA	**YES**	**NSL**	no
Pesticides								
4,4'-DDD	0.0019		0.021	*EcoSSL*	0.09	**YES**	**Bioaccumulative**	**YES**
4,4'-DDE	0.00156		0.021	*EcoSSL*	0.07	**YES**	**Bioaccumulative**	**YES**
4,4'-DDT	0.0037		0.021	*EcoSSL*	0.2	**YES**	**Bioaccumulative**	**YES**
BHC, beta-	0.00017	m	0.00398	*R5*	0.04	**YES**	**Bioaccumulative**	**YES**
BHC, delta-	0.00104	m	9.94	*R5*	0.0001	**YES**	**Bioaccumulative**	**YES**
Chlordane, alpha-	0.00301	m	0.224	*R5*	0.01	**YES**	**Bioaccumulative**	**YES**
Dieldrin	0.00655		0.0049	*EcoSSL*	1	**YES**	**Bioaccumulative**	**YES**
Endosulfan II	0.00208		0.119	*R5*	0.02	**YES**	**Bioaccumulative**	**YES**
Endrin	0.00635		0.0101	*R5*	0.6	**YES**	**Bioaccumulative**	**YES**
Heptachlor Epoxide	0.00101	m	0.152	*R5*	0.007	**YES**	**Bioaccumulative**	**YES**
Methoxychlor	0.00729		0.0199	*R5*	0.4	**YES**	**Bioaccumulative**	**YES**
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	0.129		682	*R5*	0.0002	**YES**	**Bioaccumulative**	**YES**
Acenaphthylene	0.0607		682	*R5*	0.00009	**YES**	**Bioaccumulative**	**YES**
Anthracene	0.277		1,480	*R5*	0.0002	**YES**	**Bioaccumulative**	**YES**
Benzo(a)anthracene	2.939		5.21	*R5*	0.6	**YES**	**Bioaccumulative**	**YES**
Benzo(a)pyrene	2.998		1.52	*R5*	2	**YES**	**HQ > 1**	**YES**
Benzo(b)fluoranthene	6.47		59.8	*R5*	0.1	**YES**	**Bioaccumulative**	**YES**
Benzo(g,h,i)perylene	1.434		119	*R5*	0.01	**YES**	**Bioaccumulative**	**YES**
Benzo(k)fluoranthene	2.654		148	*R5*	0.02	**YES**	**Bioaccumulative**	**YES**
Chrysene	4.008		4.73	*R5*	0.8	**YES**	**Bioaccumulative**	**YES**
Dibenzo(a,h)anthracene	0.162		18.4	*R5*	0.009	**YES**	**Bioaccumulative**	**YES**
Fluoranthene	8.402		122	*R5*	0.07	**YES**	**Bioaccumulative**	**YES**
Fluorene	0.154		122	*R5*	0.001	**YES**	**Bioaccumulative**	**YES**
Indeno(1,2,3-cd)pyrene	3.035		109	*R5*	0.03	**YES**	**Bioaccumulative**	**YES**
Naphthalene	0.357		0.0994	*R5*	4	**YES**	**HQ > 1**	no
Phenanthrene	5.962		45.7	*R5*	0.1	**YES**	**Bioaccumulative**	**YES**
Pyrene	6.298		78.5	*R5*	0.08	**YES**	**Bioaccumulative**	**YES**

Table A.5.ERA-3
Baseline Level - Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)		Ecological Screening Level (ESLs) [b] (mg/kg) Value	*Source*	Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rationale	Bioaccumulative ? [e] (YES/no)
Polychlorinated Biphenyls								
Aroclor 1254	2.857		NA		NA	**YES**	**NSL**	**YES**
Aroclor 1260	1	m	NA		NA	**YES**	**NSL**	**YES**
Inorganics								
Antimony	1.221		0.27	*EcoSSL*	5	**YES**	**HQ > 1**	no
Arsenic	23.99		18	*EcoSSL*	1	**YES**	**Bioaccumulative**	**YES**
Barium	1,724		330	*EcoSSL*	5	**YES**	**HQ > 1**	no
Cadmium	2.198		0.36	*EcoSSL*	6	**YES**	**HQ > 1**	**YES**
Chromium	157.4		26	*EcoSSL*	6	**YES**	**HQ > 1**	no
Cobalt	38.29		13	*EcoSSL*	3	**YES**	**HQ > 1**	no
Copper	13,224		28	*EcoSSL*	500	**YES**	**HQ > 1**	**YES**
Iron	40,291		NA		NA	**YES**	**NSL**	no
Lead	2,016	avg	11	*EcoSSL*	200	**YES**	**HQ > 1**	**YES**
Mercury	5.234		0.1	*R5*	50	**YES**	**HQ > 1**	no
Nickel	29.05		38	*EcoSSL*	0.8	**YES**	**Bioaccumulative**	**YES**
Selenium	0.701		0.52	*EcoSSL*	1	**YES**	**Bioaccumulative**	**YES**
Silver	1.815		4.2	*EcoSSL*	0.4	**YES**	**Bioaccumulative**	**YES**
Zinc	2,929		46	*EcoSSL*	60	**YES**	**HQ > 1**	**YES**

Notes:
– = Not available or applicable.
mg/kg = Milligrams per kilogram.
NA = Not available or applicable.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[c] The refined hazard quotient (HQ) is the ratio of the EPC to the surface soil screening level. HQs are rounded to one significant figure.
[d] Constituents with a refined hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for baseline risk assessment.
[e] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.

Table A.5.ERA-4
Baseline Level - Constituents of Potential Ecological Concern in Sediment
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

	Exposure Point Concentration [a] (mg/kg)		Ecological Screening Level (ESLs) [b] (mg/kg)		Refined HQ [c]	Baseline Level Constituent of Potential Ecological Concern? [d]		Bioaccumulative ? [e]
Constituent			**Value**	***Source***	**(unitless)**	**(YES/no)**	**Rationale**	**(YES/no)**
Inorganics								
Arsenic	10.3	m	9.8	*R3*	1	**YES**	**Bioaccumulative**	**YES**
Barium	48.9	m	NA		NA	**YES**	**NSL**	no
Beryllium	1.2	m	NA		NA	**YES**	**NSL**	no
Cadmium	0.47	m	0.99	*R3*	0.5	**YES**	**Bioaccumulative**	**YES**
Chromium	32.7	m	43.4	*R3*	0.8	no	**HQ • 1**	no
Copper	24.8	m	31.6	*R3*	0.8	**YES**	**Bioaccumulative**	**YES**
Iron	32,300	m	20,000	*R3*	2	**YES**	**HQ > 1**	no
Lead	35.8	avg	35.8	*R3*	1	**YES**	**Bioaccumulative**	**YES**
Nickel	15.2	m	22.7	*R3*	0.7	**YES**	**Bioaccumulative**	**YES**
Vanadium	62.6	m	NA		NA	**YES**	**NSL**	no
Zinc	107	m	121	*R3*	0.9	**YES**	**Bioaccumulative**	**YES**

Notes:
– = Not available or applicable.
mg/kg = Milligrams per kilogram.
NA = Not available or applicable.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
[b] See Table A.2-17 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[c] The refined hazard quotient (HQ) is the ratio of the EPC to the sediment screening level. HQs are rounded to one significant figure.
[d] Constituents with a refined hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for baseline risk assessment.
[e] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.

Table A.5.ERA-5
Maximum Scenario Food Chain Modeling for the Short-Tailed Shrew
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration [a] (mg/kg)	Soil Bioconcentration Factors [b] Invertebrate	Estimated Dietary Tissue Concentrations [c] (mg/kg) Invertebrate	Maximum Estimated Dietary Ingestion [d] mg/kg-BW-day	Toxicity Reference Values [e] mg/kg-BW-day LOAEL	Toxicity Reference Values [e] mg/kg-BW-day NOAEL	Maximum Scenario HQ [f] LOAEL	Maximum Scenario HQ [f] NOAEL
Pesticides								
4,4'-DDD	2.5E-03	1.9E+00	4.8E-03	6.5E-04	8.52E+00	1.70E+00	0.00008	0.0004
4,4'-DDE	3.0E-03	1.9E+00	5.8E-03	7.9E-04	8.52E+00	1.70E+00	0.00009	0.0005
4,4'-DDT	6.7E-03	1.9E+00	1.3E-02	1.8E-03	8.52E+00	1.70E+00	0.0002	0.001
BHC, beta-	1.7E-04	1.5E+00	2.5E-04	3.5E-05	4.26E+00	8.52E-01	0.000008	0.00004
BHC, delta-	1.0E-03	1.5E+00	1.5E-03	2.1E-04	6.82E+00	3.41E+00	0.00003	0.00006
Chlordane, alpha-	3.0E-03	1.5E+00	4.4E-03	6.1E-04	5.28E+01	5.28E+00	0.00001	0.0001
Dieldrin	9.1E-03	1.5E+00	1.3E-02	1.8E-03	4.26E-01	4.26E-02	0.004	0.04
Endosulfan II	3.8E-03	1.5E+00	5.5E-03	7.6E-04	3.20E+00	3.20E-01	0.0002	0.002
Endrin	2.0E-02	1.5E+00	2.9E-02	4.0E-03	1.06E+00	1.06E-01	0.004	0.04
Heptachlor Epoxide	1.0E-03	1.5E+00	1.5E-03	2.1E-04	2.77E+00	2.77E-01	0.00008	0.0008
Methoxychlor	1.2E-02	6.7E+00	8.2E-02	1.1E-02	1.70E+01	8.52E+00	0.0006	0.001
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	1.0E+00	5.0E-01	5.0E-01	7.6E-02	2.02E+01	2.02E+00	0.004	0.04
Acenaphthylene	3.0E-01	5.0E-01	1.5E-01	2.3E-02	1.15E+02	1.15E+03	0.0002	0.00002
Anthracene	2.1E+00	1.0E-02	2.1E-02	2.4E-02	7.03E+03	7.03E+02	0.000003	0.00003
Benzo(a)anthracene	6.9E+00	2.5E-02	1.7E-01	9.1E-02	4.26E+00	4.26E-01	0.02	0.2
Benzo(a)pyrene	5.9E+00	6.8E-02	4.0E-01	1.1E-01	1.15E+01	1.15E+00	0.01	0.1
Benzo(b)fluoranthene	1.3E+01	5.1E-02	6.6E-01	2.2E-01	3.78E+01	1.51E+00	0.006	0.1
Benzo(g,h,i)perylene	3.5E+00	4.9E-02	1.7E-01	5.7E-02	1.15E+00	1.15E-01	0.05	0.5
Benzo(k)fluoranthene	6.5E+00	5.1E-02	3.3E-01	1.1E-01	3.78E+01	1.51E+00	0.003	0.07
Chrysene	7.7E+00	3.5E-02	2.7E-01	1.1E-01	2.11E+02	2.11E+01	0.0005	0.005
Dibenzo(a,h)anthracene	9.7E-01	7.4E-02	7.1E-02	1.9E-02	1.28E-02	1.28E-03	1	10
Fluorene	1.3E+00	5.0E-01	6.5E-01	9.8E-02	3.20E+02	1.07E+02	0.0003	0.0009
Fluoranthene	2.2E+01	5.0E-01	1.1E+01	1.7E+00	8.52E+01	8.52E+00	0.02	0.2
Indeno(1,2,3-cd)pyrene	6.1E+00	8.4E-02	5.1E-01	1.3E-01	1.15E+00	1.15E-01	0.1	1
Phenanthrene	1.6E+01	2.4E-02	3.9E-01	2.1E-01	2.98E+01	2.98E+00	0.007	0.07
Pyrene	1.6E+01	1.8E-02	2.9E-01	2.0E-01	1.84E+01	1.84E+00	0.01	0.1
Polychlorinated Biphenyls								
Aroclor 1254	1.2E+01	1.5E+00	1.8E+01	2.5E+00	7.84E-01	7.84E-02	3	30
Aroclor 1260	1.0E+00	1.5E+00	1.5E+00	2.1E-01	7.84E-01	7.84E-02	0.3	3
Inorganics								
Arsenic	1.6E+02	3.9E-01	6.4E+01	1.0E+01	1.15E+01	1.15E+00	0.9	9
Cadmium	1.5E+01	2.8E+00	4.3E+01	5.8E+00	2.90E+00	2.90E-01	2	20
Copper	5.7E+04	6.8E-02	3.8E+03	1.1E+03	4.73E+01	3.65E+01	20	30
Lead	1.4E+04	5.6E-02	8.1E+02	2.5E+02	1.70E+02	1.70E+01	1	10
Nickel	2.1E+02	2.6E-02	5.5E+00	2.8E+00	1.70E+02	1.70E+01	0.02	0.2
Selenium	1.9E+00	3.9E-01	7.4E-01	1.2E-01	6.76E-01	4.10E-01	0.2	0.3
Silver	2.3E+01	3.9E-01	8.8E+00	1.4E+00	3.58E+02	3.58E+01	0.004	0.04
Zinc	2.2E+04	3.9E-01	8.5E+03	1.3E+03	6.49E+01	6.49E+00	20	200

Table A.5.ERA-5
Maximum Scenario Food Chain Modeling for the Short-Tailed Shrew
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:

HQ =	Hazard Quotient.
LOAEL =	Lowest observed adverse effect level.
mg/kg =	Milligrams per kilogram.
mg/kg-BW-day =	Milligrams per kilogram of body weight per day.
NOAEL =	No observed adverse effect level.

[a] Maximum concentration detected in surface soil (mg/kg).
[b] See Table A.2-20 for sources of soil bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.
[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.
[e] See Table A.2-23 for sources of mammalian toxicity reference values.
[f] Maximum hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.5.ERA-6
Refined Scenario Food Chain Modeling for the Short-Tailed Shrew
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)		Soil Bioconcentration Factors [b]			Estimated Dietary Tissue Concentrations [c] (mg/kg)			Refined Estimated Dietary Ingestion [d]	Toxicity Reference Values [e] mg/kg-BW-day		Refined Scenario HQ [f]	
			Invertebrate	Vegetation	Mammal	Invertebrate	Vegetation	Mammal	mg/kg-BW-day	LOAEL	NOAEL	LOAEL	NOAEL
Pesticides													
4,4'-DDD	1.9E-03		1.9E+00	2.7E-03	2.9E-01	3.7E-03	5.1E-06	5.6E-04	4.3E-04	8.52E+00	1.70E+00	0.00005	0.0003
4,4'-DDE	1.6E-03		1.9E+00	3.3E-03	2.0E-01	3.0E-03	5.2E-06	3.2E-04	3.5E-04	8.52E+00	1.70E+00	0.00004	0.0002
4,4'-DDT	3.7E-03		1.9E+00	1.6E-03	6.9E-01	7.1E-03	6.0E-06	2.6E-03	8.3E-04	8.52E+00	1.70E+00	0.0001	0.0005
BHC, beta-	1.7E-04	m	1.5E+00	4.9E-02	1.9E-03	2.5E-04	8.4E-06	3.2E-07	2.9E-05	4.26E+00	8.52E-01	0.000007	0.00003
BHC, delta-	1.0E-03	m	1.5E+00	1.9E-01	1.9E-04	1.5E-03	1.9E-04	2.0E-07	1.8E-04	6.82E+00	3.41E+00	0.00003	0.00005
Chlordane, alpha-	3.0E-03	m	1.5E+00	2.6E-03	3.0E-01	4.4E-03	7.9E-06	9.1E-04	5.2E-04	5.28E+01	5.28E+00	0.00001	0.0001
Dieldrin	6.6E-03		1.5E+00	1.6E-03	6.9E-01	9.6E-03	1.1E-05	4.5E-03	1.1E-03	4.26E-01	4.26E-02	0.003	0.03
Endrin	6.4E-03		1.5E+00	1.8E-02	1.1E-02	9.3E-03	1.1E-04	6.9E-05	1.1E-03	1.06E+00	1.06E-01	0.001	0.01
Endosulfan II	2.1E-03		1.5E+00	6.9E-02	1.1E-03	3.1E-03	1.4E-04	2.2E-06	3.6E-04	3.20E+00	3.20E-01	0.0001	0.001
Heptachlor Epoxide	1.0E-03	m	1.5E+00	5.6E-03	8.3E-02	1.5E-03	5.6E-06	8.4E-05	1.8E-04	2.77E+00	2.77E-01	0.00006	0.0006
Methoxychlor	7.3E-03		6.7E+00	1.6E+00	6.2E-04	4.9E-02	1.1E-02	4.5E-06	5.6E-03	1.70E+01	8.52E+00	0.0003	0.0007
Polycyclic Aromatic Hydrocarbons													
Acenaphthene	1.3E-01		5.0E-01	4.2E-02	2.5E-03	6.5E-02	5.4E-03	3.2E-04	8.5E-03	2.02E+01	2.02E+00	0.0004	0.004
Acenaphthylene	6.1E-02		5.0E-01	3.4E-02	3.5E-03	3.0E-02	2.1E-03	2.1E-04	3.9E-03	1.15E+02	1.15E+03	0.00003	0.000003
Anthracene	2.8E-01		1.0E-02	2.1E-02	8.5E-03	2.8E-03	5.7E-03	2.4E-03	3.1E-03	7.03E+03	7.03E+02	0.0000004	0.000004
Benzo(a)anthracene	2.9E+00		2.5E-02	4.4E-03	1.2E-01	7.3E-02	1.3E-02	3.6E-01	3.9E-02	4.26E+00	4.26E-01	0.009	0.09
Benzo(a)pyrene	3.0E+00		6.8E-02	2.7E-03	2.9E-01	2.1E-01	8.0E-03	8.8E-01	5.8E-02	1.15E+01	1.15E+00	0.005	0.05
Benzo(b)fluoranthene	6.5E+00		5.1E-02	1.2E-03	1.1E+00	3.3E-01	8.0E-03	7.2E+00	1.4E-01	3.78E+01	1.51E+00	0.004	0.09
Benzo(g,h,i)perylene	1.4E+00		4.9E-02	6.1E-04	3.8E+00	7.0E-02	8.7E-04	5.4E+00	5.2E-02	1.15E+00	1.15E-01	0.05	0.5
Benzo(k)fluoranthene	2.7E+00		5.1E-02	1.2E-03	1.1E+00	1.3E-01	3.3E-03	3.0E+00	5.8E-02	3.78E+01	1.51E+00	0.002	0.04
Chrysene	4.0E+00		3.5E-02	4.5E-03	1.2E-01	1.4E-01	1.8E-02	4.8E-01	5.8E-02	2.11E+02	2.11E+01	0.0003	0.003
Dibenzo(a,h)anthracene	1.6E-01		7.4E-02	1.6E-03	6.9E-01	1.2E-02	2.6E-04	1.1E-01	3.5E-03	1.28E-02	1.28E-03	0.3	3
Fluoranthene	8.4E+00		5.0E-01	7.4E-03	5.0E-02	4.2E+00	6.3E-02	4.2E-01	5.5E-01	8.52E+01	8.52E+00	0.006	0.06
Fluorene	1.5E-01		5.0E-01	3.2E-02	4.0E-03	7.7E-02	5.0E-03	6.1E-04	1.0E-02	3.20E+02	1.07E+02	0.00003	0.00009
Indeno(1,2,3-cd)pyrene	3.0E+00		8.4E-02	2.7E-04	1.5E+01	2.5E-01	8.3E-04	4.6E+01	3.2E-01	1.15E+00	1.15E-01	0.3	3
Phenanthrene	6.0E+00		2.4E-02	1.8E-02	1.1E-02	1.5E-01	1.1E-01	6.7E-02	7.8E-02	2.98E+01	2.98E+00	0.003	0.03
Pyrene	6.3E+00		1.8E-02	1.2E-02	2.3E-02	1.2E-01	7.4E-02	1.4E-01	7.7E-02	1.84E+01	1.84E+00	0.004	0.04
Polychlorinated Biphenyls													
Aroclor 1254	2.9E+00		1.5E+00	1.4E-03	8.9E-01	4.3E+00	4.0E-03	2.5E+00	5.2E-01	7.84E-01	7.84E-02	0.7	7
Aroclor 1260	1.0E+00	m	1.5E+00	7.3E-04	2.8E+00	1.5E+00	7.3E-04	2.8E+00	1.9E-01	7.84E-01	7.84E-02	0.2	2
Inorganics													
Arsenic	2.4E+01		3.9E-01	8.0E-03	1.0E-01	9.4E+00	1.9E-01	2.4E+00	1.3E+00	1.15E+01	1.15E+00	0.1	1
Cadmium	2.2E+00		2.8E+00	1.1E-01	2.8E-02	6.2E+00	2.4E-01	6.0E-02	7.1E-01	2.90E+00	2.90E-01	0.2	2
Copper	1.3E+04		6.8E-02	8.0E-02	5.0E-01	9.0E+02	1.1E+03	6.6E+03	2.8E+02	4.73E+01	3.65E+01	6	8
Lead	2.0E+03	avg	5.6E-02	9.0E-03	1.5E-02	1.1E+02	1.8E+01	3.0E+01	3.2E+01	1.70E+02	1.70E+01	0.2	2
Nickel	2.9E+01		2.6E-02	1.2E-02	3.0E-01	7.6E-01	3.5E-01	8.7E+00	4.3E-01	1.70E+02	1.70E+01	0.003	0.03
Selenium	7.0E-01		3.9E-01	5.0E-03	7.5E-01	2.7E-01	3.5E-03	5.3E-01	4.0E-02	6.76E-01	4.10E-01	0.06	0.1
Silver	1.8E+00		3.9E-01	8.0E-02	1.5E-01	7.1E-01	1.5E-01	2.7E-01	1.0E-01	3.58E+02	3.58E+01	0.0003	0.003
Zinc	2.9E+03		3.9E-01	3.0E-01	5.0E+00	1.1E+03	8.8E+02	1.5E+04	2.5E+02	6.49E+01	6.49E+00	4	40

Table A.5.ERA-6
Refined Scenario Food Chain Modeling for the Short-Tailed Shrew
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:

HQ =	Hazard Quotient.
LOAEL =	Lowest observed adverse effect level.
mg/kg =	Milligrams per kilogram.
mg/kg-BW-day =	Milligrams per kilogram of body weight per day.
NOAEL =	No observed adverse effect level.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
[b] See Table A.2-20 for sources of soil bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.
[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.
[e] See Table A.2-23 for sources of mammalian toxicity reference values.
[f] Refined hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.5.ERA-7
Maximum Scenario Food Chain Modeling for the American Robin
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration [a] (mg/kg)	Soil Bioconcentration Factors [b] Invertebrate	Estimated Dietary Tissue Concentrations [c] (mg/kg) Invertebrate	Maximum Estimated Dietary Ingestion [d] mg/kg-BW-day	Toxicity Reference Values [e] mg/kg-BW-day LOAEL	Toxicity Reference Values [e] mg/kg-BW-day NOAEL	Maximum Scenario HQ [f] LOAEL	Maximum Scenario HQ [f] NOAEL
Pesticides								
4,4'-DDD	2.5E-03	1.9E+00	4.8E-03	6.5E-04	2.80E-02	2.80E-03	0.02	0.2
4,4'-DDE	3.0E-03	1.9E+00	5.8E-03	7.8E-04	2.80E-02	2.80E-03	0.03	0.3
4,4'-DDT	6.7E-03	1.9E+00	1.3E-02	1.8E-03	2.80E-02	2.80E-03	0.06	0.6
BHC, beta-	1.7E-04	1.5E+00	2.5E-04	3.4E-05	2.25E+00	5.60E-01	0.00002	0.00006
BHC, delta-	1.0E-03	1.5E+00	1.5E-03	2.1E-04	2.25E+00	5.60E-01	0.00009	0.0004
Chlordane, alpha-	3.0E-03	1.5E+00	4.4E-03	6.0E-04	2.14E+01	2.14E+00	0.00003	0.0003
Dieldrin	9.1E-03	1.5E+00	1.3E-02	1.8E-03	7.70E-01	7.70E-02	0.002	0.02
Endrin	2.0E-02	1.5E+00	2.9E-02	4.0E-03	3.00E+00	3.00E-01	0.001	0.01
Endosulfan II	3.8E-03	1.5E+00	5.5E-03	7.5E-04	1.00E+02	1.00E+01	0.000008	0.00008
Heptachlor Epoxide	1.0E-03	1.5E+00	1.5E-03	2.1E-04	NA	NA	NA	NA
Methoxychlor	1.2E-02	6.7E+00	8.2E-02	1.1E-02	NA	NA	NA	NA
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	1.0E+00	5.0E-01	5.0E-01	7.7E-02	1.00E+02	1.00E+01	0.0008	0.008
Acenaphthylene	3.0E-01	5.0E-01	1.5E-01	2.3E-02	1.00E+02	1.00E+01	0.0002	0.002
Anthracene	2.1E+00	1.0E-02	2.1E-02	2.9E-02	1.00E+02	1.00E+01	0.0003	0.003
Benzo(a)anthracene	6.9E+00	2.5E-02	1.7E-01	1.1E-01	1.00E+02	1.00E+01	0.001	0.01
Benzo(a)pyrene	5.9E+00	6.8E-02	4.0E-01	1.3E-01	1.00E+02	1.00E+01	0.001	0.01
Benzo(b)fluoranthene	1.3E+01	5.1E-02	6.6E-01	2.5E-01	1.00E+02	1.00E+01	0.003	0.03
Benzo(g,h,i)perylene	3.5E+00	4.9E-02	1.7E-01	6.6E-02	1.00E+02	1.00E+01	0.0007	0.007
Benzo(k)fluoranthene	6.5E+00	5.1E-02	3.3E-01	1.2E-01	1.00E+02	1.00E+01	0.001	0.01
Chrysene	7.7E+00	3.5E-02	2.7E-01	1.3E-01	1.00E+02	1.00E+01	0.001	0.01
Dibenzo(a,h)anthracene	9.7E-01	7.4E-02	7.1E-02	2.1E-02	1.00E+02	1.00E+01	0.0002	0.002
Fluoranthene	2.2E+01	5.0E-01	1.1E+01	1.7E+00	1.00E+02	1.00E+01	0.02	0.2
Fluorene	1.3E+00	5.0E-01	6.5E-01	1.0E-01	1.00E+02	1.00E+01	0.001	0.01
Indeno(1,2,3-cd)pyrene	6.1E+00	8.4E-02	5.1E-01	1.4E-01	1.00E+02	1.00E+01	0.001	0.01
Phenanthrene	1.6E+01	2.4E-02	3.9E-01	2.5E-01	1.00E+02	1.00E+01	0.003	0.03
Pyrene	1.6E+01	1.8E-02	2.9E-01	2.4E-01	1.00E+02	1.00E+01	0.002	0.02
Polychlorinated Biphenyls								
Aroclor 1254	1.2E+01	1.5E+00	1.8E+01	2.5E+00	1.80E+00	1.80E-01	1	10
Aroclor 1260	1.0E+00	1.5E+00	1.5E+00	2.1E-01	1.80E+00	1.80E-01	0.1	1
Inorganics								
Arsenic	1.6E+02	3.9E-01	6.4E+01	1.0E+01	1.28E+01	5.14E+00	0.8	2
Cadmium	1.5E+01	2.8E+00	4.3E+01	5.7E+00	1.45E+01	1.45E+00	0.4	4
Copper	5.7E+04	6.8E-02	3.8E+03	1.2E+03	6.17E+01	4.70E+01	20	30
Lead	1.4E+04	5.6E-02	8.1E+02	2.9E+02	3.85E+01	3.85E+00	8	80
Nickel	2.1E+02	2.6E-02	5.5E+00	3.4E+00	1.07E+02	7.74E+01	0.03	0.04
Selenium	1.9E+00	3.9E-01	7.4E-01	1.2E-01	1.00E+00	5.00E-01	0.1	0.2
Silver	2.3E+01	3.9E-01	8.8E+00	1.4E+00	1.00E+00	5.00E-01	1	3
Zinc	2.2E+04	3.9E-01	8.5E+03	1.4E+03	1.31E+02	1.45E+01	10	100

Table A.5.ERA-7
Maximum Scenario Food Chain Modeling for the American Robin
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:

HQ =	Hazard Quotient.
LOAEL =	Lowest observed adverse effect level.
mg/kg =	Milligrams per kilogram.
mg/kg-BW-day =	Milligrams per kilogram of body weight per day.
NOAEL =	No observed adverse effect level.

[a] Maximum concentration detected in surface soil (mg/kg).
[b] See Table A.2-20 for sources of soil bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.
[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.
[e] See Table A.2-22 for sources of avian toxicity reference values.
[f] Maximum hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.5.ERA-8

Refined Scenario Food Chain Modeling for the American Robin

IGNITER ASSEMBLY AREA

New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)		Soil Bioconcentration Factors [b]		Estimated Dietary Tissue Concentrations [c] (mg/kg)		Refined Estimated Dietary Ingestion [d]	Toxicity Reference Values [e] mg/kg-BW-day		Refined Scenario HQ [f]	
			Invertebrate	Vegetation	Invertebrate	Vegetation	mg/kg-BW-day	LOAEL	NOAEL	LOAEL	NOAEL
Pesticides											
4,4'-DDD	1.9E-03		1.9E+00	2.7E-03	3.7E-03	5.1E-06	1.7E-04	2.80E-02	2.80E-03	0.006	0.06
4,4'-DDE	1.6E-03		1.9E+00	3.3E-03	3.0E-03	5.2E-06	1.4E-04	2.80E-02	2.80E-03	0.005	0.05
4,4'-DDT	3.7E-03		1.9E+00	1.6E-03	7.1E-03	6.0E-06	3.3E-04	2.80E-02	2.80E-03	0.01	0.1
BHC, beta-	1.7E-04	m	1.5E+00	4.9E-02	2.5E-04	8.4E-06	1.3E-05	2.25E+00	5.60E-01	0.000006	0.00002
BHC, delta-	1.0E-03	m	1.5E+00	1.9E-01	1.5E-03	1.9E-04	8.9E-05	2.25E+00	5.60E-01	0.00004	0.0002
Chlordane, alpha-	3.0E-03	m	1.5E+00	2.6E-03	4.4E-03	7.9E-06	2.1E-04	2.14E+01	2.14E+00	0.00001	0.0001
Dieldrin	6.6E-03		1.5E+00	1.6E-03	9.6E-03	1.1E-05	4.6E-04	7.70E-01	7.70E-02	0.0006	0.006
Endrin	6.4E-03		1.5E+00	1.8E-02	9.3E-03	1.1E-04	4.6E-04	3.00E+00	3.00E-01	0.0002	0.002
Endosulfan II	2.1E-03		1.5E+00	6.9E-02	3.1E-03	1.4E-04	1.6E-04	1.00E+02	1.00E+01	0.000002	0.00002
Heptachlor Epoxide	1.0E-03	m	1.5E+00	5.6E-03	1.5E-03	5.6E-06	7.3E-05	NA	NA	NA	NA
Methoxychlor	7.3E-03		6.7E+00	1.6E+00	4.9E-02	1.1E-02	3.0E-03	NA	NA	NA	NA
Polycyclic Aromatic Hydrocarbons											
Acenaphthene	1.3E-01		5.0E-01	4.2E-02	6.5E-02	5.4E-03	4.7E-03	1.00E+02	1.00E+01	0.00005	0.0005
Acenaphthylene	6.1E-02		5.0E-01	3.4E-02	3.0E-02	2.1E-03	2.1E-03	1.00E+02	1.00E+01	0.00002	0.0002
Anthracene	2.8E-01		1.0E-02	2.1E-02	2.8E-03	5.7E-03	4.1E-03	1.00E+02	1.00E+01	0.00004	0.0004
Benzo(a)anthracene	2.9E+00		2.5E-02	4.4E-03	7.3E-02	1.3E-02	4.1E-02	1.00E+02	1.00E+01	0.0004	0.004
Benzo(a)pyrene	3.0E+00		6.8E-02	2.7E-03	2.1E-01	8.0E-03	4.7E-02	1.00E+02	1.00E+01	0.0005	0.005
Benzo(b)fluoranthene	6.5E+00		5.1E-02	1.2E-03	3.3E-01	8.0E-03	9.6E-02	1.00E+02	1.00E+01	0.001	0.01
Benzo(g,h,i)perylene	1.4E+00		4.9E-02	6.1E-04	7.0E-02	8.7E-04	2.1E-02	1.00E+02	1.00E+01	0.0002	0.002
Benzo(k)fluoranthene	2.7E+00		5.1E-02	1.2E-03	1.3E-01	3.3E-03	3.9E-02	1.00E+02	1.00E+01	0.0004	0.004
Chrysene	4.0E+00		3.5E-02	4.5E-03	1.4E-01	1.8E-02	5.8E-02	1.00E+02	1.00E+01	0.0006	0.006
Dibenzo(a,h)anthracene	1.6E-01		7.4E-02	1.6E-03	1.2E-02	2.6E-04	2.6E-03	1.00E+02	1.00E+01	0.00003	0.0003
Fluoranthene	8.4E+00		5.0E-01	7.4E-03	4.2E+00	6.3E-02	2.8E-01	1.00E+02	1.00E+01	0.003	0.03
Fluorene	1.5E-01		5.0E-01	3.2E-02	7.7E-02	5.0E-03	5.4E-03	1.00E+02	1.00E+01	0.00005	0.0005
Indeno(1,2,3-cd)pyrene	3.0E+00		8.4E-02	2.7E-04	2.5E-01	8.3E-04	4.8E-02	1.00E+02	1.00E+01	0.0005	0.005
Phenanthrene	6.0E+00		2.4E-02	1.8E-02	1.5E-01	1.1E-01	9.1E-02	1.00E+02	1.00E+01	0.0009	0.009
Pyrene	6.3E+00		1.8E-02	1.2E-02	1.2E-01	7.4E-02	9.1E-02	1.00E+02	1.00E+01	0.0009	0.009
Polychlorinated Biphenyls											
Aroclor 1254	2.9E+00		1.5E+00	1.4E-03	4.3E+00	4.0E-03	2.1E-01	1.80E+00	1.80E-01	0.1	1
Aroclor 1260	1.0E+00	m	1.5E+00	7.3E-04	1.5E+00	7.3E-04	7.2E-02	1.80E+00	1.80E-01	0.04	0.4
Inorganics											
Arsenic	2.4E+01		3.9E-01	8.0E-03	9.4E+00	1.9E-01	6.9E-01	1.28E+01	5.14E+00	0.05	0.1
Cadmium	2.2E+00		2.8E+00	1.1E-01	6.2E+00	2.4E-01	2.9E-01	1.45E+01	1.45E+00	0.02	0.2
Copper	1.3E+04		6.8E-02	8.0E-02	9.0E+02	1.1E+03	3.0E+02	6.17E+01	4.70E+01	5	6
Lead	2.0E+03	avg	5.6E-02	9.0E-03	1.1E+02	1.8E+01	3.2E+01	3.85E+01	3.85E+00	0.8	8
Nickel	2.9E+01		2.6E-02	1.2E-02	7.6E-01	3.5E-01	4.3E-01	1.07E+02	7.74E+01	0.004	0.006
Selenium	7.0E-01		3.9E-01	5.0E-03	2.7E-01	3.5E-03	2.0E-02	1.00E+00	5.00E-01	0.02	0.04
Silver	1.8E+00		3.9E-01	8.0E-02	7.1E-01	1.5E-01	6.4E-02	1.00E+00	5.00E-01	0.06	0.1
Zinc	2.9E+03		3.9E-01	3.0E-01	1.1E+03	8.8E+02	1.6E+02	1.31E+02	1.45E+01	1	10

Notes:

HQ =	Hazard Quotient.
LOAEL =	Lowest observed adverse effect level.
mg/kg =	Milligrams per kilogram.
mg/kg-BW-day =	Milligrams per kilogram of body weight per day.
NOAEL =	No observed adverse effect level.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.

[b] See Table A.2-20 for sources of soil bioaccumulation factors.

[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.

[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.

[e] See Table A.2-22 for sources of avian toxicity reference values.

[f] Refined hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.5.ERA-9
Maximum Scenario Foodweb Modeling for the Mink
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Exposure Concentration [a] Sediment (mg/kg)	Sediment Bioaccumulation Factors (BAFsed) [b] Fish	Maximum Tissue Concentrations [b] (mg/kg) Fish	Maximum Daily Intake [c] mg/kg-BW-day	Mammalian Aquatic Reference Toxicity Values [d] mg/kg-BW-day LOAEL	NOAEL	Maximum Scenario HQ [e] LOAEL	NOAEL
Inorganics								
Arsenic	1.0E+01	1.0E+00	1.0E+01	6.0E-01	4.28E+00	4.28E-01	0.1	1
Cadmium	4.7E-01	1.0E+00	4.7E-01	3.0E-02	1.08E+00	1.08E-01	0.03	0.3
Copper	2.5E+01	1.0E+00	2.5E+01	1.0E+00	1.75E+01	1.36E+01	0.06	0.07
Lead	4.4E+01	1.0E+00	4.4E+01	3.0E+00	6.32E+01	6.32E+00	0.05	0.5
Nickel	1.5E+01	1.0E+00	1.5E+01	9.0E-01	6.32E+01	3.16E+01	0.01	0.03
Zinc	1.1E+02	1.0E+00	1.1E+02	6.0E+00	2.41E+01	2.41E+00	0.2	2

Notes:
–
HQ
LOAEL
mg/kg
mg/kg-BW-day
mg/L
NOAEL

[a] Exposure concentrations were maximum concentrations.
[b] See Table A.2-21 for sources of sediment bioaccumulation factors.
Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.
[c] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.
[d] See Table A.2-23 for sources of mammalian toxicity reference values.
[e] Maximum hazard quotient (HQ) = (maximum daily intake)/(toxicity reference value).

Table A.5.ERA-10
Refined Scenario Foodweb Modeling for the Mink
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Refined Exposure Concentration [a] Surface Water (mg/L)	Refined Exposure Concentration [a] Sediment (mg/kg)	Sediment Bioaccumulation Factors (BAFsed) [b] Fish	Refined Tissue Concentrations [b] (mg/kg) Fish	Refined Daily Intake [c] mg/kg-BW-day	Mammalian Aquatic Reference Toxicity Values [d] mg/kg-BW-day LOAEL	Mammalian Aquatic Reference Toxicity Values [d] mg/kg-BW-day NOAEL	Refined Scenario HQ [e] LOAEL	Refined Scenario HQ [e] NOAEL
Inorganics									
Arsenic	–	1.0E+01	1.0E+00	1.0E+01	6.0E-01	4.28E+00	4.28E-01	0.1	1
Cadmium	0.0E+00	4.7E-01	1.0E+00	4.7E-01	3.0E-02	1.08E+00	1.08E-01	0.03	0.3
Copper	0.0E+00	2.5E+01	1.0E+00	2.5E+01	1.0E+00	1.75E+01	1.36E+01	0.06	0.07
Lead	0.0E+00	3.6E+01	1.0E+00	3.6E+01	2.0E+00	6.32E+01	6.32E+00	0.03	0.3
Nickel	0.0E+00	1.5E+01	1.0E+00	1.5E+01	9.0E-01	6.32E+01	3.16E+01	0.01	0.03
Zinc	0.0E+00	1.1E+02	1.0E+00	1.1E+02	6.0E+00	2.41E+01	2.41E+00	0.2	2

Notes:

–	Not applicable.
HQ	Hazard Quotient.
LOAEL	Lowest observed adverse effect level.
mg/kg	Milligrams per kilogram.
mg/kg-BW-day	Milligrams per kilogram of body weight each day.
mg/L	Milligrams per liter.
NOAEL	No observed adverse effect level.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the refined concentration.
EPCs marked with "m" are the refined concentration; EPCs marked with "avg" are the average concentration.
[b] See Table A.2-21 for sources of sediment bioaccumulation factors.
Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.
[c] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.
[d] See Table A.2-23 for sources of mammalian toxicity reference values.
[e] Refined hazard quotient (HQ) = (refined daily intake)/(toxicity reference value).

Table A.5.ERA-11
Maximum Scenario Foodweb Modeling for the Great Blue Heron
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Exposure Concentration [a] Surface Water (mg/L)	Maximum Exposure Concentration [a] Sediment (mg/kg)	Sediment Bioaccumulation Factors (BAFsed) [b] Fish	Maximum Tissue Concentrations [b] (mg/kg) Fish	Maximum Daily Intake [c] mg/kg-BW-day	Avian Aquatic Reference Toxicity Values [d] mg/kg-BW-day LOAEL	Avian Aquatic Reference Toxicity Values [d] mg/kg-BW-day NOAEL	Maximum Scenario HQ [e] LOAEL	Maximum Scenario HQ [e] NOAEL
Inorganics									
Arsenic	–	1.0E+01	1.0E+00	1.0E+01	6.0E-01	1.28E+01	5.14E+00	0.05	0.1
Cadmium	0.0E+00	4.7E-01	1.0E+00	4.7E-01	3.0E-02	1.45E+01	1.45E+00	0.002	0.02
Copper	0.0E+00	2.5E+01	1.0E+00	2.5E+01	1.0E+00	6.17E+01	4.70E+01	0.02	0.02
Lead	0.0E+00	3.6E+01	1.0E+00	3.6E+01	2.0E+00	3.85E+01	3.85E+00	0.05	0.5
Nickel	0.0E+00	1.5E+01	1.0E+00	1.5E+01	8.0E-01	1.07E+02	7.74E+01	0.007	0.01
Zinc	0.0E+00	1.1E+02	1.0E+00	1.1E+02	6.0E+00	1.31E+02	1.45E+01	0.05	0.4

Notes:

–	Not applicable.
HQ	Hazard Quotient.
LOAEL	Lowest observed adverse effect level.
mg/kg	Milligrams per kilogram.
mg/kg-BW-day	Milligrams per kilogram of body weight each day.
mg/L	Milligrams per liter.
NOAEL	No observed adverse effect level.

[a] Exposure concentrations were maximum concentrations.
[b] See Table A.2-21 for sources of sediment bioaccumulation factors.
Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.
[c] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.
[d] See Table A.2-22 for sources of avian toxicity reference values.
[e] Maximum hazard quotient (HQ) = (maximum daily intake)/(toxicity reference value).

Table A.5.ERA-12
Refined Scenario Foodweb Modeling for the Great Blue Heron
IGNITER ASSEMBLY AREA
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

	Refined Exposure Concentration [a]		Sediment Bioaccumulation Factors (BAFsed) [b]	Refined Tissue Concentrations [b] (mg/kg)	Refined Daily Intake [c]	Avian Aquatic Reference Toxicity Values [d] mg/kg-BW-day		Refined Scenario HQ [e]	
	Surface Water	Sediment							
Constituent	(mg/L)	(mg/kg)	Fish	Fish	mg/kg-BW-day	LOAEL	NOAEL	LOAEL	NOAEL
Inorganics									
Arsenic	–	1.0E+01	1.0E+00	1.0E+01	6.0E-01	1.28E+01	5.14E+00	0.05	0.1
Cadmium	0.0E+00	4.7E-01	1.0E+00	4.7E-01	3.0E-02	1.45E+01	1.45E+00	0.002	0.02
Copper	0.0E+00	2.5E+01	1.0E+00	2.5E+01	1.0E+00	6.17E+01	4.70E+01	0.02	0.02
Lead	0.0E+00	3.6E+01	1.0E+00	3.6E+01	2.0E+00	3.85E+01	3.85E+00	0.05	0.5
Nickel	0.0E+00	1.5E+01	1.0E+00	1.5E+01	8.0E-01	1.07E+02	7.74E+01	0.007	0.01
Zinc	0.0E+00	1.1E+02	1.0E+00	1.1E+02	6.0E+00	1.31E+02	1.45E+01	0.05	0.4

Notes:

–	Not applicable.
HQ	Hazard Quotient.
LOAEL	Lowest observed adverse effect level.
mg/kg	Milligrams per kilogram.
mg/kg-BW-day	Milligrams per kilogram of body weight each day.
mg/L	Milligrams per liter.
NOAEL	No observed adverse effect level.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration.
EPCs marked with "m" are the maximum concentration; EPCs marked with "avg" are the average concentration.
[b] See Table A.2-21 for sources of sediment bioaccumulation factors.
Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.
[c] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.
[d] See Table A.2-22 for sources of avian toxicity reference values.
[e] Refined hazard quotient (HQ) = (refined daily intake)/(toxicity reference value).

Table A.6.Data-1
Surface Soil Risk Assessment Dataset
Surface Soil (0-1 foot Depth Interval)
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Volatile Organic Compounds												
2-Butanone	78-93-3	1	-	16	6	0.016	-	0.016	0.0053	-	0.0067	RYSS06
3-Octanone	106-68-3	3	-	3	100	0.009	-	0.15	–	-	–	RYSS06
Acetone	67-64-1	4	-	16	25	0.017	-	0.31	0.0053	-	0.0067	RYSS06
Ethanol	64-17-5	2	-	2	100	0.0062	-	0.087	–	-	–	RYSS06
Methylene Chloride	75-09-2	5	-	21	24	0.00061	-	3	0.0056	-	0.0067	SS-08a
Semi-Volatile Organic Compounds												
2,4-Dinitrotoluene	121-14-2	2	-	24	8	0.06	-	0.4	0.2	-	0.3	SS-08
2,6-Dinitrotoluene	606-20-2	1	-	24	4	0.32	-	0.32	0.2	-	0.3	SS-08
Benzoic Acid	65-85-0	2	-	21	10	0.15	-	0.17	0.99	-	2.6	RYSS14
bis(2-Ethylhexyl)phthalate	117-81-7	8	-	26	31	0.038	-	1.8	0.2	-	0.52	SS-07
Carbazole	86-74-8	2	-	24	8	0.1	-	0.12	0.2	-	0.52	RYSS07
Dibenzofuran	132-64-9	1	-	21	5	0.045	-	0.045	0.2	-	0.52	RYSS07
Diethylphthalate	84-66-2	1	-	21	5	0.09	-	0.09	0.2	-	0.52	RYSB7
Di-n-Butylphthalate	84-74-2	4	-	23	17	0.06	-	1.1	0.2	-	0.52	SS-08
Pentachlorophenol	87-86-5	2	-	24	8	0.11	-	830	0.97	-	2.6	TR-02C
Explosives												
4-Amino-2,6-Dinitrotoluene	19406-51-0	1	-	22	5	0.05	-	0.05	0.2	-	0.3	RYSS04
Pesticides												
4,4'-DDE	72-55-9	2	-	10	20	0.01	-	0.04	0.00083	-	0.00882	TR-02A
Alpha-BHC	319-84-6	4	-	6	67	0.00052	-	0.00077	0.0079	-	0.00882	RYSS10
Beta-BHC	319-85-7	2	-	6	33	0.00017	-	0.00025	0.00083	-	0.00882	RYSS10
Alpha-Chlordane	5103-71-9	2	-	10	20	0.02	-	0.03	0.00083	-	0.00882	SS-08
Dieldrin	60-57-1	1	-	9	11	0.27	-	0.27	0.00083	-	0.00882	TR-02C
Endrin Aldehyde	7421-93-4	1	-	8	12	0.04	-	0.04	0.00083	-	0.00882	SS-08
Polycyclic Aromatic Hydrocarbons												
2-Methylnaphthalene	91-57-6	12	-	23	52	0.00088	-	0.04	0.0021	-	0.52	SS-08
Acenaphthene	83-32-9	3	-	21	14	0.0011	-	0.0065	0.002	-	0.52	RYSS07
Acenaphthylene	208-96-8	4	-	24	17	0.00097	-	0.07	0.002	-	0.52	TR-02A
Anthracene	120-12-7	8	-	24	33	0.0015	-	0.1	0.002	-	0.52	TR-02A
Benzo(a)anthracene	56-55-3	15	-	26	58	0.0011	-	0.4	0.0022	-	0.52	TR-02A
Benzo(a)pyrene	50-32-8	15	-	26	58	0.0011	-	0.4	0.0022	-	0.52	TR-02A
Benzo(b)fluoranthene	205-99-2	15	-	26	58	0.002	-	1	0.0022	-	0.52	TR-02A
Benzo(g,h,i)perylene	191-24-2	13	-	21	62	0.0016	-	0.037	0.0022	-	0.52	RYSS05
Benzo(k)fluoranthene	207-08-9	14	-	26	54	0.00083	-	0.56	0.0022	-	0.52	TR-02A
Chrysene	218-01-9	15	-	26	58	0.0013	-	0.66	0.0022	-	0.52	TR-02A
Dibenzo(a,h)anthracene	53-70-3	7	-	24	29	0.0016	-	0.05	0.002	-	0.52	TR-02A
Fluoranthene	206-44-0	15	-	26	58	0.0015	-	0.39	0.0022	-	0.52	TR-02A
Fluorene	86-73-7	3	-	21	14	0.0011	-	0.0067	0.002	-	0.52	RYSS07
Indeno(1,2,3-cd)pyrene	193-39-5	14	-	24	58	0.0014	-	0.11	0.0022	-	0.52	TR-02A
Naphthalene	91-20-3	12	-	21	57	0.00097	-	0.0069	0.0021	-	0.52	RYSS04

Table A.6.Data-1
Surface Soil Risk Assessment Dataset
Surface Soil (0-1 foot Depth Interval)
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)		Detects Max (mg/kg)	Detection Limits Min (mg/kg)		Detection Limits Max (mg/kg)	Maximum Location
Phenanthrene	85-01-8	15	-	26	58	0.0013	-	0.1	0.0022	-	0.52	SS-08
Pyrene	129-00-0	15	-	26	58	0.001	-	0.86	0.0022	-	0.52	TR-02A
Polychlorinated Biphenyls												
Aroclor 1254	11097-69-1	7	-	26	27	0.02	-	1.7	0.03	-	0.04	SS-08
Inorganics												
Aluminum	7429-90-5	25	-	25	100	338	-	43600	–	-	–	RYSS15
Antimony	7440-36-0	11	-	22	50	0.21	-	0.58	0.51	-	0.78	RYSS12
Arsenic	7440-38-2	25	-	25	100	1.39	-	20.8	–	-	–	SS-08
Barium	7440-39-3	25	-	25	100	11.1	-	1770	–	-	–	SS-07
Beryllium	7440-41-7	23	-	25	92	0.21	-	2.46	0.1	-	0.1	RYSS10
Cadmium	7440-43-9	6	-	25	24	0.06	-	1.8	0.1	-	0.16	SS-08
Calcium	7440-70-2	25	-	25	100	611	-	196000	–	-	–	SS-07
Chromium	7440-47-3	24	-	25	96	3.1	-	59	–	-	–	RYSS04
Cobalt	7440-48-4	24	-	25	96	1.3	-	74.9	–	-	–	RYSB4
Copper	7440-50-8	24	-	25	96	2.3	-	60.2	–	-	–	SS-08
Iron	7439-89-6	25	-	25	100	2600	-	50100	–	-	–	RYSS04
Lead	7439-92-1	25	-	25	100	1.8	-	149	–	-	–	SS-08
Magnesium	7439-95-4	25	-	25	100	606	-	104000	–	-	–	SS-07
Manganese	7439-96-5	25	-	25	100	92.7	-	791	–	-	–	RYSS14
Mercury	7439-97-6	19	-	23	83	0.02	-	0.41	0.11	-	0.14	RYSB7
Nickel	7440-02-0	24	-	25	96	1.6	-	42.2	–	-	–	RYSS01
Potassium	7440-09-7	24	-	25	96	162	-	4570	–	-	–	RYSS02
Selenium	7782-49-2	3	-	22	14	0.43	-	1	0.58	-	1.35	RYSB1
Sodium	7440-23-5	22	-	22	100	5.1	-	331	–	-	–	RYSB1
Thallium	7440-28-0	20	-	25	80	0.09	-	0.89	0.21	-	0.31	RYSB7
Vanadium	7440-62-2	25	-	25	100	5	-	91.5	–	-	–	SS-08a
Zinc	7440-66-6	25	-	25	100	7.1	-	752	–	-	–	SS-08

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilogram.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table A.6.Data-2
Surface Soil Risk Assessment Dataset
Surface Soil (0-2 foot Depth Interval)
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Volatile Organic Compounds												
2-Butanone	78-93-3	1	-	16	6	0.016	-	0.016	0.0053	-	0.0067	RYSS06
3-Octanone	106-68-3	3	-	3	100	0.009	-	0.15	–	-	–	RYSS06
Acetone	67-64-1	4	-	16	25	0.017	-	0.31	0.0053	-	0.0067	RYSS06
Ethanol	64-17-5	2	-	2	100	0.0062	-	0.087	–	-	–	RYSS06
Methylene Chloride	75-09-2	5	-	21	24	0.00061	-	3	0.0056	-	0.0067	SS-08a
Semi-Volatile Organic Compounds												
2,4-Dinitrotoluene	121-14-2	2	-	25	8	0.06	-	0.4	0.2	-	0.3	SS-08
2,6-Dinitrotoluene	606-20-2	1	-	25	4	0.32	-	0.32	0.2	-	0.3	SS-08
Benzoic Acid	65-85-0	2	-	22	9	0.15	-	0.17	0.99	-	2.6	RYSS14
bis(2-Ethylhexyl)phthalate	117-81-7	8	-	27	30	0.038	-	1.8	0.2	-	0.52	SS-07
Carbazole	86-74-8	2	-	25	8	0.1	-	0.12	0.2	-	0.52	RYSS07
Dibenzofuran	132-64-9	1	-	22	5	0.045	-	0.045	0.2	-	0.52	RYSS07
Diethylphthalate	84-66-2	1	-	22	5	0.09	-	0.09	0.2	-	0.52	RYSB7
Di-n-Butylphthalate	84-74-2	5	-	24	21	0.06	-	1.1	0.2	-	0.52	SS-08
Pentachlorophenol	87-86-5	2	-	25	8	0.11	-	830	0.97	-	2.6	TR-02C
Explosives												
4-Amino-2,6-Dinitrotoluene	19406-51-0	1	-	23	4	0.05	-	0.05	0.2	-	0.3	RYSS04
Pesticides												
4,4'-DDE	72-55-9	2	-	10	20	0.01	-	0.04	0.00083	-	0.00882	TR-02A
Alpha-BHC	319-84-6	4	-	6	67	0.00052	-	0.00077	0.0079	-	0.00882	RYSS10
Beta-BHC	319-85-7	2	-	6	33	0.00017	-	0.00025	0.00083	-	0.00882	RYSS10
Alpha-Chlordane	5103-71-9	2	-	10	20	0.02	-	0.03	0.00083	-	0.00882	SS-08
Dieldrin	60-57-1	1	-	9	11	0.27	-	0.27	0.00083	-	0.00882	TR-02C
Endrin Aldehyde	7421-93-4	1	-	8	12	0.04	-	0.04	0.00083	-	0.00882	SS-08
Polycyclic Aromatic Hydrocarbons												
2-Methylnaphthalene	91-57-6	12	-	24	50	0.00088	-	0.04	0.0021	-	0.52	SS-08
Acenaphthene	83-32-9	3	-	22	14	0.0011	-	0.0065	0.002	-	0.52	RYSS07
Acenaphthylene	208-96-8	4	-	25	16	0.00097	-	0.07	0.002	-	0.52	TR-02A
Anthracene	120-12-7	8	-	25	32	0.0015	-	0.1	0.002	-	0.52	TR-02A
Benzo(a)anthracene	56-55-3	15	-	27	56	0.0011	-	0.4	0.0022	-	0.52	TR-02A
Benzo(a)pyrene	50-32-8	15	-	27	56	0.0011	-	0.4	0.0022	-	0.52	TR-02A
Benzo(b)fluoranthene	205-99-2	15	-	27	56	0.002	-	1	0.0022	-	0.52	TR-02A
Benzo(g,h,i)perylene	191-24-2	13	-	22	59	0.0016	-	0.037	0.0022	-	0.52	RYSS05
Benzo(k)fluoranthene	207-08-9	14	-	27	52	0.00083	-	0.56	0.0022	-	0.52	TR-02A
Chrysene	218-01-9	15	-	27	56	0.0013	-	0.66	0.0022	-	0.52	TR-02A
Dibenzo(a,h)anthracene	53-70-3	7	-	25	28	0.0016	-	0.05	0.002	-	0.52	TR-02A
Fluoranthene	206-44-0	15	-	27	56	0.0015	-	0.39	0.0022	-	0.52	TR-02A
Fluorene	86-73-7	3	-	22	14	0.0011	-	0.0067	0.002	-	0.52	RYSS07
Indeno(1,2,3-cd)pyrene	193-39-5	14	-	25	56	0.0014	-	0.11	0.0022	-	0.52	TR-02A
Naphthalene	91-20-3	12	-	22	55	0.00097	-	0.0069	0.0021	-	0.52	RYSS04

Table A.6.Data-2
Surface Soil Risk Assessment Dataset
Surface Soil (0-2 foot Depth Interval)
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Phenanthrene	85-01-8	15	-	27	56	0.0013	-	0.1	0.0022	-	0.52	SS-08
Pyrene	129-00-0	15	-	27	56	0.001	-	0.86	0.0022	-	0.52	TR-02A
Polychlorinated Biphenyls												
Aroclor 1254	11097-69-1	7	-	26	27	0.02	-	1.7	0.03	-	0.04	SS-08
Inorganics												
Aluminum	7429-90-5	26	-	26	100	338	-	43600	–	-	–	RYSS15
Antimony	7440-36-0	11	-	23	48	0.21	-	0.58	0.51	-	0.78	RYSS12
Arsenic	7440-38-2	26	-	26	100	1.39	-	20.8	–	-	–	SS-08
Barium	7440-39-3	26	-	26	100	11.1	-	1770	–	-	–	SS-07
Beryllium	7440-41-7	24	-	26	92	0.13	-	2.46	0.1	-	0.1	RYSS10
Cadmium	7440-43-9	6	-	26	23	0.06	-	1.8	0.1	-	0.16	SS-08
Calcium	7440-70-2	26	-	26	100	611	-	196000	–	-	–	SS-07
Chromium	7440-47-3	25	-	26	96	3.1	-	59	–	-	–	RYSS04
Cobalt	7440-48-4	25	-	26	96	1.3	-	74.9	–	-	–	RYSB4
Copper	7440-50-8	25	-	26	96	2.3	-	60.2	–	-	–	SS-08
Iron	7439-89-6	26	-	26	100	2600	-	50100	–	-	–	RYSS04
Lead	7439-92-1	26	-	26	100	1.8	-	149	–	-	–	SS-08
Magnesium	7439-95-4	26	-	26	100	266	-	104000	–	-	–	SS-07
Manganese	7439-96-5	26	-	26	100	36.6	-	791	–	-	–	RYSS14
Mercury	7439-97-6	19	-	24	79	0.02	-	0.41	0.11	-	0.14	RYSB7
Nickel	7440-02-0	25	-	26	96	1.6	-	42.2	–	-	–	RYSS01
Potassium	7440-09-7	25	-	26	96	162	-	4570	–	-	–	RYSS02
Selenium	7782-49-2	3	-	23	13	0.43	-	1	0.58	-	1.35	RYSB1
Sodium	7440-23-5	23	-	23	100	5.1	-	331	–	-	–	RYSB1
Thallium	7440-28-0	20	-	26	77	0.09	-	0.89	0.21	-	0.31	RYSB7
Vanadium	7440-62-2	26	-	26	100	5	-	91.5	–	-	–	SS-08a
Zinc	7440-66-6	26	-	26	100	6.1	-	752	–	-	–	SS-08

Notes:

– =	Not detected/ not analyzed/ not applicable.	PAH =	Polycyclic Aromatic Hydrocarbon.
CASN =	Chemical abstracts registry number.	USEPA =	United States Environmental Protection Agency.
mg/kg =	Milligrams per kilogram.	VOC =	Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.

[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table A.6.Data-3
Soil Risk Assessment Dataset
Combined Surface and Subsurface Soil
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)		Detects Max (mg/kg)	Detection Limits Min (mg/kg)		Detection Limits Max (mg/kg)	Maximum Location
Volatile Organic Compounds												
2-Butanone	78-93-3	1	-	19	5	0.016	-	0.016	0.0053	-	0.0086	RYSS06
3-Octanone	106-68-3	3	-	3	100	0.009	-	0.15	–	-	–	RYSS06
Acetone	67-64-1	4	-	19	21	0.017	-	0.31	0.0053	-	0.0086	RYSS06
Ethanol	64-17-5	2	-	2	100	0.0062	-	0.087	–	-	–	RYSS06
Methylene Chloride	75-09-2	5	-	24	21	0.00061	-	3	0.0056	-	0.0086	SS-08a
Semi-Volatile Organic Compounds												
2,4-Dinitrotoluene	121-14-2	2	-	34	6	0.06	-	0.4	0.2	-	0.3	SS-08
2,6-Dinitrotoluene	606-20-2	1	-	34	3	0.32	-	0.32	0.2	-	0.3	SS-08
Benzoic Acid	65-85-0	2	-	31	6	0.15	-	0.17	0.99	-	2.6	RYSS14
bis(2-Ethylhexyl)phthalate	117-81-7	9	-	36	25	0.038	-	1.8	0.2	-	0.52	SS-07
Carbazole	86-74-8	2	-	34	6	0.1	-	0.12	0.2	-	0.52	RYSS07
Dibenzofuran	132-64-9	1	-	31	3	0.045	-	0.045	0.2	-	0.52	RYSS07
Diethylphthalate	84-66-2	3	-	31	10	0.09	-	1.1	0.2	-	0.52	RYSB6
Di-n-Butylphthalate	84-74-2	6	-	33	18	0.06	-	1.1	0.2	-	0.52	SS-08
Pentachlorophenol	87-86-5	2	-	34	6	0.11	-	830	0.97	-	2.6	TR-02C
Explosives												
4-Amino-2,6-Dinitrotoluene	19406-51-0	2	-	32	6	0.04	-	0.05	0.2	-	0.3	RYSS04
Pesticides												
4,4'-DDE	72-55-9	2	-	10	20	0.01	-	0.04	0.00083	-	0.00882	TR-02A
Alpha-BHC	319-84-6	4	-	6	67	0.00052	-	0.00077	0.0079	-	0.00882	RYSS10
Beta-BHC	319-85-7	2	-	6	33	0.00017	-	0.00025	0.00083	-	0.00882	RYSS10
Alpha-Chlordane	5103-71-9	2	-	10	20	0.02	-	0.03	0.00083	-	0.00882	SS-08
Dieldrin	60-57-1	1	-	9	11	0.27	-	0.27	0.00083	-	0.00882	TR-02C
Endrin Aldehyde	7421-93-4	1	-	8	12	0.04	-	0.04	0.00083	-	0.00882	SS-08
Polycyclic Aromatic Hydrocarbons												
2-Methylnaphthalene	91-57-6	13	-	33	39	0.00088	-	0.04	0.0021	-	0.52	SS-08
Acenaphthene	83-32-9	3	-	31	10	0.0011	-	0.0065	0.002	-	0.52	RYSS07
Acenaphthylene	208-96-8	4	-	34	12	0.00097	-	0.07	0.002	-	0.52	TR-02A
Anthracene	120-12-7	8	-	34	24	0.0015	-	0.1	0.002	-	0.52	TR-02A
Benzo(a)anthracene	56-55-3	15	-	36	42	0.0011	-	0.4	0.0022	-	0.52	TR-02A
Benzo(a)pyrene	50-32-8	15	-	36	42	0.0011	-	0.4	0.0022	-	0.52	TR-02A
Benzo(b)fluoranthene	205-99-2	15	-	36	42	0.002	-	1	0.0022	-	0.52	TR-02A
Benzo(g,h,i)perylene	191-24-2	13	-	31	42	0.0016	-	0.037	0.0022	-	0.52	RYSS05
Benzo(k)fluoranthene	207-08-9	14	-	36	39	0.00083	-	0.56	0.0022	-	0.52	TR-02A
Chrysene	218-01-9	15	-	36	42	0.0013	-	0.66	0.0022	-	0.52	TR-02A
Dibenzo(a,h)anthracene	53-70-3	7	-	34	21	0.0016	-	0.05	0.002	-	0.52	TR-02A
Fluoranthene	206-44-0	15	-	36	42	0.0015	-	0.39	0.0022	-	0.52	TR-02A
Fluorene	86-73-7	3	-	31	10	0.0011	-	0.0067	0.002	-	0.52	RYSS07
Indeno(1,2,3-cd)pyrene	193-39-5	14	-	34	41	0.0014	-	0.11	0.0022	-	0.52	TR-02A
Naphthalene	91-20-3	13	-	31	42	0.00097	-	0.0069	0.0021	-	0.52	RYSS04

Table A.6.Data-3
Soil Risk Assessment Dataset
Combined Surface and Subsurface Soil
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b]				Detects			Detection Limits			Maximum Location
		number of detects / number of samples			FOD %	Min (mg/kg)	-	Max (mg/kg)	Min (mg/kg)	-	Max (mg/kg)	
Phenanthrene	85-01-8	15	-	36	42	0.0013	-	0.1	0.0022	-	0.52	SS-08
Pyrene	129-00-0	15	-	36	42	0.001	-	0.86	0.0022	-	0.52	TR-02A
Polychlorinated Biphenyls												
Aroclor 1254	11097-69-1	7	-	29	24	0.02	-	1.7	0.03	-	0.05	SS-08
Inorganics												
Aluminum	7429-90-5	35	-	35	100	338	-	43600	–	-	–	RYSS15
Antimony	7440-36-0	12	-	32	38	0.21	-	0.58	0.51	-	0.78	RYSS12
Arsenic	7440-38-2	35	-	35	100	1.39	-	20.8	–	-	–	SS-08
Barium	7440-39-3	35	-	35	100	11.1	-	1770	–	-	–	SS-07
Beryllium	7440-41-7	33	-	35	94	0.13	-	4.3	0.1	-	0.1	RYSB1
Cadmium	7440-43-9	6	-	35	17	0.06	-	1.8	0.1	-	0.16	SS-08
Calcium	7440-70-2	35	-	35	100	60	-	196000	–	-	–	SS-07
Chromium	7440-47-3	34	-	35	97	3.1	-	59	–	-	–	RYSS04
Cobalt	7440-48-4	34	-	35	97	1.3	-	74.9	–	-	–	RYSB4
Copper	7440-50-8	34	-	35	97	2.3	-	60.2	–	-	–	SS-08
Iron	7439-89-6	35	-	35	100	2600	-	50100	–	-	–	RYSS04
Lead	7439-92-1	35	-	35	100	1.8	-	149	–	-	–	SS-08
Magnesium	7439-95-4	35	-	35	100	190	-	104000	–	-	–	SS-07
Manganese	7439-96-5	35	-	35	100	36.6	-	791	–	-	–	RYSS14
Mercury	7439-97-6	23	-	33	70	0.02	-	0.46	0.07	-	0.14	RYSB1
Nickel	7440-02-0	34	-	35	97	1.6	-	42.2	–	-	–	RYSS01
Potassium	7440-09-7	34	-	35	97	162	-	4570	–	-	–	RYSS02
Selenium	7782-49-2	3	-	32	9	0.43	-	1	0.58	-	1.57	RYSB1
Sodium	7440-23-5	32	-	32	100	5.1	-	331	–	-	–	RYSB1
Thallium	7440-28-0	24	-	35	69	0.09	-	0.89	0.21	-	0.31	RYSB7
Vanadium	7440-62-2	35	-	35	100	5	-	91.5	–	-	–	SS-08a
Zinc	7440-66-6	35	-	35	100	6.1	-	752	–	-	–	SS-08

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilogram.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table A.6.Data-4
Sediment Risk Assessment Dataset
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects /		number of samples	FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Volatile Organic Compounds												
2-Butanone	78-93-3	2	-	14	14	0.01	-	0.1	0.0054	-	0.012	RYSD04
Acetone	67-64-1	5	-	14	36	0.003	-	0.53	0.0054	-	0.009	RYSD04
Carbon Disulfide	75-15-0	3	-	11	27	0.00062	-	0.0022	0.0054	-	0.009	RYSD04
Methylene Chloride	75-09-2	3	-	14	21	0.001	-	0.003	0.0054	-	0.016	SD-03,SD-05
Semi-Volatile Organic Compounds										-		
4-Methylphenol	106-44-5	1	-	11	9	0.036	-	0.036	0.18	-	0.52	RYSD05
Benzoic Acid	65-85-0	1	-	11	9	0.28	-	0.28	0.9	-	2.6	RYSD03
bis(2-Ethylhexyl)phthalate	117-81-7	10	-	14	71	0.047	-	0.33	0.3	-	0.52	RYSD09
Di-n-Butylphthalate	84-74-2	1	-	11	9	0.069	-	0.069	0.18	-	0.52	RYSD10
Explosives										-		
Nitroglycerine	55-63-0	2	-	11	18	0.26	-	0.57	0.32	-	0.93	RYSD03
Pentaerythritol Tetranitrate	78-11-5	2	-	11	18	0.13	-	0.23	0.36	-	0.93	RYSD09
Herbicides										-		
2,4,5-T	93-76-5	3	-	11	27	0.00567	-	0.0334	0.012	-	1.08	RYSD04
2,4,5-TP	93-72-1	2	-	11	18	0.00976	-	0.104	0.0118	-	1.08	RYSD04
2,4-D	94-75-7	1	-	11	9	0.209	-	0.209	0.024	-	2.17	RYSD08
Dalapon	75-99-0	1	-	11	9	0.107	-	0.107	0.118	-	10.8	RYSD07
Dicamba	1918-00-9	1	-	11	9	0.0497	-	0.0497	0.0235	-	2.17	RYSD04
Dichlorprop	120-36-5	1	-	11	9	0.353	-	0.353	0.0235	-	2.17	RYSD04
MCPP	93-65-2	1	-	11	9	3.53	-	3.53	12	-	1080	RYSD08
Pesticides										-		
4,4'-DDD	72-54-8	4	-	11	36	0.00068	-	0.00209	0.00072	-	0.00819	RYSD12
4,4'-DDE	72-55-9	7	-	11	64	0.00031	-	0.0084	0.00116	-	0.00819	RYSD12
4,4'-DDT	50-29-3	6	-	11	55	0.00055	-	0.004	0.00078	-	0.00819	RYSD10
Alpha-BHC	319-84-6	2	-	11	18	0.00052	-	0.00059	0.00072	-	0.00819	RYSD03
Delta-BHC	319-86-8	2	-	11	18	0.00099	-	0.0012	0.00078	-	0.00819	RYSD10
Gamma-BHC (Lindane)	58-89-9	1	-	11	9	0.00097	-	0.00097	0.00072	-	0.00819	RYSD06
Alpha-Chlordane	5103-71-9	4	-	11	36	0.00087	-	0.0101	0.00078	-	0.00819	RYSD09
Gamma-Chlordane	5566-34-7	4	-	11	36	0.00081	-	0.013	0.00078	-	0.00819	RYSD10
Dieldrin	60-57-1	4	-	11	36	0.00174	-	0.0041	0.00078	-	0.00819	RYSD10
Endosulfan II	33213-65-9	3	-	11	27	0.00025	-	0.00072	0.00078	-	0.00819	RYSD06
Endrin	72-20-8	1	-	11	9	0.0125	-	0.0125	0.00072	-	0.00819	RYSD10
Endrin Aldehyde	7421-93-4	1	-	14	7	0.04	-	0.04	0.00072	-	0.00819	SD-04
Endrin Ketone	53494-70-5	1	-	11	9	0.00203	-	0.00203	0.00072	-	0.00819	RYSD10
Heptachlor	76-44-8	2	-	11	18	0.00084	-	0.00213	0.00078	-	0.00819	RYSD10
Heptachlor Epoxide	1024-57-3	2	-	11	18	0.00399	-	0.00726	0.00078	-	0.00819	RYSD09

Table A.6.Data-4
Sediment Risk Assessment Dataset
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects /		number of samples	FOD %	Detects Min (mg/kg)	-	Max (mg/kg)	Detection Limits Min (mg/kg)	-	Max (mg/kg)	Maximum Location
Methoxychlor	72-43-5	1	-	11	9	0.0026	-	0.0026	0.00072	-	0.00819	RYSD03
Polycyclic Aromatic Hydrocarbons										-		
2-Methylnaphthalene	91-57-6	6	-	11	55	0.0014	-	0.04	0.2	-	0.3	RYSD04
Acenaphthene	83-32-9	3	-	11	27	0.0019	-	0.059	0.003	-	0.3	RYSD06
Acenaphthylene	208-96-8	4	-	11	36	0.0026	-	0.026	0.003	-	0.3	RYSD01,RYSD04
Anthracene	120-12-7	5	-	11	45	0.0034	-	0.081	0.003	-	0.3	RYSD06
Benzo(a)anthracene	56-55-3	9	-	11	82	0.0038	-	0.19	0.003	-	0.2	RYSD06
Benzo(a)pyrene	50-32-8	7	-	11	64	0.0058	-	0.17	0.003	-	0.3	RYSD06
Benzo(b)fluoranthene	205-99-2	7	-	11	64	0.011	-	0.25	0.003	-	0.3	RYSD06
Benzo(g,h,i)perylene	191-24-2	5	-	11	45	0.0038	-	0.1	0.003	-	0.3	RYSD06
Benzo(k)fluoranthene	207-08-9	7	-	11	64	0.0029	-	0.08	0.003	-	0.3	RYSD06
Chrysene	218-01-9	9	-	11	82	0.0053	-	0.17	0.003	-	0.2	RYSD06
Dibenzo(a,h)anthracene	53-70-3	3	-	11	27	0.0036	-	0.026	0.003	-	0.3	RYSD06
Fluoranthene	206-44-0	10	-	14	71	0.0079	-	0.44	0.003	-	0.2	RYSD06
Fluorene	86-73-7	4	-	11	36	0.0019	-	0.046	0.003	-	0.3	RYSD06
Indeno(1,2,3-cd)pyrene	193-39-5	5	-	11	45	0.004	-	0.12	0.003	-	0.3	RYSD06
Naphthalene	91-20-3	4	-	11	36	0.0049	-	0.043	0.003	-	0.3	RYSD04
Phenanthrene	85-01-8	8	-	11	73	0.0065	-	0.36	0.003	-	0.2	RYSD06
Pyrene	129-00-0	9	-	11	82	0.011	-	0.3	0.003	-	0.2	RYSD06
Inorganics										-		
Aluminum	7429-90-5	14	-	14	100	6660	-	27000	–	-	–	SD-05
Antimony	7440-36-0	8	-	11	73	0.34	-	1	0.79	-	0.89	RYSD03
Arsenic	7440-38-2	14	-	14	100	2.2	-	11.8	–	-	–	RYSD08,RYSD10
Barium	7440-39-3	14	-	14	100	30.4	-	113	–	-	–	SD-04
Beryllium	7440-41-7	14	-	14	100	0.42	-	1.67	–	-	–	RYSD08
Cadmium	7440-43-9	8	-	11	73	0.08	-	0.21	0.11	-	0.31	RYSD01
Calcium	7440-70-2	14	-	14	100	1850	-	176000	–	-	–	SD-03
Chromium	7440-47-3	14	-	14	100	13.6	-	80.9	–	-	–	RYSD03
Cobalt	7440-48-4	14	-	14	100	5.1	-	15	–	-	–	RYSD08
Copper	7440-50-8	14	-	14	100	4.95	-	47.6	–	-	–	SD-03
Iron	7439-89-6	14	-	14	100	8760	-	79600	–	-	–	RYSD08
Lead	7439-92-1	14	-	14	100	10.9	-	33	–	-	–	RYSD08
Magnesium	7439-95-4	14	-	14	100	1560	-	42500	–	-	–	RYSD09
Manganese	7439-96-5	14	-	14	100	90.9	-	1220	–	-	–	SD-04
Mercury	7439-97-6	9	-	11	82	0.03	-	0.08	0.07	-	0.15	RYSD07,RYSD08
Nickel	7440-02-0	14	-	14	100	6	-	24.5	–	-	–	RYSD08
Potassium	7440-09-7	14	-	14	100	400	-	2620	–	-	–	RYSD05

Table A.6.Data-4
Sediment Risk Assessment Dataset
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b]				Detects			Detection Limits			Maximum Location
		number of detects / number of samples			FOD %	Min	-	Max	Min	-	Max	
						(mg/kg)		(mg/kg)	(mg/kg)		(mg/kg)	
Selenium	7782-49-2	5	-	14	36	0.42	-	1.7	1.08	-	2.32	SD-05
Sodium	7440-23-5	12	-	14	86	13	-	110	–	-	–	SD-04
Thallium	7440-28-0	11	-	11	100	0.07	-	0.45	–	-	–	RYSD03
Vanadium	7440-62-2	14	-	14	100	16.6	-	110	–	-	–	RYSD08
Zinc	7440-66-6	14	-	14	100	16.2	-	110	–	-	–	RYSD07

Notes:
– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilogram.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.
[c] The exposure point concentration (EPC) was the upper confidence level on the mean (UCL) or the maximum concentration where the UCL was incalculable.
EPCs marked with "m" are based on the maximum detected concentration.
Exposure to lead is evaluated by predicting resultant blood lead levels using the arithmetic average (avg).
The UCLs were calculated using ProUCL 4.0. The UCL used is the one recommended by ProUCL 4.0.

Table A.6.Data-5
Surface Water Risk Assessment Dataset
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/L)	-	Detects Max (mg/L)	Detection Limits Min (mg/L)	-	Detection Limits Max (mg/L)	Maximum Location
Volatile Organic Compounds												
Carbon Disulfide	75-15-0	2	-	4	50	0.00015	-	0.0003	0.001	-	0.001	RYSW05
Chloroform	67-66-3	2	-	4	50	0.00036	-	0.00037	0.001	-	0.001	RYSW12
Semi-Volatile Organic Compounds												
Benzoic Acid	65-85-0	5	-	6	83	0.0045	-	0.0061	0.025	-	0.025	RYSW12
bis(2-Ethylhexyl)phthalate	117-81-7	4	-	6	67	0.002	-	0.008	0.005	-	0.005	RYSW12
Butylbenzylphthalate	85-68-7	3	-	6	50	0.00032	-	0.0011	0.005	-	0.005	RYSW12
Diethylphthalate	84-66-2	1	-	6	17	0.00037	-	0.00037	0.005	-	0.005	RYSW12
Di-n-Butylphthalate	84-74-2	3	-	6	50	0.00086	-	0.001	0.005	-	0.005	RYSW05
Explosives												
m-Nitrotoluene	99-08-1	3	-	6	50	0.00038	-	0.00125	0.00052	-	0.00052	RYSW04
Nitrobenzene	98-95-3	3	-	6	50	0.00013	-	0.0002	0.00026	-	0.00026	RYSW04
Nitroglycerine	55-63-0	1	-	6	17	0.00061	-	0.00061	0.00097	-	0.00097	RYSW03
Herbicides												
2,4,5-TP	93-72-1	1	-	6	17	0.00005	-	0.00005	0.0001	-	0.0001	RYSW03
2,4-D	94-75-7	2	-	6	33	0.00409	-	0.00466	0.0005	-	0.0005	RYSW12
2,4-DB	94-82-6	1	-	6	17	0.00041	-	0.00041	0.002	-	0.002	RYSW12
MCPA	94-74-6	1	-	6	17	0.11	-	0.11	0.125	-	0.125	RYSW12
MCPP	93-65-2	1	-	6	17	0.0463	-	0.0463	0.125	-	0.125	RYSW12
Pesticides												
4,4'-DDT	50-29-3	1	-	6	17	0.00001	-	0.00001	0.00002	-	0.00002	RYSW13
Delta-BHC	319-86-8	1	-	6	17	0.00001	-	0.00001	0.00002	-	0.00002	RYSW03
Dieldrin	60-57-1	2	-	6	33	0.0000063	-	7.19E-06	0.00002	-	0.00002	RYSW12
Endosulfan Sulfate	1031-07-8	1	-	6	17	0.00002	-	0.00003	0.00002	-	0.00002	RYSW05
Endrin Aldehyde	7421-93-4	1	-	6	17	0.00001	-	0.00001	0.00002	-	0.00002	RYSW05
Endrin Ketone	53494-70-5	1	-	6	17	8.28E-06	-	8.28E-06	0.00002	-	0.00002	RYSW12
Polycyclic Aromatic Hydrocarbons												
2-Methylnaphthalene	91-57-6	1	-	6	17	0.00002	-	0.00003	0.00005	-	0.005	RYSW05
Naphthalene	91-20-3	4	-	6	67	0.00002	-	0.00003	0.005	-	0.005	RYSW03,RYSW04
Phenanthrene	85-01-8	1	-	6	17	0.00002	-	0.00002	0.00005	-	0.005	RYSW05
Inorganics												
Aluminum	7429-90-5	6	-	7	86	0.11	-	0.608	0.2	-	0.2	RYSW04
Antimony	7440-36-0	3	-	6	50	0.00036	-	0.00058	0.005	-	0.005	RYSW04
Barium	7440-39-3	6	-	6	100	0.015	-	0.0796	–	-	–	RYSW12
Cadmium	7440-43-9	2	-	6	33	0.00006	-	0.00011	0.002	-	0.002	RYSW03
Calcium	7440-70-2	7	-	7	100	15.3	-	59.5	–	-	–	RYSW02
Chromium	7440-47-3	1	-	6	17	0.0055	-	0.0055	0.01	-	0.01	RYSW04
Copper	7440-50-8	1	-	7	14	0.038	-	0.038	0.02	-	0.02	WW-04

Table A.6.Data-5
Surface Water Risk Assessment Dataset
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/L)	-	Max (mg/L)	Detection Limits Min (mg/L)	-	Max (mg/L)	Maximum Location
Iron	7439-89-6	6	-	7	86	0.127	-	4.47	0.05	-	0.05	WW-04
Lead	7439-92-1	5	-	7	71	0.00088	-	0.031	0.002	-	0.002	WW-04
Magnesium	7439-95-4	7	-	7	100	6.53	-	26.6	–	-	–	RYSW05
Manganese	7439-96-5	7	-	7	100	0.0017	-	0.102	–	-	–	WW-04
Potassium	7440-09-7	7	-	7	100	1.7	-	3.75	–	-	–	RYSW12
Selenium	7782-49-2	1	-	6	17	0.00048	-	0.00048	0.005	-	0.005	RYSW02
Silver	7440-22-4	2	-	6	33	0.0052	-	0.0083	0.01	-	0.01	RYSW04
Sodium	7440-23-5	7	-	7	100	0.895	-	36.8	–	-	–	RYSW12
Zinc	7440-66-6	2	-	7	29	0.0076	-	0.274	0.02	-	0.02	WW-04

Notes:
– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/L = Milligrams per liter.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table A.6.HHRA-1
Selection of Constituents of Potential Concern for Surface Soil (0-2 foot Depth Interval)
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b]					Background Level [c]	Does Maximum Exceed RSL?		Is Constituent a Surface Soil COPC? [d]
			Industrial Scenario		Residential Scenario		Surrogate		Industrial	Residential	
		(mg/kg)	(mg/kg)		(mg/kg)			(mg/kg)	(YES, no)	(YES, no)	(YES, no)
Volatile Organic Compounds											
2-Butanone	78-93-3	1.60E-02	1.90E+04	nms	2.80E+03	ns		–	no	no	no
3-Octanone	106-68-3	1.50E-01	NA		NA			–	NA	NA	**YES**
Acetone	67-64-1	3.10E-01	6.10E+04	nms	6.10E+03	n		–	no	no	no
Ethanol	64-17-5	8.70E-02	NA		NA			–	NA	NA	**YES**
Methylene Chloride	75-09-2	3.00E+00	5.40E+01	c	1.10E+01	c		–	no	no	no
Semi-Volatile Organic Compounds											
2,4-Dinitrotoluene	121-14-2	4.00E-01	1.20E+02	n	1.20E+01	n		–	no	no	no
2,6-Dinitrotoluene	606-20-2	3.20E-01	6.20E+01	n	6.10E+00	n		–	no	no	no
Benzoic Acid	65-85-0	1.70E-01	2.50E+05	nm	2.40E+04	nm		–	no	no	no
bis(2-Ethylhexyl)phthalate	117-81-7	1.80E+00	1.20E+02	c*	3.50E+01	c*		–	no	no	no
Carbazole	86-74-8	1.20E-01	NA		NA			–	NA	NA	**YES**
Dibenzofuran	132-64-9	4.50E-02	1.00E+02	n	7.80E+00	n	Furan	–	no	no	no
Diethylphthalate	84-66-2	9.00E-02	4.90E+04	nm	4.90E+03	n		–	no	no	no
Di-n-Butylphthalate	84-74-2	1.10E+00	6.20E+03	n	6.10E+02	n		–	no	no	no
Pentachlorophenol	87-86-5	8.30E+02	9.00E+00	c	3.00E+00	c		–	**YES**	**YES**	**YES**
Explosives											
4-Amino-2,6-Dinitrotoluene	19406-51-0	5.00E-02	1.90E+02	n	1.50E+01	n		–	no	no	no
Pesticides											
4,4'-DDE	72-55-9	4.00E-02	5.10E+00	c	1.40E+00	c		–	no	no	no
Alpha-BHC	319-84-6	7.70E-04	2.70E-01	c	7.70E-02	c		–	no	no	no
Beta-BHC	319-85-7	2.50E-04	9.60E-01	c	2.70E-01	c		–	no	no	no
Alpha-Chlordane	5103-71-9	3.00E-02	6.50E+00	c*	1.60E+00	c*	Chlordane	–	no	no	no
Dieldrin	60-57-1	2.70E-01	1.10E-01	c	3.00E-02	c		–	**YES**	**YES**	**YES**
Endrin Aldehyde	7421-93-4	4.00E-02	1.80E+01	n	1.80E+00	n	Endrin	–	no	no	no
Polycyclic Aromatic Hydrocarbons											
2-Methylnaphthalene	91-57-6	4.00E-02	4.10E+02	ns	3.10E+01	n		–	no	no	no
Acenaphthene	83-32-9	6.50E-03	3.30E+03	n	3.40E+02	n		–	no	no	no
Acenaphthylene	208-96-8	7.00E-02	3.30E+03	n	3.40E+02	n	Acenaphthene	–	no	no	no
Anthracene	120-12-7	1.00E-01	1.70E+04	nm	1.70E+03	n		–	no	no	no
Benzo(a)anthracene	56-55-3	4.00E-01	2.10E+00	c	1.50E-01	c		–	no	**YES**	**YES**
Benzo(a)pyrene	50-32-8	4.00E-01	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Benzo(b)fluoranthene	205-99-2	1.00E+00	2.10E+00	c	1.50E-01	c		–	no	**YES**	**YES**
Benzo(g,h,i)perylene	191-24-2	3.70E-02	1.70E+03	n	1.70E+02	n	Pyrene	–	no	no	no
Benzo(k)fluoranthene	207-08-9	5.60E-01	2.10E+01	c	1.50E+00	c		–	no	no	no
Chrysene	218-01-9	6.60E-01	2.10E+02	c	1.50E+01	c		–	no	no	no
Dibenzo(a,h)anthracene	53-70-3	5.00E-02	2.10E-01	c	1.50E-02	c		–	no	**YES**	**YES**
Fluoranthene	206-44-0	3.90E-01	2.20E+03	n	2.30E+02	n		–	no	no	no
Fluorene	86-73-7	6.70E-03	2.20E+03	n	2.30E+02	n		–	no	no	no
Indeno(1,2,3-cd)pyrene	193-39-5	1.10E-01	2.10E+00	c	1.50E-01	c		–	no	no	no
Naphthalene	91-20-3	6.90E-03	2.00E+01	c*	3.90E+00	c*		–	no	no	no
Phenanthrene	85-01-8	1.00E-01	1.70E+04	nm	1.70E+03	n	Anthracene	–	no	no	no

Table A.6.HHRA-1
Selection of Constituents of Potential Concern for Surface Soil (0-2 foot Depth Interval)
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b]					Background Level [c]	Does Maximum Exceed RSL?		Is Constituent a Surface Soil COPC? [d]
			Industrial Scenario		Residential Scenario		Surrogate		Industrial	Residential	
		(mg/kg)	(mg/kg)		(mg/kg)			(mg/kg)	(YES, no)	(YES, no)	(YES, no)
Pyrene	129-00-0	8.60E-01	1.70E+03	n	1.70E+02	n		–	no	no	no
Polychlorinated Biphenyls											
Aroclor 1254	11097-69-1	1.70E+00	7.40E-01	c*	1.10E-01	c**		–	**YES**	**YES**	**YES**
Inorganics											
Aluminum	7429-90-5	4.36E+04	9.90E+04	nm	7.70E+03	n		4.00E+04	no	**YES**	**YES**
Antimony	7440-36-0	5.80E-01	4.10E+01	n	3.10E+00	n		–	no	no	no
Arsenic	7440-38-2	2.08E+01	1.60E+00	c	3.90E-01	c*		1.58E+01	**YES**	**YES**	**YES**
Barium	7440-39-3	1.77E+03	1.90E+04	nm	1.50E+03	n		2.09E+02	no	**YES**	**YES**
Beryllium	7440-41-7	2.46E+00	2.00E+02	n	1.60E+01	n		1.02E+00	no	no	no
Cadmium	7440-43-9	1.80E+00	8.10E+01	n	7.00E+00	n		6.90E-01	no	no	no
Calcium	7440-70-2	1.96E+05	NA		NA			–	NA	NA	no
Chromium	7440-47-3	5.90E+01	1.40E+03	c	2.80E+02	c		6.53E+01	no	no	no
Cobalt	7440-48-4	7.49E+01	3.00E+01	n	2.30E+00	n		7.23E+01	**YES**	**YES**	**YES**
Copper	7440-50-8	6.02E+01	4.10E+03	n	3.10E+02	n		5.35E+01	no	no	no
Iron	7439-89-6	5.01E+04	7.20E+04	nm	5.50E+03	n		5.10E+04	no	**YES**	no
Lead	7439-92-1	1.49E+02	8.00E+02	«	4.00E+02	«		2.68E+01	no	no	no
Magnesium	7439-95-4	1.04E+05	NA		NA			–	NA	NA	no
Manganese	7439-96-5	7.91E+02	2.30E+03	n	1.80E+02	n		2.54E+03	no	**YES**	no
Mercury	7439-97-6	4.10E-01	3.10E+01	n	2.30E+00	n		1.30E-01	no	no	no
Nickel	7440-02-0	4.22E+01	2.00E+03	n	1.60E+02	n		6.28E+01	no	no	no
Potassium	7440-09-7	4.57E+03	NA		NA			–	NA	NA	no
Selenium	7782-49-2	1.00E+00	5.10E+02	n	3.90E+01	n		–	no	no	no
Sodium	7440-23-5	3.31E+02	NA		NA			–	NA	NA	no
Thallium	7440-28-0	8.90E-01	6.60E+00	n	5.10E-01	n		2.11E+00	no	**YES**	no
Vanadium	7440-62-2	9.15E+01	7.20E+02	n	5.50E+01	n		1.08E+02	no	**YES**	no
Zinc	7440-66-6	7.52E+02	3.10E+04	nm	2.30E+03	n		2.02E+02	no	no	no

Notes:

– =	Not detected/ not analyzed/ not applicable.	NA =	Not available or not applicable.
CASN =	Chemical abstracts registry number.	RSL =	Regional Screening Level.
COPC =	Constituent of Potential Concern.	USEPA =	United States Environmental Protection Agency.
mg/kg =	Milligrams per kilogram.		

[a] Maximum concentration in surface soil (0-2 foot depth interval).

[b] The screening levels used were from USEPA (2008a). Screening levels based on non-cancer effects were adjusted downward by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = concentration may exceed ceiling limit; s = Concentration may exceed saturation concentration (Csat).
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.

[c] Background levels for metals are facility-wide soil background point estimates taken from Facility-Wide Background Study Report (IT Corporation 2001).

[d] Constituents detected with maximum concentrations greater than adjusted residential screening levels were considered COPCs unless they were metals detected at concentrations lower than background, or are essential nutrients (i.e., calcium, magnesium, potassium, sodium), or were known laboratory contaminants (i.e. acetone).

Table A.6.HHRA-2
Selection of Constituents of Potential Concern for Combined Surface and Subsurface Soil
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b]				Surrogate	Background Level [c]	Does Maximum Exceed RSL?		Is Constituent a Surface/ Subsurface Soil COPC? [d]
			Industrial Scenario		Residential Scenario				Industrial	Residential	
		(mg/kg)	(mg/kg)		(mg/kg)			(mg/kg)	(YES, no)	(YES, no)	(YES, no)
Volatile Organic Compounds											
2-Butanone	78-93-3	1.60E-02	1.90E+04	nms	2.80E+03	ns		–	no	no	no
3-Octanone	106-68-3	1.50E-01	NA		NA			–	NA	NA	**YES**
Acetone	67-64-1	3.10E-01	6.10E+04	nms	6.10E+03	n		–	no	no	no
Ethanol	64-17-5	8.70E-02	NA		NA			–	NA	NA	**YES**
Methylene Chloride	75-09-2	3.00E+00	5.40E+01	c	1.10E+01	c		–	no	no	no
Semi-Volatile Organic Compounds											
2,4-Dinitrotoluene	121-14-2	4.00E-01	1.20E+02	n	1.20E+01	n		–	no	no	no
2,6-Dinitrotoluene	606-20-2	3.20E-01	6.20E+01	n	6.10E+00	n		–	no	no	no
Benzoic Acid	65-85-0	1.70E-01	2.50E+05	nm	2.40E+04	nm		–	no	no	no
bis(2-Ethylhexyl)phthalate	117-81-7	1.80E+00	1.20E+02	c*	3.50E+01	c*		–	no	no	no
Butylbenzylphthalate	85-68-7	–	9.10E+02	c	2.60E+02	c*		–	–	–	no
Carbazole	86-74-8	1.20E-01	NA		NA			–	NA	NA	**YES**
Dibenzofuran	132-64-9	4.50E-02	1.00E+02	n	7.80E+00	n	Furan	–	no	no	no
Diethylphthalate	84-66-2	1.10E+00	4.90E+04	nm	4.90E+03	n		–	no	no	no
Di-n-Butylphthalate	84-74-2	1.10E+00	6.20E+03	n	6.10E+02	n		–	no	no	no
Pentachlorophenol	87-86-5	8.30E+02	9.00E+00	c	3.00E+00	c		–	**YES**	**YES**	**YES**
Explosives											
4-Amino-2,6-Dinitrotoluene	19406-51-0	5.00E-02	1.90E+02	n	1.50E+01	n		–	no	no	no
Pesticides											
4,4'-DDE	72-55-9	4.00E-02	5.10E+00	c	1.40E+00	c		–	no	no	no
Alpha-BHC	319-84-6	7.70E-04	2.70E-01	c	7.70E-02	c		–	no	no	no
Beta-BHC	319-85-7	2.50E-04	9.60E-01	c	2.70E-01	c		–	no	no	no
Alpha-Chlordane	5103-71-9	3.00E-02	6.50E+00	c*	1.60E+00	c*	Chlordane	–	no	no	no
Dieldrin	60-57-1	2.70E-01	1.10E-01	c	3.00E-02	c		–	**YES**	**YES**	**YES**
Endrin Aldehyde	7421-93-4	4.00E-02	1.80E+01	n	1.80E+00	n	Endrin	–	no	no	no
Polycyclic Aromatic Hydrocarbons											
2-Methylnaphthalene	91-57-6	4.00E-02	4.10E+02	ns	3.10E+01	n		–	no	no	no
Acenaphthene	83-32-9	6.50E-03	3.30E+03	n	3.40E+02	n		–	no	no	no
Acenaphthylene	208-96-8	7.00E-02	3.30E+03	n	3.40E+02	n	Acenaphthene	–	no	no	no
Anthracene	120-12-7	1.00E-01	1.70E+04	nm	1.70E+03	n		–	no	no	no
Benzo(a)anthracene	56-55-3	4.00E-01	2.10E+00	c	1.50E-01	c		–	no	**YES**	**YES**
Benzo(a)pyrene	50-32-8	4.00E-01	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Benzo(b)fluoranthene	205-99-2	1.00E+00	2.10E+00	c	1.50E-01	c		–	no	**YES**	**YES**
Benzo(g,h,i)perylene	191-24-2	3.70E-02	1.70E+03	n	1.70E+02	n	Pyrene	–	no	no	no
Benzo(k)fluoranthene	207-08-9	5.60E-01	2.10E+01	c	1.50E+00	c		–	no	no	no
Chrysene	218-01-9	6.60E-01	2.10E+02	c	1.50E+01	c		–	no	no	no
Dibenzo(a,h)anthracene	53-70-3	5.00E-02	2.10E-01	c	1.50E-02	c		–	no	**YES**	**YES**
Fluoranthene	206-44-0	3.90E-01	2.20E+03	n	2.30E+02	n		–	no	no	no
Fluorene	86-73-7	6.70E-03	2.20E+03	n	2.30E+02	n		–	no	no	no
Indeno(1,2,3-cd)pyrene	193-39-5	1.10E-01	2.10E+00	c	1.50E-01	c		–	no	no	no
Naphthalene	91-20-3	6.90E-03	2.00E+01	c*	3.90E+00	c*		–	no	no	no
Phenanthrene	85-01-8	1.00E-01	1.70E+04	nm	1.70E+03	n	Anthracene	–	no	no	no
Pyrene	129-00-0	8.60E-01	1.70E+03	n	1.70E+02	n		–	no	no	no
Polychlorinated Biphenyls											
Aroclor 1254	11097-69-1	1.70E+00	7.40E-01	c*	1.10E-01	c**		–	**YES**	**YES**	**YES**
Inorganics											
Aluminum	7429-90-5	4.36E+04	9.90E+04	nm	7.70E+03	n		4.00E+04	no	**YES**	**YES**
Antimony	7440-36-0	5.80E-01	4.10E+01	n	3.10E+00	n		–	no	no	no
Arsenic	7440-38-2	2.08E+01	1.60E+00	c	3.90E-01	c*		1.58E+01	**YES**	**YES**	**YES**

Table A.6.HHRA-2
Selection of Constituents of Potential Concern for Combined Surface and Subsurface Soil
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b]					Background Level [c]	Does Maximum Exceed RSL?		Is Constituent a Surface/ Subsurface Soil COPC? [d]
			Industrial Scenario		Residential Scenario		Surrogate		Industrial	Residential	
		(mg/kg)	(mg/kg)		(mg/kg)			(mg/kg)	(YES, no)	(YES, no)	(YES, no)
Barium	7440-39-3	1.77E+03	1.90E+04	nm	1.50E+03	n		2.09E+02	no	**YES**	**YES**
Beryllium	7440-41-7	4.30E+00	2.00E+02	n	1.60E+01	n		1.02E+00	no	no	no
Cadmium	7440-43-9	1.80E+00	8.10E+01	n	7.00E+00	n		6.90E-01	no	no	no
Calcium	7440-70-2	1.96E+05	NA		NA			–	NA	NA	no
Chromium	7440-47-3	5.90E+01	1.40E+03	c	2.80E+02	c		6.53E+01	no	no	no
Cobalt	7440-48-4	7.49E+01	3.00E+01	n	2.30E+00	n		7.23E+01	**YES**	**YES**	**YES**
Copper	7440-50-8	6.02E+01	4.10E+03	n	3.10E+02	n		5.35E+01	no	no	no
Iron	7439-89-6	5.01E+04	7.20E+04	nm	5.50E+03	n		5.10E+04	no	**YES**	no
Lead	7439-92-1	1.49E+02	8.00E+02	«	4.00E+02	«		2.68E+01	no	no	no
Magnesium	7439-95-4	1.04E+05	NA		NA			–	NA	NA	no
Manganese	7439-96-5	7.91E+02	2.30E+03	n	1.80E+02	n		2.54E+03	no	**YES**	no
Mercury	7439-97-6	4.60E-01	3.10E+01	n	2.30E+00	n		1.30E-01	no	no	no
Nickel	7440-02-0	4.22E+01	2.00E+03	n	1.60E+02	n		6.28E+01	no	no	no
Potassium	7440-09-7	4.57E+03	NA		NA			–	NA	NA	no
Selenium	7782-49-2	1.00E+00	5.10E+02	n	3.90E+01	n		–	no	no	no
Sodium	7440-23-5	3.31E+02	NA		NA			–	NA	NA	no
Thallium	7440-28-0	8.90E-01	6.60E+00	n	5.10E-01	n		2.11E+00	no	**YES**	no
Vanadium	7440-62-2	9.15E+01	7.20E+02	n	5.50E+01	n		1.08E+02	no	**YES**	no
Zinc	7440-66-6	7.52E+02	3.10E+04	nm	2.30E+03	n		2.02E+02	no	no	no

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
NA = Not available or not applicable.
RSL = Regional Screening Level.
USEPA = United States Environmental Protection Agency.

[a] Maximum concentration in combined surface and subsurface soil.

[b] The screening levels used were from USEPA (2008a). Screening levels based on non-cancer effects were adjusted downward by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = Concentration may exceed ceiling limit; s = Concentration may exceed saturation concentration (Csat).
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.

[c] Background levels for metals are facility-wide soil background point estimates taken from Facility-Wide Background Study Report (IT Corporation 2001).

[d] Constituents detected with maximum concentrations greater than adjusted residential screening levels were considered COPCs unless they were metals detected at concentrations lower than background, or are essential nutrients (i.e., calcium, magnesium, potassium, sodium), or were known laboratory contaminants (i.e. acetone).

Table A.6.HHRA-3
Selection of Constituents of Potential Concern for Sediment
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a] (mg/kg)	Adjusted Soil Regional Screening Level (RSL) [b] Residential Scenario (mg/kg)		Surrogate	Is Constituent a Sediment COPC? [c] (YES, no)
Volatile Organic Compounds						
2-Butanone	78-93-3	1.00E-01	2.80E+03	ns		no
Acetone	67-64-1	5.30E-01	6.10E+03	n		no
Carbon Disulfide	75-15-0	2.20E-03	6.70E+01	ns		no
Methylene Chloride	75-09-2	3.00E-03	1.10E+01	c		no
Semi-Volatile Organic Compounds						
4-Methylphenol	106-44-5	3.60E-02	3.10E+01	n		no
Benzoic Acid	65-85-0	2.80E-01	2.40E+04	nm		no
bis(2-Ethylhexyl)phthalate	117-81-7	3.30E-01	3.50E+01	c*		no
Di-n-Butylphthalate	84-74-2	6.90E-02	6.10E+02	n		no
Explosives						
Nitroglycerine	55-63-0	5.70E-01	6.10E-01	n		no
Pentaerythritol Tetranitrate	78-11-5	2.30E-01	NA			**YES**
Herbicides						
2,4,5-T	93-76-5	3.34E-02	6.10E+01	n		no
2,4,5-TP	93-72-1	1.04E-01	4.90E+01	n		no
2,4-D	94-75-7	2.09E-01	6.90E+01	n		no
Dalapon	75-99-0	1.07E-01	1.80E+02	n		no
Dicamba	1918-00-9	4.97E-02	1.80E+02	n		no
Dichlorprop	120-36-5	3.53E-01	NA			**YES**
MCPP	93-65-2	3.53E+00	6.10E+00	n		no
Pesticides						
4,4'-DDD	72-54-8	2.09E-03	2.00E+00	c		no
4,4'-DDE	72-55-9	8.40E-03	1.40E+00	c		no
4,4'-DDT	50-29-3	4.00E-03	1.70E+00	c*		no
Alpha-BHC	319-84-6	5.90E-04	7.70E-02	c		no
Delta-BHC	319-86-8	1.20E-03	5.20E-01	c*	gamma-BHC	no
Gamma-BHC (Lindane)	58-89-9	9.70E-04	5.20E-01	c*		no
Alpha-Chlordane	5103-71-9	1.01E-02	1.60E+00	c*	Chlordane	no
Gamma-Chlordane	5566-34-7	1.30E-02	1.60E+00	c*	Chlordane	no
Dieldrin	60-57-1	4.10E-03	3.00E-02	c		no
Endosulfan II	33213-65-9	7.20E-04	3.70E+01	n	Endosulfan	no
Endrin	72-20-8	1.25E-02	1.80E+00	n		no
Endrin Aldehyde	7421-93-4	4.00E-02	1.80E+00	n	Endrin	no
Endrin Ketone	53494-70-5	2.03E-03	1.80E+00	n	Endrin	no
Heptachlor	76-44-8	2.13E-03	1.10E-01	c		no
Heptachlor Epoxide	1024-57-3	7.26E-03	5.30E-02	c*		no
Methoxychlor	72-43-5	2.60E-03	3.10E+01	n		no
Polycyclic Aromatic Hydrocarbons						

Table A.6.HHRA-3
Selection of Constituents of Potential Concern for Sediment
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a] (mg/kg)	Adjusted Soil Regional Screening Level (RSL) [b] Residential Scenario (mg/kg)		Surrogate	Is Constituent a Sediment COPC? [c] (YES, no)
2-Methylnaphthalene	91-57-6	4.00E-02	3.10E+01	n		no
Acenaphthene	83-32-9	5.90E-02	3.40E+02	n		no
Acenaphthylene	208-96-8	2.60E-02	3.40E+02	n	Acenaphthene	no
Anthracene	120-12-7	8.10E-02	1.70E+03	n		no
Benzo(a)anthracene	56-55-3	1.90E-01	1.50E-01	c		**YES**
Benzo(a)pyrene	50-32-8	1.70E-01	1.50E-02	c		**YES**
Benzo(b)fluoranthene	205-99-2	2.50E-01	1.50E-01	c		**YES**
Benzo(g,h,i)perylene	191-24-2	1.00E-01	1.70E+02	n	Pyrene	no
Benzo(k)fluoranthene	207-08-9	8.00E-02	1.50E+00	c		no
Chrysene	218-01-9	1.70E-01	1.50E+01	c		no
Dibenzo(a,h)anthracene	53-70-3	2.60E-02	1.50E-02	c		**YES**
Fluoranthene	206-44-0	4.40E-01	2.30E+02	n		no
Fluorene	86-73-7	4.60E-02	2.30E+02	n		no
Indeno(1,2,3-cd)pyrene	193-39-5	1.20E-01	1.50E-01	c		no
Naphthalene	91-20-3	4.30E-02	3.90E+00	c*		no
Phenanthrene	85-01-8	3.60E-01	1.70E+03	n	Anthracene	no
Pyrene	129-00-0	3.00E-01	1.70E+02	n		no
Inorganics						
Aluminum	7429-90-5	2.70E+04	7.70E+03	n		**YES**
Antimony	7440-36-0	1.00E+00	3.10E+00	n		no
Arsenic	7440-38-2	1.18E+01	3.90E-01	c*		**YES**
Barium	7440-39-3	1.13E+02	1.50E+03	n		no
Beryllium	7440-41-7	1.67E+00	1.60E+01	n		no
Cadmium	7440-43-9	2.10E-01	7.00E+00	n		no
Calcium	7440-70-2	1.76E+05	NA			no
Chromium	7440-47-3	8.09E+01	2.80E+02	c		no
Cobalt	7440-48-4	1.50E+01	2.30E+00	n		**YES**
Copper	7440-50-8	4.76E+01	3.10E+02	n		no
Iron	7439-89-6	7.96E+04	5.50E+03	n		**YES**
Lead	7439-92-1	3.30E+01	4.00E+02	«		no
Magnesium	7439-95-4	4.25E+04	NA			no
Manganese	7439-96-5	1.22E+03	1.80E+02	n		**YES**
Mercury	7439-97-6	8.00E-02	2.30E+00	n		no
Nickel	7440-02-0	2.45E+01	1.60E+02	n		no
Potassium	7440-09-7	2.62E+03	NA			no
Selenium	7782-49-2	1.70E+00	3.90E+01	n		no
Sodium	7440-23-5	1.10E+02	NA			no
Thallium	7440-28-0	4.50E-01	5.10E-01	n		no
Vanadium	7440-62-2	1.10E+02	5.50E+01	n		**YES**

Table A.6.HHRA-3
Selection of Constituents of Potential Concern for Sediment
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b]			Is Constituent a Sediment COPC? [c]
			Residential Scenario		Surrogate	
		(mg/kg)	(mg/kg)			(YES, no)
Zinc	7440-66-6	1.10E+02	2.30E+03	n		no

Notes:

CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
mg/kg = Milligrams per kilogram.
NA = Not available or not applicable.
RSL = Regional Screening Level.
USEPA = United States Environmental Protection Agency.

[a] Maximum concentration in sediment.

[b] The screening levels used were risk screening levels for the residential scenario from USEPA (2008a). Screening levels based on non-cancer effects were adjusted downward by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = Concentration may exceed ceiling limit;
s = Concentration may exceed saturation concentration (Csat).
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.

[c] Constituents detected with maximum concentrations greater than adjusted residential screening levels were considered COPCs unless they were metals detected at concentrations lower than background, or are essential nutrients (i.e., calcium, magnesium, potassium, sodium), or were known laboratory contaminants (i.e. acetone).

Table A.6.HHRA-4
Selection Constituents of Potential Concern for Surface Water
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Tap Water Regional Screening Level (RSL) [b]			Is Constituent a Surface Water COPC? [c]
		(mg/L)	(mg/L)		Surrogate	(YES, no)
Volatile Organic Compounds						
Carbon Disulfide	75-15-0	3.00E-04	1.00E-01	n		no
Chloroform	67-66-3	3.70E-04	1.90E-04	c		**YES**
Semi-Volatile Organic Compounds						
Benzoic Acid	65-85-0	6.10E-03	1.50E+01	n		no
bis(2-Ethylhexyl)phthalate	117-81-7	8.00E-03	4.80E-03	c		**YES**
Butylbenzylphthalate	85-68-7	1.10E-03	3.50E-02	c		no
Diethylphthalate	84-66-2	3.70E-04	2.90E+00	n		no
Di-n-Butylphthalate	84-74-2	1.00E-03	3.70E-01	n		no
Explosives						
m-Nitrotoluene	99-08-1	1.25E-03	7.30E-02	n		no
Nitrobenzene	98-95-3	2.00E-04	3.40E-04	n		no
Nitroglycerine	55-63-0	6.10E-04	3.70E-04	n		**YES**
Herbicides						
2,4,5-TP	93-72-1	5.00E-05	2.90E-02	n		no
2,4-D	94-75-7	4.66E-03	3.70E-02	n		no
2,4-DB	94-82-6	4.10E-04	2.90E-02	n		no
MCPA	94-74-6	1.10E-01	1.80E-03	n		**YES**
MCPP	93-65-2	4.63E-02	3.70E-03	n		**YES**
Pesticides						
4,4'-DDT	50-29-3	1.00E-05	2.00E-04	c*		no
Delta-BHC	319-86-8	1.00E-05	6.10E-05	c	gamma-BHC	no
Dieldrin	60-57-1	7.19E-06	4.20E-06	c		**YES**
Endosulfan Sulfate	1031-07-8	3.00E-05	2.20E-02	n	Endosulfan	no
Endrin Aldehyde	7421-93-4	1.00E-05	1.10E-03	n	Endrin	no
Endrin Ketone	53494-70-5	8.28E-06	1.10E-03	n	Endrin	no
Polycyclic Aromatic Hydrocarbons						
2-Methylnaphthalene	91-57-6	3.00E-05	1.50E-02	n		no
Naphthalene	91-20-3	3.00E-05	1.40E-04	c*		no
Phenanthrene	85-01-8	2.00E-05	1.10E+00	n	Anthracene	no
Inorganics						
Aluminum	7429-90-5	6.08E-01	3.70E+00	n		no
Antimony	7440-36-0	5.80E-04	1.50E-03	n		no
Barium	7440-39-3	7.96E-02	7.30E-01	n		no
Cadmium	7440-43-9	1.10E-04	1.80E-03	n		no
Calcium	7440-70-2	5.95E+01	NA			no
Chromium	7440-47-3	5.50E-03	5.50E+00	n		no
Copper	7440-50-8	3.80E-02	1.50E-01	n		no

Table A.6.HHRA-4
Selection Constituents of Potential Concern for Surface Water
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Tap Water Regional Screening Level (RSL) [b]			Is Constituent a Surface Water COPC? [c]
		(mg/L)	(mg/L)		Surrogate	(YES, no)
Iron	7439-89-6	4.47E+00	2.60E+00	n		**YES**
Lead	7439-92-1	3.10E-02	1.50E-02	**		**YES**
Magnesium	7439-95-4	2.66E+01	NA			no
Manganese	7439-96-5	1.02E-01	8.80E-02	n		**YES**
Potassium	7440-09-7	3.75E+00	NA			no
Selenium	7782-49-2	4.80E-04	1.80E-02	n		no
Silver	7440-22-4	8.30E-03	1.80E-02	n		no
Sodium	7440-23-5	3.68E+01	NA			no
Zinc	7440-66-6	2.74E-01	1.10E+00	n		no

Notes:

CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
mg/L = Milligrams per liter.
NA = Not available or not applicable.
RSL = Regional Screening Level.
USEPA = United States Environmental Protection Agency.

[a] Maximum concentration in surface water.

[b] The screening levels used were risk screening levels for tap water from USEPA (2008a). Screening levels based on non-cancer effects were adjusted downward by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = Concentration may exceed ceiling limit;
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.

[c] Constituents detected with maximum concentrations greater than screening levels were considered COPCs unless they were essential nutrients (i.e., calcium, magnesium, potassium, sodium), or were known laboratory contaminants (i.e. acetone).

Table A.6.HHRA-5
Exposure Point Concentrations
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a]				Exposure Point Concentrations [b]			
		Surface Soil	Combined Surface and Subsurface Soil	Sediment	Surface Water	Surface Soil (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Sediment (mg/kg)	Surface Water (mg/L)
Volatile Organic Compounds									
1,2,3-Trichloropropane	96-18-4	no	no	no	no	–	–	–	–
1,2,4-Trimethylbenzene	95-63-6	no	no	no	no	–	–	–	–
2-Butanone	78-93-3	no	no	no	no	–	–	–	–
3-Octanone	106-68-3	**YES**	**YES**	no	no	1.50E-01 m	1.50E-01 m	–	–
4-Methyl-2-pentanone	108-10-1	no	no	no	no	–	–	–	–
Acetone	67-64-1	no	no	no	no	–	–	–	–
Bromodichloromethane	75-27-4	no	no	no	no	–	–	–	–
Carbon Disulfide	75-15-0	no	no	no	no	–	–	–	–
Chloroform	67-66-3	no	no	no	**YES**	–	–	–	3.70E-04 m
cis-1,2-Dichloroethene	156-59-2	no	no	no	no	–	–	–	–
d-Limonene	5989-27-5	no	no	no	no	–	–	–	–
Ethanol	64-17-5	**YES**	**YES**	no	no	8.70E-02 m	8.70E-02 m	–	–
m,p-Xylene	136777612	no	no	no	no	–	–	–	–
Methylene Chloride	75-09-2	no	no	no	no	–	–	–	–
p-Isopropyltoluene	99-87-6	no	no	no	no	–	–	–	–
Tetrachloroethene	127-18-4	no	no	no	no	–	–	–	–
Toluene	108-88-3	no	no	no	no	–	–	–	–
Trichloroethene	79-01-6	no	no	no	no	–	–	–	–
Xylenes (total)	1330-20-7	no	no	no	no	–	–	–	–
Semi-Volatile Organic Compounds									
1,2,4-Trichlorobenzene	120-82-1	no	no	no	no	–	–	–	–
1,2-Dichlorobenzene	95-50-1	no	no	no	no	–	–	–	–
1,3-Dichlorobenzene	541-73-1	no	no	no	no	–	–	–	–
1,4-Dichlorobenzene	106-46-7	no	no	no	no	–	–	–	–
2,4-Dinitrotoluene	121-14-2	no	no	no	no	–	–	–	–
2,6-Dinitrotoluene	606-20-2	no	no	no	no	–	–	–	–
3,3'-Dichlorobenzidine	91-94-1	no	no	no	no	–	–	–	–
4-Methylphenol	106-44-5	no	no	no	no	–	–	–	–
Benzoic Acid	65-85-0	no	no	no	no	–	–	–	–
bis(2-Ethylhexyl)phthalate	117-81-7	no	no	no	**YES**	–	–	–	8.00E-03 m
Butylbenzylphthalate	85-68-7	no	no	no	no	–	–	–	–
Carbazole	86-74-8	**YES**	**YES**	no	no	1.20E-01 m	1.20E-01 m	–	–
Dibenzofuran	132-64-9	no	no	no	no	–	–	–	–
Diethylphthalate	84-66-2	no	no	no	no	–	–	–	–
Di-n-Butylphthalate	84-74-2	no	no	no	no	–	–	–	–
Di-n-Octylphthalate	117-84-0	no	no	no	no	–	–	–	–
N-Nitrosodiphenylamine	86-30-6	no	no	no	no	–	–	–	–
Pentachlorophenol	87-86-5	**YES**	**YES**	no	no	8.30E+02 m	8.30E+02 m	–	–
Phenol	108-95-2	no	no	no	no	–	–	–	–
Dioxin/Furan Compounds									
1,2,3,4,6,7,8-HpCDD	35822-46-9	no	no	no	no	–	–	–	–

Table A.6.HHRA-5
Exposure Point Concentrations
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a]				Exposure Point Concentrations [b]			
		Surface Soil	Combined Surface and Subsurface Soil	Sediment	Surface Water	Surface Soil (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Sediment (mg/kg)	Surface Water (mg/L)
1,2,3,4,6,7,8-HpCDF	67562-39-4	no	no	no	no	–	–	–	–
1,2,3,4,7,8,9-HpCDF	55673-89-7	no	no	no	no	–	–	–	–
1,2,3,4,7,8-HxCDD	39227-28-6	no	no	no	no	–	–	–	–
1,2,3,4,7,8-HxCDF	70648-26-9	no	no	no	no	–	–	–	–
1,2,3,6,7,8-HxCDD	57653-85-7	no	no	no	no	–	–	–	–
1,2,3,6,7,8-HxCDF	57117-44-9	no	no	no	no	–	–	–	–
1,2,3,7,8,9-HxCDD	19408-74-3	no	no	no	no	–	–	–	–
1,2,3,7,8,9-HxCDF	72918-21-9	no	no	no	no	–	–	–	–
1,2,3,7,8-PeCDD	40321-76-4	no	no	no	no	–	–	–	–
1,2,3,7,8-PeCDF	57117-41-6	no	no	no	no	–	–	–	–
2,3,4,6,7,8-HxCDF	60851-34-5	no	no	no	no	–	–	–	–
2,3,4,7,8-PeCDF	57117-31-4	no	no	no	no	–	–	–	–
2,3,7,8-TCDD	1746-01-6	no	no	no	no	–	–	–	–
2,3,7,8-TCDF	51207-31-9	no	no	no	no	–	–	–	–
OCDD	3268-87-9	no	no	no	no	–	–	–	–
OCDF	39001-02-0	no	no	no	no	–	–	–	–
Explosives									
1,3,5-Trinitrobenzene	99-35-4	no	no	no	no	–	–	–	–
1,3-Dinitrobenzene	99-65-0	no	no	no	no	–	–	–	–
2,4,6-Trinitrotoluene	118-96-7	no	no	no	no	–	–	–	–
4-Amino-2,6-Dinitrotoluene	19406-51-0	no	no	no	no	–	–	–	–
m-Nitrotoluene	99-08-1	no	no	no	no	–	–	–	–
Nitrobenzene	98-95-3	no	no	no	no	–	–	–	–
Nitroglycerine	55-63-0	no	no	no	**YES**	–	–	–	6.10E-04 m
Pentaerythritol Tetranitrate	78-11-5	no	no	**YES**	no	–	–	2.30E-01 m	–
Perchlorate	14797-73-0	no	no	no	no	–	–	–	–
Herbicides									
2,4,5-T	93-76-5	no	no	no	no	–	–	–	–
2,4,5-TP	93-72-1	no	no	no	no	–	–	–	–
2,4-D	94-75-7	no	no	no	no	–	–	–	–
2,4-DB	94-82-6	no	no	no	no	–	–	–	–
Dalapon	75-99-0	no	no	no	no	–	–	–	–
Dicamba	1918-00-9	no	no	no	no	–	–	–	–
Dichlorprop	120-36-5	no	no	**YES**	no	–	–	3.53E-01 m	–
MCPA	94-74-6	no	no	no	**YES**	–	–	–	1.10E-01 m
MCPP	93-65-2	no	no	no	**YES**	–	–	–	4.63E-02 m
Pesticides									
4,4'-DDD	72-54-8	no	no	no	no	–	–	–	–
4,4'-DDE	72-55-9	no	no	no	no	–	–	–	–
4,4'-DDT	50-29-3	no	no	no	no	–	–	–	–
Alpha-BHC	319-84-6	no	no	no	no	–	–	–	–
Beta-BHC	319-85-7	no	no	no	no	–	–	–	–

Table A.6.HHRA-5
Exposure Point Concentrations
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a]				Exposure Point Concentrations [b]			
		Surface Soil	Combined Surface and Subsurface Soil	Sediment	Surface Water	Surface Soil (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Sediment (mg/kg)	Surface Water (mg/L)
Delta-BHC	319-86-8	no	no	no	no	–	–	–	–
Gamma-BHC (Lindane)	58-89-9	no	no	no	no	–	–	–	–
Alpha-Chlordane	5103-71-9	no	no	no	no	–	–	–	–
Gamma-Chlordane	5566-34-7	no	no	no	no	–	–	–	–
Dieldrin	60-57-1	**YES**	**YES**	no	**YES**	2.70E-01 m	2.70E-01 m	–	7.19E-06 m
Endosulfan I	115-29-7	no	no	no	no	–	–	–	–
Endosulfan II	33213-65-9	no	no	no	no	–	–	–	–
Endosulfan Sulfate	1031-07-8	no	no	no	no	–	–	–	–
Endrin	72-20-8	no	no	no	no	–	–	–	–
Endrin Aldehyde	7421-93-4	no	no	no	no	–	–	–	–
Endrin Ketone	53494-70-5	no	no	no	no	–	–	–	–
Heptachlor	76-44-8	no	no	no	no	–	–	–	–
Heptachlor Epoxide	1024-57-3	no	no	no	no	–	–	–	–
Methoxychlor	72-43-5	no	no	no	no	–	–	–	–
Polycyclic Aromatic Hydrocarbons									
1-Methylnaphthalene	90-12-0	no	no	no	no	–	–	–	–
2-Methylnaphthalene	91-57-6	no	no	no	no	–	–	–	–
Acenaphthene	83-32-9	no	no	no	no	–	–	–	–
Acenaphthylene	208-96-8	no	no	no	no	–	–	–	–
Anthracene	120-12-7	no	no	no	no	–	–	–	–
Benzo(a)anthracene	56-55-3	**YES**	**YES**	**YES**	no	2.42E-01	1.56E-01	1.23E-01	–
Benzo(a)pyrene	50-32-8	**YES**	**YES**	**YES**	no	2.42E-01	1.56E-01	8.91E-02	–
Benzo(b)fluoranthene	205-99-2	**YES**	**YES**	**YES**	no	4.95E-01	2.41E-01	1.39E-01	–
Benzo(g,h,i)perylene	191-24-2	no	no	no	no	–	–	–	–
Benzo(k)fluoranthene	207-08-9	no	no	no	no	–	–	–	–
Chrysene	218-01-9	no	no	no	no	–	–	–	–
Dibenzo(a,h)anthracene	53-70-3	**YES**	**YES**	**YES**	no	1.10E-02	1.04E-02	2.60E-02 m	–
Fluoranthene	206-44-0	no	no	no	no	–	–	–	–
Fluorene	86-73-7	no	no	no	no	–	–	–	–
Indeno(1,2,3-cd)pyrene	193-39-5	no	no	no	no	–	–	–	–
Naphthalene	91-20-3	no	no	no	no	–	–	–	–
Phenanthrene	85-01-8	no	no	no	no	–	–	–	–
Pyrene	129-00-0	no	no	no	no	–	–	–	–
Polychlorinated Biphenyls									
Aroclor 1254	11097-69-1	**YES**	**YES**	no	no	3.85E-01	3.44E-01	–	–
Aroclor 1260	11096-82-5	no	no	no	no	–	–	–	–
Inorganics									

Table A.6.HHRA-5
Exposure Point Concentrations
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a]				Exposure Point Concentrations [b]			
		Surface Soil	Combined Surface and Subsurface Soil	Sediment	Surface Water	Surface Soil (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Sediment (mg/kg)	Surface Water (mg/L)
Aluminum	7429-90-5	**YES**	**YES**	**YES**	no	2.56E+04	2.23E+04	2.08E+04	–
Antimony	7440-36-0	no	no	no	no	–	–	–	–
Arsenic	7440-38-2	**YES**	**YES**	**YES**	no	8.97E+00	7.92E+00	7.79E+00	–
Barium	7440-39-3	**YES**	**YES**	no	no	4.18E+02	3.08E+02	–	–
Beryllium	7440-41-7	no	no	no	no	–	–	–	–
Cadmium	7440-43-9	no	no	no	no	–	–	–	–
Calcium	7440-70-2	no	no	no	no	–	–	–	–
Chromium	7440-47-3	no	no	no	no	–	–	–	–
Cobalt	7440-48-4	**YES**	**YES**	**YES**	no	2.81E+01	2.70E+01	1.15E+01	–
Copper	7440-50-8	no	no	no	no	–	–	–	–
Iron	7439-89-6	no	no	**YES**	**YES**	–	–	3.32E+04	4.47E+00 m
Lead	7439-92-1	no	no	no	**YES**	–	–	–	7.06E-03 avg
Magnesium	7439-95-4	no	no	no	no	–	–	–	–
Manganese	7439-96-5	no	no	**YES**	**YES**	–	–	5.36E+02	1.02E-01 m
Mercury	7439-97-6	no	no	no	no	–	–	–	–
Nickel	7440-02-0	no	no	no	no	–	–	–	–
Potassium	7440-09-7	no	no	no	no	–	–	–	–
Selenium	7782-49-2	no	no	no	no	–	–	–	–
Silver	7440-22-4	no	no	no	no	–	–	–	–
Sodium	7440-23-5	no	no	no	no	–	–	–	–
Thallium	7440-28-0	no	no	no	no	–	–	–	–
Vanadium	7440-62-2	no	no	**YES**	no	–	–	5.79E+01	–
Zinc	7440-66-6	no	no	no	no	–	–	–	–

Notes:
– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilogram.
mg/L = Milligrams per liter.

[a] Constituent of Potential Concern.
[b] The exposure point concentration (EPC) was the upper confidence level on the mean (UCL) or the maximum concentration where the UCL was incalculable.
EPCs marked with "m" are based on the maximum detected concentration.
Exposure to lead is evaluated by predicting resultant blood lead levels using the arithmetic average (avg).
The UCLs were calculated using ProUCL 4.0. The UCL used is the one recommended by ProUCL 4.0.

Table A.6.HHRA-6
Risk and Hazard Calculations for Site Worker Exposure to Surface Soil (0-2 foot Depth Interval)
RAIL YARD
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Current / Future
Receptor Population: Site Worker
Receptor Age: Adult

				CANCER RISK				Percent	NON-CANCER HAZARD				Percent
	EPCs	VF *or* PEF [a]		Route-Specific Risk			Calculated	Total	Route-Specific Hazard			Calculated	Total
Constituent	(mg/kg)	(m^3/kg)		Oral	Dermal	Inhalation	Risk	ELCR	Oral	Dermal	Inhalation	Hazard	HI
				ELCRo	ELCRd	ELCRi	ELCR		HQo	HQd	HQi	HI	
Volatile Organic Compounds													
3-Octanone	1.50E-01	3.87E+03	V	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Ethanol	8.70E-02	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Semi-Volatile Organic Compounds													
Carbazole	1.20E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Pentachlorophenol	8.30E+02	1.36E+09	P	3.5E-05	5.7E-05	NA	9.2E-05	90%	2.7E-02	4.5E-02	NA	7.2E-02	26%
Polycyclic Aromatic Hydrocarbons													
Benzo(a)anthracene	2.42E-01	1.36E+09	P	6.2E-08	5.3E-08	NA	1.1E-07	0%	NA	NA	NA	NA	–
Benzo(a)pyrene	2.42E-01	1.36E+09	P	6.2E-07	5.3E-07	3.8E-11	1.1E-06	1%	NA	NA	NA	NA	–
Benzo(b)fluoranthene	4.95E-01	1.36E+09	P	1.3E-07	1.1E-07	NA	2.3E-07	0%	NA	NA	NA	NA	–
Dibenzo(a,h)anthracene	1.10E-02	1.36E+09	P	2.8E-08	2.4E-08	NA	5.2E-08	0%	NA	NA	NA	NA	–
Pesticides													
Dieldrin	2.70E-01	1.36E+09	P	1.5E-06	1.0E-06	2.2E-10	2.5E-06	2%	5.3E-03	3.5E-03	NA	8.8E-03	3%
Polychlorinated Biphenyls													
Aroclor 1254	3.85E-01	1.36E+09	P	2.7E-07	2.5E-07	3.9E-11	5.2E-07	1%	1.9E-02	1.7E-02	NA	3.6E-02	13%
Inorganics													
Aluminum	2.56E+04	1.36E+09	P	NA	NA	NA	NA	–	2.5E-02	0.0E+00	2.6E-03	2.8E-02	10%
Arsenic	8.97E+00	1.36E+09	P	4.7E-06	9.3E-07	6.9E-09	5.6E-06	6%	2.9E-02	5.8E-03	NA	3.5E-02	13%
Barium	4.18E+02	1.36E+09	P	NA	NA	NA	NA	–	2.0E-03	0.0E+00	4.2E-04	2.5E-03	1%
Cobalt	2.81E+01	1.36E+09	P	NA	NA	4.5E-08	4.5E-08	0%	9.2E-02	0.0E+00	2.4E-03	9.4E-02	34%
Lead	–	–		–	–	–	–	–	–	–	–	–	–
				Total ELCR			1E-04	100%	Total HI			0.3	100%

[a] Minimum of the volatilization factor (identified with "V") and the particulate emission factor (PEF) (identified with "P"), both derived on Table A.2-11.

–	Not applicable.	HQ	Hazard quotient.	PEF	Particulate emission factor.
ELCR	Excess lifetime cancer risk.	m^3/kg	Cubic meters per kilogram.	VF	Volatilization factor.
EPCs	Exposure point concentration in surface soil (mg/kg).	mg/kg	Milligrams per kilogram.		
HI	Hazard index (sum of the HQs).	NA	Not available.		

Equations: (see Table A.2-11)

ELCRo = (EPCs × 1 × 100 × 250 × 25 × CSFo) / (1,000,000 × 70 × 25,550)
ELCRd = (EPCs × 3,300 × 0.2 × ABSd × 250 × 25 × CSFa) / (1,000,000 × 70 × 25,550)
ELCRi = (EPCs × 20 × 250 × 25 × CSFi) / ([VF or PEF] × 70 × 25,550)

HQo = (EPCs × 1 × 100 × 250 × 25) / (1,000,000 × 70 × 9,125 × RfDo)
HQd = (EPCs × 3,300 × 0.2 × ABSd × 250 × 25) / (1,000,000 × 70 × 9,125 × RfDa)
HQi = (EPCs × 20 × 250 × 25) / ([VF or PEF] × 70 × 9,125 × RfDi)

Table A.6.HHRA-7
Risk and Hazard Calculations for Site Worker Wading Exposure to Sediment
RAIL YARD
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Current / Future
Receptor Population: Site Worker
Receptor Age: Adult

Constituent	EPCsed (mg/kg)	CANCER RISK Route-Specific Risks Oral	Dermal	Calculated Risk	Percent Total ELCR	NON-CANCER RISK Route-Specific Risks Oral	Dermal	Calculated Hazard	Percent Total HI
		ELCRo	ELCRd	ELCR		HQo	HQd	HI	
Polycyclic Aromatic Hydrocarbons									
Benzo(a)anthracene	1.23E-01	1.6E-09	1.3E-08	1.4E-08	2%	NA	NA	NA	–
Benzo(a)pyrene	8.91E-02	1.2E-08	9.2E-08	1.0E-07	14%	NA	NA	NA	–
Benzo(b)fluoranthene	1.39E-01	1.8E-09	1.4E-08	1.6E-08	2%	NA	NA	NA	–
Dibenzo(a,h)anthracene	2.60E-02	3.4E-09	2.7E-08	3.0E-08	4%	NA	NA	NA	–
Herbicides					–				–
Dichlorprop	3.53E-01	NA	NA	NA	–	NA	NA	NA	–
Explosives					–				–
Pentaerythritol Tetranitrate	2.30E-01	NA	NA	NA	–	NA	NA	NA	–
Inorganics									
Aluminum	2.08E+04	NA	NA	NA	–	1.1E-03	0.0E+00	1.1E-03	11%
Arsenic	7.79E+00	2.1E-07	3.8E-07	5.9E-07	78%	1.3E-03	2.4E-03	3.7E-03	38%
Cobalt	1.15E+01	NA	NA	NA	–	2.0E-03	0.0E+00	2.0E-03	20%
Iron	3.32E+04	NA	NA	NA	–	2.4E-03	0.0E+00	2.4E-03	25%
Manganese	5.36E+02	NA	NA	NA	–	1.9E-04	0.0E+00	1.9E-04	2%
Vanadium	5.79E+01	NA	NA	NA	–	4.2E-04	0.0E+00	4.2E-04	4%
		Total ELCR		8E-07	100%	Total HI		0.01	100%

– Not applicable.
ELCR Excess lifetime cancer risk.
EPCsed Exposure point concentration in sediment (mg/kg).
HI Hazard index (sum of the HQs).
HQ Hazard quotient.
mg/kg Milligrams per kilogram.
NA Not available.

Equations: (see Table A.2-12)

ELCRo = (EPCsed × 50 × 26 × 25 × CSFo) / (1,000,000 × 70 × 25,550)
ELCRd = (EPCsed × 5,000 × 0.6 × ABSd × 26 × 25 × CSFa) / (1,000,000 × 70 × 25,550)
HQo = (EPCsed × 50 × 26 × 25) / (1,000,000 × 70 × 9,125 × RfDo)
HQd = (EPCsed × 5,000 × 0.6 × ABSd × 26 × 25) / (1,000,000 × 70 × 9,125 × RfDa)

Table A.6.HHRA-8
Risk and Hazard Calculations for Site Worker Wading Exposure to Surface Water
RAIL YARD
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Current / Future
Receptor Population: Site Worker
Receptor Age: Adult

Constituent	EPCsw (mg/L)	DA [a] (L/cm²/day)	VFsw (L/m³)	CANCER RISK Route-Specific Risk Oral	Dermal	Inhalation	Calculated Risk	Percent Total ELCR	NON-CANCER HAZARD Route-Specific Hazard Oral	Dermal	Inhalation	Calculated Hazard	Percent Total HI
				ELCRo	ELCRd	ELCRi	ELCR		HQo	HQd	HQi	HI	
Volatile Organic Compounds													
Chloroform	3.70E-04	5.99E-05	4.24E-03	NA	NA	9.6E-11	9.6E-11	0%	1.5E-05	1.1E-05	1.2E-07	2.6E-05	0%
Semi-Volatile Organic Compounds													
Bis(2-ethylhexyl)phthalate	8.00E-03	6.38E-04	9.90E-07	1.6E-08	1.3E-07	NA	1.5E-07	65%	1.6E-04	1.3E-03	NA	1.5E-03	1%
Herbicides													
MCPA	1.10E-01	0.00E+00	6.13E-04	NA	NA	NA	NA	–	9.0E-02	0.0E+00	NA	9.0E-02	73%
MCPP	4.63E-02	0.00E+00	2.38E-07	NA	NA	NA	NA	–	1.9E-02	0.0E+00	NA	1.9E-02	15%
Pesticides													
Dieldrin	7.19E-06	2.87E-04	1.40E-04	1.7E-08	6.0E-08	1.2E-11	7.7E-08	34%	5.9E-05	2.1E-04	NA	2.7E-04	0%
Explosives													
Nitroglycerine	6.10E-04	8.88E-06	7.74E-05	1.5E-09	1.7E-10	NA	1.7E-09	1%	2.5E-03	2.8E-04	NA	2.8E-03	2%
Inorganics													
Cadmium	–	–	–	–	–	–	–	–	–	–	–	–	–
Iron	4.47E+00	8.00E-06	NA	NA	NA	NA	NA	–	2.6E-03	2.6E-04	NA	2.9E-03	2%
Lead	7.06E-03	8.00E-07	NA	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Manganese	1.02E-01	8.00E-06	NA	NA	NA	NA	NA	–	2.1E-03	5.2E-03	NA	7.3E-03	6%
				Total ELCR			2E-07	100%	Total HI			0.1	100%

[a] The dermal absorption factor (DA) was calculated using Equation [0], [1], or [2], as indicated, from Table A.2-13.

–	Not applicable.
ELCR	Excess lifetime cancer risk.
EPCsw	Exposure point concentration in surface water (mg/L).
HI	Hazard index (sum of the HQs).
HQ	Hazard quotient.
L/cm²/day	Liters per square centimeter per day.
L/m^3	Liters per cubic meter.
mg/L	Milligrams per liter.
NA	Not available.
VFsw	Volatilization factor for surface water.

Equations: (see Table A.2-13)

3.75 = Um = Mean annual wind speed (m/sec) for Roanoke, Virginia (USDOE 1986).

ELCRo = (EPCsw × 0.05 × 8 × 26 × 25 × CSFo) / (70 × 25,550)
ELCRd = (EPCsw × DA × 5,000 × 26 × 25 × CSFa) / (70 × 25,550)
ELCRi = (EPCsw × VFsw × 2 × 26 × 25 × CSFi) / (70 × 25,550)

HQo = (EPCsw × 0.05 × 8 × 26 × 25) / (70 × 9,125 × RfDo)
HQd = (EPCsw × DA × 5,000 × 26 × 25) / (70 × 9,125 × RfDa)
HQi = (EPCsw × VFsw × 2 × 26 × 25) / (70 × 9,125 × RfDi)

Table A.6.HHRA-9
Risk and Hazard Calculations for Hypothetical Future Construction Worker Exposure to Combined Surface and Subsurface Soil
RAIL YARD
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Constituent	EPCs (mg/kg)	VF *or* PEF [a] (m³/kg)		CANCER RISK Route-Specific Risk Oral ELCRo	Dermal ELCRd	Inhalation ELCRi	Calculated Risk ELCR	Percent Total ELCR	NON-CANCER HAZARD Route-Specific Hazard Oral HQo	Dermal HQd	Inhalation HQi	Calculated Hazard HI	Percent Total HI
Volatile Organic Compounds													
3-Octanone	1.50E-01	3.87E+03	V	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Ethanol	8.70E-02	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Semi-Volatile Organic Compounds													
Carbazole	1.20E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Pentachlorophenol	8.30E+02	1.36E+09	P	2.4E-06	1.8E-06	NA	4.2E-06	89%	9.3E-02	7.0E-02	NA	1.6E-01	23%
Polycyclic Aromatic Hydrocarbons													
Benzo(a)anthracene	1.56E-01	1.36E+09	P	2.7E-09	1.1E-09	NA	3.8E-09	0%	NA	NA	NA	NA	–
Benzo(a)pyrene	1.56E-01	1.36E+09	P	2.7E-08	1.1E-08	5.2E-13	3.8E-08	1%	NA	NA	NA	NA	–
Benzo(b)fluoranthene	2.41E-01	1.36E+09	P	4.2E-09	1.6E-09	NA	5.9E-09	0%	NA	NA	NA	NA	–
Dibenzo(a,h)anthracene	1.04E-02	1.36E+09	P	1.8E-09	7.1E-10	NA	2.5E-09	0%	NA	NA	NA	NA	–
Pesticides													
Dieldrin	2.70E-01	1.36E+09	P	1.0E-07	3.1E-08	4.6E-12	1.3E-07	3%	1.8E-02	5.5E-03	NA	2.4E-02	3%
Polychlorinated Biphenyls													
Aroclor 1254	3.44E-01	1.36E+09	P	1.7E-08	6.9E-09	7.3E-13	2.3E-08	0%	2.3E-02	9.7E-03	NA	3.3E-02	5%
Inorganics													
Aluminum	2.23E+04	1.36E+09	P	NA	NA	NA	NA	–	7.5E-02	0.0E+00	2.4E-03	7.7E-02	11%
Arsenic	7.92E+00	1.36E+09	P	2.8E-07	2.6E-08	1.3E-10	3.1E-07	7%	8.9E-02	8.0E-03	NA	9.7E-02	14%
Barium	3.08E+02	1.36E+09	P	NA	NA	NA	NA	–	5.2E-03	0.0E+00	3.3E-05	5.2E-03	1%
Cobalt	2.70E+01	1.36E+09	P	NA	NA	9.1E-10	9.1E-10	0%	3.0E-01	0.0E+00	7.1E-04	3.0E-01	43%
Lead	–	–		–	–	–	–	–	–	–	–	–	–
				Total ELCR			5E-06	100%	Total HI			0.7	100%

[a] Minimum of the volatilization factor (identified with "V") and the particulate emission factor (PEF) (identified with "P"), both derived on Table A.2-11.

–	Not applicable.	HQ	Hazard quotient.	PEF	Particulate emission factor.
ELCR	Excess lifetime cancer risk.	m^3/kg	Cubic meters per kilogram.	VF	Volatilization factor.
EPCs	Exposure point concentration in soil (mg/kg).	mg/kg	Milligrams per kilogram.		
HI	Hazard index (sum of the HQs).	NA	Not available.		

Equations: (see Table A.2-11)

ELCRo = (EPCs × 1 × 330 × 130 × 1 × CSFo) / (1,000,000 × 70 × 25,550)
ELCRd = (EPCs × 3,300 × 0.3 × ABSd × 130 × 1 × CSFa) / (1,000,000 × 70 × 25,550)
ELCRi = (EPCs × 20 × 130 × 1 × CSFi) / ([VF or PEF] × 70 × 25,550)

HQo = (EPCs × 1 × 330 × 130 × 1) / (1,000,000 × 70 × 182 × RfDo)
HQd = (EPCs × 3,300 × 0.3 × ABSd × 130 × 1) / (1,000,000 × 70 × 182 × RfDa)
HQi = (EPCs × 20 × 130 × 1) / ([VF or PEF] × 70 × 182 × RfDi)

Table A.6.HHRA-10
Risk and Hazard Calculations for Hypothetical Future Adult Resident Exposure to Combined Surface and Subsurface Soil
RAIL YARD
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Adult Resident
Receptor Age: Adult

Constituent	EPCs (mg/kg)	VF *or* PEF [a] (m³/kg)		CANCER RISK Route-Specific Risk Oral ELCRo	Dermal ELCRd	Inhalation ELCRi	Calculated Risk ELCR	Percent Total ELCR	NON-CANCER HAZARD Route-Specific Hazard Oral HQo	Dermal HQd	Inhalation HQi	Calculated Hazard HI	Percent Total HI
Volatile Organic Compounds													
3-Octanone	1.50E-01	3.87E+03	V	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Ethanol	8.70E-02	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Semi-Volatile Organic Compounds													
Carbazole	1.20E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Pentachlorophenol	8.30E+02	1.36E+09	P	4.7E-05	4.7E-05	NA	9.3E-05	89%	3.8E-02	3.8E-02	NA	7.6E-02	23%
Polycyclic Aromatic Hydrocarbons													
Benzo(a)anthracene	1.56E-01	1.36E+09	P	7.8E-08	4.0E-08	NA	1.2E-07	0%	NA	NA	NA	NA	–
Benzo(a)pyrene	1.56E-01	1.36E+09	P	7.8E-07	4.0E-07	4.9E-11	1.2E-06	1%	NA	NA	NA	NA	–
Benzo(b)fluoranthene	2.41E-01	1.36E+09	P	1.2E-07	6.3E-08	NA	1.8E-07	0%	NA	NA	NA	NA	–
Dibenzo(a,h)anthracene	1.04E-02	1.36E+09	P	5.2E-08	2.7E-08	NA	7.9E-08	0%	NA	NA	NA	NA	–
Pesticides													
Dieldrin	2.70E-01	1.36E+09	P	2.0E-06	8.1E-07	3.0E-10	2.8E-06	3%	7.4E-03	3.0E-03	NA	1.0E-02	3%
Polychlorinated Biphenyls													
Aroclor 1254	3.44E-01	1.36E+09	P	3.2E-07	1.8E-07	4.7E-11	5.0E-07	0%	2.4E-02	1.3E-02	NA	3.7E-02	11%
Inorganics													
Aluminum	2.23E+04	1.36E+09	P	NA	NA	NA	NA	–	3.1E-02	0.0E+00	3.1E-03	3.4E-02	10%
Arsenic	7.92E+00	1.36E+09	P	5.6E-06	6.7E-07	8.2E-09	6.3E-06	6%	3.6E-02	4.3E-03	NA	4.0E-02	12%
Barium	3.08E+02	1.36E+09	P	NA	NA	NA	NA	–	2.1E-03	0.0E+00	4.3E-04	2.5E-03	1%
Cobalt	2.70E+01	1.36E+09	P	NA	NA	5.8E-08	5.8E-08	0%	1.2E-01	0.0E+00	3.2E-03	1.3E-01	39%
Lead	–	–		–	–	–	–	–	–	–	–	–	–
				Total ELCR			1E-04	100%	Total HI			0.3	100%

[a] Minimum of the volatilization factor (identified with "V") and the particulate emission factor (PEF) (identified with "P"), both derived on Table A.2-11.

–	Not applicable.	HQ	Hazard quotient.	PEF	Particulate emission factor.
ELCR	Excess lifetime cancer risk.	m^3/kg	Cubic meters per kilogram.	VF	Volatilization factor.
EPCs	Exposure point concentration in soil (mg/kg).	mg/kg	Milligrams per kilogram.		
HI	Hazard index (sum of the HQs).	NA	Not available.		

Equations: (see Table A.2-11. Potentially mutagenic carcinogens (i.e., PAHs) adjusted to incorporate ADAFs of 2.1 for 10 years (ages 6 to 16) and 1 for the remaining 14 years as an adult. Oral example: (EPC x 1 x 100 x 350 x CSF/(1,000,000 x 365 x 70)) x ((2.1 x 10/70) + (1 x 14/70)).

ELCRo = (EPCs × 1 × 100 × 350 × 24 × CSFo) / (1,000,000 × 70 × 25,550)
ELCRd = (EPCs × 5,700 × 0.07 × ABSd × 350 × 24 × CSFa) / (1,000,000 × 70 × 25,550)
ELCRi = (EPCs × 20 × 350 × 24 × CSFi) / ([VF or PEF] × 70 × 25,550)

HQo = (EPCs × 1 × 100 × 350 × 24) / (1,000,000 × 70 × 8,760 × RfDo)
HQd = (EPCs × 5,700 × 0.07 × ABSd × 350 × 24) / (1,000,000 × 70 × 8,760 × RfDa)
HQi = (EPCs × 20 × 350 × 24) / ([VF or PEF] × 70 × 8,760 × RfDi)

Table A.6.HHRA-11
Risk and Hazard Calculations for Hypothetical Future Adult Resident Wading Exposure to Sediment
RAIL YARD
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Adult Resident
Receptor Age: Adult

Constituent	EPCsed (mg/kg)	CANCER RISK Route-Specific Risks Oral	Dermal	Calculated Risk	Percent Total ELCR	NON-CANCER RISK Route-Specific Risks Oral	Dermal	Calculated Hazard	Percent Total HI
		ELCRo	ELCRd	ELCR		HQo	HQd	HI	
Polycyclic Aromatic Hydrocarbons									
Benzo(a)anthracene	1.23E-01	4.2E-09	3.3E-08	3.7E-08	3%	NA	NA	NA	–
Benzo(a)pyrene	8.91E-02	3.1E-08	2.4E-07	2.7E-07	18%	NA	NA	NA	–
Benzo(b)fluoranthene	1.39E-01	4.8E-09	3.7E-08	4.2E-08	3%	NA	NA	NA	–
Dibenzo(a,h)anthracene	2.60E-02	8.9E-09	7.0E-08	7.8E-08	5%	NA	NA	NA	–
Herbicides					–				–
Dichlorprop	3.53E-01	NA	NA	NA	–	NA	NA	NA	–
Explosives					–				–
Pentaerythritol Tetranitrate	2.30E-01	NA	NA	NA	–	NA	NA	NA	–
Inorganics									
Aluminum	2.08E+04	NA	NA	NA	–	2.0E-03	0.0E+00	2.0E-03	11%
Arsenic	7.79E+00	3.8E-07	6.8E-07	1.1E-06	71%	2.4E-03	4.4E-03	6.8E-03	38%
Cobalt	1.15E+01	NA	NA	NA	–	3.6E-03	0.0E+00	3.6E-03	20%
Iron	3.32E+04	NA	NA	NA	–	4.5E-03	0.0E+00	4.5E-03	25%
Manganese	5.36E+02	NA	NA	NA	–	3.6E-04	0.0E+00	3.6E-04	2%
Vanadium	5.79E+01	NA	NA	NA	–	7.8E-04	0.0E+00	7.8E-04	4%
		Total ELCR		1E-06	100%	Total HI		0.02	100%

– Not applicable.
ELCR Excess lifetime cancer risk.
EPCsed Exposure point concentration in sediment (mg/kg).
HI Hazard index (sum of the HQs).
HQ Hazard quotient.
mg/kg Milligrams per kilogram.
NA Not available.

Equations: (see Table A.2-12. Potentially mutagenic carcinogens (i.e., PAHs) adjusted to incorporate ADAFs of 2.1 for 10 years (ages 6 to 16) and 1 for the remaining 14 years as an adult.
Oral example: (EPC x 50 x 48 x CSF/(1,000,000 x 365 x 70)) x ((2.1 x 10/70) + (1 x 14/70)).
ELCRo = (EPCsed × 50 × 48 × 24 × CSFo) / (1,000,000 × 70 × 25,550)
ELCRd = (EPCsed × 5,000 × 0.6 × ABSd × 48 × 24 × CSFa) / (1,000,000 × 70 × 25,550)
HQo = (EPCsed × 50 × 48 × 24) / (1,000,000 × 70 × 8,760 × RfDo)
HQd = (EPCsed × 5,000 × 0.6 × ABSd × 48 × 24) / (1,000,000 × 70 × 8,760 × RfDa)

Table A.6.HHRA-12
Risk and Hazard Calculations for Hypothetical Future Adult Resident Wading Exposure to Surface Water
RAIL YARD
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Adult Resident
Receptor Age: Adult

		DA		CANCER RISK				Percent	NON-CANCER HAZARD				Percent
	EPCsw	[a]	VFsw	Route-Specific Risk			Calculated	Total	Route-Specific Hazard			Calculated	Total
Constituent	(mg/L)	(L/cm²/day)	(L/m³)	Oral	Dermal	Inhalation	Risk	ELCR	Oral	Dermal	Inhalation	Hazard	HI
				ELCRo	ELCRd	ELCRi	ELCR		HQo	HQd	HQi	HI	
Volatile Organic Compounds													
Chloroform	3.70E-04	1.33E-05	4.24E-03	NA	NA	1.2E-09	1.2E-09	0%	2.5E-05	3.4E-05	1.6E-06	6.1E-05	0%
Semi-Volatile Organic Compounds													
Bis(2-ethylhexyl)phthalate	8.00E-03	2.25E-04	9.90E-07	2.6E-08	5.9E-07	NA	6.2E-07	67%	2.7E-04	6.2E-03	NA	6.5E-03	3%
Herbicides													
MCPA	1.10E-01	0.00E+00	6.13E-04	NA	NA	NA	NA	–	1.5E-01	0.0E+00	NA	1.5E-01	71%
MCPP	4.63E-02	0.00E+00	2.38E-07	NA	NA	NA	NA	–	3.2E-02	0.0E+00	NA	3.2E-02	15%
Pesticides													
Dieldrin	7.19E-06	1.01E-04	1.40E-04	2.7E-08	2.7E-07	1.6E-10	3.0E-07	33%	9.8E-05	1.0E-03	NA	1.1E-03	1%
Explosives													
Nitroglycerine	6.10E-04	1.11E-06	7.74E-05	2.4E-09	2.7E-10	NA	2.7E-09	0%	4.2E-03	4.6E-04	NA	4.6E-03	2%
Inorganics													
Cadmium	–	–	–	–	–	–	–	–	–	–	–	–	–
Iron	4.47E+00	1.00E-06	NA	NA	NA	NA	NA	–	4.4E-03	4.4E-04	NA	4.8E-03	2%
Lead	7.06E-03	1.00E-07	NA	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Manganese	1.02E-01	1.00E-06	NA	NA	NA	NA	NA	–	3.5E-03	8.7E-03	NA	1.2E-02	6%
				Total ELCR			9E-07	100%	Total HI			0.2	100%

[a] The dermal absorption factor (DA) was calculated using Equation [0], [1], or [2], as indicated, from Table A.2-13.

– Not applicable.
ELCR Excess lifetime cancer risk.
EPCsw Exposure point concentration in surface water (mg/L).
HI Hazard index (sum of the HQs).
HQ Hazard quotient.
L/cm²/day Liters per square centimeter per day.
L/m³ Liters per cubic meter.
mg/L Milligrams per liter.
NA Not available.
VFsw Volatilization factor for surface water.

Equations: (see Table A.2-13)
ELCRo = (EPCsw × 0.05 × 1 × 350 × 24 × CSFo) / (70 × 25,550)
ELCRd = (EPCsw × DA × 5,000 × 350 × 24 × CSFa) / (70 × 25,550)
ELCRi = (EPCsw × VFsw × 2 × 350 × 24 × CSFi) / (70 × 25,550)

3.75 = Um = Mean annual wind speed (m/sec) for Roanoke, Virginia (USDOE 1986).
HQo = (EPCsw × 0.05 × 1 × 350 × 24) / (70 × 8,760 × RfDo)
HQd = (EPCsw × DA × 5,000 × 350 × 24) / (70 × 8,760 × RfDa)
HQi = (EPCsw × VFsw × 2 × 350 × 24) / (70 × 8,760 × RfDi)

Table A.6.HHRA-13
Risk and Hazard Calculations for Hypothetical Future Child Resident Exposure to Combined Surface and Subsurface Soil
RAIL YARD
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Child Resident
Receptor Age: Child

Constituent	EPCs (mg/kg)	VF *or* PEF [a] (m^3/kg)		CANCER RISK Route-Specific Risk Oral ELCRo	Dermal ELCRd	Inhalation ELCRi	Calculated Risk ELCR	Percent Total ELCR	NON-CANCER HAZARD Route-Specific Hazard Oral HQo	Dermal HQd	Inhalation HQi	Calculated Hazard HI	Percent Total HI
Volatile Organic Compounds													
3-Octanone	1.50E-01	3.87E+03	V	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Ethanol	8.70E-02	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Semi-Volatile Organic Compounds													
Carbazole	1.20E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Pentachlorophenol	8.30E+02	1.36E+09	P	1.1E-04	7.6E-05	NA	1.9E-04	87%	3.5E-01	2.5E-01	NA	6.0E-01	21%
Polycyclic Aromatic Hydrocarbons													
Benzo(a)anthracene	1.56E-01	1.36E+09	P	3.7E-07	1.3E-07	NA	5.0E-07	0%	NA	NA	NA	NA	–
Benzo(a)pyrene	1.56E-01	1.36E+09	P	3.7E-06	1.3E-06	5.7E-11	5.0E-06	2%	NA	NA	NA	NA	–
Benzo(b)fluoranthene	2.41E-01	1.36E+09	P	5.7E-07	2.1E-07	NA	7.7E-07	0%	NA	NA	NA	NA	–
Dibenzo(a,h)anthracene	1.04E-02	1.36E+09	P	2.4E-07	8.9E-08	NA	3.3E-07	0%	NA	NA	NA	NA	–
Pesticides													
Dieldrin	2.70E-01	1.36E+09	P	4.7E-06	1.3E-06	1.7E-10	6.1E-06	3%	6.9E-02	1.9E-02	NA	8.8E-02	3%
Polychlorinated Biphenyls													
Aroclor 1254	3.44E-01	1.36E+09	P	7.5E-07	3.0E-07	2.8E-11	1.0E-06	0%	2.2E-01	8.6E-02	NA	3.1E-01	11%
Inorganics													
Aluminum	2.23E+04	1.36E+09	P	NA	NA	NA	NA	–	2.9E-01	0.0E+00	7.3E-03	2.9E-01	10%
Arsenic	7.92E+00	1.36E+09	P	1.3E-05	1.1E-06	4.8E-09	1.4E-05	7%	3.4E-01	2.8E-02	NA	3.7E-01	13%
Barium	3.08E+02	1.36E+09	P	NA	NA	NA	NA	–	2.0E-02	0.0E+00	1.0E-03	2.1E-02	1%
Cobalt	2.70E+01	1.36E+09	P	NA	NA	3.4E-08	3.4E-08	0%	1.1E+00	0.0E+00	7.4E-03	1.2E+00	41%
Lead	–	–		–	–	–	–	–	–	–	–	–	–
				Total ELCR			2E-04	100%	Total HI **			3	100%

** HI Segregated by Target Site/Critical Effect:
CNS - Central nervous system
NA - Not available
NR - None reported

HI (liver, kidney) =	0.7	HI (gastrointestinal tract) =	0
HI (CNS, whole body, immune system) =	0.3	HI (nasal, lung) =	0
HI (blood) =	0	HI (eyes, nails, hair, skin) =	2
HI (fetus, developmental) =	0.3	HI (NA, NR) =	0

[a] Minimum of the volatilization factor (identified with "V") and the particulate emission factor (PEF) (identified with "P"), both derived on Table A.2-11.

–	Not applicable.	HQ	Hazard quotient.	PEF	Particulate emission factor.
ELCR	Excess lifetime cancer risk.	m^3/kg	Cubic meters per kilogram.	VF	Volatilization factor.
EPCs	Exposure point concentration in soil (mg/kg).	mg/kg	Milligrams per kilogram.		
HI	Hazard index (sum of the HQs).	NA	Not available.		

Equations: (see Table A.2-11. Potentially mutagenic carcinogens (i.e., PAHs) adjusted to incorporate ADAFs of 4.6 for 2 years (ages 0 to 2) and 2.1 for 4 years (ages 2 to 6). Oral example: (EPC x 1 x 200 x 350 x CSF/(1,000,000 x 365 x 15)) x ((4.6 x 2/70) + (2.1 x 4/70)).

ELCRo = (EPCs × 1 × 200 × 350 × 6 × CSFo) / (1,000,000 × 15 × 25,550)
ELCRd = (EPCs × 2,800 × 0.2 × ABSd × 350 × 6 × CSFa) / (1,000,000 × 15 × 25,550)
ELCRi = (EPCs × 10 × 350 × 6 × CSFi) / ([VF or PEF] × 15 × 25,550)

HQo = (EPCs × 1 × 200 × 350 × 6) / (1,000,000 × 15 × 2,190 × RfDo)
HQd = (EPCs × 2,800 × 0.2 × ABSd × 350 × 6) / (1,000,000 × 15 × 2,190 × RfDa)
HQi = (EPCs × 10 × 350 × 6) / ([VF or PEF] × 15 × 2,190 × RfDi)

Table A.6.HHRA-14
Risk and Hazard Calculations for Hypothetical Future Child Resident Wading Exposure to Sediment
RAIL YARD
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Child Resident
Receptor Age: Child

		CANCER RISK			Percent	NON-CANCER RISK			Percent
	EPCsed	Route-Specific Risks		Calculated	Total	Route-Specific Risks		Calculated	Total
Constituent	(mg/kg)	Oral	Dermal	Risk	ELCR	Oral	Dermal	Hazard	HI
		ELCRo	ELCRd	ELCR		HQo	HQd	HI	
Polycyclic Aromatic Hydrocarbons									
Benzo(a)anthracene	1.23E-01	2.0E-08	9.8E-09	3.0E-08	2%	NA	NA	NA	–
Benzo(a)pyrene	8.91E-02	1.4E-07	7.1E-08	2.1E-07	16%	NA	NA	NA	–
Benzo(b)fluoranthene	1.39E-01	2.2E-08	1.1E-08	3.3E-08	3%	NA	NA	NA	–
Dibenzo(a,h)anthracene	2.60E-02	4.2E-08	2.1E-08	6.3E-08	5%	NA	NA	NA	–
Herbicides					–				–
Dichlorprop	3.53E-01	NA	NA	NA	–	NA	NA	NA	–
Explosives					–				–
Pentaerythritol Tetranitrate	2.30E-01	NA	NA	NA	–	NA	NA	NA	–
Inorganics									
Aluminum	2.08E+04	NA	NA	NA	–	1.8E-02	0.0E+00	1.8E-02	14%
Arsenic	7.79E+00	8.8E-07	1.0E-07	9.8E-07	74%	2.3E-02	2.6E-03	2.5E-02	20%
Cobalt	1.15E+01	NA	NA	NA	–	3.4E-02	0.0E+00	3.4E-02	26%
Iron	3.32E+04	NA	NA	NA	–	4.2E-02	0.0E+00	4.2E-02	32%
Manganese	5.36E+02	NA	NA	NA	–	3.4E-03	0.0E+00	3.4E-03	3%
Vanadium	5.79E+01	NA	NA	NA	–	7.3E-03	0.0E+00	7.3E-03	6%
		Total ELCR		1E-06	100%	Total HI		0.1	100%

– Not applicable.
ELCR Excess lifetime cancer risk.
EPCsed Exposure point concentration in sediment (mg/kg).
HI Hazard index (sum of the HQs).
HQ Hazard quotient.
mg/kg Milligrams per kilogram.
NA Not available.

Equations: (see Table A.2-12. Potentially mutagenic carcinogens (i.e., PAHs) adjusted to incorporate ADAFs of 4.6 for 2 years (ages 0 to 2) and 2.1 for 4 years (ages 2 to 6). Oral example: (EPC x 100 x 48 x CSF/(1,000,000 x 365 x 15)) x ((4.6 x 2/70) + (2.1 x 4/70)).

ELCRo = (EPCsed × 100 × 48 × 6 × CSFo) / (1,000,000 × 15 × 25,550)
ELCRd = (EPCsed × 1,900 × 0.2 × ABSd × 48 × 6 × CSFa) / (1,000,000 × 15 × 25,550)
HQo = (EPCsed × 100 × 48 × 6) / (1,000,000 × 15 × 2,190 × RfDo)
HQd = (EPCsed × 1,900 × 0.2 × ABSd × 48 × 6) / (1,000,000 × 15 × 2,190 × RfDa)

Table A.6.HHRA-15
Risk and Hazard Calculations for Hypothetical Future Child Resident Wading Exposure to Surface Water
RAIL YARD
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Child Resident
Receptor Age: Child

Constituent	EPCsw (mg/L)	DA [a] (L/cm²/day)	VFsw (L/m³)	CANCER RISK Route-Specific Risk Oral ELCRo	Dermal ELCRd	Inhalation ELCRi	Calculated Risk ELCR	Percent Total ELCR	NON-CANCER HAZARD Route-Specific Hazard Oral HQo	Dermal HQd	Inhalation HQi	Calculated Hazard HI	Percent Total HI
Volatile Organic Compounds													
Chloroform	3.70E-04	1.33E-05	4.24E-03	NA	NA	1.9E-10	1.9E-10	0%	1.6E-05	8.2E-06	9.8E-07	2.5E-05	0%
Semi-Volatile Organic Compounds		–											
Bis(2-ethylhexyl)phthalate	8.00E-03	2.25E-04	9.90E-07	4.2E-09	3.6E-08	NA	4.0E-08	65%	1.8E-04	1.5E-03	NA	1.7E-03	1%
Herbicides		–											
MCPA	1.10E-01	0.00E+00	6.13E-04	NA	NA	NA	NA	–	9.6E-02	0.0E+00	NA	9.6E-02	75%
MCPP	4.63E-02	0.00E+00	2.38E-07	NA	NA	NA	NA	–	2.0E-02	0.0E+00	NA	2.0E-02	16%
Pesticides		–											
Dieldrin	7.19E-06	1.01E-04	1.40E-04	4.3E-09	1.7E-08	2.4E-11	2.1E-08	34%	6.3E-05	2.4E-04	NA	3.1E-04	0%
Explosives		–											
Nitroglycerine	6.10E-04	1.11E-06	7.74E-05	3.9E-10	1.6E-11	NA	4.1E-10	1%	2.7E-03	1.1E-04	NA	2.8E-03	2%
Inorganics		–											
Cadmium	–	–	–	–	–	–	–	–	–	–	–	–	–
Iron	4.47E+00	1.00E-06	NA	NA	NA	NA	NA	–	2.8E-03	1.1E-04	NA	2.9E-03	2%
Lead	7.06E-03	1.00E-07	NA	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Manganese	1.02E-01	1.00E-06	NA	NA	NA	NA	NA	–	2.2E-03	2.1E-03	NA	4.4E-03	3%
				Total ELCR			6E-08	100%	Total HI			0.1	100%

[a] The dermal absorption factor (DA) was calculated using Equation [0], [1], or [2], as indicated, from Table A.2-13.

–	Not applicable.	HQ	Hazard quotient.	NA	Not available.
ELCR	Excess lifetime cancer risk.	L/cm²/day	Liters per square centimeter per day.	VFsw	Volatilization factor for surface water.
EPCsw	Exposure point concentration in surface water (mg/L).	L/m^3	Liters per cubic meter.		
HI	Hazard index (sum of the HQs).	mg/L	Milligrams per liter.		

Equations: (see Table A.2-13)

$\boxed{3.75}$ = Um = Mean annual wind speed (m/sec) for Roanoke, Virginia (USDOE 1986).

ELCRo = (EPCsw × 0.05 × 1 × 48 × 6 × CSFo) / (15 × 25,550)
ELCRd = (EPCsw × DA × 1,900 × 48 × 6 × CSFa) / (15 × 25,550)
ELCRi = (EPCsw × VFsw × 2 × 48 × 6 × CSFi) / (15 × 25,550)

HQo = (EPCsw × 0.05 × 1 × 48 × 6) / (15 × 2,190 × RfDo)
HQd = (EPCsw × DA × 1,900 × 48 × 6) / (15 × 2,190 × RfDa)
HQi = (EPCsw × VFsw × 2 × 48 × 6) / (15 × 2,190 × RfDi)

Table A.6.HHRA-16
Summary of Calculated Human Health Risks and Hazards
RAIL YARD
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

RECEPTOR Exposure Medium - Scenario	Calculation Table	Total Excess Lifetime Cancer Risk	Total Non-Cancer Hazard
Site Worker			
Surface Soil - Direct Contact	Table A.6.HHRA-6	1E-04	0.3
Sediment - Wading	Table A.6.HHRA-7	8E-07	0.01
Surface Water - Wading	Table A.6.HHRA-8	2E-07	0.1
TOTAL SITE RISKS (Site Worker):		1E-04	0.4
Hypothetical Future Construction Worker			
Combined Surface and Subsurface Soil - Direct Contact	Table A.6.HHRA-9	5E-06	0.7
TOTAL SITE RISKS (Construction Worker):		5E-06	0.7
Hypothetical Future Adult Resident			
Combined Surface and Subsurface Soil - Direct Contact	Table A.6.HHRA-10	1E-04	0.3
Sediment - Wading	Table A.6.HHRA-11	1E-06	0.02
Surface Water - Wading	Table A.6.HHRA-12	9E-07	0.2
TOTAL SITE RISKS (Adult Resident):		1E-04	0.6
Hypothetical Future Child Resident			
Combined Surface and Subsurface Soil - Direct Contact	Table A.6.HHRA-13	2E-04	3
Sediment - Wading	Table A.6.HHRA-14	1E-06	0.1
Surface Water - Wading	Table A.6.HHRA-15	6E-08	0.1
TOTAL SITE RISKS (Child Resident):		2E-04	3
Hypothetical Aggregate Child Resident (Adult + Child)			
Combined Surface and Subsurface Soil - Direct Contact		3E-04	--
Sediment - Wading		3E-06	--
Surface Water - Wading		1E-06	--
TOTAL SITE RISKS (Aggregate Resident):		3E-04	--

Table A.6.ERA-1
Screening Level -Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Background Concentration [a] (mg/kg)	Ecological Screening Level (ESLs) [b] (mg/kg)		Maximum HQ [c] (unitless)	Bioaccumulative Chemical?[d] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [e]	
			Value	*Source*			(YES/no)	Rationale
Volatile Organic Compounds								
2-Butanone	0.016	–	89.6	*R5*	0.0002	no	no	HQ • 1
3-Octanone	0.15	–	NA		NA	no	**YES**	**NSL**
Acetone	0.31	–	2.5	*R5*	0.1	no	no	HQ • 1
Ethanol	0.087	–	NA		NA	no	**YES**	**NSL**
Methylene Chloride	3	–	4.05	*R5*	0.7	no	no	HQ • 1
Semi-Volatile Organic Compounds								
2,4-Dinitrotoluene	0.4	–	1.28	*R5*	0.3	no	no	HQ • 1
2,6-Dinitrotoluene	0.32	–	0.0328	*R5*	10	no	**YES**	**HQ > 1**
Benzoic Acid	0.17	–	NA		NA	no	**YES**	**NSL**
bis(2-Ethylhexyl)phthalate	1.8	–	0.92594	*R5*	2	no	**YES**	**HQ > 1**
Carbazole	0.12	–	NA		NA	no	**YES**	**NSL**
Dibenzofuran	0.045	–	NA		NA	no	**YES**	**NSL**
Diethylphthalate	0.09	–	24.8	*R5*	0.004	no	no	HQ • 1
Di-n-Butylphthalate	1.1	–	0.15	*R5*	7	no	**YES**	**HQ > 1**
Pentachlorophenol	830	–	2.1	*EcoSSL*	400	YES	**YES**	**HQ > 1**
Explosives								
4-Amino-2,6-Dinitrotoluene	0.05	–	80	*T*	0.0006	no	no	HQ • 1
Pesticides								
4,4'-DDE	0.04	–	0.021	*EcoSSL*	2	YES	**YES**	**HQ > 1**
BHC, alpha-	0.00077	–	0.0994	*R5*	0.008	YES	**YES**	**Bioaccumulative**
BHC, beta-	0.00025	–	0.00398	*R5*	0.06	YES	**YES**	**Bioaccumulative**
Chlordane, alpha-	0.03	–	0.224	*R5*	0.1	YES	**YES**	**Bioaccumulative**
Dieldrin	0.27	–	0.0049	*EcoSSL*	60	YES	**YES**	**HQ > 1**
Endrin Aldehyde	0.04	–	0.0105	*R5*	4	no	**YES**	**HQ > 1**
Polycyclic Aromatic Hydrocarbons								
2-Methylnaphthalene	0.04	–	3.24	*R5*	0.01	no	no	HQ • 1
Acenaphthene	0.0065	–	682	*R5*	0.00001	YES	**YES**	**Bioaccumulative**
Acenaphthylene	0.07	–	682	*R5*	0.0001	YES	**YES**	**Bioaccumulative**
Anthracene	0.1	–	1,480	*R5*	0.00007	YES	**YES**	**Bioaccumulative**
Benzo(a)anthracene	0.4	–	5.21	*R5*	0.08	YES	**YES**	**Bioaccumulative**
Benzo(a)pyrene	0.4	–	1.52	*R5*	0.3	YES	**YES**	**Bioaccumulative**
Benzo(b)fluoranthene	1	–	59.8	*R5*	0.02	YES	**YES**	**Bioaccumulative**
Benzo(g,h,i)perylene	0.037	–	119	*R5*	0.0003	YES	**YES**	**Bioaccumulative**
Benzo(k)fluoranthene	0.56	–	148	*R5*	0.004	YES	**YES**	**Bioaccumulative**
Chrysene	0.66	–	4.73	*R5*	0.1	YES	**YES**	**Bioaccumulative**
Dibenzo(a,h)anthracene	0.05	–	18.4	*R5*	0.003	YES	**YES**	**Bioaccumulative**
Fluoranthene	0.39	–	122	*R5*	0.003	YES	**YES**	**Bioaccumulative**
Fluorene	0.0067	–	122	*R5*	0.00005	YES	**YES**	**Bioaccumulative**
Indeno(1,2,3-cd)pyrene	0.11	–	109	*R5*	0.001	YES	**YES**	**Bioaccumulative**
Naphthalene	0.0069	–	0.0994	*R5*	0.07	no	no	HQ • 1
Phenanthrene	0.1	–	45.7	*R5*	0.002	YES	**YES**	**Bioaccumulative**
Pyrene	0.86	–	78.5	*R5*	0.01	YES	**YES**	**Bioaccumulative**

Table A.6.ERA-1
Screening Level -Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Background Concentration [a] (mg/kg)	Ecological Screening Level (ESLs) [b] (mg/kg) Value	*Source*	Maximum HQ [c] (unitless)	Bioaccumulative Chemical?[d] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [e] (YES/no)	Rationale
Polychlorinated Biphenyls								
Aroclor 1254	1.7	–	NA		NA	YES	**YES**	**Bioaccumulative**
Inorganics								
Aluminum	43,600	40,041	50	*ORNL*	900	no	**YES**	**HQ > 1**
Antimony	0.58	NA	0.27	*EcoSSL*	2	no	**YES**	**HQ > 1**
Arsenic	20.8	15.8	18	*EcoSSL*	1	YES	**YES**	**HQ > 1**
Barium	1,770	209	330	*EcoSSL*	5	no	**YES**	**HQ > 1**
Beryllium	2.46	1.02	21	*EcoSSL*	0.1	no	no	HQ • 1
Cadmium	1.8	0.69	0.36	*EcoSSL*	5	YES	**YES**	**HQ > 1**
Calcium	196,000	NA	NA		NA	no	no	NT
Chromium	59	65.3	26	*EcoSSL*	2	YES	no	max • BKGD
Cobalt	74.9	72.3	13	*EcoSSL*	6	no	**YES**	**HQ > 1**
Copper	60.2	53.5	28	*EcoSSL*	2	YES	**YES**	**HQ > 1**
Iron	50,100	50,962	NA		NA	no	no	max • BKGD
Lead	149	26.8	11	*EcoSSL*	10	YES	**YES**	**HQ > 1**
Magnesium	104,000	NA	NA		NA	no	no	NT
Manganese	791	2,543	220	*EcoSSL*	4	no	no	max • BKGD
Mercury	0.41	0.13	0.1	*R5*	4	no	**YES**	**HQ > 1**
Nickel	42.2	62.8	38	*EcoSSL*	1	YES	no	max • BKGD
Potassium	4,570	NA	NA		NA	no	no	NT
Selenium	1	NA	0.52	*EcoSSL*	2	YES	**YES**	**HQ > 1**
Sodium	331	NA	NA		NA	no	no	NT
Thallium	0.89	2.11	0.05692	*R5*	20	no	no	max • BKGD
Vanadium	91.5	108	7.8	*EcoSSL*	10	no	no	max • BKGD
Zinc	752	202	46	*EcoSSL*	20	YES	**YES**	**HQ > 1**

Notes:

– = Not available or applicable.
mg/kg = Milligrams per kilogram.
NA = Not available or applicable.

[a] Background levels for inorganics are facility-wide soil background point estimates taken from Facility-Wide Background Study Report (IT Corporation 2001).
[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[c] The maximum hazard quotient (HQ) is the ratio of the maximum constituent concentration to the surface soil screening level. HQs are rounded to one significant figure.
[d] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.
[e] Constituents with a hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for screening level assessment unless they were essential nutrients and thus considered non-toxic (NT), or were inorganics present at concentrations below background (max • BKGD).

Table A.6.ERA-2
Screening Level - Constituents of Potential Ecological Concern in Sediment
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

		Ecological Screening Level (ESLs) [a] (mg/kg)				Screening Level Constituent of Potential Ecological Concern? [d]	
Constituent	**Maximum Concentration (mg/kg)**	**Value**	***Source***	**Maximum HQ [b] (unitless)**	**Bioaccumulative Chemical?[c] (YES/no)**	**(YES/no)**	**Rationale**
Volatile Organic Compounds							
2-Butanone	0.1	0.0424	*R5*	2	no	**YES**	**HQ > 1**
Acetone	0.53	0.0099	*R5*	50	no	**YES**	**HQ > 1**
Carbon Disulfide	0.0022	0.000851	*R3*	3	no	**YES**	**HQ > 1**
Methylene Chloride	0.003	0.159	*R5*	0.02	no	no	HQ • 1
Semi-Volatile Organic Compounds							
4-Methylphenol	0.036	0.67	*R3*	0.05	no	no	HQ • 1
Benzoic Acid	0.28	0.65	*R3*	0.4	no	no	HQ • 1
bis(2-Ethylhexyl)phthalate	0.33	0.18	*R3*	2	no	**YES**	**HQ > 1**
Di-n-Butylphthalate	0.069	6.47	*R3*	0.01	no	no	HQ • 1
Explosives							
Nitroglycerine	0.57	NA		NA	no	**YES**	**NSL**
Pentaerythritol Tetranitrate	0.23	NA		NA	no	**YES**	**NSL**
Herbicides							
2,4,5-T	0.0334	12.3	*R3*	0.003	no	no	HQ • 1
2,4,5-TP	0.104	0.675	*R3*	0.2	no	no	HQ • 1
2,4-D	0.209	1.273	*R5*	0.2	no	no	HQ • 1
Dalapon	0.107	NA		NA	no	**YES**	**NSL**
Dicamba	0.0497	NA		NA	no	**YES**	**NSL**
Dichlorprop	0.353	NA		NA	no	**YES**	**NSL**
MCPP	3.53	NA		NA	no	**YES**	**NSL**
Pesticides							
4,4'-DDD	0.00209	0.00488	*R3*	0.4	YES	**YES**	**Bioaccumulative**
4,4'-DDE	0.0084	0.00316	*R3*	3	YES	**YES**	**HQ > 1**
4,4'-DDT	0.004	7	*ORNL*	0.0006	YES	**YES**	**Bioaccumulative**
BHC, alpha-	0.00059	0.006	*R3*	0.1	YES	**YES**	**Bioaccumulative**
BHC, delta-	0.0012	6.4	*R3*	0.0002	YES	**YES**	**Bioaccumulative**
BHC, gamma- (Lindane)	0.00097	0.00237	*R3*	0.4	YES	**YES**	**Bioaccumulative**
Chlordane, alpha-	0.0101	0.00324	*R3s*	3	YES	**YES**	**HQ > 1**
Chlordane, gamma-	0.013	0.00324	*R3s*	4	no	**YES**	**HQ > 1**
Dieldrin	0.0041	0.0019	*R3*	2	YES	**YES**	**HQ > 1**
Endosulfan II	0.00072	0.014	*R3*	0.05	YES	**YES**	**Bioaccumulative**
Endrin	0.0125	0.00222	*R3*	6	YES	**YES**	**HQ > 1**
Endrin Aldehyde	0.04	0.48	*R5*	0.08	no	no	HQ • 1
Endrin Ketone	0.00203	0.00222	*R3s*	0.9	no	no	HQ • 1
Heptachlor	0.00213	0.068	*R3*	0.03	YES	**YES**	**Bioaccumulative**
Heptachlor Epoxide	0.00726	0.00247	*R3*	3	YES	**YES**	**HQ > 1**
Methoxychlor	0.0026	0.0187	*R3*	0.1	YES	**YES**	**Bioaccumulative**
Polycyclic Aromatic Hydrocarbons							
2-Methylnaphthalene	0.04	0.0202	*R3*	2	no	**YES**	**HQ > 1**
Acenaphthene	0.059	0.0067	*R3*	9	YES	**YES**	**HQ > 1**
Acenaphthylene	0.026	0.0059	*R3*	4	YES	**YES**	**HQ > 1**
Anthracene	0.081	0.0572	*R3*	1	YES	**YES**	**Bioaccumulative**
Benzo(a)anthracene	0.19	0.108	*R3*	2	YES	**YES**	**HQ > 1**

Table A.6.ERA-2
Screening Level - Constituents of Potential Ecological Concern in Sediment
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Ecological Screening Level (ESLs) [a] (mg/kg) Value	*Source*	Maximum HQ [b] (unitless)	Bioaccumulative Chemical?[c] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rationale
Benzo(a)pyrene	0.17	0.15	*R3*	1	YES	**YES**	**Bioaccumulative**
Benzo(b)fluoranthene	0.25	10.4	*R5*	0.02	YES	**YES**	**Bioaccumulative**
Benzo(g,h,i)perylene	0.1	0.17	*R3*	0.6	YES	**YES**	**Bioaccumulative**
Benzo(k)fluoranthene	0.08	0.24	*R3*	0.3	YES	**YES**	**Bioaccumulative**
Chrysene	0.17	0.166	*R3*	1	YES	**YES**	**Bioaccumulative**
Dibenzo(a,h)anthracene	0.026	0.033	*R3*	0.8	YES	**YES**	**Bioaccumulative**
Fluoranthene	0.44	0.423	*R3*	1	YES	**YES**	**Bioaccumulative**
Fluorene	0.046	0.0774	*R3*	0.6	YES	**YES**	**Bioaccumulative**
Indeno(1,2,3-cd)pyrene	0.12	0.017	*R3*	7	YES	**YES**	**HQ > 1**
Naphthalene	0.043	0.176	*R3*	0.2	no	no	HQ • 1
Phenanthrene	0.36	0.204	*R3*	2	YES	**YES**	**HQ > 1**
Pyrene	0.3	0.195	*R3*	2	YES	**YES**	**HQ > 1**
Inorganics							
Aluminum	27,000	58,000	*ARCS_PEC*	0.5	no	no	HQ • 1
Antimony	1	2	*R3*	0.5	no	no	HQ • 1
Arsenic	11.8	9.8	*R3*	1	YES	**YES**	**Bioaccumulative**
Barium	113	NA		NA	no	**YES**	**NSL**
Beryllium	1.67	NA		NA	no	**YES**	**NSL**
Cadmium	0.21	0.99	*R3*	0.2	YES	**YES**	**Bioaccumulative**
Calcium	176,000	NA		NA	no	no	NT
Chromium	80.9	43.4	*R3*	2	YES	**YES**	**HQ > 1**
Cobalt	15	50	*R3*	0.3	no	no	HQ • 1
Copper	47.6	31.6	*R3*	2	YES	**YES**	**HQ > 1**
Iron	79,600	20,000	*R3*	4	no	**YES**	**HQ > 1**
Lead	33	35.8	*R3*	0.9	YES	**YES**	**Bioaccumulative**
Magnesium	42,500	NA		NA	no	no	NT
Manganese	1,220	460	*R3*	3	no	**YES**	**HQ > 1**
Mercury	0.08	0.18	*R3*	0.4	no	no	HQ • 1
Nickel	24.5	22.7	*R3*	1	YES	**YES**	**Bioaccumulative**
Potassium	2,620	NA		NA	no	no	NT
Selenium	1.7	2	*R3*	0.9	YES	**YES**	**Bioaccumulative**
Sodium	110	NA		NA	no	no	NT
Thallium	0.45	NA		NA	no	**YES**	**NSL**
Vanadium	110	NA		NA	no	**YES**	**NSL**
Zinc	110	121	*R3*	0.9	YES	**YES**	**Bioaccumulative**

Notes:
– = Not available or applicable.
mg/kg = Milligrams per kilogram.
NA = Not available or applicable.

[a] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[b] The maximum hazard quotient (HQ) is the ratio of the maximum constituent concentration to the sediment screening level. HQs are rounded to one significant figure.
[c] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.
[d] Constituents with a hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for screening level assessment unless they were essential nutrients and thus considered non-toxic (NT).

Table A.6.ERA-3
Screening Level - Constituents of Potential Ecological Concern in Surface Water
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/L)	Ecological Screening Level (ESLs) [a] (mg/L)		Maximum HQ [b] (unitless)	Bioaccumulative Chemical?[c] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [d]	
		Value	*Source*			(YES/no)	Rationale
Volatile Organic Compounds							
Carbon Disulfide	0.0003	0.00092	*R3*	0.3	no	no	HQ • 1
Chloroform	0.00037	0.0018	*R3*	0.2	no	no	HQ • 1
Semi-Volatile Organic Compounds							
Benzoic Acid	0.0061	0.042	*R3*	0.1	no	no	HQ • 1
bis(2-Ethylhexyl)phthalate	0.008	0.016	*R3*	0.5	no	no	HQ • 1
Butylbenzylphthalate	0.0011	0.019	*R3*	0.06	no	no	HQ • 1
Diethylphthalate	0.00037	0.21	*R3*	0.002	no	no	HQ • 1
Di-n-Butylphthalate	0.001	0.019	*R3*	0.05	no	no	HQ • 1
Explosives							
m-Nitrotoluene	0.00125	0.75	*R3*	0.002	no	no	HQ • 1
Nitrobenzene	0.0002	0.22	*R5*	0.0009	no	no	HQ • 1
Nitroglycerine	0.00061	0.138	*R3*	0.004	no	no	HQ • 1
Herbicides							
2,4,5-TP	0.00005	0.03	*R3*	0.002	no	no	HQ • 1
2,4-D	0.00466	0.22	*R5*	0.02	no	no	HQ • 1
2,4-DB	0.00041	NA		NA	no	**YES**	**NSL**
MCPA	0.11	NA		NA	no	**YES**	**NSL**
MCPP	0.0463	NA		NA	no	**YES**	**NSL**
Pesticides							
4,4'-DDT	0.00001	0.0000005	*R3*	20	YES	**YES**	**HQ > 1**
BHC, delta-	0.00001	0.141	*R3*	0.00007	YES	**YES**	**Bioaccumulative**
Dieldrin	0.00000719	0.000056	*R3*	0.1	YES	**YES**	**Bioaccumulative**
Endosulfan Sulfate	0.00003	0.00222	*R5*	0.01	no	no	HQ • 1
Endrin Aldehyde	0.00001	0.00015	*R5*	0.07	no	no	HQ • 1
Endrin Ketone	0.00000828	0.000036	*R3s*	0.2	no	no	HQ • 1
Polycyclic Aromatic Hydrocarbons							
2-Methylnaphthalene	0.00003	0.0047	*R3*	0.006	no	no	HQ • 1
Naphthalene	0.00003	0.0011	*R3*	0.03	no	no	HQ • 1
Phenanthrene	0.00002	0.0004	*R3*	0.05	YES	**YES**	**Bioaccumulative**
Inorganics							
Aluminum	0.608	0.087	*R3*	7	no	**YES**	**HQ > 1**
Antimony	0.00058	0.03	*R3*	0.02	no	no	HQ • 1
Barium	0.0796	0.004	*R3*	20	no	**YES**	**HQ > 1**
Cadmium	0.00011	0.00025	*R3*	0.4	YES	**YES**	**Bioaccumulative**
Calcium	59.5	116	*R3*	NA	no	no	NT
Chromium	0.0055	0.085	*R3*	0.06	YES	**YES**	**Bioaccumulative**
Copper	0.038	0.009	*R3*	4	YES	**YES**	**HQ > 1**
Iron	4.47	0.3	*R3*	10	no	**YES**	**HQ > 1**
Lead	0.031	0.0025	*R3*	10	YES	**YES**	**HQ > 1**
Magnesium	26.6	82	*R3*	NA	no	no	NT
Manganese	0.102	0.12	*R3*	0.9	no	no	HQ • 1
Potassium	3.75	NA		NA	no	no	NT
Selenium	0.00048	0.001	*R3*	0.5	YES	**YES**	**Bioaccumulative**

Table A.6.ERA-3
Screening Level - Constituents of Potential Ecological Concern in Surface Water
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/L)	Ecological Screening Level (ESLs) [a] (mg/L)		Maximum HQ [b] (unitless)	Bioaccumulative Chemical?[c] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [d]	
		Value	***Source***			**(YES/no)**	**Rationale**
Silver	0.0083	0.0032	*R3*	3	YES	**YES**	**HQ > 1**
Sodium	36.8	680	*R3*	NA	no	no	NT
Zinc	0.274	0.12	*R3*	2	YES	**YES**	**HQ > 1**

Notes:
– = Not available or applicable.
mg/L = Milligrams per liter.
NA = Not available or applicable.

[a] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[b] The maximum hazard quotient (HQ) is the ratio of the maximum constituent concentration to the surface water screening level. HQs are rounded to one significant figure
[c] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.
[d] Constituents with a hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for screening level assessment unless they were essential nutrients and thus considered non-toxic (NT).

Table A.6.ERA-4
Baseline Level - Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)		Ecological Screening Level (ESLs) [b] (mg/kg)		Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d]		Bioaccumulative ? [e] (YES/no)
			Value	*Source*		(YES/no)	Rationale	
Volatile Organic Compounds								
3-Octanone	0.15	m	NA		NA	**YES**	**NSL**	no
Ethanol	0.087	m	NA		NA	**YES**	**NSL**	no
Semi-Volatile Organic Compounds								
2,6-Dinitrotoluene	0.32	m	0.0328	*R5*	10	**YES**	**HQ > 1**	no
Benzoic Acid	0.17	m	NA		NA	**YES**	**NSL**	no
bis(2-Ethylhexyl)phthalate	0.312		0.92594	*R5*	0.3	no	**HQ • 1**	no
Carbazole	0.12	m	NA		NA	**YES**	**NSL**	no
Dibenzofuran	0.045	m	NA		NA	**YES**	**NSL**	no
Di-n-Butylphthalate	0.213		0.15	*R5*	1	no	**HQ • 1**	no
Pentachlorophenol	830	m	2.1	*EcoSSL*	400	**YES**	**HQ > 1**	**YES**
Pesticides								
4,4'-DDE	0.04	m	0.021	*EcoSSL*	2	**YES**	**HQ > 1**	**YES**
BHC, alpha-	0.00077	m	0.0994	*R5*	0.008	**YES**	**Bioaccumulative**	**YES**
BHC, beta-	0.00025	m	0.00398	*R5*	0.06	**YES**	**Bioaccumulative**	**YES**
Chlordane, alpha-	0.03	m	0.224	*R5*	0.1	**YES**	**Bioaccumulative**	**YES**
Dieldrin	0.27	m	0.0049	*EcoSSL*	60	**YES**	**HQ > 1**	**YES**
Endrin Aldehyde	0.04	m	0.0105	*R5*	4	**YES**	**HQ > 1**	**YES**
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	0.0065	m	682	*R5*	0.00001	**YES**	**Bioaccumulative**	**YES**
Acenaphthylene	0.07	m	682	*R5*	0.0001	**YES**	**Bioaccumulative**	**YES**
Anthracene	0.0216		1,480	*R5*	0.00001	**YES**	**Bioaccumulative**	**YES**
Benzo(a)anthracene	0.242		5.21	*R5*	0.05	**YES**	**Bioaccumulative**	**YES**
Benzo(a)pyrene	0.242		1.52	*R5*	0.2	**YES**	**Bioaccumulative**	**YES**
Benzo(b)fluoranthene	0.476		59.8	*R5*	0.008	**YES**	**Bioaccumulative**	**YES**
Benzo(g,h,i)perylene	0.0231		119	*R5*	0.0002	**YES**	**Bioaccumulative**	**YES**
Benzo(k)fluoranthene	0.27		148	*R5*	0.002	**YES**	**Bioaccumulative**	**YES**
Chrysene	0.318		4.73	*R5*	0.07	**YES**	**Bioaccumulative**	**YES**
Dibenzo(a,h)anthracene	0.011		18.4	*R5*	0.0006	**YES**	**Bioaccumulative**	**YES**
Fluoranthene	0.102		122	*R5*	0.0008	**YES**	**Bioaccumulative**	**YES**
Fluorene	0.0067	m	122	*R5*	0.00005	**YES**	**Bioaccumulative**	**YES**
Indeno(1,2,3-cd)pyrene	0.0277		109	*R5*	0.0003	**YES**	**Bioaccumulative**	**YES**
Phenanthrene	0.0596		45.7	*R5*	0.001	**YES**	**Bioaccumulative**	**YES**
Pyrene	0.412		78.5	*R5*	0.005	**YES**	**Bioaccumulative**	**YES**
Polychlorinated Biphenyls								
Aroclor 1254	0.385		NA		NA	**YES**	**NSL**	**YES**
Inorganics								
Aluminum	24,984		50	*ORNL*	500	**YES**	**HQ > 1**	no
Antimony	0.368		0.27	*EcoSSL*	1	no	**HQ • 1**	no
Barium	403		330	*EcoSSL*	1	no	**HQ • 1**	no
Cadmium	0.319		0.36	*EcoSSL*	0.9	**YES**	**Bioaccumulative**	**YES**

Table A.6.ERA-4
Baseline Level - Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)		Ecological Screening Level (ESLs) [b] (mg/kg) Value	*Source*	Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rationale	Bioaccumulative ? [e] (YES/no)
Cobalt	27.35		13	*EcoSSL*	2	**YES**	**HQ > 1**	no
Copper	25.89		28	*EcoSSL*	0.9	**YES**	**Bioaccumulative**	**YES**
Iron	34,847		NA		NA	no		no
Lead	51.33		11	*EcoSSL*	5	**YES**	**HQ > 1**	**YES**
Mercury	0.135		0.1	*R5*	1	no	**HQ • 1**	no
Selenium	1	m	0.52	*EcoSSL*	2	**YES**	**HQ > 1**	**YES**
Zinc	186.4		46	*EcoSSL*	4	**YES**	**HQ > 1**	**YES**

Notes:
– = Not available or applicable.
mg/kg = Milligrams per kilogram.
NA = Not available or applicable.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[c] The refined hazard quotient (HQ) is the ratio of the EPC to the surface soil screening level. HQs are rounded to one significant figure.
[d] Constituents with a refined hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for baseline risk assessment.
[e] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.

Table A.6.ERA-5
Baseline Level - Constituents of Potential Ecological Concern in Sediment
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)		Ecological Screening Level (ESLs) [b] (mg/kg) Value	*Source*	Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rationale	Bioaccumulative ? [e] (YES/no)
Volatile Organic Compounds								
2-Butanone	0.1	m	0.0424	*R5*	2	**YES**	**HQ > 1**	no
Acetone	0.13		0.0099	*R5*	10	**YES**	**HQ > 1**	no
Carbon Disulfide	0.0022	m	0.000851	*R3*	3	**YES**	**HQ > 1**	no
Semi-Volatile Organic Compounds								
bis(2-Ethylhexyl)phthalate	0.219		0.18	*R3*	1	no	**HQ • 1**	no
Explosives								
Nitroglycerine	0.57	m	NA		NA	**YES**	**NSL**	no
Pentaerythritol Tetranitrate	0.23	m	NA		NA	**YES**	**NSL**	no
Herbicides								
Dalapon	0.107	m	NA		NA	**YES**	**NSL**	no
Dicamba	0.0497	m	NA		NA	**YES**	**NSL**	no
Dichlorprop	0.353	m	NA		NA	**YES**	**NSL**	no
MCPP	3.53	m	NA		NA	**YES**	**NSL**	no
Pesticides								
4,4'-DDD	0.00209	m	0.00488	*R3*	0.4	**YES**	**Bioaccumulative**	**YES**
4,4'-DDE	0.00368		0.00316	*R3*	1	**YES**	**Bioaccumulative**	**YES**
4,4'-DDT	0.00274		7	*ORNL*	0.0004	**YES**	**Bioaccumulative**	**YES**
BHC, alpha-	0.00059	m	0.006	*R3*	0.1	**YES**	**Bioaccumulative**	**YES**
BHC, delta-	0.0012	m	6.4	*R3*	0.0002	**YES**	**Bioaccumulative**	**YES**
BHC, gamma- (Lindane)	0.00097	m	0.00237	*R3*	0.4	**YES**	**Bioaccumulative**	**YES**
Chlordane, alpha-	0.0101	m	0.00324	*R3s*	3	**YES**	**HQ > 1**	**YES**
Chlordane, gamma-	0.013	m	0.00324	*R3s*	4	**YES**	**HQ > 1**	**YES**
Dieldrin	0.0041	m	0.0019	*R3*	2	**YES**	**HQ > 1**	**YES**
Endosulfan II	0.00072	m	0.014	*R3*	0.05	**YES**	**Bioaccumulative**	**YES**
Endrin	0.0125	m	0.00222	*R3*	6	**YES**	**HQ > 1**	**YES**
Heptachlor	0.00213	m	0.068	*R3*	0.03	**YES**	**Bioaccumulative**	**YES**
Heptachlor Epoxide	0.00726	m	0.00247	*R3*	3	**YES**	**HQ > 1**	**YES**
Methoxychlor	0.0026	m	0.0187	*R3*	0.1	**YES**	**Bioaccumulative**	**YES**
Polycyclic Aromatic Hydrocarbons								
2-Methylnaphthalene	0.0217		0.0202	*R3*	1	no	**HQ • 1**	no
Acenaphthene	0.059	m	0.0067	*R3*	9	**YES**	**HQ > 1**	**YES**
Acenaphthylene	0.026	m	0.0059	*R3*	4	**YES**	**HQ > 1**	**YES**
Anthracene	0.0447		0.0572	*R3*	0.8	**YES**	**Bioaccumulative**	**YES**
Benzo(a)anthracene	0.123		0.108	*R3*	1	**YES**	**Bioaccumulative**	**YES**
Benzo(a)pyrene	0.0891		0.15	*R3*	0.6	**YES**	**Bioaccumulative**	**YES**
Benzo(b)fluoranthene	0.139		10.4	*R5*	0.01	**YES**	**Bioaccumulative**	**YES**
Benzo(g,h,i)perylene	0.073		0.17	*R3*	0.4	**YES**	**Bioaccumulative**	**YES**
Benzo(k)fluoranthene	0.0443		0.24	*R3*	0.2	**YES**	**Bioaccumulative**	**YES**
Chrysene	0.0808		0.166	*R3*	0.5	**YES**	**Bioaccumulative**	**YES**
Dibenzo(a,h)anthracene	0.026	m	0.033	*R3*	0.8	**YES**	**Bioaccumulative**	**YES**

Table A.6.ERA-5
Baseline Level - Constituents of Potential Ecological Concern in Sediment
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)		Ecological Screening Level (ESLs) [b] (mg/kg) Value	*Source*	Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rationale	Bioaccumulative ? [e] (YES/no)
Fluoranthene	0.238		0.423	*R3*	0.6	**YES**	**Bioaccumulative**	**YES**
Fluorene	0.046	m	0.0774	*R3*	0.6	**YES**	**Bioaccumulative**	**YES**
Indeno(1,2,3-cd)pyrene	0.0824		0.017	*R3*	5	**YES**	**HQ > 1**	**YES**
Phenanthrene	0.253		0.204	*R3*	1	**YES**	**Bioaccumulative**	**YES**
Pyrene	0.125		0.195	*R3*	0.6	**YES**	**Bioaccumulative**	**YES**
Inorganics								
Arsenic	7.788		9.8	*R3*	0.8	**YES**	**Bioaccumulative**	**YES**
Barium	77.57		NA		NA	**YES**	**NSL**	no
Beryllium	1.09		NA		NA	**YES**	**NSL**	no
Cadmium	0.154		0.99	*R3*	0.2	**YES**	**Bioaccumulative**	**YES**
Chromium	45.48		43.4	*R3*	1	no	**HQ • 1**	no
Copper	24.06		31.6	*R3*	0.8	**YES**	**Bioaccumulative**	**YES**
Iron	33,199		20,000	*R3*	2	**YES**	**HQ > 1**	no
Lead	22	avg	35.8	*R3*	0.6	**YES**	**Bioaccumulative**	**YES**
Manganese	535.9		460	*R3*	1	no	**HQ • 1**	no
Nickel	17.19		22.7	*R3*	0.8	**YES**	**Bioaccumulative**	**YES**
Selenium	1.13		2	*R3*	0.6	**YES**	**Bioaccumulative**	**YES**
Thallium	0.296		NA		NA	**YES**	**NSL**	no
Vanadium	57.92		NA		NA	**YES**	**NSL**	no
Zinc	73.56		121	*R3*	0.6	**YES**	**Bioaccumulative**	**YES**

Notes:

– = Not available or applicable.
mg/kg = Milligrams per kilogram.
NA = Not available or applicable.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[c] The refined hazard quotient (HQ) is the ratio of the EPC to the sediment screening level. HQs are rounded to one significant figure.
[d] Constituents with a refined hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for baseline risk assessment.
[e] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.

Table A.6.ERA-6
Sediment Polycyclic Aromatic Hydrocarbon Toxic Units
RAIL YARD
New River Unit, Radford Army Ammunition Plant
Radford, Virginia

Location ID: / Sample Depth(Feet): / Date Collected:	Final Chronic Value (FCV) [a]	RYSD01 0 - 0.5 06/17/02			RYSD03 0 - 0.5 07/08/02			RYSD04 0 - 0.5 07/08/02			RYSD05 0 - 0.5 06/27/02		
		mg/kg_{sed}	mg/kg_{TOC}	TU	mg/kg_{sed}	mg/kg_{TOC}	TU	mg/kg_{sed}	mg/kg_{TOC}	TU	mg/kg_{sed}	mg/kg_{TOC}	TU
TOC [b] 3.4%													
2-Methylnaphthalene	446	0.0045	1.3E-01	3.0E-04	0.0029	8.5E-02	1.9E-04	0.04	1.2E+00	2.6E-03	0.0014	4.1E-02	9.2E-05
Acenaphthene	491	0.0019	5.6E-02	1.1E-04	<0.0039	5.7E-02	1.2E-04	0.025	7.4E-01	1.5E-03	<0.0030	4.4E-02	9.0E-05
Acenaphthylene	452	0.026	7.6E-01	1.7E-03	0.0044	1.3E-01	2.9E-04	0.026	7.6E-01	1.7E-03	<0.0030	4.4E-02	9.8E-05
Anthracene	594	0.0093	2.7E-01	4.6E-04	0.008	2.4E-01	4.0E-04	0.0093	2.7E-01	4.6E-04	<0.0030	4.4E-02	7.4E-05
Benzo(a)anthracene	841	0.09	2.6E+00	3.1E-03	0.035	1.0E+00	1.2E-03	0.0038	1.1E-01	1.3E-04	<0.0030	4.4E-02	5.2E-05
Benzo(a)pyrene	965	0.11	3.2E+00	3.4E-03	0.038	1.1E+00	1.2E-03	0.0058	1.7E-01	1.8E-04	<0.0030	4.4E-02	4.6E-05
Benzo(b)fluoranthene	979	0.18	5.3E+00	5.4E-03	0.074	2.2E+00	2.2E-03	0.011	3.2E-01	3.3E-04	<0.0030	4.4E-02	4.5E-05
Benzo(g,h,i)perylene	1095	0.079	2.3E+00	2.1E-03	0.013	3.8E-01	3.5E-04	0.0038	1.1E-01	1.0E-04	<0.0030	4.4E-02	4.0E-05
Benzo(k)fluoranthene	981	0.048	1.4E+00	1.4E-03	0.031	9.1E-01	9.3E-04	0.0029	8.5E-02	8.7E-05	<0.0030	4.4E-02	4.5E-05
Chrysene	844	0.097	2.9E+00	3.4E-03	0.036	1.1E+00	1.3E-03	0.0053	1.6E-01	1.8E-04	<0.0030	4.4E-02	5.2E-05
Dibenzo(a,h)anthracene	1123	0.017	5.0E-01	4.5E-04	0.0036	1.1E-01	9.4E-05	<0.0053	7.8E-02	6.9E-05	<0.0030	4.4E-02	3.9E-05
Fluoranthene	707	0.14	4.1E+00	5.8E-03	0.057	1.7E+00	2.4E-03	0.0079	2.3E-01	3.3E-04	<0.0030	4.4E-02	6.2E-05
Fluorene	538	0.0035	1.0E-01	1.9E-04	0.0019	5.6E-02	1.0E-04	0.019	5.6E-01	1.0E-03	<0.0030	4.4E-02	8.2E-05
Indeno(1,2,3-cd)pyrene	1115	0.084	2.5E+00	2.2E-03	0.017	5.0E-01	4.5E-04	0.004	1.2E-01	1.1E-04	<0.0030	4.4E-02	4.0E-05
Naphthalene	385	0.005	1.5E-01	3.8E-04	0.0066	1.9E-01	5.0E-04	0.043	1.3E+00	3.3E-03	<0.0030	4.4E-02	1.1E-04
Phenanthrene	596	0.045	1.3E+00	2.2E-03	0.02	5.9E-01	9.9E-04	0.01	2.9E-01	4.9E-04	<0.0030	4.4E-02	7.4E-05
Pyrene	697	0.15	4.4E+00	6.3E-03	0.072	2.1E+00	3.0E-03	0.011	3.2E-01	4.6E-04	<0.0030	4.4E-02	6.3E-05
Total TU [c]				0.1			0.04			0.04			0.003

Table A.6.ERA-6
Sediment Polycyclic Aromatic Hydrocarbon Toxic Units
RAIL YARD
New River Unit, Radford Army Ammunition Plant
Radford, Virginia

Location ID:	Final Chronic	RYSD06			RYSD07			RYSD08			RYSD09		
Sample Depth(Feet):	Value	0 - 0.5			0 - 0.5			0 - 0.5			0 - 0.5		
Date Collected:	(FCV) [a]	06/18/02			06/17/02			37425			37425		
		mg/kg_{sed}	mg/kg_{TOC}	TU	mg/kg_{sed}	mg/kg_{TOC}	TU	mg/kg_{sed}	mg/kg_{TOC}	TU	mg/kg_{sed}	mg/kg_{TOC}	TU
TOC [b] 3.4%													
2-Methylnaphthalene	446	0.012	3.5E-01	7.9E-04	<0.20	2.9E+00	6.6E-03	<0.20	2.9E+00	6.6E-03	0.013	3.8E-01	8.6E-04
Acenaphthene	491	0.059	1.7E+00	3.5E-03	<0.20	2.9E+00	6.0E-03	<0.20	2.9E+00	6.0E-03	<0.18	2.6E+00	5.4E-03
Acenaphthylene	452	0.0038	1.1E-01	2.5E-04	<0.20	2.9E+00	6.5E-03	<0.20	2.9E+00	6.5E-03	<0.18	2.6E+00	5.9E-03
Anthracene	594	0.081	2.4E+00	4.0E-03	0.011	3.2E-01	5.4E-04	<0.20	2.9E+00	5.0E-03	<0.18	2.6E+00	4.5E-03
Benzo(a)anthracene	841	0.19	5.6E+00	6.6E-03	0.023	6.8E-01	8.0E-04	<0.20	2.9E+00	3.5E-03	0.019	5.6E-01	6.6E-04
Benzo(a)pyrene	965	0.17	5.0E+00	5.2E-03	0.03	8.8E-01	9.1E-04	<0.20	2.9E+00	3.0E-03	0.019	5.6E-01	5.8E-04
Benzo(b)fluoranthene	979	0.25	7.4E+00	7.5E-03	0.1	2.9E+00	3.0E-03	<0.20	2.9E+00	3.0E-03	0.038	1.1E+00	1.1E-03
Benzo(g,h,i)perylene	1095	0.1	2.9E+00	2.7E-03	0.047	1.4E+00	1.3E-03	<0.20	2.9E+00	2.7E-03	<0.18	2.6E+00	2.4E-03
Benzo(k)fluoranthene	981	0.08	2.4E+00	2.4E-03	0.027	7.9E-01	8.1E-04	<0.20	2.9E+00	3.0E-03	0.011	3.2E-01	3.3E-04
Chrysene	844	0.17	5.0E+00	5.9E-03	0.06	1.8E+00	2.1E-03	<0.20	2.9E+00	3.5E-03	0.019	5.6E-01	6.6E-04
Dibenzo(a,h)anthracene	1123	0.026	7.6E-01	6.8E-04	<0.20	2.9E+00	2.6E-03	<0.20	2.9E+00	2.6E-03	<0.18	2.6E+00	2.4E-03
Fluoranthene	707	0.44	1.3E+01	1.8E-02	0.083	2.4E+00	3.5E-03	<0.20	2.9E+00	4.2E-03	0.025	7.4E-01	1.0E-03
Fluorene	538	0.046	1.4E+00	2.5E-03	<0.20	2.9E+00	5.5E-03	<0.20	2.9E+00	5.5E-03	<0.18	2.6E+00	4.9E-03
Indeno(1,2,3-cd)pyrene	1115	0.12	3.5E+00	3.2E-03	0.044	1.3E+00	1.2E-03	<0.20	2.9E+00	2.6E-03	<0.18	2.6E+00	2.4E-03
Naphthalene	385	0.027	7.9E-01	2.1E-03	<0.20	2.9E+00	7.6E-03	<0.20	2.9E+00	7.6E-03	<0.18	2.6E+00	6.9E-03
Phenanthrene	596	0.36	1.1E+01	1.8E-02	0.019	5.6E-01	9.4E-04	<0.20	2.9E+00	4.9E-03	0.021	6.2E-01	1.0E-03
Pyrene	697	0.3	8.8E+00	1.3E-02	0.068	2.0E+00	2.9E-03	<0.20	2.9E+00	4.2E-03	0.026	7.6E-01	1.1E-03
Total TU [c]				0.3			0.1			0.2			0.1

Table A.6.ERA-6
Sediment Polycyclic Aromatic Hydrocarbon Toxic Units
RAIL YARD
New River Unit, Radford Army Ammunition Plant
Radford, Virginia

Location ID: Sample Depth(Feet): Date Collected:		Final Chronic Value (FCV) [a]	RYSD10 0 - 0.5 37425			RYSD12 0 - 0.5 37432			RYSD13 0 - 0.5 37432			SD-04 0 - 0.5 35886		
			mg/kg_{sed}	mg/kg_{TOC}	TU	mg/kg_{sed}	mg/kg_{TOC}	TU	mg/kg_{sed}	mg/kg_{TOC}	TU	mg/kg_{sed}	mg/kg_{TOC}	TU
TOC [b]	**3.4%**													
2-Methylnaphthalene		446	<0.20	2.9E+00	6.6E-03	<0.27	4.0E+00	8.9E-03	<0.30	4.4E+00	9.9E-03	NA	NA	NA
Acenaphthene		491	<0.20	2.9E+00	6.0E-03	<0.27	4.0E+00	8.1E-03	<0.30	4.4E+00	9.0E-03	NA	NA	NA
Acenaphthylene		452	<0.20	2.9E+00	6.5E-03	<0.27	4.0E+00	8.8E-03	<0.30	4.4E+00	9.8E-03	NA	NA	NA
Anthracene		594	<0.20	2.9E+00	5.0E-03	<0.27	4.0E+00	6.7E-03	<0.30	4.4E+00	7.4E-03	NA	NA	NA
Benzo(a)anthracene		841	0.024	7.1E-01	8.4E-04	0.037	1.1E+00	1.3E-03	0.027	7.9E-01	9.4E-04	NA	NA	NA
Benzo(a)pyrene		965	0.033	9.7E-01	1.0E-03	<0.27	4.0E+00	4.1E-03	<0.30	4.4E+00	4.6E-03	NA	NA	NA
Benzo(b)fluoranthene		979	0.045	1.3E+00	1.4E-03	<0.27	4.0E+00	4.1E-03	<0.30	4.4E+00	4.5E-03	NA	NA	NA
Benzo(g,h,i)perylene		1095	<0.20	2.9E+00	2.7E-03	<0.27	4.0E+00	3.6E-03	<0.30	4.4E+00	4.0E-03	NA	NA	NA
Benzo(k)fluoranthene		981	0.014	4.1E-01	4.2E-04	<0.27	4.0E+00	4.0E-03	<0.30	4.4E+00	4.5E-03	NA	NA	NA
Chrysene		844	0.038	1.1E+00	1.3E-03	0.033	9.7E-01	1.1E-03	0.026	7.6E-01	9.1E-04	NA	NA	NA
Dibenzo(a,h)anthracene		1123	<0.20	2.9E+00	2.6E-03	<0.27	4.0E+00	3.5E-03	<0.30	4.4E+00	3.9E-03	NA	NA	NA
Fluoranthene		707	0.063	1.9E+00	2.6E-03	0.066	1.9E+00	2.7E-03	0.061	1.8E+00	2.5E-03	0.06	1.8E+00	2.5E-03
Fluorene		538	<0.20	2.9E+00	5.5E-03	<0.27	4.0E+00	7.4E-03	<0.30	4.4E+00	8.2E-03	NA	NA	NA
Indeno(1,2,3-cd)pyrene		1115	<0.20	2.9E+00	2.6E-03	<0.27	4.0E+00	3.6E-03	<0.30	4.4E+00	4.0E-03	NA	NA	NA
Naphthalene		385	<0.20	2.9E+00	7.6E-03	<0.27	4.0E+00	1.0E-02	<0.30	4.4E+00	1.1E-02	NA	NA	NA
Phenanthrene		596	<0.20	2.9E+00	4.9E-03	0.046	1.4E+00	2.3E-03	0.051	1.5E+00	2.5E-03	NA	NA	NA
Pyrene		697	0.054	1.6E+00	2.3E-03	0.066	1.9E+00	2.8E-03	0.064	1.9E+00	2.7E-03	NA	NA	NA
Total TU [c]					0.2			0.2			0.2			0.007

Notes:

mg/kg Milligrams per kilogram.
PAH Polycyclic aromatic hydrocarbons.
TU Toxic unit.
TOC Total organic carbon.

TU = (concentration (mg/kg_{sed}) / TOC / FCV) x UF (2.75).
An uncertainty factor (UF) of 2.75 was used. TUs > 1 are in bold font.

[a] Final Chronic Value, obtained from USEPA, 2003 (Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks for the Protection of Benthic Organisms: PAHs)
[b] Total organic carbon ranged between 2.2% to 5.4% at the site with an average TOC of 3.4%. TOC here was assumed equal to the average site TOC.
[c] Sum of Toxic Units (TU) based on the Final Chronic Value. Sediments containing less than or equal to 1 total TU s are acceptable for the protection of benthic organisms. If the total TU is greater than 1, sensitive benthic organisms may be unacceptably affected.

Table A.6.ERA-7
Baseline Level - Constituents of Potential Ecological Concern in Surface Water
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/L)		Ecological Screening Level (ESLs) [b] (mg/L) Value	*Source*	Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rationale	Bioaccumulative ? [e] (YES/no)
Herbicides								
2,4-DB	0.00041	m	NA		NA	**YES**	**NSL**	no
MCPA	0.11	m	NA		NA	**YES**	**NSL**	no
MCPP	0.0463	m	NA		NA	**YES**	**NSL**	no
Pesticides								
4,4'-DDT	0.00001	m	0.0000005	*R3*	20	**YES**	**HQ > 1**	**YES**
BHC, delta-	0.00001	m	0.141	*R3*	0.00007	**YES**	**Bioaccumulative**	**YES**
Dieldrin	0.00000719	m	0.000056	*R3*	0.1	**YES**	**Bioaccumulative**	**YES**
Polycyclic Aromatic Hydrocarbons								
Phenanthrene	0.00002	m	0.0004	*R3*	0.05	**YES**	**Bioaccumulative**	**YES**
Inorganics								
Aluminum	0.608	m	0.087	*R3*	7	**YES**	**HQ > 1**	no
Barium	0.0796	m	0.004	*R3*	20	**YES**	**HQ > 1**	no
Cadmium	0.00011	m	0.00025	*R3*	0.4	**YES**	**Bioaccumulative**	**YES**
Chromium	0.0055	m	0.085	*R3*	0.06	no	**HQ • 1**	no
Copper	0.038	m	0.009	*R3*	4	**YES**	**HQ > 1**	**YES**
Iron	4.47	m	0.3	*R3*	10	**YES**	**HQ > 1**	no
Lead	0.031	m	0.0025	*R3*	10	**YES**	**HQ > 1**	**YES**
Selenium	0.00048	m	0.001	*R3*	0.5	**YES**	**Bioaccumulative**	**YES**
Silver	0.0083	m	0.0032	*R3*	3	**YES**	**HQ > 1**	**YES**
Zinc	0.274	m	0.12	*R3*	2	**YES**	**HQ > 1**	**YES**

Notes:
– = Not available or applicable.
mg/L = Milligrams per liter.
NA = Not available or applicable.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.

[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.

[c] The refined hazard quotient (HQ) is the ratio of the EPC to the surface water screening level. HQs are rounded to one significant figure.

[d] Constituents with a refined hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for baseline risk assessment.

[e] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.

Table A.6.ERA-8
Maximum Scenario Food Chain Modeling for the Short-Tailed Shrew
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration [a] (mg/kg)	Soil Bioconcentration Factors [b] Invertebrate	Estimated Dietary Tissue Concentrations [c] (mg/kg) Invertebrate	Maximum Estimated Dietary Ingestion [d] mg/kg-BW-day	Toxicity Reference Values [e] mg/kg-BW-day LOAEL	NOAEL	Maximum Scenario HQ [f] LOAEL	NOAEL
Semi-Volatile Organic Compounds								
Pentachlorophenol	8.3E+02	5.0E-01	4.2E+02	6.3E+01	5.11E+00	5.11E-01	10	100
Pesticides								
4,4'-DDE	4.0E-02	1.9E+00	7.7E-02	1.1E-02	8.52E+00	1.70E+00	0.001	0.006
BHC, alpha-	7.7E-04	1.5E+00	1.1E-03	1.5E-04	6.82E+00	3.41E+00	0.00002	0.00004
BHC, beta-	2.5E-04	1.5E+00	3.7E-04	5.1E-05	4.26E+00	8.52E-01	0.00001	0.00006
Chlordane, alpha-	3.0E-02	1.5E+00	4.4E-02	6.1E-03	5.28E+01	5.28E+00	0.0001	0.001
Dieldrin	2.7E-01	1.5E+00	4.0E-01	5.5E-02	4.26E-01	4.26E-02	0.1	1
Endrin Aldehyde	4.0E-02	1.5E+00	5.9E-02	8.1E-03	1.06E+00	1.06E-01	0.008	0.08
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	6.5E-03	5.0E-01	3.3E-03	5.0E-04	2.02E+01	2.02E+00	0.00002	0.0002
Acenaphthylene	7.0E-02	5.0E-01	3.5E-02	5.3E-03	1.15E+02	1.15E+03	0.00005	0.000005
Anthracene	1.0E-01	1.0E-02	1.0E-03	1.1E-03	7.03E+03	7.03E+02	0.0000002	0.000002
Benzo(a)anthracene	4.0E-01	2.5E-02	1.0E-02	5.3E-03	4.26E+00	4.26E-01	0.001	0.01
Benzo(a)pyrene	4.0E-01	6.8E-02	2.7E-02	7.5E-03	1.15E+01	1.15E+00	0.0007	0.007
Benzo(b)fluoranthene	1.0E+00	5.1E-02	5.1E-02	1.7E-02	3.78E+01	1.51E+00	0.0004	0.01
Benzo(g,h,i)perylene	3.7E-02	4.9E-02	1.8E-03	6.0E-04	1.15E+00	1.15E-01	0.0005	0.005
Benzo(k)fluoranthene	5.6E-01	5.1E-02	2.8E-02	9.2E-03	3.78E+01	1.51E+00	0.0002	0.006
Chrysene	6.6E-01	3.5E-02	2.3E-02	9.5E-03	2.11E+02	2.11E+01	0.00005	0.0005
Dibenzo(a,h)anthracene	5.0E-02	7.4E-02	3.7E-03	9.8E-04	1.28E-02	1.28E-03	0.08	0.8
Fluoranthene	3.9E-01	5.0E-01	2.0E-01	3.0E-02	8.52E+01	8.52E+00	0.0004	0.004
Fluorene	6.7E-03	5.0E-01	3.4E-03	5.1E-04	3.20E+02	1.07E+02	0.000002	0.000005
Indeno(1,2,3-cd)pyrene	1.1E-01	8.4E-02	9.2E-03	2.3E-03	1.15E+00	1.15E-01	0.002	0.02
Phenanthrene	1.0E-01	2.4E-02	2.4E-03	1.3E-03	2.98E+01	2.98E+00	0.00004	0.0004
Pyrene	8.6E-01	1.8E-02	1.6E-02	1.1E-02	1.84E+01	1.84E+00	0.0006	0.006
Polychlorinated Biphenyls								
Aroclor 1254	1.7E+00	1.5E+00	2.6E+00	3.6E-01	7.84E-01	7.84E-02	0.5	5
Inorganics								
Cadmium	1.8E+00	2.8E+00	5.1E+00	6.9E-01	2.90E+00	2.90E-01	0.2	2
Copper	6.0E+01	6.8E-02	4.1E+00	1.1E+00	4.73E+01	3.65E+01	0.02	0.03
Lead	1.5E+02	5.6E-02	8.3E+00	2.6E+00	1.70E+02	1.70E+01	0.02	0.2
Selenium	1.0E+00	3.9E-01	3.9E-01	6.1E-02	6.76E-01	4.10E-01	0.09	0.1
Zinc	7.5E+02	3.9E-01	2.9E+02	4.6E+01	6.49E+01	6.49E+00	0.7	7

Table A.6.ERA-8
Maximum Scenario Food Chain Modeling for the Short-Tailed Shrew
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:

HQ =	Hazard Quotient.
LOAEL =	Lowest observed adverse effect level.
mg/kg =	Milligrams per kilogram.
mg/kg-BW-day =	Milligrams per kilogram of body weight per day.
NOAEL =	No observed adverse effect level.

[a] Maximum concentration detected in surface soil (mg/kg).
[b] See Table A.2-20 for sources of soil bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.
[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.
[e] See Table A.2-23 for sources of mammalian toxicity reference values.
[f] Maximum hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.6.ERA-9
Refined Scenario Food Chain Modeling for the Short-Tailed Shrew
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)		Soil Bioconcentration Factors [b]			Estimated Dietary Tissue Concentrations [c] (mg/kg)			Refined Estimated Dietary Ingestion [d]	Toxicity Reference Values [e] mg/kg-BW-day		Refined Scenario HQ [f]	
			Invertebrate	Vegetation	Mammal	Invertebrate	Vegetation	Mammal	mg/kg-BW-day	LOAEL	NOAEL	LOAEL	NOAEL
Semi-Volatile Organic Compounds													
Pentachlorophenol	8.3E+02	m	5.0E-01	9.8E-03	3.1E-02	4.2E+02	8.2E+00	2.6E+01	5.5E+01	5.11E+00	5.11E-01	10	100
Pesticides													
BHC, alpha-	7.7E-04	m	1.5E+00	7.7E-02	8.7E-04	1.1E-03	6.0E-05	6.7E-07	1.3E-04	6.82E+00	3.41E+00	0.00002	0.00004
BHC, beta-	2.5E-04	m	1.5E+00	4.9E-02	1.9E-03	3.7E-04	1.2E-05	4.8E-07	4.3E-05	4.26E+00	8.52E-01	0.00001	0.00005
4,4'-DDE	4.0E-02	m	1.9E+00	3.3E-03	2.0E-01	7.7E-02	1.3E-04	8.2E-03	8.9E-03	8.52E+00	1.70E+00	0.001	0.005
Chlordane, alpha-	3.0E-02	m	1.5E+00	2.6E-03	3.0E-01	4.4E-02	7.9E-05	9.0E-03	5.2E-03	5.28E+01	5.28E+00	0.0001	0.001
Dieldrin	2.7E-01	m	1.5E+00	1.6E-03	6.9E-01	4.0E-01	4.4E-04	1.9E-01	4.8E-02	4.26E-01	4.26E-02	0.1	1
Endrin Aldehyde	4.0E-02	m	1.5E+00	1.8E-02	1.1E-02	5.9E-02	7.2E-04	4.4E-04	6.9E-03	1.06E+00	1.06E-01	0.007	0.07
Polycyclic Aromatic Hydrocarbons													
Acenaphthene	6.5E-03	m	5.0E-01	4.2E-02	2.5E-03	3.3E-03	2.7E-04	1.6E-05	4.3E-04	2.02E+01	2.02E+00	0.00002	0.0002
Acenaphthylene	7.0E-02	m	5.0E-01	3.4E-02	3.5E-03	3.5E-02	2.4E-03	2.5E-04	4.6E-03	1.15E+02	1.15E+03	0.00004	0.000004
Anthracene	2.2E-02		1.0E-02	2.1E-02	8.5E-03	2.2E-04	4.5E-04	1.8E-04	2.5E-04	7.03E+03	7.03E+02	4E-08	4E-07
Benzo(a)anthracene	2.4E-01		2.5E-02	4.4E-03	1.2E-01	6.1E-03	1.1E-03	3.0E-02	3.2E-03	4.26E+00	4.26E-01	0.0008	0.008
Benzo(a)pyrene	2.4E-01		6.8E-02	2.7E-03	2.9E-01	1.7E-02	6.5E-04	7.1E-02	4.7E-03	1.15E+01	1.15E+00	0.0004	0.004
Benzo(b)fluoranthene	4.8E-01		5.1E-02	1.2E-03	1.1E+00	2.4E-02	5.9E-04	5.3E-01	1.0E-02	3.78E+01	1.51E+00	0.0003	0.007
Benzo(g,h,i)perylene	2.3E-02		4.9E-02	6.1E-04	3.8E+00	1.1E-03	1.4E-05	8.8E-02	8.5E-04	1.15E+00	1.15E-01	0.0007	0.007
Benzo(k)fluoranthene	2.7E-01		5.1E-02	1.2E-03	1.1E+00	1.4E-02	3.3E-04	3.0E-01	5.9E-03	3.78E+01	1.51E+00	0.0002	0.004
Chrysene	3.2E-01		3.5E-02	4.5E-03	1.2E-01	1.1E-02	1.4E-03	3.8E-02	4.6E-03	2.11E+02	2.11E+01	0.00002	0.0002
Dibenzo(a,h)anthracene	1.1E-02		7.4E-02	1.6E-03	6.9E-01	8.1E-04	1.8E-05	7.6E-03	2.4E-04	1.28E-02	1.28E-03	0.02	0.2
Fluoranthene	1.0E-01		5.0E-01	7.4E-03	5.0E-02	5.1E-02	7.6E-04	5.1E-03	6.7E-03	8.52E+01	8.52E+00	0.00008	0.0008
Fluorene	6.7E-03	m	5.0E-01	3.2E-02	4.0E-03	3.4E-03	2.2E-04	2.7E-05	4.4E-04	3.20E+02	1.07E+02	0.000001	0.000004
Indeno(1,2,3-cd)pyrene	2.8E-02		8.4E-02	2.7E-04	1.5E+01	2.3E-03	7.6E-06	4.2E-01	2.9E-03	1.15E+00	1.15E-01	0.003	0.03
Phenanthrene	6.0E-02		2.4E-02	1.8E-02	1.1E-02	1.5E-03	1.1E-03	6.7E-04	7.8E-04	2.98E+01	2.98E+00	0.00003	0.0003
Pyrene	4.1E-01		1.8E-02	1.2E-02	2.3E-02	7.6E-03	4.8E-03	9.4E-03	5.0E-03	1.84E+01	1.84E+00	0.0003	0.003
Polychlorinated Biphenyls													
Aroclor 1254	3.9E-01		1.5E+00	1.4E-03	8.9E-01	5.8E-01	5.4E-04	3.4E-01	7.0E-02	7.84E-01	7.84E-02	0.09	0.9
Inorganics													
Cadmium	3.2E-01		2.8E+00	1.1E-01	2.8E-02	9.1E-01	3.5E-02	8.8E-03	1.0E-01	2.90E+00	2.90E-01	0.03	0.3
Copper	2.6E+01		6.8E-02	8.0E-02	5.0E-01	1.8E+00	2.1E+00	1.3E+01	5.6E-01	4.73E+01	3.65E+01	0.01	0.02
Lead	5.1E+01		5.6E-02	9.0E-03	1.5E-02	2.9E+00	4.6E-01	7.7E-01	8.4E-01	1.70E+02	1.70E+01	0.005	0.05
Selenium	1.0E+00	m	3.9E-01	5.0E-03	7.5E-01	3.9E-01	5.0E-03	7.5E-01	5.7E-02	6.76E-01	4.10E-01	0.08	0.1
Zinc	1.9E+02		3.9E-01	3.0E-01	5.0E+00	7.3E+01	5.6E+01	9.3E+02	1.6E+01	6.49E+01	6.49E+00	0.2	2

Notes:

HQ =	Hazard Quotient.
LOAEL =	Lowest observed adverse effect level.
mg/kg =	Milligrams per kilogram.
mg/kg-BW-day =	Milligrams per kilogram of body weight per day.
NOAEL =	No observed adverse effect level.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.

[b] See Table A.2-20 for sources of soil bioaccumulation factors.

[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.

[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.

[e] See Table A.2-23 for sources of mammalian toxicity reference values.

[f] Refined hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.6.ERA-10
Maximum Scenario Food Chain Modeling for the American Robin
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration [a] (mg/kg)	Soil Bioconcentration Factors [b] Invertebrate	Estimated Dietary Tissue Concentrations [c] (mg/kg) Invertebrate	Maximum Estimated Dietary Ingestion [d] mg/kg-BW-day	Toxicity Reference Values [e] mg/kg-BW-day LOAEL	Toxicity Reference Values [e] mg/kg-BW-day NOAEL	Maximum Scenario HQ [f] LOAEL	Maximum Scenario HQ [f] NOAEL
Semi-Volatile Organic Compounds								
Pentachlorophenol	8.3E+02	5.0E-01	4.2E+02	6.4E+01	2.74E+02	2.74E+01	0.2	2
Pesticides								
4,4'-DDE	4.0E-02	1.9E+00	7.7E-02	1.0E-02	2.80E-02	2.80E-03	0.4	4
BHC, alpha-	7.7E-04	1.5E+00	1.1E-03	1.5E-04	2.25E+00	5.60E-01	0.00007	0.0003
BHC, beta-	2.5E-04	1.5E+00	3.7E-04	5.1E-05	2.25E+00	5.60E-01	0.00002	0.00009
Chlordane, alpha-	3.0E-02	1.5E+00	4.4E-02	6.0E-03	2.14E+01	2.14E+00	0.0003	0.003
Dieldrin	2.7E-01	1.5E+00	4.0E-01	5.5E-02	7.70E-01	7.70E-02	0.07	0.7
Endrin Aldehyde	4.0E-02	1.5E+00	5.9E-02	8.1E-03	3.00E+00	3.00E-01	0.003	0.03
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	6.5E-03	5.0E-01	3.3E-03	5.1E-04	1.00E+02	1.00E+01	0.000005	0.00005
Acenaphthylene	7.0E-02	5.0E-01	3.5E-02	5.4E-03	1.00E+02	1.00E+01	0.00005	0.0005
Anthracene	1.0E-01	1.0E-02	1.0E-03	1.4E-03	1.00E+02	1.00E+01	0.00001	0.0001
Benzo(a)anthracene	4.0E-01	2.5E-02	1.0E-02	6.4E-03	1.00E+02	1.00E+01	0.00006	0.0006
Benzo(a)pyrene	4.0E-01	6.8E-02	2.7E-02	8.5E-03	1.00E+02	1.00E+01	0.00009	0.0009
Benzo(b)fluoranthene	1.0E+00	5.1E-02	5.1E-02	1.9E-02	1.00E+02	1.00E+01	0.0002	0.002
Benzo(g,h,i)perylene	3.7E-02	4.9E-02	1.8E-03	7.0E-04	1.00E+02	1.00E+01	0.000007	0.00007
Benzo(k)fluoranthene	5.6E-01	5.1E-02	2.8E-02	1.1E-02	1.00E+02	1.00E+01	0.0001	0.001
Chrysene	6.6E-01	3.5E-02	2.3E-02	1.1E-02	1.00E+02	1.00E+01	0.0001	0.001
Dibenzo(a,h)anthracene	5.0E-02	7.4E-02	3.7E-03	1.1E-03	1.00E+02	1.00E+01	0.00001	0.0001
Fluoranthene	3.9E-01	5.0E-01	2.0E-01	3.1E-02	1.00E+02	1.00E+01	0.0003	0.003
Fluorene	6.7E-03	5.0E-01	3.4E-03	5.2E-04	1.00E+02	1.00E+01	0.000005	0.00005
Indeno(1,2,3-cd)pyrene	1.1E-01	8.4E-02	9.2E-03	2.6E-03	1.00E+02	1.00E+01	0.00003	0.0003
Phenanthrene	1.0E-01	2.4E-02	2.4E-03	1.6E-03	1.00E+02	1.00E+01	0.00002	0.0002
Pyrene	8.6E-01	1.8E-02	1.6E-02	1.3E-02	1.00E+02	1.00E+01	0.0001	0.001
Polychlorinated Biphenyls								
Aroclor 1254	1.7E+00	1.5E+00	2.6E+00	3.6E-01	1.80E+00	1.80E-01	0.2	2
Inorganics								
Cadmium	1.8E+00	2.8E+00	5.1E+00	6.8E-01	1.45E+01	1.45E+00	0.05	0.5
Copper	6.0E+01	6.8E-02	4.1E+00	1.3E+00	6.17E+01	4.70E+01	0.02	0.03
Lead	1.5E+02	5.6E-02	8.3E+00	3.0E+00	3.85E+01	3.85E+00	0.08	0.8
Selenium	1.0E+00	3.9E-01	3.9E-01	6.3E-02	1.00E+00	5.00E-01	0.06	0.1
Zinc	7.5E+02	3.9E-01	2.9E+02	4.7E+01	1.31E+02	1.45E+01	0.4	3

Table A.6.ERA-10
Maximum Scenario Food Chain Modeling for the American Robin
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:

HQ =	Hazard Quotient.
LOAEL =	Lowest observed adverse effect level.
mg/kg =	Milligrams per kilogram.
mg/kg-BW-day =	Milligrams per kilogram of body weight per day.
NOAEL =	No observed adverse effect level.

[a] Maximum concentration detected in surface soil (mg/kg).
[b] See Table A.2-20 for sources of soil bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.
[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.
[e] See Table A.2-22 for sources of avian toxicity reference values.
[f] Maximum hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.6.ERA-11
Refined Scenario Food Chain Modeling for the American Robin
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)		Soil Bioconcentration Factors [b]		Estimated Dietary Tissue Concentrations [c] (mg/kg)		Refined Estimated Dietary Ingestion [d]	Toxicity Reference Values [e] mg/kg-BW-day		Refined Scenario HQ [f]	
			Invertebrate	Vegetation	Invertebrate	Vegetation	mg/kg-BW-day	LOAEL	NOAEL	LOAEL	NOAEL
Semi-Volatile Organic Compounds											
Pentachlorophenol	8.3E+02	m	5.0E-01	9.8E-03	4.2E+02	8.2E+00	2.8E+01	2.74E+02	2.74E+01	0.1	1
Pesticides											
4,4'-DDE	4.0E-02	m	1.9E+00	3.3E-03	7.7E-02	1.3E-04	3.6E-03	2.80E-02	2.80E-03	0.1	1
BHC, alpha-	7.7E-04	m	1.5E+00	7.7E-02	1.1E-03	6.0E-05	5.9E-05	2.25E+00	5.60E-01	0.00003	0.0001
BHC, beta-	2.5E-04	m	1.5E+00	4.9E-02	3.7E-04	1.2E-05	1.9E-05	2.25E+00	5.60E-01	0.000008	0.00003
Chlordane, alpha-	3.0E-02	m	1.5E+00	2.6E-03	4.4E-02	7.9E-05	2.1E-03	2.14E+01	2.14E+00	0.0001	0.001
Dieldrin	2.7E-01	m	1.5E+00	1.6E-03	4.0E-01	4.4E-04	1.9E-02	7.70E-01	7.70E-02	0.02	0.2
Endrin Aldehyde	4.0E-02	m	1.5E+00	1.8E-02	5.9E-02	7.2E-04	2.9E-03	3.00E+00	3.00E-01	0.001	0.01
Polycyclic Aromatic Hydrocarbons											
Acenaphthene	6.5E-03	m	5.0E-01	4.2E-02	3.3E-03	2.7E-04	2.4E-04	1.00E+02	1.00E+01	0.000002	0.00002
Acenaphthylene	7.0E-02	m	5.0E-01	3.4E-02	3.5E-02	2.4E-03	2.5E-03	1.00E+02	1.00E+01	0.00003	0.0003
Anthracene	2.2E-02		1.0E-02	2.1E-02	2.2E-04	4.5E-04	3.2E-04	1.00E+02	1.00E+01	0.000003	0.00003
Benzo(a)anthracene	2.4E-01		2.5E-02	4.4E-03	6.1E-03	1.1E-03	3.4E-03	1.00E+02	1.00E+01	0.00003	0.0003
Benzo(a)pyrene	2.4E-01		6.8E-02	2.7E-03	1.7E-02	6.5E-04	3.8E-03	1.00E+02	1.00E+01	0.00004	0.0004
Benzo(b)fluoranthene	4.8E-01		5.1E-02	1.2E-03	2.4E-02	5.9E-04	7.0E-03	1.00E+02	1.00E+01	0.00007	0.0007
Benzo(g,h,i)perylene	2.3E-02		4.9E-02	6.1E-04	1.1E-03	1.4E-05	3.4E-04	1.00E+02	1.00E+01	0.000003	0.00003
Benzo(k)fluoranthene	2.7E-01		5.1E-02	1.2E-03	1.4E-02	3.3E-04	4.0E-03	1.00E+02	1.00E+01	0.00004	0.0004
Chrysene	3.2E-01		3.5E-02	4.5E-03	1.1E-02	1.4E-03	4.6E-03	1.00E+02	1.00E+01	0.00005	0.0005
Dibenzo(a,h)anthracene	1.1E-02		7.4E-02	1.6E-03	8.1E-04	1.8E-05	1.7E-04	1.00E+02	1.00E+01	0.000002	0.00002
Fluoranthene	1.0E-01		5.0E-01	7.4E-03	5.1E-02	7.6E-04	3.4E-03	1.00E+02	1.00E+01	0.00003	0.0003
Fluorene	6.7E-03	m	5.0E-01	3.2E-02	3.4E-03	2.2E-04	2.4E-04	1.00E+02	1.00E+01	0.000002	0.00002
Indeno(1,2,3-cd)pyrene	2.8E-02		8.4E-02	2.7E-04	2.3E-03	7.6E-06	4.4E-04	1.00E+02	1.00E+01	0.000004	0.00004
Phenanthrene	6.0E-02		2.4E-02	1.8E-02	1.5E-03	1.1E-03	9.1E-04	1.00E+02	1.00E+01	0.000009	0.00009
Pyrene	4.1E-01		1.8E-02	1.2E-02	7.6E-03	4.8E-03	6.0E-03	1.00E+02	1.00E+01	0.00006	0.0006
Polychlorinated Biphenyls											
Aroclor 1254	3.9E-01		1.5E+00	1.4E-03	5.8E-01	5.4E-04	2.8E-02	1.80E+00	1.80E-01	0.02	0.2
Inorganics											
Cadmium	3.2E-01		2.8E+00	1.1E-01	9.1E-01	3.5E-02	4.3E-02	1.45E+01	1.45E+00	0.003	0.03
Copper	2.6E+01		6.8E-02	8.0E-02	1.8E+00	2.1E+00	5.9E-01	6.17E+01	4.70E+01	0.01	0.01
Lead	5.1E+01		5.6E-02	9.0E-03	2.9E+00	4.6E-01	8.1E-01	3.85E+01	3.85E+00	0.02	0.2
Selenium	1.0E+00	m	3.9E-01	5.0E-03	3.9E-01	5.0E-03	2.9E-02	1.00E+00	5.00E-01	0.03	0.06
Zinc	1.9E+02		3.9E-01	3.0E-01	7.3E+01	5.6E+01	1.0E+01	1.31E+02	1.45E+01	0.08	0.7

Notes:

HQ =	Hazard Quotient.
LOAEL =	Lowest observed adverse effect level.
mg/kg =	Milligrams per kilogram.
mg/kg-BW-day =	Milligrams per kilogram of body weight per day.
NOAEL =	No observed adverse effect level.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.

[b] See Table A.2-20 for sources of soil bioaccumulation factors.

[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.

[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.

[e] See Table A.2-22 for sources of avian toxicity reference values.

[f] Refined hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.6.ERA-12
Maximum Scenario Food Chain Modeling for the Mink
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration [a] Surface Water (mg/L)	Maximum Concentration [a] Sediment (mg/kg)	Sediment Bioaccumulation Factors (BAFsed) [b] Fish	Estimated Dietary Tissue Concentrations [c] (mg/kg) Fish	Maximum Estimated Dietary Ingestion [d] mg/kg-BW-day	Toxicity Reference Values [e] mg/kg-BW-day LOAEL	Toxicity Reference Values [e] mg/kg-BW-day NOAEL	Maximum Scenario HQ [f] LOAEL	Maximum Scenario HQ [f] NOAEL
Pesticides									
4,4'-DDD	–	2.1E-03	1.5E+00	3.1E-03	2.0E-04	3.16E+00	6.32E-01	0.00006	0.0003
4,4'-DDE	–	8.4E-03	1.6E+01	1.4E-01	8.0E-03	3.16E+00	6.32E-01	0.003	0.01
4,4'-DDT	1.0E-05	4.0E-03	1.3E+00	5.3E-03	3.0E-04	3.16E+00	6.32E-01	0.00009	0.0005
BHC, alpha-	–	5.9E-04	NA	NA	NA	2.53E+00	1.26E+00	NA	NA
BHC, delta-	1.0E-05	1.2E-03	NA	NA	NA	2.53E+00	1.26E+00	NA	NA
BHC, gamma- (Lindane)	–	9.7E-04	NA	NA	NA	6.32E+01	6.32E+00	NA	NA
Chlordane, alpha-	–	1.0E-02	1.5E+00	1.5E-02	8.0E-04	1.96E+01	1.96E+00	0.00004	0.0004
Chlordane, gamma-	–	1.3E-02	1.5E+00	1.9E-02	1.0E-03	1.96E+01	1.96E+00	0.00005	0.0005
Dieldrin	7.2E-06	4.1E-03	3.9E+00	1.6E-02	9.0E-04	1.58E-01	1.58E-02	0.006	0.06
Endosulfan II	–	7.2E-04	NA	NA	NA	1.19E+00	1.19E-01	NA	NA
Endrin	–	1.3E-02	NA	0.0E+00	–	3.94E-01	3.94E-02	NA	NA
Heptachlor	–	2.1E-03	8.3E-01	1.8E-03	1.0E-04	4.28E-01	4.28E-02	0.0002	0.002
Heptachlor Epoxide	–	7.3E-03	8.3E-01	6.0E-03	3.0E-04	1.03E+00	1.03E-01	0.0003	0.003
Methoxychlor	–	2.6E-03	NA	NA	NA	6.32E+00	3.16E+00	NA	NA
Polycyclic Aromatic Hydrocarbons									
Acenaphthene	–	5.9E-02	3.1E-03	1.8E-04	1.0E-05	7.49E+00	7.49E-01	0.000001	0.00001
Acenaphthylene	–	2.6E-02	3.1E-03	8.1E-05	5.0E-06	4.28E+01	4.28E+02	0.0000001	0.00000001
Anthracene	–	8.1E-02	3.1E-03	2.5E-04	1.0E-05	2.61E+03	2.61E+02	0.000000004	0.00000004
Benzo(a)anthracene	–	1.9E-01	7.7E-03	1.5E-03	8.0E-05	1.58E+00	1.58E-01	0.00005	0.0005
Benzo(a)pyrene	–	1.7E-01	7.7E-03	1.3E-03	7.0E-05	4.28E+00	4.28E-01	0.00002	0.0002
Benzo(b)fluoranthene	–	2.5E-01	7.7E-03	1.9E-03	1.0E-04	1.40E+01	5.60E-01	0.000007	0.0002
Benzo(g,h,i)perylene	–	1.0E-01	7.7E-03	7.7E-04	4.0E-05	4.28E-01	4.28E-02	0.00009	0.0009
Benzo(k)fluoranthene	–	8.0E-02	7.7E-03	6.1E-04	3.0E-05	1.40E+01	5.60E-01	0.000002	0.00005
Chrysene	–	1.7E-01	7.7E-03	1.3E-03	7.0E-05	7.83E+01	7.83E+00	0.0000009	0.000009
Dibenzo(a,h)anthracene	–	2.6E-02	7.7E-03	2.0E-04	1.0E-05	4.74E-03	4.74E-04	0.002	0.02
Fluoranthene	–	4.4E-01	7.7E-03	3.4E-03	2.0E-04	3.16E+01	3.16E+00	0.000006	0.00006
Fluorene	–	4.6E-02	3.1E-03	1.4E-04	8.0E-06	1.19E+02	3.95E+01	0.00000007	0.0000002
Indeno(1,2,3-cd)pyrene	–	1.2E-01	7.7E-03	9.2E-04	5.0E-05	4.28E-01	4.28E-02	0.0001	0.001
Phenanthrene	2.0E-05	3.6E-01	3.1E-03	1.1E-03	6.0E-05	1.11E+01	1.11E+00	0.000005	0.00005
Pyrene	–	3.0E-01	7.7E-03	2.3E-03	1.0E-04	6.84E+00	6.84E-01	0.00001	0.0001
Inorganics									
Arsenic	–	1.2E+01	1.0E+00	1.2E+01	7.0E-01	4.28E+00	4.28E-01	0.2	2
Cadmium	1.1E-04	2.1E-01	1.0E+00	2.1E-01	1.0E-02	1.08E+00	1.08E-01	0.009	0.09
Copper	3.8E-02	4.8E+01	1.0E+00	4.8E+01	3.0E+00	1.75E+01	1.36E+01	0.2	0.2
Lead	3.1E-02	3.3E+01	1.0E+00	3.3E+01	2.0E+00	6.32E+01	6.32E+00	0.03	0.3
Nickel	–	2.5E+01	1.0E+00	2.5E+01	1.0E+00	6.32E+01	3.16E+01	0.02	0.03
Selenium	4.8E-04	1.7E+00	1.0E+00	1.7E+00	9.0E-02	2.51E-01	1.52E-01	0.4	0.6
Silver	8.3E-03	–	1.0E+00	NA	NA	1.33E+02	1.33E+01	NA	NA
Zinc	2.7E-01	1.1E+02	1.0E+00	1.1E+02	6.0E+00	2.41E+01	2.41E+00	0.2	2

Notes:

– =	Not applicable.
HQ =	Hazard Quotient.
LOAEL =	Lowest observed adverse effect level.
mg/kg =	Milligrams per kilogram.
mg/kg-BW-day =	Milligrams per kilogram of body weight per day.
mg/L =	Milligrams per liter.
NA =	Not available.
NOAEL =	No observed adverse effect level.

[a] Maximum concentrations detected in surface water (mg/L) and sediment (mg/kg).
[b] See Table A.2-21 for sources of sediment bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.
[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.
[e] See Table A.2-23 for sources of mammalian toxicity reference values.
[f] Maximum hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.6.ERA-13
Refined Scenario Food Chain Modeling for the Mink
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] Surface Water (mg/L)		Exposure Point Concentration [a] Sediment (mg/kg)		Sediment Bioaccumulation Factors (BAFsed) [b] Fish	Estimated Dietary Tissue Concentrations [c] (mg/kg) Fish	Refined Estimated Dietary Ingestion [d] mg/kg-BW-day	Toxicity Reference Values [e] mg/kg-BW-day LOAEL	Toxicity Reference Values [e] mg/kg-BW-day NOAEL	Refined Scenario HQ [f] LOAEL	Refined Scenario HQ [f] NOAEL
Pesticides											
4,4'-DDD	–		2.1E-03	m	1.5E+00	3.1E-03	2.0E-04	3.16E+00	6.32E-01	0.00006	0.0003
4,4'-DDE	–		3.7E-03		1.6E+01	6.0E-02	3.0E-03	3.16E+00	6.32E-01	0.0009	0.005
4,4'-DDT	1.0E-05	m	2.7E-03		1.3E+00	3.6E-03	2.0E-04	3.16E+00	6.32E-01	0.00006	0.0003
BHC, alpha-	–		5.9E-04	m	NA	NA	NA	2.53E+00	1.26E+00	NA	NA
BHC, delta-	1.0E-05	m	1.2E-03	m	NA	NA	NA	2.53E+00	1.26E+00	NA	NA
BHC, gamma- (Lindane)	–		9.7E-04	m	NA	NA	NA	6.32E+01	6.32E+00	NA	NA
Chlordane, alpha-	–		1.0E-02	m	1.5E+00	1.5E-02	9.0E-04	1.96E+01	1.96E+00	0.00005	0.0005
Chlordane, gamma-	–		1.3E-02	m	1.5E+00	1.9E-02	1.0E-03	1.96E+01	1.96E+00	0.00005	0.0005
Dieldrin	7.2E-06	m	4.1E-03	m	3.9E+00	1.6E-02	9.0E-04	1.58E-01	1.58E-02	0.006	0.06
Endosulfan II	–		7.2E-04	m	NA	NA	NA	1.19E+00	1.19E-01	NA	NA
Endrin	–		1.3E-02	m	NA	0.0E+00	–	3.94E-01	3.94E-02	NA	NA
Heptachlor	–		2.1E-03	m	8.3E-01	1.8E-03	1.0E-04	4.28E-01	4.28E-02	0.0002	0.002
Heptachlor Epoxide	–		7.3E-03	m	8.3E-01	6.0E-03	3.0E-04	1.03E+00	1.03E-01	0.0003	0.003
Methoxychlor	–		2.6E-03	m	NA	NA	NA	6.32E+00	3.16E+00	NA	NA
Polycyclic Aromatic Hydrocarbons											
Acenaphthene	–		5.9E-02	m	3.1E-03	1.8E-04	1.0E-05	7.49E+00	7.49E-01	0.000001	0.00001
Acenaphthylene	–		2.6E-02	m	3.1E-03	8.1E-05	5.0E-06	4.28E+01	4.28E+02	0.0000001	0.00000001
Anthracene	–		4.5E-02		3.1E-03	1.4E-04	8.0E-06	2.61E+03	2.61E+02	3E-09	0.00000003
Benzo(a)anthracene	–		1.2E-01		7.7E-03	9.4E-04	5.0E-05	1.58E+00	1.58E-01	0.00003	0.0003
Benzo(a)pyrene	–		8.9E-02		7.7E-03	6.8E-04	4.0E-05	4.28E+00	4.28E-01	0.000009	0.00009
Benzo(b)fluoranthene	–		1.4E-01		7.7E-03	1.1E-03	6.0E-05	1.40E+01	5.60E-01	0.000004	0.0001
Benzo(g,h,i)perylene	–		7.3E-02		7.7E-03	5.6E-04	3.0E-05	4.28E-01	4.28E-02	0.00007	0.0007
Benzo(k)fluoranthene	–		4.4E-02		7.7E-03	3.4E-04	2.0E-05	1.40E+01	5.60E-01	0.000001	0.00004
Chrysene	–		8.1E-02		7.7E-03	6.2E-04	4.0E-05	7.83E+01	7.83E+00	0.0000005	0.000005
Dibenzo(a,h)anthracene	–		2.6E-02	m	7.7E-03	2.0E-04	1.0E-05	4.74E-03	4.74E-04	0.002	0.02
Fluoranthene	–		2.4E-01		7.7E-03	1.8E-03	1.0E-04	3.16E+01	3.16E+00	0.000003	0.00003
Fluorene	–		4.6E-02	m	3.1E-03	1.4E-04	8.0E-06	1.19E+02	3.95E+01	0.00000007	0.0000002
Indeno(1,2,3-cd)pyrene	–		8.2E-02		7.7E-03	6.3E-04	4.0E-05	4.28E-01	4.28E-02	0.00009	0.0009
Phenanthrene	2.0E-05	m	2.5E-01		3.1E-03	7.9E-04	5.0E-05	1.11E+01	1.11E+00	0.000005	0.00005
Pyrene	–		1.3E-01		7.7E-03	9.6E-04	5.0E-05	6.84E+00	6.84E-01	0.000007	0.00007
Inorganics											
Arsenic	–		7.8E+00		1.0E+00	7.8E+00	4.0E-01	4.28E+00	4.28E-01	0.09	0.9
Cadmium	1.1E-04	m	1.5E-01		1.0E+00	1.5E-01	9.0E-03	1.08E+00	1.08E-01	0.008	0.08
Copper	3.8E-02	m	2.4E+01		1.0E+00	2.4E+01	1.0E+00	1.75E+01	1.36E+01	0.06	0.07
Lead	3.1E-02	m	2.2E+01	avg	1.0E+00	2.2E+01	1.0E+00	6.32E+01	6.32E+00	0.02	0.2
Nickel	–		1.7E+01		1.0E+00	1.7E+01	1.0E+00	6.32E+01	3.16E+01	0.02	0.03
Selenium	4.8E-04	m	1.1E+00		1.0E+00	1.1E+00	6.0E-02	2.51E-01	1.52E-01	0.2	0.4
Silver	8.3E-03	m	–		1.0E+00	NA	NA	1.33E+02	1.33E+01	NA	NA
Zinc	2.7E-01	m	7.4E+01		1.0E+00	7.4E+01	4.0E+00	2.41E+01	2.41E+00	0.2	2

Table A.6.ERA-13
Refined Scenario Food Chain Modeling for the Mink
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:

– =	Not applicable.
HQ =	Hazard Quotient.
LOAEL =	Lowest observed adverse effect level.
mg/kg =	Milligrams per kilogram.
mg/kg-BW-day =	Milligrams per kilogram of body weight per day.
mg/L =	Milligrams per liter.
NA =	Not available.
NOAEL =	No observed adverse effect level.

[a] Exposure point concentration (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the refined concentration. EPCs marked with "m" are the maximum concentration.

[b] See Table A.2-21 for sources of sediment bioaccumulation factors.

[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.

[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.

[e] See Table A.2-23 for sources of mammalian toxicity reference values.

[f] Refined hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.6.ERA-14
Maximum Scenario Food Chain Modeling for the Great Blue Heron
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration [a] Surface Water (mg/L)	Maximum Concentration [a] Sediment (mg/kg)	Sediment Bioaccumulation Factors (BAFsed) [b] Fish	Estimated Dietary Tissue Concentrations [c] (mg/kg) Fish	Maximum Estimated Dietary Ingestion [d] mg/kg-BW-day	Toxicity Reference Values [e] mg/kg-BW-day LOAEL	Toxicity Reference Values [e] mg/kg-BW-day NOAEL	Maximum Scenario HQ [f] LOAEL	Maximum Scenario HQ [f] NOAEL
Pesticides									
4,4'-DDD	–	2.1E-03	1.5E+00	3.1E-03	2.0E-04	2.80E-02	2.80E-03	0.007	0.07
4,4'-DDE	–	8.4E-03	1.6E+01	1.4E-01	8.0E-03	2.80E-02	2.80E-03	0.3	3
4,4'-DDT	1.0E-05	4.0E-03	1.3E+00	5.3E-03	3.0E-04	2.80E-02	2.80E-03	0.01	0.1
BHC, alpha-	–	5.9E-04	NA	NA	NA	2.25E+00	5.60E-01	NA	NA
BHC, delta-	1.0E-05	1.2E-03	NA	NA	NA	2.25E+00	5.60E-01	NA	NA
BHC, gamma- (Lindane)	–	9.7E-04	NA	NA	NA	2.00E+01	2.00E+00	NA	NA
Chlordane, alpha-	–	1.0E-02	1.5E+00	1.5E-02	8.0E-04	2.14E+01	2.14E+00	0.00004	0.0004
Chlordane, gamma-	–	1.3E-02	1.5E+00	1.9E-02	1.0E-03	2.14E+01	2.14E+00	0.00005	0.0005
Dieldrin	7.2E-06	4.1E-03	3.9E+00	1.6E-02	9.0E-04	7.70E-01	7.70E-02	0.001	0.01
Endrin	–	1.3E-02	NA	0.0E+00	–	3.00E+00	3.00E-01	NA	NA
Endosulfan II	–	7.2E-04	NA	NA	NA	1.00E+02	1.00E+01	NA	NA
Heptachlor	–	2.1E-03	8.3E-01	1.8E-03	1.0E-04	NA	NA	NA	NA
Heptachlor Epoxide	–	7.3E-03	8.3E-01	6.0E-03	3.0E-04	NA	NA	NA	NA
Methoxychlor	–	2.6E-03	NA	NA	NA	NA	NA	NA	NA
Polycyclic Aromatic Hydrocarbons									
Acenaphthene	–	5.9E-02	3.1E-03	1.8E-04	1.0E-05	1.00E+02	1.00E+01	0.0000001	0.000001
Acenaphthylene	–	2.6E-02	3.1E-03	8.1E-05	4.0E-06	1.00E+02	1.00E+01	4E-08	0.0000004
Anthracene	–	8.1E-02	3.1E-03	2.5E-04	1.0E-05	1.00E+02	1.00E+01	0.0000001	0.000001
Benzo(a)anthracene	–	1.9E-01	7.7E-03	1.5E-03	8.0E-05	1.00E+02	1.00E+01	0.0000008	0.000008
Benzo(a)pyrene	–	1.7E-01	7.7E-03	1.3E-03	7.0E-05	1.00E+02	1.00E+01	0.0000007	0.000007
Benzo(b)fluoranthene	–	2.5E-01	7.7E-03	1.9E-03	1.0E-04	1.00E+02	1.00E+01	0.000001	0.00001
Benzo(g,h,i)perylene	–	1.0E-01	7.7E-03	7.7E-04	4.0E-05	1.00E+02	1.00E+01	0.0000004	0.000004
Benzo(k)fluoranthene	–	8.0E-02	7.7E-03	6.1E-04	3.0E-05	1.00E+02	1.00E+01	0.0000003	0.000003
Chrysene	–	1.7E-01	7.7E-03	1.3E-03	7.0E-05	1.00E+02	1.00E+01	0.0000007	0.000007
Dibenzo(a,h)anthracene	–	2.6E-02	7.7E-03	2.0E-04	1.0E-05	1.00E+02	1.00E+01	0.0000001	0.000001
Fluoranthene	–	4.4E-01	7.7E-03	3.4E-03	2.0E-04	1.00E+02	1.00E+01	0.000002	0.00002
Fluorene	–	4.6E-02	3.1E-03	1.4E-04	8.0E-06	1.00E+02	1.00E+01	8E-08	0.0000008
Indeno(1,2,3-cd)pyrene	–	1.2E-01	7.7E-03	9.2E-04	5.0E-05	1.00E+02	1.00E+01	0.0000005	0.000005
Phenanthrene	2.0E-05	3.6E-01	3.1E-03	1.1E-03	6.0E-05	1.00E+02	1.00E+01	0.0000006	0.000006
Pyrene	–	3.0E-01	7.7E-03	2.3E-03	1.0E-04	1.00E+02	1.00E+01	0.000001	0.00001

Table A.6.ERA-14
Maximum Scenario Food Chain Modeling for the Great Blue Heron
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration [a] Surface Water (mg/L)	Maximum Concentration [a] Sediment (mg/kg)	Sediment Bioaccumulation Factors (BAFsed) [b] Fish	Estimated Dietary Tissue Concentrations [c] (mg/kg) Fish	Maximum Estimated Dietary Ingestion [d] mg/kg-BW-day	Toxicity Reference Values [e] mg/kg-BW-day LOAEL	Toxicity Reference Values [e] mg/kg-BW-day NOAEL	Maximum Scenario HQ [f] LOAEL	Maximum Scenario HQ [f] NOAEL
Inorganics									
Arsenic	–	1.2E+01	1.0E+00	1.2E+01	7.0E-01	1.28E+01	5.14E+00	0.05	0.1
Cadmium	1.1E-04	2.1E-01	1.0E+00	2.1E-01	1.0E-02	1.45E+01	1.45E+00	0.0007	0.007
Copper	3.8E-02	4.8E+01	1.0E+00	4.8E+01	3.0E+00	6.17E+01	4.70E+01	0.05	0.06
Lead	3.1E-02	3.3E+01	1.0E+00	3.3E+01	2.0E+00	3.85E+01	3.85E+00	0.05	0.5
Nickel	–	2.5E+01	1.0E+00	2.5E+01	1.0E+00	1.07E+02	7.74E+01	0.009	0.01
Selenium	4.8E-04	1.7E+00	1.0E+00	1.7E+00	9.0E-02	1.00E+00	5.00E-01	0.09	0.2
Silver	8.3E-03	–	1.0E+00	NA	NA	1.00E+00	5.00E-01	NA	NA
Zinc	2.7E-01	1.1E+02	1.0E+00	1.1E+02	6.0E+00	1.31E+02	1.45E+01	0.05	0.4

Notes:

– = Not applicable.
HQ = Hazard Quotient.
LOAEL = Lowest observed adverse effect level.
mg/kg = Milligrams per kilogram.
mg/kg-BW-day = Milligrams per kilogram of body weight per day.
mg/L = Milligrams per liter.
NA = Not available.
NOAEL = No observed adverse effect level.

[a] Maximum concentrations detected in surface water (mg/L) and sediment (mg/kg).
[b] See Table A.2-21 for sources of sediment bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.
[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.
[e] See Table A.2-22 for sources of avian toxicity reference values.
[f] Maximum hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.6.ERA-15
Refined Scenario Food Chain Modeling for the Great Blue Heron
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] Surface Water (mg/L)		Exposure Point Concentration [a] Sediment (mg/kg)		Sediment Bioaccumulation Factors (BAFsed) [b] Fish	Estimated Dietary Tissue Concentrations [c] (mg/kg) Fish	Refined Estimated Dietary Ingestion [d] mg/kg-BW-day	Toxicity Reference Values [e] mg/kg-BW-day LOAEL	Toxicity Reference Values [e] mg/kg-BW-day NOAEL	Refined Scenario HQ [f] LOAEL	Refined Scenario HQ [f] NOAEL
Pesticides											
4,4'-DDD	–		2.1E-03	m	1.5E+00	3.1E-03	2.0E-04	2.80E-02	2.80E-03	0.007	0.07
4,4'-DDE	–		3.7E-03		1.6E+01	6.0E-02	3.0E-03	2.80E-02	2.80E-03	0.1	1
4,4'-DDT	1.0E-05	m	2.7E-03		1.3E+00	3.6E-03	2.0E-04	2.80E-02	2.80E-03	0.007	0.07
BHC, alpha-	–		5.9E-04	m	NA	NA	NA	2.25E+00	5.60E-01	NA	NA
BHC, delta-	1.0E-05	m	1.2E-03	m	NA	NA	NA	2.25E+00	5.60E-01	NA	NA
BHC, gamma- (Lindane)	–		9.7E-04	m	NA	NA	NA	2.00E+01	2.00E+00	NA	NA
Chlordane, alpha-	–		1.0E-02	m	1.5E+00	1.5E-02	8.0E-04	2.14E+01	2.14E+00	0.00004	0.0004
Chlordane, gamma-	–		1.3E-02	m	1.5E+00	1.9E-02	1.0E-03	2.14E+01	2.14E+00	0.00005	0.0005
Dieldrin	7.2E-06	m	4.1E-03	m	3.9E+00	1.6E-02	9.0E-04	7.70E-01	7.70E-02	0.001	0.01
Endrin	–		1.3E-02	m	NA	0.0E+00	0.0E+00	3.00E+00	3.00E-01	#NUM!	#NUM!
Endosulfan II	–		7.2E-04	m	NA	NA	NA	1.00E+02	1.00E+01	NA	NA
Heptachlor	–		2.1E-03	m	8.3E-01	1.8E-03	1.0E-04	NA	NA	NA	NA
Heptachlor Epoxide	–		7.3E-03	m	8.3E-01	6.0E-03	3.0E-04	NA	NA	NA	NA
Methoxychlor	–		2.6E-03	m	NA	NA	NA	NA	NA	NA	NA
Polycyclic Aromatic Hydrocarbons											
Acenaphthene	–		5.9E-02	m	3.1E-03	1.8E-04	1.0E-05	1.00E+02	1.00E+01	0.0000001	0.000001
Acenaphthylene	–		2.6E-02	m	3.1E-03	8.1E-05	4.0E-06	1.00E+02	1.00E+01	0.00000004	0.0000004
Anthracene	–		4.5E-02		3.1E-03	1.4E-04	8.0E-06	1.00E+02	1.00E+01	0.00000008	0.0000008
Benzo(a)anthracene	–		1.2E-01		7.7E-03	9.4E-04	5.0E-05	1.00E+02	1.00E+01	0.0000005	0.000005
Benzo(a)pyrene	–		8.9E-02		7.7E-03	6.8E-04	4.0E-05	1.00E+02	1.00E+01	0.0000004	0.000004
Benzo(b)fluoranthene	–		1.4E-01		7.7E-03	1.1E-03	6.0E-05	1.00E+02	1.00E+01	0.0000006	0.000006
Benzo(g,h,i)perylene	–		7.3E-02		7.7E-03	5.6E-04	3.0E-05	1.00E+02	1.00E+01	0.0000003	0.000003
Benzo(k)fluoranthene	–		4.4E-02		7.7E-03	3.4E-04	2.0E-05	1.00E+02	1.00E+01	0.0000002	0.000002
Chrysene	–		8.1E-02		7.7E-03	6.2E-04	3.0E-05	1.00E+02	1.00E+01	0.0000003	0.000003
Dibenzo(a,h)anthracene	–		2.6E-02	m	7.7E-03	2.0E-04	1.0E-05	1.00E+02	1.00E+01	0.0000001	0.000001
Fluoranthene	–		2.4E-01		7.7E-03	1.8E-03	1.0E-04	1.00E+02	1.00E+01	0.000001	0.00001
Fluorene	–		4.6E-02	m	3.1E-03	1.4E-04	8.0E-06	1.00E+02	1.00E+01	0.00000008	0.0000008
Indeno(1,2,3-cd)pyrene	–		8.2E-02		7.7E-03	6.3E-04	3.0E-05	1.00E+02	1.00E+01	0.0000003	0.000003
Phenanthrene	2.0E-05	m	2.5E-01		3.1E-03	7.9E-04	4.0E-05	1.00E+02	1.00E+01	0.0000004	0.000004
Pyrene	–		1.3E-01		7.7E-03	9.6E-04	5.0E-05	1.00E+02	1.00E+01	0.0000005	0.000005
Inorganics											
Arsenic	–		7.8E+00		1.0E+00	7.8E+00	4.0E-01	1.28E+01	5.14E+00	0.03	0.08
Cadmium	1.1E-04	m	1.5E-01		1.0E+00	1.5E-01	8.0E-03	1.45E+01	1.45E+00	0.0006	0.006
Copper	3.8E-02	m	2.4E+01		1.0E+00	2.4E+01	1.0E+00	6.17E+01	4.70E+01	0.02	0.02
Lead	3.1E-02	m	2.2E+01	avg	1.0E+00	2.2E+01	1.0E+00	3.85E+01	3.85E+00	0.03	0.3
Nickel	–		1.7E+01		1.0E+00	1.7E+01	9.0E-01	1.07E+02	7.74E+01	0.008	0.01
Selenium	4.8E-04	m	1.1E+00		1.0E+00	1.1E+00	6.0E-02	1.00E+00	5.00E-01	0.06	0.1
Silver	8.3E-03	m	–		1.0E+00	NA	NA	1.00E+00	5.00E-01	NA	NA
Zinc	2.7E-01	m	7.4E+01		1.0E+00	7.4E+01	4.0E+00	1.31E+02	1.45E+01	0.03	0.3

Table A.6.ERA-15
Refined Scenario Food Chain Modeling for the Great Blue Heron
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:

– =	Not applicable.
HQ =	Hazard Quotient.
LOAEL =	Lowest observed adverse effect level.
mg/kg =	Milligrams per kilogram.
mg/kg-BW-day =	Milligrams per kilogram of body weight per day.
mg/L =	Milligrams per liter.
NA =	Not available.
NOAEL =	No observed adverse effect level.

[a] Exposure point concentration (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.

[b] See Table A.2-21 for sources of sediment bioaccumulation factors.

[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.

[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.

[e] See Table A.2-22 for sources of avian toxicity reference values.

[f] Refined hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.6.ERA-16
Summary of Ecological Risk Characterization Results - Terrestrial Habitat
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Soil Frequency of Detection # detects / n samples	Soil Frequency of Detection %	Soil EPC (mg/kg)		Baseline Level Assessment Hazard Quotient [a]	Baseline Level Assessment Ecological Screening Level [b] Source	Baseline Level Assessment Ecological Screening Level [b] Basis	Bioaccum-ulative ? (YES/no)	Results of Refined Food Chain Models [c] Short-tailed Shrew LOAEL HQ	Short-tailed Shrew NOAEL HQ	American Robin LOAEL HQ	American Robin NOAEL HQ
Volatile Organic Compounds												
3-Octanone	3 / 3	100%	0.15	m	NA			no	–	–	–	–
Ethanol	2 / 2	100%	0.087	m	NA			no	–	–	–	–
Semi-Volatile Organic Compounds												
2,6-Dinitrotoluene	1 / 34	3%	0.32	m	**10**	R5		no	–	–	–	–
Benzoic Acid	2 / 31	6%	0.17	m	NA			no	–	–	–	–
Carbazole	2 / 34	6%	0.12	m	NA			no	–	–	–	–
Dibenzofuran	1 / 31	3%	0.045	m	NA			no	–	–	–	–
Pentachlorophenol	2 / 34	6%	830	m	**400**	EcoSSL	avi	YES	**10**	**100**	0.1	1
Pesticides												
4,4'-DDE	2 / 10	20%	0.04	m	**2**	EcoSSL	mam	YES	0.001	0.005	0.1	1
BHC, alpha-	4 / 6	67%	0.0008	m	0.008	R5		YES	0.00002	0.00004	0.00003	0.0001
BHC, beta-	2 / 6	33%	0.0003	m	0.06	R5		YES	0.00001	0.00005	0.000008	0.00003
Chlordane, alpha-	2 / 10	20%	0.03	m	0.1	R5		YES	0.0001	0.001	0.0001	0.001
Dieldrin	1 / 9	11%	0.27	m	**60**	EcoSSL	mam	YES	0.1	1	0.02	0.2
Endrin Aldehyde	1 / 8	13%	0.04	m	**4**	R5		YES	0.007	0.07	0.001	0.01
Polycyclic Aromatic Hydrocarbons												
Acenaphthene	3 / 31	10%	0.0065	m	0.00001	R5		YES	0.00002	0.0002	0.000002	0.00002
Acenaphthylene	4 / 34	12%	0.07	m	0.0001	R5		YES	0.00004	0.000004	0.00003	0.0003
Anthracene	8 / 34	24%	0.0216		0.00001	R5		YES	0.00000004	0.0000004	0.000003	0.00003
Benzo(a)anthracene	15 / 36	42%	0.242		0.05	R5		YES	0.0008	0.008	0.00003	0.0003
Benzo(a)pyrene	15 / 36	42%	0.242		0.2	R5		YES	0.0004	0.004	0.00004	0.0004
Benzo(b)fluoranthene	15 / 36	42%	0.476		0.008	R5		YES	0.0003	0.007	0.00007	0.0007
Benzo(g,h,i)perylene	13 / 31	42%	0.0231		0.0002	R5		YES	0.0007	0.007	0.000003	0.00003
Benzo(k)fluoranthene	14 / 36	39%	0.27		0.002	R5		YES	0.0002	0.004	0.00004	0.0004
Chrysene	15 / 36	42%	0.318		0.07	R5		YES	0.00002	0.0002	0.00005	0.0005
Dibenzo(a,h)anthracene	7 / 34	21%	0.011		0.0006	R5		YES	0.02	0.2	0.000002	0.00002
Fluoranthene	15 / 36	42%	0.102		0.0008	R5		YES	0.00008	0.0008	0.00003	0.0003
Fluorene	3 / 31	10%	0.0067	m	0.00005	R5		YES	0.000001	0.000004	0.000002	0.00002
Indeno(1,2,3-cd)pyrene	14 / 34	41%	0.0277		0.0003	R5		YES	0.003	0.03	0.000004	0.00004
Phenanthrene	15 / 36	42%	0.0596		0.001	R5		YES	0.00003	0.0003	0.000009	0.00009
Pyrene	15 / 36	42%	0.412		0.005	R5		YES	0.0003	0.003	0.00006	0.0006
Polychlorinated Biphenyls												
Aroclor 1254	7 / 29	24%	0.385		NA			YES	0.09	0.9	0.02	0.2

Table A.6.ERA-16
Summary of Ecological Risk Characterization Results - Terrestrial Habitat
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Soil Frequency of Detection # detects / n samples			Soil Frequency of Detection %	Soil EPC (mg/kg)		Baseline Level Assessment: Hazard Quotient [a]	Ecological Screening Level [b] Source	Ecological Screening Level [b] Basis	Bioaccum-ulative ? (YES/no)	Short-tailed Shrew LOAEL HQ	Short-tailed Shrew NOAEL HQ	American Robin LOAEL HQ	American Robin NOAEL HQ
Inorganics														
Aluminum	35	/	35	100%	24,984		**500**	ORNL		no	–	–	–	–
Cadmium	6	/	35	17%	0.319		0.9	EcoSSL	mam	YES	0.03	0.3	0.003	0.03
Cobalt	34	/	35	97%	27.35		**2**	EcoSSL	veg	no	–	–	–	–
Copper	34	/	35	97%	25.89		0.9	EcoSSL	avi	YES	0.01	0.02	0.01	0.01
Iron	35	/	35	100%	34,847		NA			no	–	–	–	–
Lead	35	/	35	100%	51.33		**5**	EcoSSL	avi	YES	0.005	0.05	0.02	0.2
Selenium	3	/	32	9%	1	m	**2**	EcoSSL	veg	YES	0.08	0.1	0.03	0.06
Zinc	35	/	35	100%	186.4		**4**	EcoSSL	avi	YES	0.2	**2**	0.08	0.7

Results of Refined Food Chain Models [c]

Notes:

– = Not applicable.
COPEC = Constituent of Potential Ecological Concern.
EPC = Exposure point concentrations - the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration.
EPCs marked with "m" are the maximum concentration.
LOAEL HQ = Lowest observed adverse effect level hazard quotient.
mg/kg = Milligrams per kilogram.
NA = Not available.
NOAEL HQ = No observed adverse effect level hazard quotient.

[a] Hazard quotients (HQs) greater than one are presented in bold font. HQs are rounded to one significant figure (unitless).
[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
R5: Region 5 Ecological Screening Levels (USEPA 2003e; R5).
EcoSSL: USEPA Ecological Soil Screening Levels (USEPA 2005b, EcoSSL).
Where readily available (i.e., EcoSSLs), the basis of the ESL is presented.
[c] Foodchain modeling was conducted for bioaccumulative COPECs.

Table A.6.ERA-17
Summary of Ecological Risk Characterization Results - Aquatic Habitat
RAIL YARD
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

	Sediment			Surface Water			Baseline Level Assessment			Results of Refined Food Chain Models [b]			
	Frequency of Detection		EPC	Frequency of Detection		EPC	Sediment Hazard Quotient	Surface Water Hazard Quotient	Bioaccum-ulative ?	Mink		Great Blue Heron	
Constituent	# detects / n samples	%	(mg/kg)	# detects / n samples	%	(mg/L)	[a]	[a]	(YES/no)	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ
Volatile Organic Compounds													
2-Butanone	2 / 14	14%	0.1 m	0 / 4	0%	–	**2**	NA	no	–	–	–	–
Acetone	5 / 14	36%	0.13	0 / 4	0%	–	**10**	NA	no	–	–	–	–
Carbon Disulfide	3 / 11	27%	0.0022 m	2 / 4	50%	–	**3**	NA	no	–	–	–	–
Explosives													
Nitroglycerine	2 / 11	18%	0.57 m	1 / 6	17%	–	NA	NA	no	–	–	–	–
Pentaerythritol Tetranitrate	2 / 11	18%	0.23 m	0 / 6	0%	–	NA	NA	no	–	–	–	–
Herbicides													
2,4-DB	0 / 11	0%	–	1 / 6	17%	0.00041 m	–	NA	no	–	–	–	–
Dalapon	1 / 11	9%	0.107 m	0 / 6	0%	–	NA	NA	no	–	–	–	–
Dicamba	1 / 11	9%	0.0497 m	0 / 6	0%	–	NA	NA	no	–	–	–	–
Dichlorprop	1 / 11	9%	0.353 m	0 / 6	0%	–	NA	NA	no	–	–	–	–
MCPA	0 / 11	0%	–	1 / 6	17%	0.11 m	–	NA	no	–	–	–	–
MCPP	1 / 11	9%	3.53 m	1 / 6	17%	0.0463 m	NA	NA	no	–	–	–	–
Pesticides													
4,4'-DDD	4 / 11	36%	0.00209 m	0 / 6	0%	–	0.4	NA	YES	0.00006	0.0003	0.007	0.07
4,4'-DDE	7 / 11	64%	0.00368	0 / 6	0%	–	1	NA	YES	0.0009	0.005	0.1	1
4,4'-DDT	6 / 11	55%	0.00274	1 / 6	17%	0.00001 m	0.0004	**20**	YES	0.00006	0.0003	0.007	0.07
BHC, alpha-	2 / 11	18%	0.00059 m	0 / 6	0%	–	0.1	NA	YES	–	–	–	–
BHC, delta-	2 / 11	18%	0.0012 m	1 / 6	17%	0.00001 m	0.0002	0.00007	YES	–	–	–	–
BHC, gamma- (Lindane)	1 / 11	9%	0.00097 m	0 / 6	0%	–	0.4	NA	YES	–	–	–	–
Chlordane, alpha-	4 / 11	36%	0.0101 m	0 / 6	0%	–	**3**	NA	YES	0.00005	0.0005	0.00004	0.0004
Chlordane, gamma-	4 / 11	36%	0.013 m	0 / 6	0%	–	**4**	NA	YES	0.00005	0.0005	0.00005	0.0005
Dieldrin	4 / 11	36%	0.0041 m	2 / 6	33%	0.00000719 m	**2**	0.1	YES	0.006	0.06	0.001	0.01
Endosulfan II	3 / 11	27%	0.00072 m	0 / 6	0%	–	0.05	NA	YES	–	–	–	–
Endrin	1 / 11	9%	0.0125 m	0 / 6	0%	–	**6**	NA	YES	–	–	–	–
Heptachlor	2 / 11	18%	0.00213 m	0 / 6	0%	–	0.03	NA	YES	0.0002	0.002	–	–
Heptachlor Epoxide	2 / 11	18%	0.00726 m	0 / 6	0%	–	**3**	NA	YES	0.0003	0.003	–	–
Methoxychlor	1 / 11	9%	0.0026 m	0 / 6	0%	–	0.1	NA	YES	–	–	–	–
Polycyclic Aromatic Hydrocarbons													
Acenaphthene	3 / 11	27%	0.059 m	0 / 6	0%	–	**9**	NA	YES	0.000001	0.00001	0.0000001	0.000001
Acenaphthylene	4 / 11	36%	0.026 m	0 / 6	0%	–	**4**	NA	YES	0.0000001	0.00000001	0.00000004	0.0000004
Anthracene	5 / 11	45%	0.0447	0 / 6	0%	–	0.8	NA	YES	0.000000003	0.00000003	0.00000008	0.0000008
Benzo(a)anthracene	9 / 11	82%	0.123	0 / 6	0%	–	1	NA	YES	0.00003	0.0003	0.0000005	0.000005
Benzo(a)pyrene	7 / 11	64%	0.0891	0 / 6	0%	–	0.6	NA	YES	0.000009	0.00009	0.0000004	0.000004
Benzo(b)fluoranthene	7 / 11	64%	0.139	0 / 6	0%	–	0.01	NA	YES	0.000004	0.0001	0.0000006	0.000006
Benzo(g,h,i)perylene	5 / 11	45%	0.073	0 / 6	0%	–	0.4	NA	YES	0.00007	0.0007	0.0000003	0.000003
Benzo(k)fluoranthene	7 / 11	64%	0.0443	0 / 6	0%	–	0.2	NA	YES	0.000001	0.00004	0.0000002	0.000002
Chrysene	9 / 11	82%	0.0808	0 / 6	0%	–	0.5	NA	YES	0.0000005	0.000005	0.0000003	0.000003
Dibenzo(a,h)anthracene	3 / 11	27%	0.026 m	0 / 6	0%	–	0.8	NA	YES	0.002	0.02	0.0000001	0.000001
Fluoranthene	10 / 14	71%	0.238	0 / 6	0%	–	0.6	NA	YES	0.000003	0.00003	0.000001	0.00001
Fluorene	4 / 11	36%	0.046 m	0 / 6	0%	–	0.6	NA	YES	0.00000007	0.0000002	0.00000008	0.0000008
Indeno(1,2,3-cd)pyrene	5 / 11	45%	0.0824	0 / 6	0%	–	**5**	NA	YES	0.00009	0.0009	0.0000003	0.000003
Phenanthrene	8 / 11	73%	0.253	1 / 6	17%	0.00002 m	1	0.05	YES	0.000005	0.00005	0.0000004	0.000004
Pyrene	9 / 11	82%	0.125	0 / 6	0%	–	0.6	NA	YES	0.000007	0.00007	0.0000005	0.000005

Table A.6.ERA-17

Summary of Ecological Risk Characterization Results - Aquatic Habitat

RAIL YARD

New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Sediment: Frequency of Detection # detects / n samples	Sediment: %	Sediment: EPC (mg/kg)	Surface Water: Frequency of Detection # detects / n samples	Surface Water: %	Surface Water: EPC (mg/L)	Baseline Level Assessment: Sediment Hazard Quotient [a]	Baseline Level Assessment: Surface Water Hazard Quotient [a]	Bioaccum-ulative ? (YES/no)	Results of Refined Food Chain Models [b]: Mink LOAEL HQ	Mink NOAEL HQ	Great Blue Heron LOAEL HQ	Great Blue Heron NOAEL HQ
Inorganics													
Aluminum	14 / 14	100%	–	6 / 7	86%	0.608 m	–	**7**	no	–	–	–	–
Arsenic	14 / 14	100%	7.788	0 / 6	0%	–	0.8	NA	YES	0.09	0.9	0.03	0.08
Barium	14 / 14	100%	77.57	6 / 6	100%	0.0796 m	NA	**20**	no	–	–	–	–
Beryllium	14 / 14	100%	1.09	0 / 6	0%	–	NA	NA	no	–	–	–	–
Cadmium	8 / 11	73%	0.154	2 / 6	33%	0.00011 m	0.2	0.4	YES	0.008	0.08	0.0006	0.006
Copper	14 / 14	100%	24.06	1 / 7	14%	0.038 m	0.8	**4**	YES	0.06	0.07	0.02	0.02
Iron	14 / 14	100%	33,199	6 / 7	86%	4.47 m	**2**	**10**	no	–	–	–	–
Lead	14 / 14	100%	25.33 avg	5 / 7	71%	0.031 m	0.6	**10**	YES	0.02	0.2	0.03	0.3
Nickel	14 / 14	100%	17.19	0 / 6	0%	–	0.8	NA	YES	0.02	0.03	0.008	0.01
Selenium	5 / 14	36%	1.13	1 / 6	17%	0.00048 m	0.6	0.5	YES	0.2	0.4	0.06	0.1
Silver	0 / 11	0%	–	2 / 6	33%	0.0083 m	–	**3**	YES	–	–	–	–
Thallium	11 / 11	100%	0.296	0 / 6	0%	–	NA	NA	no	–	–	–	–
Vanadium	14 / 14	100%	57.92	0 / 6	0%	–	NA	NA	no	–	–	–	–
Zinc	14 / 14	100%	73.56	2 / 7	29%	0.274 m	0.6	**2**	YES	0.2	**2**	0.03	0.3

Notes:

– = Not applicable.

EPC = Exposure point concentrations - the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.

LOAEL HQ = Lowest observed adverse effect level hazard quotient.

mg/kg = Milligrams per kilogram.

mg/L = Milligrams per liter.

NOAEL HQ = No observed adverse effect level hazard quotient.

[a] Hazard quotients (HQs) greater than one are presented in bold font. HQs are rounded to one significant figure (unitless).

[b] Foodchain modeling was conducted for bioaccumulative COPECs.

Table A.7.Data-1
Soil Risk Assessment Dataset
Surface Soil (0-1 foot Depth Interval)
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Volatile Organic Compounds												
Acetone	67-64-1	3	-	18	17	0.004	-	0.07	0.0046	-	0.0064	WBGSB10
Carbon Disulfide	75-15-0	1	-	18	6	0.0008	-	0.0008	0.0045	-	0.0064	SS-04
d-Limonene	5989-27-5	1	-	1	100	0.17	-	0.17	–	-	–	WBGSB23
Methylene Chloride	75-09-2	5	-	18	28	0.002	-	0.003	0.001	-	0.0055	SS-04,SS-04a,WBGSB2,WBGSB4
p-Isopropyltoluene	99-87-6	1	-	11	9	0.0048	-	0.0048	0.001	-	0.0011	WBGSB8
Toluene	108-88-3	2	-	15	13	0.00032	-	0.0011	0.001	-	0.0051	WBGSB23
Semi-Volatile Organic Compounds												
bis(2-Ethylhexyl)phthalate	117-81-7	9	-	29	31	0.04	-	0.67	0.07	-	0.4	WBGSB25
Carbazole	86-74-8	3	-	26	12	0.038	-	0.1	0.05	-	0.4	WBGSB24
Dibenzofuran	132-64-9	2	-	26	8	0.011	-	0.014	0.06	-	0.4	WBGSB25
Di-n-Butylphthalate	84-74-2	7	-	29	24	0.04	-	0.13	0.03	-	0.4	WBGSB11
Di-n-Octylphthalate	117-84-0	1	-	24	4	0.016	-	0.016	0.02	-	0.4	WBGSB23
N-Nitrosodiphenylamine	86-30-6	1	-	26	4	0.06	-	0.06	0.01	-	0.4	WBGSB3
Dioxin/Furan Compounds												
1,2,3,4,6,7,8-HpCDD	35822-46-9	8	-	8	100	1.374E-05	-	0.000157	–	-	–	WBGSB25
1,2,3,4,6,7,8-HpCDF	67562-39-4	8	-	8	100	0.000001	-	3.1E-05	–	-	–	WBGSB25
1,2,3,4,7,8,9-HpCDF	55673-89-7	3	-	5	60	2.3E-07	-	2.05E-06	0.00000005	-	0.00000007	WBGSB25
1,2,3,4,7,8-HxCDD	39227-28-6	5	-	5	100	2.8E-07	-	3.33E-06	–	-	–	WBGSB25
1,2,3,4,7,8-HxCDF	70648-26-9	6	-	8	75	1.9E-07	-	5.64E-06	–	-	–	WBGSB25
1,2,3,6,7,8-HxCDD	57653-85-7	7	-	8	88	3.7E-07	-	6.61E-06	–	-	–	WBGSB25
1,2,3,6,7,8-HxCDF	57117-44-9	5	-	5	100	1.8E-07	-	5.08E-06	–	-	–	WBGSB25
1,2,3,7,8,9-HxCDD	19408-74-3	6	-	8	75	5.67E-07	-	8.34E-06	–	-	–	WBGSB25
1,2,3,7,8,9-HxCDF	72918-21-9	1	-	5	20	4.5E-07	-	4.5E-07	0.00000003	-	0.0000005	WBGSB25
1,2,3,7,8-PeCDD	40321-76-4	3	-	5	60	0.0000002	-	1.73E-06	0.0000001	-	0.00000011	WBGSB25
1,2,3,7,8-PeCDF	57117-41-6	3	-	5	60	0.0000001	-	1.24E-06	0.00000007	-	0.00000008	WBGTP12S
2,3,4,6,7,8-HxCDF	60851-34-5	4	-	5	80	1.4E-07	-	2.38E-06	0.00000006	-	0.00000006	WBGSB25
2,3,4,7,8-PeCDF	57117-31-4	3	-	5	60	1.3E-07	-	1.72E-06	0.00000008	-	0.00000009	WBGTP12S
2,3,7,8-TCDD	1746-01-6	4	-	5	80	3.2E-07	-	1.51E-06	0.00000006	-	0.00000006	WBGSB23
2,3,7,8-TCDF	51207-31-9	2	-	5	40	0.0000017	-	1.84E-06	0.00000006	-	0.00000021	WBGTP12S
OCDD	3268-87-9	8	-	8	100	0.0005143	-	0.0083	–	-	–	WBGTP12S
OCDF	39001-02-0	8	-	8	100	2.011E-06	-	5.86E-05	–	-	–	WBGSB25
Explosives												
Pentaerythritol Tetranitrate	78-11-5	1	-	9	11	0.11	-	0.11	0.3	-	1.2	WBGSB24

Table A.7.Data-1
Soil Risk Assessment Dataset
Surface Soil (0-1 foot Depth Interval)
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Herbicides												
2,4,5-TP	93-72-1	1	-	4	25	0.0078	-	0.0078	0.0101	-	0.0102	WBGSB25
2,4-D	94-75-7	2	-	4	50	0.0107	-	0.0302	0.0201	-	0.0202	WBGSB25
Dalapon	75-99-0	3	-	4	75	0.0223	-	0.163	1.01	-	1.01	WBGSB24
MCPP	93-65-2	1	-	4	25	2.56	-	2.56	10.1	-	101	WBGSB23
Pesticides												
4,4'-DDD	72-54-8	1	-	4	25	0.0019	-	0.0019	0.0067	-	0.00681	WBGSB25
Dieldrin	60-57-1	1	-	4	25	0.00472	-	0.00472	0.0067	-	0.00676	WBGSB24
Polycyclic Aromatic Hydrocarbons												
2-Methylnaphthalene	91-57-6	5	-	29	17	0.0016	-	0.023	0.0091	-	0.4	WBGSB25
Acenaphthene	83-32-9	3	-	29	10	0.025	-	0.32	0.0017	-	0.4	WBGSB9
Acenaphthylene	208-96-8	1	-	29	3	0.0039	-	0.0039	0.0017	-	0.4	WBGSB25
Anthracene	120-12-7	6	-	29	21	0.00037	-	0.1	0.0017	-	0.4	WBGSB25
Benzo(a)anthracene	56-55-3	9	-	29	31	0.0019	-	0.97	0.01	-	0.4	WBGSB25
Benzo(a)pyrene	50-32-8	9	-	29	31	0.0017	-	1.1	0.01	-	0.4	WBGSB25
Benzo(b)fluoranthene	205-99-2	10	-	29	34	0.0034	-	1.8	0.02	-	0.4	WBGSB25
Benzo(g,h,i)perylene	191-24-2	9	-	29	31	0.0017	-	0.96	0.01	-	0.4	WBGSB25
Benzo(k)fluoranthene	207-08-9	9	-	29	31	0.001	-	0.53	0.02	-	0.4	WBGSB25
Chrysene	218-01-9	10	-	29	34	0.0018	-	0.99	0.02	-	0.4	WBGSB25
Dibenzo(a,h)anthracene	53-70-3	4	-	27	15	0.0026	-	0.22	0.0017	-	0.4	WBGSB25
Fluoranthene	206-44-0	9	-	29	31	0.0031	-	1.6	0.01	-	0.4	WBGSB25
Fluorene	86-73-7	3	-	29	10	0.00094	-	0.028	0.0017	-	0.4	WBGSB24
Indeno(1,2,3-cd)pyrene	193-39-5	9	-	29	31	0.0018	-	1.1	0.01	-	0.4	WBGSB25
Naphthalene	91-20-3	5	-	29	17	0.00087	-	0.018	0.0072	-	0.4	WBGSB25
Phenanthrene	85-01-8	9	-	29	31	0.002	-	0.69	0.01	-	0.4	WBGSB25
Pyrene	129-00-0	10	-	29	34	0.0028	-	1.6	0.01	-	0.4	WBGSB25
Polychlorinated Biphenyls												
Aroclor 1254	11097-69-1	2	-	28	7	0.047	-	0.084	0.03	-	0.05	SS-04
Inorganics												
Aluminum	7429-90-5	56	-	56	100	8570	-	40000	–	-	–	WBGSB29
Antimony	7440-36-0	26	-	53	49	0.29	-	5.3	0.3	-	0.64	WBGSB3
Arsenic	7440-38-2	56	-	56	100	4.5	-	37.9	–	-	–	WBGSB4
Barium	7440-39-3	56	-	56	100	11.5	-	610	–	-	–	WBGSB3
Beryllium	7440-41-7	56	-	56	100	0.23	-	3.4	–	-	–	WBGTP16A
Cadmium	7440-43-9	25	-	53	47	0.066	-	2.7	0.01	-	0.13	WBGSB3
Calcium	7440-70-2	56	-	56	100	533	-	97300	–	-	–	WBGSB2
Chromium	7440-47-3	56	-	56	100	22	-	249	–	-	–	WBGSB3
Cobalt	7440-48-4	56	-	56	100	4.8	-	31.4	–	-	–	WBGSB16
Copper	7440-50-8	56	-	56	100	10.4	-	1340	–	-	–	WBGSB3
Iron	7439-89-6	56	-	56	100	17600	-	54000	–	-	–	WBGSB8

Table A.7.Data-1
Soil Risk Assessment Dataset
Surface Soil (0-1 foot Depth Interval)
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b]				Detects			Detection Limits			Maximum Location
		number of detects / number of samples			FOD %	Min - Max			Min - Max			
						(mg/kg)		(mg/kg)	(mg/kg)		(mg/kg)	
Lead	7439-92-1	56	-	56	100	11.6	-	3990	–	-	–	WBGSB3
Magnesium	7439-95-4	56	-	56	100	319	-	23200	–	-	–	WBGSB3
Manganese	7439-96-5	56	-	56	100	45.7	-	911	–	-	–	WBGTP16A
Mercury	7439-97-6	31	-	53	58	0.03	-	0.24	0.1	-	0.13	WBGTP16A
Nickel	7440-02-0	56	-	56	100	5.3	-	37	–	-	–	WBGTP16A
Potassium	7440-09-7	56	-	56	100	431	-	2910	–	-	–	WBGSB29
Selenium	7782-49-2	17	-	53	32	0.5	-	1.2	0.49	-	0.74	WBGSB11
Silver	7440-22-4	16	-	53	30	0.13	-	2.2	0.11	-	1.02	WBGSB19
Sodium	7440-23-5	53	-	53	100	10.5	-	384	–	-	–	WBGSB3
Thallium	7440-28-0	6	-	53	11	0.17	-	0.86	0.23	-	0.89	WBGSB3
Vanadium	7440-62-2	56	-	56	100	33.5	-	90.7	–	-	–	WBGSB8
Zinc	7440-66-6	56	-	56	100	15.2	-	3250	–	-	–	WBGSB3

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilogram.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.

[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table A.7.Data-2
Soil Risk Assessment Dataset
Surface Soil (0-2 foot Depth Interval)
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Max (mg/kg)	Detection Limits Min (mg/kg)	-	Max (mg/kg)	Maximum Location
Volatile Organic Compounds												
Acetone	67-64-1	3	-	18	17	0.004	-	0.07	0.0046	-	0.0064	WBGSB10
Carbon Disulfide	75-15-0	1	-	18	6	0.0008	-	0.0008	0.0045	-	0.0064	SS-04
d-Limonene	5989-27-5	1	-	1	100	0.17	-	0.17	–	-	–	WBGSB23
Methylene Chloride	75-09-2	5	-	18	28	0.002	-	0.003	0.001	-	0.0055	S-04a,WBGSB2,V
p-Isopropyltoluene	99-87-6	1	-	11	9	0.0048	-	0.0048	0.001	-	0.0011	WBGSB8
Toluene	108-88-3	2	-	15	13	0.00032	-	0.0011	0.001	-	0.0051	WBGSB23
Semi-Volatile Organic Compounds												
bis(2-Ethylhexyl)phthalate	117-81-7	10	-	42	24	0.04	-	0.67	0.07	-	0.49	WBGSB25
Carbazole	86-74-8	3	-	39	8	0.038	-	0.1	0.05	-	0.49	WBGSB24
Dibenzofuran	132-64-9	2	-	39	5	0.011	-	0.014	0.06	-	0.49	WBGSB25
Di-n-Butylphthalate	84-74-2	10	-	42	24	0.04	-	0.21	0.03	-	0.49	WBGTP1SB
Di-n-Octylphthalate	117-84-0	1	-	37	3	0.016	-	0.016	0.01	-	0.49	WBGSB23
N-Nitrosodiphenylamine	86-30-6	1	-	39	3	0.06	-	0.06	0.01	-	0.49	WBGSB3
Dioxin/Furan Compounds												
1,2,3,4,6,7,8-HpCDD	35822-46-9	9	-	9	100	1.374E-05	-	0.000157	–	-	–	WBGSB25
1,2,3,4,6,7,8-HpCDF	67562-39-4	9	-	9	100	4.4E-07	-	3.1E-05	–	-	–	WBGSB25
1,2,3,4,7,8,9-HpCDF	55673-89-7	3	-	6	50	2.3E-07	-	2.05E-06	0.00000005	-	0.00000011	WBGSB25
1,2,3,4,7,8-HxCDD	39227-28-6	6	-	6	100	2.8E-07	-	3.33E-06	–	-	–	WBGSB25
1,2,3,4,7,8-HxCDF	70648-26-9	7	-	9	78	1.3E-07	-	5.64E-06	–	-	–	WBGSB25
1,2,3,6,7,8-HxCDD	57653-85-7	8	-	9	89	3.7E-07	-	6.61E-06	–	-	–	WBGSB25
1,2,3,6,7,8-HxCDF	57117-44-9	6	-	6	100	9E-08	-	5.08E-06	–	-	–	WBGSB25
1,2,3,7,8,9-HxCDD	19408-74-3	7	-	9	78	5.67E-07	-	8.34E-06	–	-	–	WBGSB25
1,2,3,7,8,9-HxCDF	72918-21-9	1	-	6	17	4.5E-07	-	4.5E-07	0.00000003	-	0.0000005	WBGSB25
1,2,3,7,8-PeCDD	40321-76-4	4	-	6	67	0.0000002	-	1.73E-06	0.0000001	-	0.00000011	WBGSB25
1,2,3,7,8-PeCDF	57117-41-6	4	-	6	67	0.0000001	-	1.24E-06	0.00000007	-	0.00000008	WBGTP12S
2,3,4,6,7,8-HxCDF	60851-34-5	5	-	6	83	0.0000001	-	2.38E-06	0.00000006	-	0.00000006	WBGSB25
2,3,4,7,8-PeCDF	57117-31-4	4	-	6	67	1.3E-07	-	1.72E-06	0.00000008	-	0.00000009	WBGTP12S
2,3,7,8-TCDD	1746-01-6	5	-	6	83	3.2E-07	-	1.51E-06	0.00000006	-	0.00000006	WBGSB23
2,3,7,8-TCDF	51207-31-9	3	-	6	50	1.2E-07	-	1.84E-06	0.00000006	-	0.00000021	WBGTP12S
OCDD	3268-87-9	9	-	9	100	0.0005143	-	0.0083	–	-	–	WBGTP12S
OCDF	39001-02-0	9	-	9	100	1.25E-06	-	5.86E-05	–	-	–	WBGSB25
Explosives												
Pentaerythritol Tetranitrate	78-11-5	1	-	9	11	0.11	-	0.11	0.3	-	1.2	WBGSB24
Herbicides												
2,4,5-TP	93-72-1	1	-	4	25	0.0078	-	0.0078	0.0101	-	0.0102	WBGSB25
2,4-D	94-75-7	2	-	4	50	0.0107	-	0.0302	0.0201	-	0.0202	WBGSB25
Dalapon	75-99-0	3	-	4	75	0.0223	-	0.163	1.01	-	1.01	WBGSB24

Table A.7.Data-2
Soil Risk Assessment Dataset
Surface Soil (0-2 foot Depth Interval)
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)		Detects Max (mg/kg)	Detection Limits Min (mg/kg)		Detection Limits Max (mg/kg)	Maximum Location
MCPP	93-65-2	1	-	4	25	2.56	-	2.56	10.1	-	101	WBGSB23
Pesticides												
4,4'-DDD	72-54-8	1	-	4	25	0.0019	-	0.0019	0.0067	-	0.00681	WBGSB25
Dieldrin	60-57-1	1	-	4	25	0.00472	-	0.00472	0.0067	-	0.00676	WBGSB24
Polycyclic Aromatic Hydrocarbons												
2-Methylnaphthalene	91-57-6	5	-	42	12	0.0016	-	0.023	0.0091	-	0.49	WBGSB25
Acenaphthene	83-32-9	3	-	42	7	0.025	-	0.32	0.0017	-	0.49	WBGSB9
Acenaphthylene	208-96-8	1	-	42	2	0.0039	-	0.0039	0.0017	-	0.49	WBGSB25
Anthracene	120-12-7	6	-	42	14	0.00037	-	0.1	0.0017	-	0.49	WBGSB25
Benzo(a)anthracene	56-55-3	9	-	42	21	0.0019	-	0.97	0.01	-	0.49	WBGSB25
Benzo(a)pyrene	50-32-8	9	-	42	21	0.0017	-	1.1	0.01	-	0.49	WBGSB25
Benzo(b)fluoranthene	205-99-2	10	-	42	24	0.0034	-	1.8	0.02	-	0.49	WBGSB25
Benzo(g,h,i)perylene	191-24-2	10	-	42	24	0.0017	-	0.96	0.0097	-	0.49	WBGSB25
Benzo(k)fluoranthene	207-08-9	9	-	42	21	0.001	-	0.53	0.02	-	0.49	WBGSB25
Chrysene	218-01-9	10	-	42	24	0.0018	-	0.99	0.02	-	0.49	WBGSB25
Dibenzo(a,h)anthracene	53-70-3	4	-	40	10	0.0026	-	0.22	0.0017	-	0.49	WBGSB25
Fluoranthene	206-44-0	9	-	42	21	0.0031	-	1.6	0.01	-	0.49	WBGSB25
Fluorene	86-73-7	3	-	42	7	0.00094	-	0.028	0.0017	-	0.49	WBGSB24
Indeno(1,2,3-cd)pyrene	193-39-5	9	-	42	21	0.0018	-	1.1	0.01	-	0.49	WBGSB25
Naphthalene	91-20-3	5	-	42	12	0.00087	-	0.018	0.007	-	0.49	WBGSB25
Phenanthrene	85-01-8	9	-	42	21	0.002	-	0.69	0.01	-	0.49	WBGSB25
Pyrene	129-00-0	10	-	42	24	0.0028	-	1.6	0.01	-	0.49	WBGSB25
Polychlorinated Biphenyls												
Aroclor 1254	11097-69-1	2	-	30	7	0.047	-	0.084	0.03	-	0.05	SS-04
Inorganics												
Aluminum	7429-90-5	71	-	71	100	8270	-	40000	–	-	–	WBGSB29
Antimony	7440-36-0	34	-	68	50	0.29	-	5.3	0.3	-	0.64	WBGSB3
Arsenic	7440-38-2	71	-	71	100	3.8	-	37.9	–	-	–	WBGSB4
Barium	7440-39-3	71	-	71	100	11.5	-	610	–	-	–	WBGSB3
Beryllium	7440-41-7	71	-	71	100	0.23	-	3.9	–	-	–	WBGTP18A
Cadmium	7440-43-9	27	-	68	40	0.066	-	2.7	0.01	-	0.16	WBGSB3
Calcium	7440-70-2	71	-	71	100	533	-	97300	–	-	–	WBGSB2
Chromium	7440-47-3	71	-	71	100	21.5	-	249	–	-	–	WBGSB3
Cobalt	7440-48-4	71	-	71	100	2.2	-	31.4	–	-	–	WBGSB16
Copper	7440-50-8	71	-	71	100	9.5	-	1340	–	-	–	WBGSB3
Iron	7439-89-6	71	-	71	100	17100	-	54000	–	-	–	WBGSB8
Lead	7439-92-1	71	-	71	100	11.5	-	3990	–	-	–	WBGSB3
Magnesium	7439-95-4	71	-	71	100	319	-	23200	–	-	–	WBGSB3
Manganese	7439-96-5	71	-	71	100	44.2	-	911	–	-	–	WBGTP16A
Mercury	7439-97-6	35	-	68	51	0.03	-	0.24	0.1	-	0.16	WBGTP16A

Table A.7.Data-2
Soil Risk Assessment Dataset
Surface Soil (0-2 foot Depth Interval)
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Max (mg/kg)	Detection Limits Min (mg/kg)	-	Max (mg/kg)	Maximum Location
Nickel	7440-02-0	71	-	71	100	2.3	-	37.3	–	-	–	WBGTP18A
Potassium	7440-09-7	71	-	71	100	335	-	3340	–	-	–	WBGTP14B
Selenium	7782-49-2	19	-	68	28	0.5	-	1.2	0.45	-	0.8	WBGSB11
Silver	7440-22-4	22	-	68	32	0.13	-	2.2	0.11	-	1.02	WBGSB19
Sodium	7440-23-5	68	-	68	100	10.5	-	384	–	-	–	WBGSB3
Thallium	7440-28-0	7	-	68	10	0.17	-	1.2	0.23	-	1.1	WBGTP3S
Vanadium	7440-62-2	71	-	71	100	33.5	-	99.4	–	-	–	WBGTP18A
Zinc	7440-66-6	71	-	71	100	15.2	-	3250	–	-	–	WBGSB3

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilogram.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.

[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table A.7.Data-3
Soil Risk Assessment Dataset
Combined Surface and Subsurface Soil
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples	FOD %	Detects Min - Max (mg/kg) - (mg/kg)	Detection Limits Min - Max (mg/kg) - (mg/kg)	Maximum Location
Volatile Organic Compounds						
Acetone	67-64-1	3 - 29	10	0.004 - 0.07	0.0046 - 0.0072	WBGSB10
Carbon Disulfide	75-15-0	3 - 29	10	0.00039 - 0.0008	0.0045 - 0.0072	SS-04
d-Limonene	5989-27-5	1 - 1	100	0.17 - 0.17	– - –	WBGSB23
Methylene Chloride	75-09-2	5 - 29	17	0.002 - 0.003	0.001 - 0.0072	S-04a,WBGSB2,V
p-Isopropyltoluene	99-87-6	1 - 14	7	0.0048 - 0.0048	0.001 - 0.0011	WBGSB8
Toluene	108-88-3	2 - 26	8	0.00032 - 0.0011	0.001 - 0.0072	WBGSB23
Semi-Volatile Organic Compounds						
bis(2-Ethylhexyl)phthalate	117-81-7	11 - 81	14	0.04 - 0.83	0.07 - 0.49	WBGSB22
Butylbenzylphthalate	85-68-7	1 - 78	1	0.16 - 0.16	0.01 - 0.49	WBGSB22
Carbazole	86-74-8	4 - 78	5	0.023 - 0.1	0.05 - 0.49	WBGSB24
Dibenzofuran	132-64-9	3 - 78	4	0.01 - 0.014	0.06 - 0.49	WBGSB25
Di-n-Butylphthalate	84-74-2	15 - 81	19	0.04 - 0.42	0.03 - 0.49	WBGTP2A
Di-n-Octylphthalate	117-84-0	1 - 76	1	0.016 - 0.016	0.01 - 0.49	WBGSB23
N-Nitrosodiphenylamine	86-30-6	1 - 78	1	0.06 - 0.06	0.01 - 0.49	WBGSB3
Dioxin/Furan Compounds						
1,2,3,4,6,7,8-HpCDD	35822-46-9	22 - 22	100	0.00000124 - 0.000243	– - –	WBGTP2B
1,2,3,4,6,7,8-HpCDF	67562-39-4	18 - 22	82	0.00000016 - 3.587E-05	9E-08 - 1.6E-07	WBGSB22
1,2,3,4,7,8,9-HpCDF	55673-89-7	8 - 19	42	0.00000011 - 4.05E-06	3E-08 - 2.1E-07	WBGSB22
1,2,3,4,7,8-HxCDD	39227-28-6	13 - 19	68	0.00000026 - 7.23E-06	7E-08 - 2.7E-07	WBGTP2B
1,2,3,4,7,8-HxCDF	70648-26-9	13 - 22	59	0.00000013 - 0.0000183	3E-08 - 1.2E-07	WBGSB22
1,2,3,6,7,8-HxCDD	57653-85-7	15 - 22	68	0.00000037 - 0.000023	5E-08 - 2.1E-07	WBGTP2B
1,2,3,6,7,8-HxCDF	57117-44-9	12 - 19	63	0.00000009 - 8.49E-06	3E-08 - 1.2E-07	WBGSB22
1,2,3,7,8,9-HxCDD	19408-74-3	16 - 22	73	0.00000031 - 2.096E-05	1.6E-07 - 2.1E-07	WBGSB22
1,2,3,7,8,9-HxCDF	72918-21-9	4 - 19	21	0.00000045 - 1.82E-06	3E-08 - 0.0000005	WBGSB22
1,2,3,7,8-PeCDD	40321-76-4	11 - 19	58	0.0000002 - 6.85E-06	6E-08 - 1.7E-07	WBGTP2B
1,2,3,7,8-PeCDF	57117-41-6	10 - 19	53	0.00000009 - 4.16E-06	4E-08 - 0.0000001	WBGSB22
2,3,4,6,7,8-HxCDF	60851-34-5	11 - 19	58	0.0000001 - 5.28E-06	4E-08 - 1.4E-07	WBGSB22
2,3,4,7,8-PeCDF	57117-31-4	10 - 19	53	0.00000013 - 6.41E-06	4E-08 - 1.1E-07	WBGSB22
2,3,7,8-TCDD	1746-01-6	11 - 19	58	0.00000024 - 4.17E-06	5E-08 - 1.7E-07	WBGTP7A
2,3,7,8-TCDF	51207-31-9	9 - 19	47	0.00000008 - 1.035E-05	3E-08 - 2.1E-07	WBGSB22
OCDD	3268-87-9	22 - 22	100	0.00005723 - 0.0083	– - –	WBGTP12S
OCDF	39001-02-0	21 - 22	95	0.00000054 - 5.862E-05	3.9E-07 - 3.9E-07	WBGSB25
Explosives						
Pentaerythritol Tetranitrate	78-11-5	1 - 20	5	0.11 - 0.11	0.3 - 1.3	WBGSB24
Herbicides						
2,4,5-TP	93-72-1	1 - 4	25	0.0078 - 0.0078	0.0101 - 0.0102	WBGSB25
2,4-D	94-75-7	2 - 4	50	0.0107 - 0.0302	0.0201 - 0.0202	WBGSB25

Table A.7.Data-3
Soil Risk Assessment Dataset
Combined Surface and Subsurface Soil
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)		Detects Max (mg/kg)	Detection Limits Min (mg/kg)		Detection Limits Max (mg/kg)	Maximum Location
Dalapon	75-99-0	3	-	4	75	0.0223	-	0.163	1.01	-	1.01	WBGSB24
MCPP	93-65-2	1	-	4	25	2.56	-	2.56	10.1	-	101	WBGSB23
Pesticides												
4,4'-DDD	72-54-8	1	-	4	25	0.0019	-	0.0019	0.0067	-	0.00681	WBGSB25
Dieldrin	60-57-1	1	-	4	25	0.00472	-	0.00472	0.0067	-	0.00676	WBGSB24
Polycyclic Aromatic Hydrocarbons												
2-Methylnaphthalene	91-57-6	10	-	81	12	0.001	-	0.023	0.002	-	0.49	WBGSB25
Acenaphthene	83-32-9	7	-	81	9	0.0019	-	0.32	0.0017	-	0.49	WBGSB9
Acenaphthylene	208-96-8	5	-	81	6	0.0016	-	0.0039	0.0017	-	0.49	WBGSB25
Anthracene	120-12-7	9	-	81	11	0.00037	-	0.1	0.0017	-	0.49	WBGSB25
Benzo(a)anthracene	56-55-3	12	-	81	15	0.0019	-	0.97	0.002	-	0.49	WBGSB25
Benzo(a)pyrene	50-32-8	14	-	81	17	0.0017	-	1.1	0.002	-	0.49	WBGSB25
Benzo(b)fluoranthene	205-99-2	15	-	81	19	0.0034	-	1.8	0.002	-	0.49	WBGSB25
Benzo(g,h,i)perylene	191-24-2	16	-	81	20	0.0017	-	0.96	0.002	-	0.49	WBGSB25
Benzo(k)fluoranthene	207-08-9	15	-	81	19	0.001	-	0.53	0.002	-	0.49	WBGSB25
Chrysene	218-01-9	15	-	81	19	0.0018	-	0.99	0.002	-	0.49	WBGSB25
Dibenzo(a,h)anthracene	53-70-3	7	-	79	9	0.0013	-	0.22	0.0017	-	0.49	WBGSB25
Fluoranthene	206-44-0	15	-	81	19	0.00096	-	1.6	0.002	-	0.49	WBGSB25
Fluorene	86-73-7	7	-	81	9	0.00094	-	0.028	0.0017	-	0.49	WBGSB24
Indeno(1,2,3-cd)pyrene	193-39-5	12	-	81	15	0.0018	-	1.1	0.002	-	0.49	WBGSB25
Naphthalene	91-20-3	10	-	81	12	0.00087	-	0.018	0.002	-	0.49	WBGSB25
Phenanthrene	85-01-8	14	-	81	17	0.0016	-	0.69	0.002	-	0.49	WBGSB25
Pyrene	129-00-0	14	-	81	17	0.0012	-	1.6	0.002	-	0.49	WBGSB25
Polychlorinated Biphenyls												
Aroclor 1254	11097-69-1	3	-	46	7	0.047	-	0.87	0.03	-	0.05	WBGSB22
Inorganics												
Aluminum	7429-90-5	124	-	124	100	5760	-	53700	–	-	–	WBGSB47
Antimony	7440-36-0	47	-	121	39	0.27	-	5.3	0.3	-	0.71	WBGSB3
Arsenic	7440-38-2	124	-	124	100	1.7	-	37.9	–	-	–	WBGSB4
Barium	7440-39-3	124	-	124	100	11.5	-	610	–	-	–	WBGSB3
Beryllium	7440-41-7	120	-	124	97	0.12	-	3.9	0.11	-	0.59	WBGTP18A
Cadmium	7440-43-9	38	-	121	31	0.066	-	2.95	0.01	-	0.16	WBGSB22
Calcium	7440-70-2	124	-	124	100	533	-	97300	–	-	–	WBGSB2
Chromium	7440-47-3	124	-	124	100	12.5	-	256	–	-	–	WBGSB22
Cobalt	7440-48-4	124	-	124	100	1.4	-	31.4	–	-	–	WBGSB16
Copper	7440-50-8	124	-	124	100	4.37	-	1340	–	-	–	WBGSB3
Iron	7439-89-6	124	-	124	100	13400	-	61800	–	-	–	WBGSB22
Lead	7439-92-1	124	-	124	100	7.9	-	3990	–	-	–	WBGSB3
Magnesium	7439-95-4	124	-	124	100	319	-	58900	–	-	–	WBGSB2

Table A.7.Data-3
Soil Risk Assessment Dataset
Combined Surface and Subsurface Soil
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)	Maximum Location
Manganese	7439-96-5	124	-	124	100	21.3	-	911	–	-	–	WBGTP16A
Mercury	7439-97-6	54	-	121	45	0.03	-	0.24	0.05	-	0.16	WBGTP16A
Nickel	7440-02-0	124	-	124	100	1.3	-	47.5	–	-	–	WBGSB47
Potassium	7440-09-7	124	-	124	100	335	-	10600	–	-	–	WBGSB2
Selenium	7782-49-2	27	-	121	22	0.5	-	1.4	0.45	-	1.32	WBGSB43
Silver	7440-22-4	35	-	121	29	0.12	-	2.3	0.11	-	1.4	WBGSB13
Sodium	7440-23-5	119	-	121	98	9.7	-	384	1	-	33.8	WBGSB3
Thallium	7440-28-0	17	-	121	14	0.12	-	1.2	0.23	-	1.1	WBGTP3S
Vanadium	7440-62-2	124	-	124	100	28	-	99.8	–	-	–	WBGSB47
Zinc	7440-66-6	124	-	124	100	11.8	-	3250	–	-	–	WBGSB3

Notes:
– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilogram.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table A.7.Data-4
Sediment Risk Assessment Dataset
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)		Detects Max (mg/kg)	Detection Limits Min (mg/kg)		Detection Limits Max (mg/kg)	Maximum Location
Volatile Organic Compounds												
2-Butanone	78-93-3	5	-	14	36	0.015	-	0.18	0.007	-	0.019	WBGSD12
Acetone	67-64-1	11	-	14	79	0.003	-	0.23	0.0077	-	0.01	WBGSW/SD07
Carbon Disulfide	75-15-0	5	-	12	42	0.0012	-	0.0015	0.007	-	0.013	WBGSW/SD14
Methylene Chloride	75-09-2	2	-	14	14	0.002	-	0.002	0.001	-	0.019	SD-01,SD-02
Toluene	108-88-3	8	-	14	57	0.00092	-	0.61	0.0077	-	0.019	WBGSD11
Semi-Volatile Organic Compounds										-		
1,2,4-Trichlorobenzene	120-82-1	2	-	15	13	0.012	-	0.023	0.002	-	1.1	WBGSW/SD14
1,4-Dichlorobenzene	106-46-7	2	-	15	13	0.012	-	0.049	0.002	-	1.1	WBGSW/SD14
4-Methylphenol	106-44-5	4	-	17	24	0.13	-	2.2	0.26	-	1.1	WBGSD2
bis(2-Ethylhexyl)phthalate	117-81-7	9	-	17	53	0.06	-	0.33	0.26	-	0.94	WBGSW/SD14
Carbazole	86-74-8	2	-	15	13	0.14	-	0.21	0.26	-	1.1	WBGSW/SD07
Dibenzofuran	132-64-9	2	-	15	13	0.039	-	0.1	0.3	-	1.4	WBGSW/SD07
Phenol	108-95-2	1	-	15	7	0.086	-	0.086	0.26	-	1.1	WBGSW/SD14
Dioxin/Furan Compounds										-		
1,2,3,4,6,7,8-HpCDD	35822-46-9	6	-	6	100	2.11E-06	-	7.199E-05	–	-	–	WBGSD11
1,2,3,4,6,7,8-HpCDF	67562-39-4	5	-	6	83	9.4E-07	-	0.0000063	0.00000017	-	0.00000017	WBGSD11
1,2,3,4,7,8,9-HpCDF	55673-89-7	2	-	6	33	2.6E-07	-	5.4E-07	0.00000023	-	0.00000033	WBGSW/SD10
1,2,3,4,7,8-HxCDD	39227-28-6	2	-	6	33	7.1E-07	-	1.03E-06	0.00000026	-	0.00000034	WBGSD11
1,2,3,4,7,8-HxCDF	70648-26-9	2	-	6	33	9.2E-07	-	1.68E-06	0.00000014	-	0.0000002	WBGSW/SD10
1,2,3,6,7,8-HxCDD	57653-85-7	3	-	6	50	9.9E-07	-	2.04E-06	0.00000024	-	0.00000027	WBGSD11
1,2,3,6,7,8-HxCDF	57117-44-9	1	-	6	17	1.73E-06	-	1.73E-06	0.00000014	-	0.00000019	WBGSW/SD10
1,2,3,7,8,9-HxCDD	19408-74-3	4	-	6	67	9.3E-07	-	2.39E-06	0.00000026	-	0.00000026	WBGSD11
2,3,4,6,7,8-HxCDF	60851-34-5	1	-	6	17	9.4E-07	-	9.4E-07	0.00000018	-	0.00000023	WBGSW/SD10
2,3,4,7,8-PeCDF	57117-31-4	1	-	6	17	1.41E-06	-	1.41E-06	0.00000013	-	0.00000022	WBGSW/SD10
2,3,7,8-TCDF	51207-31-9	1	-	6	17	2.83E-06	-	2.83E-06	0.00000014	-	0.00000035	WBGSW/SD10
OCDD	3268-87-9	6	-	6	100	0.0001412	-	0.003422	–	-	–	WBGSD11
OCDF	39001-02-0	5	-	6	83	2.44E-06	-	1.515E-05	0.0000003	-	0.0000003	WBGSD11
Explosives										-		
1,3,5-Trinitrobenzene	99-35-4	1	-	8	12	0.41	-	0.41	0.1	-	0.25	WBGSD12
Nitroglycerine	55-63-0	1	-	8	12	0.96	-	0.96	0.46	-	1.41	WBGSD12
Herbicides										-		
2,4,5-T	93-76-5	1	-	5	20	0.00757	-	0.00757	0.0153	-	0.214	WBGSW/SD14
2,4-D	94-75-7	2	-	5	40	0.385	-	6.83	0.0356	-	0.427	WBGSW/SD14
Dicamba	1918-00-9	1	-	5	20	0.0322	-	0.0322	0.0356	-	0.427	WBGSW/SD08
MCPP	93-65-2	1	-	5	20	3.56	-	3.56	17.8	-	214	WBGSW/SD08
Pesticides										-		
4,4'-DDD	72-54-8	4	-	5	80	0.00033	-	0.00152	0.00143	-	0.00143	WBGSW/SD13
4,4'-DDE	72-55-9	4	-	6	67	0.00152	-	0.00308	0.0016	-	0.0016	WBGSW/SD08
4,4'-DDT	50-29-3	3	-	5	60	0.00142	-	0.0119	0.00102	-	0.00253	WBGSW/SD10

Table A.7.Data-4
Sediment Risk Assessment Dataset
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects /		number of samples	FOD %	Detects Min (mg/kg)	-	Max (mg/kg)	Detection Limits Min (mg/kg)	-	Max (mg/kg)	Maximum Location
Delta-BHC	319-86-8	1	-	5	20	0.00095	-	0.00095	0.00119	-	0.00253	WBGSW/SD08
Alpha-Chlordane	5103-71-9	2	-	5	40	0.00021	-	0.00071	0.00119	-	0.00253	WBGSW/SD15
Gamma-Chlordane	5566-34-7	1	-	5	20	0.00088	-	0.00088	0.00102	-	0.00253	WBGSW/SD15
Dieldrin	60-57-1	1	-	5	20	0.00347	-	0.00347	0.00102	-	0.00253	WBGSW/SD10
Endosulfan II	33213-65-9	2	-	5	40	0.00094	-	0.00161	0.00102	-	0.00253	WBGSW/SD10
Endrin Aldehyde	7421-93-4	1	-	5	20	0.00169	-	0.00169	0.00102	-	0.00253	WBGSW/SD10
Endrin Ketone	53494-70-5	2	-	5	40	0.00224	-	0.00288	0.00102	-	0.00253	WBGSW/SD14
Methoxychlor	72-43-5	1	-	5	20	0.00637	-	0.00637	0.00102	-	0.00253	WBGSW/SD14
Polycyclic Aromatic Hydrocarbons										-		
1-Methylnaphthalene	90-12-0	1	-	2	50	0.0026	-	0.0026	0.0074	-	0.0074	WBG-SE006
2-Methylnaphthalene	91-57-6	4	-	18	22	0.0022	-	0.065	0.003	-	1.1	WBGSW/SD14
Acenaphthene	83-32-9	4	-	18	22	0.014	-	0.31	0.003	-	1.1	WBGSW/SD09
Acenaphthylene	208-96-8	1	-	18	6	0.021	-	0.021	0.003	-	1.1	WBGSW/SD09
Anthracene	120-12-7	5	-	18	28	0.0048	-	0.83	0.003	-	1.1	WBGSW/SD09
Benzo(a)anthracene	56-55-3	10	-	20	50	0.0055	-	4	0.003	-	1.1	WBGSW/SD09
Benzo(a)pyrene	50-32-8	7	-	20	35	0.0057	-	3.7	0.003	-	1.1	WBGSW/SD09
Benzo(b)fluoranthene	205-99-2	9	-	20	45	0.0081	-	4.6	0.003	-	1.1	WBGSW/SD09
Benzo(g,h,i)perylene	191-24-2	5	-	18	28	0.005	-	2.1	0.003	-	1.1	WBGSW/SD09
Benzo(k)fluoranthene	207-08-9	9	-	20	45	0.0033	-	1.4	0.003	-	1.1	WBGSW/SD09
Chrysene	218-01-9	10	-	20	50	0.0077	-	4.1	0.003	-	1.1	WBGSW/SD09
Dibenzo(a,h)anthracene	53-70-3	3	-	18	17	0.0061	-	0.56	0.003	-	1.1	WBGSW/SD09
Fluoranthene	206-44-0	11	-	20	55	0.0026	-	4.9	0.003	-	1.1	WBGSW/SD09
Fluorene	86-73-7	5	-	18	28	0.0027	-	0.25	0.003	-	1.1	WBGSW/SD09
Indeno(1,2,3-cd)pyrene	193-39-5	5	-	18	28	0.0038	-	1.6	0.003	-	1.1	WBGSW/SD09
Naphthalene	91-20-3	3	-	18	17	0.0017	-	0.085	0.003	-	1.1	WBGSW/SD09
Phenanthrene	85-01-8	10	-	20	50	0.0067	-	2.8	0.003	-	1.1	WBGSW/SD09
Pyrene	129-00-0	11	-	20	55	0.0017	-	5	0.003	-	1.1	WBGSW/SD09
Inorganics										-		
Aluminum	7429-90-5	28	-	28	100	5400	-	30900	–	-	–	WBGSD17
Antimony	7440-36-0	9	-	26	35	0.51	-	3.1	0.43	-	1.89	WBGSW/SD10
Arsenic	7440-38-2	28	-	28	100	1.44	-	30.4	–	-	–	WBGSW/SD13
Barium	7440-39-3	28	-	28	100	32.3	-	179	–	-	–	WBGSW/SD10
Beryllium	7440-41-7	27	-	28	96	0.45	-	2.27	0.33	-	0.33	WBGSW/SD10
Cadmium	7440-43-9	14	-	26	54	0.09	-	2.7	0.13	-	0.37	WBGSW/SD10
Calcium	7440-70-2	28	-	28	100	1820	-	120000	–	-	–	WBGSD20
Chromium	7440-47-3	28	-	28	100	5.17	-	15400	–	-	–	WBGSW/SD10
Cobalt	7440-48-4	28	-	28	100	3.2	-	84.1	–	-	–	WBGSW/SD10
Copper	7440-50-8	28	-	28	100	6.36	-	188	–	-	–	WBGSW/SD10
Iron	7439-89-6	28	-	28	100	8530	-	293000	–	-	–	WBGSW/SD13
Lead	7439-92-1	32	-	32	100	5.61	-	109000	–	-	–	WBGSW/SD10

Table A.7.Data-4
Sediment Risk Assessment Dataset
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)		Detects Max (mg/kg)	Detection Limits Min (mg/kg)		Detection Limits Max (mg/kg)	Maximum Location
Magnesium	7439-95-4	28	-	28	100	863	-	10200	–	-	–	WBGSW/SD15
Manganese	7439-96-5	28	-	28	100	25.9	-	2310	–	-	–	WBGSW/SD13
Mercury	7439-97-6	17	-	26	65	0.03	-	0.09	0.12	-	0.37	WBGSW/SD14
Nickel	7440-02-0	28	-	28	100	4.4	-	26.8	–	-	–	WBGSW/SD08
Potassium	7440-09-7	28	-	28	100	290	-	2210	–	-	–	WBGSD2
Selenium	7782-49-2	4	-	26	15	0.81	-	1.3	0.65	-	3.79	WBGSD6,WBGSD11
Silver	7440-22-4	4	-	26	15	0.79	-	8.42	0.14	-	3.79	WBGSW/SD10
Sodium	7440-23-5	28	-	28	100	72	-	577	–	-	–	WBGSD5
Thallium	7440-28-0	12	-	28	43	0.1	-	1.7	0.43	-	2.5	WBGSD1
Vanadium	7440-62-2	28	-	28	100	14	-	106	–	-	–	WBGSW/SD10
Zinc	7440-66-6	28	-	28	100	17.1	-	17300	–	-	–	WBGSW/SD10

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilogram.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table A.7.Data-5
Surface Water Risk Assessment Dataset
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b]				Detects			Detection Limits			Maximum Location
		number of detects / number of samples			FOD %	Min (mg/L)	-	Max (mg/L)	Min (mg/L)	-	Max (mg/L)	
Volatile Organic Compounds												
2-Butanone	78-93-3	1	-	10	10	0.004	-	0.004	0.004	-	0.005	WBGDW2
Acetone	67-64-1	1	-	10	10	0.0028	-	0.0028	0.004	-	0.005	WBGSW/SD07
Carbon Disulfide	75-15-0	7	-	10	70	0.00007	-	0.00025	0.005	-	0.005	WBGSW/SD10
Chloroform	67-66-3	5	-	10	50	0.00013	-	0.003	0.001	-	0.001	WBGDW2
cis-1,2-Dichloroethene	156-59-2	1	-	10	10	0.00012	-	0.00012	0.001	-	0.001	WBGSW/SD14
Tetrachloroethene	127-18-4	1	-	10	10	0.00016	-	0.00016	0.001	-	0.001	WBGSW/SD14
Toluene	108-88-3	1	-	10	10	0.00021	-	0.00021	0.001	-	0.001	WBGSW/SD10
Trichloroethene	79-01-6	1	-	10	10	0.00011	-	0.00011	0.001	-	0.001	WBGSW/SD14
Semi-Volatile Organic Compounds												
1,2-Dichlorobenzene	95-50-1	1	-	13	8	0.00021	-	0.00021	0.001	-	0.01	WBGSW/SD13
1,3-Dichlorobenzene	541-73-1	1	-	13	8	0.00021	-	0.00021	0.001	-	0.01	WBGSW/SD13
1,4-Dichlorobenzene	106-46-7	1	-	13	8	0.00028	-	0.00028	0.001	-	0.01	WBGSW/SD13
Benzoic Acid	65-85-0	3	-	10	30	0.0052	-	0.0067	0.025	-	0.05	WBGSW/SD14
bis(2-Ethylhexyl)phthalate	117-81-7	1	-	13	8	0.0026	-	0.0026	0.005	-	0.01	WBGSW/SD14
Butylbenzylphthalate	85-68-7	1	-	13	8	0.00063	-	0.00063	0.005	-	0.01	WBGSW/SD14
Diethylphthalate	84-66-2	1	-	13	8	0.001	-	0.001	0.005	-	0.01	WBGDW1
Di-n-Butylphthalate	84-74-2	4	-	13	31	0.00013	-	0.00091	0.005	-	0.01	WBGSW/SD09
Dioxin/Furan Compounds												
OCDD	3268-87-9	4	-	4	100	1.406E-08	-	3.5E-08	–	-	–	WBGSW/SD09
Explosives												
m-Nitrotoluene	99-08-1	2	-	7	29	0.00036	-	0.00038	0.0005	-	0.00052	WBGSW/SD09
Herbicides												
2,4-D	94-75-7	2	-	5	40	0.00356	-	0.00368	0.0005	-	0.0005	WBGSW/SD08
MCPP	93-65-2	1	-	5	20	0.0541	-	0.0541	0.125	-	0.125	WBGSW/SD08
Pesticides												
Dieldrin	60-57-1	3	-	5	60	3.58E-06	-	9.01E-06	0.00002	-	0.00002	WBGSW/SD14
Polycyclic Aromatic Hydrocarbons												
1-Methylnaphthalene	90-12-0	1	-	2	50	0.000026	-	0.000026	0.000047	-	0.000047	WBG-SW005
2-Methylnaphthalene	91-57-6	3	-	15	20	0.00003	-	0.000033	0.000047	-	0.01	WBG-SW005
Acenaphthene	83-32-9	2	-	15	13	0.00002	-	0.00004	0.000047	-	0.01	WBG-SW005
Anthracene	120-12-7	2	-	15	13	0.00002	-	0.00003	0.000047	-	0.01	WBG-SW005
Fluorene	86-73-7	2	-	15	13	0.00003	-	0.000034	0.000047	-	0.01	WBG-SW005
Naphthalene	91-20-3	2	-	15	13	0.00002	-	0.00004	0.000047	-	0.01	WBGSW/SD10
Phenanthrene	85-01-8	3	-	15	20	0.000018	-	0.00005	0.00005	-	0.01	WBG-SW005
Inorganics												
Aluminum	7429-90-5	13	-	13	100	0.0392	-	0.811	–	-	–	WBGSW/SD13
Arsenic	7440-38-2	2	-	13	15	0.0086	-	0.0104	0.003	-	0.007	WBGDW6

Table A.7.Data-5
Surface Water Risk Assessment Dataset
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/L)	-	Detects Max (mg/L)	Detection Limits Min (mg/L)	-	Detection Limits Max (mg/L)	Maximum Location
Barium	7440-39-3	13	-	13	100	0.054	-	0.148	–	-	–	WBGSW/SD13
Beryllium	7440-41-7	1	-	13	8	0.0011	-	0.0011	0.001	-	0.002	WBGDW4
Calcium	7440-70-2	15	-	15	100	56.7	-	90.7	–	-	–	WBGSW/SD13
Copper	7440-50-8	6	-	13	46	0.0011	-	0.0235	0.02	-	0.02	WBGDW3
Iron	7439-89-6	14	-	15	93	0.0416	-	50.9	–	-	–	WBGSW/SD13
Lead	7439-92-1	11	-	18	61	0.00017	-	0.106	0.002	-	0.002	WBG-SW004
Magnesium	7439-95-4	15	-	15	100	12.1	-	21	–	-	–	WBGSW/SD13
Manganese	7439-96-5	14	-	15	93	0.002	-	1.47	–	-	–	WBGSW/SD13
Nickel	7440-02-0	2	-	13	15	0.0014	-	0.0015	0.001	-	0.04	WBGDW2
Potassium	7440-09-7	15	-	15	100	1.9	-	4.08	–	-	–	WBGSW/SD13
Selenium	7782-49-2	1	-	13	8	0.00044	-	0.00044	0.004	-	0.005	WBGSW/SD14
Silver	7440-22-4	2	-	13	15	0.001	-	0.0012	0.001	-	0.01	WBGDW4
Sodium	7440-23-5	15	-	15	100	6.54	-	63.9	–	-	–	WBGSW/SD15
Thallium	7440-28-0	2	-	13	15	0.0023	-	0.0054	0.002	-	0.007	WBGDW1
Vanadium	7440-62-2	6	-	15	40	0.0011	-	0.079	0.002	-	0.05	SW-01
Zinc	7440-66-6	8	-	13	62	0.018	-	0.0237	0.02	-	0.02	WBGDW3

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/L = Milligrams per liter.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.

[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table A.7.Data-6
Fish Fillet Risk Assessment Dataset
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)
Inorganics										-	
Barium	7440-39-3	6	-	8	75	0.24	-	1	0.18	-	0.19
Calcium	7440-70-2	8	-	8	100	604	-	8720	–	-	–
Chromium	7440-47-3	1	-	8	12	0.24	-	0.24	0.18	-	0.19
Copper	7440-50-8	2	-	8	25	0.52	-	0.56	0.37	-	0.39
Iron	7439-89-6	1	-	8	12	11.9	-	11.9	5.5	-	5.8
Magnesium	7439-95-4	8	-	8	100	206	-	300	–	-	–
Manganese	7439-96-5	4	-	8	50	0.23	-	0.76	0.18	-	0.19
Mercury	7439-97-6	7	-	8	88	0.03	-	0.087	0.019	-	0.019
Potassium	7440-09-7	8	-	8	100	2600	-	3170	–	-	–
Sodium	7440-23-5	8	-	8	100	418	-	1070	–	-	–
Zinc	7440-66-6	8	-	8	100	6.9	-	13.5	–	-	–

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilograms.
ND = Non-detects.

[a] All constituents analyzed for are shown.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table A.7.Data-7
Fish Whole Body Risk Assessment Dataset
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/kg)	-	Detects Max (mg/kg)	Detection Limits Min (mg/kg)	-	Detection Limits Max (mg/kg)
Inorganics										-	
Aluminum	7429-90-5	6	-	8	75	11.3	-	50.7	7.5	-	7.6
Barium	7440-39-3	8	-	8	100	0.75	-	2.4	–	-	–
Calcium	7440-70-2	8	-	8	100	5490	-	14300	–	-	–
Chromium	7440-47-3	8	-	8	100	0.26	-	0.65	–	-	–
Copper	7440-50-8	6	-	8	75	0.44	-	0.8	0.36	-	0.37
Iron	7439-89-6	8	-	8	100	24	-	74.2	–	-	–
Magnesium	7439-95-4	8	-	8	100	262	-	402	–	-	–
Manganese	7439-96-5	8	-	8	100	0.8	-	3.5	–	-	–
Mercury	7439-97-6	8	-	8	100	0.024	-	0.078	–	-	–
Potassium	7440-09-7	8	-	8	100	2590	-	2870	–	-	–
Sodium	7440-23-5	8	-	8	100	717	-	1190	–	-	–
Zinc	7440-66-6	8	-	8	100	10.7	-	25.1	–	-	–

Notes:
– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilograms.
ND = Non-detects.

[a] All constituents analyzed for are shown.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

Table A.7.HHRA-1
Selection of Constituents of Potential Concern for Surface Soil (0-2 foot Depth Interval)
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b]					Background Level [c]	Does Maximum Exceed RSL?		Is Constituent a Surface Soil COPC? [d]
			Industrial Scenario		Residential Scenario		Surrogate		Industrial	Residential	
		(mg/kg)	(mg/kg)		(mg/kg)			(mg/kg)	(YES, no)	(YES, no)	(YES, no)
Volatile Organic Compounds											
Acetone	67-64-1	7.00E-02	6.10E+04	nms	6.10E+03	n		–	no	no	no
Carbon Disulfide	75-15-0	8.00E-04	3.00E+02	ns	6.70E+01	ns		–	no	no	no
d-Limonene	5989-27-5	1.70E-01	NA		NA			–	NA	NA	**YES**
Methylene Chloride	75-09-2	3.00E-03	5.40E+01	c	1.10E+01	c		–	no	no	no
p-Isopropyltoluene	99-87-6	4.80E-03	1.10E+03	ns	2.20E+02	ns	Isopropylbenzene	–	no	no	no
Toluene	108-88-3	1.10E-03	4.60E+03	ns	5.00E+02	ns		–	no	no	no
Semi-Volatile Organic Compounds											
bis(2-Ethylhexyl)phthalate	117-81-7	6.70E-01	1.20E+02	c*	3.50E+01	c*		–	no	no	no
Carbazole	86-74-8	1.00E-01	NA		NA			–	NA	NA	**YES**
Dibenzofuran	132-64-9	1.40E-02	1.00E+02	n	7.80E+00	n	Furan	–	no	no	no
Di-n-Butylphthalate	84-74-2	2.10E-01	6.20E+03	n	6.10E+02	n		–	no	no	no
Di-n-Octylphthalate	117-84-0	1.60E-02	6.20E+03	n	6.10E+02	n	di-n-Butylphthalate	–	no	no	no
N-Nitrosodiphenylamine	86-30-6	6.00E-02	3.50E+02	c	9.90E+01	c		–	no	no	no
Dioxin/Furan Compounds											
1,2,3,4,6,7,8-HpCDD	35822-46-9	1.57E-04	1.80E-03	c	4.50E-04	c	Total HpCDD	–	no	no	no
1,2,3,4,6,7,8-HpCDF	67562-39-4	3.10E-05	1.30E-03	c	3.70E-04	c	Total HpCDF	–	no	no	no
1,2,3,4,7,8,9-HpCDF	55673-89-7	2.05E-06	1.30E-03	c	3.70E-04	c	Total HpCDF	–	no	no	no
1,2,3,4,7,8-HxCDD	39227-28-6	3.33E-06	1.80E-04	c	4.50E-05	c	Total HxCDD	–	no	no	no
1,2,3,4,7,8-HxCDF	70648-26-9	5.64E-06	1.30E-04	c	3.70E-05	c	Total HxCDF	–	no	no	no
1,2,3,6,7,8-HxCDD	57653-85-7	6.61E-06	1.80E-04	c	4.50E-05	c	Total HxCDD	–	no	no	no
1,2,3,6,7,8-HxCDF	57117-44-9	5.08E-06	1.30E-04	c	3.70E-05	c	Total HxCDF	–	no	no	no
1,2,3,7,8,9-HxCDD	19408-74-3	8.34E-06	1.80E-04	c	4.50E-05	c	Total HxCDD	–	no	no	no
1,2,3,7,8,9-HxCDF	72918-21-9	4.50E-07	1.30E-04	c	3.70E-05	c	Total HxCDF	–	no	no	no
1,2,3,7,8-PeCDD	40321-76-4	1.73E-06	1.80E-05	c	4.50E-06	c	Total PeCDD	–	no	no	no
1,2,3,7,8-PeCDF	57117-41-6	1.24E-06	4.40E-04	c	1.20E-04	c		–	no	no	no
2,3,4,6,7,8-HxCDF	60851-34-5	2.38E-06	1.30E-04	c	3.70E-05	c	Total HxCDF	–	no	no	no
2,3,4,7,8-PeCDF	57117-31-4	1.72E-06	4.40E-05	c	1.20E-05	c		–	no	no	no
2,3,7,8-TCDD	1746-01-6	1.51E-06	1.80E-05	c*	4.50E-06	c*		–	no	no	no
2,3,7,8-TCDF	51207-31-9	1.84E-06	1.30E-04	c	3.70E-05	c		–	no	no	no
OCDD	3268-87-9	8.30E-03	6.10E-02	c	1.50E-02	c		–	no	no	no
OCDF	39001-02-0	5.86E-05	4.40E-02	c	1.20E-02	c		–	no	no	no
Explosives											
Pentaerythritol Tetranitrate	78-11-5	1.10E-01	NA		NA			–	NA	NA	**YES**
Herbicides											
2,4,5-TP	93-72-1	7.80E-03	4.90E+02	n	4.90E+01	n		–	no	no	no
2,4-D	94-75-7	3.02E-02	7.70E+02	n	6.90E+01	n		–	no	no	no
Dalapon	75-99-0	1.63E-01	1.80E+03	n	1.80E+02	n		–	no	no	no
MCPP	93-65-2	2.56E+00	6.20E+01	n	6.10E+00	n		–	no	no	no
Pesticides											
4,4'-DDD	72-54-8	1.90E-03	7.20E+00	c	2.00E+00	c		–	no	no	no
Dieldrin	60-57-1	4.72E-03	1.10E-01	c	3.00E-02	c		–	no	no	no

Table A.7.HHRA-1
Selection of Constituents of Potential Concern for Surface Soil (0-2 foot Depth Interval)
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a] (mg/kg)	Adjusted Soil Regional Screening Level (RSL) [b] Industrial Scenario (mg/kg)		Residential Scenario (mg/kg)		Surrogate	Background Level [c] (mg/kg)	Does Maximum Exceed RSL? Industrial (YES, no)	Residential (YES, no)	Is Constituent a Surface Soil COPC? [d] (YES, no)
Polycyclic Aromatic Hydrocarbons											
2-Methylnaphthalene	91-57-6	2.30E-02	4.10E+02	ns	3.10E+01	n		–	no	no	no
Acenaphthene	83-32-9	3.20E-01	3.30E+03	n	3.40E+02	n		–	no	no	no
Acenaphthylene	208-96-8	3.90E-03	3.30E+03	n	3.40E+02	n	Acenaphthene	–	no	no	no
Anthracene	120-12-7	1.00E-01	1.70E+04	nm	1.70E+03	n		–	no	no	no
Benzo(a)anthracene	56-55-3	9.70E-01	2.10E+00	c	1.50E-01	c		–	no	**YES**	**YES**
Benzo(a)pyrene	50-32-8	1.10E+00	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Benzo(b)fluoranthene	205-99-2	1.80E+00	2.10E+00	c	1.50E-01	c		–	no	**YES**	**YES**
Benzo(g,h,i)perylene	191-24-2	9.60E-01	1.70E+03	n	1.70E+02	n	Pyrene	–	no	no	no
Benzo(k)fluoranthene	207-08-9	5.30E-01	2.10E+01	c	1.50E+00	c		–	no	no	no
Chrysene	218-01-9	9.90E-01	2.10E+02	c	1.50E+01	c		–	no	no	no
Dibenzo(a,h)anthracene	53-70-3	2.20E-01	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Fluoranthene	206-44-0	1.60E+00	2.20E+03	n	2.30E+02	n		–	no	no	no
Fluorene	86-73-7	2.80E-02	2.20E+03	n	2.30E+02	n		–	no	no	no
Indeno(1,2,3-cd)pyrene	193-39-5	1.10E+00	2.10E+00	c	1.50E-01	c		–	no	**YES**	**YES**
Naphthalene	91-20-3	1.80E-02	2.00E+01	c*	3.90E+00	c*		–	no	no	no
Phenanthrene	85-01-8	6.90E-01	1.70E+04	nm	1.70E+03	n	Anthracene	–	no	no	no
Pyrene	129-00-0	1.60E+00	1.70E+03	n	1.70E+02	n		–	no	no	no
Polychlorinated Biphenyls											
Aroclor 1254	11097-69-1	8.40E-02	7.40E-01	c*	1.10E-01	n		–	no	no	no
Inorganics											
Aluminum	7429-90-5	4.00E+04	9.90E+04	nm	7.70E+03	n		4.00E+04	no	**YES**	no
Antimony	7440-36-0	5.30E+00	4.10E+01	n	3.10E+00	n		–	no	**YES**	**YES**
Arsenic	7440-38-2	3.79E+01	1.60E+00	c	3.90E-01	c*		1.58E+01	**YES**	**YES**	**YES**
Barium	7440-39-3	6.10E+02	1.90E+04	nm	1.50E+03	n		2.09E+02	no	no	no
Beryllium	7440-41-7	3.90E+00	2.00E+02	n	1.60E+01	n		1.02E+00	no	no	no
Cadmium	7440-43-9	2.70E+00	8.10E+01	n	7.00E+00	n		6.90E-01	no	no	no
Calcium	7440-70-2	9.73E+04	NA		NA			–	NA	NA	no
Chromium	7440-47-3	2.49E+02	1.40E+03	c	2.80E+02	c		6.53E+01	no	no	no
Cobalt	7440-48-4	3.14E+01	3.00E+01	n	2.30E+00	n		7.23E+01	**YES**	**YES**	no
Copper	7440-50-8	1.34E+03	4.10E+03	n	3.10E+02	n		5.35E+01	no	**YES**	**YES**
Iron	7439-89-6	5.40E+04	7.20E+04	nm	5.50E+03	n		5.10E+04	no	**YES**	**YES**
Lead	7439-92-1	3.99E+03	8.00E+02	«	4.00E+02	«		2.68E+01	**YES**	**YES**	**YES**
Magnesium	7439-95-4	2.32E+04	NA		NA			–	NA	NA	no
Manganese	7439-96-5	9.11E+02	2.30E+03	n	1.80E+02	n		2.54E+03	no	**YES**	no
Mercury	7439-97-6	2.40E-01	2.80E+00	ns	6.70E-01	ns		1.30E-01	no	no	no
Nickel	7440-02-0	3.73E+01	2.00E+03	n	1.60E+02	n		6.28E+01	no	no	no
Potassium	7440-09-7	3.34E+03	NA		NA			–	NA	NA	no
Selenium	7782-49-2	1.20E+00	5.10E+02	n	3.90E+01	n		–	no	no	no
Silver	7440-22-4	2.20E+00	5.10E+02	n	3.90E+01	n		–	no	no	no
Sodium	7440-23-5	3.84E+02	NA		NA			–	NA	NA	no

Table A.7.HHRA-1
Selection of Constituents of Potential Concern for Surface Soil (0-2 foot Depth Interval)
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a] (mg/kg)	Adjusted Soil Regional Screening Level (RSL) [b] Industrial Scenario (mg/kg)		Residential Scenario (mg/kg)		Surrogate	Background Level [c] (mg/kg)	Does Maximum Exceed RSL? Industrial (YES, no)	Residential (YES, no)	Is Constituent a Surface Soil COPC? [d] (YES, no)
Thallium	7440-28-0	1.20E+00	6.60E+00	n	5.10E-01	n		2.11E+00	no	**YES**	no
Vanadium	7440-62-2	9.94E+01	7.20E+02	n	5.50E+01	n		1.08E+02	no	**YES**	no
Zinc	7440-66-6	3.25E+03	3.10E+04	nm	2.30E+03	n		2.02E+02	no	**YES**	**YES**

Notes:

– =	Not detected/ not analyzed/ not applicable.	NA =	Not available or not applicable.
CASN =	Chemical abstracts registry number.	RSL =	Regional Screening Level.
COPC =	Constituent of Potential Concern.	USEPA =	United States Environmental Protection Agency.
mg/kg =	Milligrams per kilogram.		

[a] Maximum concentration in surface soil (0-2 foot depth interval).

[b] The screening levels used were from USEPA (2008a). Screening levels based on non-cancer effects were adjusted downward by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = concentration may exceed ceiling limit; s = Concentration may exceed saturation concentration (Csat).
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.

[c] Background levels for metals are facility-wide soil background point estimates taken from Facility-Wide Background Study Report (IT Corporation, 2001).

[d] Constituents detected with maximum concentrations greater than adjusted residential screening levels were considered COPCs unless they were metals detected at concentrations lower than background, or are essential nutrients (i.e., calcium, magnesium, potassium, sodium), or were known laboratory contaminants (i.e. acetone).

Table A.7.HHRA-2
Selection of Constituents of Potential Concern for Combined Surface and Subsurface Soil
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b] Industrial Scenario		Residential Scenario		Surrogate	Background Level [c]	Does Maximum Exceed RSL? Industrial	Residential	Is Constituent a Surface/ Subsurface Soil COPC? [d]
		(mg/kg)	(mg/kg)		(mg/kg)			(mg/kg)	(YES, no)	(YES, no)	(YES, no)
Volatile Organic Compounds											
Acetone	67-64-1	7.00E-02	6.10E+04	nms	6.10E+03	n		–	no	no	no
Carbon Disulfide	75-15-0	8.00E-04	3.00E+02	ns	6.70E+01	ns		–	no	no	no
d-Limonene	5989-27-5	1.70E-01	NA		NA			–	NA	NA	**YES**
Methylene Chloride	75-09-2	3.00E-03	5.40E+01	c	1.10E+01	c		–	no	no	no
p-Isopropyltoluene	99-87-6	4.80E-03	1.10E+03	ns	2.20E+02	ns	Isopropylbenzene	–	no	no	no
Toluene	108-88-3	1.10E-03	4.60E+03	ns	5.00E+02	ns		–	no	no	no
Semi-Volatile Organic Compounds											
bis(2-Ethylhexyl)phthalate	117-81-7	8.30E-01	1.20E+02	c*	3.50E+01	c*		–	no	no	no
Butylbenzylphthalate	85-68-7	1.60E-01	9.10E+02	c	2.60E+02	c*		–	no	no	no
Carbazole	86-74-8	1.00E-01	NA		NA			–	NA	NA	**YES**
Dibenzofuran	132-64-9	1.40E-02	1.00E+02	n	7.80E+00	n	Furan	–	no	no	no
Di-n-Butylphthalate	84-74-2	4.20E-01	6.20E+03	n	6.10E+02	n		–	no	no	no
Di-n-Octylphthalate	117-84-0	1.60E-02	6.20E+03	n	6.10E+02	n	di-n-Butylphthalate	–	no	no	no
N-Nitrosodiphenylamine	86-30-6	6.00E-02	3.50E+02	c	9.90E+01	c		–	no	no	no
Dioxin/Furan Compounds											
1,2,3,4,6,7,8-HpCDD	35822-46-9	2.43E-04	1.80E-03	c	4.50E-04	c	Total HpCDD	–	no	no	no
1,2,3,4,6,7,8-HpCDF	67562-39-4	3.59E-05	1.30E-03	c	3.70E-04	c	Total HpCDF	–	no	no	no
1,2,3,4,7,8,9-HpCDF	55673-89-7	4.05E-06	1.30E-03	c	3.70E-04	c	Total HpCDF	–	no	no	no
1,2,3,4,7,8-HxCDD	39227-28-6	7.23E-06	1.80E-04	c	4.50E-05	c	Total HxCDD	–	no	no	no
1,2,3,4,7,8-HxCDF	70648-26-9	1.83E-05	1.30E-04	c	3.70E-05	c	Total HxCDF	–	no	no	no
1,2,3,6,7,8-HxCDD	57653-85-7	2.30E-05	1.80E-04	c	4.50E-05	c	Total HxCDD	–	no	no	no
1,2,3,6,7,8-HxCDF	57117-44-9	8.49E-06	1.30E-04	c	3.70E-05	c	Total HxCDF	–	no	no	no
1,2,3,7,8,9-HxCDD	19408-74-3	2.10E-05	1.80E-04	c	4.50E-05	c	Total HxCDD	–	no	no	no
1,2,3,7,8,9-HxCDF	72918-21-9	1.82E-06	1.30E-04	c	3.70E-05	c	Total HxCDF	–	no	no	no
1,2,3,7,8-PeCDD	40321-76-4	6.85E-06	1.80E-05	c	4.50E-06	c	Total PeCDD	–	no	**YES**	**YES**
1,2,3,7,8-PeCDF	57117-41-6	4.16E-06	4.40E-04	c	1.20E-04	c		–	no	no	no
2,3,4,6,7,8-HxCDF	60851-34-5	5.28E-06	1.30E-04	c	3.70E-05	c	Total HxCDF	–	no	no	no
2,3,4,7,8-PeCDF	57117-31-4	6.41E-06	4.40E-05	c	1.20E-05	c		–	no	no	no
2,3,7,8-TCDD	1746-01-6	4.17E-06	1.80E-05	c*	4.50E-06	c*		–	no	no	no
2,3,7,8-TCDF	51207-31-9	1.04E-05	1.30E-04	c	3.70E-05	c		–	no	no	no
OCDD	3268-87-9	8.30E-03	6.10E-02	c	1.50E-02	c		–	no	no	no
OCDF	39001-02-0	5.86E-05	4.40E-02	c	1.20E-02	c		–	no	no	no
Explosives											
Pentaerythritol Tetranitrate	78-11-5	1.10E-01	NA		NA			–	NA	NA	**YES**
Herbicides											
2,4,5-TP	93-72-1	7.80E-03	4.90E+02	n	4.90E+01	n		–	no	no	no
2,4-D	94-75-7	3.02E-02	7.70E+02	n	6.90E+01	n		–	no	no	no
Dalapon	75-99-0	1.63E-01	1.80E+03	n	1.80E+02	n		–	no	no	no
MCPP	93-65-2	2.56E+00	6.20E+01	n	6.10E+00	n		–	no	no	no
Pesticides											
4,4'-DDD	72-54-8	1.90E-03	7.20E+00	c	2.00E+00	c		–	no	no	no
Dieldrin	60-57-1	4.72E-03	1.10E-01	c	3.00E-02	c		–	no	no	no
Polycyclic Aromatic Hydrocarbons											
2-Methylnaphthalene	91-57-6	2.30E-02	4.10E+02	ns	3.10E+01	n		–	no	no	no
Acenaphthene	83-32-9	3.20E-01	3.30E+03	n	3.40E+02	n		–	no	no	no
Acenaphthylene	208-96-8	3.90E-03	3.30E+03	n	3.40E+02	n	Acenaphthene	–	no	no	no
Anthracene	120-12-7	1.00E-01	1.70E+04	nm	1.70E+03	n		–	no	no	no
Benzo(a)anthracene	56-55-3	9.70E-01	2.10E+00	c	1.50E-01	c		–	no	**YES**	**YES**
Benzo(a)pyrene	50-32-8	1.10E+00	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Benzo(b)fluoranthene	205-99-2	1.80E+00	2.10E+00	c	1.50E-01	c		–	no	**YES**	**YES**
Benzo(g,h,i)perylene	191-24-2	9.60E-01	1.70E+03	n	1.70E+02	n	Pyrene	–	no	no	no
Benzo(k)fluoranthene	207-08-9	5.30E-01	2.10E+01	c	1.50E+00	c		–	no	no	no
Chrysene	218-01-9	9.90E-01	2.10E+02	c	1.50E+01	c		–	no	no	no

Table A.7.HHRA-2
Selection of Constituents of Potential Concern for Combined Surface and Subsurface Soil
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Soil Regional Screening Level (RSL) [b]					Background Level [c]	Does Maximum Exceed RSL?		Is Constituent a Surface/ Subsurface Soil COPC? [d]
			Industrial Scenario		Residential Scenario		Surrogate		Industrial	Residential	
		(mg/kg)	(mg/kg)		(mg/kg)			(mg/kg)	(YES, no)	(YES, no)	(YES, no)
Dibenzo(a,h)anthracene	53-70-3	2.20E-01	2.10E-01	c	1.50E-02	c		–	**YES**	**YES**	**YES**
Fluoranthene	206-44-0	1.60E+00	2.20E+03	n	2.30E+02	n		–	no	no	no
Fluorene	86-73-7	2.80E-02	2.20E+03	n	2.30E+02	n		–	no	no	no
Indeno(1,2,3-cd)pyrene	193-39-5	1.10E+00	2.10E+00	c	1.50E-01	c		–	no	**YES**	**YES**
Naphthalene	91-20-3	1.80E-02	2.00E+01	c*	3.90E+00	c*		–	no	no	no
Phenanthrene	85-01-8	6.90E-01	1.70E+04	nm	1.70E+03	n	Anthracene	–	no	no	no
Pyrene	129-00-0	1.60E+00	1.70E+03	n	1.70E+02	n		–	no	no	no
Polychlorinated Biphenyls											
Aroclor 1254	11097-69-1	8.70E-01	7.40E-01	c*	1.10E-01	n		–	**YES**	**YES**	**YES**
Inorganics											
Aluminum	7429-90-5	5.37E+04	9.90E+04	nm	7.70E+03	n		4.00E+04	no	**YES**	**YES**
Antimony	7440-36-0	5.30E+00	4.10E+01	n	3.10E+00	n		–	no	**YES**	**YES**
Arsenic	7440-38-2	3.79E+01	1.60E+00	c	3.90E-01	c*		1.58E+01	**YES**	**YES**	**YES**
Barium	7440-39-3	6.10E+02	1.90E+04	nm	1.50E+03	n		2.09E+02	no	no	no
Beryllium	7440-41-7	3.90E+00	2.00E+02	n	1.60E+01	n		1.02E+00	no	no	no
Cadmium	7440-43-9	2.95E+00	8.10E+01	n	7.00E+00	n		6.90E-01	no	no	no
Calcium	7440-70-2	9.73E+04	NA		NA			–	NA	NA	no
Chromium	7440-47-3	2.56E+02	1.40E+03	c	2.80E+02	c		6.53E+01	no	no	no
Cobalt	7440-48-4	3.14E+01	3.00E+01	n	2.30E+00	n		7.23E+01	**YES**	**YES**	no
Copper	7440-50-8	1.34E+03	4.10E+03	n	3.10E+02	n		5.35E+01	no	**YES**	**YES**
Iron	7439-89-6	6.18E+04	7.20E+04	nm	5.50E+03	n		5.10E+04	no	**YES**	**YES**
Lead	7439-92-1	3.99E+03	8.00E+02	«	4.00E+02	«		2.68E+01	**YES**	**YES**	**YES**
Magnesium	7439-95-4	5.89E+04	NA		NA			–	NA	NA	no
Manganese	7439-96-5	9.11E+02	2.30E+03	n	1.80E+02	n		2.54E+03	no	**YES**	no
Mercury	7439-97-6	2.40E-01	2.80E+00	ns	6.70E-01	ns		1.30E-01	no	no	no
Nickel	7440-02-0	4.75E+01	2.00E+03	n	1.60E+02	n		6.28E+01	no	no	no
Potassium	7440-09-7	1.06E+04	NA		NA			–	NA	NA	no
Selenium	7782-49-2	1.40E+00	5.10E+02	n	3.90E+01	n		–	no	no	no
Silver	7440-22-4	2.30E+00	5.10E+02	n	3.90E+01	n		–	no	no	no
Sodium	7440-23-5	3.84E+02	NA		NA			–	NA	NA	no
Thallium	7440-28-0	1.20E+00	6.60E+00	n	5.10E-01	n		2.11E+00	no	**YES**	no
Vanadium	7440-62-2	9.98E+01	7.20E+02	n	5.50E+01	n		1.08E+02	no	**YES**	no
Zinc	7440-66-6	3.25E+03	3.10E+04	nm	2.30E+03	n		2.02E+02	no	**YES**	**YES**

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
mg/kg = Milligrams per kilogram.

NA =
RSL =
USEPA =

[a] Maximum concentration in combined surface and subsurface soil.

[b] The screening levels used were from USEPA (2008a). Screening levels based on non-cancer effects were adjusted downward by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = Concentration may exceed ceiling limit; s = Concentration may exceed saturation concentration (Csat).
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.

[c] Background levels for metals are facility-wide soil background point estimates taken from Facility-Wide Background Study Report (IT Corporation, 2001).

[d] Constituents detected with maximum concentrations greater than adjusted residential screening levels were considered COPCs unless they were metals detected at concentrations lower than background, or are essential nutrients (i.e., calcium, magnesium, potassium, sodium), or were known laboratory contaminants (i.e. acetone).

Table A.7.HHRA-3
Selection of Constituents of Potential Concern for Sediment
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a] (mg/kg)	Adjusted Soil Regional Screening Level (RSL) [b] Residential Scenario (mg/kg)		Adjusted Soil Regional Screening Level (RSL) [b] Surrogate	Is Constituent a Sediment COPC? [c] (YES, no)
Volatile Organic Compounds						
2-Butanone	78-93-3	1.80E-01	2.80E+03	ns		no
Acetone	67-64-1	2.30E-01	6.10E+03	n		no
Carbon Disulfide	75-15-0	1.50E-03	6.70E+01	ns		no
Methylene Chloride	75-09-2	2.00E-03	1.10E+01	c		no
Toluene	108-88-3	6.10E-01	5.00E+02	ns		no
Semi-Volatile Organic Compounds						
1,2,4-Trichlorobenzene	120-82-1	2.30E-02	8.70E+00	n		no
1,4-Dichlorobenzene	106-46-7	4.90E-02	2.60E+00	c		no
4-Methylphenol	106-44-5	2.20E+00	3.10E+01	n		no
bis(2-Ethylhexyl)phthalate	117-81-7	3.30E-01	3.50E+01	c*		no
Carbazole	86-74-8	2.10E-01	NA			**YES**
Dibenzofuran	132-64-9	1.00E-01	7.80E+00	n	Furan	no
Phenol	108-95-2	8.60E-02	1.80E+03	n		no
Dioxin/Furan Compounds						
1,2,3,4,6,7,8-HpCDD	35822-46-9	7.20E-05	4.50E-04	c	Total HpCDD	no
1,2,3,4,6,7,8-HpCDF	67562-39-4	6.30E-06	3.70E-04	c	Total HpCDF	no
1,2,3,4,7,8,9-HpCDF	55673-89-7	5.40E-07	3.70E-04	c	Total HpCDF	no
1,2,3,4,7,8-HxCDD	39227-28-6	1.03E-06	4.50E-05	c	Total HxCDD	no
1,2,3,4,7,8-HxCDF	70648-26-9	1.68E-06	3.70E-05	c	Total HxCDF	no
1,2,3,6,7,8-HxCDD	57653-85-7	2.04E-06	4.50E-05	c	Total HxCDD	no
1,2,3,6,7,8-HxCDF	57117-44-9	1.73E-06	3.70E-05	c	Total HxCDF	no
1,2,3,7,8,9-HxCDD	19408-74-3	2.39E-06	4.50E-05	c	Total HxCDD	no
2,3,4,6,7,8-HxCDF	60851-34-5	9.40E-07	3.70E-05	c	Total HxCDF	no
2,3,4,7,8-PeCDF	57117-31-4	1.41E-06	1.20E-05	c		no
2,3,7,8-TCDF	51207-31-9	2.83E-06	3.70E-05	c		no
OCDD	3268-87-9	3.42E-03	1.50E-02	c		no
OCDF	39001-02-0	1.52E-05	1.20E-02	c		no
Explosives						
1,3,5-Trinitrobenzene	99-35-4	4.10E-01	2.20E+02	n		no
Nitroglycerine	55-63-0	9.60E-01	6.10E-01	n		**YES**
Herbicides						
2,4,5-T	93-76-5	7.57E-03	6.10E+01	n		no
2,4-D	94-75-7	6.83E+00	6.90E+01	n		no
Dicamba	1918-00-9	3.22E-02	1.80E+02	n		no
MCPP	93-65-2	3.56E+00	6.10E+00	n		no
Pesticides						
4,4'-DDD	72-54-8	1.52E-03	2.00E+00	c		no
4,4'-DDE	72-55-9	3.08E-03	1.40E+00	c		no
4,4'-DDT	50-29-3	1.19E-02	1.70E+00	c*		no
Delta-BHC	319-86-8	9.50E-04	5.20E-01	c*	gamma-BHC	no
Alpha-Chlordane	5103-71-9	7.10E-04	1.60E+00	c*	Chlordane	no
Gamma-Chlordane	5566-34-7	8.80E-04	1.60E+00	c*	Chlordane	no
Dieldrin	60-57-1	3.47E-03	3.00E-02	c		no
Endosulfan II	33213-65-9	1.61E-03	3.70E+01	n	Endosulfan	no
Endrin Aldehyde	7421-93-4	1.69E-03	1.80E+00	n	Endrin	no
Endrin Ketone	53494-70-5	2.88E-03	1.80E+00	n	Endrin	no
Methoxychlor	72-43-5	6.37E-03	3.10E+01	n		no
Polycyclic Aromatic Hydrocarbons						
1-Methylnaphthalene	90-12-0	2.60E-03	2.20E+01	c		no
2-Methylnaphthalene	91-57-6	6.50E-02	3.10E+01	n		no
Acenaphthene	83-32-9	3.10E-01	3.40E+02	n		no
Acenaphthylene	208-96-8	2.10E-02	3.40E+02	n	Acenaphthene	no
Anthracene	120-12-7	8.30E-01	1.70E+03	n		no
Benzo(a)anthracene	56-55-3	4.00E+00	1.50E-01	c		**YES**
Benzo(a)pyrene	50-32-8	3.70E+00	1.50E-02	c		**YES**
Benzo(b)fluoranthene	205-99-2	4.60E+00	1.50E-01	c		**YES**

Table A.7.HHRA-3
Selection of Constituents of Potential Concern for Sediment
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a] (mg/kg)	Adjusted Soil Regional Screening Level (RSL) [b] Residential Scenario (mg/kg)		Surrogate	Is Constituent a Sediment COPC? [c] (YES, no)
Benzo(g,h,i)perylene	191-24-2	2.10E+00	1.70E+02	n	Pyrene	no
Benzo(k)fluoranthene	207-08-9	1.40E+00	1.50E+00	c		no
Chrysene	218-01-9	4.10E+00	1.50E+01	c		no
Dibenzo(a,h)anthracene	53-70-3	5.60E-01	1.50E-02	c		**YES**
Fluoranthene	206-44-0	4.90E+00	2.30E+02	n		no
Fluorene	86-73-7	2.50E-01	2.30E+02	n		no
Indeno(1,2,3-cd)pyrene	193-39-5	1.60E+00	1.50E-01	c		**YES**
Naphthalene	91-20-3	8.50E-02	3.90E+00	c*		no
Phenanthrene	85-01-8	2.80E+00	1.70E+03	n	Anthracene	no
Pyrene	129-00-0	5.00E+00	1.70E+02	n		no
Inorganics						
Aluminum	7429-90-5	3.09E+04	7.70E+03	n		**YES**
Antimony	7440-36-0	3.10E+00	3.10E+00	n		no
Arsenic	7440-38-2	3.04E+01	3.90E-01	c*		**YES**
Barium	7440-39-3	1.79E+02	1.50E+03	n		no
Beryllium	7440-41-7	2.27E+00	1.60E+01	n		no
Cadmium	7440-43-9	2.70E+00	7.00E+00	n		no
Calcium	7440-70-2	1.20E+05	NA			no
Chromium	7440-47-3	1.54E+04	2.80E+02	c		**YES**
Cobalt	7440-48-4	8.41E+01	2.30E+00	n		**YES**
Copper	7440-50-8	1.88E+02	3.10E+02	n		no
Iron	7439-89-6	2.93E+05	5.50E+03	n		**YES**
Lead	7439-92-1	1.09E+05	4.00E+02	«		**YES**
Magnesium	7439-95-4	1.02E+04	NA			no
Manganese	7439-96-5	2.31E+03	1.80E+02	n		**YES**
Mercury	7439-97-6	9.00E-02	6.70E-01	ns		no
Nickel	7440-02-0	2.68E+01	1.60E+02	n		no
Potassium	7440-09-7	2.21E+03	NA			no
Selenium	7782-49-2	1.30E+00	3.90E+01	n		no
Silver	7440-22-4	8.42E+00	3.90E+01	n		no
Sodium	7440-23-5	5.77E+02	NA			no
Thallium	7440-28-0	1.70E+00	5.10E-01	n		**YES**
Vanadium	7440-62-2	1.06E+02	5.50E+01	n		**YES**
Zinc	7440-66-6	1.73E+04	2.30E+03	n		**YES**

Notes:
CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
mg/kg = Milligrams per kilogram.
NA = Not available or not applicable.
RSL = Regional Screening Level.
USEPA = United States Environmental Protection Agency.

[a] Maximum concentration in sediment.

[b] The screening levels used were risk screening levels for the residential scenario from USEPA (2008a). Screening levels based on non-cancer effects were adjusted downward by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = Concentration may exceed ceiling limit; s = Concentration may exceed saturation concentration (Csat).
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.

[c] Constituents detected with maximum concentrations greater than adjusted residential screening levels were considered COPCs unless they were metals detected at concentrations lower than background, or are essential nutrients (i.e., calcium, magnesium, potassium, sodium), or were known laboratory contaminants (i.e. acetone).

Table A.7.HHRA-4
Selection Constituents of Potential Concern for Surface Water
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Tap Water Regional Screening Level (RSL) [b]			Is Constituent a Surface Water COPC? [c]
		(mg/L)	(mg/L)		Surrogate	(YES, no)
Volatile Organic Compounds						
2-Butanone	78-93-3	4.00E-03	7.10E-01	n		no
Acetone	67-64-1	2.80E-03	2.20E+00	n		no
Carbon Disulfide	75-15-0	2.50E-04	1.00E-01	n		no
Chloroform	67-66-3	3.00E-03	1.90E-04	c		**YES**
cis-1,2-Dichloroethene	156-59-2	1.20E-04	3.70E-02	n		no
Tetrachloroethene	127-18-4	1.60E-04	1.10E-04	c		**YES**
Toluene	108-88-3	2.10E-04	2.30E-01	n		no
Trichloroethene	79-01-6	1.10E-04	1.70E-03	c		no
Semi-Volatile Organic Compounds						
1,2-Dichlorobenzene	95-50-1	2.10E-04	3.70E-02	n		no
1,3-Dichlorobenzene	541-73-1	2.10E-04	3.70E-02	n	1,2-Dichlorobenzene	no
1,4-Dichlorobenzene	106-46-7	2.80E-04	4.30E-04	c		no
Benzoic Acid	65-85-0	6.70E-03	1.50E+01	n		no
bis(2-Ethylhexyl)phthalate	117-81-7	2.60E-03	4.80E-03	c		no
Butylbenzylphthalate	85-68-7	6.30E-04	3.50E-02	c		no
Diethylphthalate	84-66-2	1.00E-03	2.90E+00	n		no
Di-n-Butylphthalate	84-74-2	9.10E-04	3.70E-01	n		no
Dioxin/Furan Compounds						
OCDD	3268-87-9	3.50E-08	1.70E-06	c		no
Explosives						
m-Nitrotoluene	99-08-1	3.80E-04	7.30E-02	n		no
Herbicides						
2,4-D	94-75-7	3.68E-03	3.70E-02	n		no
MCPP	93-65-2	5.41E-02	3.70E-03	n		**YES**
Pesticides						
Dieldrin	60-57-1	9.01E-06	4.20E-06	c		**YES**
Polycyclic Aromatic Hydrocarbons						
1-Methylnaphthalene	90-12-0	2.60E-05	2.30E-03	c		no
2-Methylnaphthalene	91-57-6	3.30E-05	1.50E-02	n		no
Acenaphthene	83-32-9	4.00E-05	2.20E-01	n		no
Anthracene	120-12-7	3.00E-05	1.10E+00	n		no
Fluorene	86-73-7	3.40E-05	1.50E-01	n		no
Naphthalene	91-20-3	4.00E-05	1.40E-04	c*		no
Phenanthrene	85-01-8	5.00E-05	1.10E+00	n	Anthracene	no
Inorganics						
Aluminum	7429-90-5	8.11E-01	3.70E+00	n		no
Arsenic	7440-38-2	1.04E-02	4.50E-05	c		**YES**

Table A.7.HHRA-4
Selection Constituents of Potential Concern for Surface Water
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a]	Adjusted Tap Water Regional Screening Level (RSL) [b]			Is Constituent a Surface Water COPC? [c]
		(mg/L)	(mg/L)		Surrogate	(YES, no)
Barium	7440-39-3	1.48E-01	7.30E-01	n		no
Beryllium	7440-41-7	1.10E-03	7.30E-03	n		no
Calcium	7440-70-2	9.07E+01	NA			no
Copper	7440-50-8	2.35E-02	1.50E-01	n		no
Iron	7439-89-6	5.09E+01	2.60E+00	n		**YES**
Lead	7439-92-1	1.06E-01	1.50E-03	«		**YES**
Magnesium	7439-95-4	2.10E+01	NA			no
Manganese	7439-96-5	1.47E+00	8.80E-02	n		**YES**
Nickel	7440-02-0	1.50E-03	7.30E-02	n		no
Potassium	7440-09-7	4.08E+00	NA			no
Selenium	7782-49-2	4.40E-04	1.80E-02	n		no
Silver	7440-22-4	1.20E-03	1.80E-02	n		no
Sodium	7440-23-5	6.39E+01	NA			no
Thallium	7440-28-0	5.40E-03	2.40E-04	n		**YES**
Vanadium	7440-62-2	7.90E-02	2.60E-02	n		**YES**
Zinc	7440-66-6	2.37E-02	1.10E+00	n		no

Notes:

CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
mg/L = Milligrams per liter.
NA = Not available or not applicable.
RSL = Regional Screening Level.
USEPA = United States Environmental Protection Agency.

[a] Maximum concentration in surface water.

[b] The screening levels used were risk screening levels for tap water from USEPA (2008a). Screening levels based on non-cancer effects were adjusted downward by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = Concentration may exceed ceiling limit;
« The screening level for lead is based on noncancer effects but uses a non-standard method and, therefore, is not adjusted by 0.1.
Some RSL values were based on surrogates as identified next to each value.

[c] Constituents detected with maximum concentrations greater than screening levels were considered COPCs unless they were essential nutrients (i.e., calcium, magnesium, potassium, sodium), or were known laboratory contaminants (i.e. acetone).

Table A.7.HHRA-5
Selection Constituents of Potential Concern for Fish Consumption
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentration [a] (mg/kg)	Is Constituent a Fish Fillet COPC? [c] (YES, no)
Inorganics			
Barium	7440-39-3	1.00E+00	**YES**
Calcium	7440-70-2	8.72E+03	no
Chromium	7440-47-3	2.40E-01	**YES**
Copper	7440-50-8	5.60E-01	**YES**
Iron	7439-89-6	1.19E+01	**YES**
Magnesium	7439-95-4	3.00E+02	no
Manganese	7439-96-5	7.60E-01	**YES**
Mercury	7439-97-6	8.70E-02	**YES**
Potassium	7440-09-7	3.17E+03	no
Sodium	7440-23-5	1.07E+03	no
Zinc	7440-66-6	1.35E+01	**YES**

Notes:
CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
mg/kg = Milligrams per kilogram.
NA = Not available or not applicable.

[a] Maximum concentration in fish fillet.
[c] Constituents detected were considered COPCs unless they were essential nutrients (i.e., calcium, magnesium, potassium, sodium), or were known laboratory contaminants (i.e. acetone).

Table A.7.HHRA-6
Exposure Point Concentrations
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a]						Exposure Point Concentrations [b]					
		Surface Soil	Combined Surface and Subsurface Soil	Combined Surface Soil and Sediment	Combined Surface and Subsurface Soil and Sediment	Sediment	Surface Water	Surface Soil (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Combined Surface Soil and Sediment (mg/kg)	Combined Surface and Subsurface Soil and Sediment (mg/kg)	Sediment (mg/kg)	Surface Water (mg/L)
Volatile Organic Compounds													
1,2,3-Trichloropropane	96-18-4	no	no	no	no	no	no	–	–	–	–	–	–
1,2,4-Trimethylbenzene	95-63-6	no	no	no	no	no	no	–	–	–	–	–	–
2-Butanone	78-93-3	no	no	no	no	no	no	–	–	–	–	–	–
3-Octanone	106-68-3	no	no	no	no	no	no	–	–	–	–	–	–
4-Methyl-2-pentanone	108-10-1	no	no	no	no	no	no	–	–	–	–	–	–
Acetone	67-64-1	no	no	no	no	no	no	–	–	–	–	–	–
Bromodichloromethane	75-27-4	no	no	no	no	no	no	–	–	–	–	–	–
Carbon Disulfide	75-15-0	no	no	no	no	no	no	–	–	–	–	–	–
Chloroform	67-66-3	no	no	no	no	no	**YES**	–	–	–	–	–	1.29E-03
cis-1,2-Dichloroethene	156-59-2	no	no	no	no	no	no	–	–	–	–	–	–
d-Limonene	5989-27-5	**YES**	**YES**	**YES**	**YES**	no	no	1.70E-01 m	1.70E-01 m	1.70E-01 m	1.70E-01 m	–	–
Ethanol	64-17-5	no	no	no	no	no	no	–	–	–	–	–	–
m,p-Xylene	136777612	no	no	no	no	no	no	–	–	–	–	–	–
Methylene Chloride	75-09-2	no	no	no	no	no	no	–	–	–	–	–	–
p-Isopropyltoluene	99-87-6	no	no	no	no	no	no	–	–	–	–	–	–
Tetrachloroethene	127-18-4	no	no	no	no	no	**YES**	–	–	–	–	–	1.60E-04 m
Toluene	108-88-3	no	no	no	no	no	no	–	–	–	–	–	–
Trichloroethene	79-01-6	no	no	no	no	no	no	–	–	–	–	–	–
Xylenes (total)	1330-20-7	no	no	no	no	no	no	–	–	–	–	–	–
Semi-Volatile Organic Compounds													
1,2,4-Trichlorobenzene	120-82-1	no	no	no	no	no	no	–	–	–	–	–	–
1,2-Dichlorobenzene	95-50-1	no	no	no	no	no	no	–	–	–	–	–	–
1,3-Dichlorobenzene	541-73-1	no	no	no	no	no	no	–	–	–	–	–	–
1,4-Dichlorobenzene	106-46-7	no	no	no	no	no	no	–	–	–	–	–	–
2,4-Dinitrotoluene	121-14-2	no	no	no	no	no	no	–	–	–	–	–	–
2,6-Dinitrotoluene	606-20-2	no	no	no	no	no	no	–	–	–	–	–	–
3,3'-Dichlorobenzidine	91-94-1	no	no	no	no	no	no	–	–	–	–	–	–
4-Methylphenol	106-44-5	no	no	no	no	no	no	–	–	–	–	–	–
Benzoic Acid	65-85-0	no	no	no	no	no	no	–	–	–	–	–	–
bis(2-Ethylhexyl)phthalate	117-81-7	no	no	no	no	no	no	–	–	–	–	–	–
Butylbenzylphthalate	85-68-7	no	no	no	no	no	no	–	–	–	–	–	–
Carbazole	86-74-8	**YES**	**YES**	**YES**	**YES**	**YES**	no	1.00E-01 m	1.00E-01 m	1.21E-01	7.81E-02	2.10E-01 m	–
Dibenzofuran	132-64-9	no	no	no	no	no	no	–	–	–	–	–	–
Diethylphthalate	84-66-2	no	no	no	no	no	no	–	–	–	–	–	–
Di-n-Butylphthalate	84-74-2	no	no	no	no	no	no	–	–	–	–	–	–
Di-n-Octylphthalate	117-84-0	no	no	no	no	no	no	–	–	–	–	–	–
N-Nitrosodiphenylamine	86-30-6	no	no	no	no	no	no	–	–	–	–	–	–
Pentachlorophenol	87-86-5	no	no	no	no	no	no	–	–	–	–	–	–
Phenol	108-95-2	no	no	no	no	no	no	–	–	–	–	–	–

Table A.7.HHRA-6
Exposure Point Concentrations
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a]						Exposure Point Concentrations [b]					
		Surface Soil	Combined Surface and Subsurface Soil	Combined Surface Soil and Sediment	Combined Surface and Subsurface Soil and Sediment	Sediment	Surface Water	Surface Soil (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Combined Surface Soil and Sediment (mg/kg)	Combined Surface and Subsurface Soil and Sediment (mg/kg)	Sediment (mg/kg)	Surface Water (mg/L)
Dioxin/Furan Compounds													
1,2,3,4,6,7,8-HpCDD	35822-46-9	no	no	no	no	no	no	–	–	–	–	–	–
1,2,3,4,6,7,8-HpCDF	67562-39-4	no	no	no	no	no	no	–	–	–	–	–	–
1,2,3,4,7,8,9-HpCDF	55673-89-7	no	no	no	no	no	no	–	–	–	–	–	–
1,2,3,4,7,8-HxCDD	39227-28-6	no	no	no	no	no	no	–	–	–	–	–	–
1,2,3,4,7,8-HxCDF	70648-26-9	no	no	no	no	no	no	–	–	–	–	–	–
1,2,3,6,7,8-HxCDD	57653-85-7	no	no	no	no	no	no	–	–	–	–	–	–
1,2,3,6,7,8-HxCDF	57117-44-9	no	no	no	no	no	no	–	–	–	–	–	–
1,2,3,7,8,9-HxCDD	19408-74-3	no	no	no	no	no	no	–	–	–	–	–	–
1,2,3,7,8,9-HxCDF	72918-21-9	no	no	no	no	no	no	–	–	–	–	–	–
1,2,3,7,8-PeCDD	40321-76-4	no	**YES**	no	**YES**	no	no	–	1.98E-06	–	1.45E-06	–	–
1,2,3,7,8-PeCDF	57117-41-6	no	no	no	no	no	no	–	–	–	–	–	–
2,3,4,6,7,8-HxCDF	60851-34-5	no	no	no	no	no	no	–	–	–	–	–	–
2,3,4,7,8-PeCDF	57117-31-4	no	no	no	no	no	no	–	–	–	–	–	–
2,3,7,8-TCDD	1746-01-6	no	no	no	no	no	no	–	–	–	–	–	–
2,3,7,8-TCDF	51207-31-9	no	no	no	no	no	no	–	–	–	–	–	–
OCDD	3268-87-9	no	no	no	no	no	no	–	–	–	–	–	–
OCDF	39001-02-0	no	no	no	no	no	no	–	–	–	–	–	–
Explosives										–	–		
1,3,5-Trinitrobenzene	99-35-4	no	no	no	no	no	no	–	–	–	–	–	–
1,3-Dinitrobenzene	99-65-0	no	no	no	no	no	no	–	–	–	–	–	–
2,4,6-Trinitrotoluene	118-96-7	no	no	no	no	no	no	–	–	–	–	–	–
4-Amino-2,6-Dinitrotoluene	19406-51-0	no	no	no	no	no	no	–	–	–	–	–	–
m-Nitrotoluene	99-08-1	no	no	no	no	no	no	–	–	–	–	–	–
Nitrobenzene	98-95-3	no	no	no	no	no	no	–	–	–	–	–	–
Nitroglycerine	55-63-0	no	no	**YES**	**YES**	**YES**	no	–	–	9.60E-01 m	9.60E-01 m	9.60E-01 m	–
Pentaerythritol Tetranitrate	78-11-5	**YES**	**YES**	**YES**	**YES**	no	no	1.10E-01 m	1.10E-01 m	1.10E-01 m	1.10E-01 m	–	–
Perchlorate	14797-73-0	no	no	no	no	no	no	–	–	–	–	–	–
Herbicides													
2,4,5-T	93-76-5	no	no	no	no	no	no	–	–	–	–	–	–
2,4,5-TP	93-72-1	no	no	no	no	no	no	–	–	–	–	–	–
2,4-D	94-75-7	no	no	no	no	no	no	–	–	–	–	–	–
2,4-DB	94-82-6	no	no	no	no	no	no	–	–	–	–	–	–
Dalapon	75-99-0	no	no	no	no	no	no	–	–	–	–	–	–
Dicamba	1918-00-9	no	no	no	no	no	no	–	–	–	–	–	–
Dichlorprop	120-36-5	no	no	no	no	no	no	–	–	–	–	–	–
MCPA	94-74-6	no	no	no	no	no	no	–	–	–	–	–	–
MCPP	93-65-2	no	no	no	no	no	**YES**	–	–	–	–	–	5.41E-02 m

Table A.7.HHRA-6
Exposure Point Concentrations
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a]						Exposure Point Concentrations [b]					
		Surface Soil	Combined Surface and Subsurface Soil	Combined Surface Soil and Sediment	Combined Surface and Subsurface Soil and Sediment	Sediment	Surface Water	Surface Soil (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Combined Surface Soil and Sediment (mg/kg)	Combined Surface and Subsurface Soil and Sediment (mg/kg)	Sediment (mg/kg)	Surface Water (mg/L)
Pesticides													
4,4'-DDD	72-54-8	no	no	no	no	no	no	–	–	–	–	–	–
4,4'-DDE	72-55-9	no	no	no	no	no	no	–	–	–	–	–	–
4,4'-DDT	50-29-3	no	no	no	no	no	no	–	–	–	–	–	–
Alpha-BHC	319-84-6	no	no	no	no	no	no	–	–	–	–	–	–
Beta-BHC	319-85-7	no	no	no	no	no	no	–	–	–	–	–	–
Delta-BHC	319-86-8	no	no	no	no	no	no	–	–	–	–	–	–
Gamma-BHC (Lindane)	58-89-9	no	no	no	no	no	no	–	–	–	–	–	–
Alpha-Chlordane	5103-71-9	no	no	no	no	no	no	–	–	–	–	–	–
Gamma-Chlordane	5566-34-7	no	no	no	no	no	no	–	–	–	–	–	–
Dieldrin	60-57-1	no	no	no	no	no	**YES**	–	–	–	–	–	9.01E-06 m
Endosulfan I	115-29-7	no	no	no	no	no	no	–	–	–	–	–	–
Endosulfan II	33213-65-9	no	no	no	no	no	no	–	–	–	–	–	–
Endosulfan Sulfate	1031-07-8	no	no	no	no	no	no	–	–	–	–	–	–
Endrin	72-20-8	no	no	no	no	no	no	–	–	–	–	–	–
Endrin Aldehyde	7421-93-4	no	no	no	no	no	no	–	–	–	–	–	–
Endrin Ketone	53494-70-5	no	no	no	no	no	no	–	–	–	–	–	–
Heptachlor	76-44-8	no	no	no	no	no	no	–	–	–	–	–	–
Heptachlor Epoxide	1024-57-3	no	no	no	no	no	no	–	–	–	–	–	–
Methoxychlor	72-43-5	no	no	no	no	no	no	–	–	–	–	–	–
Polycyclic Aromatic Hydrocarbons													
1-Methylnaphthalene	90-12-0	no	no	no	no	no	no	–	–	–	–	–	–
2-Methylnaphthalene	91-57-6	no	no	no	no	no	no	–	–	–	–	–	–
Acenaphthene	83-32-9	no	no	no	no	no	no	–	–	–	–	–	–
Acenaphthylene	208-96-8	no	no	no	no	no	no	–	–	–	–	–	–
Anthracene	120-12-7	no	no	no	no	no	no	–	–	–	–	–	–
Benzo(a)anthracene	56-55-3	**YES**	**YES**	**YES**	**YES**	**YES**	no	1.72E-01	7.92E-02	2.57E-01	1.65E-01	2.32E+00	–
Benzo(a)pyrene	50-32-8	**YES**	**YES**	**YES**	**YES**	**YES**	no	2.11E-01	1.01E-01	2.59E-01	1.69E-01	6.20E-01	–
Benzo(b)fluoranthene	205-99-2	**YES**	**YES**	**YES**	**YES**	**YES**	no	3.12E-01	1.32E-01	3.36E-01	2.19E-01	7.35E-01	–
Benzo(g,h,i)perylene	191-24-2	no	no	no	no	no	no	–	–	–	–	–	–
Benzo(k)fluoranthene	207-08-9	no	no	no	no	no	no	–	–	–	–	–	–
Chrysene	218-01-9	no	no	no	no	no	no	–	–	–	–	–	–
Dibenzo(a,h)anthracene	53-70-3	**YES**	**YES**	**YES**	**YES**	**YES**	no	2.20E-01 m	4.44E-02	6.29E-02	4.71E-02	5.60E-01 m	–
Fluoranthene	206-44-0	no	no	no	no	no	no	–	–	–	–	–	–
Fluorene	86-73-7	no	no	no	no	no	no	–	–	–	–	–	–
Indeno(1,2,3-cd)pyrene	193-39-5	**YES**	**YES**	**YES**	**YES**	**YES**	no	1.85E-01	8.96E-02	1.62E-01	1.09E-01	3.06E-01	–
Naphthalene	91-20-3	no	no	no	no	no	no	–	–	–	–	–	–
Phenanthrene	85-01-8	no	no	no	no	no	no	–	–	–	–	–	–
Pyrene	129-00-0	no	no	no	no	no	no	–	–	–	–	–	–
Polychlorinated Biphenyls													
Aroclor 1254	11097-69-1	no	**YES**	no	**YES**	no	no	–	8.70E-01 m	–	8.70E-01 m	–	–
Aroclor 1260	11096-82-5	no	no	no	no	no	no	–	–	–	–	–	–

Table A.7.HHRA-6
Exposure Point Concentrations
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	COPC? [a]						Exposure Point Concentrations [b]					
		Surface Soil	Combined Surface and Subsurface Soil	Combined Surface Soil and Sediment	Combined Surface and Subsurface Soil and Sediment	Sediment	Surface Water	Surface Soil (mg/kg)	Combined Surface and Subsurface Soil (mg/kg)	Combined Surface Soil and Sediment (mg/kg)	Combined Surface and Subsurface Soil and Sediment (mg/kg)	Sediment (mg/kg)	Surface Water (mg/L)
Inorganics													
Aluminum	7429-90-5	no	**YES**	**YES**	**YES**	**YES**	no	–	1.96E+04	1.89E+04	1.92E+04	1.92E+04	–
Antimony	7440-36-0	**YES**	**YES**	**YES**	**YES**	no	no	8.61E-01	7.21E-01	8.00E-01	7.13E-01	–	–
Arsenic	7440-38-2	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	1.18E+01	9.75E+00	1.12E+01	1.04E+01	8.69E+00	1.04E-02 m
Barium	7440-39-3	no	no	no	no	no	no	–	–	–	–	–	–
Beryllium	7440-41-7	no	no	no	no	no	no	–	–	–	–	–	–
Cadmium	7440-43-9	no	no	no	no	no	no	–	–	–	–	–	–
Calcium	7440-70-2	no	no	no	no	no	no	–	–	–	–	–	–
Chromium	7440-47-3	no	no	**YES**	**YES**	**YES**	no	–	–	8.77E+02	5.86E+02	6.05E+03	–
Cobalt	7440-48-4	no	no	**YES**	**YES**	**YES**	no	–	–	1.29E+01	1.43E+01	2.45E+01	–
Copper	7440-50-8	**YES**	**YES**	**YES**	**YES**	no	no	1.77E+02	9.84E+01	1.12E+02	8.54E+01	–	–
Iron	7439-89-6	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	3.60E+04	3.51E+04	3.83E+04	3.65E+04	7.47E+04	3.99E+01
Lead	7439-92-1	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	2.13E+02 avg	1.55E+02 avg	7.87E+03	5.23E+03	3.61E+03 avg	1.93E-02 avg
Magnesium	7439-95-4	no	no	no	no	no	no	–	–	–	–	–	–
Manganese	7439-96-5	no	no	**YES**	**YES**	**YES**	**YES**	–	–	3.88E+02	3.12E+02	8.31E+02	1.15E+00
Mercury	7439-97-6	no	no	no	no	no	no	–	–	–	–	–	–
Nickel	7440-02-0	no	no	no	no	no	no	–	–	–	–	–	–
Potassium	7440-09-7	no	no	no	no	no	no	–	–	–	–	–	–
Selenium	7782-49-2	no	no	no	no	no	no	–	–	–	–	–	–
Silver	7440-22-4	no	no	no	no	no	no	–	–	–	–	–	–
Sodium	7440-23-5	no	no	no	no	no	no	–	–	–	–	–	–
Thallium	7440-28-0	no	no	**YES**	**YES**	**YES**	**YES**	–	–	2.82E-01	2.77E-01	3.89E-01	5.40E-03 m
Vanadium	7440-62-2	no	no	**YES**	**YES**	**YES**	**YES**	–	–	6.02E+01	6.08E+01	4.90E+01	2.60E-02
Zinc	7440-66-6	**YES**	**YES**	**YES**	**YES**	**YES**	no	7.17E+02	4.01E+02	1.46E+03	9.92E+02	6.81E+03	–

Notes:
– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/kg = Milligrams per kilogram.
mg/L = Milligrams per liter.

[a] Constituent of Potential Concern.
[b] The exposure point concentration (EPC) was the upper confidence level on the mean (UCL) or the maximum concentration where the UCL was incalculable.
EPCs marked with "m" are based on the maximum detected concentration.
Exposure to lead is evaluated by predicting resultant blood lead levels using the arithmetic average (avg).
The UCLs were calculated using ProUCL 4.0. The UCL used is the one recommended by ProUCL 4.0.

Table A.7.HHRA-7
Risk and Hazard Calculations for Site Worker Exposure to Surface Soil (0-2 foot Depth Interval)
WESTERN BURNING GROUND
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Current / Future
Receptor Population: Site Worker
Receptor Age: Adult

Constituent	EPCs (mg/kg)	VF *or* PEF [a] (m³/kg)		CANCER RISK Route-Specific Risk Oral	Dermal	Inhalation	Calculated Risk	Percent Total ELCR	NON-CANCER HAZARD Route-Specific Hazard Oral	Dermal	Inhalation	Calculated Hazard	Percent Total HI
				ELCRo	ELCRd	ELCRi	ELCR		HQo	HQd	HQi	HI	
Volatile Organic Compounds													
d-Limonene	1.70E-01	4.05E+03	V	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Semi-Volatile Organic Compounds													
Carbazole	1.00E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Polycyclic Aromatic Hydrocarbons													
Benzo(a)anthracene	1.72E-01	1.36E+09	P	4.4E-08	3.8E-08	NA	8.2E-08	1%	NA	NA	NA	NA	–
Benzo(a)pyrene	2.11E-01	1.36E+09	P	5.4E-07	4.6E-07	3.4E-11	1.0E-06	10%	NA	NA	NA	NA	–
Benzo(b)fluoranthene	3.12E-01	1.36E+09	P	8.0E-08	6.8E-08	NA	1.5E-07	2%	NA	NA	NA	NA	–
Dibenzo(a,h)anthracene	2.20E-01	1.36E+09	P	5.6E-07	4.8E-07	NA	1.0E-06	11%	NA	NA	NA	NA	–
Indeno(1,2,3-cd)pyrene	1.85E-01	1.36E+09	P	4.7E-08	4.0E-08	NA	8.8E-08	1%	NA	NA	NA	NA	–
Explosives													
Pentaerythritol Tetranitrate	1.10E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Inorganics													
Antimony	8.61E-01	1.36E+09	P	NA	NA	NA	NA	–	2.1E-03	0.0E+00	NA	2.1E-03	2%
Arsenic	1.18E+01	1.36E+09	P	6.2E-06	1.2E-06	9.1E-09	7.4E-06	76%	3.9E-02	7.6E-03	NA	4.6E-02	44%
Copper	1.77E+02	1.36E+09	P	NA	NA	NA	NA	–	4.3E-03	0.0E+00	NA	4.3E-03	4%
Iron	3.60E+04	1.36E+09	P	NA	NA	NA	NA	–	5.0E-02	0.0E+00	NA	5.0E-02	48%
Lead	2.13E+02	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Zinc	7.17E+02	1.36E+09	P	NA	NA	NA	NA	–	2.3E-03	0.0E+00	NA	2.3E-03	2%
				Total ELCR			1E-05	100%	Total HI			0.1	100%

[a] Minimum of the volatilization factor (identified with "V") and the particulate emission factor (PEF) (identified with "P"), both derived on Table A.2-11.

–	Not applicable.	HQ	Hazard quotient.	PEF	Particulate emission factor.
ELCR	Excess lifetime cancer risk.	m^3/kg	Cubic meters per kilogram.	VF	Volatilization factor.
EPCs	Exposure point concentration in surface soil (mg/kg).	mg/kg	Milligrams per kilogram.		
HI	Hazard index (sum of the HQs).	NA	Not available.		

Equations: (see Table A.2-11)

ELCRo = (EPCs × 1 × 100 × 250 × 25 × CSFo) / (1,000,000 × 70 × 25,550)
ELCRd = (EPCs × 3,300 × 0.2 × ABSd × 250 × 25 × CSFa) / (1,000,000 × 70 × 25,550)
ELCRi = (EPCs × 20 × 250 × 25 × CSFi) / ([VF or PEF] × 70 × 25,550)

HQo = (EPCs × 1 × 100 × 250 × 25) / (1,000,000 × 70 × 9,125 × RfDo)
HQd = (EPCs × 3,300 × 0.2 × ABSd × 250 × 25) / (1,000,000 × 70 × 9,125 × RfDa)
HQi = (EPCs × 20 × 250 × 25) / ([VF or PEF] × 70 × 9,125 × RfDi)

Table A.7.HHRA-8
Risk and Hazard Calculations for Site Worker Wading Exposure to Sediment
WESTERN BURNING GROUND
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Current / Future
Receptor Population: Site Worker
Receptor Age: Adult

Constituent	EPCsed (mg/kg)	CANCER RISK Route-Specific Risks Oral	Dermal	Calculated Risk	Percent Total ELCR	NON-CANCER RISK Route-Specific Risks Oral	Dermal	Calculated Hazard	Percent Total HI
		ELCRo	ELCRd	ELCR		HQo	HQd	HI	
Semi-Volatile Organic Compounds									
Carbazole	2.10E-01	NA	NA	NA	–	NA	NA	NA	–
Polycyclic Aromatic Hydrocarbons									
Benzo(a)anthracene	2.32E+00	3.1E-08	2.4E-07	2.7E-07	11%	NA	NA	NA	–
Benzo(a)pyrene	6.20E-01	8.2E-08	6.4E-07	7.2E-07	30%	NA	NA	NA	–
Benzo(b)fluoranthene	7.35E-01	9.8E-09	7.6E-08	8.6E-08	4%	NA	NA	NA	–
Dibenzo(a,h)anthracene	5.60E-01	7.4E-08	5.8E-07	6.5E-07	27%	NA	NA	NA	–
Indeno(1,2,3-cd)pyrene	3.06E-01	4.1E-09	3.2E-08	3.6E-08	1%	NA	NA	NA	–
Explosives					–				–
Nitroglycerine	9.60E-01	3.0E-10	1.8E-09	2.1E-09	0%	4.9E-04	2.9E-03	3.4E-03	3%
Inorganics									
Aluminum	1.92E+04	NA	NA	NA	–	9.7E-04	0.0E+00	9.7E-04	1%
Arsenic	8.69E+00	2.4E-07	4.3E-07	6.6E-07	27%	1.5E-03	2.7E-03	4.1E-03	3%
Chromium	6.05E+03	NA	NA	NA	–	1.0E-01	0.0E+00	1.0E-01	84%
Cobalt	2.45E+01	NA	NA	NA	–	4.2E-03	0.0E+00	4.2E-03	3%
Iron	7.47E+04	NA	NA	NA	–	5.4E-03	0.0E+00	5.4E-03	4%
Lead	3.61E+03	NA	NA	NA	–	NA	NA	NA	–
Manganese	8.31E+02	NA	NA	NA	–	3.0E-04	0.0E+00	3.0E-04	0%
Thallium	3.89E-01	NA	NA	NA	–	2.5E-04	0.0E+00	2.5E-04	0%
Vanadium	4.90E+01	NA	NA	NA	–	3.6E-04	0.0E+00	3.6E-04	0%
Zinc	6.81E+03	NA	NA	NA	–	1.2E-03	0.0E+00	1.2E-03	1%
		Total ELCR		2E-06	100%	Total HI		0.1	100%

–	Not applicable.	HQ	Hazard quotient.
ELCR	Excess lifetime cancer risk.	mg/kg	Milligrams per kilogram.
EPCsed	Exposure point concentration in sediment (mg/kg).	NA	Not available.
HI	Hazard index (sum of the HQs).		

Equations: (see Table A.2-12)

ELCRo = (EPCsed × 50 × 26 × 25 × CSFo) / (1,000,000 × 70 × 25,550)

ELCRd = (EPCsed × 5,000 × 1 × ABSd × 26 × 25 × CSFa) / (1,000,000 × 70 × 25,550)

HQo = (EPCsed × 50 × 26 × 25) / (1,000,000 × 70 × 9,125 × RfDo)

HQd = (EPCsed × 5,000 × 1 × ABSd × 26 × 25) / (1,000,000 × 70 × 9,125 × RfDa)

Table A.7.HHRA-9
Risk and Hazard Calculations for Site Worker Wading Exposure to Surface Water
WESTERN BURNING GROUND
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Current / Future
Receptor Population: Site Worker
Receptor Age: Adult

Constituent	EPCsw (mg/L)	DA [a] (L/cm²/day)	VFsw (L/m³)	CANCER RISK Route-Specific Risk Oral	Dermal	Inhalation	Calculated Risk	Percent Total ELCR	NON-CANCER HAZARD Route-Specific Hazard Oral	Dermal	Inhalation	Calculated Hazard	Percent Total HI
				ELCRo	ELCRd	ELCRi	ELCR		HQo	HQd	HQi	HI	
Volatile Organic Compounds													
Chloroform	1.29E-03	5.99E-05	4.24E-03	NA	NA	3.4E-10	3.4E-10	0%	5.3E-05	3.9E-05	4.2E-07	9.2E-05	0%
Tetrachloroethene	1.60E-04	2.97E-04	3.79E-03	1.3E-08	4.7E-08	9.6E-12	5.9E-08	2%	6.5E-06	2.4E-05	1.7E-08	3.1E-05	0%
Herbicides													
MCPP	5.41E-02	0.00E+00	2.38E-07	NA	NA	NA	NA	–	2.2E-02	0.0E+00	NA	2.2E-02	12%
Pesticides													
Dieldrin	9.01E-06	2.87E-04	1.40E-04	2.1E-08	7.5E-08	1.6E-11	9.6E-08	4%	7.3E-05	2.6E-04	NA	3.4E-04	0%
Inorganics													
Arsenic	1.04E-02	8.00E-06	NA	2.3E-06	2.3E-07	NA	2.5E-06	94%	1.4E-02	1.4E-03	NA	1.6E-02	8%
Iron	3.99E+01	8.00E-06	NA	NA	NA	NA	NA	–	2.3E-02	2.3E-03	NA	2.6E-02	14%
Lead	1.93E-02	8.00E-07	NA	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Manganese	1.15E+00	8.00E-06	NA	NA	NA	NA	NA	–	2.3E-02	5.9E-02	NA	8.2E-02	45%
Thallium	5.40E-03	8.00E-06	NA	NA	NA	NA	NA	–	2.7E-02	2.7E-03	NA	3.0E-02	16%
Vanadium	2.60E-02	8.00E-06	NA	NA	NA	NA	NA	–	1.5E-03	5.8E-03	NA	7.3E-03	4%
				Total ELCR			3E-06	100%	Total HI			0.2	100%

[a] The dermal absorption factor (DA) was calculated using Equation [0], [1], or [2], as indicated, from Table A.2-13.

–	Not applicable.	HQ	Hazard quotient.	NA	Not available.
ELCR	Excess lifetime cancer risk.	L/cm²/day	Liters per square centimeter per day.	VFsw	Volatilization factor for surface water.
EPCsw	Exposure point concentration in surface water.	L/m^3	Liters per cubic meter.		
HI	Hazard index (sum of the HQs).	mg/L	Milligrams per liter.		

Equations: (see Table A.2-13)

3.75 = Um = Mean annual wind speed (m/sec) for Roanoke, Virginia (USDOE 1986).

ELCRo = (EPCsw × 0.05 × 8 × 26 × 25 × CSFo) / (70 × 25,550)
ELCRd = (EPCsw × DA × 5,000 × 26 × 25 × CSFa) / (70 × 25,550)
ELCRi = (EPCsw × VFsw × 2 × 26 × 25 × CSFi) / (70 × 25,550)

HQo = (EPCsw × 0.05 × 8 × 26 × 25) / (70 × 9,125 × RfDo)
HQd = (EPCsw × DA × 5,000 × 26 × 25) / (70 × 9,125 × RfDa)
HQi = (EPCsw × VFsw × 2 × 26 × 25) / (70 × 9,125 × RfDi)

Table A.7.HHRA-10
Risk and Hazard Calculations for Hypothetical Future Construction Worker Exposure to Combined Surface and Subsurface Soil
WESTERN BURNING GROUND
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Constituent	EPCs (mg/kg)	VF *or* PEF [a] (m^3/kg)		CANCER RISK Route-Specific Risk Oral	Dermal	Inhalation	Calculated Risk	Percent Total ELCR	NON-CANCER HAZARD Route-Specific Hazard Oral	Dermal	Inhalation	Calculated Hazard	Percent Total HI
				ELCRo	ELCRd	ELCRi	ELCR		HQo	HQd	HQi	HI	
Volatile Organic Compounds													
d-Limonene	1.70E-01	4.05E+03	V	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Semi-Volatile Organic Compounds													
Carbazole	1.00E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Polycyclic Aromatic Hydrocarbons													
Benzo(a)anthracene	7.92E-02	1.36E+09	P	1.4E-09	5.4E-10	NA	1.9E-09	0%	NA	NA	NA	NA	–
Benzo(a)pyrene	1.01E-01	1.36E+09	P	1.8E-08	6.9E-09	3.3E-13	2.5E-08	5%	NA	NA	NA	NA	–
Benzo(b)fluoranthene	1.32E-01	1.36E+09	P	2.3E-09	9.0E-10	NA	3.2E-09	1%	NA	NA	NA	NA	–
Dibenzo(a,h)anthracene	4.44E-02	1.36E+09	P	7.8E-09	3.0E-09	NA	1.1E-08	2%	NA	NA	NA	NA	–
Indeno(1,2,3-cd)pyrene	8.96E-02	1.36E+09	P	1.6E-09	6.1E-10	NA	2.2E-09	0%	NA	NA	NA	NA	–
Dioxin/Furan Compounds													
1,2,3,7,8-PeCDD	1.98E-06	1.36E+09	P	6.2E-09	5.6E-10	2.8E-13	6.7E-09	1%	NA	NA	NA	NA	–
Polychlorinated Biphenyls													
Aroclor 1254	8.70E-01	1.36E+09	P	4.2E-08	1.8E-08	1.9E-12	5.9E-08	12%	5.9E-02	2.5E-02	NA	8.3E-02	18%
Explosives													
Pentaerythritol Tetranitrate	1.10E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Inorganics													
Aluminum	1.96E+04	1.36E+09	P	NA	NA	NA	NA	–	6.6E-02	0.0E+00	2.1E-03	6.8E-02	15%
Antimony	7.21E-01	1.36E+09	P	NA	NA	NA	NA	–	6.1E-03	0.0E+00	NA	6.1E-03	1%
Arsenic	9.75E+00	1.36E+09	P	3.5E-07	3.2E-08	1.6E-10	3.8E-07	78%	1.1E-01	9.9E-03	NA	1.2E-01	26%
Copper	9.84E+01	1.36E+09	P	NA	NA	NA	NA	–	8.3E-03	0.0E+00	NA	8.3E-03	2%
Iron	3.51E+04	1.36E+09	P	NA	NA	NA	NA	–	1.7E-01	0.0E+00	NA	1.7E-01	37%
Lead	1.55E+02	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Zinc	4.01E+02	1.36E+09	P	NA	NA	NA	NA	–	4.5E-03	0.0E+00	NA	4.5E-03	1%
				Total ELCR			5E-07	100%	Total HI			0.5	100%

[a] Minimum of the volatilization factor (identified with "V") and the particulate emission factor (PEF) (identified with "P"), both derived on Table A.2-11.

–	Not applicable.	HQ	Hazard quotient.	PEF	Particulate emission factor.
ELCR	Excess lifetime cancer risk.	m^3/kg	Cubic meters per kilogram.	VF	Volatilization factor.
EPCs	Exposure point concentration in soil (mg/kg).	mg/kg	Milligrams per kilogram.		
HI	Hazard index (sum of the HQs).	NA	Not available.		

Table A.7.HHRA-10
Risk and Hazard Calculations for Hypothetical Future Construction Worker Exposure to Combined Surface and Subsurface Soil
WESTERN BURNING GROUND
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Equations: (see Table A.2-11)

ELCRo = (EPCs × 1 × 330 × 130 × 1 × CSFo) / (1,000,000 × 70 × 25,550)
ELCRd = (EPCs × 3,300 × 0.3 × ABSd × 130 × 1 × CSFa) / (1,000,000 × 70 × 25,550)
ELCRi = (EPCs × 20 × 130 × 1 × CSFi) / ([VF or PEF] × 70 × 25,550)

HQo = (EPCs × 1 × 330 × 130 × 1) / (1,000,000 × 70 × 182 × RfDo)
HQd = (EPCs × 3,300 × 0.3 × ABSd × 130 × 1) / (1,000,000 × 70 × 182 × RfDa)
HQi = (EPCs × 20 × 130 × 1) / ([VF or PEF] × 70 × 182 × RfDi)

Table A.7.HHRA-11
Risk and Hazard Calculations for Hypothetical Future Adult Resident Exposure to Combined Surface and Subsurface Soil
WESTERN BURNING GROUND
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Adult Resident
Receptor Age: Adult

Constituent	EPCs (mg/kg)	VF *or* PEF [a] (m^3/kg)		CANCER RISK Route-Specific Risk Oral ELCRo	Dermal ELCRd	Inhalation ELCRi	Calculated Risk ELCR	Percent Total ELCR	NON-CANCER HAZARD Route-Specific Hazard Oral HQo	Dermal HQd	Inhalation HQi	Calculated Hazard HI	Percent Total HI
Volatile Organic Compounds													
d-Limonene	1.70E-01	4.05E+03	V	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Semi-Volatile Organic Compounds													
Carbazole	1.00E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Polycyclic Aromatic Hydrocarbons													
Benzo(a)anthracene	7.92E-02	1.36E+09	P	4.0E-08	2.1E-08	NA	6.0E-08	1%	NA	NA	NA	NA	–
Benzo(a)pyrene	1.01E-01	1.36E+09	P	5.1E-07	2.6E-07	3.1E-11	7.7E-07	7%	NA	NA	NA	NA	–
Benzo(b)fluoranthene	1.32E-01	1.36E+09	P	6.6E-08	3.4E-08	NA	1.0E-07	1%	NA	NA	NA	NA	–
Dibenzo(a,h)anthracene	4.44E-02	1.36E+09	P	2.2E-07	1.2E-07	NA	3.4E-07	3%	NA	NA	NA	NA	–
Indeno(1,2,3-cd)pyrene	8.96E-02	1.36E+09	P	4.5E-08	2.3E-08	NA	6.8E-08	1%	NA	NA	NA	NA	–
Dioxin/Furan Compounds													
1,2,3,7,8-PeCDD	1.98E-06	1.36E+09	P	1.2E-07	1.4E-08	1.8E-11	1.4E-07	1%	NA	NA	NA	NA	–
Polychlorinated Biphenyls													
Aroclor 1254	8.70E-01	1.36E+09	P	8.2E-07	4.6E-07	1.2E-10	1.3E-06	12%	6.0E-02	3.3E-02	NA	9.3E-02	37%
Explosives													
Pentaerythritol Tetranitrate	1.10E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Inorganics													
Aluminum	1.96E+04	1.36E+09	P	NA	NA	NA	NA	–	2.7E-02	0.0E+00	2.8E-03	3.0E-02	12%
Antimony	7.21E-01	1.36E+09	P	NA	NA	NA	NA	–	2.5E-03	0.0E+00	NA	2.5E-03	1%
Arsenic	9.75E+00	1.36E+09	P	6.9E-06	8.2E-07	1.0E-08	7.7E-06	74%	4.5E-02	5.3E-03	NA	5.0E-02	20%
Copper	9.84E+01	1.36E+09	P	NA	NA	NA	NA	–	3.4E-03	0.0E+00	NA	3.4E-03	1%
Iron	3.51E+04	1.36E+09	P	NA	NA	NA	NA	–	6.9E-02	0.0E+00	NA	6.9E-02	28%
Lead	1.55E+02	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Zinc	4.01E+02	1.36E+09	P	NA	NA	NA	NA	–	1.8E-03	0.0E+00	NA	1.8E-03	1%
				Total ELCR			1E-05	100%	Total HI			0.2	100%

[a] Minimum of the volatilization factor (identified with "V") and the particulate emission factor (PEF) (identified with "P"), both derived on Table A.2-11.

–	Not applicable.	HQ	Hazard quotient.	PEF	Particulate emission factor.
ELCR	Excess lifetime cancer risk.	m^3/kg	Cubic meters per kilogram.	VF	Volatilization factor.
EPCs	Exposure point concentration in soil (mg/kg).	mg/kg	Milligrams per kilogram.		
HI	Hazard index (sum of the HQs).	NA	Not available.		

Table A.7.HHRA-11
Risk and Hazard Calculations for Hypothetical Future Adult Resident Exposure to Combined Surface and Subsurface Soil
WESTERN BURNING GROUND
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Adult Resident
Receptor Age: Adult

Equations: (see Table A.2-11. Potentially mutagenic carcinogens (i.e., PAHs) adjusted to incorporate ADAFs of 2.1 for 10 years (ages 6 to 16) and 1 for the remaining 14 years as an adult. Oral example: (EPC x 1 x 100 x 350 x CSF/(1,000,000 x 365 x 70)) x ((2.1 x 10/70) + (1 x 14/70)).

ELCRo = (EPCs × 1 × 100 × 350 × 24 × CSFo) / (1,000,000 × 70 × 25,550)
ELCRd = (EPCs × 5,700 × 0.07 × ABSd × 350 × 24 × CSFa) / (1,000,000 × 70 × 25,550)
ELCRi = (EPCs × 20 × 350 × 24 × CSFi) / ([VF or PEF] × 70 × 25,550)

HQo = (EPCs × 1 × 100 × 350 × 24) / (1,000,000 × 70 × 8,760 × RfDo)
HQd = (EPCs × 5,700 × 0.07 × ABSd × 350 × 24) / (1,000,000 × 70 × 8,760 × RfDa)
HQi = (EPCs × 20 × 350 × 24) / ([VF or PEF] × 70 × 8,760 × RfDi)

Table A.7.HHRA-12
Risk and Hazard Calculations for Hypothetical Future Adult Resident Wading Exposure to Sediment
WESTERN BURNING GROUND
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Adult Resident
Receptor Age: Adult

Constituent	EPCsed (mg/kg)	CANCER RISK Route-Specific Risks Oral	Dermal	Calculated Risk	Percent Total ELCR	NON-CANCER RISK Route-Specific Risks Oral	Dermal	Calculated Hazard	Percent Total HI
		ELCRo	ELCRd	ELCR		HQo	HQd	HI	
Semi-Volatile Organic Compounds									
Carbazole	2.10E-01	NA	NA	NA	–	NA	NA	NA	–
Polycyclic Aromatic Hydrocarbons									
Benzo(a)anthracene	2.32E+00	8.0E-08	6.2E-07	7.0E-07	12%	NA	NA	NA	–
Benzo(a)pyrene	6.20E-01	2.1E-07	1.7E-06	1.9E-06	33%	NA	NA	NA	–
Benzo(b)fluoranthene	7.35E-01	2.5E-08	2.0E-07	2.2E-07	4%	NA	NA	NA	–
Dibenzo(a,h)anthracene	5.60E-01	1.9E-07	1.5E-06	1.7E-06	29%	NA	NA	NA	–
Indeno(1,2,3-cd)pyrene	3.06E-01	1.0E-08	8.2E-08	9.2E-08	2%	NA	NA	NA	–
Dioxin/Furan Compounds									
Explosives					–				–
Nitroglycerine	9.60E-01	5.3E-10	3.2E-09	3.7E-09	0%	9.0E-04	5.4E-03	6.3E-03	3%
Inorganics									
Aluminum	1.92E+04	NA	NA	NA	–	1.8E-03	0.0E+00	1.8E-03	1%
Arsenic	8.69E+00	4.2E-07	7.6E-07	1.2E-06	20%	2.7E-03	4.9E-03	7.6E-03	3%
Chromium	6.05E+03	NA	NA	NA	–	1.9E-01	0.0E+00	1.9E-01	84%
Cobalt	2.45E+01	NA	NA	NA	–	7.7E-03	0.0E+00	7.7E-03	3%
Iron	7.47E+04	NA	NA	NA	–	1.0E-02	0.0E+00	1.0E-02	4%
Lead	3.61E+03	NA	NA	NA	–	NA	NA	NA	–
Manganese	8.31E+02	NA	NA	NA	–	5.6E-04	0.0E+00	5.6E-04	0%
Thallium	3.89E-01	NA	NA	NA	–	4.6E-04	0.0E+00	4.6E-04	0%
Vanadium	4.90E+01	NA	NA	NA	–	6.6E-04	0.0E+00	6.6E-04	0%
Zinc	6.81E+03	NA	NA	NA	–	2.1E-03	0.0E+00	2.1E-03	1%
		Total ELCR		6E-06	100%	Total HI		0.2	100%

** HI Segregated by Target Site/Critical Effect:

HI (liver, kidney) =	0.01
HI (CNS, whole body, immune system) =	0.001
HI (blood) =	0.01
HI (fetus, developmental) =	0.00
HI (gastrointestinal tract) =	0.01
HI (eyes, nails, hair, skin) =	0.02
HI (NA, NR) =	0

CNS - Central nervous system
NA - Not available
NR - None reported

Table A.7.HHRA-12
Risk and Hazard Calculations for Hypothetical Future Adult Resident Wading Exposure to Sediment
WESTERN BURNING GROUND
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Adult Resident
Receptor Age: Adult

–	Not applicable.
ELCR	Excess lifetime cancer risk.
EPCsed	Exposure point concentration in sediment (mg/kg).
HI	Hazard index (sum of the HQs).
HQ	Hazard quotient.
mg/kg	Milligrams per kilogram.
NA	Not available.

Equations: (see Table A.2-12. Potentially mutagenic carcinogens (i.e., PAHs) adjusted to incorporate ADAFs of 2.1 for 10 years (ages 6 to 16) and 1 for the remaining 14 years as an adult.
Oral example: (EPC x 50 x 48 x CSF/(1,000,000 x 365 x 70)) x ((2.1 x 10/70) + (1 x 14/70)).

ELCRo = (EPCsed × 50 × 48 × 24 × CSFo) / (1,000,000 × 70 × 25,550)

ELCRd = (EPCsed × 5,000 × 1 × ABSd × 48 × 24 × CSFa) / (1,000,000 × 70 × 25,550)

HQo = (EPCsed × 50 × 48 × 24) / (1,000,000 × 70 × 8,760 × RfDo)

HQd = (EPCsed × 5,000 × 1 × ABSd × 48 × 24) / (1,000,000 × 70 × 8,760 × RfDa)

Table A.7.HHRA-13
Risk and Hazard Calculations for Hypothetical Future Adult Resident Wading Exposure to Surface Water
WESTERN BURNING GROUND
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Adult Resident
Receptor Age: Adult

Constituent	EPCsw (mg/L)	DA [a] (L/cm²/day)	VFsw (L/m³)	CANCER RISK: Route-Specific Risk: Oral	Dermal	Inhalation	Calculated Risk	Percent Total ELCR	NON-CANCER HAZARD: Route-Specific Hazard: Oral	Dermal	Inhalation	Calculated Hazard	Percent Total HI
				ELCRo	ELCRd	ELCRi	ELCR		HQo	HQd	HQi	HI	
Volatile Organic Compounds													
Chloroform	1.29E-03	1.33E-05	4.24E-03	NA	NA	5.9E-10	5.9E-10	0%	1.2E-05	1.6E-05	7.7E-07	2.9E-05	0%
Tetrachloroethene	1.60E-04	8.70E-05	3.79E-03	2.8E-09	2.4E-08	1.7E-11	2.7E-08	4%	1.5E-06	1.3E-05	3.1E-08	1.5E-05	0%
Herbicides													
MCPP	5.41E-02	0.00E+00	2.38E-07	NA	NA	NA	NA	–	5.1E-03	0.0E+00	NA	5.1E-03	12%
Pesticides													
Dieldrin	9.01E-06	1.01E-04	1.40E-04	4.6E-09	4.7E-08	2.8E-11	5.2E-08	8%	1.7E-05	1.7E-04	NA	1.9E-04	0%
Inorganics													
Arsenic	1.04E-02	1.00E-06	NA	5.0E-07	5.0E-08	NA	5.5E-07	87%	3.3E-03	3.3E-04	NA	3.6E-03	8%
Iron	3.99E+01	1.00E-06	NA	NA	NA	NA	NA	–	5.4E-03	5.4E-04	NA	5.9E-03	14%
Lead	1.93E-02	1.00E-07	NA	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Manganese	1.15E+00	1.00E-06	NA	NA	NA	NA	NA	–	5.4E-03	1.4E-02	NA	1.9E-02	45%
Thallium	5.40E-03	1.00E-06	NA	NA	NA	NA	NA	–	6.3E-03	6.3E-04	NA	7.0E-03	16%
Vanadium	2.60E-02	1.00E-06	NA	NA	NA	NA	NA	–	3.5E-04	1.3E-03	NA	1.7E-03	4%
					Total ELCR		6E-07	100%		Total HI		0.04	100%

[a] The dermal absorption factor (DA) was calculated using Equation [0], [1], or [2], as indicated, from Table A.2-13.

–	Not applicable.	HQ	Hazard quotient.	NA	Not available.
ELCR	Excess lifetime cancer risk.	L/cm²/day	Liters per square centimeter per day.	VFsw	Volatilization factor for surface water.
EPCsw	Exposure point concentration in surface water.	L/m^3	Liters per cubic meter.		
HI	Hazard index (sum of the HQs).	mg/L	Milligrams per liter.		

Equations: (see Table A.2-13)

3.75 = Um = Mean annual wind speed (m/sec) for Roanoke, Virginia (USDOE 1986).

ELCRo = (EPCsw × 0.05 × 1 × 48 × 24 × CSFo) / (70 × 25,550)
ELCRd = (EPCsw × DA × 5,000 × 48 × 24 × CSFa) / (70 × 25,550)
ELCRi = (EPCsw × VFsw × 2 × 48 × 24 × CSFi) / (70 × 25,550)

HQo = (EPCsw × 0.05 × 1 × 48 × 24) / (70 × 8,760 × RfDo)
HQd = (EPCsw × DA × 5,000 × 48 × 24) / (70 × 8,760 × RfDa)
HQi = (EPCsw × VFsw × 2 × 48 × 24) / (70 × 8,760 × RfDi)

Table A.7.HHRA-14
Risk and Hazard Calculations for Hypothetical Future Adult Receptor from Consumption of Fish
WESTERN BURNING GROUND
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Adult Resident
Receptor Age: Adult

Constituent	EPCfish (mg/kg)	CANCER RISK	Percent Total ELCR	NON-CANCER RISK Oral	Percent Total HI
		ELCRo		HQo	
Inorganics					
Barium	1.00E+00	NA	–	3.7E-03	1%
Chromium	2.40E-01	NA	–	5.9E-02	19%
Copper	5.60E-01	NA	–	1.0E-02	3%
Iron	1.19E+01	NA	–	1.3E-02	4%
Manganese	7.60E-01	NA	–	4.0E-03	1%
Mercury	8.70E-02	NA	–	2.1E-01	70%
Zinc	1.35E+01	NA	–	3.3E-02	11%
Total		NA		0.3	

–	Not applicable.	HQ	Hazard quotient.
ELCR	Excess lifetime cancer risk.	mg/kg	Milligrams per kilogram.
EPCfish	Exposure point concentration in fish fillet (mg/kg).	NA	Not available.
HI	Hazard index (sum of the HQs).		

Equations: (see Table A.2-14)
ELCRo = (EPCfish × 0.054 × 350 × 24 × CSFo) / (70 × 25,550)
HQo = (EPCfish × 0.054 × 350 × 24) / (70 × 8,760 × RfDo)

Table A.7.HHRA-15
Risk and Hazard Calculations for Hypothetical Future Child Resident Exposure to Combined Surface and Subsurface Soil
WESTERN BURNING GROUND
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Child Resident
Receptor Age: Child

Constituent	EPCs (mg/kg)	VF *or* PEF [a] (m^3/kg)		CANCER RISK Route-Specific Risk Oral	Dermal	Inhalation	Calculated Risk	Percent Total ELCR	NON-CANCER HAZARD Route-Specific Hazard Oral	Dermal	Inhalation	Calculated Hazard	Percent Total HI
				ELCRo	ELCRd	ELCRi	ELCR		HQo	HQd	HQi	HI	
Volatile Organic Compounds													
d-Limonene	1.70E-01	4.05E+03	V	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Semi-Volatile Organic Compounds													
Carbazole	1.00E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Polycyclic Aromatic Hydrocarbons													
Benzo(a)anthracene	7.92E-02	1.36E+09	P	1.9E-07	6.8E-08	NA	2.5E-07	1%	NA	NA	NA	NA	–
Benzo(a)pyrene	1.01E-01	1.36E+09	P	2.4E-06	8.6E-07	3.7E-11	3.2E-06	12%	NA	NA	NA	NA	–
Benzo(b)fluoranthene	1.32E-01	1.36E+09	P	3.1E-07	1.1E-07	NA	4.2E-07	2%	NA	NA	NA	NA	–
Dibenzo(a,h)anthracene	4.44E-02	1.36E+09	P	1.0E-06	3.8E-07	NA	1.4E-06	5%	NA	NA	NA	NA	–
Indeno(1,2,3-cd)pyrene	8.96E-02	1.36E+09	P	2.1E-07	7.7E-08	NA	2.9E-07	1%	NA	NA	NA	NA	–
Dioxin/Furan Compounds													
1,2,3,7,8-PeCDD	1.98E-06	1.36E+09	P	2.8E-07	2.4E-08	1.1E-11	3.1E-07	1%	NA	NA	NA	NA	–
Polychlorinated Biphenyls													
Aroclor 1254	8.70E-01	1.36E+09	P	1.9E-06	7.5E-07	7.0E-11	2.7E-06	10%	5.6E-01	2.2E-01	NA	7.7E-01	35%
Explosives													
Pentaerythritol Tetranitrate	1.10E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Inorganics													
Aluminum	1.96E+04	1.36E+09	P	NA	NA	NA	NA	–	2.5E-01	0.0E+00	6.4E-03	2.6E-01	12%
Antimony	7.21E-01	1.36E+09	P	NA	NA	NA	NA	–	2.3E-02	0.0E+00	NA	2.3E-02	1%
Arsenic	9.75E+00	1.36E+09	P	1.6E-05	1.3E-06	5.9E-09	1.7E-05	67%	4.2E-01	3.5E-02	NA	4.5E-01	21%
Copper	9.84E+01	1.36E+09	P	NA	NA	NA	NA	–	3.1E-02	0.0E+00	NA	3.1E-02	1%
Iron	3.51E+04	1.36E+09	P	NA	NA	NA	NA	–	6.4E-01	0.0E+00	NA	6.4E-01	29%
Lead	1.55E+02	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Zinc	4.01E+02	1.36E+09	P	NA	NA	NA	NA	–	1.7E-02	0.0E+00	NA	1.7E-02	1%
				Total ELCR			3E-05	100%	Total HI **			2	100%

** HI Segregated by Target Site/Critical Effect:	HI (liver, kidney) =	0.6	HI (gastrointestinal tract) =	0.7
CNS - Central nervous system	HI (CNS, whole body, immune system) =	0.8	HI (nasal, lung) =	0
NA - Not available	HI (blood) =	0.7	HI (eyes, nails, hair, skin) =	1
NR - None reported	HI (fetus, developmental) =	0.3	HI (NA, NR) =	0

[a] Minimum of the volatilization factor (identified with "V") and the particulate emission factor (PEF) (identified with "P"), both derived on Table A.2-11.

–	Not applicable.	HQ	Hazard quotient.	PEF	Particulate emission factor.
ELCR	Excess lifetime cancer risk.	m^3/kg	Cubic meters per kilogram.	VF	Volatilization factor.
EPCs	Exposure point concentration in soil (mg/kg).	mg/kg	Milligrams per kilogram.		
HI	Hazard index (sum of the HQs).	NA	Not available.		

Table A.7.HHRA-15
Risk and Hazard Calculations for Hypothetical Future Child Resident Exposure to Combined Surface and Subsurface Soil
WESTERN BURNING GROUND
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Child Resident
Receptor Age: Child

Equations: (see Table A.2-11. Potentially mutagenic carcinogens (i.e., PAHs) adjusted to incorporate ADAFs of 4.6 for 2 years (ages 0 to 2) and 2.1 for 4 years (ages 2 to 6). Oral example: (EPC x 1 x 200 x 350 x CSF/(1,000,000 x 365 x 15)) x ((4.6 x 2/70) + (2.1 x 4/70)).

ELCRo = (EPCs × 1 × 200 × 350 × 6 × CSFo) / (1,000,000 × 15 × 25,550)
ELCRd = (EPCs × 2,800 × 0.2 × ABSd × 350 × 6 × CSFa) / (1,000,000 × 15 × 25,550)
ELCRi = (EPCs × 10 × 350 × 6 × CSFi) / ([VF or PEF] × 15 × 25,550)

HQo = (EPCs × 1 × 200 × 350 × 6) / (1,000,000 × 15 × 2,190 × RfDo)
HQd = (EPCs × 2,800 × 0.2 × ABSd × 350 × 6) / (1,000,000 × 15 × 2,190 × RfDa)
HQi = (EPCs × 10 × 350 × 6) / ([VF or PEF] × 15 × 2,190 × RfDi)

Table A.7.HHRA-16
Risk and Hazard Calculations for Hypothetical Future Child Resident Wading Exposure to Sediment
WESTERN BURNING GROUND
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Child Resident
Receptor Age: Child

		CANCER RISK			Percent	NON-CANCER RISK			Percent
	EPCsed	Route-Specific Risks		Calculated	Total	Route-Specific Risks		Calculated	Total
Constituent	(mg/kg)	Oral	Dermal	Risk	ELCR	Oral	Dermal	Hazard	HI
		ELCRo	ELCRd	ELCR		HQo	HQd	HI	
Semi-Volatile Organic Compounds									
Carbazole	2.10E-01	NA	NA	NA	–	NA	NA	NA	–
Polycyclic Aromatic Hydrocarbons									
Benzo(a)anthracene	2.32E+00	3.7E-07	1.8E-07	5.6E-07	12%	NA	NA	NA	–
Benzo(a)pyrene	6.20E-01	1.0E-06	4.9E-07	1.5E-06	31%	NA	NA	NA	–
Benzo(b)fluoranthene	7.35E-01	1.2E-07	5.8E-08	1.8E-07	4%	NA	NA	NA	–
Dibenzo(a,h)anthracene	5.60E-01	9.0E-07	4.5E-07	1.3E-06	28%	NA	NA	NA	–
Indeno(1,2,3-cd)pyrene	3.06E-01	4.9E-08	2.4E-08	7.4E-08	2%	NA	NA	NA	–
Dioxin/Furan Compounds									
Explosives					–				–
Nitroglycerine	9.60E-01	1.2E-09	4.7E-10	1.7E-09	0%	8.4E-03	3.2E-03	1.2E-02	1%
Inorganics									
Aluminum	1.92E+04	NA	NA	NA	–	1.7E-02	0.0E+00	1.7E-02	1%
Arsenic	8.69E+00	9.8E-07	1.1E-07	1.1E-06	23%	2.5E-02	2.9E-03	2.8E-02	1%
Chromium	6.05E+03	NA	NA	NA	–	1.8E+00	0.0E+00	1.8E+00	87%
Cobalt	2.45E+01	NA	NA	NA	–	7.2E-02	0.0E+00	7.2E-02	4%
Iron	7.47E+04	NA	NA	NA	–	9.4E-02	0.0E+00	9.4E-02	5%
Lead	3.61E+03	NA	NA	NA	–	NA	NA	NA	–
Manganese	8.31E+02	NA	NA	NA	–	5.2E-03	0.0E+00	5.2E-03	0%
Thallium	3.89E-01	NA	NA	NA	–	4.3E-03	0.0E+00	4.3E-03	0%
Vanadium	4.90E+01	NA	NA	NA	–	6.1E-03	0.0E+00	6.1E-03	0%
Zinc	6.81E+03	NA	NA	NA	–	2.0E-02	0.0E+00	2.0E-02	1%
		Total ELCR		5E-06	100%	Total HI **		2	100%

** HI Segregated by Target Site/Critical Effect:

HI (liver, kidney) =	0.1	HI (gastrointestinal tract) =	0.09
HI (CNS, whole body, immune system) =	0.005	HI (eyes, nails, hair, skin) =	0.1
HI (blood) =	0.1	HI (NA, NR) =	2
HI (fetus, developmental) =	0.02		

CNS - Central nervous system
NA - Not available
NR - None reported

Table A.7.HHRA-16
Risk and Hazard Calculations for Hypothetical Future Child Resident Wading Exposure to Sediment
WESTERN BURNING GROUND
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Child Resident
Receptor Age: Child

–	Not applicable.	HQ	Hazard quotient.
ELCR	Excess lifetime cancer risk.	mg/kg	Milligrams per kilogram.
EPCsed	Exposure point concentration in sediment (mg/kg).	NA	Not available.
HI	Hazard index (sum of the HQs).		

Equations: (see Table A.2-12. Potentially mutagenic carcinogens (i.e., PAHs) adjusted to incorporate ADAFs of 4.6 for 2 years (ages 0 to 2) and 2.1 for 4 years (ages 2 to 6). Oral example: (EPC x 100 x 48 x CSF/(1,000,000 x 365 x 15)) x ((4.6 x 2/70) + (2.1 x 4/70)).

ELCRo = (EPCsed × 100 × 48 × 6 × CSFo) / (1,000,000 × 15 × 25,550)

ELCRd = (EPCsed × 1,900 × 0.2 × ABSd × 48 × 6 × CSFa) / (1,000,000 × 15 × 25,550)

HQo = (EPCsed × 100 × 48 × 6) / (1,000,000 × 15 × 2,190 × RfDo)

HQd = (EPCsed × 1,900 × 0.2 × ABSd × 48 × 6) / (1,000,000 × 15 × 2,190 × RfDa)

Table A.7.HHRA-17
Risk and Hazard Calculations for Hypothetical Future Child Resident Wading Exposure to Surface Water
WESTERN BURNING GROUND
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Child Resident
Receptor Age: Child

Constituent	EPCsw (mg/L)	DA [a] (L/cm²/day)	VFsw (L/m³)	CANCER RISK Route-Specific Risk Oral	Dermal	Inhalation	Calculated Risk	Percent Total ELCR	NON-CANCER HAZARD Route-Specific Hazard Oral	Dermal	Inhalation	Calculated Hazard	Percent Total HI
				ELCRo	ELCRd	ELCRi	ELCR		HQo	HQd	HQi	HI	
Volatile Organic Compounds													
Chloroform	1.29E-03	1.33E-05	4.24E-03	NA	NA	6.6E-10	6.6E-10	0%	5.7E-05	2.9E-05	3.4E-06	8.9E-05	0%
Tetrachloroethene	1.60E-04	8.70E-05	3.79E-03	3.2E-09	1.1E-08	1.9E-11	1.4E-08	2%	7.0E-06	2.3E-05	1.4E-07	3.0E-05	0%
Herbicides													
MCPP	5.41E-02	0.00E+00	2.38E-07	NA	NA	NA	NA	–	2.4E-02	0.0E+00	NA	2.4E-02	16%
Pesticides													
Dieldrin	9.01E-06	1.01E-04	1.40E-04	5.4E-09	2.1E-08	3.1E-11	2.6E-08	4%	7.9E-05	3.0E-04	NA	3.8E-04	0%
Inorganics													
Arsenic	1.04E-02	1.00E-06	NA	5.9E-07	2.2E-08	NA	6.1E-07	94%	1.5E-02	5.8E-04	NA	1.6E-02	11%
Iron	3.99E+01	1.00E-06	NA	NA	NA	NA	NA	–	2.5E-02	9.5E-04	NA	2.6E-02	17%
Lead	1.93E-02	1.00E-07	NA	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Manganese	1.15E+00	1.00E-06	NA	NA	NA	NA	NA	–	2.5E-02	2.4E-02	NA	4.9E-02	33%
Thallium	5.40E-03	1.00E-06	NA	NA	NA	NA	NA	–	3.0E-02	1.1E-03	NA	3.1E-02	20%
Vanadium	2.60E-02	1.00E-06	NA	NA	NA	NA	NA	–	1.6E-03	2.4E-03	NA	4.0E-03	3%
				Total ELCR			6E-07	100%	Total HI			0.1	100%

[a] The dermal absorption factor (DA) was calculated using Equation [0], [1], or [2], as indicated, from Table 2-13.

– Not applicable.
ELCR Excess lifetime cancer risk.
EPCsw Exposure point concentration in surface water.
HI Hazard index (sum of the HQs).
HQ Hazard quotient.
L/cm²/day Liters per square centimeter per day.
L/m^3 Liters per cubic meter.
mg/L Milligrams per liter.
NA Not available.
VFsw Volatilization factor for surface water.

Equations: (see Table A.2-13)

3.75 = Um = Mean annual wind speed (m/sec) for Roanoke, Virginia (USDOE 1986).

ELCRo = (EPCsw × 0.050 × 1 × 48 × 6 × CSFo) / (15 × 25,550)
ELCRd = (EPCsw × DA × 1,900 × 48 × 6 × CSFa) / (15 × 25,550)
ELCRi = (EPCsw × VFsw × 2 × 48 × 6 × CSFi) / (15 × 25,550)

HQo = (EPCsw × 0.050 × 1 × 48 × 6) / (15 × 2,190 × RfDo)
HQd = (EPCsw × DA × 1,900 × 48 × 6) / (15 × 2,190 × RfDa)
HQi = (EPCsw × VFsw × 2 × 48 × 6) / (15 × 2,190 × RfDi)

Table A.7.HHRA-18
Risk and Hazard Calculations for Hypothetical Future Child Receptor from Consumption of Fish
WESTERN BURNING GROUND
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Child Resident
Receptor Age: Child

Constituent	EPCfish (mg/kg)	CANCER RISK	Percent Total ELCR	NON-CANCER RISK Oral	Percent Total HI
		ELCRo		HQo	
Inorganics					
Barium	1.00E+00	NA	–	1.7E-02	1%
Chromium	2.40E-01	NA	–	2.8E-01	19%
Copper	5.60E-01	NA	–	4.8E-02	3%
Iron	1.19E+01	NA	–	5.9E-02	4%
Manganese	7.60E-01	NA	–	1.9E-02	1%
Mercury	8.70E-02	NA	–	1.0E+00	70%
Zinc	1.35E+01	NA	–	1.6E-01	11%
Total		NA		1	

– Not applicable.
ELCR Excess lifetime cancer risk.
EPCfish Exposure point concentration in fish fillet (mg/kg).
HI Hazard index (sum of the HQs).
HQ Hazard quotient.
mg/kg Milligrams per kilogram.
NA Not available.

Equations: (see Table A.2-14)
ELCRo = (EPCfish × 0.054 × 350 × 6 × CSFo) / (15 × 25,550)
HQo = (EPCfish × 0.054 × 350 × 6) / (15 × 2,190 × RfDo)

[illegible]-19
[illegible]
[illegible]
[illegible]
[illegible]

Scenario Timeframe: Future
Receptor Population: Adult Resident
Receptor Age: Adult

Constituent	EPCsed (mg/kg)	CANCER RISK Route-Specific Risks Oral	Dermal	Calculated Risk	Percent Total ELCR	NON-CANCER RISK Route-Specific Risks Oral	Dermal	Calculated Hazard	Percent Total HI
		ELCRo	ELCRd	ELCR		HQo	HQd	HI	
[illegible]									
Carbazole	2.10E-01	NA	NA	NA		NA	NA	NA	
[illegible]									
Benzo(a)anthracene	2.32E+00	3.3E-09	2.6E-08	2.9E-08	12%	NA	NA	NA	
Benzo(a)pyrene	6.20E-01	8.9E-09	6.9E-08	7.8E-08	33%	NA	NA	NA	
Benzo(b)fluoranthene	7.35E-01	1.1E-09	8.2E-09	9.2E-09	4%	NA	NA	NA	
Dibenzo(a,h)anthracene	5.60E-01	8.0E-09	6.2E-08	7.0E-08	29%	NA	NA	NA	
Indeno(1,2,3-cd)pyrene	3.06E-01	4.4E-10	3.4E-09	3.8E-09	2%	NA	NA	NA	
[illegible]									
[illegible]									
Nitroglycerine	9.60E-01	2.2E-11	1.3E-10	1.5E-10	0%	3.8E-05	2.3E-04	2.6E-04	3%
[illegible]									
Aluminum	1.92E+04	NA	NA	NA		7.5E-05	0.0E+00	7.5E-05	1%
Arsenic	8.69E+00	1.7E-08	3.1E-08	4.9E-08	20%	1.1E-04	2.0E-04	3.2E-04	3%
Chromium	6.05E+03	NA	NA	NA		7.9E-03	0.0E+00	7.9E-03	84%
Cobalt	2.45E+01	NA	NA	NA		3.2E-04	0.0E+00	3.2E-04	3%
Iron	7.47E+04	NA	NA	NA		4.2E-04	0.0E+00	4.2E-04	4%
Lead	3.61E+03	NA	NA	NA		NA	NA	NA	
Manganese	8.31E+02	NA	NA	NA		2.3E-05	0.0E+00	2.3E-05	0%
Thallium	3.89E-01	NA	NA	NA		1.9E-05	0.0E+00	1.9E-05	0%
Vanadium	4.90E+01	NA	NA	NA		2.7E-05	0.0E+00	2.7E-05	0%
Zinc	6.81E+03	NA	NA	NA		8.9E-05	0.0E+00	8.9E-05	1%
		Total ELCR		2E-07	100%	Total HI		0.009	100%

HI Segregated by Target Site/Critical Effect:

CNS - Central nervous system	HI (liver, kidney) =	0.0005	HI (gastrointestinal tract) =	0.0004
NA - Not available	HI (CNS, whole body, immune system) =	0.00002	HI (eyes, nails, hair, skin) =	0.0007
NR - None reported	HI (blood) =	0.0005	HI (NA, NR) =	0.008
	HI (fetus, developmental) =	0.00007		

[illegible]-19

[illegible]

Scenario Timeframe: Future
Receptor Population: Adult Resident
Receptor Age: Adult

□	Not applicable.	H□	Ha□ard quotient.
ELCR	E□cess lifetime cancer risk.	mg/kg	Milligrams per kilogram.
EPCsed	E□posure point concentration in sediment (mg/kg).	NA	Not available.
HI	Ha□ard inde□ (sum of the H□s).		

Equations: (see Table A.2-12. Potentially mutagenic carcinogens (i.e., PAHs) ad□usted to incorporate ADAFs of 2.1 for 10 years (ages 6 to 16) and 1 for the remaining 14 years as an adult.
Oral e□ample: (EPC □50 □2 □CSF/(1,000,000 □365 □70)) □((2.1 □10/70) □(1 □14/70)).

ELCRo □ (EPCsed □ 50 □ 2 □ 24 □ CSFo) / (1,000,000 □ 70 □ 25,550)

ELCRd □ (EPCsed □ 5,000 □ 1 □ ABSd □ 2 □ 24 □ CSFa) / (1,000,000 □ 70 □ 25,550)

H□o □ (EPCsed □ 50 □ 2 □ 24) / (1,000,000 □ 70 □ 8,760 □ RfDo)

H□d □ (EPCsed □ 5,000 □ 1 □ ABSd □ 2 □ 24) / (1,000,000 □ 70 □ 8,760 □ RfDa)

[illegible]

Scenario Timeframe: Future	
Receptor Population: Child Resident	
Receptor Age: Child	

Constituent	EPCsed (mg/kg)	CANCER RISK: Route-Specific Risks Oral (ELCRo)	Dermal (ELCRd)	Calculated Risk (ELCR)	Percent Total ELCR	NON-CANCER RISK: Route-Specific Risks Oral (HQo)	Dermal (HQd)	Calculated Hazard (HI)	Percent Total HI
[illegible]									
Carbazole	2.10E-01	NA	NA	NA		NA	NA	NA	
[illegible]									
Benzo(a)anthracene	2.32E+00	1.6E-08	7.7E-09	2.3E-08	12%	NA	NA	NA	
Benzo(a)pyrene	6.20E-01	4.2E-08	2.1E-08	6.2E-08	31%	NA	NA	NA	
Benzo(b)fluoranthene	7.35E-01	4.9E-09	2.4E-09	7.4E-09	4%	NA	NA	NA	
Dibenzo(a,h)anthracene	5.60E-01	3.8E-08	1.9E-08	5.6E-08	28%	NA	NA	NA	
Indeno(1,2,3-cd)pyrene	3.06E-01	2.1E-09	1.0E-09	3.1E-09	2%	NA	NA	NA	
[illegible]									
[illegible]									
Nitroglycerine	9.60E-01	5.1E-11	1.9E-11	7.1E-11	0%	3.5E-04	1.3E-04	4.8E-04	1%
[illegible]									
Aluminum	1.92E+04	NA	NA	NA		7.0E-04	0.0E+00	7.0E-04	1%
Arsenic	8.69E+00	4.1E-08	4.7E-09	4.5E-08	23%	1.1E-03	1.2E-04	1.2E-03	1%
Chromium	6.05E+03	NA	NA	NA		7.4E-02	0.0E+00	7.4E-02	87%
Cobalt	2.45E+01	NA	NA	NA		3.0E-03	0.0E+00	3.0E-03	4%
Iron	7.47E+04	NA	NA	NA		3.9E-03	0.0E+00	3.9E-03	5%
Lead	3.61E+03	NA	NA	NA		NA	NA	NA	
Manganese	8.31E+02	NA	NA	NA		2.2E-04	0.0E+00	2.2E-04	0%
Thallium	3.89E-01	NA	NA	NA		1.8E-04	0.0E+00	1.8E-04	0%
Vanadium	4.90E+01	NA	NA	NA		2.6E-04	0.0E+00	2.6E-04	0%
Zinc	6.81E+03	NA	NA	NA		8.3E-04	0.0E+00	8.3E-04	1%
		Total ELCR		2E-07	100%	Total HI		0.08	100%

HI Segregated by Target Site/Critical Effect:

HI (liver, kidney) =	0.004
HI (CNS, whole body, immune system) =	0.0002
HI (blood) =	0.005
HI (fetus, developmental) =	0.0007
HI (gastrointestinal tract) =	0.004
HI (eyes, nails, hair, skin) =	0.004
HI (NA, NR) =	0.07

CNS - Central nervous system
NA - Not available
NR - None reported

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Scenario Timeframe: Future Receptor Population: Child Resident Receptor Age: Child

--	Not applicable.	HQ	Hazard quotient.
ELCR	Excess lifetime cancer risk.	mg/kg	Milligrams per kilogram.
EPCsed	Exposure point concentration in sediment (mg/kg).	NA	Not available.
HI	Hazard index (sum of the HQs).		

Equations: (see Table A.2-12. Potentially mutagenic carcinogens (i.e., PAHs) adjusted to incorporate ADAFs of 4.6 for 2 years (ages 0 to 2) and 2.1 for 4 years (ages 2 to 6). Oral example: (EPC × 100 × 2 × CSF/(1,000,000 × 365 × 15)) × ((4.6 × 2/70) + (2.1 × 4/70)).

ELCRo = (EPCsed × 100 × 2 × 6 × CSFo) / (1,000,000 × 15 × 25,550)

ELCRd = (EPCsed × 1,900 × 0.2 × ABSd × 2 × 6 × CSFa) / (1,000,000 × 15 × 25,550)

HQo = (EPCsed × 100 × 2 × 6) / (1,000,000 × 15 × 2,190 × RfDo)

HQd = (EPCsed × 1,900 × 0.2 × ABSd × 2 × 6) / (1,000,000 × 15 × 2,190 × RfDa)

Table A.7.HHRA-21
Risk and Hazard Calculations for Site Worker Exposure to Combined Surface Soil and Sediment
WESTERN BURNING GROUND
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Current / Future
Receptor Population: Site Worker
Receptor Age: Adult

Constituent	EPCs (mg/kg)	VF *or* PEF [a] (m^3/kg)		CANCER RISK Route-Specific Risk Oral ELCRo	Dermal ELCRd	Inhalation ELCRi	Calculated Risk ELCR	Percent Total ELCR	NON-CANCER HAZARD Route-Specific Hazard Oral HQo	Dermal HQd	Inhalation HQi	Calculated Hazard HI	Percent Total HI
Volatile Organic Compounds													
d-Limonene	1.70E-01	4.05E+03	V	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Semi-Volatile Organic Compounds													
Carbazole	1.21E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Polycyclic Aromatic Hydrocarbons													
Benzo(a)anthracene	2.57E-01	1.36E+09	P	6.6E-08	5.6E-08	NA	1.2E-07	1%	NA	NA	NA	NA	–
Benzo(a)pyrene	2.59E-01	1.36E+09	P	6.6E-07	5.7E-07	4.1E-11	1.2E-06	11%	NA	NA	NA	NA	–
Benzo(b)fluoranthene	3.36E-01	1.36E+09	P	8.6E-08	7.4E-08	NA	1.6E-07	1%	NA	NA	NA	NA	–
Dibenzo(a,h)anthracene	6.29E-02	1.36E+09	P	1.6E-07	1.4E-07	NA	3.0E-07	3%	NA	NA	NA	NA	–
Indeno(1,2,3-cd)pyrene	1.62E-01	1.36E+09	P	4.1E-08	3.5E-08	NA	7.7E-08	1%	NA	NA	NA	NA	–
Explosives													
Nitroglycerine	9.60E-01	1.36E+09	P	5.7E-09	3.8E-09	NA	9.5E-09	0%	9.4E-03	6.2E-03	NA	1.6E-02	3%
Pentaerythritol Tetranitrate	1.10E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Inorganics													
Aluminum	1.89E+04	1.36E+09	P	NA	NA	NA	NA	–	1.9E-02	0.0E+00	1.9E-03	2.0E-02	4%
Antimony	8.00E-01	1.36E+09	P	NA	NA	NA	NA	–	2.0E-03	0.0E+00	NA	2.0E-03	0%
Arsenic	1.12E+01	1.36E+09	P	5.9E-06	1.2E-06	8.7E-09	7.1E-06	65%	3.7E-02	7.3E-03	NA	4.4E-02	9%
Chromium	8.77E+02	1.36E+09	P	NA	NA	1.9E-06	1.9E-06	17%	2.9E-01	0.0E+00	1.3E-03	2.9E-01	58%
Cobalt	1.29E+01	1.36E+09	P	NA	NA	2.1E-08	2.1E-08	0%	4.2E-02	0.0E+00	1.1E-03	4.3E-02	9%
Copper	1.12E+02	1.36E+09	P	NA	NA	NA	NA	–	2.7E-03	0.0E+00	NA	2.7E-03	1%
Iron	3.83E+04	1.36E+09	P	NA	NA	NA	NA	–	5.4E-02	0.0E+00	NA	5.4E-02	11%
Lead	7.87E+03	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Manganese	3.88E+02	1.36E+09	P	NA	NA	NA	NA	–	2.7E-03	0.0E+00	3.9E-03	6.6E-03	1%
Thallium	2.82E-01	1.36E+09	P	NA	NA	NA	NA	–	3.4E-03	0.0E+00	NA	3.4E-03	1%
Vanadium	6.02E+01	1.36E+09	P	NA	NA	NA	NA	–	8.4E-03	0.0E+00	NA	8.4E-03	2%
Zinc	1.46E+03	1.36E+09	P	NA	NA	NA	NA	–	4.8E-03	0.0E+00	NA	4.8E-03	1%
					Total ELCR		1E-05	100%		Total HI		0.5	100%

[a] Minimum of the volatilization factor (identified with "V") and the particulate emission factor (PEF) (identified with "P"), both derived on Table A.2-11.

–	Not applicable.	HQ	Hazard quotient.	PEF	Particulate emission factor.
ELCR	Excess lifetime cancer risk.	m^3/kg	Cubic meters per kilogram.	VF	Volatilization factor.
EPCs	Exposure point concentration in surface soil (mg/kg).	mg/kg	Milligrams per kilogram.		
HI	Hazard index (sum of the HQs).	NA	Not available.		

Equations: (see Table A.2-11)

ELCRo = (EPCs × 1 × 100 × 250 × 25 × CSFo) / (1,000,000 × 70 × 25,550)

HQo = (EPCs × 1 × 100 × 250 × 25) / (1,000,000 × 70 × 9,125 × RfDo)

Table A.7.HHRA-21
Risk and Hazard Calculations for Site Worker Exposure to Combined Surface Soil and Sediment
WESTERN BURNING GROUND
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Current / Future
Receptor Population: Site Worker
Receptor Age: Adult

ELCRd = (EPCs × 3,300 × 0.2 × ABSd × 250 × 25 × CSFa) / (1,000,000 × 70 × 25,550)
ELCRi = (EPCs × 20 × 250 × 25 × CSFi) / ([VF or PEF] × 70 × 25,550)

HQd = (EPCs × 3,300 × 0.2 × ABSd × 250 × 25) / (1,000,000 × 70 × 9,125 × RfDa)
HQi = (EPCs × 20 × 250 × 25) / ([VF or PEF] × 70 × 9,125 × RfDi)

Table A.7.HHRA-22
Risk and Hazard Calculations for Hypothetical Future Construction Worker Exposure to Combined Surface and Subsurface Soil and Sediment
WESTERN BURNING GROUND
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Constituent	EPCs (mg/kg)	VF *or* PEF [a] (m^3/kg)		CANCER RISK Route-Specific Risk Oral ELCRo	Dermal ELCRd	Inhalation ELCRi	Calculated Risk ELCR	Percent Total ELCR	NON-CANCER HAZARD Route-Specific Hazard Oral HQo	Dermal HQd	Inhalation HQi	Calculated Hazard HI	Percent Total HI
Volatile Organic Compounds													
d-Limonene	1.70E-01	4.05E+03	V	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Semi-Volatile Organic Compounds													
Carbazole	1.21E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Polycyclic Aromatic Hydrocarbons													
Benzo(a)anthracene	2.57E-01	1.36E+09	P	4.5E-09	1.8E-09	NA	6.3E-09	1%	NA	NA	NA	NA	–
Benzo(a)pyrene	2.59E-01	1.36E+09	P	4.5E-08	1.8E-08	8.6E-13	6.3E-08	11%	NA	NA	NA	NA	–
Benzo(b)fluoranthene	3.36E-01	1.36E+09	P	5.9E-09	2.3E-09	NA	8.2E-09	1%	NA	NA	NA	NA	–
Dibenzo(a,h)anthracene	6.29E-02	1.36E+09	P	1.1E-08	4.3E-09	NA	1.5E-08	3%	NA	NA	NA	NA	–
Indeno(1,2,3-cd)pyrene	1.62E-01	1.36E+09	P	2.8E-09	1.1E-09	NA	3.9E-09	1%	NA	NA	NA	NA	–
Dioxin/Furan Compounds													
1,2,3,7,8-PeCDD	1.73E-06	1.36E+09	P	5.4E-09	4.9E-10	2.5E-13	5.9E-09	1%	NA	NA	NA	NA	–
Polychlorinated Biphenyls													
Aroclor 1254	8.40E-02	1.36E+09	P	4.0E-09	1.7E-09	1.8E-13	5.7E-09	1%	5.7E-03	2.4E-03	NA	8.0E-03	1%
Explosives													
Nitroglycerine	9.60E-01	1.36E+09	P	3.9E-10	1.2E-10	NA	5.1E-10	0%	3.2E-02	9.7E-03	NA	4.2E-02	5%
Pentaerythritol Tetranitrate	1.10E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Inorganics													
Aluminum	1.89E+04	1.36E+09	P	NA	NA	NA	NA	–	6.4E-02	0.0E+00	2.0E-03	6.6E-02	8%
Antimony	8.00E-01	1.36E+09	P	NA	NA	NA	NA	–	6.7E-03	0.0E+00	NA	6.7E-03	1%
Arsenic	1.12E+01	1.36E+09	P	4.0E-07	3.6E-08	1.8E-10	4.4E-07	75%	1.3E-01	1.1E-02	NA	1.4E-01	17%
Chromium	8.77E+02	1.36E+09	P	NA	NA	3.9E-08	3.9E-08	7%	1.5E-01	0.0E+00	4.4E-03	1.5E-01	19%
Cobalt	1.29E+01	1.36E+09	P	NA	NA	4.3E-10	4.3E-10	0%	1.5E-01	0.0E+00	3.4E-04	1.5E-01	18%
Copper	1.12E+02	1.36E+09	P	NA	NA	NA	NA	–	9.5E-03	0.0E+00	NA	9.5E-03	1%
Iron	3.83E+04	1.36E+09	P	NA	NA	NA	NA	–	1.8E-01	0.0E+00	NA	1.8E-01	23%
Lead	7.87E+03	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Manganese	3.88E+02	1.36E+09	P	NA	NA	NA	NA	–	9.3E-03	0.0E+00	4.1E-03	1.3E-02	2%
Thallium	2.82E-01	1.36E+09	P	NA	NA	NA	NA	–	1.2E-03	0.0E+00	NA	1.2E-03	0%
Vanadium	6.02E+01	1.36E+09	P	NA	NA	NA	NA	–	2.9E-02	0.0E+00	NA	2.9E-02	4%
Zinc	1.46E+03	1.36E+09	P	NA	NA	NA	NA	–	1.6E-02	0.0E+00	NA	1.6E-02	2%
					Total ELCR		6E-07	100%		Total HI		0.8	100%

[a] Minimum of the volatilization factor (identified with "V") and the particulate emission factor (PEF) (identified with "P"), both derived on Table A.2-11.

–	Not applicable.	HQ	Hazard quotient.	PEF	Particulate emission factor.
ELCR	Excess lifetime cancer risk.	m^3/kg	Cubic meters per kilogram.	VF	Volatilization factor.
EPCs	Exposure point concentration in soil (mg/kg).	mg/kg	Milligrams per kilogram.		
HI	Hazard index (sum of the HQs).	NA	Not available.		

Table A.7.HHRA-22
Risk and Hazard Calculations for Hypothetical Future Construction Worker Exposure to Combined Surface and Subsurface Soil and Sediment
WESTERN BURNING GROUND
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Equations: (see Table A.2-11)

ELCRo = (EPCs × 1 × 330 × 130 × 1 × CSFo) / (1,000,000 × 70 × 25,550)
ELCRd = (EPCs × 3,300 × 0.3 × ABSd × 130 × 1 × CSFa) / (1,000,000 × 70 × 25,550)
ELCRi = (EPCs × 20 × 130 × 1 × CSFi) / ([VF or PEF] × 70 × 25,550)

HQo = (EPCs × 1 × 330 × 130 × 1) / (1,000,000 × 70 × 182 × RfDo)
HQd = (EPCs × 3,300 × 0.3 × ABSd × 130 × 1) / (1,000,000 × 70 × 182 × RfDa)
HQi = (EPCs × 20 × 130 × 1) / ([VF or PEF] × 70 × 182 × RfDi)

Table A.7.HHRA-23
Risk and Hazard Calculations for Hypothetical Future Adult Resident Exposure to Combined Surface and Subsurface Soil and Sediment
WESTERN BURNING GROUND
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Adult Resident
Receptor Age: Adult

Constituent	EPCs (mg/kg)	VF *or* PEF [a] (m^3/kg)		CANCER RISK Route-Specific Risk Oral ELCRo	Dermal ELCRd	Inhalation ELCRi	Calculated Risk ELCR	Percent Total ELCR	NON-CANCER HAZARD Route-Specific Hazard Oral HQo	Dermal HQd	Inhalation HQi	Calculated Hazard HI	Percent Total HI
Volatile Organic Compounds													
d-Limonene	1.70E-01	4.05E+03	V	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Semi-Volatile Organic Compounds													
Carbazole	1.21E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Polycyclic Aromatic Hydrocarbons													
Benzo(a)anthracene	2.57E-01	1.36E+09	P	1.3E-07	6.7E-08	NA	2.0E-07	1%	NA	NA	NA	NA	–
Benzo(a)pyrene	2.59E-01	1.36E+09	P	1.3E-06	6.7E-07	8.1E-11	2.0E-06	13%	NA	NA	NA	NA	–
Benzo(b)fluoranthene	3.36E-01	1.36E+09	P	1.7E-07	8.7E-08	NA	2.6E-07	2%	NA	NA	NA	NA	–
Dibenzo(a,h)anthracene	6.29E-02	1.36E+09	P	3.1E-07	1.6E-07	NA	4.8E-07	3%	NA	NA	NA	NA	–
Indeno(1,2,3-cd)pyrene	1.62E-01	1.36E+09	P	8.1E-08	4.2E-08	NA	1.2E-07	1%	NA	NA	NA	NA	–
Dioxin/Furan Compounds													
1,2,3,7,8-PeCDD	1.73E-06	1.36E+09	P	1.1E-07	1.3E-08	1.6E-11	1.2E-07	1%	NA	NA	NA	NA	–
Polychlorinated Biphenyls													
Aroclor 1254	8.40E-02	1.36E+09	P	7.9E-08	4.4E-08	1.2E-11	1.2E-07	1%	5.8E-03	3.2E-03	NA	9.0E-03	1%
Explosives													
Nitroglycerine	9.60E-01	1.36E+09	P	7.7E-09	3.1E-09	NA	1.1E-08	0%	1.3E-02	5.2E-03	NA	1.8E-02	3%
Pentaerythritol Tetranitrate	1.10E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Inorganics													
Aluminum	1.89E+04	1.36E+09	P	NA	NA	NA	NA	–	2.6E-02	0.0E+00	2.7E-03	2.9E-02	4%
Antimony	8.00E-01	1.36E+09	P	NA	NA	NA	NA	–	2.7E-03	0.0E+00	NA	2.7E-03	0%
Arsenic	1.12E+01	1.36E+09	P	7.9E-06	9.5E-07	1.2E-08	8.9E-06	60%	5.1E-02	6.1E-03	NA	5.7E-02	8%
Chromium	8.77E+02	1.36E+09	P	NA	NA	2.5E-06	2.5E-06	17%	4.0E-01	0.0E+00	1.8E-03	4.0E-01	58%
Cobalt	1.29E+01	1.36E+09	P	NA	NA	2.8E-08	2.8E-08	0%	5.9E-02	0.0E+00	1.5E-03	6.1E-02	9%
Copper	1.12E+02	1.36E+09	P	NA	NA	NA	NA	–	3.8E-03	0.0E+00	NA	3.8E-03	1%
Iron	3.83E+04	1.36E+09	P	NA	NA	NA	NA	–	7.5E-02	0.0E+00	NA	7.5E-02	11%
Lead	7.87E+03	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Manganese	3.88E+02	1.36E+09	P	NA	NA	NA	NA	–	3.8E-03	0.0E+00	5.5E-03	9.2E-03	1%
Thallium	2.82E-01	1.36E+09	P	NA	NA	NA	NA	–	4.8E-03	0.0E+00	NA	4.8E-03	1%
Vanadium	6.02E+01	1.36E+09	P	NA	NA	NA	NA	–	1.2E-02	0.0E+00	NA	1.2E-02	2%
Zinc	1.46E+03	1.36E+09	P	NA	NA	NA	NA	–	6.7E-03	0.0E+00	NA	6.7E-03	1%
					Total ELCR		1E-05	100%		Total HI		0.7	100%

[a] Minimum of the volatilization factor (identified with "V") and the particulate emission factor (PEF) (identified with "P"), both derived on Table A.2-11.

–	Not applicable.	HQ	Hazard quotient.	PEF	Particulate emission factor.
ELCR	Excess lifetime cancer risk.	m^3/kg	Cubic meters per kilogram.	VF	Volatilization factor.
EPCs	Exposure point concentration in soil (mg/kg).	mg/kg	Milligrams per kilogram.		
HI	Hazard index (sum of the HQs).	NA	Not available.		

Table A.7.HHRA-23
Risk and Hazard Calculations for Hypothetical Future Adult Resident Exposure to Combined Surface and Subsurface Soil and Sediment
WESTERN BURNING GROUND
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Adult Resident
Receptor Age: Adult

Equations: (see Table A.2-11. Potentially mutagenic carcinogens (i.e., PAHs) adjusted to incorporate ADAFs of 2.1 for 10 years (ages 6 to 16) and 1 for the remaining 14 years as an adult. Oral example: (EPC x 1 x 100 x 350 x CSF/(1,000,000 x 365 x 70)) x ((2.1 x 10/70) + (1 x 14/70)).

ELCRo = (EPCs × 1 × 100 × 350 × 24 × CSFo) / (1,000,000 × 70 × 25,550)
ELCRd = (EPCs × 5,700 × 0.07 × ABSd × 350 × 24 × CSFa) / (1,000,000 × 70 × 25,550)
ELCRi = (EPCs × 20 × 350 × 24 × CSFi) / ([VF or PEF] × 70 × 25,550)

HQo = (EPCs × 1 × 100 × 350 × 24) / (1,000,000 × 70 × 8,760 × RfDo)
HQd = (EPCs × 5,700 × 0.07 × ABSd × 350 × 24) / (1,000,000 × 70 × 8,760 × RfDa)
HQi = (EPCs × 20 × 350 × 24) / ([VF or PEF] × 70 × 8,760 × RfDi)

Table A.7.HHRA-24
Risk and Hazard Calculations for Hypothetical Future Child Resident Exposure to Combined Surface and Subsurface Soil and Sediment
WESTERN BURNING GROUND
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Child Resident
Receptor Age: Child

Constituent	EPCs (mg/kg)	VF *or* PEF [a] (m³/kg)		CANCER RISK Route-Specific Risk Oral ELCRo	Dermal ELCRd	Inhalation ELCRi	Calculated Risk ELCR	Percent Total ELCR	NON-CANCER HAZARD Route-Specific Hazard Oral HQo	Dermal HQd	Inhalation HQi	Calculated Hazard HI	Percent Total HI
Volatile Organic Compounds													
d-Limonene	1.70E-01	4.05E+03	V	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Semi-Volatile Organic Compounds													
Carbazole	1.21E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Polycyclic Aromatic Hydrocarbons													
Benzo(a)anthracene	2.57E-01	1.36E+09	P	6.0E-07	2.2E-07	NA	8.2E-07	2%	NA	NA	NA	NA	–
Benzo(a)pyrene	2.59E-01	1.36E+09	P	6.1E-06	2.2E-06	9.5E-11	8.3E-06	24%	NA	NA	NA	NA	–
Benzo(b)fluoranthene	3.36E-01	1.36E+09	P	7.9E-07	2.9E-07	NA	1.1E-06	3%	NA	NA	NA	NA	–
Dibenzo(a,h)anthracene	6.29E-02	1.36E+09	P	1.5E-06	5.4E-07	NA	2.0E-06	6%	NA	NA	NA	NA	–
Indeno(1,2,3-cd)pyrene	1.62E-01	1.36E+09	P	3.8E-07	1.4E-07	NA	5.2E-07	1%	NA	NA	NA	NA	–
Dioxin/Furan Compounds													
1,2,3,7,8-PeCDD	1.73E-06	1.36E+09	P	2.5E-07	2.1E-08	9.2E-12	2.7E-07	1%	NA	NA	NA	NA	–
Polychlorinated Biphenyls													
Aroclor 1254	8.40E-02	1.36E+09	P	1.8E-07	7.2E-08	6.7E-12	2.6E-07	1%	5.4E-02	2.1E-02	NA	7.5E-02	1%
Explosives													
Nitroglycerine	9.60E-01	1.36E+09	P	1.8E-08	5.0E-09	NA	2.3E-08	0%	1.2E-01	3.4E-02	NA	1.6E-01	2%
Pentaerythritol Tetranitrate	1.10E-01	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Inorganics													
Aluminum	1.89E+04	1.36E+09	P	NA	NA	NA	NA	–	2.4E-01	0.0E+00	6.2E-03	2.5E-01	4%
Antimony	8.00E-01	1.36E+09	P	NA	NA	NA	NA	–	2.6E-02	0.0E+00	NA	2.6E-02	0%
Arsenic	1.12E+01	1.36E+09	P	1.8E-05	1.6E-06	6.8E-09	2.0E-05	58%	4.8E-01	4.0E-02	NA	5.2E-01	8%
Chromium	8.77E+02	1.36E+09	P	NA	NA	1.5E-06	1.5E-06	4%	3.7E+00	0.0E+00	4.1E-03	3.7E+00	59%
Cobalt	1.29E+01	1.36E+09	P	NA	NA	1.6E-08	1.6E-08	0%	5.5E-01	0.0E+00	3.5E-03	5.5E-01	9%
Copper	1.12E+02	1.36E+09	P	NA	NA	NA	NA	–	3.6E-02	0.0E+00	NA	3.6E-02	1%
Iron	3.83E+04	1.36E+09	P	NA	NA	NA	NA	–	7.0E-01	0.0E+00	NA	7.0E-01	11%
Lead	7.87E+03	1.36E+09	P	NA	NA	NA	NA	–	NA	NA	NA	NA	–
Manganese	3.88E+02	1.36E+09	P	NA	NA	NA	NA	–	3.5E-02	0.0E+00	1.3E-02	4.8E-02	1%
Thallium	2.82E-01	1.36E+09	P	NA	NA	NA	NA	–	4.5E-02	0.0E+00	NA	4.5E-02	1%
Vanadium	6.02E+01	1.36E+09	P	NA	NA	NA	NA	–	1.1E-01	0.0E+00	NA	1.1E-01	2%
Zinc	1.46E+03	1.36E+09	P	NA	NA	NA	NA	–	6.2E-02	0.0E+00	NA	6.2E-02	1%
					Total ELCR		3E-05	100%		Total HI **		6	100%

** HI Segregated by Target Site/Critical Effect:
CNS - Central nervous system
NA - Not available
NR - None reported

HI (liver, kidney) =	0.9	HI (gastrointestinal tract) =	0.7
HI (CNS, whole body, immune system) =	0	HI (nasal, lung) =	4
HI (blood) =	0.8	HI (eyes, nails, hair, skin) =	1
HI (fetus, developmental) =	0.2	HI (NA, NR) =	0

Table A.7.HHRA-24
Risk and Hazard Calculations for Hypothetical Future Child Resident Exposure to Combined Surface and Subsurface Soil and Sediment
WESTERN BURNING GROUND
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Child Resident
Receptor Age: Child

[a] Minimum of the volatilization factor (identified with "V") and the particulate emission factor (PEF) (identified with "P"), both derived on Table A.2-11.

–	Not applicable.	HQ	Hazard quotient.	PEF	Particulate emission factor.
ELCR	Excess lifetime cancer risk.	m^3/kg	Cubic meters per kilogram.	VF	Volatilization factor.
EPCs	Exposure point concentration in soil (mg/kg).	mg/kg	Milligrams per kilogram.		
HI	Hazard index (sum of the HQs).	NA	Not available.		

<u>Equations:</u> (see Table A.2-11. Potentially mutagenic carcinogens (i.e., PAHs) adjusted to incorporate ADAFs of 4.6 for 2 years (ages 0 to 2) and 2.1 for 4 years (ages 2 to 6). Oral example: (EPC x 1 x 200 x 350 x CSF/(1,000,000 x 365 x 15)) x ((4.6 x 2/70) + (2.1 x 4/70)).

ELCRo = (EPCs × 1 × 200 × 350 × 6 × CSFo) / (1,000,000 × 15 × 25,550)
ELCRd = (EPCs × 2,800 × 0.2 × ABSd × 350 × 6 × CSFa) / (1,000,000 × 15 × 25,550)
ELCRi = (EPCs × 10 × 350 × 6 × CSFi) / ([VF or PEF] × 15 × 25,550)

HQo = (EPCs × 1 × 200 × 350 × 6) / (1,000,000 × 15 × 2,190 × RfDo)
HQd = (EPCs × 2,800 × 0.2 × ABSd × 350 × 6) / (1,000,000 × 15 × 2,190 × RfDa)
HQi = (EPCs × 10 × 350 × 6) / ([VF or PEF] × 15 × 2,190 × RfDi)

Table A.7.HHRA-25
Summary of Calculated Human Health Risks and Hazards
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

RECEPTOR Exposure Medium - Scenario	Calculation Table	Total Excess Lifetime Cancer Risk	Total Non-Cancer Hazard
Site Worker			
Surface Soil - Direct Contact	Table A.7.HHRA-7	1E-05	0.1
Sediment - Wading	Table A.7.HHRA-8	2E-06	0.1
Surface Water - Wading	Table A.7.HHRA-9	3E-06	0.2
TOTAL SITE RISKS (Site Worker):		1E-05	0.4
Hypothetical Future Construction Worker			
Combined Surface and Subsurface Soil - Direct Contact	Table A.7.HHRA-10	5E-07	0.5
TOTAL SITE RISKS (Construction Worker):		5E-07	0.5
Hypothetical Future Adult Resident			
Combined Surface and Subsurface Soil - Direct Contact	Table A.7.HHRA-11	1E-05	0.2
Sediment - Wading	Table A.7.HHRA-12	6E-06	0.2
Surface Water - Wading	Table A.7.HHRA-13	6E-07	0.04
Fish Consumption	Table A.7.HHRA-14	NA	0.3
TOTAL SITE RISKS (Adult Resident):		2E-05	0.8
Hypothetical Future Child Resident			
Combined Surface and Subsurface Soil - Direct Contact	Table A.7.HHRA-15	3E-05	2
Sediment - Wading	Table A.7.HHRA-16	5E-06	2
Surface Water - Wading	Table A.7.HHRA-17	6E-07	0.1
Fish Consumption	Table A.7.HHRA-18	NA	1
TOTAL SITE RISKS (Child Resident):		3E-05	6
Hypothetical Future Aggregate Resident (Adult + Child)			
Combined Surface and Subsurface Soil - Direct Contact		4E-05	--
Sediment - Wading		1E-05	--
Surface Water - Wading		1E-06	--
Fish Consumption		NA	--
TOTAL SITE RISKS (Aggregate Resident):		5E-05	--

Table A.7.HHRA-26
Summary of Calculated Human Health Risks and Hazards for Combined Soil and Sediment
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

RECEPTOR Exposure Medium - Scenario	Calculation Table	Total Excess Lifetime Cancer Risk	Total Non-Cancer Hazard
Site Worker			
Surface Soil and Sediment - Direct Contact	Table A.7.HHRA-21	1E-05	0.5
TOTAL SITE RISKS (Site Worker):		1E-05	0.5
Hypothetical Future Construction Worker			
Combined Surface and Subsurface Soil and Sediment- Direct Coı	Table A.7.HHRA-22	6E-07	0.8
TOTAL SITE RISKS (Construction Worker):		6E-07	0.8
Hypothetical Future Adult Resident			
Combined Surface and Subsurface Soil and Sediment - Direct Cc	Table A.7.HHRA-23	1E-05	0.7
TOTAL SITE RISKS (Adult Resident):		1E-05	0.7
Hypothetical Future Child Resident			
Combined Surface and Subsurface Soil and Sediment- Direct Coı	Table A.7.HHRA-24	3E-05	6
TOTAL SITE RISKS (Child Resident):		3E-05	6
Hypothetical Future Aggregate Resident (Adult + Child)			
Combined Surface and Subsurface Soil and Sediment - Direct Contact		5E-05	--
TOTAL SITE RISKS (Aggregate Resident):		5E-05	--

Table A.7.HHRA-27
Blood Lead Level Estimates for a Hypothetical Current Commercial/Industrial Worker Receptor
from Exposure to Surface Soil (0-1 feet below ground surface)
WESTERN BURNING GROUND
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Exposure Variable	PbB Equation1		Description of Exposure Variable	Units	Values for Non-Residential Exposure Scenario			
					Using Equation 1		Using Equation 2	
	1*	2**			GSDi = Hom	GSDi = Het	GSDi = Hom	GSDi = Het
PbS	X	X	Soil lead concentration	ug/g or ppm	**213**	**213**	**213**	**213**
Rfetal/maternal	X	X	Fetal/maternal PbB ratio	--	0.9	0.9	0.9	0.9
BKSF	X	X	Biokinetic Slope Factor	ug/dL per ug/day	0.4	0.4	0.4	0.4
GSDi	X	X	Geometric standard deviation PbB	--	2.1	2.3	2.1	2.3
PbB0	X	X	Baseline PbB	ug/dL	1.5	1.7	1.5	1.7
IRS	X		Soil ingestion rate (including soil-derived indoor dust)	g/day	0.05	0.05	--	--
IRS+D		X	Total ingestion rate of outdoor soil and indoor dust	g/day	--	--	0.05	0.05
WS		X	Weighting factor; fraction of IRS+D ingested as outdoor soil	--	--	--	1.0	1.0
KSD		X	Mass fraction of soil in dust	--	--	--	0.7	0.7
AFS, D	X	X	Absorption fraction (same for soil and dust)	--	0.12	0.12	0.12	0.12
EFS, D	X	X	Exposure frequency (same for soil and dust)	days/yr	**219**	**219**	**219**	**219**
ATS, D	X	X	Averaging time (same for soil and dust)	days/yr	365	365	365	365
PbBadult	**PbB of adult worker, geometric mean**			**ug/dL**	**1.8**	**2.0**	**1.8**	**2.0**
PbBfetal, 0.95	**95th percentile PbB among fetuses of adult workers**			**ug/dL**	**5.5**	**7.1**	**5.5**	**7.1**
PbBt	**Target PbB level of concern (e.g., 10 ug/dL)**			**ug/dL**	**10.0**	**10.0**	**10.0**	**10.0**
P(PbBfetal > PbBt)	**Probability that fetal PbB > PbBt, assuming lognormal distribution**			**%**	**0.7%**	**2.0%**	**0.7%**	**2.0%**

Calculations of Blood Lead Concentrations (PbBs)
U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee
Version date 05/19/03

Table A.7.HHRA-27
Blood Lead Level Estimates for a Hypothetical Current Commercial/Industrial Worker Receptor
from Exposure to Surface Soil (0-1 feet below ground surface)
WESTERN BURNING GROUND
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

1 Equation 1 does not apportion exposure between soil and dust ingestion (excludes WS, KSD).
When IRS = IRS+D and WS = 1.0, the equations yield the same PbBfetal,0.95.

***Equation 1, based on Eq. 1, 2 in USEPA (1996).**

PbB adult =	(PbS*BKSF*IRS+D*AFS,D*EFS/ATS.D) + PbB0
PbB fetal, 0.95 =	PbBadult * (GSDi1.645 * R)

****Equation 2, alternate approach based on Eq. 1, 2, and A-19 in USEPA (1996).**

PbB adult =	PbS*BKSF*([(IRS+D)*AFS*EFS*WS]+[KSD*(IRS+D)*(1-WS)*AFD*EFD])/365+PbB0
PbB fetal, 0.95 =	PbBadult * (GSDi1.645 * R)

References:

USEPA 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risk Associated with Adult Exposure to Lead in Soil. Technical Review Workgroup for Lead. December.
USEPA 2003b. Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risk Associated with Adult Exposure to Lead in Soil. Adult Lead Model (ALM). Technical Review Workgroup for Lead. January.

Notes:

g/day =	Gram(s) per day.	ppm =	Part(s) per million.
GSDi =	Individual Geometric Standard Deviations.	µg/day =	Microgram(s) per day.
Het =	Heterogeneous population.	µg/dL =	Microgram(s) per deciliter.
Hom =	Homogeneous population.	µg/g =	Microgram(s) per gram.
PbB =	Blood lead.	yr =	Year.

USEPA Adult Lead Model (2003b) was used to assess exposure to lead.
Input values in bold font were receptor- and site-specific.

Table A.7.HHRA-28
Blood Lead Level Estimates for a Hypothetical Future Child and Adult Resident Receptor
from Exposure to Surface and Subsurface Soil
WESTERN BURNING GROUND
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

ADULT RESIDENT

Exposure Variable	PbB Equation1		Description of Exposure Variable	Units	Values for Non-Residential Exposure Scenario			
					Using Equation 1		Using Equation 2	
	1*	2**			GSDi = Hom	GSDi = Het	GSDi = Hom	GSDi = Het
PbS	X	X	Soil lead concentration	ug/g or ppm	**155**	**155**	**155**	**155**
Rfetal/maternal	X	X	Fetal/maternal PbB ratio	--	0.9	0.9	0.9	0.9
BKSF	X	X	Biokinetic Slope Factor	ug/dL per ug/day	0.4	0.4	0.4	0.4
GSDi	X	X	Geometric standard deviation PbB	--	2.1	2.3	2.1	2.3
PbB0	X	X	Baseline PbB	ug/dL	1.5	1.7	1.5	1.7
IRS	X		Soil ingestion rate (including soil-derived indoor dust)	g/day	0.05	0.05	--	--
IRS+D		X	Total ingestion rate of outdoor soil and indoor dust	g/day	--	--	0.05	0.05
WS		X	Weighting factor; fraction of IRS+D ingested as outdoor soil	--	--	--	1.0	1.0
KSD		X	Mass fraction of soil in dust	--	--	--	0.7	0.7
AFS, D	X	X	Absorption fraction (same for soil and dust)	--	0.12	0.12	0.12	0.12
EFS, D	X	X	Exposure frequency (same for soil and dust)	days/yr	**365**	**365**	**365**	**365**
ATS, D	X	X	Averaging time (same for soil and dust)	days/yr	365	365	365	365
PbBadult	**PbB of adult worker, geometric mean**			**ug/dL**	**1.9**	**2.1**	**1.9**	**2.1**
PbBfetal, 0.95	**95th percentile PbB among fetuses of adult workers**			**ug/dL**	**5.7**	**7.3**	**5.7**	**7.3**
PbBt	**Target PbB level of concern (e.g., 10 ug/dL)**			**ug/dL**	**10.0**	**10.0**	**10.0**	**10.0**
P(PbBfetal > PbBt)	**Probability that fetal PbB > PbBt, assuming lognormal distribution**			**%**	**0.8%**	**2.2%**	**0.8%**	**2.2%**

Calculations of Blood Lead Concentrations (PbBs)
U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee
Version date 05/19/03

Table A.7.HHRA-28
Blood Lead Level Estimates for a Hypothetical Future Child and Adult Resident Receptor
from Exposure to Surface and Subsurface Soil
WESTERN BURNING GROUND
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

1 Equation 1 does not apportion exposure between soil and dust ingestion (excludes WS, KSD).
When IRS = IRS+D and WS = 1.0, the equations yield the same PbBfetal,0.95.

***Equation 1, based on Eq. 1, 2 in USEPA (1996).**

PbB adult =	(PbS*BKSF*IRS+D*AFS,D*EFS/ATS.D) + PbB0
PbB fetal, 0.95 =	PbBadult * (GSDi1.645 * R)

****Equation 2, alternate approach based on Eq. 1, 2, and A-19 in USEPA (1996).**

PbB adult =	PbS*BKSF*([(IRS+D)*AFS*EFS*WS]+[KSD*(IRS+D)*(1-WS)*AFD*EFD])/365+PbB0
PbB fetal, 0.95 =	PbBadult * (GSDi1.645 * R)

References:
USEPA 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risk Associated with Adult Exposure to Lead in Soil. Technical Review Workgroup for Lead. December.
USEPA 2003b. Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risk Associated with Adult Exposure to Lead in Soil. Adult Lead Model (ALM). Technical Review Workgroup for Lead. January.

Notes:

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GSDi =	Individual Geometric Standard Deviations.	µg/day =	Microgram(s) per day.
Het =	Heterogeneous population.	µg/dL =	Microgram(s) per deciliter.
Hom =	Homogeneous population.	µg/g =	Microgram(s) per gram.
PbB =	Blood lead.	yr =	Year.

USEPA Adult Lead Model (2003b) was used to assess exposure to lead.
Input values in bold font were receptor- and site-specific.

Table A.7.HHRA-28
Blood Lead Level Estimates for a Hypothetical Future Child and Adult Resident Receptor
from Exposure to Surface and Subsurface Soil
WESTERN BURNING GROUND
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

CHILD RESIDENT

Description of Result	Units	Result
Geometric Mean PbB	ug/dL	4.3
Percent Above 10 ug/dL	%	3.5

LEAD MODEL FOR WINDOWS Version 1.1 [a]

==
Model Version: 1.1 Build9
User Name:
Date:
Site Name: Western Burning Ground
Operable Unit:
Run Mode: Research
==

****** Air ******

Indoor Air Pb Concentration: 30.000 percent of outdoor.
Other Air Parameters:

Age	Time Outdoors (hours)	Ventilation Rate (m3/day)	Lung Absorption (%)	Outdoor Air Pb Conc (ug Pb/m3)
.5-1	1.000	2.000	32.000	0.100
1-2	2.000	3.000	32.000	0.100
2-3	3.000	5.000	32.000	0.100
3-4	4.000	5.000	32.000	0.100
4-5	4.000	5.000	32.000	0.100
5-6	4.000	7.000	32.000	0.100
6-7	4.000	7.000	32.000	0.100

Table A.7.HHRA-28
Blood Lead Level Estimates for a Hypothetical Future Child and Adult Resident Receptor
from Exposure to Surface and Subsurface Soil
WESTERN BURNING GROUND
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

****** Diet ******

Age	Diet Intake (ug/day)
.5-1	2.260
1-2	1.960
2-3	2.130
3-4	2.040
4-5	1.950
5-6	2.050
6-7	2.220

****** Drinking Water ******

Water Consumption:

Age	Water (L/day)
.5-1	0.200
1-2	0.500
2-3	0.520
3-4	0.530
4-5	0.550
5-6	0.580
6-7	0.590

Drinking Water Concentration: 4.000 ug Pb/L

Table A.7.HHRA-28
Blood Lead Level Estimates for a Hypothetical Future Child and Adult Resident Receptor
from Exposure to Surface and Subsurface Soil
WESTERN BURNING GROUND
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

****** Soil & Dust ******

Age	Soil (ug Pb/g)[b]	House Dust (ug Pb/g)[c]
.5-1	623.000	70.000
1-2	623.000	70.000
2-3	623.000	70.000
3-4	623.000	70.000
4-5	623.000	70.000
5-6	623.000	70.000
6-7	623.000	70.000

****** Alternate Intake ******

Age	Alternate (ug Pb/day)
.5-1	0.000
1-2	0.000
2-3	0.000
3-4	0.000
4-5	0.000
5-6	0.000
6-7	0.000

****** Maternal Contribution: Infant Model ******

Maternal Blood Concentration: 1.000 ug Pb/dL

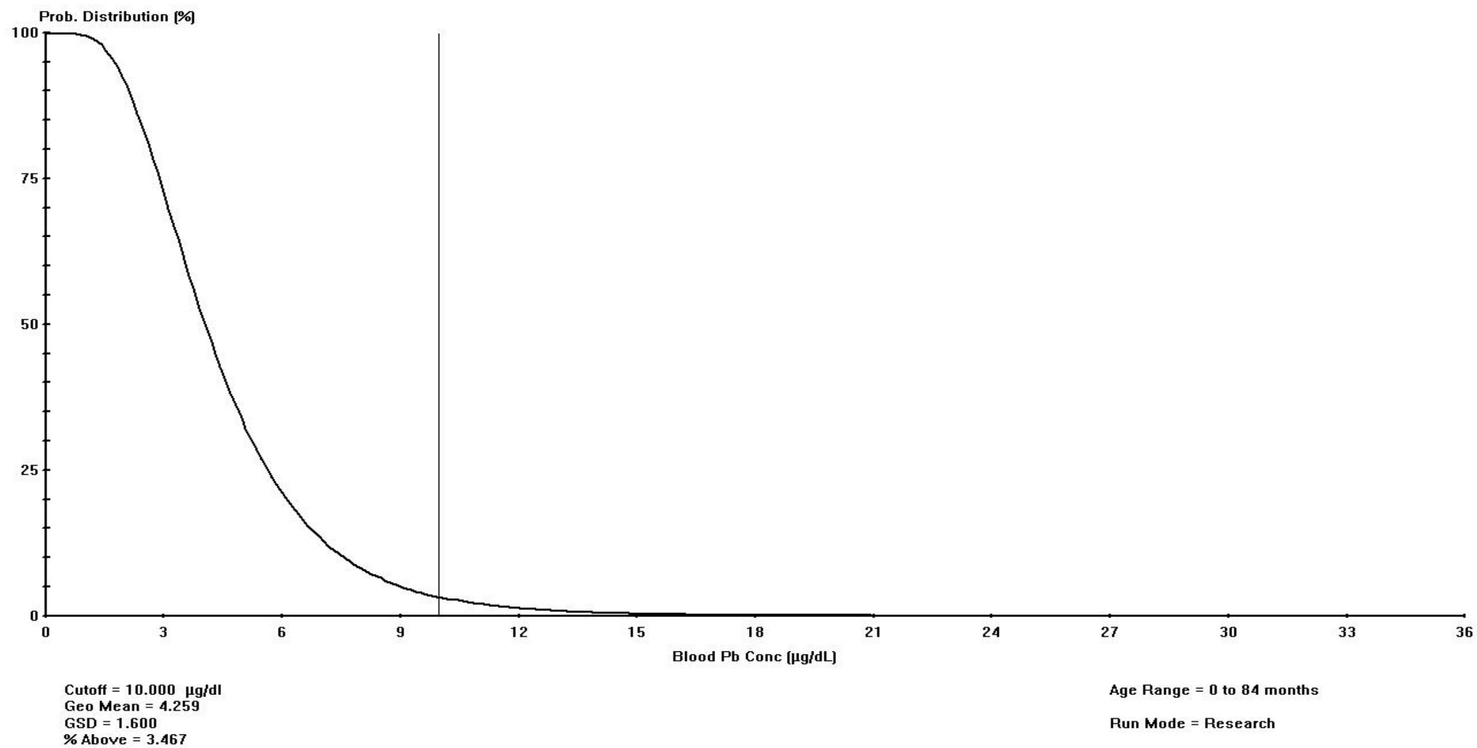
Table A.7.HHRA-28
Blood Lead Level Estimates for a Hypothetical Future Child and Adult Resident Receptor
from Exposure to Surface and Subsurface Soil
WESTERN BURNING GROUND
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
****

Year	Air (ug/day)	Diet (ug/day)	Alternate (ug/day)	Water (ug/day)
.5-1	0.021	1.022	0.000	0.362
1-2	0.034	0.871	0.000	0.889
2-3	0.062	0.962	0.000	0.939
3-4	0.067	0.934	0.000	0.971
4-5	0.067	0.918	0.000	1.036
5-6	0.093	0.975	0.000	1.103
6-7	0.093	1.062	0.000	1.129

Year	Soil+Dust (ug/day)	Total (ug/day)	Blood (ug/dL)
.5-1	7.355	8.760	4.7
1-2	11.483	13.278	5.5
2-3	11.662	13.625	5.1
3-4	11.827	13.798	4.8
4-5	9.006	11.027	4.0
5-6	8.189	10.361	3.3
6-7	7.777	10.061	2.9

Table A.7.HHRA-28
Blood Lead Level Estimates for a Hypothetical Future Child and Adult Resident Receptor
from Exposure to Surface and Subsurface Soil
WESTERN BURNING GROUND
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia



Notes:

[a] Model parameters are defaults, except where noted.

[b] Time-weighted arithmetic mean for soil and sediment.

[c] Because sediments do not routinely produce household dust, this value equals the average soil concentration multiplied

Table A.7.HHRA-29
Blood Lead Level Estimates for a Hypothetical Future Adult Resident Receptor
from Exposure to Sediment
WESTERN BURNING GROUND
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Exposure Variable	PbB Equation1 1*	PbB Equation1 2**	Description of Exposure Variable	Units	Values for Non-Residential Exposure Scenario: Using Equation 1 GSDi = Hom	Using Equation 1 GSDi = Het	Using Equation 2 GSDi = Hom	Using Equation 2 GSDi = Het
PbS	X	X	Soil lead concentration	ug/g or ppm	**3610**	**3610**	**3610**	**3610**
Rfetal/maternal	X	X	Fetal/maternal PbB ratio	--	0.9	0.9	0.9	0.9
BKSF	X	X	Biokinetic Slope Factor	ug/dL per ug/day	0.4	0.4	0.4	0.4
GSDi	X	X	Geometric standard deviation PbB	--	2.1	2.3	2.1	2.3
PbB0	X	X	Baseline PbB	ug/dL	1.5	1.7	1.5	1.7
IRS	X		Soil ingestion rate (including soil-derived indoor dust)	g/day	0.05	0.05	--	--
IRS+D		X	Total ingestion rate of outdoor soil and indoor dust	g/day	--	--	0.05	0.05
WS		X	Weighting factor; fraction of IRS+D ingested as outdoor soil	--	--	--	1.0	1.0
KSD		X	Mass fraction of soil in dust	--	--	--	0.7	0.7
AFS, D	X	X	Absorption fraction (same for soil and dust)	--	0.12	0.12	0.12	0.12
EFS, D	X	X	Exposure frequency (same for soil and dust)	days/yr	**48**	**48**	**48**	**48**
ATS, D	X	X	Averaging time (same for soil and dust)	days/yr	365	365	365	365
PbBadult			**PbB of adult worker, geometric mean**	**ug/dL**	**2.6**	**2.8**	**2.6**	**2.8**
PbBfetal, 0.95			**95th percentile PbB among fetuses of adult workers**	**ug/dL**	**8.0**	**10.1**	**8.0**	**10.1**
PbBt			**Target PbB level of concern (e.g., 10 ug/dL)**	**ug/dL**	**10.0**	**10.0**	**10.0**	**10.0**
P(PbBfetal > PbBt)			**Probability that fetal PbB > PbBt, assuming lognormal distribution**	**%**	**2.6%**	**5.1%**	**2.6%**	**5.1%**

Calculations of Blood Lead Concentrations (PbBs)
U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee
Version date 05/19/03

Table A.7.HHRA-29
Blood Lead Level Estimates for a Hypothetical Future Adult Resident Receptor
from Exposure to Sediment
WESTERN BURNING GROUND
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

1 Equation 1 does not apportion exposure between soil and dust ingestion (excludes WS, KSD).
When IRS = IRS+D and WS = 1.0, the equations yield the same PbBfetal,0.95.

***Equation 1, based on Eq. 1, 2 in USEPA (1996).**

PbB adult =	(PbS*BKSF*IRS+D*AFS,D*EFS/ATS.D) + PbB0
PbB fetal, 0.95 =	PbBadult * (GSDi1.645 * R)

****Equation 2, alternate approach based on Eq. 1, 2, and A-19 in USEPA (1996).**

PbB adult =	PbS*BKSF*([(IRS+D)*AFS*EFS*WS]+[KSD*(IRS+D)*(1-WS)*AFD*EFD])/365+PbB0
PbB fetal, 0.95 =	PbBadult * (GSDi1.645 * R)

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USEPA 2003b. Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risk Associated with Adult Exposure to Lead in Soil. Adult Lead Model (ALM). Technical Review Workgroup for Lead. January.

Notes:

g/day =	Gram(s) per day.	ppm =	Part(s) per million.
GSDi =	Individual Geometric Standard Deviations.	µg/day =	Microgram(s) per day.
Het =	Heterogeneous population.	µg/dL =	Microgram(s) per deciliter.
Hom =	Homogeneous population.	µg/g =	Microgram(s) per gram.
PbB =	Blood lead.	yr =	Year.

USEPA Adult Lead Model (2003b) was used to assess exposure to lead.
Input values in bold font were receptor- and site-specific.

Table A.7.HHRA-30
Blood Lead Level Estimates for a Hypothetical Construction Worker Receptor
from Exposure to Surface and Subsurface Soil
WESTERN BURNING GROUND
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Exposure Variable	PbB Equation1		Description of Exposure Variable	Units	Values for Non-Residential Exposure Scenario			
					Using Equation 1		Using Equation 2	
	1*	2**			GSDi = Hom	GSDi = Het	GSDi = Hom	GSDi = Het
PbS	X	X	Soil lead concentration	ug/g or ppm	**155**	**155**	**155**	**155**
Rfetal/maternal	X	X	Fetal/maternal PbB ratio	--	0.9	0.9	0.9	0.9
BKSF	X	X	Biokinetic Slope Factor	ug/dL per ug/day	0.4	0.4	0.4	0.4
GSDi	X	X	Geometric standard deviation PbB	--	2.1	2.3	2.1	2.3
PbB0	X	X	Baseline PbB	ug/dL	1.5	1.7	1.5	1.7
IRS	X		Soil ingestion rate (including soil-derived indoor dust)	g/day	0.10	0.10	--	--
IRS+D		X	Total ingestion rate of outdoor soil and indoor dust	g/day	--	--	0.10	0.10
WS		X	Weighting factor; fraction of IRS+D ingested as outdoor soil	--	--	--	1.0	1.0
KSD		X	Mass fraction of soil in dust	--	--	--	0.7	0.7
AFS, D	X	X	Absorption fraction (same for soil and dust)	--	0.12	0.12	0.12	0.12
EFS, D	X	X	Exposure frequency (same for soil and dust)	days/yr	**130**	**130**	**130**	**130**
ATS, D	X	X	Averaging time (same for soil and dust)	days/yr	365	365	365	365
PbBadult	**PbB of adult worker, geometric mean**			**ug/dL**	**1.8**	**2.0**	**1.8**	**2.0**
PbBfetal, 0.95	**95th percentile PbB among fetuses of adult workers**			**ug/dL**	**5.4**	**7.0**	**5.4**	**7.0**
PbBt	**Target PbB level of concern (e.g., 10 ug/dL)**			**ug/dL**	**10.0**	**10.0**	**10.0**	**10.0**
P(PbBfetal > PbBt)	**Probability that fetal PbB > PbBt, assuming lognormal distribution**			**%**	**0.7%**	**1.9%**	**0.7%**	**1.9%**

Calculations of Blood Lead Concentrations (PbBs)
U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee
Version date 05/19/03

Table A.7.HHRA-30
Blood Lead Level Estimates for a Hypothetical Construction Worker Receptor
from Exposure to Surface and Subsurface Soil
WESTERN BURNING GROUND
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

1 Equation 1 does not apportion exposure between soil and dust ingestion (excludes WS, KSD).
When IRS = IRS+D and WS = 1.0, the equations yield the same PbBfetal,0.95.

***Equation 1, based on Eq. 1, 2 in USEPA (1996).**

PbB adult =	(PbS*BKSF*IRS+D*AFS,D*EFS/ATS.D) + PbB0
PbB fetal, 0.95 =	PbBadult * (GSDi1.645 * R)

****Equation 2, alternate approach based on Eq. 1, 2, and A-19 in USEPA (1996).**

PbB adult =	PbS*BKSF*([(IRS+D)*AFS*EFS*WS]+[KSD*(IRS+D)*(1-WS)*AFD*EFD])/365+PbB0
PbB fetal, 0.95 =	PbBadult * (GSDi1.645 * R)

References:

USEPA 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risk Associated with Adult Exposure to Lead in Soil. Technical Review Workgroup for Lead. December.

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Notes:

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Het =	Heterogeneous population.	µg/dL =	Microgram(s) per deciliter.
Hom =	Homogeneous population.	µg/g =	Microgram(s) per gram.
PbB =	Blood lead.	yr =	Year.

USEPA Adult Lead Model (2003b) was used to assess exposure to lead.
Input values in bold font were receptor- and site-specific.

Table A.7.HHRA-31
Summary of Calculated Blood Lead Level Estimates
WESTERN BURNING GROUND
Reasonable Maximum Exposure (RME) Scenario
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Exposure Medium/Receptor	Model Used [a]	Receptor Blood Lead Level[b] Adult 50th Percentile/ Geometric Mean (µg/dL)	Receptor Blood Lead Level[b] Child range in seven years (µg/dL)	Fetus Blood Level [b] 95th Percentile (µg/dL)
WESTERN BURNING GROUND				
Surface Soil (0-1 feet below ground surface)				
Hypothetical Current Commercial/Industrial Worker Receptor	USEPA ALM	2.0	–	7.1
Surface and Subsurface Soil				
Hypothetical Construction Worker Receptor	USEPA ALM	2.0	–	7.0
Hypothetical Future Child Resident Receptor	IEUBK	–	2.9 - 5.5	–
Hypothetical Future Adult Resident Receptor	USEPA ALM	2.1	–	7.3
Sediment				
Hypothetical Future Child Resident Receptor	IEUBK	–	NC	–
Hypothetical Future Adult Resident Receptor	USEPA ALM	2.8	–	10

Notes:
– = Not applicable.
NC = Not calculable.
µg/dL = Microgram(s) per deciliter.

[a] USEPA ALM: USEPA Adult Lead Methodology Spreadsheet.
USEPA Technical Review Workgroup for Lead, Adult Lead Committee (USEPA 2003b).
USEPA IEUBK: USEPA Integrated Exposure Uptake Biogenetic Model for Lead in Children (USEPA 2005).
[b] Compare to a target blood lead level of 10 µg/dL.

Table A.7.ERA-1
Screening Level -Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Background Concentration [a] (mg/kg)	Ecological Screening Level (ESLs) [b] (mg/kg) Value	*Source*	Maximum HQ [c] (unitless)	Bioaccumulative Chemical? [d] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [e] (YES/no)	Rational
Volatile Organic Compounds								
Acetone	0.07	–	2.5	*R5*	0.03	no	no	HQ • 1
Carbon Disulfide	0.0008	–	0.09412	*R5*	0.008	no	no	HQ • 1
d-Limonene	0.17	–	NA		NA	no	**YES**	**NSL**
Methylene Chloride	0.003	–	4.05	*R5*	0.0007	no	no	HQ • 1
p-Isopropyltoluene	0.0048	–	NA		NA	no	**YES**	**NSL**
Toluene	0.0011	–	5.45	*R5*	0.0002	no	no	HQ • 1
Semi-Volatile Organic Compounds								
bis(2-Ethylhexyl)phthalate	0.67	–	0.92594	*R5*	0.7	no	no	HQ • 1
Carbazole	0.1	–	NA		NA	no	**YES**	**NSL**
Dibenzofuran	0.014	–	NA		NA	no	**YES**	**NSL**
Di-n-Butylphthalate	0.13	–	0.15	*R5*	0.9	no	no	HQ • 1
Di-n-Octylphthalate	0.016	–	709	*R5*	0.00002	no	no	HQ • 1
N-Nitrosodiphenylamine	0.06	–	0.545	*R5*	0.1	no	no	HQ • 1
Dioxin/Furan Compounds								
Dioxin Toxicity Equivalents [f]	9.90E-06	–	0.000000199	*R5s*	50	no	**YES**	**HQ > 1**
Explosives								
Pentaerythritol Tetranitrate	0.11	–	NA		NA	no	**YES**	**NSL**
Herbicides								
2,4,5-TP	0.0078	–	0.109	*R5*	0.07	no	no	HQ • 1
2,4-D	0.0302	–	0.272	*R5*	0.1	no	no	HQ • 1
Dalapon	0.163	–	NA		NA	no	**YES**	**NSL**
MCPP	2.56	–	NA		NA	no	**YES**	**NSL**
Pesticides								
4,4'-DDD	0.0019	–	0.021	*EcoSSL*	0.09	YES	**YES**	**Bioaccumulative**
Dieldrin	0.00472	–	0.0049	*EcoSSL*	1	YES	**YES**	**Bioaccumulative**
Polycyclic Aromatic Hydrocarbons								
2-Methylnaphthalene	0.023	–	3.24	*R5*	0.007	no	no	HQ • 1
Acenaphthene	0.32	–	682	*R5*	0.0005	YES	**YES**	**Bioaccumulative**
Acenaphthylene	0.0039	–	682	*R5*	0.000006	YES	**YES**	**Bioaccumulative**
Anthracene	0.1	–	1,480	*R5*	0.00007	YES	**YES**	**Bioaccumulative**
Benzo(a)anthracene	0.97	–	5.21	*R5*	0.2	YES	**YES**	**Bioaccumulative**
Benzo(a)pyrene	1.1	–	1.52	*R5*	0.7	YES	**YES**	**Bioaccumulative**
Benzo(b)fluoranthene	1.8	–	59.8	*R5*	0.03	YES	**YES**	**Bioaccumulative**
Benzo(g,h,i)perylene	0.96	–	119	*R5*	0.008	YES	**YES**	**Bioaccumulative**
Benzo(k)fluoranthene	0.53	–	148	*R5*	0.004	YES	**YES**	**Bioaccumulative**
Chrysene	0.99	–	4.73	*R5*	0.2	YES	**YES**	**Bioaccumulative**
Dibenzo(a,h)anthracene	0.22	–	18.4	*R5*	0.01	YES	**YES**	**Bioaccumulative**
Fluoranthene	1.6	–	122	*R5*	0.01	YES	**YES**	**Bioaccumulative**
Fluorene	0.028	–	122	*R5*	0.0002	YES	**YES**	**Bioaccumulative**
Indeno(1,2,3-cd)pyrene	1.1	–	109	*R5*	0.01	YES	**YES**	**Bioaccumulative**
Naphthalene	0.018	–	0.0994	*R5*	0.2	no	no	HQ • 1

Table A.7.ERA-1
Screening Level -Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Background Concentration [a] (mg/kg)	Ecological Screening Level (ESLs) [b] (mg/kg)		Maximum HQ [c] (unitless)	Bioaccumulative Chemical? [d] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [e]	
			Value	*Source*			(YES/no)	Rational
Phenanthrene	0.69	–	45.7	*R5*	0.02	YES	**YES**	**Bioaccumulative**
Pyrene	1.6	–	78.5	*R5*	0.02	YES	**YES**	**Bioaccumulative**
Polychlorinated Biphenyls								
Aroclor 1254	0.084	–	NA		NA	YES	**YES**	**Bioaccumulative**
Inorganics								
Aluminum	40,000	40,041	50	*ORNL*	800	no	no	max • BKGD
Antimony	5.3	NA	0.27	*EcoSSL*	20	no	**YES**	**HQ > 1**
Arsenic	37.9	15.8	18	*EcoSSL*	2	YES	**YES**	**HQ > 1**
Barium	610	209	330	*EcoSSL*	2	no	**YES**	**HQ > 1**
Beryllium	3.4	1.02	21	*EcoSSL*	0.2	no	no	HQ • 1
Cadmium	2.7	0.69	0.36	*EcoSSL*	8	YES	**YES**	**HQ > 1**
Calcium	97,300	NA	NA		NA	no	no	NT
Chromium	249	65.3	26	*EcoSSL*	10	YES	**YES**	**HQ > 1**
Cobalt	31.4	72.3	13	*EcoSSL*	2	no	no	max • BKGD
Copper	1,340	53.5	28	*EcoSSL*	50	YES	**YES**	**HQ > 1**
Iron	54,000	50,962	NA		NA	no	**YES**	**NSL**
Lead	3,990	26.8	11	*EcoSSL*	400	YES	**YES**	**HQ > 1**
Magnesium	23,200	NA	NA		NA	no	no	NT
Manganese	911	2,543	220	*EcoSSL*	4	no	no	max • BKGD
Mercury	0.24	0.13	0.1	*R5*	2	no	**YES**	**HQ > 1**
Nickel	37	62.8	38	*EcoSSL*	1	YES	no	max • BKGD
Potassium	2,910	NA	NA		NA	no	no	NT
Selenium	1.2	NA	0.52	*EcoSSL*	2	YES	**YES**	**HQ > 1**
Silver	2.2	NA	4.2	*EcoSSL*	0.5	YES	**YES**	**Bioaccumulative**
Sodium	384	NA	NA		NA	no	no	NT
Thallium	0.86	2.11	0.05692	*R5*	20	no	no	max • BKGD
Vanadium	90.7	108	7.8	*EcoSSL*	10	no	no	max • BKGD
Zinc	3,250	202	46	*EcoSSL*	70	YES	**YES**	**HQ > 1**

Notes:
– = Not available or applicable.
mg/kg = Milligrams per kilogram.
NA = Not available or applicable.

[a] Background levels for inorganics are facility-wide soil background point estimates taken from Facility-Wide Background Study Report (IT Corporation 2001).
[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[c] The maximum hazard quotient (HQ) is the ratio of the maximum constituent concentration to the surface soil screening level. HQs are rounded to one significant figure.
[d] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.
[e] (COPECs) for screening level assessment unless they were essential nutrients and thus considered non-toxic (NT), or were inorganics present at concentrations below background (max • BKGD).
[f] Sum of individual dioxin/furan compounds multiplied by their individual TEFs.

Table A.7.ERA-2
Screening Level - Constituents of Potential Ecological Concern in Sediment
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Ecological Screening Level (ESLs) [a] (mg/kg)		Maximum HQ [b] (unitless)	Bioaccumulative Chemical? [c] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [d]	
		Value	*Source*			(YES/no)	Rational
Volatile Organic Compounds							
2-Butanone	0.18	0.0424	*R5*	4	no	**YES**	**HQ > 1**
Acetone	0.23	0.0099	*R5*	20	no	**YES**	**HQ > 1**
Carbon Disulfide	0.0015	0.000851	*R3*	2	no	**YES**	**HQ > 1**
Methylene Chloride	0.002	0.159	*R5*	0.01	no	no	HQ • 1
Toluene	0.61	1.22	*R5*	0.5	no	no	HQ • 1
Semi-Volatile Organic Compounds							
1,2,4-Trichlorobenzene	0.023	2.1	*R3*	0.01	YES	**YES**	**Bioaccumulative**
1,4-Dichlorobenzene	0.049	0.599	*R3*	0.08	YES	**YES**	**Bioaccumulative**
4-Methylphenol	2.2	0.67	*R3*	3	no	**YES**	**HQ > 1**
bis(2-Ethylhexyl)phthalate	0.33	0.18	*R3*	2	no	**YES**	**HQ > 1**
Carbazole	0.21	NA		NA	no	**YES**	**NSL**
Dibenzofuran	0.1	0.415	*R3*	0.2	no	no	HQ • 1
Phenol	0.086	0.42	*R3*	0.2	no	no	HQ • 1
Dioxin/Furan Compounds							
Dioxin Toxicity Equivalents [e]	2.82E-06	0.00000085	*R3s*	3	YES	**YES**	**HQ > 1**
Explosives							
1,3,5-Trinitrobenzene	0.41	NA		NA	no	**YES**	**NSL**
Nitroglycerine	0.96	NA		NA	no	**YES**	**NSL**
Herbicides							
2,4,5-T	0.00757	12.3	*R3*	0.0006	no	no	HQ • 1
2,4-D	6.83	1.273	*R5*	5	no	**YES**	**HQ > 1**
Dicamba	0.0322	NA		NA	no	**YES**	**NSL**
MCPP	3.56	NA		NA	no	**YES**	**NSL**
Pesticides							
4,4'-DDD	0.00152	0.00488	*R3*	0.3	YES	**YES**	**Bioaccumulative**
4,4'-DDE	0.00308	0.00316	*R3*	1	YES	**YES**	**Bioaccumulative**
4,4'-DDT	0.0119	7	*ORNL*	0.002	YES	**YES**	**Bioaccumulative**
BHC, delta-	0.00095	6.4	*R3*	0.0001	YES	**YES**	**Bioaccumulative**
Chlordane, alpha-	0.00071	0.00324	*R3s*	0.2	YES	**YES**	**Bioaccumulative**
Chlordane, gamma-	0.00088	0.00324	*R3s*	0.3	no	no	HQ • 1
Dieldrin	0.00347	0.0019	*R3*	2	YES	**YES**	**HQ > 1**
Endosulfan II	0.00161	0.014	*R3*	0.1	YES	**YES**	**Bioaccumulative**
Endrin Aldehyde	0.00169	0.48	*R5*	0.004	no	no	HQ • 1
Endrin Ketone	0.00288	0.00222	*R3s*	1	no	no	HQ • 1
Methoxychlor	0.00637	0.0187	*R3*	0.3	YES	**YES**	**Bioaccumulative**
Polycyclic Aromatic Hydrocarbons							
1-Methylnaphthalene	0.0026	0.0202	*R3s*	0.1	no	no	HQ • 1
2-Methylnaphthalene	0.065	0.0202	*R3*	3	no	**YES**	**HQ > 1**
Acenaphthene	0.31	0.0067	*R3*	50	YES	**YES**	**HQ > 1**
Acenaphthylene	0.021	0.0059	*R3*	4	YES	**YES**	**HQ > 1**
Anthracene	0.83	0.0572	*R3*	10	YES	**YES**	**HQ > 1**
Benzo(a)anthracene	4	0.108	*R3*	40	YES	**YES**	**HQ > 1**
Benzo(a)pyrene	3.7	0.15	*R3*	20	YES	**YES**	**HQ > 1**
Benzo(b)fluoranthene	4.6	10.4	*R5*	0.4	YES	**YES**	**Bioaccumulative**
Benzo(g,h,i)perylene	2.1	0.17	*R3*	10	YES	**YES**	**HQ > 1**
Benzo(k)fluoranthene	1.4	0.24	*R3*	6	YES	**YES**	**HQ > 1**

Table A.7.ERA-2
Screening Level - Constituents of Potential Ecological Concern in Sediment
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/kg)	Ecological Screening Level (ESLs) [a] (mg/kg)		Maximum HQ [b] (unitless)	Bioaccumulative Chemical? [c] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [d]	
		Value	***Source***			**(YES/no)**	**Rational**
Chrysene	4.1	0.166	*R3*	20	YES	**YES**	**HQ > 1**
Dibenzo(a,h)anthracene	0.56	0.033	*R3*	20	YES	**YES**	**HQ > 1**
Fluoranthene	4.9	0.423	*R3*	10	YES	**YES**	**HQ > 1**
Fluorene	0.25	0.0774	*R3*	3	YES	**YES**	**HQ > 1**
Indeno(1,2,3-cd)pyrene	1.6	0.017	*R3*	90	YES	**YES**	**HQ > 1**
Naphthalene	0.085	0.176	*R3*	0.5	no	no	HQ • 1
Phenanthrene	2.8	0.204	*R3*	10	YES	**YES**	**HQ > 1**
Pyrene	5	0.195	*R3*	30	YES	**YES**	**HQ > 1**
Inorganics							
Aluminum	30,900	58,000	*ARCS_PEC*	0.5	no	no	HQ • 1
Antimony	3.1	2	*R3*	2	no	**YES**	**HQ > 1**
Arsenic	30.4	9.8	*R3*	3	YES	**YES**	**HQ > 1**
Barium	179	NA		NA	no	**YES**	**NSL**
Beryllium	2.27	NA		NA	no	**YES**	**NSL**
Cadmium	2.7	0.99	*R3*	3	YES	**YES**	**HQ > 1**
Calcium	120,000	NA		NA	no	no	NT
Chromium	15,400	43.4	*R3*	400	YES	**YES**	**HQ > 1**
Cobalt	84.1	50	*R3*	2	no	**YES**	**HQ > 1**
Copper	188	31.6	*R3*	6	YES	**YES**	**HQ > 1**
Iron	293,000	20,000	*R3*	10	no	**YES**	**HQ > 1**
Lead	109,000	35.8	*R3*	3000	YES	**YES**	**HQ > 1**
Magnesium	10,200	NA		NA	no	no	NT
Manganese	2,310	460	*R3*	5	no	**YES**	**HQ > 1**
Mercury	0.09	0.18	*R3*	0.5	no	no	HQ • 1
Nickel	26.8	22.7	*R3*	1	YES	**YES**	**Bioaccumulative**
Potassium	2,210	NA		NA	no	no	NT
Selenium	1.3	2	*R3*	0.7	YES	**YES**	**Bioaccumulative**
Silver	8.42	1	*R3*	8	YES	**YES**	**HQ > 1**
Sodium	577	NA		NA	no	no	NT
Thallium	1.7	NA		NA	no	**YES**	**NSL**
Vanadium	106	NA		NA	no	**YES**	**NSL**
Zinc	17,300	121	*R3*	100	YES	**YES**	**HQ > 1**

Notes:

– = Not available or applicable.
mg/kg = Milligrams per kilogram.
NA = Not available or applicable.

[a] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[b] The maximum hazard quotient (HQ) is the ratio of the maximum constituent concentration to the sediment screening level. HQs are rounded to one significant figure.
[c] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.
[d] Constituents with a hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for screening level assessment unless they were essential nutrients and thus considered non-toxic (NT).
[e] Sum of individual dioxin/furan compounds multiplied by their individual TEFs.

Table A.7.ERA-3
Screening Level - Constituents of Potential Ecological Concern in Surface Water
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/L)	Ecological Screening Level (ESLs) [a] (mg/L)		Maximum HQ [b] (unitless)	Bioaccumulative Chemical? [c] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [d]	
		Value	*Source*			(YES/no)	Rational
Volatile Organic Compounds							
2-Butanone	0.004	14	*R3*	0.0003	no	no	HQ • 1
Acetone	0.0028	1.5	*R3*	0.002	no	no	HQ • 1
Carbon Disulfide	0.00025	0.00092	*R3*	0.3	no	no	HQ • 1
Chloroform	0.003	0.0018	*R3*	2	no	**YES**	**HQ > 1**
cis-1,2-Dichloroethene	0.00012	0.97	*R3s*	0.0001	no	no	HQ • 1
Tetrachloroethene	0.00016	0.111	*R3*	0.001	no	no	HQ • 1
Toluene	0.00021	0.002	*R3*	0.1	no	no	HQ • 1
Trichloroethene	0.00011	0.021	*R3*	0.005	no	no	HQ • 1
Semi-Volatile Organic Compounds							
1,2-Dichlorobenzene	0.00021	0.0007	*R3*	0.3	YES	**YES**	**Bioaccumulative**
1,3-Dichlorobenzene	0.00021	0.15	*R3*	0.001	YES	**YES**	**Bioaccumulative**
1,4-Dichlorobenzene	0.00028	0.026	*R3*	0.01	YES	**YES**	**Bioaccumulative**
Benzoic Acid	0.0067	0.042	*R3*	0.2	no	no	HQ • 1
bis(2-Ethylhexyl)phthalate	0.0026	0.016	*R3*	0.2	no	no	HQ • 1
Butylbenzylphthalate	0.00063	0.019	*R3*	0.03	no	no	HQ • 1
Diethylphthalate	0.001	0.21	*R3*	0.005	no	no	HQ • 1
Di-n-Butylphthalate	0.00091	0.019	*R3*	0.05	no	no	HQ • 1
Dioxin/Furan Compounds							
Dioxin Toxicity Equivalents [e]	3.50E-12	3.1E-12	*R3s*	1	YES	**YES**	**Bioaccumulative**
Explosives							
m-Nitrotoluene	0.00038	0.75	*R3*	0.0005	no	no	HQ • 1
Herbicides							
2,4-D	0.00368	0.22	*R5*	0.02	no	no	HQ • 1
MCPP	0.0541	NA		NA	no	**YES**	**NSL**
Pesticides							
Dieldrin	0.00000901	0.000056	*R3*	0.2	YES	**YES**	**Bioaccumulative**
Polycyclic Aromatic Hydrocarbons							
1-Methylnaphthalene	0.000026	0.0021	*R3*	0.01	no	no	HQ • 1
2-Methylnaphthalene	0.000033	0.0047	*R3*	0.007	no	no	HQ • 1
Acenaphthene	0.00004	0.0058	*R3*	0.007	YES	**YES**	**Bioaccumulative**
Anthracene	0.00003	0.000012	*R3*	3	YES	**YES**	**HQ > 1**
Fluorene	0.000034	0.003	*R3*	0.01	YES	**YES**	**Bioaccumulative**
Naphthalene	0.00004	0.0011	*R3*	0.04	no	no	HQ • 1
Phenanthrene	0.00005	0.0004	*R3*	0.1	YES	**YES**	**Bioaccumulative**
Inorganics							
Aluminum	0.811	0.087	*R3*	9	no	**YES**	**HQ > 1**
Arsenic	0.0104	0.005	*R3*	2	YES	**YES**	**HQ > 1**
Barium	0.148	0.004	*R3*	40	no	**YES**	**HQ > 1**
Beryllium	0.0011	0.00066	*R3*	2	no	**YES**	**HQ > 1**
Calcium	90.7	116	*R3*	NA	no	no	NT
Copper	0.0235	0.009	*R3*	3	YES	**YES**	**HQ > 1**
Iron	50.9	0.3	*R3*	200	no	**YES**	**HQ > 1**
Lead	0.106	0.0025	*R3*	40	YES	**YES**	**HQ > 1**

Table A.7.ERA-3
Screening Level - Constituents of Potential Ecological Concern in Surface Water
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration (mg/L)	Ecological Screening Level (ESLs) [a] (mg/L)		Maximum HQ [b] (unitless)	Bioaccumulative Chemical? [c] (YES/no)	Screening Level Constituent of Potential Ecological Concern? [d]	
		Value	*Source*			(YES/no)	Rational
Magnesium	21	82	*R3*	NA	no	no	NT
Manganese	1.47	0.12	*R3*	10	no	**YES**	**HQ > 1**
Nickel	0.0015	0.052	*R3*	0.03	YES	**YES**	**Bioaccumulative**
Potassium	4.08	NA		NA	no	no	NT
Selenium	0.00044	0.001	*R3*	0.4	YES	**YES**	**Bioaccumulative**
Silver	0.0012	0.0032	*R3*	0.4	YES	**YES**	**Bioaccumulative**
Sodium	63.9	680	*R3*	NA	no	no	NT
Thallium	0.0054	0.0008	*R3*	7	no	**YES**	**HQ > 1**
Vanadium	0.079	0.02	*R3*	4	no	**YES**	**HQ > 1**
Zinc	0.0237	0.12	*R3*	0.2	YES	**YES**	**Bioaccumulative**

Notes:
– = Not available or applicable.
mg/L = Milligrams per liter.
NA = Not available or applicable.

[a] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[b] The maximum hazard quotient (HQ) is the ratio of the maximum constituent concentration to the surface soil screening level. HQs are rounded to one significant figure.
[c] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.
[d] Constituent with a hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential
[e] Sum of individual dioxin/furan compounds multiplied by their individual TEFs.

Table A.7.ERA-4
Baseline Level - Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)		TEF [b]	Ecological Screening Level (ESLs) [b] (mg/kg) Value	*Source*	Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rational	Bioaccumulative ? [e] (YES/no)
Volatile Organic Compounds									
d-Limonene	0.17	m	–	NA		NA	**YES**	**NSL**	no
p-Isopropyltoluene	0.0048	m	–	NA		NA	**YES**	**NSL**	no
Semi-Volatile Organic Compounds									
Carbazole	0.1	m	–	NA		NA	**YES**	**NSL**	no
Dibenzofuran	0.014	m	–	NA		NA	**YES**	**NSL**	no
Dioxin/Furan Compounds									
Dioxin Toxicity Equivalents	9.90E-06	m		0.000000199	*R5s*	50	**YES**	**HQ > 1**	**YES**
Explosives									
Pentaerythritol Tetranitrate	0.11	m	–	NA		NA	**YES**	**NSL**	no
Herbicides									
Dalapon	0.163	m	–	NA		NA	**YES**	**NSL**	no
MCPP	2.56	m	–	NA		NA	**YES**	**NSL**	no
Pesticides									
4,4'-DDD	0.0019	m	–	0.021	*EcoSSL*	0.09	**YES**	**Bioaccumulative**	**YES**
Dieldrin	0.00472	m	–	0.0049	*EcoSSL*	1	**YES**	**Bioaccumulative**	**YES**
Polycyclic Aromatic Hydrocarbons									
Acenaphthene	0.32	m	–	682	*R5*	0.0005	**YES**	**Bioaccumulative**	**YES**
Acenaphthylene	0.0039	m	–	682	*R5*	0.000006	**YES**	**Bioaccumulative**	**YES**
Anthracene	0.035		–	1,480	*R5*	0.00002	**YES**	**Bioaccumulative**	**YES**
Benzo(a)anthracene	0.132		–	5.21	*R5*	0.03	**YES**	**Bioaccumulative**	**YES**
Benzo(a)pyrene	0.164		–	1.52	*R5*	0.1	**YES**	**Bioaccumulative**	**YES**
Benzo(b)fluoranthene	0.228		–	59.8	*R5*	0.004	**YES**	**Bioaccumulative**	**YES**
Benzo(g,h,i)perylene	0.148		–	119	*R5*	0.001	**YES**	**Bioaccumulative**	**YES**
Benzo(k)fluoranthene	0.123		–	148	*R5*	0.0008	**YES**	**Bioaccumulative**	**YES**
Chrysene	0.164		–	4.73	*R5*	0.03	**YES**	**Bioaccumulative**	**YES**
Dibenzo(a,h)anthracene	0.22	m	–	18.4	*R5*	0.01	**YES**	**Bioaccumulative**	**YES**
Fluoranthene	0.236		–	122	*R5*	0.002	**YES**	**Bioaccumulative**	**YES**
Fluorene	0.028	m	–	122	*R5*	0.0002	**YES**	**Bioaccumulative**	**YES**
Indeno(1,2,3-cd)pyrene	0.145		–	109	*R5*	0.001	**YES**	**Bioaccumulative**	**YES**
Phenanthrene	0.119		–	45.7	*R5*	0.003	**YES**	**Bioaccumulative**	**YES**
Pyrene	0.2		–	78.5	*R5*	0.003	**YES**	**Bioaccumulative**	**YES**
Polychlorinated Biphenyls									
Aroclor 1254	0.084	m	–	NA		NA	**YES**	**NSL**	**YES**

Table A.7.ERA-4
Baseline Level - Constituents of Potential Ecological Concern in Surface Soil (0-1 foot Depth Interval)
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)	TEF [b]	Ecological Screening Level (ESLs) [b] (mg/kg)		Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d]		Bioaccumulative ? [e] (YES/no)
			Value	*Source*		(YES/no)	Rational	
Inorganics								
Antimony	0.836	–	0.27	*EcoSSL*	3	**YES**	**HQ > 1**	no
Arsenic	10.72	–	18	*EcoSSL*	0.6	**YES**	**Bioaccumulative**	**YES**
Barium	68.87	–	330	*EcoSSL*	0.2	no	HQ • 1	no
Cadmium	0.322	–	0.36	*EcoSSL*	0.9	**YES**	**Bioaccumulative**	**YES**
Chromium	55.92	–	26	*EcoSSL*	2	**YES**	**HQ > 1**	no
Copper	145.5	–	28	*EcoSSL*	5	**YES**	**HQ > 1**	**YES**
Iron	35,755	–	NA		NA	**YES**	**NSL**	no
Lead	698	–	11	*EcoSSL*	60	**YES**	**HQ > 1**	**YES**
Mercury	0.0954	–	0.1	*R5*	1	no	HQ • 1	no
Selenium	0.625	–	0.52	*EcoSSL*	1	**YES**	**Bioaccumulative**	**YES**
Silver	0.37	–	4.2	*EcoSSL*	0.09	**YES**	**Bioaccumulative**	**YES**
Zinc	593.9	–	46	*EcoSSL*	10	**YES**	**HQ > 1**	**YES**

Notes:
– = Not available or applicable.
mg/kg = Milligrams per kilogram.
NA = Not available or applicable.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[c] The refined hazard quotient (HQ) is the ratio of the EPC to the surface soil screening level. HQs are rounded to one significant figure.
[d] Constituents with a refined hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for baseline risk assessment.
[e] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.

Table A.7.ERA-5
Baseline Level - Constituents of Potential Ecological Concern in Sediment
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	**Exposure Point Concentration [a] (mg/kg)**		**Ecological Screening Level (ESLs) [b] (mg/kg)**		**Refined HQ [c] (unitless)**	**Baseline Level Constituent of Potential Ecological Concern? [d]**		**Bioaccumulative ? [e] (YES/no)**
			Value	***Source***		**(YES/no)**	**Rational**	
Volatile Organic Compounds								
2-Butanone	0.0737		0.0424	*R5*	2	**YES**	**HQ > 1**	no
Acetone	0.107		0.0099	*R5*	10	**YES**	**HQ > 1**	no
Carbon Disulfide	0.00143		0.000851	*R3*	2	**YES**	**HQ > 1**	no
Semi-Volatile Organic Compounds								
1,2,4-Trichlorobenzene	0.023	m	2.1	*R3*	0.01	**YES**	**Bioaccumulative**	**YES**
1,4-Dichlorobenzene	0.049	m	0.599	*R3*	0.08	**YES**	**Bioaccumulative**	**YES**
4-Methylphenol	2.2	m	0.67	*R3*	3	**YES**	**HQ > 1**	no
bis(2-Ethylhexyl)phthalate	0.214		0.18	*R3*	1	no	HQ • 1	no
Carbazole	0.21	m	NA		NA	**YES**	**NSL**	no
Dioxin/Furan Compounds								
Dioxin Toxicity Equivalents	2.8E-06	m	0.00000085	*R3s*	3	**YES**	**HQ > 1**	**YES**
Explosives								
1,3,5-Trinitrobenzene	0.41	m	NA		NA	**YES**	**NSL**	no
Nitroglycerine	0.96	m	NA		NA	**YES**	**NSL**	no
Herbicides								
2,4-D	6.83	m	1.273	*R5*	5	**YES**	**HQ > 1**	no
Dicamba	0.0322	m	NA		NA	**YES**	**NSL**	no
MCPP	3.56	m	NA		NA	**YES**	**NSL**	no
Pesticides								
4,4'-DDD	0.00152	m	0.00488	*R3*	0.3	**YES**	**Bioaccumulative**	**YES**
4,4'-DDE	0.00308	m	0.00316	*R3*	1	**YES**	**Bioaccumulative**	**YES**
4,4'-DDT	0.0119	m	7	*ORNL*	0.002	**YES**	**Bioaccumulative**	**YES**
BHC, delta-	0.00095	m	6.4	*R3*	0.0001	**YES**	**Bioaccumulative**	**YES**
Chlordane, alpha-	0.00071	m	0.00324	*R3s*	0.2	**YES**	**Bioaccumulative**	**YES**
Dieldrin	0.00347	m	0.0019	*R3*	2	**YES**	**HQ > 1**	**YES**
Endosulfan II	0.00161	m	0.014	*R3*	0.1	**YES**	**Bioaccumulative**	**YES**
Methoxychlor	0.00637	m	0.0187	*R3*	0.3	**YES**	**Bioaccumulative**	**YES**
Polycyclic Aromatic Hydrocarbons								
2-Methylnaphthalene	0.065	m	0.0202	*R3*	3	**YES**	**HQ > 1**	no
Acenaphthene	0.31	m	0.0067	*R3*	50	**YES**	**HQ > 1**	**YES**
Acenaphthylene	0.021	m	0.0059	*R3*	4	**YES**	**HQ > 1**	**YES**
Anthracene	0.201		0.0572	*R3*	4	**YES**	**HQ > 1**	**YES**
Benzo(a)anthracene	2.322		0.108	*R3*	20	**YES**	**HQ > 1**	**YES**
Benzo(a)pyrene	0.62		0.15	*R3*	4	**YES**	**HQ > 1**	**YES**
Benzo(b)fluoranthene	0.735		10.4	*R5*	0.07	**YES**	**Bioaccumulative**	**YES**
Benzo(g,h,i)perylene	0.386		0.17	*R3*	2	**YES**	**HQ > 1**	**YES**
Benzo(k)fluoranthene	0.24		0.24	*R3*	1	**YES**	**Bioaccumulative**	**YES**
Chrysene	2.38		0.166	*R3*	10	**YES**	**HQ > 1**	**YES**
Dibenzo(a,h)anthracene	0.56	m	0.033	*R3*	20	**YES**	**HQ > 1**	**YES**
Fluoranthene	0.891		0.423	*R3*	2	**YES**	**HQ > 1**	**YES**

Table A.7.ERA-5
Baseline Level - Constituents of Potential Ecological Concern in Sediment
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)		Ecological Screening Level (ESLs) [b] (mg/kg) Value	*Source*	Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rational	Bioaccumulative ? [e] (YES/no)
Fluorene	0.0913		0.0774	*R3*	1	**YES**	**Bioaccumulative**	**YES**
Indeno(1,2,3-cd)pyrene	0.306		0.017	*R3*	20	**YES**	**HQ > 1**	**YES**
Phenanthrene	0.484		0.204	*R3*	2	**YES**	**HQ > 1**	**YES**
Pyrene	0.854		0.195	*R3*	4	**YES**	**HQ > 1**	**YES**
Inorganics								
Antimony	0.966		2	*R3*	0.5	no	HQ • 1	no
Arsenic	8.685		9.8	*R3*	0.9	**YES**	**Bioaccumulative**	**YES**
Barium	92.82		NA		NA	**YES**	**NSL**	no
Beryllium	1.164		NA		NA	**YES**	**NSL**	no
Cadmium	0.507		0.99	*R3*	0.5	**YES**	**Bioaccumulative**	**YES**
Chromium	6,048		43.4	*R3*	100	**YES**	**HQ > 1**	no
Cobalt	24.48		50	*R3*	0.5	no	HQ • 1	no
Copper	54.79		31.6	*R3*	2	**YES**	**HQ > 1**	**YES**
Iron	74,658		20,000	*R3*	4	**YES**	**HQ > 1**	no
Lead	37,445		35.8	*R3*	1,000	**YES**	**HQ > 1**	**YES**
Manganese	831.3		460	*R3*	2	**YES**	**HQ > 1**	no
Nickel	15.71		22.7	*R3*	0.7	**YES**	**Bioaccumulative**	**YES**
Selenium	1.3	m	2	*R3*	0.7	**YES**	**Bioaccumulative**	**YES**
Silver	8.42	m	1	*R3*	8	**YES**	**HQ > 1**	**YES**
Thallium	0.389		NA		NA	**YES**	**NSL**	no
Vanadium	49.04		NA		NA	**YES**	**NSL**	no
Zinc	6,810		121	*R3*	60	**YES**	**HQ > 1**	**YES**

Notes:

– = Not available or applicable.
mg/kg = Milligrams per kilogram.
NA = Not available or applicable.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.

[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.

[c] The refined hazard quotient (HQ) is the ratio of the EPC to the sediment screening level. HQs are rounded to one significant figure.

[d] Constituents with a refined hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for baseline risk assessment.

[e] Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.

Table A.7.ERA-6
Sediment Polycyclic Aromatic Hydrocarbon Toxic Units
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant
Radford, Virginia

Location ID: Sample Depth(Feet): Date Collected:	Final Chronic Value (FCV) [a]	SD-01 0 - 0.5 35585.00			SD-02 0 - 0.5 35585.00			WBGSD1 0 - 0.5 35992.00			WBGSD2 0 - 0.5 35992.00		
		mg/kg_{sed}	mg/kg_{TOC}	TU	mg/kg_{sed}	mg/kg_{TOC}	TU	mg/kg_{sed}	mg/kg_{TOC}	TU	mg/kg_{sed}	mg/kg_{TOC}	TU
TOC (%) [b]		**3.40%**			**3.40%**			**3.40%**			**3.40%**		
TOC (mg/kg)		NA			NA			NA			NA		
2-Methylnaphthalene	446	NA	NA	NA	NA	NA	NA	<0.42	6.2E+00	1.4E-02	<0.92	1.4E+01	3.0E-02
Acenaphthene	491	NA	NA	NA	NA	NA	NA	<0.42	6.2E+00	1.3E-02	<0.92	1.4E+01	2.8E-02
Acenaphthylene	452	NA	NA	NA	NA	NA	NA	<0.42	6.2E+00	1.4E-02	<0.92	1.4E+01	3.0E-02
Anthracene	594	NA	NA	NA	NA	NA	NA	<0.42	6.2E+00	1.0E-02	<0.92	1.4E+01	2.3E-02
Benzo(a)anthracene	841	0.09	2.6E+00	3.1E-03	0.1	2.9E+00	3.5E-03	<0.42	6.2E+00	7.3E-03	<0.92	1.4E+01	1.6E-02
Benzo(a)pyrene	965	0.09	2.6E+00	2.7E-03	ND	NA	NA	<0.42	6.2E+00	6.4E-03	<0.92	1.4E+01	1.4E-02
Benzo(b)fluoranthene	979	0.09	2.6E+00	2.7E-03	0.1	2.9E+00	3.0E-03	<0.42	6.2E+00	6.3E-03	<0.92	1.4E+01	1.4E-02
Benzo(g,h,i)perylene	1095	NA	NA	NA	NA	NA	NA	<0.42	6.2E+00	5.6E-03	<0.92	1.4E+01	1.2E-02
Benzo(k)fluoranthene	981	0.09	2.6E+00	2.7E-03	0.1	2.9E+00	3.0E-03	<0.42	6.2E+00	6.3E-03	<0.92	1.4E+01	1.4E-02
Chrysene	844	0.09	2.6E+00	3.1E-03	0.13	3.8E+00	4.5E-03	<0.42	6.2E+00	7.3E-03	<0.92	1.4E+01	1.6E-02
Dibenzo(a,h)anthracene	1123	NA	NA	NA	NA	NA	NA	<0.42	6.2E+00	5.5E-03	<0.92	1.4E+01	1.2E-02
Fluoranthene	707	0.3	8.8E+00	1.2E-02	0.2	5.9E+00	8.3E-03	<0.42	6.2E+00	8.7E-03	<0.92	1.4E+01	1.9E-02
Fluorene	538	NA	NA	NA	NA	NA	NA	<0.42	6.2E+00	1.1E-02	<0.92	1.4E+01	2.5E-02
Indeno(1,2,3-cd)pyrene	1115	NA	NA	NA	NA	NA	NA	<0.42	6.2E+00	5.5E-03	<0.92	1.4E+01	1.2E-02
Naphthalene	385	NA	NA	NA	NA	NA	NA	<0.42	6.2E+00	1.6E-02	<0.92	1.4E+01	3.5E-02
Phenanthrene	596	0.12	3.5E+00	5.9E-03	0.15	4.4E+00	7.4E-03	<0.42	6.2E+00	1.0E-02	<0.92	1.4E+01	2.3E-02
Pyrene	697	0.2	5.9E+00	8.4E-03	0.15	4.4E+00	6.3E-03	<0.42	6.2E+00	8.9E-03	<0.92	1.4E+01	1.9E-02
sum TU				0.041			0.036			0.156			0.342
Total TU [c]				0.1			0.1			0.4			0.9

Table A.7.ERA-6
Sediment Polycyclic Aromatic Hydrocarbon Toxic Units
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant
Radford, Virginia

Location ID: Sample Depth(Feet): Date Collected:	**Final Chronic Value (FCV) [a]**	**WBGSD3 0 - 0.5 35992.00**			**WBGSD4 0 - 0.5 36307.00**			**WBGSD5 0 - 0.5 36307.00**			**WBGSD6 0 - 0.5 36307.00**		
		mg/kg_{sed}	**mg/kg_{TOC}**	**TU**	**mg/kg_{sed}**	**mg/kg_{TOC}**	**TU**	**mg/kg_{sed}**	**mg/kg_{TOC}**	**TU**	**mg/kg_{sed}**	**mg/kg_{TOC}**	**TU**
TOC (%) [b]		**3.40%**			**2.18%**			**3.93%**			**3.73%**		
TOC (mg/kg)		NA			21,842			39,276			37,330		
2-Methylnaphthalene	446	<0.94	1.4E+01	3.1E-02	<0.69	1.6E+01	3.5E-02	<1.1	1.4E+01	3.1E-02	<0.85	1.1E+01	2.6E-02
Acenaphthene	491	<0.94	1.4E+01	2.8E-02	<0.69	1.6E+01	3.2E-02	<1.1	1.4E+01	2.9E-02	<0.85	1.1E+01	2.3E-02
Acenaphthylene	452	<0.94	1.4E+01	3.1E-02	<0.69	1.6E+01	3.5E-02	<1.1	1.4E+01	3.1E-02	<0.85	1.1E+01	2.5E-02
Anthracene	594	<0.94	1.4E+01	2.3E-02	<0.69	1.6E+01	2.7E-02	<1.1	1.4E+01	2.4E-02	<0.85	1.1E+01	1.9E-02
Benzo(a)anthracene	841	<0.94	1.4E+01	1.6E-02	<0.69	1.6E+01	1.9E-02	<1.1	1.4E+01	1.7E-02	<0.85	1.1E+01	1.4E-02
Benzo(a)pyrene	965	<0.94	1.4E+01	1.4E-02	<0.69	1.6E+01	1.6E-02	<1.1	1.4E+01	1.5E-02	<0.85	1.1E+01	1.2E-02
Benzo(b)fluoranthene	979	<0.94	1.4E+01	1.4E-02	<0.69	1.6E+01	1.6E-02	<1.1	1.4E+01	1.4E-02	<0.85	1.1E+01	1.2E-02
Benzo(g,h,i)perylene	1095	<0.94	1.4E+01	1.3E-02	<0.69	1.6E+01	1.4E-02	<1.1	1.4E+01	1.3E-02	<0.85	1.1E+01	1.0E-02
Benzo(k)fluoranthene	981	<0.94	1.4E+01	1.4E-02	<0.69	1.6E+01	1.6E-02	<1.1	1.4E+01	1.4E-02	<0.85	1.1E+01	1.2E-02
Chrysene	844	<0.94	1.4E+01	1.6E-02	<0.69	1.6E+01	1.9E-02	<1.1	1.4E+01	1.7E-02	<0.85	1.1E+01	1.3E-02
Dibenzo(a,h)anthracene	1123	<0.94	1.4E+01	1.2E-02	<0.69	1.6E+01	1.4E-02	<1.1	1.4E+01	1.2E-02	<0.85	1.1E+01	1.0E-02
Fluoranthene	707	<0.94	1.4E+01	2.0E-02	<0.69	1.6E+01	2.2E-02	<1.1	1.4E+01	2.0E-02	<0.85	1.1E+01	1.6E-02
Fluorene	538	<0.94	1.4E+01	2.6E-02	<0.69	1.6E+01	2.9E-02	<1.1	1.4E+01	2.6E-02	<0.85	1.1E+01	2.1E-02
Indeno(1,2,3-cd)pyrene	1115	<0.94	1.4E+01	1.2E-02	<0.69	1.6E+01	1.4E-02	<1.1	1.4E+01	1.3E-02	<0.85	1.1E+01	1.0E-02
Naphthalene	385	<0.94	1.4E+01	3.6E-02	<0.69	1.6E+01	4.1E-02	<1.1	1.4E+01	3.6E-02	<0.85	1.1E+01	3.0E-02
Phenanthrene	596	<0.94	1.4E+01	2.3E-02	<0.69	1.6E+01	2.7E-02	<1.1	1.4E+01	2.3E-02	<0.85	1.1E+01	1.9E-02
Pyrene	697	<0.94	1.4E+01	2.0E-02	<0.69	1.6E+01	2.3E-02	<1.1	1.4E+01	2.0E-02	<0.85	1.1E+01	1.6E-02
sum TU				0.350			0.400			0.354			0.288
Total TU [c]				1			1			1			0.8

Table A.7.ERA-6
Sediment Polycyclic Aromatic Hydrocarbon Toxic Units
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant
Radford, Virginia

Location ID: Sample Depth(Feet): Date Collected:	Final Chronic Value (FCV) [a]	WBGSD11 0 - 0.5 37434.00			WBGSD12 0 - 0.5 37433.00			WBGSD16 0 - 0.5 38184.00			WBG-SE005 0 - 0.5 39660.00		
		mg/kg_{sed}	mg/kg_{TOC}	TU	mg/kg_{sed}	mg/kg_{TOC}	TU	mg/kg_{sed}	mg/kg_{TOC}	TU	mg/kg_{sed}	mg/kg_{TOC}	TU
TOC (%) [b]		**2.42%**			**3.40%**			**3.40%**			**3.40%**		
TOC (mg/kg)		24200			NA			NA			NA		
2-Methylnaphthalene	446	<0.0040	8.3E-02	1.9E-04	<0.36	5.3E+00	1.2E-02	<0.016	2.4E-01	5.3E-04	<0.0074	1.1E-01	2.4E-04
Acenaphthene	491	<0.0040	8.3E-02	1.7E-04	<0.36	5.3E+00	1.1E-02	0.029	8.5E-01	1.7E-03	<0.0074	1.1E-01	2.2E-04
Acenaphthylene	452	<0.0040	8.3E-02	1.8E-04	<0.36	5.3E+00	1.2E-02	<0.016	2.4E-01	5.2E-04	<0.0074	1.1E-01	2.4E-04
Anthracene	594	<0.0040	8.3E-02	1.4E-04	<0.36	5.3E+00	8.9E-03	0.078	2.3E+00	3.9E-03	<0.0074	1.1E-01	1.8E-04
Benzo(a)anthracene	841	<0.0040	8.3E-02	9.8E-05	0.053	1.6E+00	1.9E-03	0.16	4.7E+00	5.6E-03	0.0055	1.6E-01	1.9E-04
Benzo(a)pyrene	965	<0.0040	8.3E-02	8.6E-05	0.054	1.6E+00	1.6E-03	0.17	5.0E+00	5.2E-03	<0.0074	1.1E-01	1.1E-04
Benzo(b)fluoranthene	979	<0.0040	8.3E-02	8.4E-05	0.09	2.6E+00	2.7E-03	0.27	7.9E+00	8.1E-03	0.0096	2.8E-01	2.9E-04
Benzo(g,h,i)perylene	1095	<0.0040	8.3E-02	7.5E-05	<0.36	5.3E+00	4.8E-03	0.095	2.8E+00	2.6E-03	<0.0074	1.1E-01	9.9E-05
Benzo(k)fluoranthene	981	<0.0040	8.3E-02	8.4E-05	0.022	6.5E-01	6.6E-04	0.12	3.5E+00	3.6E-03	0.0053	1.6E-01	1.6E-04
Chrysene	844	<0.0040	8.3E-02	9.8E-05	0.065	1.9E+00	2.3E-03	0.17	5.0E+00	5.9E-03	0.0087	2.6E-01	3.0E-04
Dibenzo(a,h)anthracene	1123	<0.0040	8.3E-02	7.4E-05	<0.36	5.3E+00	4.7E-03	<0.016	2.4E-01	2.1E-04	<0.0074	1.1E-01	9.7E-05
Fluoranthene	707	0.0026	1.1E-01	1.5E-04	0.13	3.8E+00	5.4E-03	0.39	1.1E+01	1.6E-02	0.015	4.4E-01	6.2E-04
Fluorene	538	<0.0040	8.3E-02	1.5E-04	<0.36	5.3E+00	9.8E-03	0.026	7.6E-01	1.4E-03	<0.0074	1.1E-01	2.0E-04
Indeno(1,2,3-cd)pyrene	1115	<0.0040	8.3E-02	7.4E-05	<0.36	5.3E+00	4.7E-03	0.096	2.8E+00	2.5E-03	<0.0074	1.1E-01	9.8E-05
Naphthalene	385	<0.0040	8.3E-02	2.1E-04	<0.36	5.3E+00	1.4E-02	<0.016	2.4E-01	6.1E-04	<0.0074	1.1E-01	2.8E-04
Phenanthrene	596	<0.0040	8.3E-02	1.4E-04	0.066	1.9E+00	3.3E-03	0.22	6.5E+00	1.1E-02	0.0067	2.0E-01	3.3E-04
Pyrene	697	0.0017	7.0E-02	1.0E-04	0.11	3.2E+00	4.6E-03	0.27	7.9E+00	1.1E-02	0.018	5.3E-01	7.6E-04
sum TU				0.002			0.104			0.081			0.004
Total TU [c]				0.006			0.3			0.2			0.01

Table A.7.ERA-6
Sediment Polycyclic Aromatic Hydrocarbon Toxic Units
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant
Radford, Virginia

Location ID: Sample Depth(Feet): Date Collected:	Final Chronic Value (FCV) [a]	WBG-SE006 0 - 0.5 39660.00			WBGSW/SD07 0 - 0.5 37433.00			WBGSW/SD08 0 - 0.5 37432.00			WBGSW/SD09 0 - 0.5 37432.00		
		mg/kg_{sed}	mg/kg_{TOC}	TU	mg/kg_{sed}	mg/kg_{TOC}	TU	mg/kg_{sed}	mg/kg_{TOC}	TU	mg/kg_{sed}	mg/kg_{TOC}	TU
TOC (%) [b]		**3.40%**			**5.37%**			**3.40%**			**3.40%**		
TOC (mg/kg)		NA			53700			NA			NA		
2-Methylnaphthalene	446	0.0028	8.2E-02	1.8E-04	0.0022	4.1E-02	9.2E-05	<0.0040	5.9E-02	1.3E-04	0.062	1.8E+00	4.1E-03
Acenaphthene	491	0.014	4.1E-01	8.4E-04	<0.0043	4.0E-02	8.2E-05	<0.0040	5.9E-02	1.2E-04	0.31	9.1E+00	1.9E-02
Acenaphthylene	452	<0.0046	6.8E-02	1.5E-04	<0.0043	4.0E-02	8.9E-05	<0.0040	5.9E-02	1.3E-04	0.021	6.2E-01	1.4E-03
Anthracene	594	0.025	7.4E-01	1.2E-03	0.0048	8.9E-02	1.5E-04	<0.0040	5.9E-02	9.9E-05	0.83	2.4E+01	4.1E-02
Benzo(a)anthracene	841	0.042	1.2E+00	1.5E-03	0.009	1.7E-01	2.0E-04	<0.0040	5.9E-02	7.0E-05	4	1.2E+02	1.4E-01
Benzo(a)pyrene	965	0.038	1.1E+00	1.2E-03	0.0057	1.1E-01	1.1E-04	<0.0040	5.9E-02	6.1E-05	3.7	1.1E+02	1.1E-01
Benzo(b)fluoranthene	979	0.047	1.4E+00	1.4E-03	0.0081	1.5E-01	1.5E-04	<0.0040	5.9E-02	6.0E-05	4.6	1.4E+02	1.4E-01
Benzo(g,h,i)perylene	1095	0.02	5.9E-01	5.4E-04	0.005	9.3E-02	8.5E-05	<0.0040	5.9E-02	5.4E-05	2.1	6.2E+01	5.6E-02
Benzo(k)fluoranthene	981	0.029	8.5E-01	8.7E-04	0.0033	6.1E-02	6.3E-05	<0.0040	5.9E-02	6.0E-05	1.4	4.1E+01	4.2E-02
Chrysene	844	0.042	1.2E+00	1.5E-03	0.0077	1.4E-01	1.7E-04	<0.0040	5.9E-02	7.0E-05	4.1	1.2E+02	1.4E-01
Dibenzo(a,h)anthracene	1123	0.0061	1.8E-01	1.6E-04	<0.0043	4.0E-02	3.6E-05	<0.0040	5.9E-02	5.2E-05	0.56	1.6E+01	1.5E-02
Fluoranthene	707	0.11	3.2E+00	4.6E-03	0.019	3.5E-01	5.0E-04	<0.0040	5.9E-02	8.3E-05	4.9	1.4E+02	2.0E-01
Fluorene	538	0.014	4.1E-01	7.7E-04	0.0027	5.0E-02	9.3E-05	<0.0040	5.9E-02	1.1E-04	0.25	7.4E+00	1.4E-02
Indeno(1,2,3-cd)pyrene	1115	0.024	7.1E-01	6.3E-04	0.0038	7.1E-02	6.3E-05	<0.0040	5.9E-02	5.3E-05	1.6	4.7E+01	4.2E-02
Naphthalene	385	<0.0046	6.8E-02	1.8E-04	0.0017	3.2E-02	8.2E-05	<0.0040	5.9E-02	1.5E-04	0.085	2.5E+00	6.5E-03
Phenanthrene	596	0.087	2.6E+00	4.3E-03	0.014	2.6E-01	4.4E-04	<0.0040	5.9E-02	9.9E-05	2.8	8.2E+01	1.4E-01
Pyrene	697	0.094	2.8E+00	4.0E-03	0.015	2.8E-01	4.0E-04	<0.0040	5.9E-02	8.4E-05	5	1.5E+02	2.1E-01
sum TU				0.024			0.003			0.001			1.327
Total TU [c]				0.07			0.008			0.004			**4**

Table A.7.ERA-6
Sediment Polycyclic Aromatic Hydrocarbon Toxic Units
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant
Radford, Virginia

Location ID: **Sample Depth(Feet):** **Date Collected:**	**Final Chronic Value (FCV) [a]**	**WBGSW/SD10 0 - 0.5 37433.00**			**WBGSW/SD13 0 - 0.5 37433.00**			**WBGSW/SD14 0 - 0.5 37432.00**			**WBGSW/SD15 0 - 0.5 37434.00**		
		mg/kg$_{sed}$	**mg/kg$_{TOC}$**	**TU**	**mg/kg$_{sed}$**	**mg/kg$_{TOC}$**	**TU**	**mg/kg$_{sed}$**	**mg/kg$_{TOC}$**	**TU**	**mg/kg$_{sed}$**	**mg/kg$_{TOC}$**	**TU**
TOC (%) [b]		**2.86%**			**3.40%**			**3.40%**			**3.40%**		
TOC (mg/kg)		28600			NA			NA			NA		
2-Methylnaphthalene	446	<0.0030	5.2E-02	1.2E-04	<0.64	9.4E+00	2.1E-02	0.065	1.9E+00	4.3E-03	<0.36	5.3E+00	1.2E-02
Acenaphthene	491	<0.0030	5.2E-02	1.1E-04	<0.64	9.4E+00	1.9E-02	0.052	1.5E+00	3.1E-03	<0.36	5.3E+00	1.1E-02
Acenaphthylene	452	<0.0030	5.2E-02	1.2E-04	<0.64	9.4E+00	2.1E-02	<0.41	6.0E+00	1.3E-02	<0.36	5.3E+00	1.2E-02
Anthracene	594	<0.0030	5.2E-02	8.8E-05	<0.64	9.4E+00	1.6E-02	0.14	4.1E+00	6.9E-03	<0.36	5.3E+00	8.9E-03
Benzo(a)anthracene	841	<0.0030	5.2E-02	6.2E-05	<0.64	9.4E+00	1.1E-02	0.56	1.6E+01	2.0E-02	0.025	7.4E-01	8.7E-04
Benzo(a)pyrene	965	<0.0030	5.2E-02	5.4E-05	<0.64	9.4E+00	9.8E-03	0.44	1.3E+01	1.3E-02	<0.36	5.3E+00	5.5E-03
Benzo(b)fluoranthene	979	<0.0030	5.2E-02	5.4E-05	<0.64	9.4E+00	9.6E-03	0.55	1.6E+01	1.7E-02	<0.36	5.3E+00	5.4E-03
Benzo(g,h,i)perylene	1095	<0.0030	5.2E-02	4.8E-05	<0.64	9.4E+00	8.6E-03	0.26	7.6E+00	7.0E-03	<0.36	5.3E+00	4.8E-03
Benzo(k)fluoranthene	981	<0.0030	5.2E-02	5.3E-05	<0.64	9.4E+00	9.6E-03	0.15	4.4E+00	4.5E-03	<0.36	5.3E+00	5.4E-03
Chrysene	844	<0.0030	5.2E-02	6.2E-05	<0.64	9.4E+00	1.1E-02	0.56	1.6E+01	2.0E-02	0.023	6.8E-01	8.0E-04
Dibenzo(a,h)anthracene	1123	<0.0030	5.2E-02	4.7E-05	<0.64	9.4E+00	8.4E-03	0.098	2.9E+00	2.6E-03	<0.36	5.3E+00	4.7E-03
Fluoranthene	707	<0.0030	5.2E-02	7.4E-05	<0.64	9.4E+00	1.3E-02	0.63	1.9E+01	2.6E-02	0.05	1.5E+00	2.1E-03
Fluorene	538	<0.0030	5.2E-02	9.7E-05	<0.64	9.4E+00	1.7E-02	0.071	2.1E+00	3.9E-03	<0.36	5.3E+00	9.8E-03
Indeno(1,2,3-cd)pyrene	1115	<0.0030	5.2E-02	4.7E-05	<0.64	9.4E+00	8.4E-03	0.25	7.4E+00	6.6E-03	<0.36	5.3E+00	4.7E-03
Naphthalene	385	<0.0030	5.2E-02	1.4E-04	<0.64	9.4E+00	2.4E-02	0.058	1.7E+00	4.4E-03	<0.36	5.3E+00	1.4E-02
Phenanthrene	596	<0.0030	5.2E-02	8.8E-05	<0.64	9.4E+00	1.6E-02	0.52	1.5E+01	2.6E-02	0.026	7.6E-01	1.3E-03
Pyrene	697	<0.0030	5.2E-02	7.5E-05	<0.64	9.4E+00	1.4E-02	0.73	2.1E+01	3.1E-02	0.03	8.8E-01	1.3E-03
sum TU				0.001			0.238			0.208			0.104
Total TU [c]				0.004			0.7			0.6			0.3

Notes:
mg/kg Milligrams per kilogram.
PAH Polycyclic aromatic hydrocarbons.
TU Toxic unit.
TOC Total organic carbon.

TU = (concentration (mg/kg$_{sed}$) / TOC / FCV) x UF (2.75).
An uncertainty factor (UF) of 2.75 was used. TUs > 1 are in bold font.

[a] Final Chronic Value, obtained from USEPA, 2003 (Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks for the Protection of Benthic Organisms: PAHs)
[b] Where TOC was available for a sample, it was used in the calculation, otherwise, the average TOC at the site was used instead. Total organic carbon ranged between 2.2% to 5.4% at the site with an average TOC of 3.4%.
[c] Sum of Toxic Units (TU) based on the Final Chronic Value, including an uncertainty factor of 2.75. Sediments containing less than or equal to 1 total TU s are acceptable for the protection of benthic organisms. If the total TU is greater than 1, sensitive benthic organisms may be unacceptably affected.

Table A.7.ERA-7
Baseline Level - Constituents of Potential Ecological Concern in Surface Water
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/L)		Ecological Screening Level (ESLs) [b] (mg/L) Value	*Source*	Refined HQ [c] (unitless)	Baseline Level Constituent of Potential Ecological Concern? [d] (YES/no)	Rational	Bioaccumulative ? [e] (YES/no)
Volatile Organic Compounds								
Chloroform	0.00129		0.0018	*R3*	0.7	no	HQ • 1	no
Semi-Volatile Organic Compounds								
1,2-Dichlorobenzene	0.00021	m	0.0007	*R3*	0.3	**YES**	**Bioaccumulative**	**YES**
1,3-Dichlorobenzene	0.00021	m	0.15	*R3*	0.001	**YES**	**Bioaccumulative**	**YES**
1,4-Dichlorobenzene	0.00028	m	0.026	*R3*	0.01	**YES**	**Bioaccumulative**	**YES**
Dioxin/Furan Compounds								
Dioxin Toxicity Equivalents	3.504E-12	m	3.1E-12	*R3s*	1	**YES**	**Bioaccumulative**	**YES**
Herbicides								
MCPP	0.0541	m	NA		NA	**YES**	**NSL**	no
Pesticides								
Dieldrin	0.00000901	m	0.000056	*R3*	0.2	**YES**	**Bioaccumulative**	**YES**
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	0.00004	m	0.0058	*R3*	0.007	**YES**	**Bioaccumulative**	**YES**
Anthracene	0.00003	m	0.000012	*R3*	3	**YES**	**HQ > 1**	**YES**
Fluorene	0.000034	m	0.003	*R3*	0.01	**YES**	**Bioaccumulative**	**YES**
Phenanthrene	0.00005	m	0.0004	*R3*	0.1	**YES**	**Bioaccumulative**	**YES**
Inorganics								
Aluminum	0.351		0.087	*R3*	4	**YES**	**HQ > 1**	no
Arsenic	0.0104	m	0.005	*R3*	2	**YES**	**HQ > 1**	**YES**
Barium	0.0952		0.004	*R3*	20	**YES**	**HQ > 1**	no
Beryllium	0.0011	m	0.00066	*R3*	2	**YES**	**HQ > 1**	no
Copper	0.0185		0.009	*R3*	2	**YES**	**HQ > 1**	**YES**
Iron	39.87		0.3	*R3*	100	**YES**	**HQ > 1**	no
Lead	0.0248		0.0025	*R3*	10	**YES**	**HQ > 1**	**YES**
Manganese	1.154		0.12	*R3*	10	**YES**	**HQ > 1**	no
Nickel	0.0015	m	0.052	*R3*	0.03	**YES**	**Bioaccumulative**	**YES**
Selenium	0.00044	m	0.001	*R3*	0.4	**YES**	**Bioaccumulative**	**YES**
Silver	0.0012	m	0.0032	*R3*	0.4	**YES**	**Bioaccumulative**	**YES**
Thallium	0.0054	m	0.0008	*R3*	7	**YES**	**HQ > 1**	no
Vanadium	0.026		0.02	*R3*	1	no	HQ • 1	no
Zinc	0.0208		0.12	*R3*	0.2	**YES**	**Bioaccumulative**	**YES**

Table A.7.ERA-7
Baseline Level - Constituents of Potential Ecological Concern in Surface Water
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Notes:

– =	Not available or applicable.
mg/L =	Milligrams per liter.
NA =	Not available or applicable.
[a]	Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
[b]	See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
[c]	The refined hazard quotient (HQ) is the ratio of the EPC to the surface water screening level. HQs are rounded to one significant figure.
[d]	Constituents with a refined hazard quotient (HQ) greater than 1 (HQ > 1), without a screening level (NSL), or bioaccumulative were considered constituents of potential ecological concern (COPECs) for baseline risk assessment.
[e]	Constituent was considered a bioaccumulative compound if listed on Table 4-2 of USEPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.

Table A.7.ERA-8
Maximum Scenario Food Chain Modeling for the Short-Tailed Shrew
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration [a] (mg/kg)	Soil Bioconcentration Factors [b] Invertebrate	Estimated Dietary Tissue Concentrations [c] (mg/kg) Invertebrate	Maximum Estimated Dietary Ingestion [d] mg/kg-BW-day	Toxicity Reference Values [e] mg/kg-BW-day LOAEL	Toxicity Reference Values [e] mg/kg-BW-day NOAEL	Maximum Scenario HQ [f] LOAEL	Maximum Scenario HQ [f] NOAEL
Dioxin/Furan Compounds								
Dioxin Toxicity Equivalents	9.9E-06	ln(Ci) = 1.182 * ln(Cs) + 3.533	4.1E-10	9.8E-08	2.1E-05	2.1E-06	0.005	0.05
Pesticides								
4,4'-DDD	1.9E-03	1.9E+00	3.7E-03	5.0E-04	8.5E+00	1.7E+00	0.00006	0.0003
Dieldrin	4.7E-03	1.5E+00	6.9E-03	9.5E-04	4.3E-01	4.3E-02	0.002	0.02
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	3.2E-01	5.0E-01	1.6E-01	2.4E-02	2.0E+01	2.0E+00	0.001	0.01
Acenaphthylene	3.9E-03	5.0E-01	2.0E-03	3.0E-04	1.2E+02	1.2E+03	0.000003	0.0000003
Anthracene	1.0E-01	1.0E-02	1.0E-03	1.1E-03	7.0E+03	7.0E+02	0.0000002	0.000002
Benzo(a)anthracene	9.7E-01	2.5E-02	2.4E-02	1.3E-02	4.3E+00	4.3E-01	0.003	0.03
Benzo(a)pyrene	1.1E+00	6.8E-02	7.5E-02	2.1E-02	1.2E+01	1.2E+00	0.002	0.02
Benzo(b)fluoranthene	1.8E+00	5.1E-02	9.1E-02	3.0E-02	3.8E+01	1.5E+00	0.0008	0.02
Benzo(g,h,i)perylene	9.6E-01	4.9E-02	4.7E-02	1.6E-02	1.2E+00	1.2E-01	0.01	0.1
Benzo(k)fluoranthene	5.3E-01	5.1E-02	2.7E-02	8.8E-03	3.8E+01	1.5E+00	0.0002	0.006
Chrysene	9.9E-01	3.5E-02	3.5E-02	1.4E-02	2.1E+02	2.1E+01	0.00007	0.0007
Dibenzo(a,h)anthracene	2.2E-01	7.4E-02	1.6E-02	4.3E-03	1.3E-02	1.3E-03	0.3	3
Fluoranthene	1.6E+00	5.0E-01	8.0E-01	1.2E-01	8.5E+01	8.5E+00	0.001	0.01
Fluorene	2.8E-02	5.0E-01	1.4E-02	2.1E-03	3.2E+02	1.1E+02	0.000007	0.00002
Indeno(1,2,3-cd)pyrene	1.1E+00	8.4E-02	9.2E-02	2.3E-02	1.2E+00	1.2E-01	0.02	0.2
Phenanthrene	6.9E-01	2.4E-02	1.7E-02	9.1E-03	3.0E+01	3.0E+00	0.0003	0.003
Pyrene	1.6E+00	1.8E-02	2.9E-02	2.0E-02	1.8E+01	1.8E+00	0.001	0.01
Polychlorinated Biphenyls								
Aroclor 1254	8.4E-02	1.5E+00	1.3E-01	1.8E-02	7.8E-01	7.8E-02	0.02	0.2
Inorganics								
Arsenic	3.8E+01	3.9E-01	1.5E+01	2.3E+00	1.2E+01	1.2E+00	0.2	2
Cadmium	2.7E+00	2.8E+00	7.7E+00	1.0E+00	2.9E+00	2.9E-01	0.3	3
Copper	1.3E+03	6.8E-02	9.1E+01	2.5E+01	4.7E+01	3.7E+01	0.5	0.7
Lead	4.0E+03	5.6E-02	2.2E+02	6.8E+01	1.7E+02	1.7E+01	0.4	4
Selenium	1.2E+00	3.9E-01	4.7E-01	7.4E-02	6.8E-01	4.1E-01	0.1	0.2
Silver	2.2E+00	3.9E-01	8.6E-01	1.3E-01	3.6E+02	3.6E+01	0.0004	0.004
Zinc	3.3E+03	3.9E-01	1.3E+03	2.0E+02	6.5E+01	6.5E+00	3	30

Notes:
HQ = Hazard Quotient.
LOAEL = Lowest observed adverse effect level.
mg/kg = Milligrams per kilogram.
mg/kg-BW-day Milligrams per kilogram of body weight each day.
NOAEL = No observed adverse effect level.

[a] Maximum concentration detected in surface soil (mg/kg).
[b] See Table A.2-20 for sources of soil bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.
[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.
[e] See Table A.2-23 for sources of mammalian toxicity reference values.
[f] Maximum hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.7.ERA-9
Refined Scenario Food Chain Modeling for the Short-Tailed Shrew
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)		Soil Bioconcentration Factors [b] Invertebrate	Vegetation	Mammal	Estimated Dietary Tissue Concentrations [c] (mg/kg) Invertebrate	Vegetation	Mammal	Refined Estimated Dietary Ingestion [d] mg/kg-BW-day	Toxicity Reference Values [e] mg/kg-BW-day LOAEL	NOAEL	Refined Scenario HQ [f] LOAEL	NOAEL
Dioxin/Furan Compounds													
Dioxin Toxicity Equivalents	9.9E-06	m	ln(Ci) = 1.182 * ln(Cs) + 3.533	NA	7.1E-06	4.1E-10	NA	7.0E-11	9.8E-08	2.1E-05	2.1E-06	0.005	0.05
Pesticides													
4,4'-DDD	1.9E-03	m	1.9E+00	2.7E-03	2.9E-01	3.7E-03	5.1E-06	5.6E-04	4.3E-04	8.5E+00	1.7E+00	0.00005	0.0003
Dieldrin	4.7E-03	m	1.5E+00	1.6E-03	6.9E-01	6.9E-03	7.7E-06	3.3E-03	8.3E-04	4.3E-01	4.3E-02	0.002	0.02
Polycyclic Aromatic Hydrocarbons													
Acenaphthene	3.2E-01	m	5.0E-01	4.2E-02	2.5E-03	1.6E-01	1.3E-02	8.0E-04	2.1E-02	2.0E+01	2.0E+00	0.001	0.01
Acenaphthylene	3.9E-03	m	5.0E-01	3.4E-02	3.5E-03	2.0E-03	1.3E-04	1.4E-05	2.6E-04	1.2E+02	1.2E+03	0.000002	2E-07
Anthracene	3.5E-02		1.0E-02	2.1E-02	8.5E-03	3.6E-04	7.3E-04	3.0E-04	4.0E-04	7.0E+03	7.0E+02	6E-08	6E-07
Benzo(a)anthracene	1.3E-01		2.5E-02	4.4E-03	1.2E-01	3.3E-03	5.8E-04	1.6E-02	1.8E-03	4.3E+00	4.3E-01	0.0004	0.004
Benzo(a)pyrene	1.6E-01		6.8E-02	2.7E-03	2.9E-01	1.1E-02	4.4E-04	4.8E-02	3.1E-03	1.2E+01	1.2E+00	0.0003	0.003
Benzo(b)fluoranthene	2.3E-01		5.1E-02	1.2E-03	1.1E+00	1.2E-02	2.8E-04	2.6E-01	5.0E-03	3.8E+01	1.5E+00	0.0001	0.003
Benzo(g,h,i)perylene	1.5E-01		4.9E-02	6.1E-04	3.8E+00	7.2E-03	9.0E-05	5.6E-01	5.4E-03	1.2E+00	1.2E-01	0.005	0.05
Benzo(k)fluoranthene	1.2E-01		5.1E-02	1.2E-03	1.1E+00	6.2E-03	1.5E-04	1.4E-01	2.7E-03	3.8E+01	1.5E+00	0.00007	0.002
Chrysene	1.6E-01		3.5E-02	4.5E-03	1.2E-01	5.7E-03	7.4E-04	2.0E-02	2.4E-03	2.1E+02	2.1E+01	0.00001	0.0001
Dibenzo(a,h)anthracene	2.2E-01	m	7.4E-02	1.6E-03	6.9E-01	1.6E-02	3.6E-04	1.5E-01	4.8E-03	1.3E-02	1.3E-03	0.4	4
Fluoranthene	2.4E-01		5.0E-01	7.4E-03	5.0E-02	1.2E-01	1.8E-03	1.2E-02	1.6E-02	8.5E+01	8.5E+00	0.0002	0.002
Fluorene	2.8E-02		5.0E-01	3.2E-02	4.0E-03	1.4E-02	9.0E-04	1.1E-04	1.8E-03	3.2E+02	1.1E+02	0.000006	0.00002
Indeno(1,2,3-cd)pyrene	1.5E-01		8.4E-02	2.7E-04	1.5E+01	1.2E-02	4.0E-05	2.2E+00	1.5E-02	1.2E+00	1.2E-01	0.01	0.1
Phenanthrene	1.2E-01		2.4E-02	1.8E-02	1.1E-02	2.9E-03	2.1E-03	1.3E-03	1.5E-03	3.0E+01	3.0E+00	0.00005	0.0005
Pyrene	2.0E-01		1.8E-02	1.2E-02	2.3E-02	3.7E-03	2.3E-03	4.6E-03	2.4E-03	1.8E+01	1.8E+00	0.0001	0.001
Polychlorinated Biphenyls													
Aroclor 1254	8.4E-02	m	1.5E+00	1.4E-03	8.9E-01	1.3E-01	1.2E-04	7.5E-02	1.6E-02	7.8E-01	7.8E-02	0.02	0.2
Inorganics													
Arsenic	1.1E+01		3.9E-01	8.0E-03	1.0E-01	4.2E+00	8.6E-02	1.1E+00	5.8E-01	1.2E+01	1.2E+00	0.05	0.5
Cadmium	3.2E-01		2.8E+00	1.1E-01	2.8E-02	9.1E-01	3.5E-02	8.9E-03	1.0E-01	2.9E+00	2.9E-01	0.03	0.3
Copper	1.5E+02		6.8E-02	8.0E-02	5.0E-01	9.9E+00	1.2E+01	7.3E+01	3.1E+00	4.7E+01	3.7E+01	0.07	0.08
Lead	7.0E+02		5.6E-02	9.0E-03	1.5E-02	3.9E+01	6.3E+00	1.0E+01	1.1E+01	1.7E+02	1.7E+01	0.06	0.6
Selenium	6.3E-01		3.9E-01	5.0E-03	7.5E-01	2.4E-01	3.1E-03	4.7E-01	3.5E-02	6.8E-01	4.1E-01	0.05	0.09
Silver	3.7E-01		3.9E-01	8.0E-02	1.5E-01	1.4E-01	3.0E-02	5.6E-02	2.0E-02	3.6E+02	3.6E+01	0.00006	0.0006
Zinc	5.9E+02		3.9E-01	3.0E-01	5.0E+00	2.3E+02	1.8E+02	3.0E+03	5.1E+01	6.5E+01	6.5E+00	0.8	8

Notes:

HQ = Hazard Quotient.
LOAEL = Lowest observed adverse effect level.
mg/kg = Milligrams per kilogram.
mg/kg-BW-day = Milligrams per kilogram of body weight each day.
NA Not applicable.
NOAEL = No observed adverse effect level.

[a] Exposure point concentration (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration.
EPCs marked with "m" are the maximum concentration.
[b] See Table A.2-20 for sources of soil bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.
[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.
[e] See Table A.2-23 for sources of mammalian toxicity reference values.
[f] Refined hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.7.ERA-10
Maximum Scenario Food Chain Modeling for the American Robin
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration [a] (mg/kg)	Soil Bioconcentration Factors [b] Invertebrate	Estimated Dietary Tissue Concentrations [c] (mg/kg) Invertebrate	Maximum Estimated Dietary Ingestion [d] mg/kg-BW-day	Toxicity Reference Values [e] mg/kg-BW-day LOAEL	Toxicity Reference Values [e] mg/kg-BW-day NOAEL	Maximum Scenario HQ [f] LOAEL	Maximum Scenario HQ [f] NOAEL
Dioxin/Furan Compounds								
Dioxin Toxicity Equivalents	9.9E-06	ln(Ci) = 1.182 * ln(Cs) + 3.533	4.1E-10	1.3E-07	1.4E-04	1.4E-05	0.0009	0.009
Pesticides								
4,4'-DDD	1.9E-03	1.9E+00	3.7E-03	5.0E-04	2.8E-02	2.8E-03	0.02	0.2
Dieldrin	4.7E-03	1.5E+00	6.9E-03	9.5E-04	7.7E-01	7.7E-02	0.001	0.01
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	3.2E-01	5.0E-01	1.6E-01	2.5E-02	1.0E+02	1.0E+01	0.0003	0.003
Acenaphthylene	3.9E-03	5.0E-01	2.0E-03	3.1E-04	1.0E+02	1.0E+01	0.000003	0.00003
Anthracene	1.0E-01	1.0E-02	1.0E-03	1.4E-03	1.0E+02	1.0E+01	0.00001	0.0001
Benzo(a)anthracene	9.7E-01	2.5E-02	2.4E-02	1.5E-02	1.0E+02	1.0E+01	0.0002	0.002
Benzo(a)pyrene	1.1E+00	6.8E-02	7.5E-02	2.4E-02	1.0E+02	1.0E+01	0.0002	0.002
Benzo(b)fluoranthene	1.8E+00	5.1E-02	9.1E-02	3.5E-02	1.0E+02	1.0E+01	0.0004	0.004
Benzo(g,h,i)perylene	9.6E-01	4.9E-02	4.7E-02	1.8E-02	1.0E+02	1.0E+01	0.0002	0.002
Benzo(k)fluoranthene	5.3E-01	5.1E-02	2.7E-02	1.0E-02	1.0E+02	1.0E+01	0.0001	0.001
Chrysene	9.9E-01	3.5E-02	3.5E-02	1.7E-02	1.0E+02	1.0E+01	0.0002	0.002
Dibenzo(a,h)anthracene	2.2E-01	7.4E-02	1.6E-02	4.8E-03	1.0E+02	1.0E+01	0.00005	0.0005
Fluoranthene	1.6E+00	5.0E-01	8.0E-01	1.2E-01	1.0E+02	1.0E+01	0.001	0.01
Fluorene	2.8E-02	5.0E-01	1.4E-02	2.2E-03	1.0E+02	1.0E+01	0.00002	0.0002
Indeno(1,2,3-cd)pyrene	1.1E+00	8.4E-02	9.2E-02	2.6E-02	1.0E+02	1.0E+01	0.0003	0.003
Phenanthrene	6.9E-01	2.4E-02	1.7E-02	1.1E-02	1.0E+02	1.0E+01	0.0001	0.001
Pyrene	1.6E+00	1.8E-02	2.9E-02	2.4E-02	1.0E+02	1.0E+01	0.0002	0.002
Polychlorinated Biphenyls								
Aroclor 1254	8.4E-02	1.5E+00	1.3E-01	1.8E-02	1.8E+00	1.8E-01	0.01	0.1
Inorganics								
Arsenic	3.8E+01	3.9E-01	1.5E+01	2.4E+00	1.3E+01	5.1E+00	0.2	0.5
Cadmium	2.7E+00	2.8E+00	7.7E+00	1.0E+00	1.5E+01	1.5E+00	0.07	0.7
Copper	1.3E+03	6.8E-02	9.1E+01	2.9E+01	6.2E+01	4.7E+01	0.5	0.6
Lead	4.0E+03	5.6E-02	2.2E+02	7.9E+01	3.9E+01	3.9E+00	2	20
Selenium	1.2E+00	3.9E-01	4.7E-01	7.6E-02	1.0E+00	5.0E-01	0.08	0.2
Silver	2.2E+00	3.9E-01	8.6E-01	1.4E-01	1.0E+00	5.0E-01	0.1	0.3
Zinc	3.3E+03	3.9E-01	1.3E+03	2.1E+02	1.3E+02	1.5E+01	2	10

Notes:
HQ = Hazard Quotient.
LOAEL = Lowest observed adverse effect level.
mg/kg = Milligrams per kilogram.
mg/kg-BW-day = Milligrams per kilogram of body weight each day.
NOAEL = No observed adverse effect level.

[a] Maximum concentration detected in surface soil (mg/kg).
[b] See Table A.2-20 for sources of soil bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.
[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.
[e] See Table A.2-22 for sources of avian toxicity reference values.
[f] Maximum hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.7.ERA-11
Refined Scenario Food Chain Modeling for the American Robin
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] (mg/kg)		Soil Bioconcentration Factors [b]		Estimated Dietary Tissue Concentrations [c] (mg/kg)		Refined Estimated Dietary Ingestion [d]	Toxicity Reference Values [e] mg/kg-BW-day		Refined Scenario HQ [f]	
			Invertebrate	Vegetation	Invertebrate	Vegetation	mg/kg-BW-day	LOAEL	NOAEL	LOAEL	NOAEL
Dioxin/Furan Compounds											
Dioxin Toxicity Equivalents	9.9E-06	m	4.2E-05	NA	4.1E-10	NA	1.3E-07	1.4E-04	1.4E-05	0.0009	0.009
Pesticides											
4,4'-DDD	1.9E-03	m	1.9E+00	2.7E-03	3.7E-03	5.1E-06	1.7E-04	2.8E-02	2.8E-03	0.006	0.06
Dieldrin	4.7E-03	m	1.5E+00	1.6E-03	6.9E-03	7.7E-06	3.3E-04	7.7E-01	7.7E-02	0.0004	0.004
Polycyclic Aromatic Hydrocarbons											
Acenaphthene	3.2E-01	m	5.0E-01	4.2E-02	1.6E-01	1.3E-02	1.0E-02	1.0E+02	1.0E+01	0.0001	0.001
Acenaphthylene	3.9E-03	m	5.0E-01	3.4E-02	2.0E-03	1.3E-04	1.3E-04	1.0E+02	1.0E+01	0.000001	0.00001
Anthracene	3.5E-02		1.0E-02	2.1E-02	3.6E-04	7.3E-04	4.6E-04	1.0E+02	1.0E+01	0.000005	0.00005
Benzo(a)anthracene	1.3E-01		2.5E-02	4.4E-03	3.3E-03	5.8E-04	1.8E-03	1.0E+02	1.0E+01	0.00002	0.0002
Benzo(a)pyrene	1.6E-01		6.8E-02	2.7E-03	1.1E-02	4.4E-04	2.5E-03	1.0E+02	1.0E+01	0.00003	0.0003
Benzo(b)fluoranthene	2.3E-01		5.1E-02	1.2E-03	1.2E-02	2.8E-04	3.4E-03	1.0E+02	1.0E+01	0.00003	0.0003
Benzo(g,h,i)perylene	1.5E-01		4.9E-02	6.1E-04	7.2E-03	9.0E-05	2.2E-03	1.0E+02	1.0E+01	0.00002	0.0002
Benzo(k)fluoranthene	1.2E-01		5.1E-02	1.2E-03	6.2E-03	1.5E-04	1.8E-03	1.0E+02	1.0E+01	0.00002	0.0002
Chrysene	1.6E-01		3.5E-02	4.5E-03	5.7E-03	7.4E-04	2.3E-03	1.0E+02	1.0E+01	0.00002	0.0002
Dibenzo(a,h)anthracene	2.2E-01	m	7.4E-02	1.6E-03	1.6E-02	3.6E-04	3.4E-03	1.0E+02	1.0E+01	0.00003	0.0003
Fluoranthene	2.4E-01		5.0E-01	7.4E-03	1.2E-01	1.8E-03	7.7E-03	1.0E+02	1.0E+01	0.00008	0.0008
Fluorene	2.8E-02	m	5.0E-01	3.2E-02	1.4E-02	9.0E-04	9.1E-04	1.0E+02	1.0E+01	0.000009	0.00009
Indeno(1,2,3-cd)pyrene	1.5E-01		8.4E-02	2.7E-04	1.2E-02	4.0E-05	2.3E-03	1.0E+02	1.0E+01	0.00002	0.0002
Phenanthrene	1.2E-01		2.4E-02	1.8E-02	2.9E-03	2.1E-03	1.6E-03	1.0E+02	1.0E+01	0.00002	0.0002
Pyrene	2.0E-01		1.8E-02	1.2E-02	3.7E-03	2.3E-03	2.7E-03	1.0E+02	1.0E+01	0.00003	0.0003
Polychlorinated Biphenyls											
Aroclor 1254	8.4E-02	m	1.5E+00	1.4E-03	1.3E-01	1.2E-04	6.2E-03	1.8E+00	1.8E-01	0.003	0.03
Inorganics											
Arsenic	1.1E+01		3.9E-01	8.0E-03	4.2E+00	8.6E-02	3.0E-01	1.3E+01	5.1E+00	0.02	0.06
Cadmium	3.2E-01		2.8E+00	1.1E-01	9.1E-01	3.5E-02	4.0E-02	1.5E+01	1.5E+00	0.003	0.03
Copper	1.5E+02		6.8E-02	8.0E-02	9.9E+00	1.2E+01	2.2E+00	6.2E+01	4.7E+01	0.04	0.05
Lead	7.0E+02		5.6E-02	9.0E-03	3.9E+01	6.3E+00	1.0E+01	3.9E+01	3.9E+00	0.3	3
Selenium	6.3E-01		3.9E-01	5.0E-03	2.4E-01	3.1E-03	1.7E-02	1.0E+00	5.0E-01	0.02	0.03
Silver	3.7E-01		3.9E-01	8.0E-02	1.4E-01	3.0E-02	1.0E-02	1.0E+00	5.0E-01	0.01	0.02
Zinc	5.9E+02		3.9E-01	3.0E-01	2.3E+02	1.8E+02	1.7E+01	1.3E+02	1.5E+01	0.1	1

Notes:
HQ = Hazard Quotient.
LOAEL = Lowest observed adverse effect level.
mg/kg = Milligrams per kilogram.
mg/kg-BW-day = Milligrams per kilogram of body weight each day.
NA Not applicable.
NOAEL = No observed adverse effect level.

[a] Exposure point concentration (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration. EPCs marked with "m" are the maximum concentration.
[b] See Table A.2-20 for sources of soil bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.
[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.
[e] See Table A.2-22 for sources of avian toxicity reference values.
[f] Refined hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.7.ERA-12
Maximum Scenario Food Chain Modeling for the Mink
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration [a] Surface Water (mg/L)	Maximum Concentration [a] Sediment (mg/kg)	Sediment Bioaccumulation Factors (BAFsed) [b] Fish	Maximum Estimated and Measured Dietary Tissue Concentrations [c] (mg/kg) Fish	Maximum Estimated Dietary Ingestion [d] mg/kg-BW-day	Toxicity Reference Values [e] mg/kg-BW-day LOAEL	Toxicity Reference Values [e] mg/kg-BW-day NOAEL	Maximum Scenario HQ [f] LOAEL	Maximum Scenario HQ [f] NOAEL
Semi-Volatile Organic Compounds									
1,2,4-Trichlorobenzene	–	2.3E-02	7.7E-03	1.8E-04	1.0E-05	--	--	NA	NA
1,2-Dichlorobenzene	2.1E-04	–	7.7E-03	0.0E+00	3.0E-05	--	--	NA	NA
1,3-Dichlorobenzene	2.1E-04	–	7.7E-03	0.0E+00	3.0E-05	--	--	NA	NA
1,4-Dichlorobenzene	2.8E-04	4.9E-02	7.7E-03	3.8E-04	6.0E-05	--	--	NA	NA
Dioxin/Furan Compounds									
Dioxin Toxicity Equivalents	3.5E-12	2.8E-06	9.43E-06	2.7E-11	2.0E-12	7.9E-06	7.9E-07	0.0000003	0.000003
Pesticides									
4,4'-DDD	–	1.5E-03	1.5E+00	2.2E-03	1.0E-04	3.2E+00	6.3E-01	0.00003	0.0002
4,4'-DDE	–	3.1E-03	1.6E+01	5.1E-02	3.0E-03	3.2E+00	6.3E-01	0.0009	0.005
4,4'-DDT	–	1.2E-02	1.3E+00	1.6E-02	9.0E-04	3.2E+00	6.3E-01	0.0003	0.001
BHC, delta-	–	9.5E-04	NA	NA	NA	2.5E+00	1.3E+00	NA	NA
Chlordane, alpha-	–	7.1E-04	1.5E+00	1.0E-03	6.0E-05	2.0E+01	2.0E+00	0.000003	0.00003
Dieldrin	9.0E-06	3.5E-03	3.9E+00	1.4E-02	8.0E-04	1.6E-01	1.6E-02	0.005	0.05
Endosulfan II	–	1.6E-03	NA	NA	NA	1.2E+00	1.2E-01	NA	NA
Methoxychlor	–	6.4E-03	NA	NA	NA	6.3E+00	3.2E+00	NA	NA
Polycyclic Aromatic Hydrocarbons									
Acenaphthene	4.0E-05	3.1E-01	3.1E-03	9.6E-04	6.0E-05	7.5E+00	7.5E-01	0.000008	0.00008
Acenaphthylene	–	2.1E-02	3.1E-03	6.5E-05	4.0E-06	4.3E+01	4.3E+02	0.00000009	0.000000009
Anthracene	3.0E-05	8.3E-01	3.1E-03	2.6E-03	2.0E-04	2.6E+03	2.6E+02	0.00000008	0.0000008
Benzo(a)anthracene	–	4.0E+00	7.7E-03	3.1E-02	2.0E-03	1.6E+00	1.6E-01	0.001	0.01
Benzo(a)pyrene	–	3.7E+00	7.7E-03	2.8E-02	2.0E-03	4.3E+00	4.3E-01	0.0005	0.005
Benzo(b)fluoranthene	–	4.6E+00	7.7E-03	3.5E-02	2.0E-03	1.4E+01	5.6E-01	0.0001	0.004
Benzo(g,h,i)perylene	–	2.1E+00	7.7E-03	1.6E-02	9.0E-04	4.3E-01	4.3E-02	0.002	0.02
Benzo(k)fluoranthene	–	1.4E+00	7.7E-03	1.1E-02	6.0E-04	1.4E+01	5.6E-01	0.00004	0.001
Chrysene	–	4.1E+00	7.7E-03	3.1E-02	2.0E-03	7.8E+01	7.8E+00	0.00003	0.0003
Dibenzo(a,h)anthracene	–	5.6E-01	7.7E-03	4.3E-03	2.0E-04	4.7E-03	4.7E-04	0.04	0.4
Fluoranthene	–	4.9E+00	7.7E-03	3.8E-02	2.0E-03	3.2E+01	3.2E+00	0.00006	0.0006
Fluorene	3.4E-05	2.5E-01	3.1E-03	7.8E-04	5.0E-05	1.2E+02	4.0E+01	0.0000004	0.000001
Indeno(1,2,3-cd)pyrene	–	1.6E+00	7.7E-03	1.2E-02	7.0E-04	4.3E-01	4.3E-02	0.002	0.02
Phenanthrene	5.0E-05	2.8E+00	3.1E-03	8.7E-03	5.0E-04	1.1E+01	1.1E+00	0.00005	0.0005
Pyrene	–	5.0E+00	7.7E-03	3.8E-02	2.0E-03	6.8E+00	6.8E-01	0.0003	0.003

Table A.7.ERA-12
Maximum Scenario Food Chain Modeling for the Mink
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration [a] Surface Water (mg/L)	Maximum Concentration [a] Sediment (mg/kg)	Sediment Bioaccumulation Factors (BAFsed) [b] Fish	Maximum Estimated and Measured Dietary Tissue Concentrations [c] (mg/kg) Fish	Maximum Estimated Dietary Ingestion [d] mg/kg-BW-day	Toxicity Reference Values [e] mg/kg-BW-day LOAEL	Toxicity Reference Values [e] mg/kg-BW-day NOAEL	Maximum Scenario HQ [f] LOAEL	Maximum Scenario HQ [f] NOAEL
Inorganics									
Arsenic	1.0E-02	3.0E+01	1.0E+00	0.0E+00	1.0E-03	4.3E+00	4.3E-01	0.0002	0.002
Cadmium	–	2.7E+00	1.0E+00	0.0E+00	–	1.1E+00	1.1E-01	NA	NA
Copper	2.4E-02	1.9E+02	1.0E+00	8.0E-01	5.0E-02	1.8E+01	1.4E+01	0.003	0.004
Lead	1.1E-01	1.1E+05	1.0E+00	0.0E+00	1.0E-02	6.3E+01	6.3E+00	0.0002	0.002
Nickel	1.5E-03	2.7E+01	1.0E+00	0.0E+00	2.0E-04	6.3E+01	3.2E+01	0.000003	0.000006
Selenium	4.4E-04	1.3E+00	1.0E+00	0.0E+00	5.0E-05	2.5E-01	1.5E-01	0.0002	0.0003
Silver	1.2E-03	8.4E+00	1.0E+00	0.0E+00	1.0E-04	1.3E+02	1.3E+01	0.0000008	0.000008
Zinc	2.4E-02	1.7E+04	1.0E+00	2.5E+01	1.0E+00	2.4E+01	2.4E+00	0.04	0.4

Notes:

– =	Not applicable.
HQ =	Hazard Quotient.
LOAEL =	Lowest observed adverse effect level.
mg/kg =	Milligrams per kilogram.
mg/kg-BW-day =	Milligrams per kilogram of body weight per day.
mg/L =	Milligrams per liter.
NA =	Not available.
NOAEL =	No observed adverse effect level.

[a] Maximum concentrations detected in surface water (mg/L) and sediment (mg/kg).

[b] See Table A.2-21 for sources of sediment bioaccumulation factors.

[c] Measured whole body fish tissue concentrations were used where available (i.e., for inorganic); if constituent was not detected in whole body fish tissue, it was assumed equal to zero. Where constituents were not analyzed for in whole body fish tissue samples, tissue concentrations were estimated using the following formula:
Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.

[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.

[e] See Table A.2-23 for sources of mammalian toxicity reference values.

[f] Maximum hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.7.ERA-13
Refined Scenario Food Chain Modeling for the Mink
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] Surface Water (mg/L)	Exposure Point Concentration [a] Sediment (mg/kg)	Sediment Bioaccumulation Factors (BAFsed) [b] Fish	Refined Estimated and Measured Dietary Tissue Concentrations [c] (mg/kg) Fish	Refined Estimated Dietary Ingestion [d] mg/kg-BW-day	Toxicity Reference Values [e] mg/kg-BW-day LOAEL	Toxicity Reference Values [e] mg/kg-BW-day NOAEL	Refined Scenario HQ [f] LOAEL	Refined Scenario HQ [f] NOAEL
Semi-Volatile Organic Compounds									
1,2,4-Trichlorobenzene	–	2.3E-02 m	7.7E-03	1.8E-04	1.0E-05	--	--	NA	NA
1,2-Dichlorobenzene	2.1E-04 m	–	7.7E-03	0.0E+00	3.0E-05	--	--	NA	NA
1,3-Dichlorobenzene	2.1E-04 m	–	7.7E-03	0.0E+00	3.0E-05	--	--	NA	NA
1,4-Dichlorobenzene	2.8E-04 m	4.9E-02 m	7.7E-03	3.8E-04	6.0E-05	--	--	NA	NA
Dioxin/Furan Compounds									
Dioxin Toxicity Equivalents	3.5E-12 m	2.8E-06 m	9.43E-06	2.7E-11	2.0E-12	7.9E-06	7.9E-07	3E-07	0.000003
Pesticides									
4,4'-DDD	–	1.5E-03 m	1.5E+00	2.2E-03	1.0E-04	3.2E+00	6.3E-01	0.00003	0.0002
4,4'-DDE	–	3.1E-03 m	1.6E+01	5.1E-02	3.0E-03	3.2E+00	6.3E-01	0.0009	0.005
4,4'-DDT	–	1.2E-02 m	1.3E+00	1.6E-02	9.0E-04	3.2E+00	6.3E-01	0.0003	0.001
BHC, delta-	–	9.5E-04 m	NA	NA	NA	2.5E+00	1.3E+00	NA	NA
Chlordane, alpha-	–	7.1E-04 m	1.5E+00	1.0E-03	6.0E-05	2.0E+01	2.0E+00	0.000003	0.00003
Dieldrin	9.0E-06 m	3.5E-03 m	3.9E+00	1.4E-02	8.0E-04	1.6E-01	1.6E-02	0.005	0.05
Endosulfan II	–	1.6E-03 m	NA	NA	NA	1.2E+00	1.2E-01	NA	NA
Methoxychlor	–	6.4E-03 m	NA	NA	NA	6.3E+00	3.2E+00	NA	NA
Polycyclic Aromatic Hydrocarbons									
Acenaphthene	4.0E-05 m	3.1E-01 m	3.1E-03	9.6E-04	6.0E-05	7.5E+00	7.5E-01	0.000008	0.00008
Acenaphthylene	–	2.1E-02 m	3.1E-03	6.5E-05	4.0E-06	4.3E+01	4.3E+02	9E-08	9E-09
Anthracene	3.0E-05 m	2.0E-01	3.1E-03	6.2E-04	4.0E-05	2.6E+03	2.6E+02	2E-08	2E-07
Benzo(a)anthracene	–	2.3E+00	7.7E-03	1.8E-02	1.0E-03	1.6E+00	1.6E-01	0.0006	0.006
Benzo(a)pyrene	–	6.2E-01	7.7E-03	4.8E-03	3.0E-04	4.3E+00	4.3E-01	0.00007	0.0007
Benzo(b)fluoranthene	–	7.4E-01	7.7E-03	5.6E-03	3.0E-04	1.4E+01	5.6E-01	0.00002	0.0005
Benzo(g,h,i)perylene	–	3.9E-01	7.7E-03	3.0E-03	2.0E-04	4.3E-01	4.3E-02	0.0005	0.005
Benzo(k)fluoranthene	–	2.4E-01	7.7E-03	1.8E-03	1.0E-04	1.4E+01	5.6E-01	0.000007	0.0002
Chrysene	–	2.4E+00	7.7E-03	1.8E-02	1.0E-03	7.8E+01	7.8E+00	0.00001	0.0001
Dibenzo(a,h)anthracene	–	5.6E-01 m	7.7E-03	4.3E-03	2.0E-04	4.7E-03	4.7E-04	0.04	0.4
Fluoranthene	–	8.9E-01	7.7E-03	6.8E-03	4.0E-04	3.2E+01	3.2E+00	0.00001	0.0001
Fluorene	3.4E-05 m	9.1E-02	3.1E-03	2.8E-04	2.0E-05	1.2E+02	4.0E+01	2E-07	5E-07
Indeno(1,2,3-cd)pyrene	–	3.1E-01	7.7E-03	2.3E-03	1.0E-04	4.3E-01	4.3E-02	0.0002	0.002
Phenanthrene	5.0E-05 m	4.8E-01	3.1E-03	1.5E-03	9.0E-05	1.1E+01	1.1E+00	0.000008	0.00008
Pyrene	–	8.5E-01	7.7E-03	6.5E-03	4.0E-04	6.8E+00	6.8E-01	0.00006	0.0006

Table A.7.ERA-13
Refined Scenario Food Chain Modeling for the Mink
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] Surface Water (mg/L)		Exposure Point Concentration [a] Sediment (mg/kg)		Sediment Bioaccumulation Factors (BAFsed) [b] Fish	Refined Estimated and Measured Dietary Tissue Concentrations [c] (mg/kg) Fish	Refined Estimated Dietary Ingestion [d] mg/kg-BW-day	Toxicity Reference Values [e] mg/kg-BW-day LOAEL	Toxicity Reference Values [e] mg/kg-BW-day NOAEL	Refined Scenario HQ [f] LOAEL	Refined Scenario HQ [f] NOAEL
Inorganics											
Arsenic	1.0E-02	m	8.7E+00		1.0E+00	0.0E+00	1.0E-03	4.3E+00	4.3E-01	0.0002	0.002
Cadmium	–		5.1E-01		1.0E+00	0.0E+00	–	1.1E+00	1.1E-01	NA	NA
Copper	1.9E-02		5.5E+01		1.0E+00	8.0E-01	5.0E-02	1.8E+01	1.4E+01	0.003	0.004
Lead	2.5E-02	avg	3.7E+04	avg	1.0E+00	0.0E+00	3.0E-03	6.3E+01	6.3E+00	0.00005	0.0005
Nickel	1.5E-03	m	1.6E+01		1.0E+00	0.0E+00	2.0E-04	6.3E+01	3.2E+01	0.000003	0.000006
Selenium	4.4E-04	m	1.3E+00	m	1.0E+00	0.0E+00	5.0E-05	2.5E-01	1.5E-01	0.0002	0.0003
Silver	1.2E-03	m	8.4E+00	m	1.0E+00	0.0E+00	1.0E-04	1.3E+02	1.3E+01	8E-07	0.000008
Zinc	2.1E-02		6.8E+03		1.0E+00	2.5E+01	1.0E+00	2.4E+01	2.4E+00	0.04	0.4

Notes:
– = Not applicable.
HQ = Hazard Quotient.
LOAEL = Lowest observed adverse effect level.
mg/kg = Milligrams per kilogram.
mg/kg-BW-day = Milligrams per kilogram of body weight per day.
mg/L = Milligrams per liter.
NA = Not available.
NOAEL = No observed adverse effect level.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration.
EPCs marked with "m" are the maximum concentration.
[b] See Table A.2-21 for sources of sediment bioaccumulation factors.
[c] Measured whole body fish tissue concentrations were used where available (i.e., for inorganic); if constituent was not detected in whole body fish tissue, it was assumed equal to zero.
Where constituents were not analyzed for in whole body fish tissue samples, tissue concentrations were estimated using the following formula:
Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.
[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.
[e] See Table A.2-23 for sources of mammalian toxicity reference values.
[f] Refined hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.7.ERA-14
Maximum Scenario Food Chain Modeling for the Great Blue Heron
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration [a] Surface Water (mg/L)	Maximum Concentration [a] Sediment (mg/kg)	Sediment Bioaccumulation Factors (BAFsed) [b] Fish	Maximum Estimated and Measured Dietary Tissue Concentrations [c] (mg/kg) Fish	Maximum Estimated Dietary Ingestion [d] mg/kg-BW-day	Toxicity Reference Values [e] mg/kg-BW-day LOAEL	Toxicity Reference Values [e] mg/kg-BW-day NOAEL	Maximum Scenario HQ [f] LOAEL	Maximum Scenario HQ [f] NOAEL
Semi-Volatile Organic Compounds									
1,2,4-Trichlorobenzene	–	2.3E-02	7.7E-03	1.8E-04	1.0E-05	--	--	NA	NA
1,2-Dichlorobenzene	2.1E-04	–	7.7E-03	0.0E+00	4.0E-06	--	--		
1,3-Dichlorobenzene	2.1E-04	–	7.7E-03	0.0E+00	4.0E-06	--	--		
1,4-Dichlorobenzene	2.8E-04	4.9E-02	7.7E-03	3.8E-04	3.0E-05	--	--	NA	NA
Dioxin/Furan Compounds									
Dioxin Toxicity Equivalents	3.5E-12	2.8E-06	9.43E-06	2.7E-11	2.0E-12	1.4E-04	1.4E-05	1E-08	0.0000001
Pesticides									
4,4'-DDD	–	1.5E-03	1.5E+00	2.2E-03	1.0E-04	2.8E-02	2.8E-03	0.004	0.04
4,4'-DDE	–	3.1E-03	1.6E+01	5.1E-02	3.0E-03	2.8E-02	2.8E-03	0.1	1
4,4'-DDT	–	1.2E-02	1.3E+00	1.6E-02	9.0E-04	2.8E-02	2.8E-03	0.03	0.3
BHC, delta-	–	9.5E-04	NA	NA	NA	2.3E+00	5.6E-01	NA	NA
Chlordane, alpha-	–	7.1E-04	1.5E+00	1.0E-03	6.0E-05	2.1E+01	2.1E+00	0.000003	0.00003
Dieldrin	9.0E-06	3.5E-03	3.9E+00	1.4E-02	8.0E-04	7.7E-01	7.7E-02	0.001	0.01
Endosulfan II	–	1.6E-03	NA	NA	NA	1.0E+02	1.0E+01	NA	NA
Methoxychlor	–	6.4E-03	NA	NA	NA	NA	NA	NA	NA
Polycyclic Aromatic Hydrocarbons									
Acenaphthene	4.0E-05	3.1E-01	3.1E-03	9.6E-04	5.0E-05	1.0E+02	1.0E+01	0.0000005	0.000005
Acenaphthylene	–	2.1E-02	3.1E-03	6.5E-05	4.0E-06	1.0E+02	1.0E+01	4E-08	0.0000004
Anthracene	3.0E-05	8.3E-01	3.1E-03	2.6E-03	1.0E-04	1.0E+02	1.0E+01	0.000001	0.00001
Benzo(a)anthracene	–	4.0E+00	7.7E-03	3.1E-02	2.0E-03	1.0E+02	1.0E+01	0.00002	0.0002
Benzo(a)pyrene	–	3.7E+00	7.7E-03	2.8E-02	2.0E-03	1.0E+02	1.0E+01	0.00002	0.0002
Benzo(b)fluoranthene	–	4.6E+00	7.7E-03	3.5E-02	2.0E-03	1.0E+02	1.0E+01	0.00002	0.0002
Benzo(g,h,i)perylene	–	2.1E+00	7.7E-03	1.6E-02	9.0E-04	1.0E+02	1.0E+01	0.000009	0.00009
Benzo(k)fluoranthene	–	1.4E+00	7.7E-03	1.1E-02	6.0E-04	1.0E+02	1.0E+01	0.000006	0.00006
Chrysene	–	4.1E+00	7.7E-03	3.1E-02	2.0E-03	1.0E+02	1.0E+01	0.00002	0.0002
Dibenzo(a,h)anthracene	–	5.6E-01	7.7E-03	4.3E-03	2.0E-04	1.0E+02	1.0E+01	0.000002	0.00002
Fluoranthene	–	4.9E+00	7.7E-03	3.8E-02	2.0E-03	1.0E+02	1.0E+01	0.00002	0.0002
Fluorene	3.4E-05	2.5E-01	3.1E-03	7.8E-04	4.0E-05	1.0E+02	1.0E+01	0.0000004	0.000004
Indeno(1,2,3-cd)pyrene	–	1.6E+00	7.7E-03	1.2E-02	7.0E-04	1.0E+02	1.0E+01	0.000007	0.00007
Phenanthrene	5.0E-05	2.8E+00	3.1E-03	8.7E-03	5.0E-04	1.0E+02	1.0E+01	0.000005	0.00005
Pyrene	–	5.0E+00	7.7E-03	3.8E-02	2.0E-03	1.0E+02	1.0E+01	0.00002	0.0002

Table A.7.ERA-14
Maximum Scenario Food Chain Modeling for the Great Blue Heron
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Maximum Concentration [a] Surface Water (mg/L)	Maximum Concentration [a] Sediment (mg/kg)	Sediment Bioaccumulation Factors (BAFsed) [b] Fish	Maximum Estimated and Measured Dietary Tissue Concentrations [c] (mg/kg) Fish	Maximum Estimated Dietary Ingestion [d] mg/kg-BW-day	Toxicity Reference Values [e] mg/kg-BW-day LOAEL	Toxicity Reference Values [e] mg/kg-BW-day NOAEL	Maximum Scenario HQ [f] LOAEL	Maximum Scenario HQ [f] NOAEL
Inorganics									
Arsenic	1.0E-02	3.0E+01	1.0E+00	0.0E+00	2.0E-04	1.3E+01	5.1E+00	0.00002	0.00004
Cadmium	–	2.7E+00	1.0E+00	0.0E+00	–	1.5E+01	1.5E+00	NA	NA
Copper	2.4E-02	1.9E+02	1.0E+00	8.0E-01	4.0E-02	6.2E+01	4.7E+01	0.0006	0.0009
Lead	1.1E-01	1.1E+05	1.0E+00	0.0E+00	2.0E-03	3.9E+01	3.9E+00	0.00005	0.0005
Nickel	1.5E-03	2.7E+01	1.0E+00	0.0E+00	3.0E-05	1.1E+02	7.7E+01	0.0000003	0.0000004
Selenium	4.4E-04	1.3E+00	1.0E+00	0.0E+00	8.0E-06	1.0E+00	5.0E-01	0.000008	0.00002
Silver	1.2E-03	8.4E+00	1.0E+00	0.0E+00	2.0E-05	1.0E+00	5.0E-01	0.00002	0.00004
Zinc	2.4E-02	1.7E+04	1.0E+00	2.5E+01	1.0E+00	1.3E+02	1.5E+01	0.008	0.07

Notes:

– = Not applicable.
HQ = Hazard Quotient.
LOAEL = Lowest observed adverse effect level.
mg/kg = Milligrams per kilogram.
mg/kg-BW-day = Milligrams per kilogram of body weight per day.
mg/L = Milligrams per liter.
NA = Not available.
NOAEL = No observed adverse effect level.

[a] Maximum concentrations detected in surface water (mg/L) and sediment (mg/kg).
[b] See Table A.2-21 for sources of sediment bioaccumulation factors.
[c] Measured whole body fish tissue concentrations were used where available (i.e., for inorganic); if constituent was not detected in whole body fish tissue, it was assumed equal to zero.
Where constituents were not analyzed for in whole body fish tissue samples, tissue concentrations were estimated using the following formula:
Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.
[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.
[e] See Table A.2-22 for sources of avian toxicity reference values.
[f] Maximum hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.7.ERA-15
Refined Scenario Food Chain Modeling for the Great Blue Heron
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Exposure Point Concentration [a] Surface Water (mg/L)		Exposure Point Concentration [a] Sediment (mg/kg)		0 Sediment Bioaccumulation Factors (BAFsed) [b] Fish	Refined Estimated and Measured Dietary Tissue Concentrations [c] (mg/kg) Fish	Refined Estimated Dietary Ingestion [d] mg/kg-BW-day	Toxicity Reference Values [e] mg/kg-BW-day LOAEL	Toxicity Reference Values [e] mg/kg-BW-day NOAEL	Refined Scenario HQ [f] LOAEL	Refined Scenario HQ [f] NOAEL
Semi-Volatile Organic Compounds											
1,2,4-Trichlorobenzene	–		2.3E-02	m	7.7E-03	1.8E-04	1.0E-05	--	--	NA	NA
1,4-Dichlorobenzene	2.8E-04	m	4.9E-02		7.7E-03	3.8E-04	3.0E-05	--	--	NA	NA
1,2-Dichlorobenzene	2.1E-04	m	–		7.7E-03	0.0E+00	4.0E-06	--	--	NA	NA
1,3-Dichlorobenzene	2.1E-04	m	–	m	7.7E-03	0.0E+00	4.0E-06	--	--	NA	NA
Dioxin/Furan Compounds											
Dioxin Toxicity Equivalents	3.5E-12	m	2.8E-06	m	9.43E-06	2.7E-11	2.0E-12	1.4E-04	1.4E-05	0.00000001	0.0000001
Pesticides											
4,4'-DDD	–		1.5E-03	m	1.5E+00	2.2E-03	1.0E-04	2.8E-02	2.8E-03	0.004	0.04
4,4'-DDE	–		3.1E-03	m	1.6E+01	5.1E-02	3.0E-03	2.8E-02	2.8E-03	0.1	1
4,4'-DDT	–		1.2E-02	m	1.3E+00	1.6E-02	9.0E-04	2.8E-02	2.8E-03	0.03	0.3
BHC, delta-	–		9.5E-04	m	NA	NA	NA	2.3E+00	5.6E-01	NA	NA
Chlordane, alpha-	–		7.1E-04	m	1.5E+00	1.0E-03	6.0E-05	2.1E+01	2.1E+00	0.000003	0.00003
Dieldrin	9.0E-06	m	3.5E-03	m	3.9E+00	1.4E-02	8.0E-04	7.7E-01	7.7E-02	0.001	0.01
Endosulfan II	–		1.6E-03	m	NA	NA	NA	1.0E+02	1.0E+01	NA	NA
Methoxychlor	–		6.4E-03	m	NA	NA	NA	NA	NA	NA	NA
Polycyclic Aromatic Hydrocarbons											
Acenaphthene	4.0E-05	m	3.1E-01	m	3.1E-03	9.6E-04	5.0E-05	1.0E+02	1.0E+01	0.0000005	0.000005
Acenaphthylene	–		2.1E-02	m	3.1E-03	6.5E-05	4.0E-06	1.0E+02	1.0E+01	0.00000004	0.0000004
Anthracene	3.0E-05	m	2.0E-01		3.1E-03	6.2E-04	3.0E-05	1.0E+02	1.0E+01	0.0000003	0.000003
Benzo(a)anthracene	–		2.3E+00		7.7E-03	1.8E-02	1.0E-03	1.0E+02	1.0E+01	0.00001	0.0001
Benzo(a)pyrene	–		6.2E-01		7.7E-03	4.8E-03	3.0E-04	1.0E+02	1.0E+01	0.000003	0.00003
Benzo(b)fluoranthene	–		7.4E-01		7.7E-03	5.6E-03	3.0E-04	1.0E+02	1.0E+01	0.000003	0.00003
Benzo(g,h,i)perylene	–		3.9E-01		7.7E-03	3.0E-03	2.0E-04	1.0E+02	1.0E+01	0.000002	0.00002
Benzo(k)fluoranthene	–		2.4E-01		7.7E-03	1.8E-03	1.0E-04	1.0E+02	1.0E+01	0.000001	0.00001
Chrysene	–		2.4E+00		7.7E-03	1.8E-02	1.0E-03	1.0E+02	1.0E+01	0.00001	0.0001
Dibenzo(a,h)anthracene	–		5.6E-01	m	7.7E-03	4.3E-03	2.0E-04	1.0E+02	1.0E+01	0.000002	0.00002
Fluoranthene	–		8.9E-01		7.7E-03	6.8E-03	4.0E-04	1.0E+02	1.0E+01	0.000004	0.00004
Fluorene	3.4E-05	m	9.1E-02		3.1E-03	2.8E-04	2.0E-05	1.0E+02	1.0E+01	0.0000002	0.000002
Indeno(1,2,3-cd)pyrene	–		3.1E-01		7.7E-03	2.3E-03	1.0E-04	1.0E+02	1.0E+01	0.000001	0.00001
Phenanthrene	5.0E-05	m	4.8E-01		3.1E-03	1.5E-03	8.0E-05	1.0E+02	1.0E+01	0.0000008	0.000008
Pyrene	–		8.5E-01		7.7E-03	6.5E-03	4.0E-04	1.0E+02	1.0E+01	0.000004	0.00004
Inorganics											
Arsenic	1.0E-02	m	8.7E+00		1.0E+00	0.0E+00	2.0E-04	1.3E+01	5.1E+00	0.00002	0.00004
Cadmium	–		5.1E-01		1.0E+00	0.0E+00	–	1.5E+01	1.5E+00	NA	NA
Copper	1.9E-02		5.5E+01		1.0E+00	8.0E-01	4.0E-02	6.2E+01	4.7E+01	0.0006	0.0009
Lead	2.5E-02	av	3.7E+04	avg	1.0E+00	0.0E+00	5.0E-04	3.9E+01	3.9E+00	0.00001	0.0001
Nickel	1.5E-03	m	1.6E+01		1.0E+00	0.0E+00	3.0E-05	1.1E+02	7.7E+01	0.0000003	0.0000004
Selenium	4.4E-04	m	1.3E+00	m	1.0E+00	0.0E+00	8.0E-06	1.0E+00	5.0E-01	0.000008	0.00002
Silver	1.2E-03	m	8.4E+00	m	1.0E+00	0.0E+00	2.0E-05	1.0E+00	5.0E-01	0.00002	0.00004
Zinc	2.1E-02		6.8E+03		1.0E+00	2.5E+01	1.0E+00	1.3E+02	1.5E+01	0.008	0.07

Notes:

– =	Not applicable.
HQ =	Hazard Quotient.
LOAEL =	Lowest observed adverse effect level.
mg/kg =	Milligrams per kilogram.
mg/kg-BW-day =	Milligrams per kilogram of body weight per day.
mg/L =	Milligrams per liter.
NA =	Not available.
NOAEL =	No observed adverse effect level.

[a] Exposure point concentrations (EPCs) are the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration.
EPCs marked with "m" are the maximum concentration.

[b] See Table A.2-21 for sources of sediment bioaccumulation factors.

[c] Measured whole body fish tissue concentrations were used where available (i.e., for inorganic); if constituent was not detected in whole body fish tissue, it was assumed equal to zero.
Where constituents were not analyzed for in whole body fish tissue samples, tissue concentrations were estimated using the following formula:
Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor.

[d] See Table A.2-24 for equations used to estimate dietary ingestion and Table A.2-19 for receptor exposure assumptions.

[e] See Table A.2-22 for sources of avian toxicity reference values.

[f] Refined hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to one significant figure.

Table A.7.ERA-16
Summary of Ecological Risk Characterization Results - Terrestrial Habitat
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Soil: Frequency of Detection # detects		/ n samples	%	EPC (mg/kg)		Baseline Level Assessment: Hazard Quotient [a]	Ecological Screening Level [b] Source	Ecological Screening Level [b] Basis	Bioaccum-ulative ? (YES/no)	Results of Refined Food Chain Models [c]: Short-tailed Shrew LOAEL HQ	Short-tailed Shrew NOAEL HQ	American Robin LOAEL HQ	American Robin NOAEL HQ
Volatile Organic Compounds														
d-Limonene	1	-	1	100%	0.17	m	NA			no	–	–	–	–
p-Isopropyltoluene	1	-	11	9%	0.0048	m	NA			no	–	–	–	–
Semi-Volatile Organic Compounds														
Carbazole	3	-	26	12%	0.1	m	NA			no	–	–	–	–
Dibenzofuran	2	-	26	8%	0.014	m	NA			no	–	–	–	–
Dioxin/Furan Compounds														
Dioxin Toxicity Equivalents	8	-	8	100%	9.9E-06	m	**50**	R5s		YES	0.005	0.05	0.0009	0.009
Explosives														
Pentaerythritol Tetranitrate	1	-	9	11%	0.11	m	NA			no	–	–	–	–
Herbicides														
Dalapon	3	-	4	75%	0.163	m	NA			no	–	–	–	–
MCPP	1	-	4	25%	2.56	m	NA			no	–	–	–	–
Pesticides														
4,4'-DDD	1	-	4	25%	0.0019	m	0.09	EcoSSL	mam	YES	0.00005	0.0003	0.006	0.06
Dieldrin	1	-	4	25%	0.00472	m	1	EcoSSL	mam	YES	0.002	0.02	0.0004	0.004
Polycyclic Aromatic Hydrocarbons														
Acenaphthene	3	-	29	10%	0.32	m	0.0005	R5		YES	0.001	0.01	0.0001	0.001
Acenaphthylene	1	-	29	3%	0.0039	m	0.000006	R5		YES	0.000002	0.0000002	0.000001	0.00001
Anthracene	6	-	29	21%	0.035		0.00002	R5		YES	6E-08	0.0000006	0.000005	0.00005
Benzo(a)anthracene	9	-	29	31%	0.132		0.03	R5		YES	0.0004	0.004	0.00002	0.0002
Benzo(a)pyrene	9	-	29	31%	0.164		0.1	R5		YES	0.0003	0.003	0.00003	0.0003
Benzo(b)fluoranthene	10	-	29	34%	0.228		0.004	R5		YES	0.0001	0.003	0.00003	0.0003
Benzo(g,h,i)perylene	9	-	29	31%	0.148		0.001	R5		YES	0.005	0.05	0.00002	0.0002
Benzo(k)fluoranthene	9	-	29	31%	0.123		0.0008	R5		YES	0.00007	0.002	0.00002	0.0002
Chrysene	10	-	29	34%	0.164		0.03	R5		YES	0.00001	0.0001	0.00002	0.0002
Dibenzo(a,h)anthracene	4	-	27	15%	0.22	m	0.01	R5		YES	0.4	**4**	0.00003	0.0003
Fluoranthene	9	-	29	31%	0.236		0.002	R5		YES	0.0002	0.002	0.00008	0.0008
Fluorene	3	-	29	10%	0.028	m	0.0002	R5		YES	0.000006	0.00002	0.000009	0.00009
Indeno(1,2,3-cd)pyrene	9	-	29	31%	0.145		0.001	R5		YES	0.01	0.1	0.00002	0.0002
Phenanthrene	9	-	29	31%	0.119		0.003	R5		YES	0.00005	0.0005	0.00002	0.0002
Pyrene	10	-	29	34%	0.2		0.003	R5		YES	0.0001	0.001	0.00003	0.0003
Polychlorinated Biphenyls														
Aroclor 1254	2	-	28	7%	0.084	m	NA			YES	0.02	0.2	0.003	0.03

Table A.7.ERA-16
Summary of Ecological Risk Characterization Results - Terrestrial Habitat
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	Soil Frequency of Detection # detects	-	n samples	%	EPC (mg/kg)	Baseline Level Assessment Hazard Quotient [a]	Ecological Screening Level [b] Source	Basis	Bioaccum-ulative ? (YES/no)	Results of Refined Food Chain Models [c] Short-tailed Shrew LOAEL HQ	Short-tailed Shrew NOAEL HQ	American Robin LOAEL HQ	American Robin NOAEL HQ
Inorganics													
Antimony	26	-	53	49%	0.836	**3**	EcoSSL	mam	no	–	–	–	–
Arsenic	56	-	56	100%	10.72	0.6	EcoSSL	veg	YES	0.05	0.5	0.02	0.06
Cadmium	25	-	53	47%	0.322	0.9	EcoSSL	mam	YES	0.03	0.3	0.003	0.03
Chromium	56	-	56	100%	55.92	**2**	EcoSSL	avi	no	–	–	–	–
Copper	56	-	56	100%	145.5	**5**	EcoSSL	avi	YES	0.07	0.08	0.04	0.05
Iron	56	-	56	100%	35,755	NA			no	–	–	–	–
Lead	56	-	56	100%	698	**60**	EcoSSL	avi	YES	0.06	0.6	0.3	**3**
Selenium	17	-	53	32%	0.625	1	EcoSSL	veg	YES	0.05	0.09	0.02	0.03
Silver	16	-	53	30%	0.37	0.09	EcoSSL	avi	YES	0.00006	0.0006	0.01	0.02
Zinc	56	-	56	100%	593.9	**10**	EcoSSL	avi	YES	0.8	**8**	0.1	1

Notes:
– = Not applicable.
COPEC = Constituent of Potential Ecological Concern.
EPC = Exposure point concentrations - the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration.
EPCs marked with "m" are the maximum concentration.
LOAEL HQ = Lowest observed adverse effect level hazard quotient.
mg/kg = Milligrams per kilogram.
NA = Not available.
NOAEL HQ = No observed adverse effect level hazard quotient.

[a] Hazard quotients (HQs) greater than one are presented in bold font. HQs are rounded to one significant figure (unitless).
[b] See Table A.2-18 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
R5: Region 5 Ecological Screening Levels (USEPA 2003e; R5).
EcoSSL: USEPA Ecological Soil Screening Levels (USEPA 2005b, EcoSSL).
Where readily available (i.e., EcoSSLs), the basis of the ESL is presented.
[c] Foodchain modeling was conducted for bioaccumulative COPECs.

Table A.7.ERA-17
Summary of Ecological Risk Characterization Results - Aquatic Habitat
WESTERN BURNING GROUND
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

	Sediment			Surface Water			Baseline Level Assessment			Results of Refined Food Chain Models [b]			
	Frequency of Detection		EPC	Frequency of Detection		EPC	Sediment Hazard Quotient	Surface Water Hazard Quotient	Bioaccum-ulative ?	Mink		Great Blue Heron	
Constituent	# detects / n samples	%	(mg/kg)	# detects / n samples	%	(mg/L)	[a]	[a]	(YES/no)	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ
Volatile Organic Compounds													
2-Butanone	5 - 14	36%	0.0737	1 - 10	10%	0.004 m	**2**	0.0003	no	–	–	–	–
Acetone	11 - 14	79%	0.107	1 - 10	10%	0.0028 m	**10**	0.002	no	–	–	–	–
Carbon Disulfide	5 - 12	42%	0.00143	7 - 10	70%	0.0002	**2**	0.2	no	–	–	–	–
Semi-Volatile Organic Compounds				-									
1,2,4-Trichlorobenzene	2 - 15	13%	0.023 m	0 - 13	0%	–	0.01	NA	YES	–	–	–	–
1,2-Dichlorobenzene	0 - 15	0%	–	1 - 13	8%	0.0002 m	NA	0.3	YES	–	–	–	–
1,3-Dichlorobenzene	0 - 15	0%	–	1 - 13	8%	0.0002 m	NA	0.001	YES	–	–	–	–
1,4-Dichlorobenzene	2 - 15	13%	0.049 m	1 - 13	8%	0.0003 m	0.08	0.01	YES	–	–	–	–
4-Methylphenol	4 - 17	24%	2.2 m	0 - 13	0%	–	**3**	NA	no	–	–	–	–
Carbazole	2 - 15	13%	0.21 m	0 - 13	0%	–	NA	NA	no	–	–	–	–
Dioxin/Furan Compounds				-									
Dioxin Toxicity Equivalents	6 - 6	100%	2.8E-06 m	4 - 4	100%	4E-12 m	**3**	1	YES	0.0000003	0.000003	0.00000001	0.0000001
Explosives				-									
1,3,5-Trinitrobenzene	1 - 8	13%	0.41 m	0 - 7	0%	–	NA	NA	no	–	–	–	–
Nitroglycerine	1 - 8	13%	0.96 m	0 - 7	0%	–	NA	NA	no	–	–	–	–
Herbicides				-									
2,4-D	2 - 5	40%	6.83 m	2 - 5	40%	0.0037 m	**5**	0.02	no	–	–	–	–
Dicamba	1 - 5	20%	0.0322 m	0 - 5	0%	–	NA	NA	no	–	–	–	–
MCPP	1 - 5	20%	3.56 m	1 - 5	20%	0.0541 m	NA	NA	no	–	–	–	–
Pesticides				-									
4,4'-DDD	4 - 5	80%	0.00152 m	0 - 5	0%	–	0.3	NA	YES	0.00003	0.0002	0.004	0.04
4,4'-DDE	4 - 6	67%	0.00308 m	0 - 5	0%	–	1	NA	YES	0.0009	0.005	0.1	1
4,4'-DDT	3 - 5	60%	0.0119 m	0 - 5	0%	–	0.002	NA	YES	0.0003	0.001	0.03	0.3
BHC, delta-	1 - 5	20%	0.00095 m	0 - 5	0%	–	0.0001	NA	YES	–	–	–	–
Chlordane, alpha-	2 - 5	40%	0.00071 m	0 - 5	0%	–	0.2	NA	YES	0.000003	0.00003	0.000003	0.00003
Dieldrin	1 - 5	20%	0.00347 m	3 - 5	60%	9E-06 m	**2**	0.2	YES	0.005	0.05	0.001	0.01
Endosulfan II	2 - 5	40%	0.00161 m	0 - 5	0%	–	0.1	NA	YES	–	–	–	–
Methoxychlor	1 - 5	20%	0.00637 m	0 - 5	0%	–	0.3	NA	YES	–	–	–	–
Polycyclic Aromatic Hydrocarbons				-									
2-Methylnaphthalene	4 - 18	22%	0.065 m	3 - 15	20%	3E-05 m	**3**	0.007	no	–	–	–	–
Acenaphthene	4 - 18	22%	0.31 m	2 - 15	13%	4E-05 m	**50**	0.007	YES	0.000008	0.00008	0.0000005	0.000005
Acenaphthylene	1 - 18	6%	0.021 m	0 - 15	0%	–	**4**	NA	YES	0.00000009	0.000000009	0.00000004	0.0000004
Anthracene	5 - 18	28%	0.201	2 - 15	13%	3E-05 m	**4**	**3**	YES	0.00000002	0.0000002	0.0000003	0.000003
Benzo(a)anthracene	10 - 20	50%	2.322	0 - 15	0%	–	**20**	NA	YES	0.0006	0.006	0.00001	0.0001
Benzo(a)pyrene	7 - 20	35%	0.62	0 - 15	0%	–	**4**	NA	YES	0.00007	0.0007	0.000003	0.00003
Benzo(b)fluoranthene	9 - 20	45%	0.735	0 - 15	0%	–	0.07	NA	YES	0.00002	0.0005	0.000003	0.00003
Benzo(g,h,i)perylene	5 - 18	28%	0.386	0 - 15	0%	–	**2**	NA	YES	0.0005	0.005	0.000002	0.00002
Benzo(k)fluoranthene	9 - 20	45%	0.24	0 - 15	0%	–	1	NA	YES	0.000007	0.0002	0.000001	0.00001
Chrysene	10 - 20	50%	2.38	0 - 15	0%	–	**10**	NA	YES	0.00001	0.0001	0.00001	0.0001
Dibenzo(a,h)anthracene	3 - 18	17%	0.56 m	0 - 15	0%	–	**20**	NA	YES	0.04	0.4	0.000002	0.00002
Fluoranthene	11 - 20	55%	0.891	0 - 15	0%	–	**2**	NA	YES	0.00001	0.0001	0.000004	0.00004
Fluorene	5 - 18	28%	0.0913	2 - 15	13%	3E-05 m	1	0.01	YES	0.0000002	0.0000005	0.0000002	0.000002
Indeno(1,2,3-cd)pyrene	5 - 18	28%	0.306	0 - 15	0%	–	**20**	NA	YES	0.0002	0.002	0.000001	0.00001
Phenanthrene	10 - 20	50%	0.484	3 - 15	20%	5E-05 m	**2**	0.1	YES	0.000008	0.00008	0.0000008	0.000008
Pyrene	11 - 20	55%	0.854	0 - 15	0%	–	**4**	NA	YES	0.00006	0.0006	0.000004	0.00004

Table A.7.ERA-17

Summary of Ecological Risk Characterization Results - Aquatic Habitat

WESTERN BURNING GROUND

New River Unit, Radford Army Ammunition Plant, Radford, Virginia

	Sediment			Surface Water			Baseline Level Assessment Sediment	Baseline Level Assessment Surface Water		Results of Refined Food Chain Models [b]			
	Frequency of Detection		EPC	Frequency of Detection		EPC	Hazard Quotient	Hazard Quotient	Bioaccum-ulative ?	Mink		Great Blue Heron	
Constituent	**# detects / n samples**	**%**	**(mg/kg)**	**# detects / n samples**	**%**	**(mg/L)**	**[a]**	**[a]**	**(YES/no)**	**LOAEL HQ**	**NOAEL HQ**	**LOAEL HQ**	**NOAEL HQ**
Inorganics				-									
Aluminum	28 - 28	100%	19,156	13 - 13	100%	0.351	0.3	**4**	no	–	–	–	–
Barium	28 - 28	100%	92.82	13 - 13	100%	0.0952	NA	**20**	no	–	–	–	–
Beryllium	27 - 28	96%	1.164	1 - 13	8%	0.0011 m	NA	**2**	no	–	–	–	–
Cadmium	14 - 26	54%	0.507	0 - 13	0%	–	0.5	NA	YES	–	–	–	–
Chromium	28 - 28	100%	6,048	0 - 13	0%	–	**100**	NA	no	–	–	–	–
Copper	28 - 28	100%	54.79	6 - 13	46%	0.0185	**2**	**2**	YES	0.003	0.004	0.0006	0.0009
Iron	28 - 28	100%	74,658	14 - 15	93%	39.87	**4**	**100**	no	–	–	–	–
Lead	32 - 32	100%	37,445	11 - 18	61%	0.0248	**1,000**	**10**	YES	0.00005	0.0005	0.00001	0.0001
Manganese	28 - 28	100%	831.3	14 - 15	93%	1.154	**2**	**10**	no	–	–	–	–
Nickel	28 - 28	100%	15.71	2 - 13	15%	0.0015 m	0.7	0.03	YES	0.000003	0.000006	0.0000003	0.0000004
Selenium	4 - 26	15%	1.3 m	1 - 13	8%	0.0004 m	0.7	0.4	YES	0.0002	0.0003	0.000008	0.00002
Silver	4 - 26	15%	8.42 m	2 - 13	15%	0.0012 m	**8**	0.4	YES	0.0000008	0.000008	0.00002	0.00004
Thallium	12 - 28	43%	0.389	2 - 13	15%	0.0054 m	NA	**7**	no	–	–	–	–
Vanadium	28 - 28	100%	49.04	6 - 15	40%	0.026	NA	1	no	–	–	–	–
Zinc	28 - 28	100%	6,810	8 - 13	62%	0.0208	**60**	0.2	YES	0.04	0.4	0.008	0.07

Notes:

– =	Not applicable.
EPC =	Exposure point concentrations - the minimum of the upper confidence limit (UCL) on the mean and the maximum concentration.
	EPCs marked with "m" are the maximum concentration.
FOD	Frequency of Detection.
LOAEL HQ =	Lowest observed adverse effect level hazard quotient.
mg/kg =	Milligrams per kilogram.
mg/L =	Milligrams per liter.
NOAEL HQ =	No observed adverse effect level hazard quotient.
[a]	Hazard quotients (HQs) greater than one are presented in bold font. HQs are rounded to one significant figure (unitless).
[b]	Foodchain modeling was conducted for bioaccumulative COPECs.

Table A.8.HHRA-1
Groundwater Risk Assessment Dataset
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent [a]	CASN	Frequency of Detection (FOD) [b] number of detects / number of samples			FOD %	Detects Min (mg/L)	-	Detects Max (mg/L)	Detection Limits Min (mg/L)	-	Detection Limits Max (mg/L)	Maximum Location	Exposure Point Concentration [c] (mg/L)
Volatile Organic Compounds													
Acetone	67-64-1	6	-	26	23	1.90E-03	-	4.10E-02	5.00E-03	-	2.50E-02	WBGMW02	0.007986
Carbon Disulfide	75-15-0	1	-	26	4	4.50E-04	-	4.50E-04	1.00E-03	-	2.00E-03	IAAMW02	0.00045 m
Chloroform	67-66-3	2	-	26	8	8.50E-04	-	1.20E-03	1.00E-03	-	1.00E-03	WBGMW01	0.0012 m
Chloromethane	74-87-3	13	-	25	52	9.30E-04	-	1.70E-03	1.00E-03	-	2.00E-03	WBGMW01	0.001224
Methyl tert-butyl ether	1634-4-4	1	-	15	7	1.10E-02	-	1.10E-02	1.00E-03	-	1.00E-03	IAAMW02	0.011 m
Toluene	108-88-3	1	-	26	4	7.00E-04	-	7.00E-04	1.00E-03	-	1.00E-03	BLAMW01	0.0007 m
Semi-Volatile Organic Compounds													
2,6-Dinitrotoluene	606-20-2	1	-	25	4	3.90E-04	-	3.90E-04	2.00E-04	-	3.80E-04	NBG-MW-02	0.00039 m
Dioxin/Furan Compounds													
1,2,3,4,6,7,8-HpCDD	35822-46-9	4	-	15	27	3.12E-09	-	4.79E-08	5.39E-09	-	5.17E-08	WBGMW01	4.79E-08 m
1,2,3,4,6,7,8-HpCDF	67562-39-4	9	-	15	60	1.38E-09	-	3.08E-08	5.98E-09	-	5.17E-08	WBGMW01	1.3525E-08
1,2,3,4,7,8,9-HpCDF	55673-89-7	1	-	15	7	4.12E-09	-	4.12E-09	5.46E-09	-	5.17E-08	NBG-MW-01	4.12E-09 m
1,2,3,4,7,8-HxCDD	39227-28-6	2	-	15	13	2.84E-09	-	5.75E-09	5.39E-09	-	5.17E-08	NBG-MW-01	5.75E-09 m
1,2,3,4,7,8-HxCDF	70648-26-9	8	-	15	53	1.73E-09	-	8.02E-09	5.46E-09	-	5.17E-08	WBGMW01	5.3504E-09
1,2,3,6,7,8-HxCDD	57653-85-7	2	-	15	13	3.24E-09	-	5.13E-09	5.39E-09	-	5.17E-08	NBG-MW-01	5.13E-09 m
1,2,3,6,7,8-HxCDF	57117-44-9	7	-	15	47	1.10E-09	-	6.25E-09	5.39E-09	-	5.17E-08	NBG-MW-01	3.4897E-09
1,2,3,7,8,9-HxCDD	19408-74-3	2	-	15	13	3.33E-09	-	5.54E-09	5.39E-09	-	5.17E-08	NBG-MW-01	5.54E-09 m
1,2,3,7,8,9-HxCDF	72918-21-9	2	-	15	13	2.36E-09	-	6.23E-09	5.39E-09	-	5.17E-08	NBG-MW-01	6.23E-09 m
1,2,3,7,8-PeCDD	40321-76-4	4	-	15	27	2.94E-09	-	7.77E-09	5.39E-09	-	5.17E-08	NBG-MW-01	7.77E-09 m
1,2,3,7,8-PeCDF	57117-41-6	6	-	15	40	9.01E-10	-	1.90E-08	5.39E-09	-	5.17E-08	BLAMW02	9.3357E-09
2,3,4,6,7,8-HxCDF	60851-34-5	4	-	15	27	9.89E-10	-	4.19E-09	5.39E-09	-	5.17E-08	NBG-MW-01	4.19E-09 m
2,3,4,7,8-PeCDF	57117-31-4	8	-	15	53	9.68E-10	-	1.58E-08	5.46E-09	-	5.17E-08	BLAMW02	7.3631E-09
2,3,7,8-TCDD	1746-01-6	3	-	15	20	3.15E-09	-	4.25E-09	1.13E-09	-	5.05E-08	BLAMW02	4.25E-09 m
2,3,7,8-TCDF	51207-31-9	5	-	15	33	7.43E-10	-	1.21E-08	2.31E-09	-	1.03E-08	BLAMW02	1.21E-08 m
OCDD	3268-87-9	10	-	15	67	6.28E-09	-	3.95E-07	1.00E-08	-	1.09E-08	WBGMW01	2.4064E-07
OCDF	39001-02-0	7	-	15	47	5.05E-09	-	9.26E-08	1.00E-08	-	1.20E-08	WBGMW01	2.7599E-08
Explosives													
Nitrobenzene	98-95-3	1	-	25	4	5.10E-04	-	5.10E-04	2.00E-04	-	3.80E-04	WBGMW03	0.00051 m
o-Nitrotoluene	88-72-2	1	-	25	4	2.93E-04	-	2.93E-04	2.00E-04	-	3.80E-04	BLAMW02	0.000293 m
Pentaerythritol Tetranitrate	78-11-5	1	-	25	4	1.39E-03	-	1.39E-03	1.11E-03	-	3.80E-03	IAAMW02	0.00139 m
Perchlorate	14797-73-0	7	-	11	64	9.10E-05	-	2.00E-04	2.00E-04	-	2.00E-04	IAAMW04	0.0002 m
Tetryl	479-45-8	2	-	25	8	3.02E-04	-	4.50E-04	2.00E-04	-	3.80E-04	NBG-MW-02	0.00045 m
Polycyclic Aromatic Hydrocarbons													
Anthracene	120-12-7	1	-	29	3	2.10E-05	-	2.10E-05	9.20E-05	-	1.30E-03	SPRING02	0.000021 m
Fluoranthene	206-44-0	1	-	29	3	1.90E-05	-	1.90E-05	9.20E-05	-	1.30E-03	IAAMW03	0.000019 m
Naphthalene	91-20-3	2	-	29	7	3.20E-05	-	4.40E-05	9.20E-05	-	1.30E-03	RY_SPRING002	0.000044 m
Phenanthrene	85-01-8	2	-	29	7	2.20E-05	-	3.80E-05	9.20E-05	-	1.30E-03	RY_SPRING002	0.000038 m
Pyrene	129-00-0	1	-	29	3	1.90E-05	-	1.90E-05	9.20E-05	-	1.30E-03	BLAMW01	0.000019 m
Inorganics Unfiltered													
Aluminum	7429-90-5	11	-	18	61	6.07E-02	-	7.20E-02	2.00E-01	-	2.00E-01	IAAMW02	0.06748
Arsenic	7440-38-2	1	-	18	6	1.83E-03	-	1.83E-03	1.25E-03	-	5.00E-03	IAAMW02	0.00183 m
Barium	7440-39-3	17	-	18	94	1.08E-02	-	2.00E-01	4.00E-02	-	4.00E-02	WBGMW03	0.09416
Cadmium	7440-43-9	11	-	18	61	4.16E-04	-	5.74E-04	5.00E-03	-	5.00E-03	IAAMW02	0.000514
Calcium	7440-70-2	18	-	18	100	4.17E+01	-	1.03E+02	ND	-	ND	IAAMW03	71.414
Chromium	7440-47-3	7	-	18	39	6.56E-04	-	2.20E-03	1.25E-03	-	1.00E-02	BLAMW01	0.001281
Cobalt	7440-48-4	1	-	18	6	2.55E-03	-	2.55E-03	3.12E-03	-	1.50E-02	WBGMW01	0.00255 m
Iron	7439-89-6	3	-	18	17	1.39E-02	-	5.39E-01	2.50E-02	-	1.00E-01	IAAMW02	0.539 m
Magnesium	7439-95-4	18	-	18	100	4.11E+00	-	4.31E+01	ND	-	ND	WBGMW01	25.19
Manganese	7439-96-5	13	-	18	72	1.62E-03	-	2.85E-02	3.75E-03	-	1.50E-02	BLAMW02	0.01817
Nickel	7440-02-0	11	-	18	61	7.77E-04	-	3.38E-02	2.50E-03	-	1.00E-02	BLAMW02	0.01023
Potassium	7440-09-7	17	-	18	94	1.07E+00	-	5.22E+00	5.00E+00	-	5.00E+00	WBGMW01	2.926
Sodium	7440-23-5	18	-	18	100	1.01E+00	-	5.85E+01	ND	-	ND	IAAMW02	40.692
Zinc	7440-66-6	10	-	18	56	1.64E-03	-	7.10E-03	5.00E-03	-	2.00E-02	NBG-MW-01	0.005044

Notes:

– = Not detected/ not analyzed/ not applicable.
CASN = Chemical abstracts registry number.
mg/L = Milligrams per liter.
ND = Non-detects.
PAH = Polycyclic Aromatic Hydrocarbon.
USEPA = United States Environmental Protection Agency.
VOC = Volatile Organic Compound.

[a] Only chemicals detected at least once in all five areas are presented.
For duplicate samples, the highest detected value or the lowest detection limit were used.
For constituents analyzed in two methods, the result of the more precise method was used i.e., USEPA method 8260 over 8270 for VOCs, method 8270-SIM over method 8270 for PAHs, and method 8330 over method 8260 or 8270 for explosives.
[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.
[c] The exposure point concentration (EPC) was the upper confidence level on the mean (UCL) or the maximum concentration where the UCL was incalculable.
EPCs marked with "m" are based on the maximum detected concentration.
The UCLs were calculated using ProUCL 4.2. The UCL used is the one recommended by ProUCL 4.2.

Table A.8.HHRA-2
Selection of Constituents of Potential Concern for Groundwater
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent	CASN	Maximum Concentrations [a]	Adjusted Tap Water Regional Screening Level (RSL) [b]			Is Constituent a Groundwater COPC? [c]
		(mg/L)	(mg/L)		Surrogate	(YES, no)
Volatile Organic Compounds						
Acetone	67-64-1	4.10E-02	2.20E+00	n		no
Carbon Disulfide	75-15-0	4.50E-04	1.00E-01	n		no
Chloroform	67-66-3	1.20E-03	1.90E-04	c		**YES**
Chloromethane	74-87-3	1.70E-03	1.90E-02	n		no
Methyl tert-butyl ether	1634-4-4	1.10E-02	1.20E-02	c		no
Toluene	108-88-3	7.00E-04	2.30E-01	n		no
Semi-Volatile Organic Compounds						
2,6-Dinitrotoluene	606-20-2	3.90E-04	3.70E-03	n		no
Dioxin/Furan Compounds						
1,2,3,4,6,7,8-HpCDD	35822-46-9	4.79E-08	5.20E-08	c	Total HpCDD	no
1,2,3,4,6,7,8-HpCDF	67562-39-4	3.08E-08	5.20E-08	c	Total HpCDF	no
1,2,3,4,7,8,9-HpCDF	55673-89-7	4.12E-09	5.20E-08	c	Total HpCDF	no
1,2,3,4,7,8-HxCDD	39227-28-6	5.75E-09	5.20E-09	c	Total HxCDD	**YES**
1,2,3,4,7,8-HxCDF	70648-26-9	8.02E-09	5.20E-09	c	Total HxCDF	**YES**
1,2,3,6,7,8-HxCDD	57653-85-7	5.13E-09	5.20E-09	c	Total HxCDD	no
1,2,3,6,7,8-HxCDF	57117-44-9	6.25E-09	5.20E-09	c	Total HxCDF	**YES**
1,2,3,7,8,9-HxCDD	19408-74-3	5.54E-09	5.20E-09	c	Total HxCDD	**YES**
1,2,3,7,8,9-HxCDF	72918-21-9	6.23E-09	5.20E-09	c	Total HxCDF	**YES**
1,2,3,7,8-PeCDD	40321-76-4	7.77E-09	5.20E-10	c	Total PeCDD	**YES**
1,2,3,7,8-PeCDF	57117-41-6	1.90E-08	1.70E-08	c		**YES**
2,3,4,6,7,8-HxCDF	60851-34-5	4.19E-09	5.20E-09	c	Total HxCDF	no
2,3,4,7,8-PeCDF	57117-31-4	1.58E-08	1.70E-09	c		**YES**
2,3,7,8-TCDD	1746-01-6	4.25E-09	5.20E-10	c*		**YES**
2,3,7,8-TCDF	51207-31-9	1.21E-08	5.20E-09	c		**YES**
OCDD	3268-87-9	3.95E-07	1.70E-06	c		no
OCDF	39001-02-0	9.26E-08	1.70E-06	c		no
Explosives						
Nitrobenzene	98-95-3	5.10E-04	1.20E-04	n		**YES**
o-Nitrotoluene	88-72-2	2.93E-04	3.10E-04	c		no
Pentaerythritol Tetranitrate	78-11-5	1.39E-03	NA			**YES**
Perchlorate	14797-73-0	2.00E-04	2.60E-03	n		no
Tetryl	479-45-8	4.50E-04	1.50E-02	n		no
Polycyclic Aromatic Hydrocarbons						
Anthracene	120-12-7	2.10E-05	1.10E+00	n		no
Fluoranthene	206-44-0	1.90E-05	1.50E-01	n		no
Naphthalene	91-20-3	4.40E-05	1.40E-04	c*		no
Phenanthrene	85-01-8	3.80E-05	1.10E+00	n	Anthracene	no
Pyrene	129-00-0	1.90E-05	1.10E-01	n		no
Inorganics Unfiltered						
Aluminum	7429-90-5	7.20E-02	3.70E+00	n		no
Arsenic	7440-38-2	1.83E-03	4.50E-05	c		**YES**
Barium	7440-39-3	2.00E-01	7.30E-01	n		no
Cadmium	7440-43-9	5.74E-04	1.80E-03	n		no
Calcium	7440-70-2	1.03E+02	NA			no
Chromium [d]	7440-47-3	2.20E-03	5.50E+00	n		no
Cobalt	7440-48-4	2.55E-03	1.10E-03	n		**YES**
Iron	7439-89-6	5.39E-01	2.60E+00	n		no
Magnesium	7439-95-4	4.31E+01	NA			no
Manganese	7439-96-5	2.85E-02	8.80E-02	n		no
Nickel	7440-02-0	3.38E-02	7.30E-02	n		no
Potassium	7440-09-7	5.22E+00	NA			no
Sodium	7440-23-5	5.85E+01	NA			no
Zinc	7440-66-6	7.10E-03	1.10E+00	n		no

Notes:

CASN = Chemical abstracts registry number.
COPC = Constituent of Potential Concern.
mg/L = Milligrams per liter.
NA = Not available or not applicable.
RSL = Regional Screening Level.
USEPA = United States Environmental Protection Agency.

[a] Maximum concentrations in groundwater.

[b] The screening levels used were risk screening levels for tap water from USEPA (2008a). Screening levels based on non-cancer effects were adjusted by a factor of 10. For chemicals whose screening levels were based on cancer effects but the noncancer screening level was less than 10x the cancer level (tagged with c**), the non-cancer level was used after adjustment.
c = cancer; * = where: n RSL < 100X c RSL; ** = where n RSL < 10X c RSL; n = noncancer; m = Concentration may exceed ceiling limit;
Some RSL values were based on surrogates as identified next to each value.

[c] Constituents detected with maximum concentrations greater than screening levels were considered COPCs unless they were known laboratory contaminants or essential nutrients.

[d] Chromium (III) (Insoluble Salts) was used for the tap-water RSL value.

Table A.8.HHRA-3
Groundwater Exposure Point Concentrations
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Concern (COPC)	CASN	Is Constuituent a Chemical of Potential Concern (COPC)?	Exposure Point Concentration (EPC) [a] (mg/L)
Volatile Organic Compounds			
Acetone	67-64-1	no	–
Carbon Disulfide	75-15-0	no	–
Chloroform	67-66-3	**YES**	1.20E-03 m
Chloromethane	74-87-3	no	–
Methyl tert-butyl ether	1634-4-4	no	–
Toluene	108-88-3	no	–
2,6-Dinitrotoluene	606-20-2	no	–
Dioxin/Furan Compounds			
1,2,3,4,6,7,8-HpCDD	35822-46-9	no	–
1,2,3,4,6,7,8-HpCDF	67562-39-4	no	–
1,2,3,4,7,8,9-HpCDF	55673-89-7	no	–
1,2,3,4,7,8-HxCDD	39227-28-6	**YES**	5.75E-09 m
1,2,3,4,7,8-HxCDF	70648-26-9	**YES**	5.35E-09
1,2,3,6,7,8-HxCDD	57653-85-7	no	–
1,2,3,6,7,8-HxCDF	57117-44-9	**YES**	3.49E-09
1,2,3,7,8,9-HxCDD	19408-74-3	**YES**	5.54E-09 m
1,2,3,7,8,9-HxCDF	72918-21-9	**YES**	6.23E-09 m
1,2,3,7,8-PeCDD	40321-76-4	**YES**	7.77E-09 m
1,2,3,7,8-PeCDF	57117-41-6	**YES**	9.34E-09
2,3,4,6,7,8-HxCDF	60851-34-5	no	–
2,3,4,7,8-PeCDF	57117-31-4	**YES**	7.36E-09
2,3,7,8-TCDD	1746-01-6	**YES**	4.25E-09 m
2,3,7,8-TCDF	51207-31-9	**YES**	1.21E-08 m
OCDD	3268-87-9	no	–
OCDF	39001-02-0	no	–
Explosives			
Nitrobenzene	98-95-3	**YES**	5.10E-04 m
o-Nitrotoluene	88-72-2	no	–
Pentaerythritol Tetranitrate	78-11-5	**YES**	1.39E-03 m
Perchlorate	14797-73-0	no	–
Tetryl	479-45-8	no	–
Polycyclic Aromatic Hydrocarbons			
Anthracene	120-12-7	no	–
Fluoranthene	206-44-0	no	–
Naphthalene	91-20-3	no	–
Phenanthrene	85-01-8	no	–
Pyrene	129-00-0	no	–
Inorganics Unfiltered			
Aluminum	7429-90-5	no	–
Arsenic	7440-38-2	**YES**	1.83E-03 m
Barium	7440-39-3	no	–
Cadmium	7440-43-9	no	–
Calcium	7440-70-2	no	–
Chromium	7440-47-3	no	–
Cobalt	7440-48-4	**YES**	2.55E-03 m
Iron	7439-89-6	no	–
Magnesium	7439-95-4	no	–
Manganese	7439-96-5	no	–
Nickel	7440-02-0	no	–
Potassium	7440-09-7	no	–
Sodium	7440-23-5	no	–
Zinc	7440-66-6	no	–

Notes:
mg/L = Milligrams per liter.

[a] The exposure point concentration (EPC) was the upper confidence level on the mean (UCL) or the maximum concentration where the UCL was incalculable.
EPCs marked with "m" are based on the maximum detected concentration.
The UCLs were calculated using ProUCL 4.2. The UCL used is the one recommended by ProUCL 4.2.

Table A.8.HHRA-4
Risk and Hazard Calculations for Hypothetical Future Adult Resident Exposure to Groundwater
Using Data from Filtered Groundwater Samples for Inorganic Constituents
SITEWIDE GROUNDWATER EVALUATION
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Adult Resident
Receptor Age: Adult

Constituent	EPCgw (mg/L)	DA [a] (L/cm²/day)		CANCER RISK: Route-Specific Risks: Oral	Dermal	Inhalation	Calculated Risk	Percent Total ELCR	NON-CANCER HAZARD: Route-Specific Risks: Oral	Dermal	Inhalation	Calculated Hazard	Percent Total HI
				ELCRo	ELCRd	ELCRi	ELCR		HQo	HQd	HQi	HI	
Volatile Organic Compounds													
Chloroform	1.20E-03	1.01E-05	[1]	NA	NA	4.5E-06	4.5E-06	4%	3.3E-03	3.0E-04	5.9E-03	9.5E-03	2%
Dioxin/Furan Compounds													
1,2,3,4,7,8-HxCDD	5.75E-09	1.56E-03	[0]	7.0E-07	9.9E-06	–	1.1E-05	9%	NA	NA	–	NA	–
1,2,3,4,7,8-HxCDF	5.35E-09	1.23E-03	[0]	6.5E-07	7.3E-06	–	7.9E-06	7%	NA	NA	–	NA	–
1,2,3,6,7,8-HxCDF	3.49E-09	1.23E-03	[0]	4.3E-07	4.7E-06	–	5.2E-06	5%	NA	NA	–	NA	–
1,2,3,7,8,9-HxCDD	5.54E-09	0.00E+00	[1]	6.8E-07	0.0E+00	–	6.8E-07	1%	NA	NA	–	NA	–
1,2,3,7,8,9-HxCDF	6.23E-09	1.87E-04	[0]	7.6E-07	1.3E-06	–	2.0E-06	2%	NA	NA	–	NA	–
1,2,3,7,8-PeCDD	7.77E-09	2.24E-04	[0]	9.5E-06	1.9E-05	–	2.9E-05	25%	NA	NA	–	NA	–
1,2,3,7,8-PeCDF	9.34E-09	4.34E-04	[0]	3.4E-07	1.3E-06	–	1.7E-06	1%	NA	NA	–	NA	–
2,3,4,7,8-PeCDF	7.36E-09	4.34E-04	[0]	2.7E-06	1.1E-05	–	1.3E-05	12%	NA	NA	–	NA	–
2,3,7,8-TCDD	4.25E-09	0.00E+00	[1]	5.2E-06	0.0E+00	–	5.2E-06	5%	1.2E-01	0.0E+00	–	1.2E-01	21%
2,3,7,8-TCDF	1.21E-08	2.52E-04	[0]	1.5E-06	3.4E-06	–	4.8E-06	4%	NA	NA	–	NA	–
Explosives													
Nitrobenzene	5.10E-04	8.42E-06	[1]	NA	NA	3.4E-06	3.4E-06	3%	7.0E-03	5.3E-04	2.7E-02	3.4E-02	6%
Pentaerythritol Tetranitrate	1.39E-03	6.38E-07	[0]	NA	NA	–	NA	–	NA	NA	–	NA	–
Inorganics													
Arsenic	1.83E-03	5.80E-07	[0]	2.6E-05	1.3E-07	–	2.6E-05	23%	1.7E-01	8.7E-04	–	1.7E-01	30%
Cobalt	2.55E-03	2.32E-07	[0]	NA	NA	–	NA	–	2.3E-01	4.9E-04	–	2.3E-01	42%
				Total ELCR			1E-04	100%	Total HI			0.6	100%

[a] The dermal absorption factor (DA) was calculated using Equation [0], [1], or [2], as indicated, from Table A.2-15.

–	Not applicable.
ELCR	Excess lifetime cancer risk.
EPCgw	Exposure point concentration in groundwater (mg/L).
HI	Hazard index (sum of the HQs).
HQ	Hazard quotient.
L/cm²/day	Liters per square centimeter per day.
mg/L	Milligrams per liter.
NA	Not available.

Equations: (see Table 2-15)

ELCRo = (EPCgw × 2 × 350 × 24 × CSFo) / (70 × 25,550)
ELCRd = (EPCgw × DA × 18,000 × 350 × 24 × CSFa) / (70 × 25,550)
ELCRi (VOCs only) = (EPCgw × 0.5 × 20 × 350 × 24 × CSFi) / (70 × 25,550)

HQo = (EPCgw × 2 × 350 × 24) / (70 × 8,760 × RfDo)
HQd = (EPCgw × DA × 18,000 × 350 × 24) / (70 × 8,760 × RfDa)
HQi (VOCs only) = (EPCgw × 0.5 × 20 × 350 × 24) / (70 × 8,760 × RfDi)

Table A.8.HHRA-5
Risk and Hazard Calculations for Hypothetical Future Child Resident Exposure to Groundwater
Using Data from Filtered Groundwater Samples for Inorganic Constituents
SITEWIDE GROUNDWATER EVALUATION
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Future
Receptor Population: Child Resident
Receptor Age: Child

Constituent	EPCgw (mg/L)	DA [a] (L/cm²/day)		CANCER RISK Route-Specific Risks Oral			Calculated Risk	Percent Total ELCR	NON-CANCER HAZARD Route-Specific Risks Oral			Calculated Hazard	Percent Total HI
				Oral	Dermal	Inhalation			Oral	Dermal	Inhalation		
				ELCRo	ELCRd	ELCRi	ELCR		HQo	HQd	HQi	HI	
Volatile Organic Compounds													
Chloroform	1.20E-03	1.33E-05	[1]	NA	NA	2.6E-06	2.6E-06	4%	7.7E-03	6.7E-04	1.4E-02	2.2E-02	2%
Dioxin/Furan Compounds													
1,2,3,4,7,8-HxCDD	5.75E-09	2.69E-03	[0]	4.1E-07	7.3E-06	–	7.7E-06	10%	NA	NA	–	NA	–
1,2,3,4,7,8-HxCDF	5.35E-09	2.13E-03	[0]	3.8E-07	5.4E-06	–	5.7E-06	8%	NA	NA	–	NA	–
1,2,3,6,7,8-HxCDF	3.49E-09	2.13E-03	[0]	2.5E-07	3.5E-06	–	3.7E-06	5%	NA	NA	–	NA	–
1,2,3,7,8,9-HxCDD	5.54E-09	0.00E+00	[1]	3.9E-07	0.0E+00	–	3.9E-07	1%	NA	NA	–	NA	–
1,2,3,7,8,9-HxCDF	6.23E-09	3.22E-04	[0]	4.4E-07	9.4E-07	–	1.4E-06	2%	NA	NA	–	NA	–
1,2,3,7,8-PeCDD	7.77E-09	3.87E-04	[0]	5.5E-06	1.4E-05	–	2.0E-05	26%	NA	NA	–	NA	–
1,2,3,7,8-PeCDF	9.34E-09	7.48E-04	[0]	2.0E-07	9.9E-07	–	1.2E-06	2%	NA	NA	–	NA	–
2,3,4,7,8-PeCDF	7.36E-09	7.48E-04	[0]	1.6E-06	7.8E-06	–	9.3E-06	12%	NA	NA	–	NA	–
2,3,7,8-TCDD	4.25E-09	0.00E+00	[1]	3.0E-06	0.0E+00	–	3.0E-06	4%	2.7E-01	0.0E+00	–	2.7E-01	21%
2,3,7,8-TCDF	1.21E-08	4.34E-04	[0]	8.6E-07	2.5E-06	–	3.3E-06	4%	NA	NA	–	NA	–
Explosives													
Nitrobenzene	5.10E-04	1.11E-05	[1]	NA	NA	2.0E-06	2.0E-06	3%	1.6E-02	1.2E-03	6.3E-02	8.0E-02	6%
Pentaerythritol Tetranitrate	1.39E-03	1.10E-06	[0]	NA	NA	–	NA	–	NA	NA	–	NA	–
Inorganics													
Arsenic	1.83E-03	1.00E-06	[0]	1.5E-05	9.9E-08	–	1.5E-05	20%	3.9E-01	2.6E-03	–	3.9E-01	30%
Cobalt	2.55E-03	4.00E-07	[0]	NA	NA	–	NA	–	5.4E-01	1.4E-03	–	5.4E-01	42%
				Total ELCR			8E-05	100%	Total HI			1	100%

[a] The dermal absorption factor (DA) was calculated using Equation [0], [1], or [2], as indicated, from Table A.2-15.

–	Not applicable.	HQ	Hazard quotient.
ELCR	Excess lifetime cancer risk.	L/cm²/day	Liters per square centimeter per day.
EPCgw	Exposure point concentration in groundwater (mg/L).	mg/L	Milligrams per liter.
HI	Hazard index (sum of the HQs).	NA	Not available.

Equations: (see Table 2-15)

ELCRo = (EPCgw × 1 × 350 × 6 × CSFo) / (15 × 25,550)
ELCRd = (EPCgw × DA × 6,600 × 350 × 6 × CSFa) / (15 × 25,550)
ELCRi (VOCs only) = (EPCgw × 0.5 × 10 × 350 × 6 × CSFi) / (15 × 25,550)

HQo = (EPCgw × 1 × 350 × 6) / (15 × 2,190 × RfDo)
HQd = (EPCgw × DA × 6,600 × 350 × 6) / (15 × 2,190 × RfDa)
HQi (VOCs only) = (EPCgw × 0.5 × 10 × 350 × 6) / (15 × 2,190 × RfDi)

Table A.8.HHRA-6
Risk and Hazard Calculations for Site Worker Exposure to Groundwater
Using Data from Filtered Groundwater Samples for Inorganic Constituents
SITEWIDE GROUNDWATER EVALUATION
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Scenario Timeframe: Current
Receptor Population: Site Worker
Receptor Age: Adult

Constituent	EPCgw (mg/L)	DA [a] (L/cm²/day)		CANCER RISK Route-Specific Risks Oral	Dermal	Calculated Risk	Percent Total ELCR	NON-CANCER HAZARD Route-Specific Risks Oral	Dermal	Calculated Hazard	Percent Total HI
				ELCRo	ELCRd	ELCR		HQo	HQd	HI	
Volatile Organic Compounds											
Chloroform	1.20E-03	5.48E-06	[1]	NA	NA	NA	–	2.3E-03	1.5E-05	2.4E-03	1%
Dioxin/Furan Compounds											
1,2,3,4,7,8-HxCDD	5.75E-09	4.57E-04	[0]	5.2E-07	2.9E-07	8.1E-07	2%	NA	NA	NA	–
1,2,3,4,7,8-HxCDF	5.35E-09	3.62E-04	[0]	4.9E-07	2.1E-07	7.0E-07	2%	NA	NA	NA	–
1,2,3,6,7,8-HxCDF	3.49E-09	3.62E-04	[0]	3.2E-07	1.4E-07	4.5E-07	1%	NA	NA	NA	–
1,2,3,7,8,9-HxCDD	5.54E-09	0.00E+00	[1]	5.0E-07	0.0E+00	5.0E-07	1%	NA	NA	NA	–
1,2,3,7,8,9-HxCDF	6.23E-09	5.47E-05	[0]	5.7E-07	3.7E-08	6.0E-07	2%	NA	NA	NA	–
1,2,3,7,8-PeCDD	7.77E-09	6.58E-05	[0]	7.1E-06	5.6E-07	7.6E-06	20%	NA	NA	NA	–
1,2,3,7,8-PeCDF	9.34E-09	1.27E-04	[0]	2.5E-07	3.9E-08	2.9E-07	1%	NA	NA	NA	–
2,3,4,7,8-PeCDF	7.36E-09	1.27E-04	[0]	2.0E-06	3.1E-07	2.3E-06	6%	NA	NA	NA	–
2,3,7,8-TCDD	4.25E-09	0.00E+00	[1]	3.9E-06	0.0E+00	3.9E-06	10%	8.3E-02	0.0E+00	8.3E-02	22%
2,3,7,8-TCDF	1.21E-08	7.38E-05	[0]	1.1E-06	9.7E-08	1.2E-06	3%	NA	NA	NA	–
Explosives											
Nitrobenzene	5.10E-04	4.56E-06	[1]	NA	NA	NA	–	5.0E-03	2.7E-05	5.0E-03	1%
Pentaerythritol Tetranitrate	1.39E-03	1.87E-07	[0]	NA	NA	NA	–	NA	NA	NA	–
Inorganics											
Arsenic	1.83E-03	1.70E-07	[0]	1.9E-05	3.9E-09	1.9E-05	51%	1.2E-01	2.4E-05	1.2E-01	32%
Cobalt	2.55E-03	6.80E-08	[0]	NA	NA	NA	–	1.7E-01	1.4E-05	1.7E-01	44%
				Total ELCR		4E-05	100%	Total HI		0.4	100%

[a] The dermal absorption factor (DA) was calculated using Equation [0], [1], or [2], as indicated, from Table A.2-15.

– Not applicable.
ELCR Excess lifetime cancer risk.
EPCgw Exposure point concentration in groundwater (mg/L).
HI Hazard index (sum of the HQs).
HQ Hazard quotient.
L/cm²/day Liters per square centimeter per day.
mg/L Milligrams per liter.
NA Not available.

Equations: (see Table 2-15)

ELCRo = (EPCgw × 2 × 250 × 25 × CSFo) / (70 × 25,550)
ELCRd = (EPCgw × DA × 2,400 × 250 × 25 × CSFa) / (70 × 25,550)
HQo = (EPCgw × 2 × 250 × 25) / (70 × 9,125 × RfDo)
HQd = (EPCgw × DA × 2,400 × 250 × 25) / (70 × 9,125 × RfDa)

Table A.8.HHRA-7
Summary of Calculated Risks and Hazards, New River Unit, Radford Army Ammunition Plant, Radford, Virginia
SITEWIDE GROUNDWATER EVALUATION
REASONABLE MAXIMUM EXPOSURE
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

RECEPTOR Exposure Medium - Scenario	Calculation Table	Total Excess Lifetime Cancer Risk	Total Non-Cancer Hazard
Using filtered data for inorganic COPCs			
Hypothetical Future Adult Resident			
Groundwater - Potable Use	Table A.8.HHRA-4	1E-04	0.6
Hypothetical Future Child Resident			
Groundwater - Potable Use	Table A.8.HHRA-5	8E-05	1
Site Worker			
Groundwater - Potable Use	Table A.8.HHRA-6	4E-05	0.4

Table A.8.HHRA-8
Vapor Intrusion Model for Adult Resident Exposure to Groundwater
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

GW-SCREEN
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
67663	1.20E+00	Chloroform

MORE ê

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/groundwater temperature, T_S (°C)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
200	400	SC	10	

MORE ê

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type (Lookup Soil Parameters)	ENTER Vadose zone soil dry bulk density, ρ_b^V (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)
L			L	1.59	0.399	0.148

MORE ê

ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
1.0E-06	1	70	24	24	350

Used to calculate risk-based groundwater concentration.

Note: Using USEPA (2004b) Spreadsheet for the Johnson and Ettinger Model - Groundwater Screen. Version 3.1. Last modified 02/2004.

Table A.8.HHRA-8
Vapor Intrusion Model for Adult Resident Exposure to Groundwater
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
NA	NA	NA	7.92E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
2.0E-08	NA

MESSAGE SUMMARY BELOW:

END

Note: Using USEPA (2004b) Spreadsheet for the Johnson and Ettinger Model - Groundwater Screen. Version 3.1. Last modified 02/2004.

Table A.8.HHRA-8
Vapor Intrusion Model for Adult Resident Exposure to Groundwater
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

GW-SCREEN
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
98953	5.10E-01	Nitrobenzene

MORE ê

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (^oC)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
200	400	SC	10	

MORE ê

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^V (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)
L			L	1.59	0.399	0.148

Lookup Soil Parameters

MORE ê

ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
1.0E-06	1	70	24	24	350

Used to calculate risk-based groundwater concentration.

Note: Using USEPA (2004b) Spreadsheet for the Johnson and Ettinger Model - Groundwater Screen. Version 3.1. Last modified 02/2004.

Table A.8.HHRA-8
Vapor Intrusion Model for Adult Resident Exposure to Groundwater
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
NA	NA	NA	2.09E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	3.2E-06

MESSAGE SUMMARY BELOW:

END

Note: Using USEPA (2004b) Spreadsheet for the Johnson and Ettinger Model - Groundwater Screen. Version 3.1. Last modified 02/2004.

Table A.8.HHRA-9
Vapor Intrusion Model for Child Resident Exposure to Groundwater
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

GW-SCREEN
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
67663	1.20E+00	Chloroform

MORE ê

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
200	400	SC	10	

MORE ê

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type (Lookup Soil Parameters)	ENTER Vadose zone soil dry bulk density, ρ_b^V (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)
L			L	1.59	0.399	0.148

MORE ê

ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
1.0E-06	1	70	6	6	350

Used to calculate risk-based groundwater concentration.

Note: Using USEPA (2004b) Spreadsheet for the Johnson and Ettinger Model - Groundwater Screen. Version 3.1. Last modified 02/2004.

Table A.8.HHRA-9
Vapor Intrusion Model for Child Resident Exposure to Groundwater
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
NA	NA	NA	7.92E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
5.0E-09	NA

MESSAGE SUMMARY BELOW:

END

Note: Using USEPA (2004b) Spreadsheet for the Johnson and Ettinger Model - Groundwater Screen. Version 3.1. Last modified 02/2004.

Table A.8.HHRA-9
Vapor Intrusion Model for Child Resident Exposure to Groundwater
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

GW-SCREEN
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
98953	5.10E-01	Nitrobenzene

MORE ê

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
200	400	SC	10	

MORE ê

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type (Lookup Soil Parameters)	ENTER Vadose zone soil dry bulk density, ρ_b^V (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)
L			L	1.59	0.399	0.148

MORE ê

ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
1.0E-06	1	70	6	6	350

Used to calculate risk-based groundwater concentration.

Note: Using USEPA (2004b) Spreadsheet for the Johnson and Ettinger Model - Groundwater Screen. Version 3.1. Last modified 02/2004.

Table A.8.HHRA-9
Vapor Intrusion Model for Child Resident Exposure to Groundwater
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
NA	NA	NA	2.09E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	3.2E-06

MESSAGE SUMMARY BELOW:

END

Note: Using USEPA (2004b) Spreadsheet for the Johnson and Ettinger Model - Groundwater Screen. Version 3.1. Last modified 02/2004.

Table A.8.HHRA-10
Vapor Intrusion Model for Site Worker Exposure to Groundwater
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

GW-SCREEN
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
67663	1.20E+00	Chloroform

MORE ê

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (^oC)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
200	400	SC	10	

MORE ê

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type (Lookup Soil Parameters)	ENTER Vadose zone soil dry bulk density, ρ_b^V (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)
L			L	1.59	0.399	0.148

MORE ê

ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
1.0E-06	1	70	25	25	250

Used to calculate risk-based groundwater concentration.

Note: Using USEPA (2004b) Spreadsheet for the Johnson and Ettinger Model - Groundwater Screen. Version 3.1. Last modified 02/2004.

Table A.8.HHRA-10
Vapor Intrusion Model for Site Worker Exposure to Groundwater
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
NA	NA	NA	7.92E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
1.5E-08	NA

MESSAGE SUMMARY BELOW:

END

Note: Using USEPA (2004b) Spreadsheet for the Johnson and Ettinger Model - Groundwater Screen. Version 3.1. Last modified 02/2004.

GW-SCREEN
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
98953	5.10E-01	Nitrobenzene

MORE ê

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (^oC)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
200	400	SC	10	

MORE ê

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type (Lookup Soil Parameters)	ENTER Vadose zone soil dry bulk density, ρ_b^V (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)
L			L	1.59	0.399	0.148

MORE ê

ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
1.0E-06	1	70	25	25	250

Used to calculate risk-based groundwater concentration.

Note: Using USEPA (2004b) Spreadsheet for the Johnson and Ettinger Model - Groundwater Screen. Version 3.1. Last modified 02/2004.

Table A.8.HHRA-10
Vapor Intrusion Model for Site Worker Exposure to Groundwater
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
NA	NA	NA	2.09E+06	NA

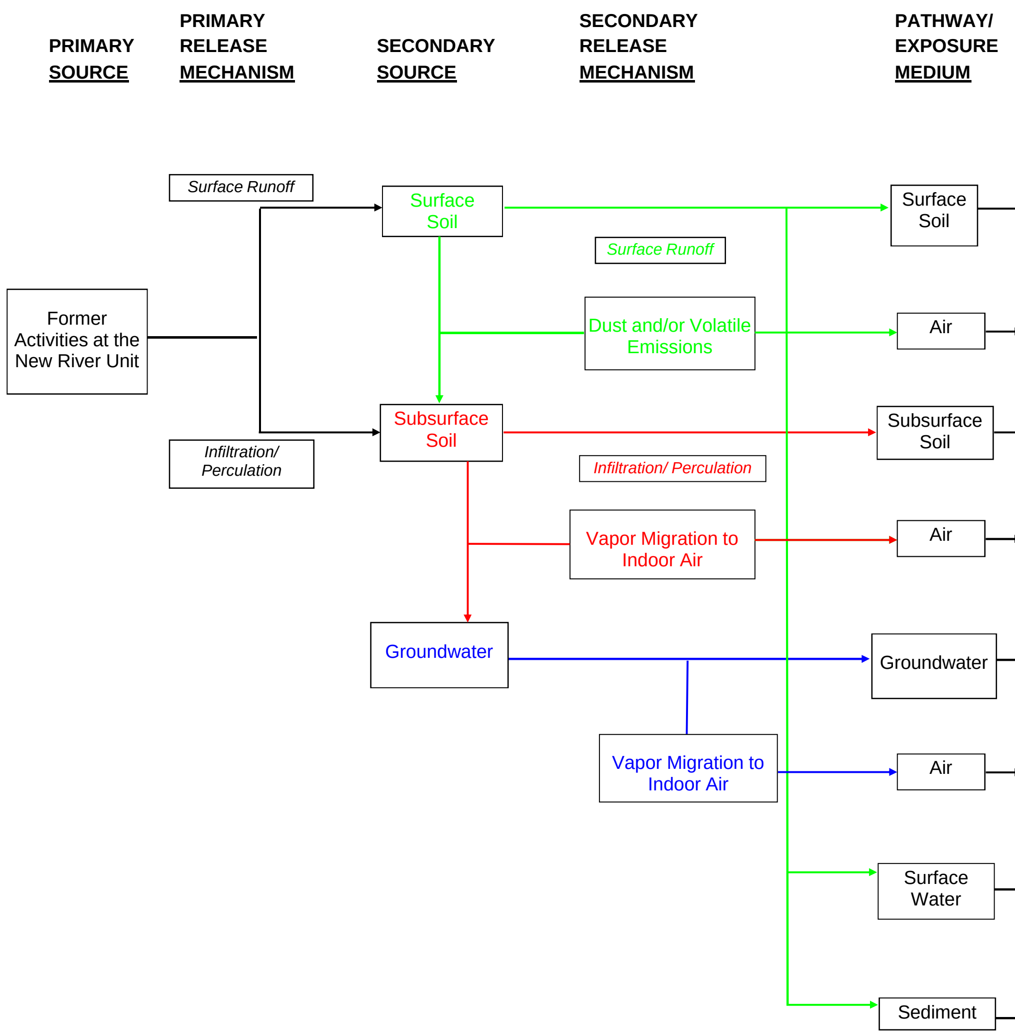
INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	2.3E-06

MESSAGE SUMMARY BELOW:

END

Note: Using USEPA (2004b) Spreadsheet for the Johnson and Ettinger Model - Groundwater Screen. Version 3.1. Last modified 02/2004.



Exposure Medium	EXPOSURE ROUTE	Current: Site Worker	Current: Trespasser	Future: Construction Worker	Future: Adult Resident	Future: Child Resident
Surface Soil	Ingestion	x	x	NA	x	x
	Dermal	x	x	NA	x	x
	Inhalation	x	x	NA	x	x
Air	Inhalation	x	x	x	x	x
Subsurface Soil	Ingestion	NA	NA	x	x	x
	Dermal	NA	NA	x	x	x
	Inhalation	NA	NA	x	x	x
Air	Inhalation	x	NA	x	x	x
Groundwater	Ingestion	NA	NA	NA	x	x
	Dermal	NA	NA	NA	x	x
	Inhalation	NA	NA	NA	x	x
Air	Inhalation	NA	NA	NA	x	x
Surface Water	Ingestion	x	x	NA	x	x
	Dermal	x	x	NA	x	x
	Inhalation	x	x	NA	x	x
	Fish Ingestion	NA	x	NA	x	x
Sediment	Ingestion	x	x	NA	x	x
	Dermal	x	x	NA	x	x

NA Pathway not applicable.
x Potential pathway.

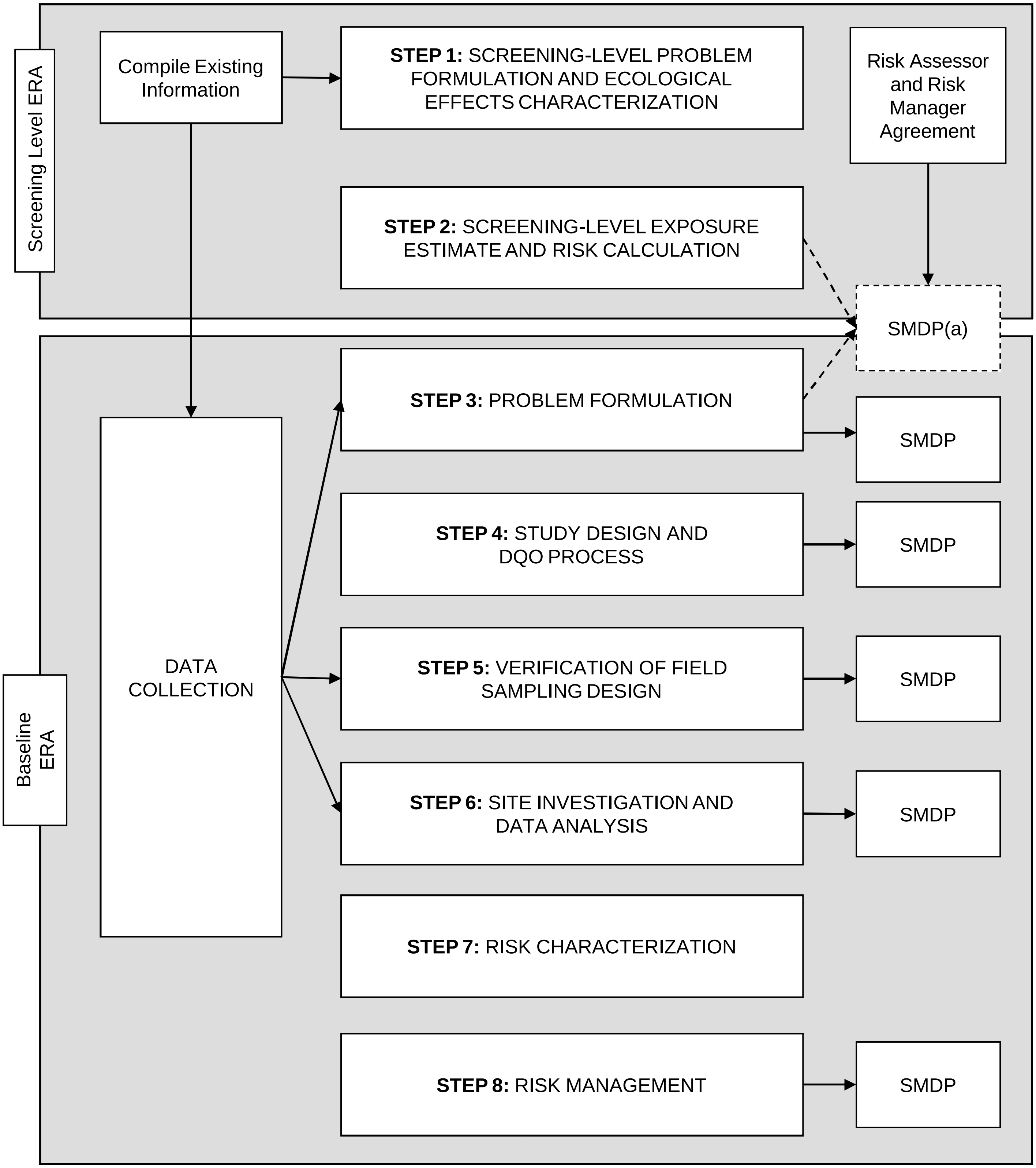
ARCADIS

Conceptual Site Model for Potential Human Health Receptors
New River Unit
Radford Army Ammunition Plant
RADFORD, VIRGINIA

Figure 2-1

Figure 2-2

Eight-Step Ecological Risk Assessment Process



Notes:

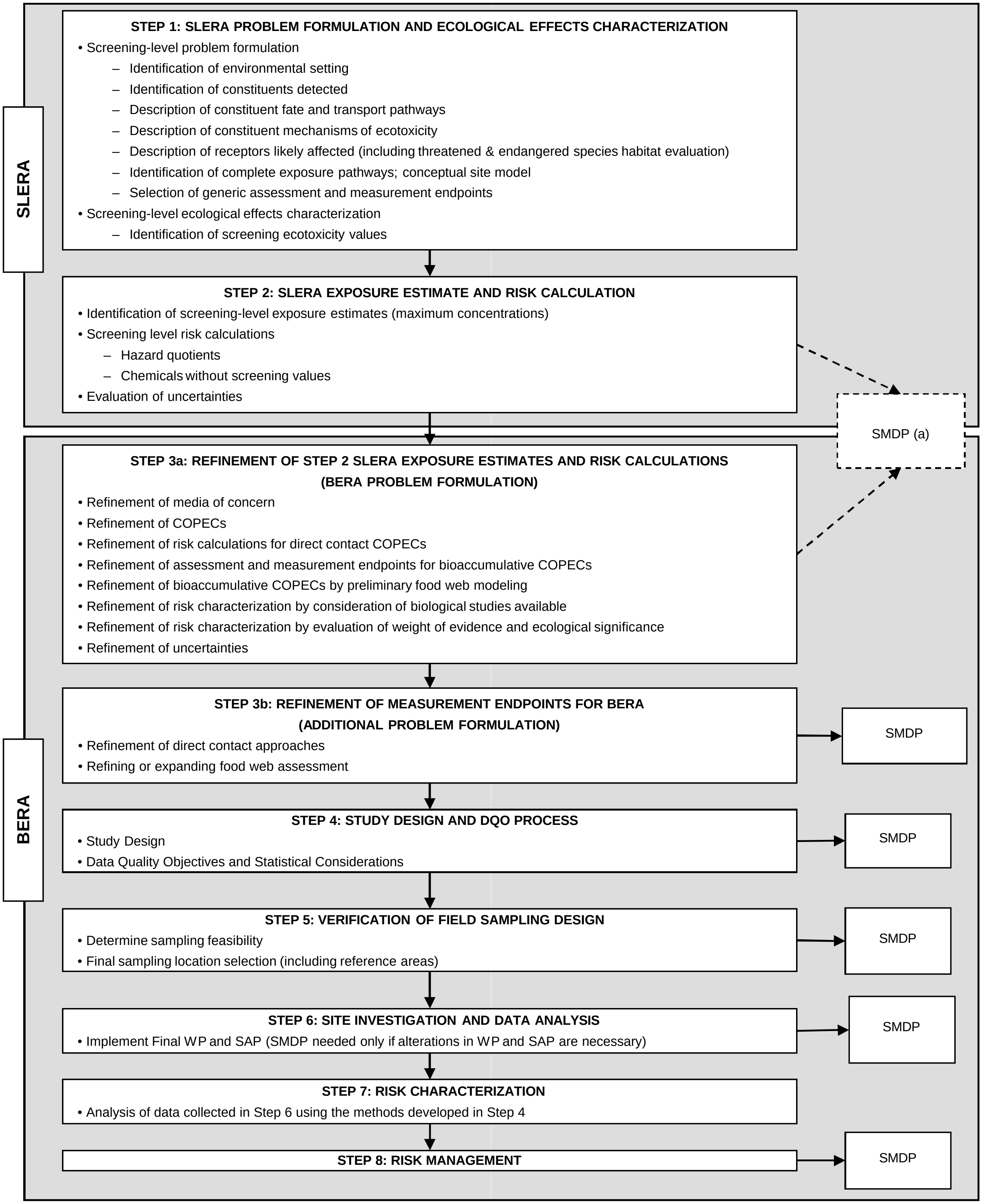
(a) SMDP occurs EITHER after Step 2 or after Step 3a

ERA Ecological Risk Assessment

SMDP Scientific Management Decision Point

Source Adapted from USEPA 2000b

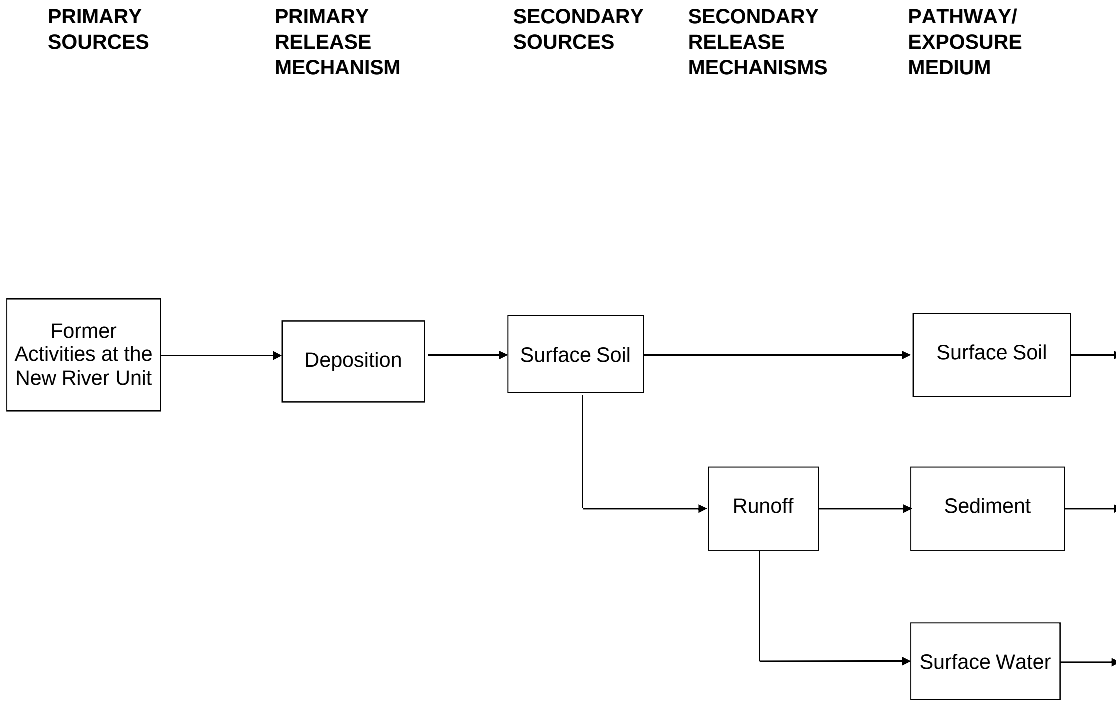
Figure 2-3
Expanded Eight-Step Ecological Risk Assessment Process



Notes:

(a) SMDP occurs EITHER after Step 2 or after Step 3a
COPECs Constituents of Potential Ecological Concern
DQO Data Quality Objectives
GW Groundwater
SAP Sampling and Analysis Plan
SMDP Scientific Management Decision Point
WP Work Plan
BERA Baseline ERA
SLERA Screening-level ERA

Source: Adapted from USEPA 1997 and 2000a



RECEPTORS

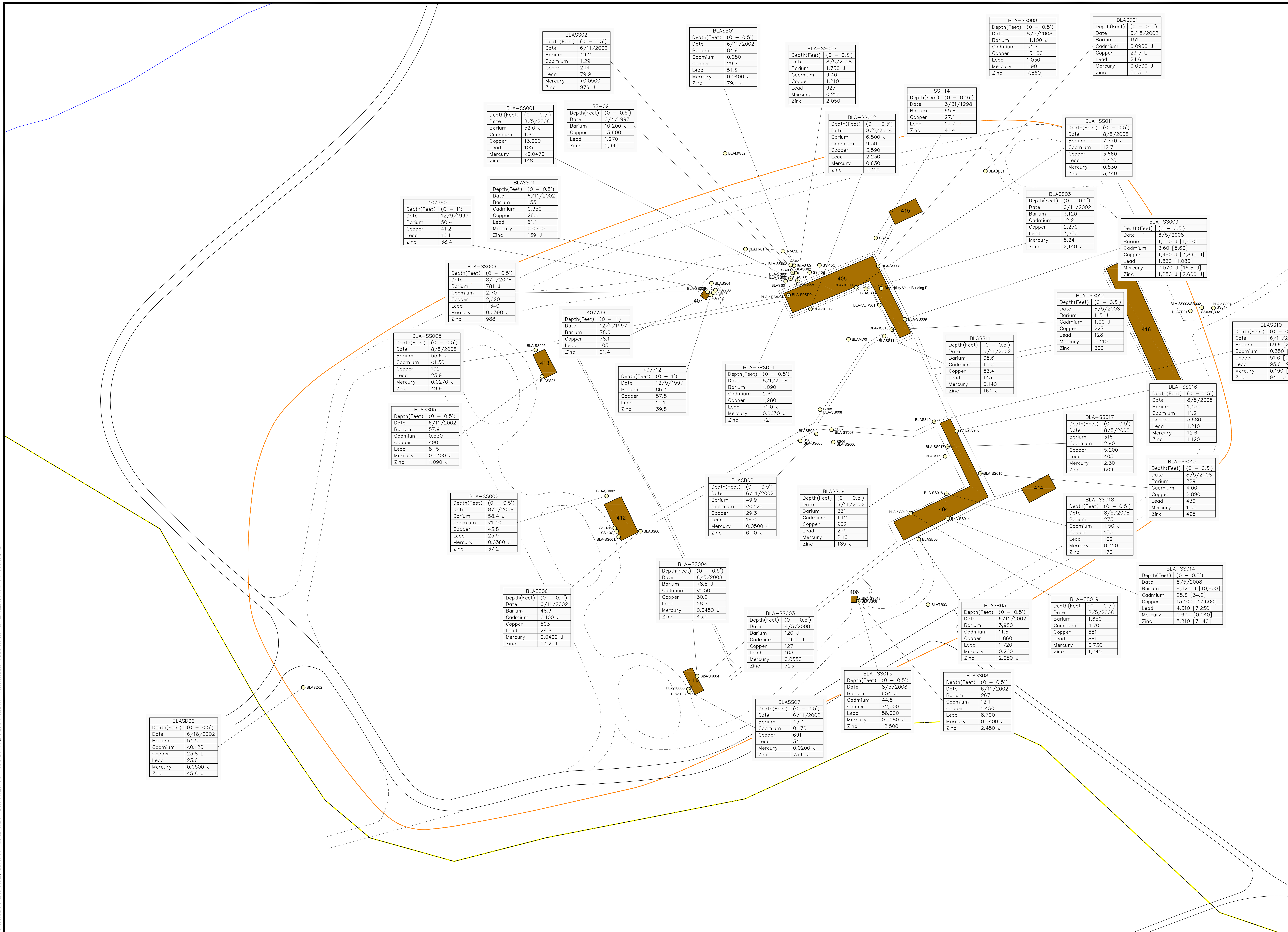
Pathway/Exposure Medium	EXPOSURE ROUTE	Terrestrial Wildlife	Terrestrial Plants	Benthic or Aquatic Organisms
Surface Soil	Ingestion	x	NA	NA
	Direct Contact	x	x	NA
	Food Web	x	NA	NA
	Uptake	NA	x	NA
Sediment	Ingestion	x	NA	x
	Direct Contact	x	NA	x
	Food Web	x	NA	x
	Uptake	NA	NA	x
Surface Water	Ingestion	x	NA	x
	Direct Contact	x	NA	x
	Food Web	x	NA	x
	Uptake	NA	NA	x

NA Pathway not applicable.
x Potential pathway.

ARCADIS

Conceptual Site Model for Potential Ecological Receptors
New River Unit
Radford Army Ammunition Plant
RADFORD, VIRGINIA

Figure 2-4



Legend

- Sample Location All Detects Below RSLs
- Sample Location Above Industrial Criteria and Background (Inorganics only)
- Sample Location Above Residential Criteria and Background (Inorganics only)
- Building Debris Disposal Trench
- Surface Water
- Paved Roads
- Drainage Ditch
- SWMU Area
- 1303 Building Footprint and Identification

Analytical Data Legend

J	Constituent concentration qualified as estimated
K	Estimated concentration bias high
L	Estimated concentration bias low
B	Constituent concentration quantified as estimated
3.4	Yellow shaded results indicate detection above Residential RSL
903	Green shaded results indicate detection above Industrial RSL
903	Bolded results indicate detection above Background (Inorganics only)
	Units for Soil and Sediment Samples reported in mg/kg (Miligrams per kilogram)
	Units for TCLP Samples reported in mg/L (Miligrams per Liter)

0 70 140
SCALE IN FEET

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

CONCENTRATIONS DETECTED IN SURFACE SOIL (0-1 FT BGS) INCLUDING: BARIUM, CADMIUM, COPPER, LEAD, MERCURY, AND ZINC
BAG LOADING AREA

ARCADIS

FIGURE 4-1

Legend

- Sample Location All Detects Below RSLs
- Sample Location Above Industrial Criteria and Background (Inorganics only)
- Sample Location Above Residential Criteria and Background (Inorganics only)
- Building Debris Disposal Trench
- Surface Water
- Paved Roads
- Drainage Ditch
- SWMU Area
- Building Footprint and Identification

Analytical Data Legend

J	Constituent concentration qualified as estimated
K	Estimated concentration bias high
L	Estimated concentration bias low
B	Constituent concentration quantified as estimated
3.4	Yellow shaded results indicate detection above Residential RSL
903	Green shaded results indicate detection above Industrial RSL
903	Bolded results indicate detection above Background (Inorganics only)
	Units for Soil and Sediment Samples reported in mg/kg (Miligrams per kilogram)
	Units for TCLP Samples reported in mg/L (Miligrams per Liter)

0 120 240

SCALE IN FEET

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

CONCENTRATIONS DETECTED IN SURFACE SOIL (0-1 FT BGS) INCLUDING: AROCLOR 1254 AND AROCLOR 1260
IGNITER ASSEMBLY AREA

ARCADIS

FIGURE
5-1

Legend

- Sample Location All Detects Below RSLs
- Sample Location Above Industrial Criteria and Background (Inorganics only)
- Sample Location Above Residential Criteria and Background (Inorganics only)
- Building Debris Disposal Trench
- Surface Water
- Paved Roads
- Drainage Ditch
- SWMU Area
- Building Footprint and Identification

Analytical Data Legend

J	Constituent concentration qualified as estimated
K	Estimated concentration bias high
L	Estimated concentration bias low
B	Constituent concentration quantified as estimated
3.4	Yellow shaded results indicate detection above Residential RSL
903	Green shaded results indicate detection above Industrial RSL
903	Bolded results indicate detection above Background (Inorganics only)
	Units for Soil and Sediment Samples reported in mg/kg (Miligrams per kilogram)
	Units for TCLP Samples reported in mg/L (Miligrams per Liter)

Note: Sample Locations SS-11a and SS-11b not located

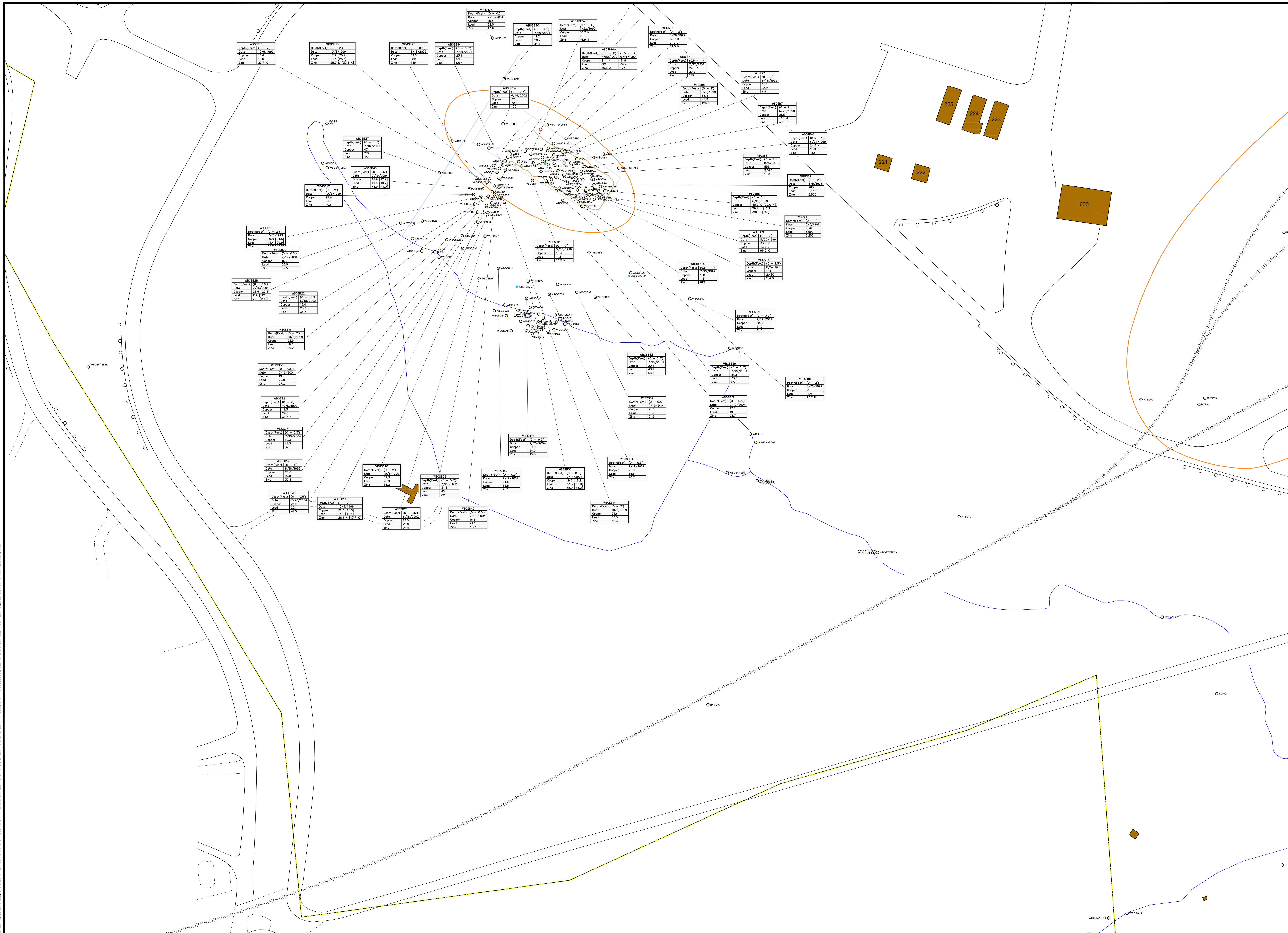
0 120 240
SCALE IN FEET

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

CONCENTRATIONS DETECTED IN SURFACE SOIL (0-1 FT BGS) INCLUDING: BARIUM, CHROMIUM, COPPER, LEAD, MERCURY, AND ZINC
IGNITER ASSEMBLY AREA

ARCADIS

FIGURE
5-2



Legend

- Sample Location All Detects Below RSLs
- Sample Location Above Industrial Criteria and Background (Inorganics only)
- Sample Location Above Residential Criteria and Background (Inorganics only)
- Building Debris Disposal Trench
- Surface Water
- Paved Roads
- Drainage Ditch
- SWMU Area
- 1303 Building Footprint and Identification

Analytical Data Legend

J	Constituent concentration qualified as estimated
K	Estimated concentration bias high
L	Estimated concentration bias low
B	Constituent concentration quantified as estimated
3.4	Yellow shaded results indicate detection above Residential RSL
903	Green shaded results indicate detection above Industrial RSL
903	Bolded results indicate detection above Background (Inorganics only)
	Units for Soil and Sediment Samples reported in mg/kg (Miligrams per kilogram)
	Units for TCLP Samples reported in mg/L (Miligrams per Liter)

Note: Sample Locations SS-04, SS-04a, and SS-05 not located

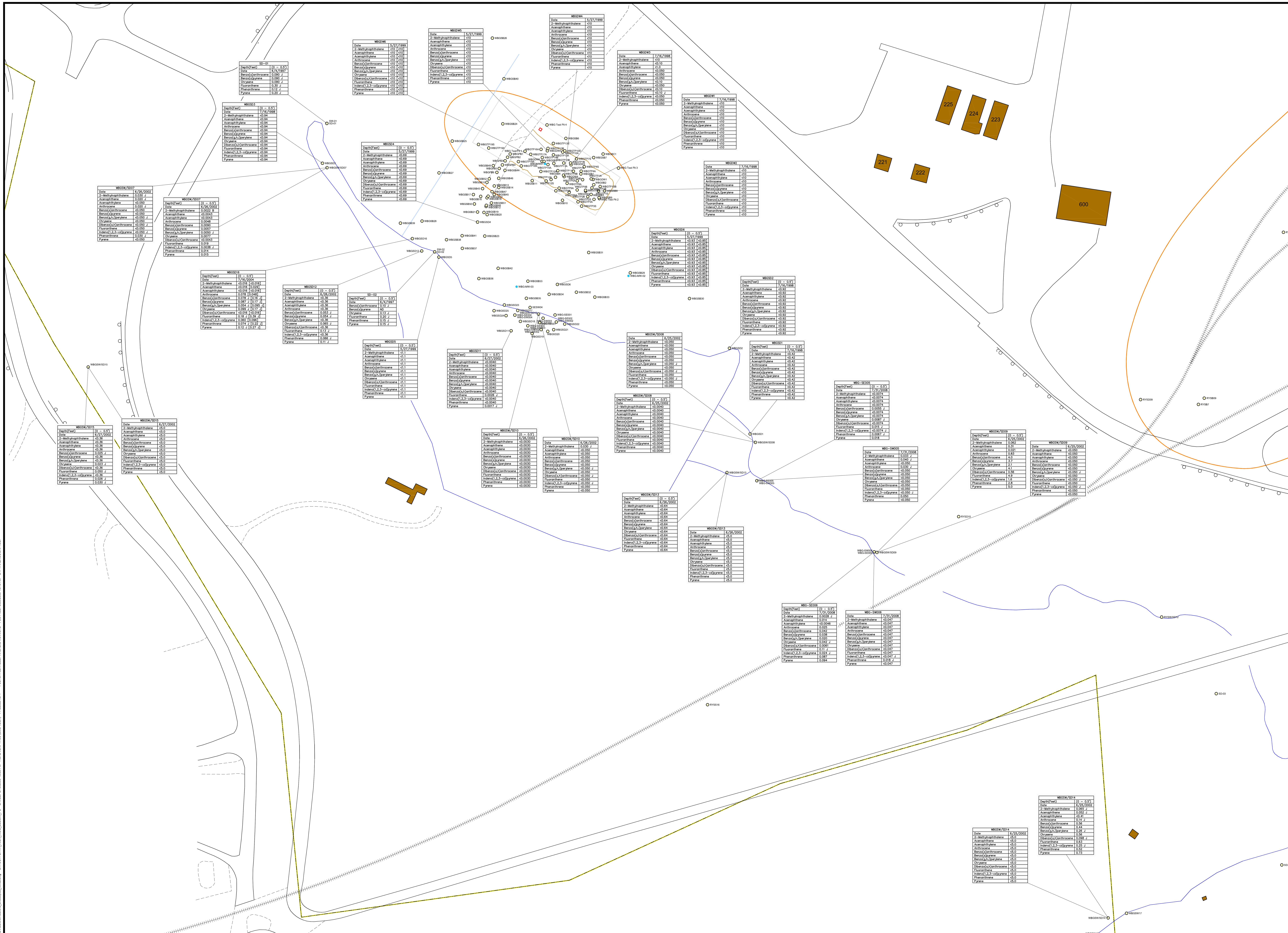
0 70 140
SCALE IN FEET

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

CONCENTRATIONS DETECTED IN SURFACE SOIL (0-1 FT BGS) INCLUDING: COPPER, LEAD, AND ZINC
WESTERN BURNING GROUND

ARCADIS

FIGURE
7-1

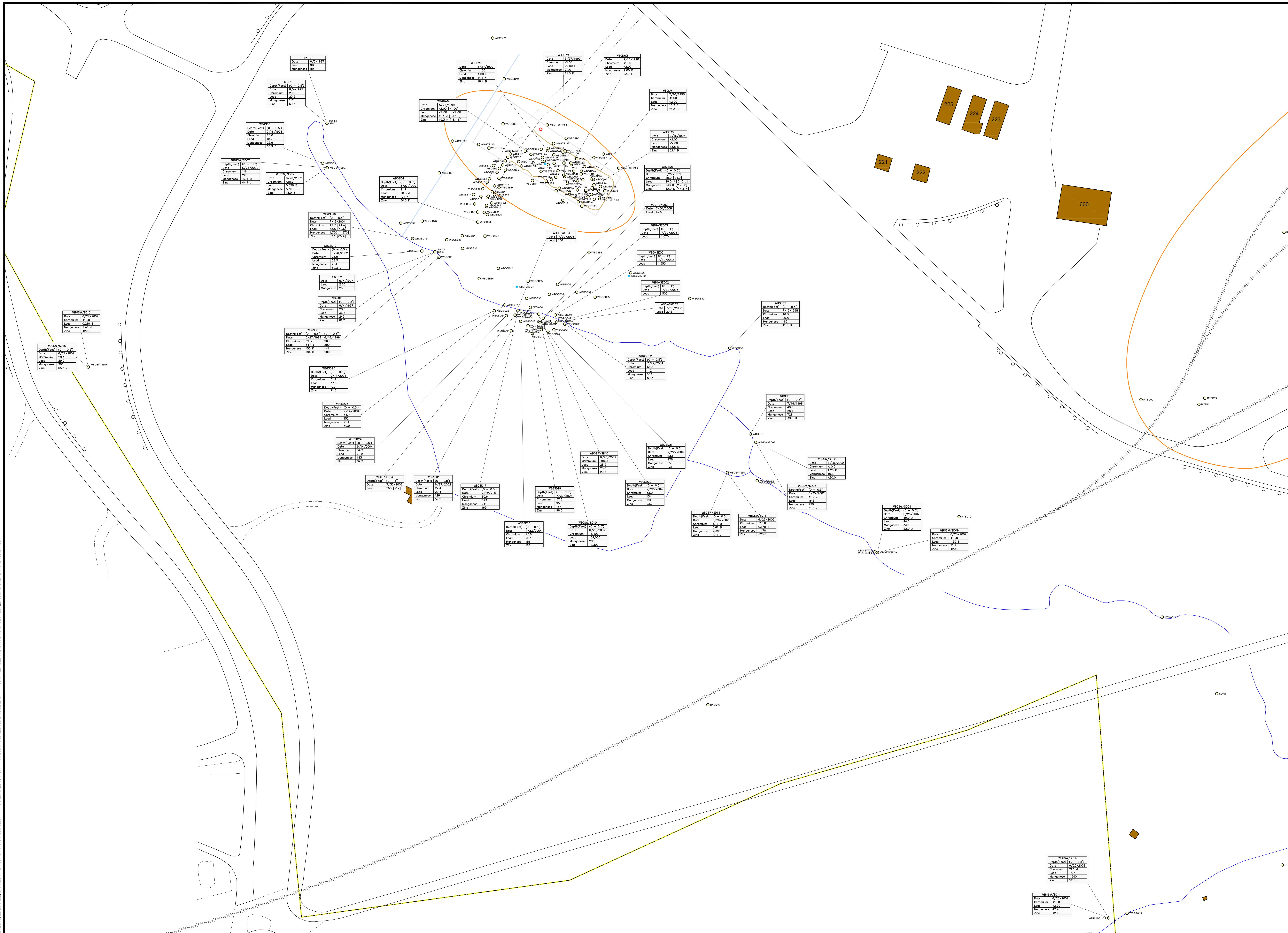


RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

CONCENTRATIONS DETECTED IN SEDIMENT AND SURFACE WATER INCLUDING: POLYCYCLIC AROMATIC HYDROCARBONS WESTERN BURNING GROUND

ARCADIS

FIGURE 7-2



Legend

- Sample Location All Detects Below RSLs
- Sample Location Above Industrial Criteria and Background (Inorganics only)
- Sample Location Above Residential Criteria and Background (Inorganics only)
- Building Debris Disposal Trench
- Surface Water
- Paved Roads
- Drainage Ditch
- SWMU Area
- 1303 Building Footprint and Identification

Analytical Data Legend

J	Constituent concentration qualified as estimated
K	Estimated concentration bias high
L	Estimated concentration bias low
B	Constituent concentration quantified as estimated
3.4	Yellow shaded results indicate detection above Residential RSL
903	Green shaded results indicate detection above Industrial RSL
903	Bolded results indicate detection above Background (Inorganics only)
	Units for Soil and Sediment Samples reported in mg/kg (Miligrams per kilogram)
	Units for TCLP Samples reported in mg/L (Miligrams per Liter)

0 70 140

SCALE IN FEET

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

CONCENTRATIONS DETECTED IN SEDIMENT AND SURFACE WATER INCLUDING: CHROMIUM, LEAD, AND ZINC WESTERN BURNING GROUND

ARCADIS

FIGURE 7-3

Appendix B

RFAAP-NRU Sample Locations

Appendix C

Building Debris Disposal Trench
Analytical Reports

Appendix D

Bag Loading Area Analytical Reports

Appendix E

Igniter Assembly Area Analytical Reports

Appendix F

Western Burning Ground Analytical Reports

Appendix G

Site-Wide Groundwater Analytical Reports