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FINAL

Removal Action Work Plan for the Northern Burning Ground New River Unit (RAAP-044)

Radford Army Ammunition Plant
Radford, Virginia

Prepared for:
Radford Army Ammunition Plant

December 2009

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

www.atk.com

December 8, 2009

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

Subject: Transmittal Acknowledgement,
Final Removal Action Work Plan for the Northern Burning Ground,
Radford Army Ammunition Plant, New River Unit
December 2009

Dear Mr. Cutler:

This letter is to acknowledge transmittal of the subject document that was sent to you on December 4, 2009. Enclosed is a copy of the 4 December 2009 transmittal email.

Note with this work plan we believe, as a best management practice, the facility has complied with the substantive requirements in 262.34(a).

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 10009
Richmond, VA 23240-0009

E. A. Lohman
Virginia Department of Environmental Quality
Blue Ridge Regional Office
3019 Peters Creek Road
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09-815-194
JMcKenna

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
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J. McKenna, ACO Staff
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Coordination: J. McKenna

J. McKenna

09-815-194
JMcKenna

Greene, Anne

From: McKenna, Jim J Mr CIV USA AMC [jim.mckenna@us.army.mil]
Sent: Friday, December 04, 2009 1:24 PM
To: Anne Greene; dennis.druck@us.army.mil; diane.wisbeck@arcadis-us.com; durwood willis2; jerome.redder@atk.com; jim spencer; jtcutler@deq.virginia.gov; Karen Sismour; Lohman,Elizabeth; Mendoza, Rich; Meyer, Tom NAB02; Parks, Jeffrey N; Timothy.Leahy@shawgrp.com; Tina_MacGillivray@URSCorp.com; Kalinowski, Chris; Jeremy Flint
Subject: Final Removal Action Work Plan for the Northern Burning Ground (UNCLASSIFIED)

Importance: High

Classification: UNCLASSIFIED
Caveats: FOUO

All:

Note the contractor will ship the subject document with a copy of this email to the POCs and tracking numbers below.

An acknowledgment letter will follow.

Thank you for your support of the Radford Army Ammunition Plant Installation Restoration Program.

Jim McKenna

Name (# of Copies) - FedEx Tracking Number:

James McKenna (2 Copies and 2 CDs) - Chris Kalinowski to hand deliver

Richard Mendoza (1 Copy and 1 CD) - 7930 7218 0120 Susan Ryan (1 CD) - 7981 9295 0906 Tom Meyer (1 Copy and 1 CD) - 7930 7218 8279 Elizabeth Lohman (1 CD) - 7981 9296 1031 Dennis Druck (1 Copy) - 7981 9340 2013 James Cutler (1 Copy) - 7930 7264 6806 Karen Sismour (1 Copy) - 7930 7265 0820

Classification: UNCLASSIFIED
Caveats: FOUO

Removal Action Work Plan for the Northern Burning Ground

Radford Army Ammunition Plant,
Radford, Virginia

Christopher Kalinowski
Site Manager

Diane Wisbeck
Project Manager

Prepared for:
Radford Army Ammunition Plant

Prepared by:
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Our Ref.:
GP08RAAP.4NBG

Date:
December 2009

Table of Contents

Table of Contents

Figures

Appendices

Table of Contents

List of Acronyms and Abbreviations

AEC	Corrective Action Objective
ATK	Alliant Tech Systems, Inc.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
EE/CA	Engineering Evaluation/Cost Analysis
EPC	Exposure Point Concentration
ft	feet
ft bgs	feet below ground surface
ft msl	feet above mean sea level
HASP	Health and Safety Plan
IRP	Installation Restoration Program
MMA	Main Manufacturing Area
MWP	Master Work Plan
NBG	Northern Burning Ground
NROW	New River Ordinance Works
NRU	New River Unit
QAPA	Quality Assurance Plan Addendum
QA/QC	Quality Assurance/Quality Control
RAL	Remedial Action Level
RFAAP	Radford Army Ammunition Plant
SOP	Standard Operating Procedure
TCLP	Toxicity Characteristic Leaching Procedure
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency
VDEQ	Virginia Department of Environmental Quality
XRF	X-Ray Fluorescence

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 and Compensation Liability Act (CERCLA).

This site-specific Remedial Action Work Plan has been prepared to outline the scope of work for the soil removal action that will be conducted at the Northern Burning Ground (NBG) site within the RFAAP-NRU. As presented in the July 2009 Engineering Evaluation/Cost Analysis (EE/CA) prepared for the NBG (ARCADIS 2009), the removal action at the NBG is being performed to remediate lead and chromium impacts that have been identified in surface and near surface soils at the site. This work plan incorporates by reference applicable sections of the Master Work Plan (URS, 2003) and Standard Operating Procedures (SOPs). The health and safety requirements for fieldwork at the RFAAP-NRU are included in the Health and Safety Plan (HASP) addendum (ARCADIS, 2008a), which has been provided under separate cover. ARCADIS has also prepared a Quality Assurance Plan Addendum (QAPA) (ARCADIS, 2008b) to the Master Work Plan, which has been attached as Appendix A.

1.1 Site History

The RFAAP-NRU was established in 1940, and was originally known as the New River Ordinance Works (NROW). The NROW was incorporated into the RFAAP in 1945. The RFAAP-NRU facility operated as a bag manufacturing and loading plant for artillery, cannon, and mortar projectiles during World War II. Although active manufacturing activities at the RFAAP-NRU were reported to have ceased in the 1940's (after World War II), portions of the RFAAP-NRU are still utilized as storage facilities for operations at the MMA.

The area of the RFAAP-NRU identified as the NBG was temporarily utilized as a burning ground for the facility. Anecdotal evidence suggests that the burning operations may have been conducted to remove energetics from metal components used in the former manufacturing activities at the site. No buildings have existed at the NBG site; burning operations were conducted directly on the ground surface.

1.2 Site Description

The NBG study area is located in the northwest portion of the RFAAP-NRU, east of Gate 20, along Guard Road (Figure 1-2). A dirt road follows the outer perimeter of the NBG and defines the outermost boundary of the site. A drainage ditch parallels Guard Road on the north side of the site. The majority of the area identified as the NBG is heavily wooded, with the exception of a small area in the central portion of the site where burning operations are believed to have been performed. This central portion of the site has a grass and shrub groundcover and a few small trees. Little to no visible evidence of past burning activities is apparent. A site map depicting the layout of the NBG is presented in Figure 1-3.

Although there is significant topographic relief across the RFAAP-NRU, the majority of the NBG is relatively level at an elevation of approximately 2,100 feet above mean sea level (ft msl). Land surface elevation in the western half of the RFAAP-NRU ranges from 2,020 ft msl to 2,115 ft msl. Surface water runoff from the NBG flows toward the drainage ditch that runs parallel to the paved surface road on the northern boundary of the site.

1.3 Nature and Extent of Contamination

Comprehensive environmental investigations were completed at the NBG between 1997 and 2008. These investigations included soil, sediment, and groundwater sampling activities; on-site screening of soils using X-Ray Fluorescence (XRF); and a geophysical survey. The findings of these investigations are discussed in detail within the July 2009 EE/CA for the NBG. Tables summarizing the historical soil analytical data collected from the NBG during the course of environmental investigation are provided in Appendix B. A site map depicting the analytical results from soil samples at the NBG is also provided as Figure 1-4.

While several constituents were identified in soil and sediment samples collected from the NBG, the results of a site specific risk assessment for the site concluded that lead and chromium in soil were the only constituents that presented unacceptable risks

under current/future industrial and/or hypothetical future residential land use scenarios. The exposure point concentration (EPC) for lead, which was based on the average concentration of lead detected in surface soil at the site, was greater than both the residential and industrial screening levels. Chromium was only found to present a potential non-cancer hazard to individuals under the hypothetical future residential land use scenario. The ecological risk assessment activities for the NBG concluded that no significant adverse effects were expected for environmental receptors at the site. The findings of the human health and ecological risk assessments for the NBG are presented in greater detail within the July 2009 EE/CA.

1.4 Purpose and Objectives of Remedial Action

As presented in the July 2009 EE/CA and the corresponding Action Memorandum, a soil removal action has been selected for the NBG that will mitigate exposure to lead and chromium containing soils and allow for unrestricted future development. This action will be the final remedy for the site. The removal action will include the excavation of soils at the site containing lead and chromium at concentrations above their respective site specific remedial action levels (RALs) of 3,000 mg/kg and 2,827 mg/kg. Based on historical investigation activities at the NBG, the footprint of the required excavation has been delineated to an approximately 110 ft by 50 ft area in the central portion of the site as shown in Figure 1-5. The depth of excavation will extend to 1 ft bgs throughout most of the excavation footprint; with the exception of an approximately 35 ft by 10 ft area where the depth will extend to 4 ft bgs (see Figure 1-5). It should be noted that in addition to lead and chromium this area also contains the highest concentrations of Aroclor 1254 and dioxins/furans that were detected during historical investigations; although these constituents were not identified as risk drivers for the site. In total, approximately 250 cubic yards of soil will be removed from the site and transported to an off-site facility for stabilization and disposal.

2. Scope of Work

This section outlines the scope of work that will be completed for the soil removal action at the Northern Burning Ground.

2.1 Site Preparation

2.1.1 Subsurface Utility Clearance

Prior to commencing any soil disturbance activities, ARCADIS will complete a preliminary site inspection and utility mark-out to identify any potential surface or subsurface impedances to the proposed work. The utility locating services will be performed by a professional utility locator under the supervision of ARCADIS.

2.1.2 Pre-Excavation Survey

ARCADIS will clearly mark the boundaries of the excavation area prior to the required site clearing and excavation activities. The boundaries will be marked using GPS coordinates and verified based on field measurements from monitoring well NBG-MW01. Standard survey equipment will also be utilized to measure existing ground surface elevations at several key points throughout the excavation area to establish a record of baseline conditions. These points will be resurveyed during the excavation activities to confirm that the required depth of excavation is achieved. The survey points will also be utilized during site restoration to ensure that the site is backfilled to the appropriate levels.

2.1.3 Establish Truck and Equipment Access/Egress Routes

All equipment and dump trucks will enter the NBG work area from the dirt road that loops around the southern portion of the site. See proposed truck route on Figure 2-1. ARCADIS will need to clear/move several large pine trees that have fallen across the road prior to commencing additional site activities. ARCADIS may also have to clear several large (standing) pine trees in order to provide equipment access to the excavation area. ARCADIS will make every effort to minimize the number of trees that must be brought down to access the site. In the event that portions the dirt roads used for site access/egress need improvement to accommodate the dump trucks or other equipment used during the removal action, ARCADIS may install a temporary gravel layer. The gravel layer would be placed on a non-woven geotextile fabric to provide support and allow for easy removal at the completion of the project.

2.1.4 Erosion and Sediment control

Prior to any intrusive activities, ARCADIS will erect silt fencing along the northern perimeter of the proposed excavation area as shown on Figure 2-2. Additional silt fencing will be installed if site conditions warrant. The silt fencing will be used to prevent erosion from transporting sediment from the excavation area to the surface water drainage ditch located on the northern perimeter of the site. The silt fencing will be left in place until site vegetation has been re-established.

2.1.5 Clearing and Grubbing

Prior to performing the excavation activities ARCADIS will clear and grub all non-grass vegetation within the excavation footprint. This will include the removal of several woody shrubs and pine trees. The site clearing activities may also include the removal of any large trees on the perimeter of the excavation area or roads that may impede site work and/or site access. All cleared vegetation will be spread in the wooded areas of the NBG that surround the excavation footprint and allowed to decay naturally. The cleared vegetation will not be placed in areas that impede vehicle traffic on the access roads or access to the hunting stands located in the surrounding woods.

2.1.6 Truck Loading and Equipment Decontamination Area

ARCADIS will establish a truck loading and equipment decontamination area on the southern perimeter of excavation area. The decontamination area will consist of a temporary decontamination pad that will be utilized for personnel, equipment and vehicles, as warranted. Based on the size of the excavation, it is anticipated that earth moving equipment will have to enter the area of excavation; thus; tracks, wheels and undercarriage of equipment will require decontamination. Equipment and vehicle decontamination will be conducted using water. Decontamination water will be containerized and characterized for off-site disposal. The proposed location of the decontamination area is presented in Figure 2-3. The decontamination water containers will be temporarily staged in the designated waste storage area located near Gate 20 while awaiting characterization.

2.2 Excavation

The footprint of the excavation area is presented in Figure 1-5. The depth of the excavation will extend to 1 ft bgs throughout much of this area, with the exception of an approximately 35 ft by 10 ft area in the central portion of the site that will extend to 4 ft

bgs. The bulk of the excavation work will be performed using conventional mechanical earth moving equipment. However, hand digging may be required in the immediate vicinity of a stick-up monitoring well located in the central portion of the excavation. If possible, the excavation equipment will stay within the footprint of the excavation and/or truck loading area to minimize the potential transport of impacted soils from the work area. In total, it is estimated that approximately 250 cubic yards of material will be excavated for this removal action.

In order to minimize handling of impacted material, the excavated soil will be direct loaded onto dump trucks for transport to the off-site disposal facility (Michigan Disposal). If necessary to expedite the pace of work, small stockpiles of soil may be formed within the footprint of the excavation; however, the stockpiles shall not exceed the volume of one dump truck load. Any stockpiles that are formed will be placed on 10 ml polyethylene tarps to prevent re-contaminatiion of the previously excavated areas. No stockpiles will be left on-site overnight.

2.3 Dust Control

The excavation area, soil stockpiles, and access roads will be kept free of excess dust to the extent practicable. The proposed handling practices provide for the minimization of fugitive dust by minimizing the number of times the soil is handled. ARCADIS will control fugitive dust emissions, if necessary, using approved temporary dust control methods to include water sprinkling and/or similar methods. Water for dust control will be obtained from clean (potable) sources.

2.4 Waste Material Transport and Disposal

Soils designated for off-site disposal will be placed directly into dump trucks. Once a truck is fully loaded, the soil load will be covered with polyethylene-coated tarps or other suitable covers that are properly secured for transport. Loose soil on the exterior of the truck will be removed prior to leaving the truck loading area. A vehicle log denoting when each truck has entered and left the site will be maintained and will include each truck's identification number, driver identification, the times of arrival and departure, and the approximate volume of material hauled. The soil will then be transported by Capitol Environmental, Inc., to an Alliant Tech Systems, Inc. (ATK) approved, fully-permitted Subtitle D disposal facility (Michigan Disposal).

Transportation of the impacted soil will be conducted in accordance with the applicable regulations, including the requirements of the U.S. Department of Transportation

(USDOT). Materials transporters will be appropriately licensed, permitted, and in compliance with all applicable regulations. The waste disposal contractor will submit copies of all manifests to the ARCADIS representative. Copies of the final waste manifests and weigh tickets will also be provided to ARCADIS upon receipt of the material at the disposal facility

Once at the disposal facility the soils will be mixed with a stabilization media to reduce the potential for leachable constituents. The facility will likely perform a TCLP analysis on the material to ensure that it has been sufficiently stabilized. Once stabilized, the material will be properly disposed of in a Subtitle D cell.

2.5 Confirmation Sampling

During the removal activity, confirmation samples will be collected from the excavation sidewalls approximately every 30 feet on the northeast and northwest perimeter of the excavation. Samples will also be collected on 15 ft centers from the base of the excavation. The samples will be field screened for lead and chromium using an XRF screening device to ensure that lead concentrations exceeding the lead RAL of 3,000 mg/kg and chromium RAL of 1,620 mg/kg are not left in place. Half of these samples will also be submitted for laboratory analysis of lead and chromium by USEPA Method 6010 to confirm the XRF field screening results and the success of the removal action. Samples will not be collected from the southern perimeter of the excavation because historical sampling has confirmed the extent of lead and chromium impacts in this area. If necessary, the excavation footprint will be expanded on the northern boundary based on the results of the field screening program. The soil samples will be collected in accordance with the sampling procedures outlined in the Master Work Plan for the RFAAP (URS 2003). QA/QC samples will be collected in accordance with the Draft Quality Assurance Plan Addendum (QAPA) (ARCADIS, 2008b).

2.6 Backfill, Grading, and Site Restoration

The excavated area will be backfilled with clean material from an approved off-site source upon completion of the excavation activities. Analytical reports documenting the quality of the fill material will be obtained prior to delivery of the material to the site. Once on-site, the backfill material will be compacted in place by tamping in 1-ft lifts using the bucket of the excavator. Backfilling will continue until the excavation is filled to pre-existing conditions and/or level with the surrounding grade. It is estimated that approximately 250 cubic yards of fill material will be required.

Once the entire excavation has been backfilled, all disturbed areas shall be evenly graded and a 2-inch layer of top soil shall be added to the backfill area. Annular rye grass seed, or an approved equal, will be spread over the backfill area along with a thin layer of wheat-straw mulch to prevent erosion. The silt fencing installed for the excavation activities will be left in place until vegetation is re-established throughout the disturbed areas.

2.7 Health and Safety

All phases of work for the removal action at the NBG will be conducted in accordance with the requirements and procedures outlined in ARCADIS' Health and Safety Plan Addendum (HSPA) (ARCADIS, 2008a) to the Master Work Plan (URS 2003). Job Safety Analysis (JSA)/Job Loss Analysis (JLA) forms have been completed for each of the safety critical tasks that will be performed during the field work for this removal action. The JSAs/JLAs identify specific hazards that could be encountered during an action as well as control methods to protect employees and property from hazards. The JSAs/JLAs also list the type of personal protective equipment (PPE) required for the completion of the work. The following JSAs/JLAs are provided in Appendix C, along with a list of emergency contact information:

- Heavy Equipment Operation
- Excavation and Trenching
- Site Clearing
- Silt Fence Installation
- Soil Sampling
- Equipment Decontamination

In addition to the HSPA and the information provided in Appendix C, a copy of the ARCADIS Field Health and Safety Handbook will be available on-site. This handbook contains relevant general topics and is used as part of the overall health and safety process. To aid in the consistency of the process the handbook will be used as an informational source in conjunction with this HSPA. The following four (4) handbook sections are minimally required reading for this project:

- Section III-F. General Housekeeping, Personal Hygiene and Field Sanitation
- Section III-G. Site Security, Work Zone and Decontamination for HAZWOPER Sites
- Section III-GG. HAZWOPER and HAZMAT Response
- Section III-II. Drums and other Material Handling

All on-site personnel during the removal action will be fully trained and compliant with the OSHA HAZWOPER regulations. Health and Safety tailgate meetings will be performed at the beginning of each work day and when personnel return from any extended break. These meetings will ensure that all site personnel are fully aware of the specific conditions and hazards present at the site and the emergency response procedures. All Health and Safety meetings will be documented on *Site Activities Tailgate Health and Safety Briefing Form* provide in Appendix D of the HSPA.

3. Quality Control

Quality control/quality assurance (QA/QC) for this work will be handled in accordance with the Master Quality Assurance Project Plan (QAPP) (URS, 2003) as amended by the project QAPA, provided in Appendix A. This section describes the site-specific quality measures and protocol that will be utilized for the removal action at the NBG.

3.1 Data Quality Objectives for Measurement Data

Data Quality Objectives (DQOs) for the NBG removal action have been designed to ensure the success of the removal action in achieving the remedial action objectives. The confirmation sampling program described in Section 2.5 was designed to collect a sufficient number of samples to establish a record of post removal action constituent concentrations. The types of analyses have been chosen to correspond with the manner in which the previous data was collected. Although the general analyses types will be consistent with prior analyses, the specific methodologies used for this effort will be in accordance with Appendix A.

3.2 Measurement/Data Acquisition

Field, laboratory, and data handling procedures relating to activities performed at RFAAP-NRU will conform to the specific requirements detailed in the Master Work Plan (MWP) (URS, 2003) and Appendix A. In accordance with the project requirements, duplicate samples will be collected at a rate of one sample per 20 for each sample matrix.

3.3 Assessment/Oversight

Assessment and oversight activities for this site will be conducted in accordance with the MWP and Appendix A. The field activities scheduled to take place, and the associated sections of the MWP that describe the methodology are summarized below.

Activity	Standard Operating Procedure
Field logbook recordkeeping	10.1
Decontamination	80.1
Soil sampling	30.1
Sample labeling	50.1

Activity	Standard Operating Procedure
Sample packaging	50.2
Management of investigation derived materials	70.1

3.4 Data Validation and Usability

Data validation for samples collected and analyzed by the off-site laboratory from the NBG will be conducted in accordance with Section 9 of the QAPA (Appendix A).

4. Schedule and Reporting

ARCADIS anticipates the field work activities discussed in this report will be conducted within one work week in December 2009. Once the analytical data for the confirmation samples has been received from the laboratory and all waste manifests have been received from the disposal facility, a Completion Report will be prepared summarizing the full details of the removal action, including any deviations from this plan. This report will be submitted to VDEQ and will be utilized to document that the goals of the remedial action have been achieved for the site and that a No Further Action determination will be provided by VDEQ. The overall schedule for the NBG removal action is presented in Appendix D.

5. References

ARCADIS, 2009a. Engineering Evaluation/Cost Analysis (EE/CA), Northern Burning Ground, New River Unit (RAAP-044), Radford Army Ammunition Plant, Radford, Virginia. July

ARCADIS, 2008a. DRAFT Health and Safety Plan Addendum, Radford Army Ammunition Plant, Radford, Virginia, April.

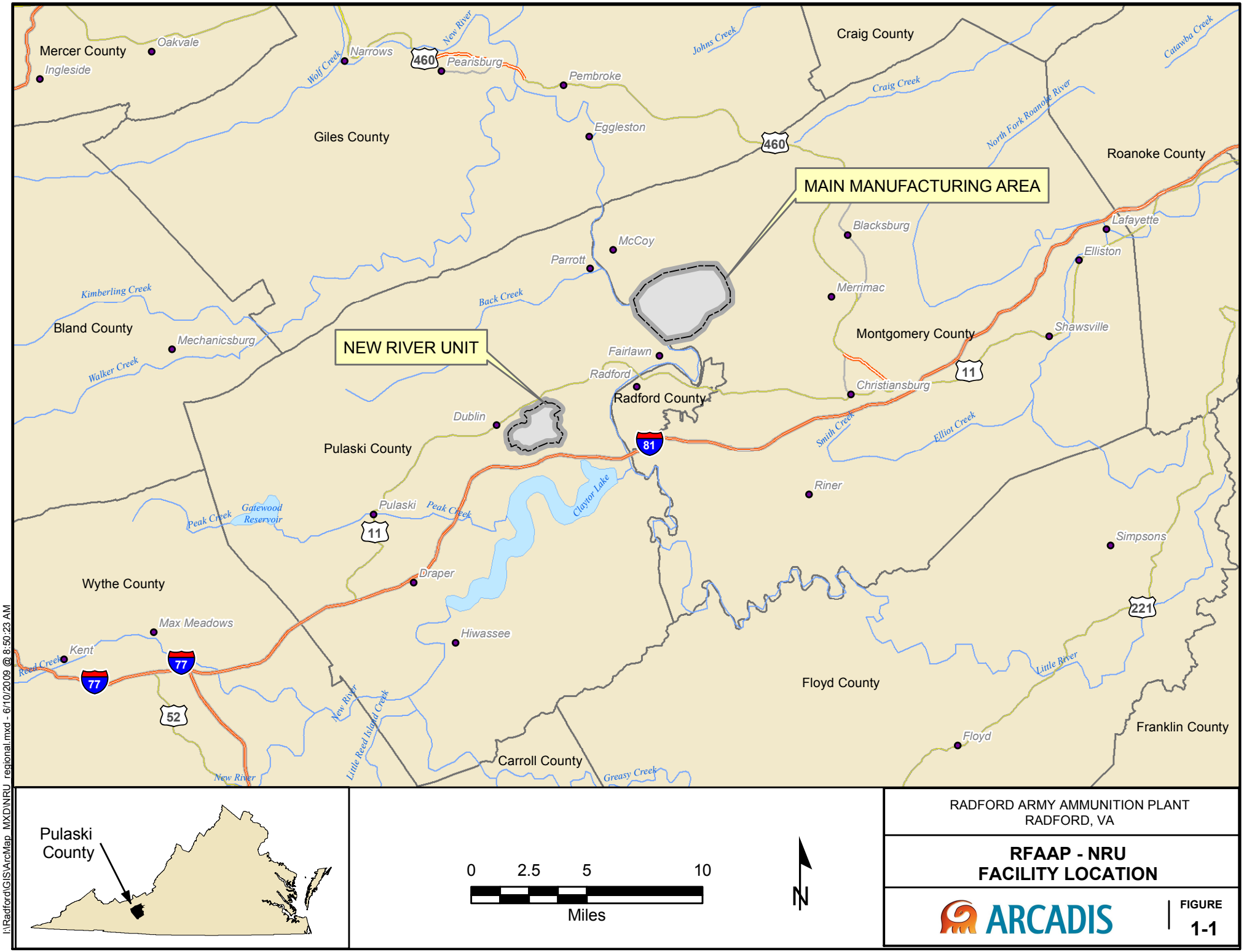
ARCADIS, 2008b. DRAFT Quality Assurance Plan Addendum, Radford Army Ammunition Plant, Radford, Virginia, April.

ARCADIS. 2008c. DRAFT Remedial Investigation Work Plan Addendum 27, New River Unit (RFAAP-044), Radford Army Ammunition Plant, Radford, Virginia, June.

Shaw, 2003. Internal Draft New River Unit Investigation Report: BDDT, BLA, IAA, NBG, RY & WBG, Radford Army Ammunition Plant, Radford, Virginia. September.

URS, 2003. Master Work Plan, Radford Army Ammunition Plant, Radford, Virginia. August.

Figures


MAIN MANUFACTURING AREA
NEW RIVER UNIT
Mercer County
Oakvale
Ingleside
Narrows
Wolf Creek
New River
460
Pearisburg
Pembroke
Johns Creek
Craig County
Catawba Creek
Craig Creek
North Fork Roanoke River
Giles County
Eggleston
460
Roanoke County
Blacksburg
Lafayette
Elliston
McCoy
Parrott
Merrimac
Kimberling Creek
Back Creek
Bland County
Mechanicsburg
Walker Creek
Montgomery County
Shawsville
Fairlawn
Radford
Christiansburg
11
Radford County
Dublin
Pulaski County
81
Smith Creek
Elliot Creek
Riner
Claytor Lake
Pulaski
Peak Creek
Gatewood Reservoir
11
Simpsons
Draper
Wythe County
Max Meadows
Hiwassee
221
Kent
Reed Creek
77
77
Little River
Floyd County
52
New River
Little Reed Island Creek
Franklin County
Floyd
Carroll County
Greasy Creek
New River
Pulaski County
0
2.5
5
10
Miles
N
RADFORD ARMY AMMUNITION PLANT
RADFORD, VA
RFAAP - NRU
FACILITY LOCATION
ARCADIS
FIGURE
1-1
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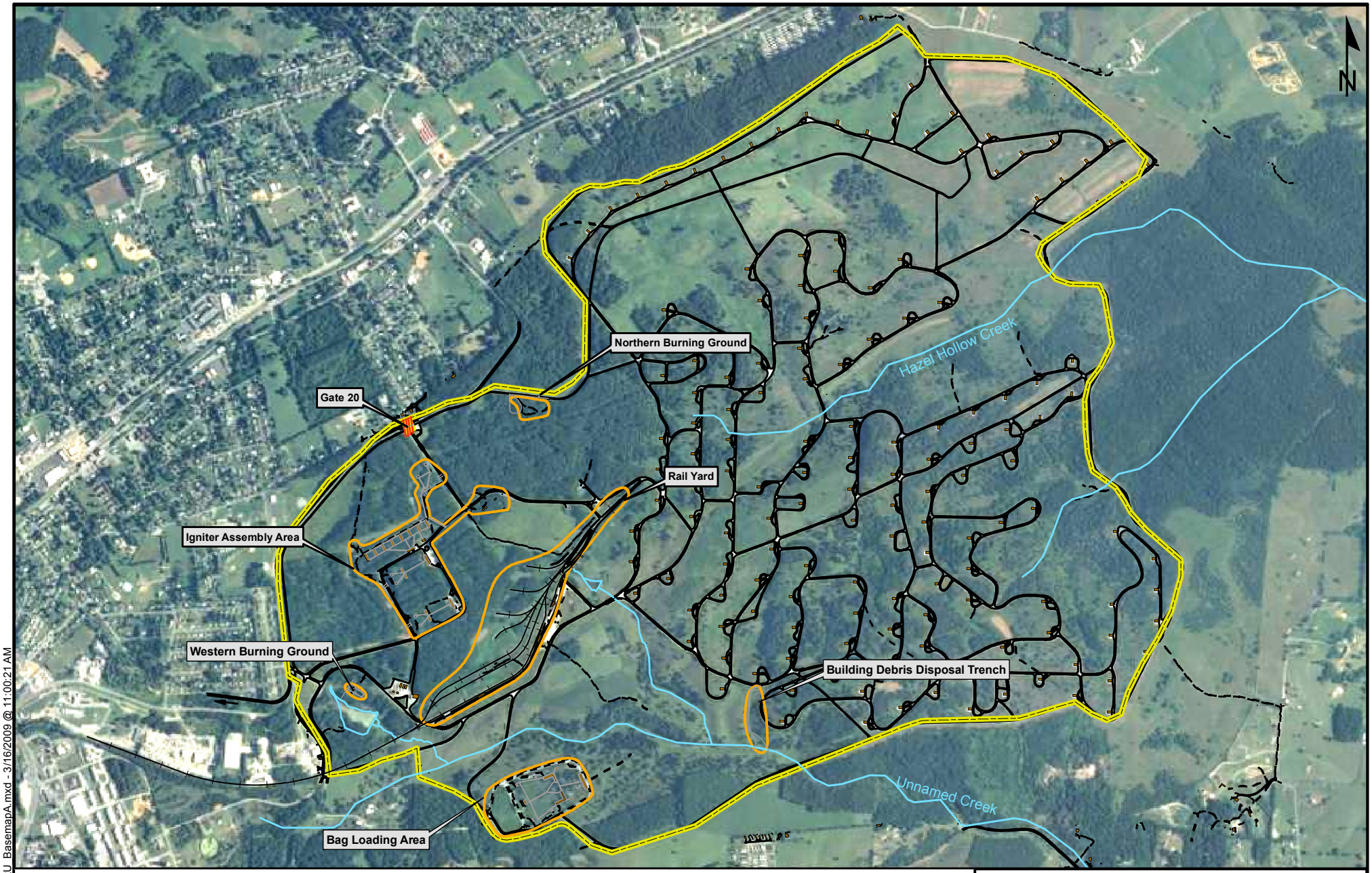


LEGEND

- 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

NEW RIVER UNIT STUDY AREAS

ARCADIS

FIGURE 1-2

I:\Radford\GIS\ArcMap_MXD\NRU_BasemapA.mxd - 3/16/2009 @ 11:00:21 AM

N

NBGSD01
NBG-MW-02
NBGSD03
NBGSD02
NBGSB32
NBGSD04
NBGSB4
NBGSB26
NBGSB15
NBGSB2
NBGDW3
NBGSB25
SS-02
NBGSB30
NBGDW11
NBGDW10
NBGDW4
NBGSB9
NBGSB21
NBGDW1
NBGSB24
NBGSB27
NBGDW5
NBGSB8
NBGSB14
NBGDW13
NBGDW2
NBGDW7
NBGDW12
NBGDW6
NBGSB20
NBGSB3
NBGSB23
NBGDW9
NBGSB1
NBGSB13
NBGSB7
NBGSB33
NBGSB10
NBGSB11
NBGSB16
NBGSB12
NBGDW8
NBG-MW-01
NBGSB17
NBGSB22
NBGSB29
SS-01
NBGSB31
NBGSB18
NBGSB19
NBGSB6
NBGSB28
NBGSB5

Legend

- HISTORICAL SOIL SAMPLE LOCATIONS
- GROUNDWATER LOCATIONS
- PAVED ROADS
- DIRT ROADS
- LOW AREA
- DRAINAGE DITCH
- CULVERT
- STUDY AREA
- NRU BOUNDARY

0 60 120 Feet

GRAPHIC SCALE

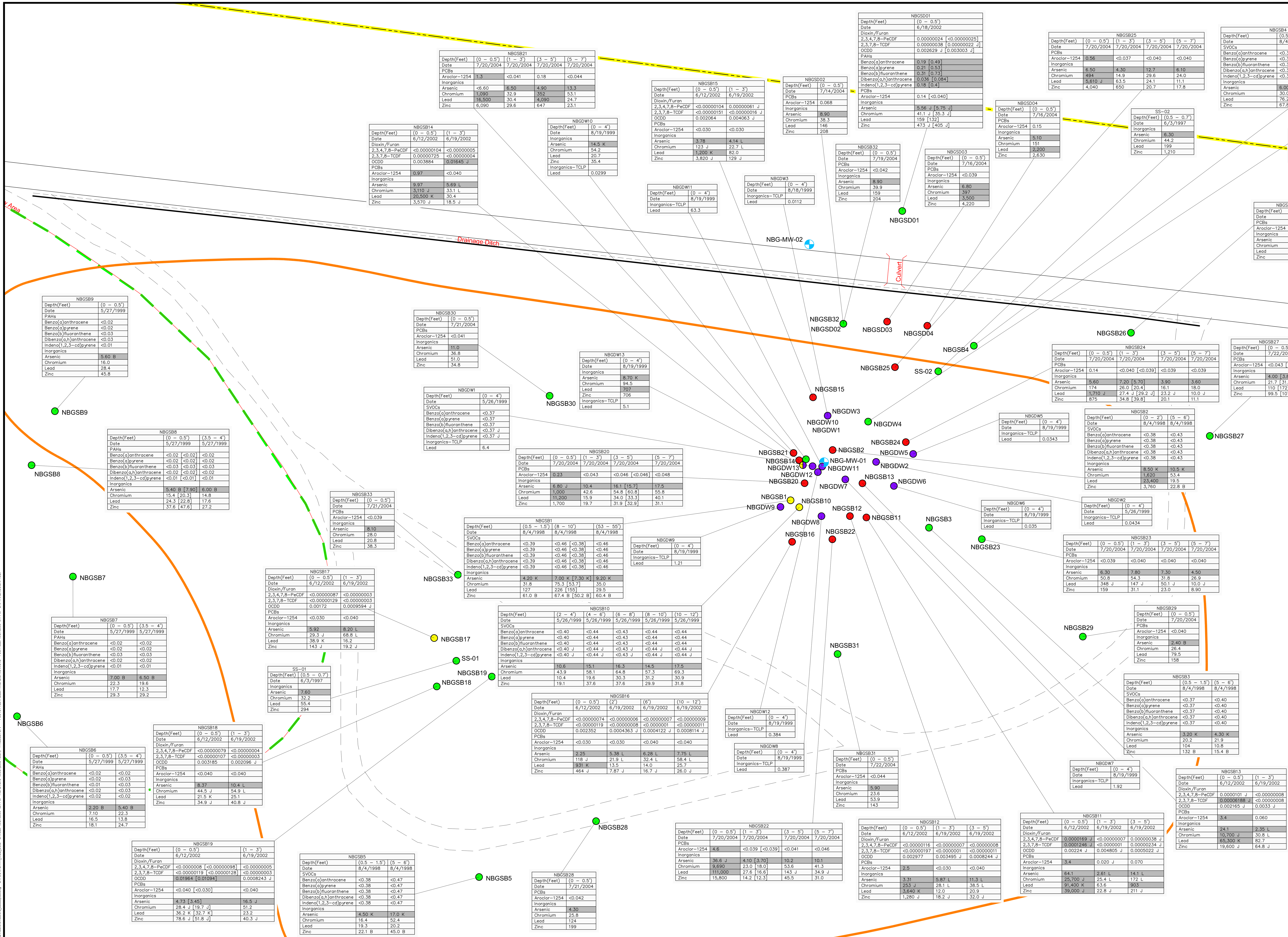
THE NORTHERN BURNING GROUND AT THE NEW RIVER UNIT
RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

NORTHERN BURNING GROUND SITE LAYOUT

ARCADIS

FIGURE 1-3

NYC: SER 4/AIT: DB: TBR LD: TBR PIC: TL
Radford (GP08RAAP.00PM)
I:\Radford\GIS\ArcMap_MXD\NRU_NBG_Basemap.mxd - 3/16/2009 @ 10:31:05 AM



Legend

- Historical Sample Location
- Historical Sample Location Above Industrial Criteria
- Historical Sample Location Exceeding Residential Criteria
- Inorganic TCLP Sample
- Groundwater Locations
- Paved Roads
- Dirt Roads
- Low Area
- Drainage Ditch
- Culvert
- Study Area
- NRU Boundary

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	Bolded results indicate exceedances of Residential RSL
903	Bolded and Shaded results indicate exceedances of Industrial RSL

Units for Soil and Sediment Samples reported in mg/kg (Miligrams per kilogram)

Units for TCLP Samples reported in mg/L (Miligrams per Liter)

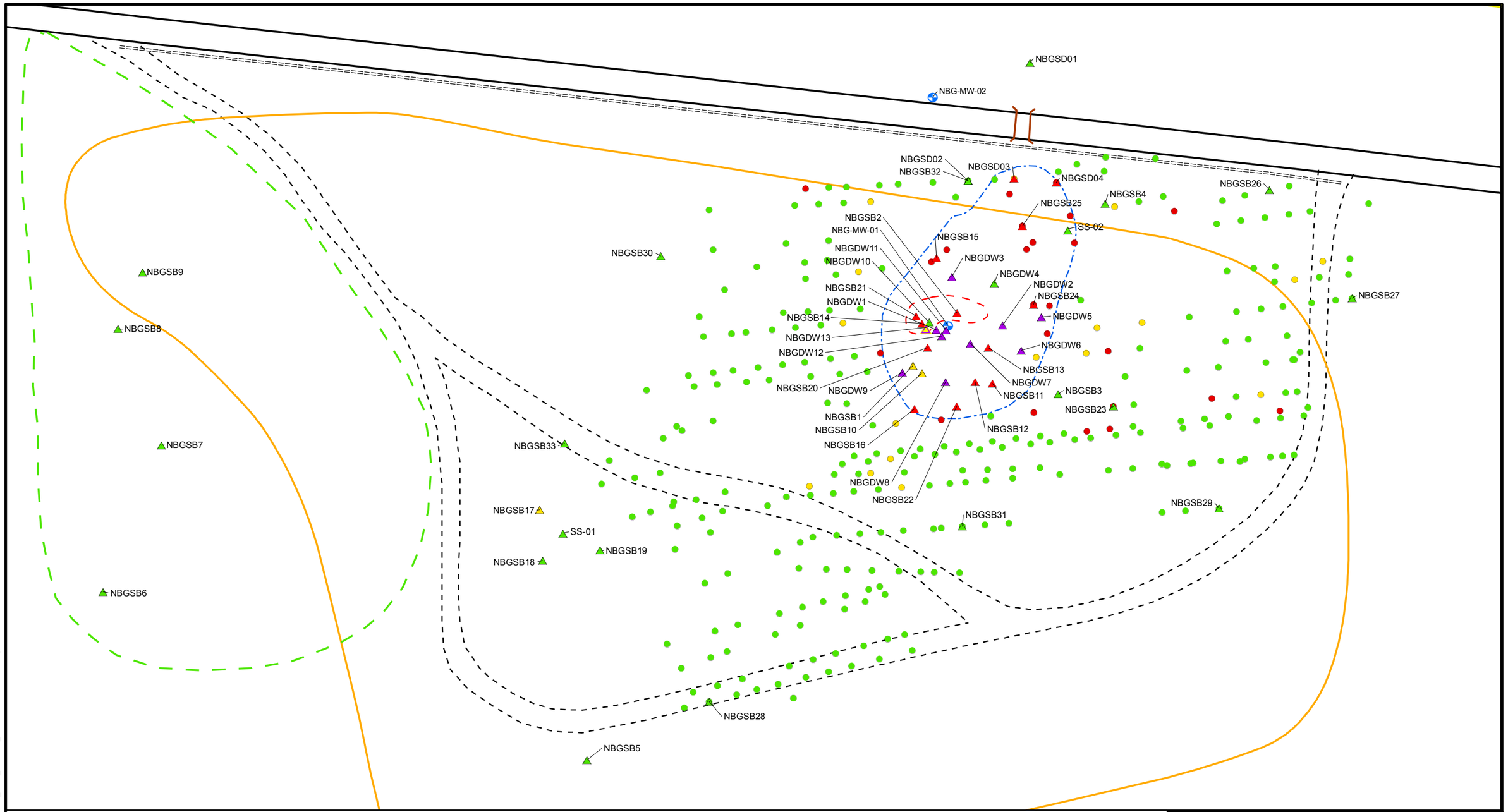
0 20 40 FEET
GRAPHIC SCALE

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA
EE/CA

NORTHERN BURNING GROUND SOIL SAMPLING RESULTS

ARCADIS

FIGURE 1-4



Legend

- HISTORICAL SAMPLE LOCATION
- HISTORICAL SAMPLE LOCATION EXCEEDING RESIDENTIAL CRITERIA
- HISTORICAL SAMPLE LOCATION EXCEEDING INDUSTRIAL CRITERIA
- INORGANIC TCLP SAMPLE

XRF LEAD SCREENING RESULT

- <400 MG/KG
- 400 - 750 MG/KG
- >750 MG/KG
- GROUNDWATER LOCATIONS

- ESTIMATED EXCAVATION TO DEPTH OF 1 FOOT
- ESTIMATED EXCAVATION TO DEPTH OF 4 FEET
- STUDY AREA
- NRU BOUNDARY

- LOW AREA
- DRAINAGE DITCH
- CULVERT
- PAVED ROADS
- DIRT ROADS

0 40 80 Feet

GRAPHIC SCALE

N

THE NORTHERN BURNING GROUND AT THE NEW RIVER UNIT
RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

ESTIMATED FOOTPRINT OF EXCAVATION FOR ALTERNATIVE 3

ARCADIS

FIGURE
1-5

NYC: SER 4/AIT: DB: TBR LD: TBR PIC: TL
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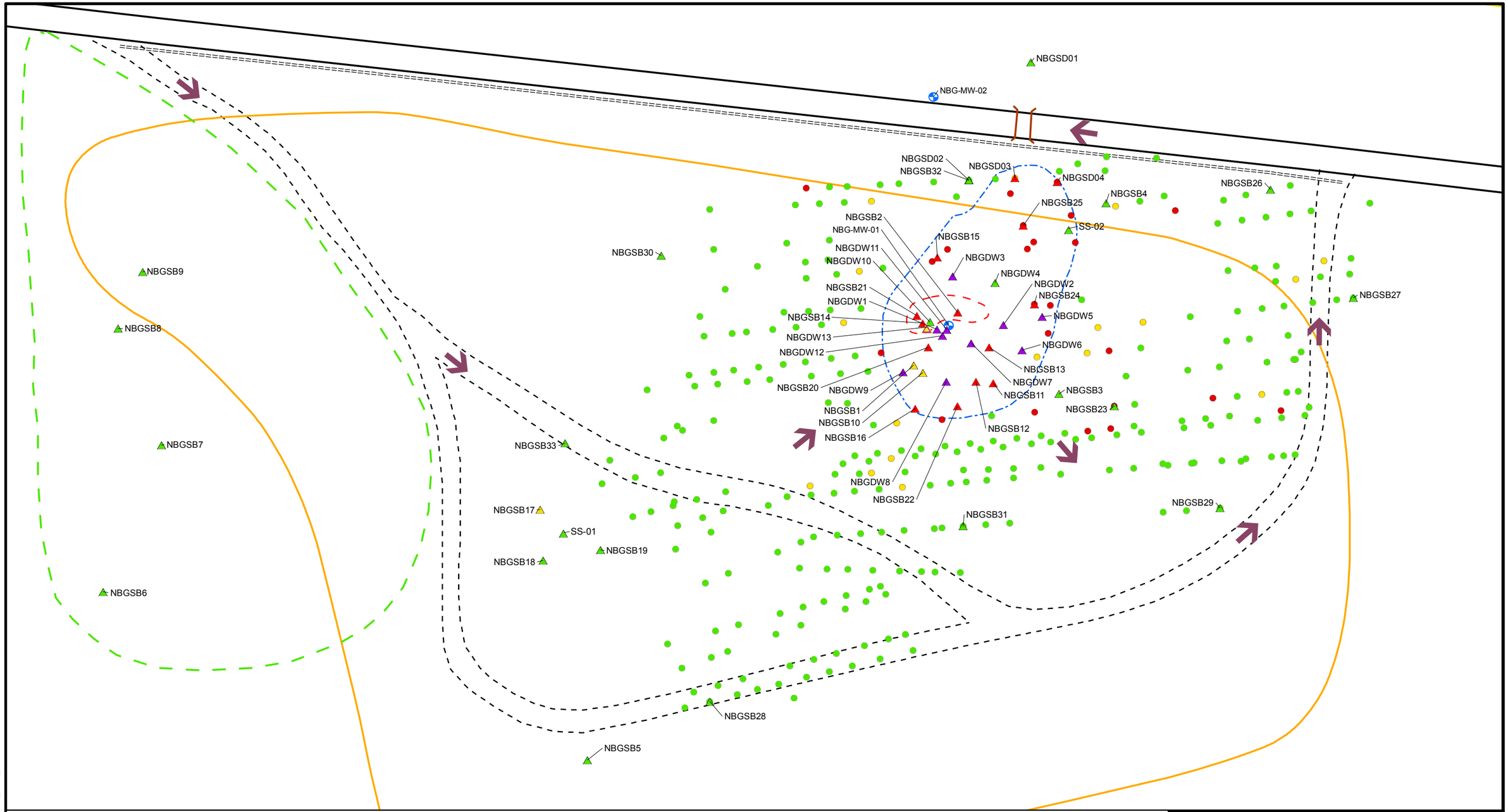

Legend

- HISTORICAL SAMPLE LOCATION
- HISTORICAL SAMPLE LOCATION EXCEEDING RESIDENTIAL CRITERIA
- HISTORICAL SAMPLE LOCATION EXCEEDING INDUSTRIAL CRITERIA
- INORGANIC TCLP SAMPLE

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- ESTIMATED EXCAVATION TO DEPTH OF 4 FEET
- STUDY AREA
- NRU BOUNDARY

- LOW AREA
- DRAINAGE DITCH
- CULVERT
- PAVED ROADS
- DIRT ROADS

TRUCK AND EQUIPMENT SITE ACCESS ROUTES

0 40 80 Feet

GRAPHIC SCALE

THE NORTHERN BURNING GROUND AT THE NEW RIVER UNIT
RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

TRUCK AND EQUIPMENT SITE ACCESS ROUTES

ARCADIS

FIGURE 2-1

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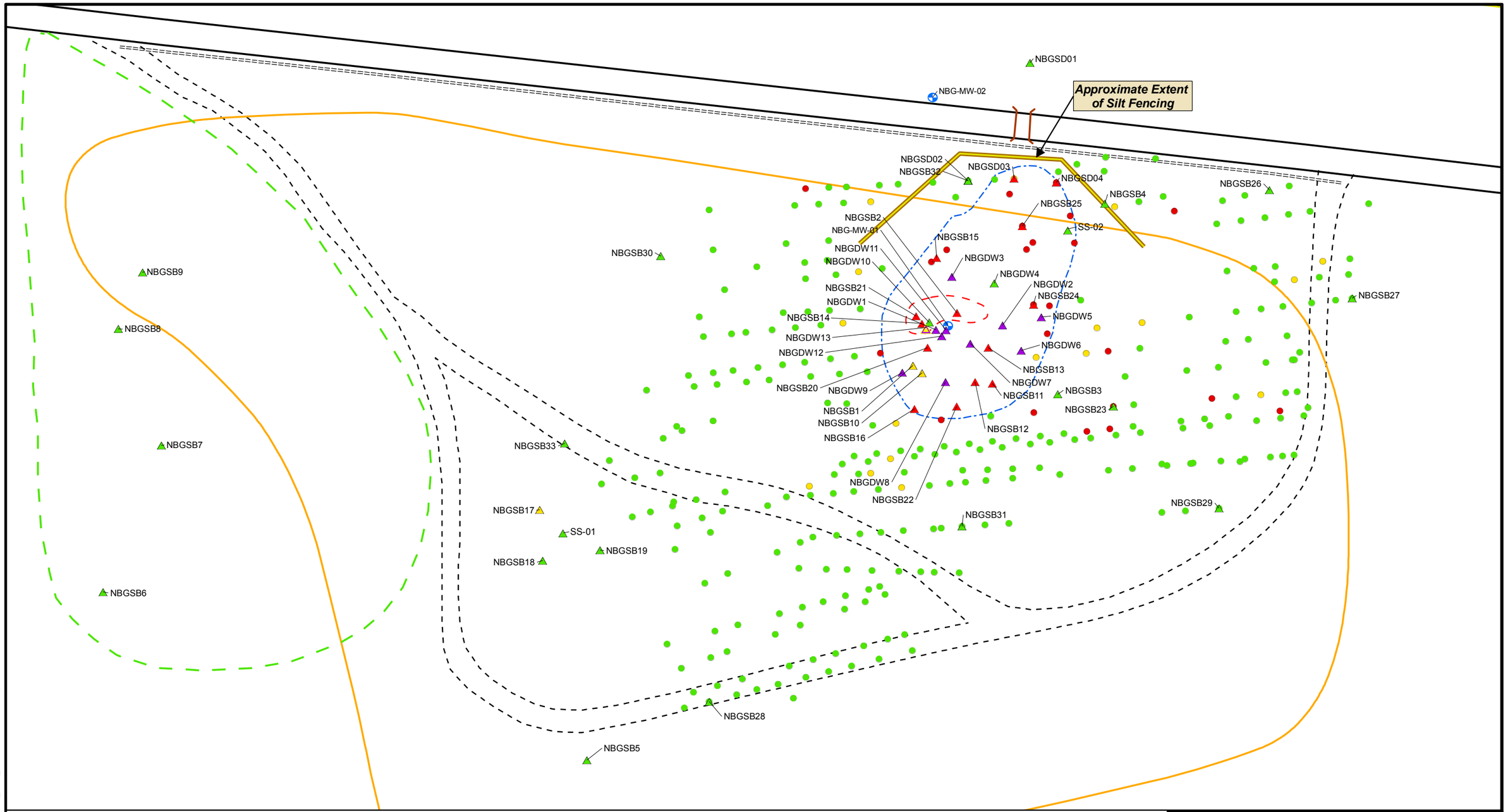

Legend

- HISTORICAL SAMPLE LOCATION
- HISTORICAL SAMPLE LOCATION EXCEEDING RESIDENTIAL CRITERIA
- HISTORICAL SAMPLE LOCATION EXCEEDING INDUSTRIAL CRITERIA
- INORGANIC TCLP SAMPLE

XRF LEAD SCREENING RESULT

- <400 MG/KG
- 400 - 750 MG/KG
- >750 MG/KG
- GROUNDWATER LOCATIONS

- ESTIMATED EXCAVATION TO DEPTH OF 1 FOOT
- ESTIMATED EXCAVATION TO DEPTH OF 4 FEET
- STUDY AREA
- NRU BOUNDARY

- LOW AREA
- DRAINAGE DITCH
- CULVERT
- PAVED ROADS
- DIRT ROADS

- APPROXIMATE EXTENT OF SILT FENCING

N

0 40 80 Feet

GRAPHIC SCALE

THE NORTHERN BURNING GROUND AT THE NEW RIVER UNIT
RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

SILT FENCING LOCATIONS

ARCADIS

FIGURE
2-2

NYC: SER 4/AIT: DB: TBR LD: TBR PIC: TL
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NBGSD01
NBG-MW-02
NBGSD02
NBGSB32
NBGSD03
NBGSD04
NBGSB26
NBGSB4
NBGSB25
NBGSB2
SS-02
NBG-MW-01
NBGSB15
NBGSB30
NBGDW11
NBGDW10
NBGDW3
NBGSB9
NBGDW4
NBGDW2
NBGSB21
NBGSB24
NBGDW1
NBGSB27
NBGSB14
NBGDW5
NBGSB8
NBGDW13
NBGDW6
NBGDW12
NBGSB13
NBGDW7
NBGSB20
NBGDW9
NBGSB11
NBGSB3
NBGSB1
NBGSB12
NBGSB23
NBGSB10
NBGSB16
NBGSB7
NBGSB33
Decontamination Area
NBGDW8
NBGSB22
NBGSB29
Truck Loading Area
NBGSB31
NBGSB17
SS-01
NBGSB19
NBGSB18
NBGSB6
NBGSB28
NBGSB5

Legend

- HISTORICAL SAMPLE LOCATION
- HISTORICAL SAMPLE LOCATION EXCEEDING RESIDENTIAL CRITERIA
- HISTORICAL SAMPLE LOCATION EXCEEDING INDUSTRIAL CRITERIA
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- NRU BOUNDARY

- LOW AREA
- DRAINAGE DITCH
- CULVERT
- PAVED ROADS
- DIRT ROADS

- TRUCK LOADING AND EQUIPMENT DECONTAMINATION AREAS

N

0 40 80 Feet

GRAPHIC SCALE

THE NORTHERN BURNING GROUND AT THE NEW RIVER UNIT
RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

TRUCK LOADING AND EQUIPMENT DECONTAMINATION AREAS

ARCADIS

FIGURE
2-3

NYC: SER 4/AIT: DB: TBR LD: TBR PIC: TL
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Appendix A

Quality Assurance Plan Addendum

Imagine the result

US Army Corps of Engineers
Baltimore District

INTERNAL DRAFT

QUALITY ASSURANCE PLAN ADDENDUM

PERFORMANCE BASED PROJECT (PBC)

Prepared for:

Radford Army Ammunition Plant

APRIL 2008

ARCADIS
Infrastructure, environment, facilities

INTERNAL DRAFT

Quality Assurance Plan Addendum Performance Based Contract (PBC)

Radford Army Ammunition Plant,
Radford, Virginia

April 2008

Jane Kennedy
Project Chemist

Kurt Beil
Quality Assurance Manager

Tim Llewellyn
Project Manager

Quality Assurance Plan Addendum
Performance Based Contract (PBC)

Radford Army Ammunition Plant,
Radford, Virginia

ENVIRONMENT

Prepared for:
Radford Army Ammunition Plant

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

Our Ref.:
GP08RAAP.C000.CC008

Date:
April 14, 2008

Title and Approval Page

Site Name/Project Name: Radford Army Ammunition Plant
Site Location: Radford, Virginia

Quality Assurance Plan Addendum for PBC2

Document Title

USEPA Region III and Virginia Department of Environmental Quality

Lead Organization

Jane Kennedy, ARCADIS

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Preparer's Address, Telephone Number, and E-mail Address

April 15, 2008

Preparation Date (Day/Month/Year)

Approval Signatures

Contract Officers Representative: _____
Signature

Tom Meyer/ US Army Corps of Engineers
April 15, 2008
Printed Name/Organization/Date

VDEQ Federal Facilities Project Manager: _____
Signature

Jim Cutler / VDEQ /April 15, 2008
Printed Name/Organization/Date

USEPA RCRA Project Manager: _____
Signature

William Geiger / USEPA Region 3 / April 15, 2008
Printed Name/Organization/Date

ATK Environmental Lead: _____
Signature

Jerome Redder / ATK / April, 2008
Printed Name/Title/Date

Table of Contents

Table of Contents

Table of Contents

Tables

Table of Contents

Table of Contents

Figures

Appendices

Table of Contents

List of Acronyms and Abbreviations

ATK	Alliant Techsystems
ASTM	American Society of Testing Materials
BDDT	Building Debris Disposal Trench
BLA	Bag Loading Area
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
COC	Chain-of-Custody
COD	Chemical Oxygen Demand
DOD	Department of Defense
DQO	Data Quality Objective
EDD	Electronic Data Deliverable
EQuIS	Environmental Quality Information Systems
FHSO	Field Health and Safety Officer
FRA	Field Readiness Assessment
ft	Feet
g	Gram
GC	Gas Chromatography
GO/CO	Government-Owned Contractor-Operated
GW	Groundwater
HSA	Horseshoe Area
HASP	Health and Safety Plan
HSPA	Health and Safety Plan Addendum
HSWA	Hazardous and Solid Waste Amendments
IAA	Igniter Assembly Area
ICP	Inductively Coupled Plasma

List of Acronyms and Abbreviations Continued

IRP	Installation Restoration Program
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
MHSP	Master Health and Safety Plan
MMA	Main Manufacturing Area
MQAP	Master Quality Assurance Plan
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MW	Monitoring Well
MWP	Master Work Plan
NBG	Northern Burning Ground
NCP	Natural Oil and Hazardous Substances Contingency Plan
NELAP	National Environmental Laboratory Accreditation Program
NFA	No Further Action
NFG	National Functional Guidelines
NIST	National Institute of Standards and Technology
NRU	New River Unit
PBC	Performance Based Contract
PM	Project Manager
PMP	Project Manager Plan
QA	Quality Assurance
QC	Quality Control
QA/QC	Quality Assurance/Quality Control
QAM	Quality Assurance Manual
QAP	Quality Assurance Plan
QAPA	Quality Assurance Plan Addendum
R	Rinse Blank

List of Acronyms and Abbreviations Continued

RAAP	Radford Army Ammunition Plant
RBC	Risk-Based Concentration
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RL	Reporting Limit
RY	Rail Yard
SARA	Superfund Amendments and Reauthorization Act
SOP	Standard Operating Procedure
SVOC	Semi-volatile Organic Compound
SWMU	Solid Waste Management Unit
TB	Trip Blank
TAL	Target Analyte List
TCE	Trichloroethene
TCL	Target Compound List
TM	Task Manager
TNT	Trinitrotoluene
TOC	Total Organic Carbon
TSDF	Treatment, Storage, and Disposal Facility
USEPA	United States Environmental Protection Agency
VDEQ	Virginia Department of Environmental Quality
VPDES	Virginia Permitted Discharge Elimination System
VOC	Volatile Organic Compound
WBG	Western Burning Ground

Quality Assurance Plan Addendum
Performance Based Contract (PBC)

Radford Army Ammuntition Plant, Radford, Virginia

1. Introduction and Background

This Quality Assurance Plan Addendum (QAPA) describes the project background and quality assurance (QA) mechanisms that will be implemented to ensure that usable data will be generated during the project execution for the Performance Based Contract (PBC) awarded to ARCADIS associated with the environmental restoration program at Radford Army Ammunition Plant (RAAP) Radford, Virginia. Work will be conducted under contract W91ZLK-05-D-0015: Task 0002. This is the second PBC contract awarded for RAAP, and is thus referred to as PBC2.

This Quality Assurance Plan Addendum (QAPA) is prepared in conjunction with the Master Work Plan (MWP) and the Master Quality Assurance Plan (MQAP) to address the PBC2 specific responsibilities and authorities that will be implemented during supplemental investigative and remediation activities. The project objectives will be met through the execution of the Standard Operating Procedure (SOP) included in the MWP, or as appended to this document and site, or area specific work plans.

The Installation Restoration Program (IRP) activities at RAAP operate in accordance with the provisions of the Resource Conservation and Recovery Act (RCRA) as amended by the Hazardous and Solid Waste Amendments (HSWA) of 1984 at the Main Manufacturing Area (MMA), and the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA), and the Natural Oil and Hazardous Substances Contingency Plan (NCP) at the New River Unit (NRU). The U.S. Environmental Protection Agency (USEPA) issued a final Hazardous Waste Management Permit – Part II (Part II Permit) to RAAP in September 2000. This permit addresses the corrective action requirements for all Solid and Hazardous Waste Management Units (SWMUs) at RAAP.

1.1 Project Scope and History

This QAPA supports the environmental restoration of RAAP sites identified in the PBC2 contract. The goal of this PBC is to meet the requirements for all sites, as defined in the contract and summarized in the Project Management Plan (PMP) (ARCADIS, 2008). The full scope of services for this contract is defined in PBC2. All work performed under this contract will be consistent with all applicable regulatory requirements, and relevant Department of Defense (DoD) and Army policy.

1.2 Site Location and History

The MMA is an industrial area with ongoing propellant manufacturing operations. The MMA is regulated under a RCRA permit finalized in 2000, to be renegotiated in 2010. The MMA areas addressed in this Project Management Plan (PMP) include two distinct sites, SWMU 31 (RAAP-026) and RAAP-031, and two related sites, RAAP-042 and -047. Sites RAAP-042 and -047 are related by a persistent, low-level trichloroethene (TCE) groundwater (GW) plume from an unsubstantiated source. RAAP-042 is a closed surface impoundment measuring approximately 100 ft x 150 ft. The impoundment (HWMU #5) was first used in 1970. It was unlined until 1981, when a liner was added. It was taken out of operation in 1986 and closed in 1989. During operation, the impoundment received storm water runoff, spill and washdown water from the neutralization from the acid tank farm (nitric and sulfuric acids). Before 1983, some wastewater also contained nitrocellulose. RAAP-047 is a high-security active manufacturing section of the South Bank MMA. The area is on a river terrace which slopes northward down toward the New River. The river is greater than 3,000 feet away and approximately 100 to 150 ft lower in elevation.

SWMU-31 (RAAP-026) is located in the MMA, in the northwest section of the HSA. The New River flows from northeast to southwest along the northern boundary of SWMU-31. The site consists of three connected, unlined settling lagoons which accepted effluent from Power House No. 2 until the 1980s. The lagoons are presently operational, accepting effluent from the water treatment plant. The effluent consists of overflow from drinking water settling tanks and backwash from filter cleaning. The lagoons are arranged sequentially, with the primary lagoon directly accepting effluent and subsequently discharging to the secondary and tertiary lagoons. Effluent from the secondary and tertiary lagoons is regulated under a Virginia Permitted Discharge Elimination System (VPDES) permit. RAAP-031 consists of 0.045 acres located near the nitrocellulose A-line production area. A shallow concrete ditch approximately 2-ft wide runs through the site at the base of a grassy bank.

The NRU comprises more than 2,800 acres and is located approximately 6 miles from the MMA. An initial phase of remedial investigation has been completed at the site, which led to the identification of six individual areas within the greater unit requiring additional characterization and possible remediation: the Building Debris Disposal Trench (BDDT), the Bag Loading Area (BLA); the Igniter Assembly Area (IAA), the Rail Yard (RY), the Northern Burning Ground (NBG), and the Western Burning Ground (WBG). These six sites span an area of approximately 800 acres. The NRU is

managed under CERCLA, which allows for consideration of the NRU as one site with six internal areas of concern.

1.3 Status of Environmental Restoration Program

Remediation at the MMA is being conducted pursuant to RCRA Corrective Action requirements with regulatory coordination, as appropriate, with the Virginia Department of Environmental Quality (VDEQ) and the USEPA Region III. The Commonwealth of Virginia received RCRA corrective action authority in 2000 but in conjunction with the USEPA-State corrective action transition process, remediation is currently being coordinated consistent with the Permit for Corrective Action and Waste Minimization pursuant to RCRA as amended by the Hazardous Waste and Solid Waste Amendments of 1984 issued in September 2000 by USEPA (Permit Number VA1210020730). This permit will be renegotiated with VDEQ in 2010, at which time the contractor will be required to comply with the new permit. RAAP has separate permits issued by the Commonwealth of Virginia that manage the treatment, storage, and disposal facility (TSDF) operations pertaining to RCRA Subtitle C, D, and Subpart X. The Commonwealth of Virginia has also issued a post-closure care permit for closed HWMUs listed in the RCRA operating permit.

Work is being conducted at the NRU under CERCLA with the VDEQ in the lead regulatory role and the U.S. Army as the lead Federal Agency.

2. Master Quality Assurance Plan

The MQAP was prepared as a site-wide planning document (URS, 2003). The QAPA is designed to be used in conjunction with the MQAP for work conducted by ARCADIS. It specifies field and laboratory procedures that will be used in support of the investigation, delineation, and remediation activities. This document has been prepared in accordance with USEPA *Requirements for Quality Assurance Project Plans for Environmental Data Operations*, EPA QA/R-5 (March 2001); *Guidance for Quality Assurance Project Plans*, EPA QA/G-5, EPA/240/R-02/009 (December 2002); and the REGION III QAPP Preparation Checklist (USEPA Region III, 2001)

The available SOPs previously published in are listed in Table 2-1. Specific quality control (QC) requirements include development of Data Quality Objectives (DQOs), performance of internal QC checks, and execution of appropriate analytical procedures during investigative and remedial activities are presented herein.

Applicable ARCADIS SOPs will be included in site specific work plan addenda. If an SOP for an activity is necessary and has not previously been referenced, the SOP will be prepared as necessary.

3. Document Distribution

The distribution list for all submittals is presented in the PMP. In addition to the standard document submittal list, the QAPA will also be provided to the entities identified below.

QAPA Supplemental Distribution List	Address
Kurt Beil, PE ARCADIS Quality Assurance Manager	ARCADIS 6 Terry Drive Suite 300 Newtown, PA 18940 Tel : 267.685.1800
Jane Kennedy ARCADIS Project Chemist	ARCADIS US 3850 N. Causeway Blvd. Suite 1600 Metairie, LA 70002 Tel: 504.832.4174
Marcia McGinnity Empirical Laboratories Project Manager	Empirical Laboratories, LLC 227 French Landing Dr. Suite 550 Nashville, TN 37228
Brandon Dunmore Air Toxics Project Manager	Air Toxics, Inc. 180-B Blue Ravine Road Folsom, CA 95630
ARCADIS Field Operations Manager	Prior to initiation of field operations

4. Project Organization and Responsibilities

4.1 Project Organization

The ARCADIS organizational chart for PBC2 is presented on Figure 4-1. The Project Manager (PM), Task Managers (TM)s, and Field Operations Managers are primarily responsible for the implementation of the QA program.

The primary USEPA and VDEQ personnel involved with this project include the following:

- William Geiger: USEPA RCRA PM - who will provide oversight and other additional duties; and

- Jim Cutler: VDEQ PM - who will provide oversight and perform other additional duties.

The specific QA responsibilities of the key ARCADIS project personnel and subcontractors are described below.

4.2 ARCADIS Staff

This section describes the roles and responsibilities of the ARCADIS project team members.

4.2.1 Project Manager

For the RAAP project, Mr. Tim Llewellyn will be the PM. Mr. Llewellyn will assign the Task Managers and oversee the implementation of all schedules and budgets. He will establish and interpret PBC2 contract policies and procedures and access appropriate ARCADIS resources in order to maintain technical quality. Mr. Llewellyn will coordinate with the ARCADIS Federal Programs Manager (Ms. Lee Ann Smith) and ARCADIS Technical Advisors on issues that impact the overall quality of ARCADIS' performance on the contract.

The PM is responsible for distributing documents to the U.S. Army, USEPA, VDEQ, and Task Managers who in turn distribute it to the appropriate technical staff. Additional information regarding responsibilities of the PM is provided in the PMP.

4.2.2 Deputy Project Manager

Ms. Diane Wisbeck will support the PM in contract management as well as task implementation, document preparation, personnel coordination, and budget management. Ms. Wisbeck will perform a key role in ensuring compliance with quality performance objectives. She will identify required resources and initiate acquisition of appropriate assets to complete project requirements. She will coordinate operations to ensure compliance with the project schedules. Ms. Wisbeck with also track project budges assist with quality program implementation and coordinate document preparation and submittal.

4.2.3 Task Project Managers

The Task Managers (TMs) will be responsible for the overall quality of work performed under PBC2 as it relates to the following specific roles:

- Overseeing day-to-day of task performance including all technical and administrative operations;
- Performing assessment and oversight duties as described in the PMP, MQAP and QAPA;
- Selecting and monitoring technical staff;
- Managing the development of area specific Work Plans;
- Reviewing and approving all final reports and other work products; and
- Distributing the QAPA to the ARCADIS technical staff.

TMs are as follows:

- Mr. Christopher Sharp; and
- Mr. Chris Kalinowski.

4.2.4 QA Manager

The Corporate QA Manager for the RAAP project, Mr. Kurt Beil, is responsible for oversight of all QA/QC activities. He will remain independent of day-to-day direct project involvement, but will have the responsibility for ensuring that all project and task-specific QA/QC requirements are met. He will have direct access to corporate staff, as necessary, to resolve any QA/QC problems, disputes, or deficiencies. The QA Manager's duties include:

- Reviewing and approving the QAPA and site-specific Work Plans;
- Reviewing and approving substantive changes to the QAPA and site-specific Work Plans;
- Reviewing any new work orders with the PM to determine if the QAPA requires; and
- Conducting field audits, as appropriate, in conjunction with the corporate QA office and keeping written records of those audits.

4.2.5 Health and Safety Manager

Mr. Charles Webster will serve as the project Health and Safety Manager. The Health and Safety Manager will review and internally approve the Health and Safety Plan Addendum (HSPA) that will be designed to the specific needs and operations associated with PBC2. In consultation with the PM, the Health and Safety Manager will ensure that an adequate level of personal protection exists for anticipated potential hazards for field personnel. On-site health and safety will be the responsibility of the Field Health and Safety Officer (FHSO). The FHSO will work in coordination with the PM and the project Health and Safety Manager to ensure that all activities are conducted safely and in accordance with the HSPA as well as facility requirements.

4.2.6 Project Chemist

The RAAP Project Chemist, Ms. Jane Kennedy, is responsible for data validation and verification, the generation of QC reports, and oversight of analytical laboratories. The Project Chemist's specific duties include:

- Developing the project QAPA and QA aspects of site specific Work Plans;

- Providing external review of analytical activities by performance of assessment and oversight duties as appropriate;

- Coordinating with the PM, Site TM's, and laboratory management to ensure that QA objectives appropriate to the project are set and that laboratory and field personnel are aware of these objectives;

- Reporting nonconformance with either QC criteria or QA objectives to the appropriate managers including recommending, implementing, and/or reviewing corrective actions;

- Conducting definitive analytical data evaluation and review to provide information on data limitations based on specific QC criteria; and

- Establishing that data meet the project technical, QC criteria, assessing the usability and extent of bias of data not meeting the specific technical, and quality criteria.

4.2.7 Field Operations Leaders

The Field Operations Leaders will be determined based on the specific field activities to be performed. The Field Operations Leader is responsible for coordinating the categories of work such as GW sampling, monitor well installation, well development, soil borings, and sampling. The Field Operations Leader will also be responsible for the assignment of on-site personnel and for providing technical assistance when required. The Field Operations Leader is responsible for ensuring that technical matters pertaining to the field-sampling program are addressed. He will ensure that work is being conducted as specified in the technical plans.

In addition, the Field Operations Leader is responsible for field quality assurance / quality control (QA/QC) procedures and for safety-related issues. The Field Operations Leader will coordinate all sampling activities and will ensure the availability and maintenance of all sampling materials/equipment. The Field Operations Leader or his designee will be responsible for the completion of all sampling and chain-of-custody (COC) documentation and will ensure custody of all samples is appropriately maintained.

Prior to initiation of field activities, the Field Operations Leader will utilize a copy of the MQAP and this QAPA with applicable SOPs and other project documents to conduct a

field staff orientation and briefing to acquaint project personnel with the sites and assign field responsibilities.

4.2.8 Technical Staff

The technical staff for this program will be drawn from a pool of technical resources within ARCADIS. The technical staff will implement project and site tasks, analyze data, and prepare reports/support materials. All technical personnel assigned will be experienced professionals who possess the degree of specialization and technical competence required to perform the required work effectively and efficiently. All technical staff will be familiar with the Master Health and Safety Plan (MHSP) and the ARCADIS HSPA as well as all relevant work plans, SOPs, and policies applicable to the fieldwork performed. Each field sampling team will have a copy of the HSPA, and area specific Work Plans in their possession while conducting fieldwork.

4.3 Subcontractors

4.3.1 Laboratories

Independent laboratories providing analytical services will be utilized, as appropriate, for the various project requirements including confirmation sampling, routine monitoring, and pilot/benchscale studies. Analytical chemistry laboratories shall be accredited, under the National Environmental Laboratory Accreditation Program (NELAP) for the analytical parameters required for the project for which accreditation is available through the primary accrediting state. The laboratory QA programs will be reviewed and approved by the ARCADIS Project Chemist. The laboratory will assign an experienced PM to coordinate analytical support with the project chemistry team. The laboratory staff will include a qualified QA Manager/Coordinator, who reports directly to laboratory management independently of the technical operations of the laboratory, to oversee technical adherence to the laboratory QA programs and the RAAP MQAP and QAPA. The specific duties of the laboratory PM and QA Manager/Coordinator for the RAAP analyses include:

- Reviewing the RAAP MQAP, QAPA, and area specific Work Plans to verify that analytical operations will meet project requirements as defined in the RAAP documents;

- Documenting and implementing RAAP-specific QA/QC requirements in the laboratory and reviewing analytical data (10 percent for the QA Officer) to verify the requirements were met;

- Reviewing receipt of all sample shipments and notifying the Site Manager and Project Chemist of any discrepancies within 1 day of receipt;

- Conducting internal laboratory audits to assess implementation of the laboratory Quality Assurance Manual (QAM) and procedures and providing written records of those audits;

- Rapidly notifying the Site Manager and Project Chemist regarding laboratory nonconformance with the QAPA or analytical QA/QC problems affecting RAAP samples; and

- Coordinating with the project and laboratory management to implement corrective actions as required by the MQAP, QAPA, and internal laboratory QAM.

Empirical Laboratories, LLC (Empirical) located in Nashville, TN, will be the primary laboratory performing analytical services for environmental samples collected at RAAP. Empirical will subcontract the dioxin/furan analyses to SGS Environmental Services (Wilmington, NC). Microseeps, Inc. of Pittsburgh, Pennsylvania, will perform dissolved gases analyses as required during remedial operations. Air Toxics, Inc. (Folsom, CA) will analyze soil gas samples and other air analyses that may be required for the project.

Appendix A of this QAPA includes the Empirical QAM, reporting and detection limits, and QC limits. Appendix B of this QAPA includes the Air Toxics QAM, reporting and detection limits, and QC limits. The QAMs for SGS and Microseeps are included by reference and will be maintained in the project files.

Geotechnical laboratories will be selected based on project requirements and will be identified in the site specific work plans. Selection criteria for geotechnical laboratories will be based on previous performance on ARCADIS projects or satisfactory recommendations.

4.3.2 Other Subcontractors

Other subcontractors will provide services under the direct supervision or direction of the ARCADIS PM or TMs or appropriate designated staff. The drilling, surveying, and other subcontractors are responsible for performance in accordance with the individual subcontracts and applicable portions of the QAPA as defined in each subcontract package. Subcontractors are responsible for rapidly notifying the Site Manager regarding nonconformance with the MQAP, QAPA, or QA/QC problems affecting RAAP operations. Subcontractors must coordinate with the Site Manager to implement corrective actions designated in this QAPA.

4.4 Key Points of Contact

Below are the names and points of contact for ARCADIS personnel and subcontractors.

Project Responsibility / Name / Email	Address / Telephone Number
Project Manager Tim Llewellyn Email: tim.llewellyn@arcadis-us.com	ARCADIS US 1114 Benfield Boulevard Suite A Millersville, MD 21108 Tel: 410.987.0032
Deputy Project Manager Diane Wisbeck Email: diane.wisbeck@arcadis-us.com	ARCADIS US 1114 Benfield Boulevard Suite A Millersville, MD 21108 Tel: 410.987.0032
Geology/Hydrology Joseph Quinnan, PE, PG Email: joseph.quinnan@arcadis-us.com	ARCADIS-US 10559 Citation Dr. Suite 100 Brighton, MI 48114 Tel : 810.225.1943
Health and Safety Manager Charles Webster Email: charles.webster@arcadis-us.com	ARCADIS US 6723 Towpath Rd Syracuse, NY 13214 Tel: 720.344.7200
Quality Assurance Manager Kurt Beil, PE Email: kurt.beil@arcadis-us.com	ARCADIS-US 6 Terry Dr. Suite 300 Newtown, PA 18940 Tel: 267.685.1800

Project Responsibility / Name / Email	Address / Telephone Number
Project Chemistry and Data Validation Jane Kennedy Email: jane.kennedy@arcadis-us.com	ARCADIS US 3850 N. Causeway Blvd. Suite 1600 Metairie, LA 70002 Tel: 504.832.4174
Subcontractors	
Empirical Laboratoires, LLC Marcia McGinnity Email: MMcGinnity@EmpirLabs.com	Empirical Laboratories, LLC 227 French Landing Dr. Suite 550 Nashville, TN 37228 Tel: 615.345.1115
Air Toxics, Inc. Brandon Dunmore Email: b.dunmore@airtoxics.com	Air Toxics, Inc. 180-B Blue Ravine Road Folsom, CA 95630 Tel: 916-985-1000

5. Quality Assurance Objectives

QA is defined as the overall system of activities for assuring the reliability of data produced. The site specific work plans in conjunction with the RAAP MWP and MQAP present investigative, chemical, and regulatory measures associated with the QA Objectives of the PBC2 scope. Conformance with referenced SOPs and QA protocols presented in the MQAP and this QAPA will ensure attainment of QA objectives. The overall system integrates the quality planning, assessment, and corrective actions of various groups in the organization to provide the independent QA program necessary to establish and maintain an effective system for collection and analysis of environmental samples and related activities. The program encompasses the generation of complete data with its subsequent review, validation, and documentation. Section 3 of the MQAP presents the general QA objectives and source documents for the Levels of Concern (LOCs). This section of the QAPA addresses additional QA objectives for the PBC2.

The DQO process is a strategic planning approach to ensure environmental data is of the appropriate type, quantity, and quality for decision-making. Project-specific DQOs are included in Table 2-3 for investigative activities. The overall QA objective is to develop and implement procedures for sample and data collection, shipment, evaluation, and reporting that will allow reviewers to assess whether the field and laboratory procedures meet the criteria and endpoints established in the DQOs. DQOs are qualitative and quantitative statements that outline the decision-making process and specify the data required to support corrective actions. DQOs specify the level of uncertainty that will be accepted in results derived from environmental data. Guidance for the DQOs Process (USEPA, 2004), and Guidance for DQOs for Hazardous Waste Sites (USEPA, 2000) formed the basis for the DQO process and development of RAAP data quality criteria and performance specifications.

DQOs will be established for each site specific work plan because the DQOs will vary across projects. A table summarizing the DQO process will be included in each work plan. Following is a summary of the seven steps that will be conducted to develop the DQOs.

1. **State the Problem:** Define the problem to focus the study. Specific activities conducted during this process step include

    a. the identification of the planning team and the primary decision-maker,

b. the statement of the problem, and

c. the identification of available resources, constraints, and deadlines.

2. **Identify the Decision:** Define the decision statement that the study will attempt to resolve. Activities conducted during this step of the process involve the following:

   a. identification of the principal study question(s), and

   b. definition of resultant alternative actions.

3. **Identify Inputs to the Decision:** Identify information inputs required for resolving the decision statement and assessing which inputs require environmental measures. This step of the process includes identification of the data that will be required to make the decision, identification of the information sources, identification of data required for establishment of study action levels, and confirmation of appropriate field sampling and analytical methods. The type of information that is needed to resolve the decision statement and the sources of this information may include the following:

   a. Risk-Based Concentration (RBCs) in the most recent version of the USEPA Region III screening standards, Federal Maximum Contaminant Levels (MCLs), and Commonwealth of Virginia Water Quality Criteria;

   b. Method Detection Limits (MDLs) and Reporting Limits (RLs) for the site chemicals of interest;

   c. Results of an examination of site use, operational history, environmental setting, GW and surface water use and characteristics, and soil exposure characteristics;

   d. Results of physical testing of soil for geotechnical properties; and

   e. Validated results of chemical analyses performed on site samples.

4. **Define the Boundaries:** Define decision statement spatial and temporal boundaries. This step specifies

a. the spatial boundary,

b. the target population characteristics, applicable geographic areas and associated homogeneous characteristics, and

c. the constraints on sample collection.

5. **Develop a Decision Rule:** Define the following:

   a. the parameters of interest,

   b. the action levels, and

   c. develop a decision rule.

6. **Specify Acceptable Limits on Decision Errors:** Specify the decision-maker's tolerable limits on decision errors. This step includes identification of**:**

   a. parameter range of interest,

   b. decision errors, and

7. **Optimize Data Design:** Identify data collection activities commensurate with data quality specifications. This final step in the process consists of:

   a. reviewing DQO outputs and existing environmental data,

   b. developing data collection design alternatives, and

   c. documentation of operational details and theoretical assumptions.

6. Sample Management

Sample management objectives will be met through adherence to the sample identification procedures (identification convention), documentation requirements, and COC procedures in the MWP.

6.1 Sample Locations, Numbers and Types

The site specific work plans will provide itemizations of the samples to be collected, sample depths (if applicable), and analytical parameters for environmental samples proposed during this investigation. Rationale for locations and types of samples with associated QC samples identified. Data use will also be defined in the specific work plans.

6.2 Sample Container, Preservation Method, and Holding Time Requirements

The volumes, containers, and preservatives required for the sampling activities are listed in Table 6-1. The laboratory will provide new, pre-cleaned sample containers. The laboratory shall use an approved specialty container supplier that prepares the containers in accordance with USEPA bottle preparation procedures. The laboratory must maintain a record of all sample bottle lot numbers shipped to RAAP in the event of a contamination problem. Trip blanks (TB) will be transported to the site inside the same cooler/box as the Volatile Organic Compound (VOC) vials.

Sample container lids will not be mixed. All sample lids must stay with the original containers as provided by the supplier. Bottle lids (with any associated bottle) exhibiting cracks, splits, or chips shall be appropriately discarded.

Pre-preserved containers obtained from the laboratory shall be used for all samples requiring preservation. Reagents used for preservation will be reagent-grade chemicals supplied by the laboratory. Each bottle received from the laboratory must be clearly labeled with the type of chemical preservative in the bottle and the test parameters that will be determined from sample collected in the container. Sample containers will not be stored at the site for longer than 30 days.

Bottle orders will be submitted to the laboratory 5 working days prior to commencement of field operations to allow supplies of clean, fresh containers and preservatives to be shipped to the facility.

Sample preservation will be verified on receipt at the laboratory with the exception of aqueous VOC samples. VOC sample preservation shall be verified prior to analysis. The preservation or pH check will be recorded on the sample receipt form or other appropriate logbook. If the samples are improperly preserved, a corrective action form will be submitted to the laboratory PM for follow-up action. The laboratory will notify the ARCADIS Field Operations Manager or Project Chemist to implement corrective actions in the field to ensure sufficient preservative is added at the time of sample collection.

Sample holding times will be based on published EPA guidance and will be calculated for the date and time of collection. A list of preservatives and holding times for each type of analysis are presented in Table 6-1. Additional preservation requirements and holding times for non-target analyses are listed in 40 Code of Federal Regulations (CFR) Part 136. Preservatives and holding times not listed in Table 6-1 applicable to a specific area will be provided in the site specific work plan.

6.3 Sample Identification

Each sample will be identified by a **unique** sample identification number in the logbook and on the COC record using an alphanumeric code. Field samples will be linked to geographic location via location codes. Where possible, location codes will link historical sample data with new data. Field samples will be identified using the following convention where historical identifications (IDs) are not available, contradict or duplicate the IDs previously used:

- Historical sampling locations/IDs will be utilized where possible to facilitate data linking.

- The SWMU, OU, Area, or Monitoring Well (MW) number in the format “SWMU##”, “OU##”. “A##”or “MW##” as based on the associated SWMU, operable unit, area or location of the sample collection point at the facility;

- GW, surface water, and sediment sample IDs will end with the date (in “mmddyy” format);

- Soil samples will end with the depth interval (in ft).

- Blind duplicate samples will be labeled sequentially, starting at 1, in the form OU##DUP01[location type code](mmddyy).

Following are some examples:

- GW Sample collected from MW 47 on June 1, 2008, would be: MW-47 (060108); and
- Surface Soil Sample 4 collected from 0 to 6 inches at SWMU 57 would be: SWMU57-SS004(0-0.5).
- General location type codes are listed below:
  - MW - monitor well or the current convention will be continued using MI, RI, PZ, etc.;
  - TW - temporary well;
  - SB - soil boring (by drilling);
  - GP - soil by direct push (or Geoprobe®);
  - SS - surface soil by trowel or other hand collection method;
  - EX - excavation;
  - SW - surface water by any collection method; and
  - SE - sediment by any collection method.

In addition to the above nomenclature, the COC will be completed to include the Sample Type and Sample Matrix using the codes defined below. Acceptable sample type codes are listed below:

- N - normal or primary sample;
- FD - field duplicate;
- EB - equipment blank; and
- TB - trip blank

The sample matrix will be identified using the following codes:

- IDM – investigation derived material;
- SO - soil sample;
- SE - sediment sample;

- WG - groundwater;
- WS - surface water;
- WT – wastewater; and
- SL - sludge.

These are the commonly used sampling codes. Additional coding will be developed as necessary to maintain electronic database integrity.

Field duplicate samples will be given a “blind” unique number that is different from the original sample while incorporating the standard sample pattern. This number with the corresponding field sample ID will be recorded in the field logbook, so that the duplicates can be identified at a later date.

Samples collected with an additional volume for matrix spike/matrix spike duplicates (MS/MSDs) will be designated on the COC in the remarks column.

Sample coolers will be identified with a unique number that will incorporate the cooler number and the date shipped to the laboratory. Cooler Number 1 for samples shipped on May 5, 2008, would be would be identified as 1-050508. The COC included in this cooler will carry the same number as the cooler.

Equipment blanks will be identified using the sample type code (i.e., EB) followed by the date as “MMDDYY” as a parenthetical statement. If more than one equipment blank is generated for a single day an alpha numeric character will be added to differentiate the blanks. For TBs, the sample code of “TB” will be followed by the cooler identification number. For example the TB associated with Cooler Number 3-050508 submitted on May 5, 2008 would be identified as TB3-050508.

COC records will be completed and shipped with the samples to the laboratories. Each COC will include the cooler number which will also identify the COC for sample tracking purposes. A copy of the COC will be retained with the field records. If samples are shipped by commercial carrier, the shipping records will be maintained in the project files with the field records.

SOP 50.1 in the MWP provides details on sample label completion.

6.4 Sample Handling and Custody Requirements

Field and laboratory personnel will, at all times, be aware of the need to maintain all samples, whether in the field or in the laboratory, under strict COC protocols and in a manner to retain physical properties and chemical composition. The following sections detail sample handling and sample custody requirements from collection to ultimate disposal.

6.4.1 Sample Handling

The transportation and handling of samples will be accomplished in a manner that not only protects the integrity of the sample, but also documents sample custody. Regulations for the packaging, marking, labeling, and shipping of hazardous materials are promulgated by the U.S. Department of Transportation (DOT) in 49 CFR 171 through 177. The procedures for sample packing and shipping in accordance with regulatory requirements are documented in the HSPA (Transportation of Hazardous Materials).

6.4.2 Sample Packaging

MWP SOP 50.2 provides information on sample packaging. This section includes addition requirements and details for PBC2.

Samples will be packaged carefully to avoid breakage or cross contamination and will be shipped to the laboratory at proper temperatures. The following general packaging guidelines will be followed in addition to the DOT requirements:

- Sample containers will generally be segregated according to sample matrix and expected contaminant concentration. Soil samples will not be shipped with water samples, and low-concentration samples will not be shipped with medium- and high-concentration samples;

- Sample bottles from specific sampling locations will be placed in the same cooler where possible;

- In cases where samples for volatile analysis will be shipped in several coolers on a single day, VOC vials may be consolidated into a single cooler to minimize the number of required TBs;

- Temperature blanks may be provided by the laboratory or prepared in the field prior to sealing coolers;

- Under no circumstances will packing material such as sawdust or sand be used;

- Custody seals will be affixed to the sample cooler in such a way as to indicate any tampering during shipment and then dated and initialed; and

6.4.3 Sample Custody

The primary objective of the COC procedures is to provide an accurate, traceable record of the possession and handling of a sample from collection through completion of all required analyses and final disposal. Formal sample custody procedures begin when sample collection is initiated. Sample identification documents will be carefully prepared so that sample identification, COC, and integrity are maintained and sample disposition controlled.

A sample is in custody if it is:

- In a sampling team member's physical possession;

- In a sampling team member's view;

- Locked in a vehicle;

- In a custody-sealed container during shipment via commercial courier; or

- Held in a secured area that is restricted to authorized personnel.

The laboratory must follow internal written and approved procedures for shipping, receiving, logging, and internally transferring samples.

6.4.3.1 Field Custody Procedures

Pre-cleaned sample containers will be shipped to RAAP or other location designated by the Field Operations Leader. The Field Operations Leader may record receipt of the sample containers in the project logbook. The following field custody procedures will be used for collection of samples:

- As few persons as possible should handle samples;

- The sample collector is personally responsible for the care and custody of samples collected until they are transferred to another person or dispatched properly under COC protocols;

- The Field Operations Leader will determine whether proper custody procedures were followed during field operations and decide if replacement samples are required.

6.4.3.2 Chain-of-Custody Record

MWP SOP 10.4 provides COC form protocols. In addition, the COC record must be fully completed by the technical staff designated by the Field Operations Manager as responsible for sample shipment to the appropriate laboratory for analysis. In addition, if samples are known to require rapid turnaround in the laboratory because of project time constraints or analytical concerns (e.g., extraction time or sample retention period limitations), the person completing the COC record should note these constraints in the "Remarks" section of the COC record. The COC record should also indicate any special preservation techniques necessary or whether the samples need to be filtered and clearly indicate field QC samples for MS/MSD, TBs, and equipment blanks. The original signed COC record accompanies the samples from the field to the laboratory where receipt is documented by appropriate signatures and dates. Copies of the COC records are maintained with the project file.

7. Documentation

Section 5.6 of the MQAP and MWPSOPs provide the primary methodology for 10.1 through 10.4 field documentation. Additional information regarding documentation and management to be employed under PBC2 are listed below.

7.1 Corrections to Field Documentation

As with all bound data logbooks, no pages will be removed for any reason. If corrections are necessary on any field documentation, they will be made by drawing a single line through the original entry (so that the original entry can still be read) and writing the corrected entry alongside it. The correction must be initialed and dated. Corrections will include an explanation footnote, as applicable.

7.2 Photographs

Photographs will be taken as directed by the team leader. Documentation by a photograph will ensure the validity as a visual representation of an existing situation. A log will be developed to track the media that the photos are filed on (e.g., compact disc, floppy disk). Photographs, as developed or transferred to electronic media, shall be compiled into a photograph log and information recorded in field notebooks added to the log with appropriate photographs. The following information will be noted in the log for digital or non-digital photographs as applicable to the media utilized for preservation:

- Date, time, location, and direction photograph was taken;
- Reasons why the photograph was taken; and
- Sequential number of the photograph and the film roll number or electronic media identification.

7.3 Laboratory Data Reporting/Record Retention

Analytical data reports for samples collected in conjunction with contaminant delineation, risk assessment, or remediation attainment verification at RAAP will include the following items and will be defined as a Level 4 Data Package. The elements of the Level 4 (CLP-like) Data Package include all of the Level 2 (defined below) components and instrument tuning, initial and continuing calibrations, raw data

associated with instrument performance and sample analysis. Level 4 reports will also contain a summary report or batch identification report clearly linking all QC results to actual field sample results. The case narrative will present an explanation of all QC results reported outside control limits and samples analyzed at dilutions where all results are non-detect. The laboratory report will include copies of any nonconformance or corrective action forms associated with data generation.

The majority of analytical data packages will be defined as a Level 2 Data Package and will not include raw or calibration data. Level 2 Data Packages for RAAP will include a fully-executed COC sample receipt checklist cross-reference table of field samples that identifies laboratory and sample number preparation and analytical batch numbers, analytical results, collection and analysis dates, RLs, dilution factors, surrogate recoveries, method blank data, laboratory control samples (LCSs), matrix spikes, laboratory replicates, laboratory control limits, and explanation of data flags, as well as a case narrative and fully executed COC.

Soils will be reported on a dry weight basis. The Reporting and (MDLs) will be corrected for percent moisture (soils only) and all dilution factors. Any compounds found less than the RL, but greater than the MDL should be reported and qualified with a “J” flag as estimated.

The laboratory will provide an electronic data deliverable (EDD) that matches all data reported on the hard copy analytical report. Electronic data report requirements are described in Section 9.3.

All records related to the analytical effort will be maintained at the laboratory or in the office (for field screening data) in access controlled areas for at least 1 year. All records will be maintained in a secure location for a period of 6 years after the final report is issued.

7.4 Electronic Data Retention

Electronic data and media retention policies will correlate with hard copy data retention at the laboratories as well as other points of electronic data generation. Additionally, electronic data must be subject to back-up routines that will enable recovery of data that may become corrupted or lost due to instrument, computer, and/or power failures. Electronic media will be stored in climate-controlled areas to minimize potential for degradation. Storage areas will be access limited.

8. Analytical Procedures

This section supplements Section 7.0 of the MQAP. Analytical methods will be USEPA approved unless non-standard methods are required to evaluate the presence of unanticipated or unusual compounds. Additional USEPA-approved methods that may be utilized are published in references listed below. The primary analytical methods anticipated to be utilized for samples collected during RAAP activities are listed in Table 6-1. The analytical methods are referenced in:

- Test Methods for Evaluating Solid Waste, Physical Chemical Methods, 3rd edition, SW-846, 1997 as amended;
- 40 CFR Part 136, Guidelines Establishing Test Procedures for the Analysis of Pollutants under the Clean Water Act;
- Standard Methods for the Examination of Water and Wastewater, APHA, AWWA, WEF, 21st Edition, 2005; and
- Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, Revised March 1983.

The primary parameter lists that may be reported and associated MDLs, RLs and screening standards are identified in Tables 8-1 through 8-6.

Where non-standard analytical chemistry methods are required, the Project Chemist will review performance data with the laboratory for any non-standard method prior to utilization of the procedure. The method for determination of dissolved light hydrocarbons is a non-standard method developed by Microseeps to detect very low concentrations of target compounds in groundwater. This is the only method currently anticipated that is not an EPA approved method.

Specific performance criteria, including QA protocols, for each analytical method are documented in the published methods and laboratory SOPs and the laboratory QAM. The laboratory SOPs will be examined as necessary. Note that “QAM” is a generic term for the laboratory QA document, which describes the laboratory program to ensure data of known quality are generated. The Empirical QAM is provided in Appendix A. The Air Toxics QAM is provided as Appendix B. The SGS Environmental Services (Dioxin/Furans) and Microseeps (dissolved light hydrocarbons) QAMs are included by reference to this document.

8.1 Physical/Geotechnical Analysis

Soil samples may require the determination of physical/geotechnical parameters. Analyses will be conducted for the following:

- Grain-size analysis (ASTM D 422);
- Atterberg limits (ASTM D 4318);
- Soil moisture content (ASTM D 2216);
- Total organic carbon (Walkley-Black Method);
- pH (ASTM D 4972): and
- Cation Exchange Capacity.

8.2 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

Primary calibration information is presented in Section 7.0 of the MQAP. Laboratory and field instruments and equipment used for sample analysis will be serviced and maintained by qualified personnel. Procedures will be implemented to ensure that instruments are operating properly and that calibrations are correct prior to analysis and reporting of any sample parameters.

8.2.1 Field Equipment Maintenance Field Equipment Maintenance

ARCADIS primarily rents equipment as necessary to complete field operations and acquire the necessary data. All equipment will be inspected upon receipt to ensure that it is in working order. Field personnel will be familiar with the appropriate calibration and use of all rental equipment. Supplier, type of instrument, and instrument identification numbers will be recorded in the field documentation. Calibration of all rental equipment will be verified.

Additional information for Field instrumentation is included in Section 7.4 of the MQAP.

8.2.2 Laboratory Equipment Maintenance

The laboratory must maintain an adequate stock of spare parts and consumables for all analytical equipment. Routine preventive maintenance procedures should be documented in the laboratory SOPs and/or QAM. Maintenance performed on each piece of equipment must be documented in a maintenance logbook. Daily checks of the laboratory deionized water and other support systems will be performed. The laboratory will have backup instrumentation or a process in place for most of the analytical equipment to minimize potential adverse impacts on data quality due to instrument malfunction. For example, the laboratory should have duplicate instrumentation and/or maintain service agreements for rapid response with the manufacturer major laboratory instruments (e.g., GC/MS, ICP).

8.3 Instrument Calibration and Frequency

All instruments and equipment used during sampling and analysis will be operated, calibrated, and maintained according to the manufacturer's guidelines and recommendations, as well as criteria set forth in the applicable analytical methodologies and SOPs. The laboratory QAM (Appendix A) provides brief descriptions of instrument calibration procedures to be performed by the analytical laboratories. Personnel properly trained in these procedures will perform operation, calibration, and maintenance of all instruments. Documentation of all routine and special maintenance and calibration information will be maintained in an appropriate logbook or reference file and will be available for inspection. All laboratory instrument calibration is set forth in analytical method SOPs.

Field instrument calibration will be performed in accordance with the applicable SOP. Table 8-7 lists typical monitoring equipment used during fieldwork. This equipment is representative of instruments typically required for RAAP GW and field sampling operations. All field personnel receive annual refresher training on the field operation of all health and safety related equipment, which includes calibration procedures. Brief descriptions of calibration procedures for major field instruments are provided in Table 8-7. All equipment calibration performed in the field must be recorded on the field instrument calibration forms and the documentation will be retained in the project file.

8.4 Inspection/Acceptance Requirements for Supplies and Consumables

Acquisition and/or purchase of material, equipment, and services will be prepared, reviewed, and approved in accordance with the requirements laboratory SOPs or as set forth in the ARCADIS subcontracting procedures, as applicable.

8.4.1 Standard Reagent Receipt and Traceability

For analytical laboratory operations, all standards are obtained directly from USEPA or through a reliable commercial supplier with a proven record for quality, traceable standards. All commercially supplied standards must be traceable to USEPA or National Institute of Standards and Technology (NIST) reference standards, and appropriate documentation will be obtained from the supplier. The certificates will be kept on file in a central location. When standards are received, they will be documented with the following: date received, chemical, lot number, concentration, and date opened or expiration date. When standards are prepared from these source materials, information will be included in a logbook with date of preparation, lot source, amount used, final volumes, resulting concentration, and preparer's initials. Laboratory SOPs and standards/reagent records will be reviewed during laboratory audits or if QC problems arise to ensure traceability requirements are met.

For field operations, standards are primarily applicable to chemical preservatives as described in Section 6.2 and field instrument calibration solutions for pH, conductivity, and turbidity. Chemical preservatives are typically obtained from the laboratory that is responsible for maintaining the traceability records. Field instrument calibration standards are obtained from chemical suppliers and records maintained by ARCADIS.

8.4.2 Field Sampling Equipment Procedures

Field supplies and equipment will be obtained from a reputable and reliable distribution company. The Field Operations Leader will inspect all supplies and equipment upon receipt at the site to verify that the correct materials were received. ARCADIS has established a program for maintaining field equipment to ensure that the equipment is available in good working order when and where it is needed. This program consists of the following elements:

- A list of reputable and reliable equipment rental suppliers to provide additional or specialized instrumentation as necessary to meet project requirements;

- An equipment manual is obtained from the rental supplier and kept on site during field activities as a guide to calibration and maintenance;

- Field personnel are trained in the proper use and care of equipment on an as-needed basis;

- MWP and/ or ARCADIS SOPs for field instrument used will be utilized. New SOPs shall be prepared, as necessary, to encompass appropriate field activities;

- Applicable SOPs will be available to field personnel for all work performed;

- The Field Operations Leader is responsible to make sure that the equipment is tested, cleaned, charged, and calibrated in accordance with the manufacturer's instructions before being taken to the job site; and

- A calibration/maintenance log accompanies each piece of equipment and is used to identify drift in the calibration over time, which might indicate the need for replacement of sensors or factory calibration.

8.5 Field Quality Control Elements

QC components that will be used by ARCADIS during operations at RAAP are presented below and in Section 8.0 of the MQAP. The quality components include the field QC samples and the laboratory QC elements. Rinse blanks (R), TBs, and field duplicates will be collected during the acquisition of environmental samples at RAAP. Table 8-8 presents guidelines for the collection of QC samples that will be taken in conjunction with environmental sampling. Field QC acceptance criteria are summarized in Table 8-9.

Miscellaneous QC samples may also include the analysis of source water, filters, and monitor well drilling fluids (if used). Because the water supply source is used in decontamination and well drilling activities, it may be necessary to determine the possibility for the introduction of outside contaminants. Filters may be used to evaluate dissolved constituents in GW. Filter blanks will be prepared to evaluate the potential contribution of constituents of interest to the samples. Filter blanks will be collected, preserved, and analyzed in the same manner as the field samples that they represent. Drilling fluids that are used during well installation may also be analyzed in order to assess the possibility of mud constituents affecting GW samples. Miscellaneous field QC samples will be defined and discussed in the OU-Specific Work Plan.

8.6 Laboratory Quality Control Elements

The laboratory QC elements are summarized in Table 8-10. Specific laboratory analytical QC criteria and corrective actions are summarized in Tables 8-11 through 8-17.

Analytical performance is monitored through various QC samples and spikes, such as laboratory method blanks, surrogate spikes, laboratory control sample (LCS), MS/MSDs and replicate samples. All QC samples are performed on the basis of a laboratory batch. Two basic types of batches are used: the preparation batch and the analytical batch. The preparation batch includes all samples processed as a unit during organic sample preparation, metals digestion, or wet chemistry preparation. Preparation batches will not exceed 20 samples excluding associated QC samples. The analytical batch consists of all samples analyzed together in the actual analytical sequence and is also limited to a maximum of 10 or 20 samples based on the method. The QC samples associated with sample preparation include method blanks, laboratory control samples (and duplicates), and matrix spikes (and duplicates). Surrogates are introduced into samples during preparation for extractable organic constituents or prior to purging for VOCs. For some analyses, such as volatile organics, the analytical batch is equivalent to the preparation batch. The analytical sequence includes calibration standards, instrument blanks, and reference standards.

Instances may arise where elevated concentrations of target analytes/compounds, non-homogeneous samples, or matrix interferences preclude achieving the detection limits or associated QC target criteria in a specific sample. In such instances, data will be examined on a case-by-case basis during the data validation process to determine the usability of the reported values. The laboratory will report the reason for deviations from these detection limits or noncompliance with QC criteria in the case narrative. The laboratory QC samples listed below will be prepared and analyzed at the frequency presented in Table 8-18.

The laboratory-specific QC criteria are provided in appendix A (Empirical) and B (Air Topics) SGS.

Following is a discussion of each type of QC sample utilized in the analytical laboratories.

8.6.1 Laboratory Method Blank

A laboratory method blank is an analyte-free material of similar matrix processed in the same manner, in the same analytical batch, and at the same time as a project sample. The blank is prepared using American Society of Testing Materials (ASTM) Type II water when analyzing water samples and, where practical, pre-cleaned sand or other solid material, such as sodium sulfate, when analyzing solid samples. The laboratory method blank sample is prepared in the same batch with the project samples at a frequency of 1 laboratory method blank per batch of 20 (or fewer) project samples for the given matrix type. The laboratory method blanks serve to demonstrate a contamination-free environment in the laboratory, reagents, and glassware utilized in sample preparation and analysis. The goal is for method blanks to be free of contamination or at a maximum less than the RL. Low-level contamination may be present, but must be less than RLs for undiluted samples. If contaminants are present in the method blank but not in project samples, no further action is required. Where blank contamination exceeds general method guidance criteria, the laboratory shall re-prepare and re-analyze the samples or shall contact the ARCADIS Project Chemist for determination of appropriate corrective action. Qualification of constituents detected in method blanks and in associated field samples will be based on the criteria set forth in the validation section of this QAPP. All sources of contamination that are not common laboratory contaminants as defined in the method SOPs must be investigated as part of the corrective action process.

8.6.2 Surrogate Standards

For certain organic methods, all samples, including the method blanks and QC samples, are spiked with a set of specific surrogate standards to monitor the accuracy of the analytical determination. Surrogate spikes are added at the start of the laboratory preparation process. Surrogate compounds are not typically found in environmental samples. QC criteria for surrogate recoveries are method- and matrix-specific. Surrogate recoveries must be within QC limits for method blanks and LCS samples to demonstrate acceptable method performance. If surrogate recoveries are outside QC criteria for method blanks or LCS samples, corrective action is required and the Project Chemist should be notified. The percent recovery of surrogates in a specific sample provides an indication of the total accuracy of the analytical method in that specific sample only. Surrogate recoveries that are outside QC criteria for a sample indicate a potential matrix effect. Matrix effects must be verified based on review of recoveries in the method blank or LCS, sample reanalysis, or evaluation of interfering compounds. Sample clean-up procedures required by the laboratory SOPs

must be implemented to alleviate potential matrix problems. Surrogate recoveries are calculated using the following formula.

$$\%R = \frac{SR}{SA} \times 100$$

Where:

%R = % Recovery

SR = Sample Result

SA = Surrogate Concentration Added

8.6.3 Laboratory Control Samples and Laboratory Control Sample Duplicates

An LCS or LCS Duplicate (LCSD) consists of ASTM Type II water and, where practical, pre-cleaned sand or sodium sulfate for solid matrices, or a purchased performance testing sample. Type II water is defined (D1193-91- Standard Specification for Reagent Water) by ASTM as “water that has greater than 1 megaohm-cm resistivity”. The referenced ASTM method covers requirements for water suitable for use in methods of chemical analysis and physical testing. The source of the chemicals utilized for LCS spiking will be from a different supply source than the calibration standards. Where second source standards are not available, the LCS must be spiked with materials from a separate manufacturing lot of the standard. The analytical laboratory will maintain complete records of standards tracking and preparation which will be available for review as necessary. Any deviation from utilization of second source standards will be approved by the Project Chemist.

The LCS is generally spiked with all of the analytes of interest near the mid-point of the calibration range as defined by the method. In some instances, spiking with a subset of the target compounds will be acceptable for the LCS where permissible in the SW-846 method protocol and with approval of the Project Chemist. The LCS is processed under the same sample preparation, surrogate and internal standards addition, and analytical protocols as the project samples. LCSs are analyzed at the frequency of 1 per batch of 20 samples or fewer of similar matrixes. The recovery of target analytes in the LCS provides an evaluation of method performance and accuracy. Method control may be established based on the subset of compounds listed in the method. LCSDs are analyzed with some methods but are not required QA components. LCSDs are

prepared and analyzed by the same protocols as the LCS. LCSD analyses provide precision evaluation of the method performance in addition to the accuracy information.

Laboratory QC criteria for LCSs and LCSDs are established for each method and matrix. Appendices G and H list the control limits for the laboratories performing analyses for MLAAP. The laboratory will update the QC limits annually. The LCS recovery of the method-specific control compounds/analytes must be within the laboratory-established control limits to demonstrate acceptable method performance. If the LCS recoveries are outside QC criteria for more than a few target analytes, recoveries are significantly low (<10 percent) and corrective action is required. After corrective action is complete, sample re-analysis is required for the failed parameters. If LCS recoveries exceed the QC criteria, and that parameter is not detected in any of the samples, re-analysis is not necessary. For any other deviations from the LCS control limits that cannot be resolved by sample re-analysis within holding times, the Project Chemist must be notified immediately. If critical samples are affected, the ARCADIS Task Manager may determine that resampling is required.

8.6.4 Matrix Spike and Matrix Spike Duplicate Samples

The MS and MSD samples consist of a project sample processed as three separate samples. Additional sample volume will be collected in the field, identified on the COC, and provided to the laboratory for use as the MS and MSD samples. In addition to the regular addition of monitoring standards (internal standards, surrogate), spiking analytes are added to the second sample aliquot. Generally, all method target analytes, if compatible, are added. A subset of target analytes may be used if indicated in the method SOP. An MS and MSD will be prepared for every batch of 20 samples (or fewer) for a given matrix unless sufficient sample volume is not available. Where site specific MSs cannot be performed, the laboratory shall include a batch MS/MSD or blank spike for additional evaluation of method performance in accordance with SW-846 method protocols and the laboratory SOP. Percent recoveries for batch specific MS/MSDs will be utilized only to evaluate method performance. Site samples will not be qualified based solely on the spike recoveries in matrices from other locations where the batch LCS is in control. Equipment and TBs must not be utilized for matrix spike evaluation. MS/MSD recoveries are a measure of the performance of the method on the matrices of samples being analyzed. MS recoveries outside the control limits for batches where the LCS is demonstrated to be in control indicate potential matrix effects. Sample clean-up procedures may be warranted for samples with severe matrix effects. The laboratory shall notify the Project Chemist of instances of extreme matrix effects on the analytical data to determine appropriate corrective action.

The percent recovery (%R) formula is as follows:

$$\%R = \frac{SSR - SR}{SA} \times 100$$

Where:

SSR = Spike Sample Result

SR = Sample Result

SA = Spike Added

MS and MSD recovery control limits will be based on laboratory established control limits for the methods performed. The Project Chemist will review the laboratory control limits prior to approval for use for project samples.

The RPD between the MS and MSD recoveries is calculated by the laboratory utilizing the following formula.

$$RPD = \left(\frac{PR - DR}{\frac{1}{2}(PR + DR)} \right) \times 100$$

Where:

PR = Primary Sample Result

DR = Duplicate Sample Result

The laboratory-derived advisory control limit for RPD will be utilized for evaluation of precision for MS pairs. Laboratory control limits are provided in Appendices G and H.

8.6.5 Laboratory Replicate Sample

A laboratory replicate consists of a second aliquot selected by the laboratory from the same project sample. These types of QC samples are primarily used in inorganic analyses including general chemistry techniques. Selection of replicate samples from a heterogeneous matrix requires homogenization to ensure that representative portions are analyzed. One sample per batch of 20 samples or fewer per matrix is analyzed in lieu of an MSD. The duplicate is prepared for methods that typically show concentrations of target analytes above MDLs, such as wet chemistry methods. The RPDs between the recoveries in the original and duplicate spikes measure the precision of the analytical method on the actual project samples. These limits will be utilized to evaluate laboratory precision for replicate samples prepared in the laboratory for methods where MSDs are not appropriate. If all other QC criteria are met, RPD results outside control limits indicate potential matrix effects and non-homogeneity of the sample. The laboratory shall investigate significant deviations in the RPD results by observing the sample to determine any visual heterogeneity or reviewing sample data for matrix interference. If visual observation does not indicate a potential problem, the sample may be re-analyzed. Potential matrix effects are reported and discussed in the case narrative. The RPD is calculated using the same formula as the RPD for the MS/MSD.

8.6.6 Calibration Verification Standards

A standard is obtained from a different source or, at a minimum, a different lot from that of the calibration standard. A check standard result is used to verify an existing calibration or calibration curve. The check standard provides information on the accuracy of the instrumental analytical method independent of various sample matrices. Calibration verification standards are analyzed with each analytical batch as applicable to the analytical method and SOP.

8.6.7 Method-Specific QC Samples

The laboratory will follow all specific quality processes as defined by the analytical method and laboratory SOP. Method-specific QC samples may include analysis of other QC samples or standards identified in the specific method SOP. Method-specific QC samples or standards include internal standards for gas chromatography (GC) and/or GC/mass spectroscopy (GC/MS) methods, post-digestion spikes and serial dilutions for metals analysis, and interference check samples for ICP analysis.

8.6.8 Performance Checks

The laboratory will perform analyses of performance test samples as required to maintain NELAP and other applicable accreditations. The Project Chemist will review laboratory performance test sample results on a semiannual basis. In the event that the laboratory fails any performance test parameters that impact the project samples, the laboratory will immediately notify the Project Chemist to identify appropriate corrective action implementation and to determine if any project data have been impacted.

9. Data Reduction, Validation, Reporting, and Management

In general, EPA-approved Methods will be performed for analytical work associated with PBC2. The method for quantitation of dissolved light hydrocarbons will be performed by Microseeps Laboratories, Inc., Pittsburg, PA. This method is a non-standard method to achieve very low detection limits for the compounds of interest during the monitoring of in-situ remediation systems. All other methods are EPA approved.

All laboratories performing analytical methods will be accredited under the NELAP. Additional details for the laboratory deliverables may be found in Section 9.8.3 of the MQAP and Section 4.2.4 of this document. Analytical data reports will be included in the primary investigation or study report in which the data are presented.

9.1 Detection and Reporting Limits

The laboratory MDLs and quantitative RLs are provided in Tables 8-11 through 8-17.

9.2 Rounding Rules

This section supplements Section 9.2 of the MQAP. Rounding to significant figures will be in accordance with current EPA method guidelines. The reported values must match the electronic data and utilize the same rounding routines.

9.3 Electronic Data Management

Electronic data management provides the ability to track samples and results from work plan implementation to the final report. The surveyor will provide coordinates for all sample locations in electronic format. The Field Operations Leader will review all field data for accuracy. Field data, as appropriate or applicable, will be manually entered into spreadsheet for incorporation into the project database. Risk evaluation screening standards will also be uploaded to the database.

ARCADIS will use the Environmental Quality Information Systems (EQuIS) data management system to handle environmental data for the RAAP project. EQuIS is a comprehensive geo-environmental data management database designed to store analytical test data and related data. EQuIS can be used for report and chart generation and is integrated with multiple statistical, numerical modeling, and data visualization tools.

The laboratory will provide an EDD for all analytical reports in accordance with requirements for upload to the EQuIS database system. Summary QC data will be included in the EDD to allow electronic screening of certain QC parameters.

The Project Chemist or designee will review approximately 5 percent of electronic laboratory and field data to verify the results against the hard copy and check for transcription errors. A greater than 15 percent discrepancy rate in two consecutive datasets will require additional review and verification.

Historical site data will be imported into the project database as necessary to support the PBC2. Data qualifiers and annotations previously applied will be incorporated. It is assumed that historical qualification has been applied consistent with CERCLA requirements. Qualification protocols for data generated under this QAPA and associated documents are described in Section 9.6 and are consistent with CERCLA guidance.

9.4 Data Validation

This section provides supplemental information associated with Section 9.5 of the MQAP. Data validation and usability criteria set forth in the MQAP as appended by this QAPA shall be followed unless otherwise amended in the area specific Work Plan.

9.4.1 Data Review, Validation, and Verification Requirements

Manual combined with electronic data validation will be conducted by a data validator not directly associated with the field-sampling program. The Project Chemist will oversee the performance of data validation functions. Data validation will be performed by knowledgeable and experienced individuals who can best perform evaluations within the necessary validation components. Validation staff qualifications will include experience with each of the elements required for the data verification and validation including ensuring that the measuring system meets the user's needs, assigning qualifiers to individual data values, assessing the relevancy of performance criteria, and concluding that data can proceed to quality assessment and reporting.

9.4.2 Validation and Verification Methods

Data validation will be conducted as set forth in this Section and Section 9.5.2 of the MQAP. Validation criteria will be based on these QA documents plus the analytical method performance criteria, laboratory QAM, laboratory control limits, USEPA Region

III guidance, USEPA Region III Modifications and professional judgment. The USEPA National Functional Guidelines (NFGs) for Organic and Inorganic data review will primarily be utilized as guidance for method qualification because the USEPA Contract Laboratory Program (CLP) methods will not be performed.

For samples collected in support of contaminant delineation, risk assessment, and confirmation of remedial goal attainment, 100 percent of the data will undergo Region III Manual Levels M-2/IM-1 data verification and validation. Approximately 10 percent of samples, collected for the above purpose, will additionally be validated in accordance with Region III M-3/IM-2. Selection of data packages for in-depth review will be random across the time period of sample collection. Levels M-3 and IM-2 will be performed on an SDG or complete laboratory report basis. Individual samples will not be singled out for particular levels of validation.

Samples collected in support of long-term operations and maintenance of selected remedies, pilot or bench scale studies, wastewater discharge compliance, or waste characterization for disposal will not be validated. If anomalous results are observed, a Level M-1/IM-1 review will be performed. Additional verification validation will be performed as necessary if this level of review indicates potential deficiencies with laboratory performance.

Data validation will be summarized in a checklist style report documenting the items reviewed with text explanations and notations of deficiencies and a summary of the qualifications applied to the analytical data. For data that will undergo the M-2/M-3/IM-2 validations, field documents will be reviewed within the perspective of impact to data quality. Any issues noted in field documentation or records that could impact data usability or quality will be noted in the validation reports.

9.5 Reconciliation with Data Usability Requirements

For routine assessments of data quality, ARCADIS will implement the data validation procedures described in Section 9.0 of the MQAP as appended by this QAPA. The data validators will assign appropriate data qualifiers to indicate limitations on the data. The Project Chemistry team will be responsible for evaluating compliance with project requirements. Deviations from the analytical performance criteria will be documented in the data validation reports.

The Project Chemist will work with the final users of the data in performing overall data quality assessments. The data quality assessment may include some or all the following steps:

- Data that are determined to be incomplete or not usable for the project will be discussed with the project team. If critical data points are involved which impact the ability to complete the project objectives, the data users will report immediately to the TM. The TM will discuss the resolution of the issue with the ARCADIS PM and implement the necessary corrective actions (for example, resampling);

- Data that are non-detect but have RLs elevated due to blank contamination or matrix interference will be compared to screening values (see Appendices B and C). If RLs exceed the screening values, then the results will be handled as appropriate for data use; and

- Data qualified as estimated (biased high, biased low) will be utilized if it is determined that the data are useable for their intended purpose. If an estimated result is close to a screening value, then there is uncertainty in any conclusions as to whether the result exceeds the screening value. The data user must evaluate the potential uncertainty in developing recommendations for the site. If estimated results become critical data points in making final decisions on the site, the PM and TM should evaluate the use of the results and may consider the data point incomplete.

Data validation codes relate to identification (confidence concerning the presence or absence of compounds) and quantitation of target parameters. The standard data validation codes that will be utilized are defined below:

Code	Definition
R	Data point is unusable due to serious deficiencies in analytical and QC criteria. The presence or absence of the analyte/compound can not be verified
UB	Not detected substantially above the level reported in laboratory or field blanks. For organics - 5X (10X for common lab contaminants) or for metals - 10X. Data point considered non-detect at the value qualified.

Code	Definition
U	Analyte/Compound not detected. The associated value indicates the concentration above which the result would be considered a quantitative value.
J	Reported value is considered an approximate concentration.
K	Estimated value, biased high.
L	Estimated value, biased low.
UJ, UK, UL	Analyte/compound not detected above the quantitation limit. However, the reported quantitation limit is approximate (biased high, biased low).

The ultimate data assessment process involves comparing analytical results to screening values and background concentrations to determine whether the contamination present is site related (i.e., above background levels) or significant (i.e., above screening values). Additional data assessment may be performed on site-by-site basis. Any additional procedures for data quality assessment will be provided in the area specific work plan.

10. Assessment/Oversight

Assessment and oversight procedures for the RAAP activities will be implemented in accordance with the MQAP, this QAPA, the PMP and other applicable documents. The QAPA in conjunction with the MQAP outlines general roles and responsibilities for the project team. Additional procedures will be developed as necessary to meet the DQOs of a specific RAAP Area of Concern or SWMU and will be presented in an addendum to the QAPA or included in the site specific Work Plan. The following section supplements Section 11.0 of the MQAP.

10.1 Assessments and Response Actions

Assessment activities include management and assessments, technical systems audits, and performance evaluations. Management assessments include routinely scheduled meetings and conference calls to evaluate staff utilization. Assignment of qualified personnel to RAAP projects, maintenance of schedules and budgets, and quality of project deliverables are verified as part of these assessments. Performance evaluations are used to ensure that trained and qualified staff is utilized for the project. Technical assessment activities applicable to RAAP projects include peer review, data quality reviews, and technical system audits (i.e., laboratory and field). Technical systems audits include review and evaluation of field and laboratory performance to assess the implementation of quality programs and directives. Procedures for peer review and technical assessments are summarized briefly below. Both the overall and direct technical assessment activities may result in the need for corrective action. The procedure for implementing a corrective action response program for both field and laboratory situations are summarized briefly below.

10.1.1 Field Inspections

The Field Operations Manager will be responsible for inspecting all field activities to verify compliance of the activities with the project plans, Health and Safety programs, and project QA documents.

10.1.2 Laboratory Audits

The laboratories must implement a comprehensive program of internal audits to verify the compliance of their analytical and management systems with the SOPs and QA Manuals. The laboratory may be requested to perform a project-specific audit to verify compliance with RAAP project requirements. The laboratory must be accredited under

NELAP and maintain current accreditation for RAAP methods and parameters where accreditation is available through the primary accrediting authority. No laboratory audits are planned by ARCADIS.

No outside laboratory audits are anticipated. The laboratory NELAP audit reports will be reviewed by the Project Chemist, as appropriate.

10.2 Corrective Action

Corrective actions will be implemented as necessary to insure data and project quality. In conjunction with the QA Manager and Project Chemist, the TM is responsible for initiating and implementing corrective action in the field. The PM and/or TMs are responsible for implementing, as necessary, corrective action in office settings. The laboratory PM, in conjunction with the laboratory technical staff and QA manager, is responsible for implementing corrective action in the laboratory. It is their combined responsibility to ensure that all analytical procedures are followed as specified and that the data generated meet the prescribed acceptance criteria. Any specific corrective actions necessary will be clearly documented in the logbooks or analytical reports.

10.2.1 Field Corrective Action Scenarios

The need for corrective action in the field may be determined by technical assessments or by more direct means such as equipment malfunction. Once a problem has been identified, it may be addressed immediately or an audit report may serve as notification to project management staff that corrective action is necessary. Immediate corrective actions taken in the field will be documented in the project logbook. Corrective actions may include, but are not limited to:

- Correcting equipment decontamination or sample handling procedures if field blanks indicate contamination;
- Recalibrating field instruments and checking battery charge;
- Training field personnel in correct sample handling or collection procedures; and
- Accepting data with an acknowledged level of uncertainty.

After a corrective action has been implemented, its effectiveness will be verified. If the action does not resolve the problem, appropriate personnel will be assigned to investigate and effectively remedy the problem.

Implementation of a Field Readiness Assessment (FRA) prior to start of fieldwork, as specified by SWP HSP-1.11, "Field Readiness Assessment Process," is required. The FRA will be constructed to determine readiness of the field activities to be performed. A FRA will be conducted:

- Prior to initial start of major phases of fieldwork;
- Prior to initiation of any significant change to the scope of work;
- As required in the Task Hazard Analysis (Exhibit 1 of the HSPA); or
- Anytime deemed necessary by the Health and Safety Manager, QA/QC Manager, or the PM.

Work considered routine (collection of water levels, routine system maintenance established in the existing work plans, etc.) may be addressed in a single FRA conducted at the start of fieldwork. Each event does not require an FRA to be conducted. Work considered "skill of the craft" (utilization of a plumber to hook water lines, etc.) is generally exempt from the FRA except the ARCADIS Site Manager or Field Operations Leader will ensure the work activity will not create a safety concern or create an unplanned interruption of site activities. This may be conducted through implementation of an FRA.

An example FRA template is presented in the HSPA.

10.2.2 Laboratory Corrective Action Scenarios

Out-of-control QC data, laboratory audits, or outside data review may determine the need for corrective action in the laboratory. Corrective actions may include, but are not limited to:

- Reanalyzing samples, if holding times permit;
- Correcting laboratory procedures;

- Recalibrating instruments using freshly prepared standards;
- Replacing solvents or other reagents that give unacceptable blank values;
- Training additional laboratory personnel in correct sample preparation and analysis procedures; and
- Accepting data with an acknowledged level of uncertainty.

Specific laboratory corrective actions for analytical deficiencies must be consistent with the analytical method. The laboratory corrective actions must be defined in analytical SOPs. Any deviations from the analytical SOP require corrective actions and documentation with approval of the ARCADIS Project Chemist. Whenever the ARCADIS Project Chemist deems corrective action necessary, the laboratory PM will ensure that the following steps are taken:

- The cause of the problem is investigated and identified;
- Appropriate corrective action is determined;
- Corrective action is implemented and the effectiveness verified by the laboratory QA Officer; and
- Documentation of the corrective action verification is provided to the Project Chemist in a timely manner.

11. References

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Tables

Table 2-1
Quality Assurance Measures Discussed in the MQAP
Radford Army Ammunition Plant, Radford, Virginia

Quality Assurance Measure	Section in MQAP	SOP No. (MWP Appendix A)
Project Organization and Responsibilities	2.0	--
Lines of Authority	2.2	--
Chemical Data Measurements	3.2	--
Levels of Concern	3.3	--
Site Investigation	4.0/5.0	20.1, 20.2, 20.3, 20.5, 20.9, 20.11, 20.12, 30.1, 30.2, 30.7, 30.8, 30.9, 40.1, 40.2, 40.3, 50.1, 50.2 70.1, 80.1
Remediation System Monitoring	NA	--
Documentation Requirements	5.6	10.1, 10.2, 10.3, 50.1
Chain-of-custody Requirements	5.7	10.4, 50.2
Calibration Procedures	7.0	90.1
Data Reduction, Validation, Reporting, and Management	9.0	--
Corrective Action	10.0	--
Quality Assessments	11.0	--

NA – Not Addressed

Table 6-1
Summary of Methods, Containers, Preservatives, and Holding Times
Radford Army Ammunition Plant
Radford, Virginia

Parameter	Matrix	Preparation Method	Analytical Method	Container	Preservative	Holding Time (a)
Primary Parameters						
TCL VOCs	Water	5030, 5032	8260	3 x 40-mL vial with Teflon-lined septum	Cool 4°C, pH<2 HCl	14 days
	Solid	5035	8260	3 x Encore™ ®	Cool 4°C	48 hours to preservation; 14 days to analysis
TCL SVOCs	Water	3510, 3520 (b)	8270	1 x 1-L amber G	Cool 4°C	7 days to extraction and 40 to analysis
	Solid	3540, 3550 (b)	8270	1 x 8-oz amber G	Cool 4°C	14 days to extract and 40 to analysis
PAHs	Water	3510, 3520 (b)	8270 (Low Level)	1 x 1-L amber G	Cool 4°C	7 days to extract and 40 to analysis
	Solid	3540, 3550 (b)	8270 (Low Level)	1 x 8-oz amber G	Cool 4°C	14 days to extract and 40 to analysis
TCL PCBs	Water	3510, 3520 (b)	8082	1 x 1-L amber G	Cool 4°C	7 days to extract and 40 to analysis
	Solid	3540, 3550 (b)	8082	1 x 8-oz amber G	Cool 4°C	14 days to extract and 40 to analysis
TCL Organochlorine Pestides	Water	3510, 3520 (b)	8081	1 x 1-L amber G	Cool 4°C	7 days to extract and 40 to analysis
	Solid	3540, 3550 (b)	8081	1 x 8-oz amber G	Cool 4°C	14 days to extract and 40 to analysis
Organochlorine Herbicides	Water	NA	8151	1 x 1-L amber G	Cool 4°C	7 days to extract and 40 to analysis
	Solid	NA	8151	1 x 8-oz amber G	Cool 4°C	14 days to extract and 40 to analysis
Explosives	Water	NA	8330, 8332, 8095	1 x 1-L amber G	Cool 4°C	7 days to extract and 40 to analysis

Table 6-1
Summary of Methods, Containers, Preservatives, and Holding Times
Radford Army Ammunition Plant
Radford, Virginia

Parameter	Matrix	Preparation Method	Analytical Method	Container	Preservative	Holding Time (a)
	Solid	NA	8330, 8332, 8095	1 x 8-oz amber G	Cool 4°C	14 days to extract and 40 to analysis
Metals (except Mercury)	Water	3005, 3010	6010 / 6020	1 x 1-L PE	pH <2 with HNO_3, Cool 4°C	6 months
	Solid	3050, 3051	6010	1 x 8-oz amber G	Cool 4°C	6 months
Mercury	Water	NA	7470	1 x 1-L PE	pH <2 with HNO_3, Cool 4°C	28 days
	Solid	NA	7471	1 x 8-oz amber G	Cool 4°C	28 days
Cyanide (Total)	Water	NA	9010 / 9012 / 9014	1 x 1-L PE	pH >12 with NaOH, Cool °4C	14 days
	Solid	NA	9010 / 9012 / 9014	1 x 8-oz amber G	Cool 4°C	14 days
Perchlorate	Water	NA	314.1	1 x 120-ml PE	Cool 4°C	28 days
	Solid	NA	314.1	1 x 4-oz PE	Cool 4°C	28 days
Dioxins/Furans	Water	NA	8290	2 x 1-L amber G + 2 x 40-ml vials	Cool 4°C	30 days to extract and 45 to analysis
	Solid	NA	8290	1 x 8-oz amber G	Cool 4°C	30 days to extract and 45 to analysis
Waste Characterization Parameters						
TCLP Metals	Solid	1311 3005, 3010	6010, 6020 & 7470	1 x 1-L wide mouth G	Cool 4°C	14 days from collection to Leach
TCLP VOCs	Solid	1311 5030, 5032	8260	1 x 4-oz G packed full	Cool 4°C	14 days from collection to Leach
TCLP SVOCs	Solid	1311 3510, 3520	8270	1 x 1-L wide mouth G	Cool 4°C	14 days from collection to Leach
TCLP Pest/PCBs	Solid	1311 3510, 3520	8081/8082	1 x 1-L wide mouth G	Cool 4°C	14 days from collection to Leach
Ignitability	Solid	Na	1010	250 ml wide mouth G	Cool 4°C	NA
Reactivity	Solid	Na	9010 / 9012/ 9014	250 ml wide mouth G	Cool 4°C	Sulfide 7 days

Table 6-1
Summary of Methods, Containers, Preservatives, and Holding Times
Radford Army Ammunition Plant
Radford, Virginia

Parameter	Matrix	Preparation Method	Analytical Method	Container	Preservative	Holding Time (a)
			and 9034			Cyanide 14 days
Corrosivity (pH)	Solid	NA	9045	250 ml wide mouth G	Cool 4°C	Analyze ASAP
General Chemistry Parameters						
MNA Gases	Water	NA	AM20GAX	4 x 40-mL vial with butyl rubber-lined septum	Cool 4°C	14 days (c)
Total & Dissolved Iron & Manganese	Water	3005, 3010	6010 / 6020	1 x 1-L PE	pH <2 with HNO_3	6 months
Alkalinity	Water	NA	SM 2320 B	120 ml PE	Cool 4°C	14 days
Ammonia	Water	NA	350.1 /4500-NH_3	120 ml PE	pH <2 with H_2SO_4; Cool 4°C	28 days
Chemical Oxygen Demand (COD)	Water	NA	410.3 / SM 5220 C / Hach 8000	120 ml PE	pH <2 with H_2SO_4; Cool 4°C	28 days
Chloride	Water	NA	SM 4500-Cl / 300	120 ml PE	Cool 4°C	28 days
Ferrous Iron	Water	NA	SM3500-FE-D	250 ml PE	None	Analyze ASAP
Hardness		NA	130.1	250 ml PE	pH <2 with HNO_3; Cool 4°C	6 months
Nitrate	Water	NA	353.2 / 300	120 ml PE	Cool 4°C	2 days
Nitrite	Water	NA	353.2 / 300	120 ml PE	Cool 4°C	2 days
Nitrate/Nitrite	Water	NA	353.2 / 300	120 ml PE	pH <2 with H_2SO_4	28 days
Phosphate	Water	NA	300	120 ml PE	pH <2 with H_2SO_4	28 days
Sulfate	Water	NA	9038 / 9056 / 300	120 ml PE	Cool 4°C	28 days
Sulfide	Water	NA	9034	500 ml PE	2 ml ZnAc; Cool 4°C	7 days
Total Dissolved Solids (TDS)	Water	NA	SM 2540 C	500 ml PE	Cool 4°C	7 days
Total Suspended Solids (TSS)	Water	NA	SM 2540 D	500 ml PE	Cool 4°C	7 days

Table 6-1
Summary of Methods, Containers, Preservatives, and Holding Times
Radford Army Ammunition Plant
Radford, Virginia

Parameter	Matrix	Preparation Method	Analytical Method	Container	Preservative	Holding Time (a)
Total Organic Carbon (TOC)	Water	NA	SM 5310 C	125 ml amber G	pH <2 with HCl or H_2SO_4, Cool 4°C	28 days
Dissolved Organic Carbon (DOC)	Water	NA	SM 5310 C	125 ml amber G	AFTER FILTRATION: pH <2 with HCl or H_2SO_4, Cool 4°C	28 days

Maximum holding time allowed from date of collection.
Clean-up methods may be applicable if matrix interference is encountered. Clean-up methods may include alumina (Method 3610), florisil (Method 3620), silica gel (Method 3630), gel permeation chromatography (GPC) (Method 3640), and sulfur (Method 3660). Selection of appropriate method is based on nature of interference and target compounds.
This holding time is a contractual holding time that has been established by ARCADIS.

°C – Degrees centigrade
G – glass
MNA- Monitored Natural Attenuation
NA – Not Applicable
PE – Polyethylene
SVOCs – Semivolatile Organic Compounds
TAL – Target Analyte List OLM
TCL – Target Compound List OLM 3.2
TCLP – Toxicity Characteristic Leaching Procedure
VOCs – Volatile Organic Compounds

Table 8-1
Summary of Analyte Method Detection Limits, Reporting Limits, and Risk Screening Levels for TCL VOCs (Method 8260B)
Soil and Water Samples MQAP Addendum PBC-2
Radford Army Ammunition Plant,
Radford, Virginia

Compound	CAS Number	Laboratory-Specific Method Detection and Reporting Limits (a)				USEPA MCLs	USEPA Region III Risk-Based Concentrations (b)									USEPA Region III BTAG Screening Levels (c)		
		Soil		Water			Tap Water			Soil Industrial			Soil Residential			Aqueous Fresh Water	Soil	Sediment
		MDL	Reporting Limit	MDL	Reporting Limit	MCL	C/N	RBC	Adjusted RBC	C/N	RBC	Adjusted RBC	C/N	RBC	Adjusted RBC			
		mg/kg	mg/kg	ug/L	ug/L	ug/L		ug/L	ug/L		mg/kg	mg/kg		mg/kg	mg/kg	ug/L	mg/kg	mg/kg
1,1,1-Trichloroethane	71-55-6	0.001	0.005	0.33	1		N	1.70E+03	1.70E+02	N	2.90E+05	2.90E+04	N	2.20E+04	2.20E+03	1.10E+01	3.00E-01	3.00E-02
1,1,2,2-Tetrachloroethane	79-34-5	0.001	0.005	0.33	1	--	C	5.30E-02	5.30E-02	C	1.40E+01	1.40E+01	C	3.20E+00	3.20E+00	6.10E+02	3.00E-01	1.40E+00
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	0.001	0.005	0.5	1	--	N	5.90E+04	5.90E+03	N	3.10E+07	3.10E+06	N	2.30E+06	2.30E+05	--	-	--
1,1,2-Trichloroethane	79-00-5	0.001	0.005	0.33	1	--	C	1.90E-01	1.90E-01	C	5.00E+01	5.00E+01	C	1.10E+01	1.10E+01	1.20E+03	3.00E-01	1.20E+00
1,1-Dichloroethane	75-34-3	0.001	0.005	0.33	1	--	N	9.00E+02	9.00E+01	N	2.00E+05	2.00E+04	N	1.60E+04	1.60E+03	4.70E+01	3.00E-01	--
1,1-Dichloroethene	75-35-4	0.001	0.005	0.42	1	--	N	3.50E+02	3.50E+01	N	5.10E+04	5.10E+03	N	3.90E+03	3.90E+02	2.50E+01	-	3.10E-02
1,2,4-Trichlorobenzene	120-82-1	0.001	0.005	0.57	2	7.00E+01	N	6.10E+01	6.10E+00	N	1.00E+04	1.00E+03	N	7.80E+02	7.80E+01	2.40E+01	1.00E-01	2.10E+00
1,2-Dibromo-3-chloropropane	96-12-8	0.001	0.005	0.33	2	-	C	2.00E-04	2.00E-04	C	3.60E+00	3.60E+00	C	2.00E-01	2.00E-01	--	-	--
1,2-Dibromoethane	106-93-4	0.001	0.005	0.33	1	-	C	5.30E-03	5.30E-03	C	1.40E+00	1.40E+00	C	3.20E-01	3.20E-01	--	5.00E+00	--
1,2-Dichlorobenzene	95-50-1	0.001	0.005	0.33	1	-	N	2.70E+02	2.70E+01	N	9.20E+04	9.20E+03	N	7.00E+03	7.00E+02	7.00E-01	1.00E-01	1.70E-02
1,2-Dichloroethane	107-06-2	0.001	0.005	0.33	1	-	C	1.20E-01	1.20E-01	C	3.10E+01	3.10E+01	C	7.00E+00	7.00E+00	1.00E+02	8.70E+02	--
1,2-Dichloropropane	78-87-5	0.001	0.005	0.33	1	5.00E+00	C	1.60E-01	1.60E-01	C	4.20E+01	4.20E+01	C	9.40E+00	9.40E+00	--	3.00E-01	--
1,3-Dichlorobenzene	541-73-1	0.001	0.005	0.38	1	-	N	1.80E+01	1.80E+00	N	3.10E+03	3.10E+02	N	2.30E+02	2.30E+01	1.50E+02	-	4.40E+00
1,4-Dichlorobenzene	106-46-7	0.001	0.005	0.33	1	-	C	4.70E-01	4.70E-01	C	1.20E+02	1.20E+02	C	2.70E+01	2.70E+01	2.60E+01	1.00E-01	6.00E-01
2-Butanone	78-93-3	0.002	0.01	1.5	10	--	N	7.00E+03	7.00E+02	N	6.10E+05	6.10E+04	N	4.70E+04	4.70E+03	1.40E+04	-	--
2-Hexanone	591-78-6	0.002	0.01	1	5	--	--	--	--	--	--	--	--	--	--	9.90E+01	-	--
4-Methyl-2-pentanone	108-10-1	0.001	0.01	1.5	5	--	N	6.30E+03	6.30E+02	--	--	--	--	--	--	1.70E+02	1.00E+02	--
Acetone	67-64-1	0.002	0.05	3.3	10	--	N	5.50E+03	5.50E+02	N	9.20E+05	9.20E+04	N	7.00E+04	7.00E+03	1.50E+03	-	--
Benzene	71-43-2	0.001	0.005	0.33	1	5.00E+00	C	3.40E-01	3.40E-01	C	5.20E+01	5.20E+01	C	1.20E+01	1.20E+01	3.70E+02	1.00E-01	--
Bromodichloromethane	75-27-4	0.001	0.005	0.33	1	8.00E+01	C	1.70E-01	1.70E-01	C	4.60E+01	4.60E+01	C	1.00E+01	1.00E+01	--	4.50E+02	--
Bromoform	75-25-2	0.001	0.005	0.5	1	8.00E+01	C	8.50E+00	8.50E+00	C	3.60E+02	3.60E+02	C	8.10E+01	8.10E+01	3.20E+02	-	6.50E-01
Bromomethane	74-83-9	0.001	0.01	0.5	2	-	N	8.50E+00	8.50E-01	N	1.40E+03	1.40E+02	N	1.10E+02	1.10E+01	--	-	--
Carbon disulfide	75-15-0	0.001	0.005	0.33	1	-	N	1.00E+03	1.00E+02	N	1.00E+05	1.00E+04	N	7.80E+03	7.80E+02	9.20E-01	-	8.50E-04
Carbon tetrachloride	56-23-5	0.001	0.005	0.33	1	5.00E+00	C	1.60E-01	1.60E-01	C	2.20E+01	2.20E+01	C	4.90E+00	4.90E+00	1.30E+01	3.00E-01	6.40E-02
Chlorobenzene	108-90-7	0.001	0.005	0.33	1	1.00E+02	N	9.00E+01	9.00E+00	N	2.00E+04	2.00E+03	N	1.60E+03	1.60E+02	1.30E+00	1.00E-01	8.40E-03
Chloroethane	75-00-3	0.001	0.01	0.5	2	-	C	3.60E+00	3.60E+00	C	9.90E+02	9.90E+02	C	2.20E+02	2.20E+02	--	-	--
Chloroform	67-66-3	0.001	0.005	0.33	1	8.00E+01	C	1.50E-01	1.50E-01	N	1.00E+04	1.00E+03	N	7.80E+02	7.80E+01	1.80E+00	3.00E-01	--
Chloromethane	74-87-3	0.001	0.01	0.5	2	-	N	1.90E+02	1.90E+01	--	--	--	--	--	--	--	-	--
cis-1,2-Dichloroethene	156-59-2	0.001	0.005	0.44	1	7.00E+01	N	6.10E+01	6.10E+00	N	1.00E+04	1.00E+03	N	7.80E+02	7.80E+01	--	3.00E-01	--
cis-1,3-Dichloropropene	10061-01-5	0.001	0.005	0.33	1	5.00E+00	C	4.40E-01	4.40E-01	C	2.90E+01	2.90E+01	C	6.40E+00	6.40E+00	--	3.00E-01	--
Cyclohexane	110-82-7	0.001	0.005	0.33	2	-	N	1.20E+04	1.20E+03	--	--	--	--	--	--	--	-	--
Dibromochloromethane	124-48-1	0.001	0.005	0.33	1	6.00E+01	C	1.30E-01	1.30E-01	C	3.40E+01	3.40E+01	C	7.60E+00	7.60E+00	--	-	--
Dichlorodifluoromethane	75-71-8	0.001	0.01	0.5	2	--	N	3.50E+02	3.50E+01	N	2.00E+05	2.00E+04	N	1.60E+04	1.60E+03	--	-	--
Ethylbenzene	100-41-4	0.001	0.005	0.35	1	7.00E+02	N	1.30E+03	1.30E+02	N	1.00E+05	1.00E+04	N	7.80E+03	7.80E+02	9.00E+01	1.00E-01	1.10E+00
Isopropylbenzene	98-82-8	0.001	0.005	0.33	1	--	N	6.60E+02	6.60E+01	N	1.00E+05	1.00E+04	N	7.80E+03	7.80E+02	2.60E+00	-	8.60E-02
Methyl acetate	79-20-9	0.002	0.005	0.87	2	--	N	6.10E+03	6.10E+02	N	1.00E+06	1.00E+05	N	7.80E+04	7.80E+03	--	-	--
methyl tert-Butyl ether	1634-04-4	0.001	0.005	0.33	1	--	C	2.60E+00	2.60E+00	C	7.20E+02	7.20E+02	C	1.60E+02	1.60E+02	1.10E+04	-	--

Table 8-1
Summary of Analyte Method Detection Limits, Reporting Limits, and Risk Screening Levels for TCL VOCs (Method 8260B)
Soil and Water Samples MQAP Addendum PBC-2
Radford Army Ammunition Plant,
Radford, Virginia

Compound	CAS Number	Laboratory-Specific Method Detection and Reporting Limits (a)				USEPA MCLs	USEPA Region III Risk-Based Concentrations (b)									USEPA Region III BTAG Screening Levels (c)		
		Soil		Water			Tap Water			Soil Industrial			Soil Residential			Aqueous Fresh Water	Soil	Sediment
		MDL	Reporting Limit	MDL	Reporting Limit	MCL	C/N	RBC	Adjusted RBC	C/N	RBC	Adjusted RBC	C/N	RBC	Adjusted RBC			
		mg/kg	mg/kg	ug/L	ug/L	ug/L		ug/L	ug/L		mg/kg	mg/kg		mg/kg	mg/kg	ug/L	mg/kg	mg/kg
Methylcyclohexane	108-87-2	0.001	0.005	0.33	1	--	N	6.30E+03	6.30E+02	--	--	--	--	--	--	--	-	--
Methylene chloride	75-09-2	0.001	0.04	0.66	2	--	C	4.10E+00	4.10E+00	C	3.80E+02	3.80E+02	C	8.50E+01	8.50E+01	9.80E+01	3.00E-01	--
Styrene	100-42-5	0.001	0.005	0.33	1	1.00E+02	N	1.60E+03	1.60E+02	N	2.00E+05	2.00E+04	N	1.60E+04	1.60E+03	7.20E+01	1.00E-01	5.60E-01
Tetrachloroethene	127-18-4	0.001	0.005	0.33	1	5.00E+00	C	1.00E-01	1.00E-01	C	5.30E+00	5.30E+00	C	1.20E+00	1.20E+00	1.10E+02	3.00E-01	4.70E-01
Toluene	108-88-3	0.001	0.005	0.33	1	1.00E+03	N	2.30E+03	2.30E+02	N	8.20E+04	8.20E+03	N	6.30E+03	6.30E+02	2.00E+00	1.00E-01	--
trans-1,2-Dichloroethene	156-60-5	0.001	0.005	0.4	1	1.00E+02	N	1.10E+02	1.10E+01	N	2.00E+04	2.00E+03	N	1.60E+03	1.60E+02	9.70E+02	3.00E-01	1.10E+00
trans-1,3-Dichloropropene	10061-02-6	0.001	0.005	0.33	1	-	C	4.40E-01	4.40E-01	C	2.90E+01	2.90E+01	C	6.40E+00	6.40E+00	--	3.00E-01	--
Trichloroethene	79-01-6	0.001	0.005	0.33	1	5.00E+00	C	2.60E-02	2.60E-02	C	7.20E+00	7.20E+00	C	1.60E+00	1.60E+00	2.10E+01	3.00E-01	9.70E-02
Trichlorofluoromethane	75-69-4	0.001	0.01	0.5	2		N	1.30E+03	1.30E+02	N	3.10E+05	3.10E+04	N	2.30E+04	2.30E+03		-	--
Vinyl Chloride	75-01-4	0.001	0.01	0.5	2	2.00E+00	C	1.50E-02	1.50E-02	-	--	-	C	9.00E-02	9.00E-02	9.30E+02	3.00E-01	--
Xylenes	1330-20-7	0.002	0.005	0.33	1	1.00E+04	N	2.10E+02	2.10E+01	N	2.00E+05	2.00E+04	N	1.60E+04	1.60E+03	1.30E+01	1.00E-01	--

Notes:

(a) Method Detection Limits and Reporting Limits provided by Empirical Laboratories, LLC

(b) USEPA Region 3 Risk-based Concentrations (October 2007)

(c) BTAG Screening Levels [1995 (soil), 2004 (surface water and sediment)].

Acronyms:

-- = Screening level unavailable.
BTAG = Biological Technical Assistance Group
CAS = Chemical Abstract Service
C!/N = RBC at HI of 0.1 < RBC-c; RBC from alternate RBC table.
C= RBC based cancer endpoint.
MCL = Maximum Contaminant Level
MDL = Method Detection Limit
mg/kg = Milligram Per kilogram
N = RBC based on non-carcinogenic endpoint.
PCBs = Polychlorinated Biphenyls
RBC = USEPA Region III Risk
RL = Reporting Limit
TCL = Target Compound List
ug/L = Microgram Per liter
VOC = volatile organic compound

Table 8-2
Summary of Analyte Method Detection Limits, Reporting Limits, and Risk Screening Levels for TCL SVOCs (Method 8270C)
Soil and Water Samples MQAP Addendum - PBC2
Radford Army Ammunition Plant,
Radford, Virginia

Compound	CAS Number	Laboratory-Specific Method Detection and Reporting Limits (a)				USEPA MCLs	USEPA Region III Risk-Based Concentrations (b)									USEPA Region III BTAG Screening Levels (c)		
		Soil		Water			Tap Water			Soil Industrial			Soil Residential			Aqueous Fresh Water	Soil	Sediment
		MDL	Reporting Limit	MDL	Reporting Limit	MCL	C/N	RBC	Adjusted RBC	C/N	RBC	Adjusted RBC	C/N	RBC	Adjusted RBC			
		mg/kg	mg/kg	M ug/L	M ug/L	M ug/L		M ug/L	M ug/L		mg/kg	mg/kg		mg/kg	mg/kg	M ug/L	mg/kg	mg/kg
1,1'-Biphenyl	92-52-4	0.1	0.33	1	5		N	3.00E+02	3.00E+01	N	5.10E+04	5.10E+03	N	3.90E+03	3.90E+02	1.40E+01	-	1.20E+00
2,2'-oxybis(1-Chloropropane)	108-60-1	0.1	0.33	1	5	--	C		2.60E-01	C	4.10E+01	4.10E+01	C	9.10E+00	9.10E+00	--	-	--
2,4,5-Trichlorophenol	95-95-4	0.1	0.33	1	5	--	N	3.70E+03	3.70E+02	N	1.00E+05	1.00E+04	N	7.80E+03	7.80E+02	--	1.00E-01	--
2,4,6-Trichlorophenol	88-06-2	0.1	0.33	1	5	--	C	6.10E+00	6.10E+00	C	2.60E+02	2.60E+02	C	5.80E+01	5.80E+01	4.90E+00	1.00E-01	2.10E-01
2,4-Dichlorophenol	120-83-2	0.1	0.33	1	5	--	N	1.10E+02	1.10E+01	N	3.10E+03	3.10E+02	N	2.30E+02	2.30E+01	1.10E+01	1.00E-01	1.20E-01
2,4-Dimethylphenol	105-67-9	0.1	1.3	2	20	--	N	7.30E+02	7.30E+01	N	2.00E+04	2.00E+03	N	1.60E+03	1.60E+02	--	1.00E-01	2.90E-02
2,4-Dinitrophenol	51-28-5	0.167	3.3	7	50	--	N	7.30E+01	7.30E+00	N	2.00E+03	2.00E+02	N	1.60E+02	1.60E+01	--	1.00E-01	--
2,4-Dinitrotoluene	121-14-2	0.1	0.33	1	5	--	N	7.30E+01	7.30E+00	N	2.00E+03	2.00E+02	N	1.60E+02	1.60E+01	4.40E+01	-	4.20E-02
2,6-Dinitrotoluene	606-20-2	0.1	0.33	1	5	--	N	3.70E+01	3.70E+00	N	1.00E+03	1.00E+02	N	7.80E+01	7.80E+00	8.10E+01	-	--
2-Chloronaphthalene	91-58-7	0.1	0.33	1.5	5	--	N	4.90E+02	4.90E+01	N	8.20E+04	8.20E+03	N	6.30E+03	6.30E+02	--	-	--
2-Chlorophenol	95-57-8	0.1	0.33	1.5	5	--	N	3.00E+01	3.00E+00	N	5.10E+03	5.10E+02	N	3.90E+02	3.90E+01	2.40E+01	1.00E-01	3.10E-02
2-Methylnaphthalene	91-57-6	0.1	0.33	1	5	--	N	2.40E+01	2.40E+00	N	4.10E+03	4.10E+02	N	3.10E+02	3.10E+01	4.70E+00	-	2.00E-02
2-Methylphenol	95-48-7	0.1	0.33	1	5	--	N	1.80E+03	1.80E+02	N	5.10E+04	5.10E+03	N	3.90E+03	3.90E+02	1.30E+01	1.00E-01	--
2-Nitroaniline	88-74-4	0.1	1.3	1	20	--	--	--	--	--	--	--	--	--	--	--	-	--
2-Nitrophenol	88-75-5	0.1	0.33	1	5	--	--	--	--	--	--	--	--	--	--	1.90E+03	-	--
3,3'-Dichlorobenzidine	91-94-1	0.167	0.33	1.5	5	--	C	1.50E-01	1.50E-01	C	6.40E+00	6.40E+00	C	1.40E+00	1.40E+00	4.50E+00	-	1.30E-01
3-Nitroaniline	99-09-2	0.167	1.3	1.5	20	--	--	--	--	--	--	--	--	--	--	--	-	--
4,6-Dinitro-2-methylphenol	534-52-1	0.167	1.3	2.5	20	--	--	--	--	--	--	--	--	--	--	--	-	--
4-Bromophenyl-phenylether	101-55-3	0.1	0.33	1	5	--	--	--	--	--	--	--	--	--	--	1.50E+00	-	1.20E+00
4-Chloro-3-Methylphenol	59-50-7	0.1	0.33	1	5	--	--	--	--	--	--	--	--	--	--	--	-	--
4-Chloroaniline	106-47-8	0.1	0.33	1	5	--	N	1.50E+02	1.50E+01	N	4.10E+03	4.10E+02	N	3.10E+02	3.10E+01	2.30E+02	-	--
4-Chlorophenyl-phenylether	7005-72-3	0.1	0.33	1.5	5	--	--	--	--	--	--	--	--	--	--	--	-	0.00E+00
4-Methylphenol	106-44-5	0.1	0.33	1	5	--	N	1.80E+02	1.80E+01	N	5.10E+03	5.10E+02	N	3.90E+02	3.90E+01	5.40E+02	1.00E-01	6.70E-01
4-Nitroaniline	100-01-6	0.1	1.3	1	20	--	--	--	--	--	--	--	--	--	--	--	-	--
4-Nitrophenol	100-02-7	0.1	1.3	3	20	--	-	--	-	-	--	-	-	--	-	6.00E+01	1.00E-01	--
Acenaphthene	83-32-9	0.1	0.33	1.5	5	--	N	3.70E+02	3.70E+01	N	6.10E+04	6.10E+03	N	4.70E+03	4.70E+02	5.80E+00	1.00E-01	6.70E-03
Acenaphthylene [1]	208-96-8	0.1	0.33	1.5	5	--	N	1.80E+02	1.80E+01	N	3.10E+04	3.10E+03	N	2.30E+03	2.30E+02	--	1.00E-01	5.90E-03
Acetophenone	98-86-2	0.1	0.33	1	5	--	N	6.10E+02	6.10E+01	N	1.00E+05	1.00E+04	N	7.80E+03	7.80E+02	--	-	--
Anthracene	120-12-7	0.1	0.33	1	5	--	N	1.80E+03	1.80E+02	N	3.10E+05	3.10E+04	N	2.30E+04	2.30E+03	1.20E-02	1.00E-01	5.70E-02
Atrazine	1912-24-9	0.1	0.33	1	5	3.00E+00	C	3.00E-01	3.00E-01	C	1.30E+01	1.30E+01	C	2.90E+00	2.90E+00	1.80E+00	-	6.60E-03
Benzaldehyde	100-52-7	0.1	0.33	1	5	--	N	3.70E+03	3.70E+02	N	1.00E+05	1.00E+04	N	7.80E+03	7.80E+02	--	-	--
Benzo(a)anthracene	56-55-3	0.1	0.33	1	5	--	C	3.00E-02	3.00E-02	C	3.90E+00	3.90E+00	C	2.20E-01	2.20E-01	1.80E-02	1.00E-01	1.10E-01
Benzo(a)pyrene	50-32-8	0.1	0.33	1	5	2.00E-01	C	3.00E-03	3.00E-03	C	3.90E-01	3.90E-01	C	2.20E-02	2.20E-02	1.50E-02	1.00E-01	1.50E-01
Benzo(b)fluoranthene	205-99-2	0.1	0.33	1	5	--	C	3.00E-02	3.00E-02	C	3.90E+00	3.90E+00	C	2.20E-01	2.20E-01	--	1.00E-01	--
Benzo(g,h,i)perylene [1]	191-24-2	0.1	0.33	1.5	5	--	N	1.80E+02	1.80E+01	N	3.10E+04	3.10E+03	N	2.30E+03	2.30E+02	--	1.00E-01	1.70E-01
Benzo(k)fluoranthene	207-08-9	0.1	0.33	1	5	--	C	3.00E-01	3.00E-01	C	3.90E+01	3.90E+01	C	2.20E+00	2.20E+00	--	1.00E-01	2.40E-01
Bis(2-chloroethoxy)methane	111-91-1	0.1	0.33	1	5	--	--	--	--	--	--	--	--	--	--	--	-	--

Table 8-2
Summary of Analyte Method Detection Limits, Reporting Limits, and Risk Screening Levels for TCL SVOCs (Method 8270C)
Soil and Water Samples MQAP Addendum - PBC2
Radford Army Ammunition Plant,
Radford, Virginia

Compound	CAS Number	Laboratory-Specific Method Detection and Reporting Limits (a)				USEPA MCLs	USEPA Region III Risk-Based Concentrations (b)									USEPA Region III BTAG Screening Levels (c)		
		Soil		Water			Tap Water			Soil Industrial			Soil Residential			Aqueous Fresh Water	Soil	Sediment
		MDL	Reporting Limit	MDL	Reporting Limit	MCL	C/N	RBC	Adjusted RBC	C/N	RBC	Adjusted RBC	C/N	RBC	Adjusted RBC			
		mg/kg	mg/kg	M ug/L	M ug/L	M ug/L		M ug/L	M ug/L		mg/kg	mg/kg		mg/kg	mg/kg	M ug/L	mg/kg	mg/kg
Bis(2-chloroethyl)ether	111-44-4	0.167	0.33	2.5	2	--	C	9.60E-03	9.60E-03	C	2.60E+00	2.60E+00	C	5.80E-01	5.80E-01	--	-	--
Bis(2-ethylhexyl)phthalate	117-81-7	0.1	0.33	1	5	6.00E+00	C	4.80E+00	4.80E+00	C	2.00E+02	2.00E+02	C	4.60E+01	4.60E+01	1.60E+01	-	1.80E-01
Butylbenzylphthalate	85-68-7	0.1	0.33	1	5	--	N	7.30E+03	7.30E+02	N	2.00E+05	2.00E+04	N	1.60E+04	1.60E+03	1.90E+01	-	1.10E+01
Caprolactam	105-60-2	0.1	0.33	1	5	--	N	1.80E+04	1.80E+03	N	5.10E+05	5.10E+04	N	3.90E+04	3.90E+03	--	-	--
Carbazole	86-74-8	0.1	0.67	1	10	--	C	3.30E+00	3.30E+00	C	1.40E+02	1.40E+02	C	3.20E+01	3.20E+01	--	-	--
Chrysene	218-01-9	0.1	0.33	1	5	--	C	3.00E+00	3.00E+00	C	3.90E+02	3.90E+02	C	2.20E+01	2.20E+01	--	1.00E-01	1.70E-01
Dibenz(a,h)anthracene	53-70-3	0.1	0.33	1	5	--	C	3.00E-03	3.00E-03	C	3.90E-01	3.90E-01	C	2.20E-02	2.20E-02	--	1.00E-01	3.30E-02
Dibenzofuran	132-64-9	0.1	0.33	1	5	--	--	--	--	--	--	--	--	--	--	3.70E+00	-	4.20E-01
Diethylphthalate	84-66-2	0.1	0.33	1	5	--	N	2.90E+04	2.90E+03	N	8.20E+05	8.20E+04	N	6.30E+04	6.30E+03	2.10E+02	-	6.00E-01
Dimethylphthalate	131-11-3	0.1	0.33	1	5	--	--	--	--	--	--	--	--	--	--	--	-	--
Di-n-butylphthalate	84-74-2	0.1	0.33	1	5	--	N	3.70E+03	3.70E+02	N	1.00E+05	1.00E+04	N	7.80E+03	7.80E+02	1.90E+01	-	6.50E+00
Di-n-octylphthalate	117-84-0	0.1	0.33	1	5	--	--	--	--	--	--	--	--	--	--	2.20E+01	-	--
Fluoranthene	206-44-0	0.1	0.33	1	5	--	N	1.50E+03	1.50E+02	N	4.10E+04	4.10E+03	N	3.10E+03	3.10E+02	4.00E-02	1.00E-01	4.20E-01
Fluorene	86-73-7	0.1	0.33	1.5	5		N	2.40E+02	2.40E+01	N	4.10E+04	4.10E+03	N	3.10E+03	3.10E+02	3.00E+00	1.00E-01	7.70E-02
Hexachlorobenzene	118-74-1	0.1	0.33	1	5	1.00E+00	C	4.20E-02	4.20E-02	C	1.80E+00	1.80E+00	C	4.00E-01	4.00E-01	3.00E-04	-	2.00E-02
Hexachlorobutadiene	87-68-3	0.1	0.33	1.5	5	--	C!/N	8.60E-01	7.30E-01	C!/N	3.70E+01	2.00E+01	C!/N	8.20E+00	1.60E+00	1.30E+00	-	--
Hexachlorocyclopentadiene	77-47-4	0.1	0.33	1	5	5.00E+01	N	2.20E+02	2.20E+01	N	6.10E+03	6.10E+02	N	4.70E+02	4.70E+01	--	-	--
Hexachloroethane	67-72-1	0.1	0.33	2.5	5	--	C!/N	4.80E+00	3.70E+00	C!/N	2.00E+02	1.00E+02	C!/N	4.60E+01	7.80E+00	1.20E+01	-	1.00E+00
Indeno(1,2,3-cd)pyrene	193-39-5	0.15	0.33	1.5	5	--	C	3.00E-02	3.00E-02	C	3.90E+00	3.90E+00	C	2.20E-01	2.20E-01	--	1.00E-01	1.70E-02
Isophorone	78-59-1	0.1	0.33	1	5	--	C	7.00E+01	7.00E+01	C	3.00E+03	3.00E+03	C	6.70E+02	6.70E+02	--	-	--
Naphthalene	91-20-3	0.1	0.33	1.5	5	--	N	6.50E+00	6.50E-01	N	2.00E+04	2.00E+03	N	1.60E+03	1.60E+02	1.10E+00	1.00E-01	1.80E-01
Nitrobenzene	98-95-3	0.1	0.33	1	5	--	N	3.50E+00	3.50E-01	N	5.10E+02	5.10E+01	N	3.90E+01	3.90E+00	--	-	--
N-Nitrosodi-n-propylamine	621-64-7	0.1	0.33	1.5	5	--	C	9.60E-03	9.60E-03	C	4.10E-01	4.10E-01	C	9.10E-02	9.10E-02	--	-	--
N-Nitrosodiphenylamine	86-30-6	0.1	0.33	1	5	--	C	1.40E+01	1.40E+01	C	5.80E+02	5.80E+02	C	1.30E+02	1.30E+02	2.10E+02	-	2.70E+00
Pentachlorophenol	87-86-5	0.1	1.3	1.5	20	1.00E+00	C	5.60E-01	5.60E-01	C	2.40E+01	2.40E+01	C	5.30E+00	5.30E+00	5.00E-01	1.00E-01	5.00E-01
Phenol	108-95-2	0.1	0.33	1	5	--	N	1.10E+04	1.10E+03	N	3.10E+05	3.10E+04	N	2.30E+04	2.30E+03	4.00E+00	1.00E-01	4.20E-01
Pyrene	129-00-0	0.1	0.33	1	5	--	N	1.80E+02	1.80E+01	N	3.10E+04	3.10E+03	N	2.30E+03	2.30E+02	2.50E-02	1.00E-01	2.00E-01
Acenaphthene	83-32-9	0.0014	0.0033	0.011	0.05	--	N	3.70E+02	3.70E+01	N	6.10E+04	6.10E+03	N	4.70E+03	4.70E+02	5.80E+00	1.00E-01	6.70E-03
Acenaphthylene [1]	208-96-8	0.00082	0.0033	0.019	0.05	--	N	1.80E+02	1.80E+01	N	3.10E+04	3.10E+03	N	2.30E+03	2.30E+02	--	1.00E-01	5.90E-03
Anthracene	120-12-7	0.00069	0.0033	0.021	0.05	--	N	1.80E+03	1.80E+02	N	3.10E+05	3.10E+04	N	2.30E+04	2.30E+03	1.20E-02	1.00E-01	5.70E-02
Benzo(a)anthracene	56-55-3	0.00131	0.0033	0.017	0.05	--	C	3.00E-02	3.00E-02	C	3.90E+00	3.90E+00	C	2.20E-01	2.20E-01	1.80E-02	1.00E-01	1.10E-01
Benzo(a)pyrene	50-32-8	0.00118	0.0033	0.017	0.05	2.00E-01	C	3.00E-03	3.00E-03	C	3.90E-01	3.90E-01	C	2.20E-02	2.20E-02	1.50E-02	1.00E-01	1.50E-01
Benzo(b)fluoranthene	205-99-2	0.00126	0.0033	0.018	0.05	--	C	3.00E-02	3.00E-02	C	3.90E+00	3.90E+00	C	2.20E-01	2.20E-01	--	1.00E-01	--
Benzo(g,h,i)perylene [1]	191-24-2	0.0022	0.0033	0.013	0.05	--	N	1.80E+02	1.80E+01	N	3.10E+04	3.10E+03	N	2.30E+03	2.30E+02	--	1.00E-01	1.70E-01
Benzo(k)fluoranthene	207-08-9	0.00123	0.0033	0.012	0.05	--	C	3.00E-01	3.00E-01	C	3.90E+01	3.90E+01	C	2.20E+00	2.20E+00	--	1.00E-01	2.40E-01
Chrysene	218-01-9	0.00094	0.0033	0.012	0.05	--	C	3.00E+00	3.00E+00	C	3.90E+02	3.90E+02	C	2.20E+01	2.20E+01	--	1.00E-01	1.70E-01
Dibenz(a,h)anthracene	53-70-3	0.00085	0.0033	0.02	0.005	--	C	3.00E-03	3.00E-03	C	3.90E-01	3.90E-01	C	2.20E-02	2.20E-02	--	1.00E-01	3.30E-02
Fluoranthene	206-44-0	0.00093	0.0033	0.016	0.05	--	N	1.50E+03	1.50E+02	N	4.10E+04	4.10E+03	N	3.10E+03	3.10E+02	4.00E-02	1.00E-01	4.20E-01

Table 8-2
Summary of Analyte Method Detection Limits, Reporting Limits, and Risk Screening Levels for TCL SVOCs (Method 8270C)
Soil and Water Samples MQAP Addendum - PBC2
Radford Army Ammunition Plant,
Radford, Virginia

Compound	CAS Number	Laboratory-Specific Method Detection and Reporting Limits (a)				USEPA MCLs	USEPA Region III Risk-Based Concentrations (b)									USEPA Region III BTAG Screening Levels (c)		
		Soil		Water			Tap Water			Soil Industrial			Soil Residential			Aqueous Fresh Water	Soil	Sediment
		MDL	Reporting Limit	MDL	Reporting Limit	MCL	C/N	RBC	Adjusted RBC	C/N	RBC	Adjusted RBC	C/N	RBC	Adjusted RBC			
		mg/kg	mg/kg	M ug/L	M ug/L	M ug/L		M ug/L	M ug/L		mg/kg	mg/kg		mg/kg	mg/kg	M ug/L	mg/kg	mg/kg
Fluorene	86-73-7	0.00093	0.0033	0.016	0.05		N	2.40E+02	2.40E+01	N	4.10E+04	4.10E+03	N	3.10E+03	3.10E+02	3.00E+00	1.00E-01	7.70E-02
2-Methylnaphthalene	91-57-6	0.0013	0.0033	0.018	0.05	--	N	2.40E+01	2.40E+00	N	4.10E+03	4.10E+02	N	3.10E+02	3.10E+01	4.70E+00	-	2.00E-02
Indeno(1,2,3-cd)pyrene	193-39-5	0.00108	0.0033	0.018	0.05	--	C	3.00E-02	3.00E-02	C	3.90E+00	3.90E+00	C	2.20E-01	2.20E-01	--	1.00E-01	1.70E-02
Naphthalene	91-20-3	0.00158	0.0033	0.01	0.05	--	N	6.50E+00	6.50E-01	N	2.00E+04	2.00E+03	N	1.60E+03	1.60E+02	1.10E+00	1.00E-01	1.80E-01
Pyrene	129-00-0	0.00072	0.0033	0.024	0.05	--	N	1.80E+02	1.80E+01	N	3.10E+04	3.10E+03	N	2.30E+03	2.30E+02	2.50E-02	1.00E-01	2.00E-01

Notes:

(a) Method Detection Limits and Reporting Limits provided by Empirical Laboratories, LLC

(b) USEPA Region 3 Risk-based Concentrations (October 2007)

(c) BTAG Screening Levels [1995 (soil), 2004 (surface water and sediment)].

Acronyms:

-- = Screening level unavailable.

BTAG = Biological Technical Assistance Group

CAS = Chemical Abstract Service

C!/N = RBC at HI of 0.1 < RBC-c; RBC from alternate RBC table.

C= RBC based cancer endpoint.

MCL = Maximum Contaminant Level

MDL = Method Detection Limit

mg/kg = Milligram Per kilogram

N = RBC based on non-carcinogenic endpoint.

PCBs = Polychlorinated Biphenyls

RBC = USEPA Region III Risk

RL = Reporting Limit

SVOC = Semivolatile organic compound

TCL = Target Compound List

ug/L = Microgram Per liter

Table 8-3
Summary of Analyte Detection Limits, Reporting Limits, and Risk Screening Levels for TAL Metals
(Methods 6010, 6020, 7470)
Soil and Water Samples MQAP Addendum - PBC2
Radford Army Ammunition Plant,
Radford Virginia

Compound	CAS Number	Laboratory-Specific Method Detection and Reporting Limits (a)				USEPA MCLs	USEPA Region III Risk-Based Concentrations (b)									USEPA Region III BTAG Screening Levels (c)		
		Soil		Water			Tap Water			Soil Industrial			Soil Residential			Aqueous Fresh Water	Soil	Sediment
		MDL	Reporting Limit	MDL	Reporting Limit	MCL	C/N	RBC	Adjusted RBC	C/N	RBC	Adjusted RBC	C/N	RBC	Adjusted RBC			
		mg/kg	mg/kg	ug/L	ug/L	ug/L		ug/L	ug/L		mg/kg	mg/kg		mg/kg	mg/kg	ug/L	mg/kg	mg/kg
Aluminum	7429-90-5	15	40	75	200		N	3.70E+04	3.70E+03	N	1.00E+06	1.00E+05	N	7.80E+04	7.80E+03	8.70E+01	1.00E+00	--
Antimony	7440-36-0	1	3	5	15	6.00E+00	N	1.50E+01	1.50E+00	N	4.10E+02	4.10E+01	N	3.10E+01	3.10E+00	3.00E+01	4.80E-01	2.00E+00
Arsenic	7440-38-2	0.6	2	3	10	1.00E+01	C	4.50E-02	4.50E-02	C	1.90E+00	1.90E+00	C	4.30E-01	4.30E-01	5.00E+00	3.30E+02	9.80E+00
Barium	7440-39-3	1	40	5	200	2.00E+03	N	7.30E+03	7.30E+02	N	2.00E+05	2.00E+04	N	1.60E+04	1.60E+03	4.00E+00	4.40E+02	--
Beryllium	7440-41-7	0.2	1	1	5	4.00E+00	N	7.30E+01	7.30E+00	N	2.00E+03	2.00E+02	N	1.60E+02	1.60E+01	6.60E-01	2.00E-02	--
Cadmium	7440-43-9	0.2	1	1	5	5.00E+00	N	1.80E+01	1.80E+00	N	5.10E+02	5.10E+01	N	3.90E+01	3.90E+00	2.50E-01	2.50E+00	9.90E-01
Calcium	7440-70-2	200	1000	1000	5000	--	--	--	--	--	-	--	--	--	--	1.20E+05	--	--
Chromium	7440-47-3	0.4	2	2	10	1.00E+02	N	1.10E+02	1.10E+01	N	3.10E+03	3.10E+02	N	2.30E+02	2.30E+01	8.50E+01	7.50E-03	4.30E+01
Cobalt	7440-48-4	1	3	5	15	--	--	--	--	--	-	--	--	--	--	2.30E+01	1.00E+02	5.00E+01
Copper	7440-50-8	1	5	5	25	1.30E+03	N	1.50E+03	1.50E+02	N	4.10E+04	4.10E+03	N	3.10E+03	3.10E+02	9.00E+00	1.50E+01	3.20E+01
Cyanide	57-12-5	0.25	10	0.125	5	2.00E+02	N	7.30E+02	7.30E+01	N	2.00E+04	2.00E+03	N	1.60E+03	1.60E+02	5.00E+00	5.00E-03	1.00E-01
Iron	7439-89-6	6	20	30	100	--	N	2.60E+04	2.60E+03	N	7.20E+05	7.20E+04	N	5.50E+04	5.50E+03	3.00E+02	1.20E+01	2.00E+04
Lead[2]	7439-92-1	0.3	0.6	1.5	3	1.50E+01	--	--	--	--	7.50E+02	7.50E+02	--	4.00E+02	4.00E+02	2.50E+00	1.00E-02	3.60E+01
Magnesium	7439-95-4	200	1000	1000	5000	--	--	--	--	--	-	--	--	--	--	8.20E+04	4.40E+03	--
Manganese	7439-96-5	0.6	3	5	15	--	N	7.30E+02	7.30E+01	N	2.00E+04	2.00E+03	N	1.60E+03	1.60E+02	1.20E+02	3.30E+02	4.60E+02
Mercury[3]	7439-97-6	0.013	0.033	0.08	0.2	2.00E+00	--	--	--	N	3.10E+02	3.10E+01	N	2.30E+01	2.30E+00	1.00E-01	5.80E-02	1.80E-01
Nickel	7440-02-0	1	8	5	10	--	N	7.30E+02	7.30E+01	N	2.00E+04	2.00E+03	N	1.60E+03	1.60E+02	5.20E+01	2.00E+00	2.30E+01
Potassium	7440-09-7	200	500	1000	2000	--	--	--	--	--	-	--	--	--	--	--	--	--
Selenium	7782-49-2	0.6	1	5	10	5.00E+01	N	1.80E+02	1.80E+01	N	5.10E+03	5.10E+02	N	3.90E+02	3.90E+01	1.00E+00	1.80E+00	2.00E+00
Silver	7440-22-4	0.2	2	2	10	--	N	1.80E+02	1.80E+01	N	5.10E+03	5.10E+02	N	3.90E+02	3.90E+01	3.20E+00	9.80E-06	1.00E+00
Sodium	7440-23-5	200	1000	1000	5000	--	--	--	--	--	-	--	--	--	--	6.80E+05	--	--
Thallium	7440-28-0	0.6	2	3	10	2.00E+00	N	2.60E+00	2.60E-01	N	7.20E+01	7.20E+00	N	5.50E+00	5.50E-01	8.00E-01	1.00E-03	--

Table 8-3
Summary of Analyte Detection Limits, Reporting Limits, and Risk Screening Levels for TAL Metals
(Methods 6010, 6020, 7470)
Soil and Water Samples MQAP Addendum - PBC2
Radford Army Ammunition Plant,
Radford Virginia

Compound	CAS Number	Laboratory-Specific Method Detection and Reporting Limits (a)				USEPA MCLs	USEPA Region III Risk-Based Concentrations (b)									USEPA Region III BTAG Screening Levels (c)		
		Soil		Water			Tap Water			Soil Industrial			Soil Residential			Aqueous Fresh Water	Soil	Sediment
		MDL	Reporting Limit	MDL	Reporting Limit	MCL	C/N	RBC	Adjusted RBC	C/N	RBC	Adjusted RBC	C/N	RBC	Adjusted RBC			
		mg/kg	mg/kg	ug/L	ug/L	ug/L		ug/L	ug/L		mg/kg	mg/kg		mg/kg	mg/kg	ug/L	mg/kg	mg/kg
Vanadium	7440-62-2	1	10	5	50	--	N	3.70E+01	3.70E+00	N	1.00E+03	1.00E+02	N	7.80E+01	7.80E+00	2.00E+01	5.00E-01	--
Zinc	7440-66-6	1	4	10	20	--	N	1.10E+04	1.10E+03	N	3.10E+05	3.10E+04	N	2.30E+04	2.30E+03	1.20E+02	1.00E+01	1.20E+02

Notes:

(a) Method Detection Limits and Reporting Limits provided by Empirical Laboratories, LLC

(b) USEPA Region 3 Risk-based Concentrations (October 2007)

(c) BTAG Screening Levels [1995 (soil), 2004 (surface water and sediment)].

Acronyms:

-- = Screening level unavailable.
BTAG = Biological Technical Assistance Group
CAS = Chemical Abstract Service
C!/N = RBC at HI of 0.1 < RBC-c; RBC from alternate RBC table.
C= RBC based cancer endpoint.
MCL = Maximum Contaminant Level
MDL = Method Detection Limit
mg/kg = Milligram Per kilogram
N = RBC based on non-carcinogenic endpoint.
PCBs = Polychlorinated Biphenyls
RBC = USEPA Region III Risk
RL = Reporting Limit
TCL = Target Compound List
ug/L = Microgram Per liter

Table 8-4
Summary of Analyte MDLs, Reporting Limits, and Risk Screening Levels for TCL Pesticides (8081A), and PCBs (8082), and Herbicides (8151)
Radford Army Ammunition Plant, Radford, Virginia

	CAS Number	Laboratory-Specific Method Detection and Reporting Limits (a)				USEPA MCLs	USEPA Region III Risk-Based Concentrations (b)									USEPA Region III BTAG Screening Levels (c)		
		Soil		Water			Tap Water			Soil Industrial			Soil Residential			Aqueous Fresh Water	Soil	Sediment
		MDL	Reporting Limit	MDL	Reporting Limit	MCL	C/N	RBC	Adjusted RBC	C/N	RBC	Adjusted RBC	C/N	RBC	Adjusted RBC			
		mg/kg	mg/kg	ug/L	ug/L	ug/L		ug/L	ug/L		mg/kg	mg/kg		mg/kg	mg/kg	ug/L	mg/kg	mg/kg
Pesticides by Method 8081A																		
4,4'-DDD	72-54-8	0.0002	0.0005	0.005	0.015		C	2.80E-01	2.80E-01	C	1.20E+01	1.20E+01	C	2.70E+00	2.70E+00	1.10E-02	1.00E-01	4.90E-03
4,4'-DDE	72-55-9	0.0002	0.0005	0.005	0.015	--	C	2.00E-01	2.00E-01	C	8.40E+00	8.40E+00	C	1.90E+00	1.90E+00	--	1.00E-01	3.20E-03
4,4'-DDT	50-29-3	0.0002	0.0005	0.005	0.015	--	C	2.00E-01	2.00E-01	C	8.40E+00	8.40E+00	C	1.90E+00	1.90E+00	1.00E-03	1.00E-01	--
Aldrin	309-00-2	0.0002	0.0005	0.005	0.015	--	C	3.90E-03	3.90E-03	C	1.70E-01	1.70E-01	C	3.80E-02	3.80E-02	3.00E+00	1.00E-01	2.00E-03
alpha-BHC	319-84-6	0.0002	0.0005	0.005	0.015	--	C	1.10E-02	1.10E-02	C	4.50E-01	4.50E-01	C	1.00E-01	1.00E-01	--	1.00E+02	6.00E-03
alpha-Chlordane	5103-71-9	0.0002	0.0005	0.005	0.015	--	C	1.90E-01	1.90E-01	C	8.20E+00	8.20E+00	C	1.80E+00	1.80E+00	--	1.00E-01	--
gamma-Chlordane	5103-74-2	0.0002	0.0005	0.005	0.015	--	C	1.90E-01	1.90E-01	C	8.20E+00	8.20E+00	C	1.80E+00	1.80E+00	--	1.00E-01	--
beta-BHC	319-85-7	0.0002	0.0005	0.005	0.015	--	C	3.70E-02	3.70E-02	C	1.60E+00	1.60E+00	C	3.50E-01	3.50E-01	--	1.00E+02	5.00E-03
delta-BHC	319-86-8	0.0002	0.0005	0.005	0.015	--	C	1.10E-02	1.10E-02	C	4.50E-01	4.50E-01	C	1.00E-01	1.00E-01	1.40E+02	1.00E+02	6.40E+00
Dieldrin	60-57-1	0.0002	0.0005	0.005	0.015	--	C	4.20E-03	4.20E-03	C	1.80E-01	1.80E-01	C	4.00E-02	4.00E-02	5.60E-02	1.00E-01	1.90E-03
Endosulfan I	959-98-8	0.0002	0.0005	0.005	0.015	--	N	2.20E+02	2.20E+01	N	6.10E+03	6.10E+02	N	4.70E+02	4.70E+01	5.10E-02	-	2.90E-03
Endosulfan II	33213-65-9	0.0002	0.0005	0.005	0.015	--	N	2.20E+02	2.20E+01	N	6.10E+03	6.10E+02	N	4.70E+02	4.70E+01	5.10E-02	-	1.40E-02
Endosulfan sulfate	1031-07-8	0.0002	0.0005	0.005	0.015	--	N	2.20E+02	2.20E+01	N	6.10E+03	6.10E+02	N	4.70E+02	4.70E+01	--	-	5.40E-03
Endrin	72-20-8	0.0002	0.0005	0.005	0.015	2.00E+00	N	1.10E+01	1.10E+00	N	3.10E+02	3.10E+01	N	2.30E+01	2.30E+00	3.60E-02	1.00E-01	2.20E-03
Endrin aldehyde	7421-93-4	0.0002	0.0005	0.005	0.015	--	N	1.10E+01	1.10E+00	N	3.10E+02	3.10E+01	N	2.30E+01	2.30E+00	--	1.00E-01	--
Endrin ketone	53494-70-5	0.0002	0.0005	0.005	0.015	--	N	1.10E+01	1.10E+00	N	3.10E+02	3.10E+01	N	2.30E+01	2.30E+00	--	1.00E-01	--
gamma-BHC (Lindane)	58-89-9	0.0002	0.0005	0.005	0.015	2.00E-01	C	5.20E-02	5.20E-02	C	2.20E+00	2.20E+00	C	4.90E-01	4.90E-01	--	1.00E-01	--
Heptachlor	76-44-8	0.0002	0.0005	0.005	0.015	4.00E-01	C	1.50E-02	1.50E-02	C	6.40E-01	6.40E-01	C	1.40E-01	1.40E-01	3.80E-03	1.00E-01	6.80E-02
Heptachlor epoxide	1024-57-3	0.0002	0.0005	0.005	0.015	2.00E-01	C	7.40E-03	7.40E-03	C	3.10E-01	3.10E-01	C	7.00E-02	7.00E-02	3.80E-03	1.00E-01	2.50E-03
Methoxychlor	72-43-5	0.0002	0.0005	0.005	0.015	4.00E+01	N	1.80E+02	1.80E+01	N	5.10E+03	5.10E+02	N	3.90E+02	3.90E+01	1.90E-02	1.00E-01	1.90E-02
Toxaphene	8001-35-2	0.011	0.033	0.33	1	3.00E+00	C	6.10E-02	6.10E-02	C	2.60E+00	2.60E+00	C	5.80E-01	5.80E-01	2.00E-04	-	1.00E-03
Polychlorinated Biphenyls by Method 8082																		
Aroclor 1016	12674-11-2	0.005	0.017	0.125	0.5	0.5	C!/N	9.60E-01	2.60E-01	C!/N	4.10E+01	7.20E+00	N	5.50E+00	5.50E-01	7.40E-05	1.00E-01	--
Aroclor 1221	11104-28-2	0.005	0.017	0.125	0.5	0.5	C	3.30E-02	3.30E-02	C	1.40E+00	1.40E+00	C	3.20E-01	3.20E-01	7.40E-05	1.00E-01	--
Aroclor 1232	11141-16-5	0.005	0.017	0.125	0.5	0.5	C	3.30E-02	3.30E-02	C	1.40E+00	1.40E+00	C	3.20E-01	3.20E-01	7.40E-05	1.00E-01	--
Aroclor 1242	53469-21-9	0.005	0.017	0.125	0.5	0.5	C	3.30E-02	3.30E-02	C	1.40E+00	1.40E+00	C	3.20E-01	3.20E-01	7.40E-05	1.00E-01	--
Aroclor 1248	12672-29-6	0.005	0.017	0.125	0.5	0.5	C	3.30E-02	3.30E-02	C	1.40E+00	1.40E+00	C	3.20E-01	3.20E-01	7.40E-05	1.00E-01	--
Aroclor 1254	11097-69-1	0.005	0.017	0.125	0.5	0.5	C	3.30E-02	3.30E-02	C	1.40E+00	1.40E+00	C!/N	3.20E-01	1.60E-01	7.40E-05	1.00E-01	--
Aroclor 1260	11096-82-5	0.005	0.017	0.125	0.5	0.5	C	3.30E-02	3.30E-02	C	1.40E+00	1.40E+00	C	3.20E-01	3.20E-01	7.40E-05	1.00E-01	--
Herbicides by Method 8151																		
2,4,5-T	93-76-5	0.0025	0.0075	0.025	0.075	--	N	3.65E+02	3.65E+01	N	1.02E+04	1.02E+03	N	7.82E+02	7.82E+01	686	--	12.3
2,4,5-TP (Silvex)	93-72-1	0.025	0.0075	0.025	0.075	5.00E+01	N	2.92E+02	2.92E+01	N	8.18E+03	8.18E+02	N	6.26E+02	6.26E+01	30	--	0.675
2,4-D	94-75-7	0.025	0.075	0.25	0.75	7.00E+01	N	3.65E+02	3.65E+01	N	1.02E+04	1.02E+03	N	7.82E+02	7.82E+01	--	--	--
2-4-DB	94-82-6	0.025	0.075	0.25	0.75	--	N	2.92E+02	2.92E+01	N	8.18E+03	8.18E+02	N	6.26E+02	6.26E+01	--	--	--

Table 8-4
Summary of Analyte MDLs, Reporting Limits, and Risk Screening Levels for TCL Pesticides (8081A), and PCBs (8082), and Herbicides (8151)
Radford Army Ammunition Plant, Radford, Virginia

	CAS Number	Laboratory-Specific Method Detection and Reporting Limits (a)				USEPA MCLs	USEPA Region III Risk-Based Concentrations (b)									USEPA Region III BTAG Screening Levels (c)		
		Soil		Water			Tap Water			Soil Industrial			Soil Residential			Aqueous Fresh Water	Soil	Sediment
		MDL	Reporting Limit	MDL	Reporting Limit	MCL	C/N	RBC	Adjusted RBC	C/N	RBC	Adjusted RBC	C/N	RBC	Adjusted RBC			
		mg/kg	mg/kg	ug/L	ug/L	ug/L		ug/L	ug/L		mg/kg	mg/kg		mg/kg	mg/kg	ug/L	mg/kg	mg/kg
Dalapon	75-99-0	0.0625	0.19	0.625	1.9	2.00E+02	N	1.10E+03	1.10E+02	N	3.07E+04	3.07E+03	N	2.35E+03	2.35E+02	--	--	--
Dicamba	1918-00-9	0.0625	0.19	0.625	1.9	--	N	1.10E+03	1.10E+02	N	3.07E+04	3.07E+03	N	2.35E+03	2.35E+02	--	--	--
Dichlorprop	120-36-5	0.025	0.075	0.25	0.75	--	--	--	--	--	--	--	--	--	--	--	--	--
Dinoseb	88-85-7	0.0125	0.038	0.125	0.38	7.00E+00	N	3.65E+01	3.65E+00	N	1.02E+03	1.02E+02	N	7.82E+01	7.82E+00	0.05	--	0.000611
MCPA	94-74-6	2.5	7.5	25	75	--	N	1.83E+01	1.83E+00	N	5.11E+02	5.11E+01	N	3.91E+01	3.91E+00	--	--	--
MCPP (Mecoprop)	93-65-2	2.5	7.5	25	75	--	N	3.65E+01	3.65E+00	N	1.02E+03	1.02E+02	N	7.82E+01	7.82E+00	--	--	--

Notes:
(a) Method Detection Limits and Reporting Limits provided by Empirical Laboratories, LLC
(b) USEPA Region 3 Risk-based Concentrations (October 2007)
(c) BTAG Screening Levels [1995 (soil), 2004 (surface water and sediment)].

Acronyms:
-- = Screening level unavailable.
BTAG = Biological Technical Assistance Group
CAS = Chemical Abstract Service
C!/N = RBC at HI of 0.1 < RBC-c; RBC from alternate RBC table.
C= RBC based cancer endpoint.
MCL = Maximum Contaminant Level
MDL = Method Detection Limit
mg/kg = Milligram Per kilogram
N = RBC based on non-carcinogenic endpoint.
PCBs = Polychlorinated Biphenyls
RBC = USEPA Region III Risk
RL = Reporting Limit
TCL = Target Compound List
ug/L = Microgram Per liter

Table 8-5
Summary of Analyte Detection Limits, Reporting Limits, and Risk Screening Levels for Explosives (Methods 8330, 8330M, and 8332)
Soil and Water Samples MQAP Addendum - PBC2
Radford Army Ammunition Plant,
Radford, Virginia

	CAS Number	Laboratory-Specific Method Detection and Reporting Limits (a)				USEPA MCLs	USEPA Region III Risk-Based Concentrations (b)									USEPA Region III BTAG Screening Levels (c)		
		Soil		Water			Tap Water			Soil Industrial			Soil Residential			Aqueous Fresh Water	Soil	Sediment
		MDL	Reporting Limit	MDL	Reporting Limit	MCL	C/N	RBC	Adjusted RBC	C/N	RBC	Adjusted RBC	C/N	RBC	Adjusted RBC			
		mg/k	mg/kg	ug/L	ug/L	ug/L		ug/L	ug/L		mg/kg	mg/kg		mg/kg	mg/kg	ug/L	mg/k	mg/kg
Compounds by Method 8330																		
1,3,5-Trinitrobenzene	99-35-4	0.1	0.5	0.1	0.5	NA	N	1.1E+03	1.1E+02	N	3.1E+04	3.1E+03	N	2.3E+03	2.3E+02	--	--	--
1,3-Dinitrobenzene	99-65-0	0.1	0.5	0.1	0.36	NA	N	3.7E+00	3.7E-01	N	1.0E+02	1.0E+01	N	7.8E+00	7.8E-01	--	--	--
2,4,6-Trinitrotoluene	118-96-7	0.1	0.5	0.1	0.5	NA	C/N	2.2E+00	1.8E+00	C!/N	9.5E+01	5.1E+01	C!/N	2.1E+01	3.9E+00	1.0E+02	--	9.2E-02
2,4-Dinitrotoluene	121-14-2	0.13	0.5	0.1	0.5	NA	N	7.3E+01	7.3E+00	N	2.0E+03	2.0E+02	N	1.6E+02	1.6E+01	4.4E+01	--	4.2E-02
2,6-Dinitrotoluene	606-20-2	0.13	0.5	0.1	0.5	NA	N	3.7E+01	3.7E+00	N	1.0E+03	1.0E+02	N	7.8E+01	7.8E+00	8.1E+01	--	--
2-Amino-4,6-dinitrotoluene	35572-78-2	0.15	0.5	0.1	0.5	NA	N	7.3E+01	7.3E+00	N	2.0E+03	2.0E+02	N	1.6E+02	1.6E+01	1.5E+03	--	--
2-Nitrotoluene	88-72-2	0.1	0.5	0.1	0.5	NA	N	6.1E+01	6.1E+00	N	1.0E+04	1.0E+03	N	7.8E+02	7.8E+01		--	--
3-Nitrotoluene	99-08-1	0.15	0.5	0.1	0.5	NA										7.5E+02	--	--
4-Amino-2,6-dinitrotoluene	1946-51-0	0.1	0.5	0.1	0.5	NA	N	7.3E+01	7.3E+00	N	2.0E+03	2.0E+02	N	1.6E+02	1.6E+01		--	--
4-Nitrotoluene	99-99-0	0.1	0.5	0.1	0.5	NA										1.9E+03	--	4.1E+00
HMX	2691-41-0	0.1	0.5	0.1	0.5	NA	N	1.8E+03	1.8E+02	N	5.1E+04	5.1E+03	N	3.9E+03	3.9E+02	1.5E+02	--	--
Nitrobenzene	98-95-3	0.11	0.5	0.1	0.33	NA	N	3.5E+00	3.5E-01	N	5.1E+02	5.1E+01	N	3.9E+01	3.9E+00		--	--
RDX	121-82-4	0.1	0.5	0.1	0.5	NA	C	6.1E-01	6.1E-01	C	2.6E+01	2.6E+01	C	5.8E+00	5.8E+00	3.6E+02	--	1.3E-02
Tetryl (Methyl-2,4,6-trinitrophenylnitramine)	479-45-8	0.1	0.5	0.1	0.5	NA	N	1.5E+02	1.5E+01	N	4.1E+03	4.1E+02	N	3.1E+02	3.1E+01	--	--	--
PETN	78-11-5	1.6	5	1.3	5	NA	--	--	--	--	--	--	--	--	--	8.5E+04	--	--
Compound by Method 8332																		
Nitroglycerin	55-63-0	1.6	4.8	1.3	4.8	NA	N	3.7E+00	3.7E-01	N	1.0E+02	1.0E+01	N	7.8E+00	7.8E-01	1.4E+02	--	--

Notes:
(a) Method Detection Limits and Reporting Limits provided by Empirical Laboratories, LLC
(b) USEPA Region 3 Risk-based Concentrations (October 2007)
(c) BTAG Screening Levels [1995 (soil), 2004 (surface water and sediment)].

Acronyms:
-- = Screening level unavailable.
BTAG = Biological Technical Assistance Group
C!/N = RBC at HI of 0.1 < RBC-c; RBC from alternate RBC table.
C= RBC based cancer endpoint.
CAS = Chemical Abstract Service
HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
MCL = Maximum Contaminant Level
MDL = Method Detection Limit
mg/kg = Milligram Per kilogram
N = RBC based on non-carcinogenic endpoint.
PCBs = Polychlorinated Biphenyls
RBC = USEPA Region III Risk
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine
RL = Reporting Limit
TCL = Target Compound List
ug/L = Microgram Per liter

Table 8-6
Summary of Analyte Detection Limits, Reporting Limits, and Risk Screening Levels for Dioxin/Furans (Mehtod 8290)
Soil and Water Samples PBC2 Project QAPP Addendum
Radford Army Ammnunition Plant,
Radford, Virginia

Dioxins and Furans by Method 8290	CAS Number	Laboratory-Specific Method Detection and Reporting Limits				USEPA MCLs	USEPA Region III Risk-Based Concentrations									USEPA Region III BTAG Screening Levels		
		Soil		Water			Tap Water			Soil Industrial			Soil Residential			Aqueous Fresh Water	Soil	Sediment
		MDL	Reporting Limit	MDL	Reporting Limit	MCL	C/N	RBC	Adjusted RBC	C/N	RBC	Adjusted RBC	C/N	RBC	Adjusted RBC			
		ppt	ppt	ppq	ppq	ug/L		ug/L	ug/L		mg/kg	mg/kg		mg/kg	mg/kg	ug/L	mg/kg	mg/kg
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1746-01-6	0.0591	1	0.94	10	3.00E-05	C	4.46E-07	--	C	1.91E-05	--	C	4.26E-06	--	--	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	40321-76-4	0.288	5	0.963	50	--	--		--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)[a]	39227-28-6	0.187	5	1.23	50	--	C	1.08E-05	--	C	4.62E-04	--	C	1.03E-04	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)[a]	57653-85-7	0.276	5	2.06	50	--	C	1.08E-05	--	C	4.62E-04	--	C	1.03E-04	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)[a]	19408-74-3	0.288	5	1.46	50	--	C	1.08E-05	--	C	4.62E-04	--	C	1.03E-04	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	35822-46-9	0.293	5	3.46	50	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	3268-87-9	0.644	10	1.03	100	--	--	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	51207-31-9	0.162	1	0.563	10	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	57117-41-6	0.367	5	2.25	50	--	--	--	--	--	--	--	--	--	--	--	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	57117-31-4	0.247	5	1.5	50	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	70648-26-9	0.336	5	2.59	50	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	57117-44-9	0.153	5	2.02	50	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	72918-21-9	1.05	5	2.16	50	--	--	--	--	--	--	--	--	--	--	--	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	60851-34-5	0.304	5	2.97	50	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	67562-39-4	0.604	5	1.79	50	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	55673-89-7	0.257	5	1.94	50	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,5,6,7,8-Octachlorodibenzofuran (OCDF)	39001-02-0	0.694	10	2.52	100	--	--	--	--	--	--	--	--	--	--	--	--	--

Notes:
CAS = Chemical Abstract Service
ppt = part per trillion
ppq = part per quadrillion
ug/L = Microgram Per liter
MDL = Method Detection Limit
RL = Reporting Limit
Method Detection Limits provided by SGS Environmental Services, Inc,
-- = No Risk Criteria Available

MCL = Maximum Contaminant Level
BTAG = Biological Technical Assistance Group
Soil - BTAG Screening Draft Values, 1995
Water - BTAG Freshwater Screening Values, 2004
Sediment - BTAG Sediment Screening Values, 2004
RBC = USEPA Region III Risk Based Concentration, Oct 2007
C/N = Carcinogenic /Noncarcinogenic
[a] = RBC value is for Hexachlorodibenzo-p-dioxin mix
[b] = Reporting limit was not low enough to meet screening criteria - but MDL does

Table 8-7
General Field Equipment and Calibration Procedures
Radford Army Ammunition Plant
Radford, Virginia

Instrument or Equipment	Description	Field Calibration Procedure	Performance Criteria	Responsible Personnel
pH/Conductivity, Temperature Meter	Meter designed for field use with battery operation. Range pH: 0 to 14 S.U. Range conductivity: 0 to 2,000 uS.	Instruments are factory-calibrated and automatically compensate for temperature. Calibration of the meters for pH will be completed each day immediately prior to use in accordance with ARCADIS SOPs T106 and/or T131 and the manufacturers recommendations. In general pH meter calibration will include two pH buffers bracketing expected pH range of samples to be measured (i.e. 7.00 and 4.00) with a verification of the slope using a third buffer (4.00 or 10.00) The electrode will be rinsed between buffers and stored in the manufacturer recommended solutions between field measurements. Conductivity calibrations are conducted similarly to the pH calibration utilizing two calibration standards and adjusting the meter to the appropriate values. Calibrations will be verified with a pH buffer at least every 4 hours and at the end of the sampling day.	pH +/- 0.01 S.U. Conductivity at +/- 2%FSD. The instrument will be checked with a pH buffer every 4 hours and at the end of the sampling day. If the response is greater than $\pm$ 0.2 S.U. from the standard, complete re-calibration will be conducted. Conductivity will be checked every 4 hours.	Sample Collection Personnel
pH/Conductivity, Temperature, Dissolved oxygen (DO), Oxidation/ Reduction (REDOX) Meter	YSI Model 600 XL probe with YSI Model 610-D display instrumentation or the QED FC4000. Units must automatically correct for salinity at low DO readings by estimating salinity from temperature and conductivity measurements, and then internally adjusting the DO reading. The probes must contain separate pH, temperature, conductivity, DO, and ORP probes in one unit.	Each day prior to use, the pH, specific conductance, DO, and ORP probes will be calibrated or tested for responsiveness in accordance with ARCADIS SOPs and the manufacturers recommendations. The pH probe will be calibrated utilizing two buffers (pH 7.00, then pH 4.00), and a verification buffer. The ORP probe is then calibrated with the ORP standard solution (Zobell), and the DO probe is checked with saturated air in accordance with manufacturers guidance The probes should be rinsed with deionized water between each calibration solution and following calibration. Used calibration solution is to be discarded. Finally, the conductivity probe is checked with a solution of known conductivity.	Turbidity and DO - +/- 10% pH +/- 0.01 S.U. Conductivity at +/- 2%FSD The instrument calibration will be verified every 4 hours and at the end of the sampling day. For pH, if the calibration check is greater than $\pm$ 0.2 S.U. from the true value, complete calibration will be conducted.	Project Geologist, Sample Collection Personnel

Table 8-7
General Field Equipment and Calibration Procedures
Radford Army Ammunition Plant
Radford, Virginia

Instrument or Equipment	Description	Field Calibration Procedure	Performance Criteria	Responsible Personnel
Turbidimeter	Nephelometer designed for field use with battery operation. Range 0.01 to 1000 NTU.	The unit is factory calibrated. Unit responsiveness will be checked prior to use each day with appropriate standards provided by the supplier. The responsiveness is checked on the 0 to 10 range, 0 to 100 range, and 0 to 1000 range.	+/- 10%	Sample Collection Personnel
HNU Photoionization Detector	Photoionization detector that is a portable, non-destructive trace gas analyzer. Units must be Class I, Division 2, Grade A,B,C,D. Unit must have rechargeable battery, range of 0 to 2000 ppm, and a 10.2 or 11.7 eV lamp. Calibration check gas (e.g., isobutylene must be provided with unit).	Instrument is calibrated internally prior to shipment from the warehouse or every 6 months, whichever is more frequent. In the field, HNUs will be calibrated at the start of each day in accordance with manufacturers instructions. If a significant change in weather occurs during the day (i.e., change in humidity or temperature) or if the unit is turned off for an extended period, the instrument will be recalibrated at prior to use. When an HNU is used to screen samples in the field, periodic ambient readings will also be recorded in the logbook. The general calibration procedure include: • Turn unit on and allow for five minute warm-up; • Set span control for probe being used (10.2 or 11.7); • Set function switch to standby position and adjust zero using zero adjust knob; • Set function switch to the 0 to 200 ppm range; • Connect the analyzer to the regulator and calibration gas cylinder • 0pen the regulator valve and allow the meter reading to stabilize; and • Using the span knob, adjust the meter to the concentration indicated on the calibration gas cylinder.	Meter must be able to adjust properly using the span knob or the lamp may require cleaning.	Site Safety Officer

Table 8-8
Field Quality Control Samples
Radford Army Ammunition Plant, Radford, Virginia

Control	Purpose of Sample	Collection Frequency
Field Duplicate	Ensure precision in sample homogeneity during collection and analysis	20% of field samples per matrix
Rinse Blank	Ensure the decontamination of sampling equipment has been adequately performed; to assess cross contamination and/or incidental contamination to the sample container	1 per 20 samples per matrix per sample technique
Temperature Blank	To verify sample cooler temperature upon receipt at the laboratory	1 per cooler
Trip Blank	To evaluate potential cross contamination of samples during transport or storage.	1 per cooler containing sample requiring VOC analyses

Table 8-9
Field Quality Control Elements Acceptance Criteria
Radford Army Ammunition Plant, Radford, Virginia

Item	DQO	Parameter	Frequency of Association	Criteria Goal
Field Duplicates	P, R	Organics	1 per 10 samples	RPD < 40% Aqueous; difference + RL* RPD < 60% Solid; difference + 2xRL*
Trip Blank	A,R	VOCs in water	1 per cooler with aqueous VOCs	No target analytes detected greater than the RL
Rinse Blank	A,R	Entire	1 per 20 samples per matrix per equipment type requiring decontamination	No target analytes detected greater than the RL
Chain of Custody Forms	R	Entire	Every sample	Filled out correctly to include signatures; no missing or incorrect information.
Representative Sampling Forms	R	Entire	Every sample	Filled out correctly to include signatures; no missing or incorrect information.
Field Logbook	R	Entire	Every sample	Filled out correctly to include analytical parameters; map file data; and applicable coding information.
Field Instrument Calibration Logs	A	Entire	Every measurement	Measurements must have associated calibration reference

A = Accuracy C = Comparability R = Representativeness P = Precision

Table 8-10
Analytical Quality Control Elements
Radford Army Ammunition Plant, Radford, Virginia

Item	DQO	Parameter	Frequency of Association	Criteria Requirement
Analytical Method	C	Entire	Each analysis	Method analyses based on USEPA methods as defined in Section 2.5
Chemical Data Packages	C	Entire	Each lot/batch	Pass peer review and formal QA/QC check.
Laboratory System Controls	A,C,P, R	Entire	During laboratory operations	No deficiencies
Holding Time	A,C,P, R	Entire	Each analysis	No deficiencies (Table 6-1)
Initial and Continuing Calibrations	A, P	Entire	As method applicable	Must meet method criteria and laboratory SOPs.
Method Blanks	A,R	Entire	Each lot/batch	No target analyte detected in the method blanks greater than RL
Laboratory Control Sample (LCS) and LSC Duplicate	A	Entire	Each lot/batch	Must meet criteria as defined in Tables 8-7 through 8-13
Matrix Spike MS, MS Duplicates, and Laboratory Replicates	A,P	Entire	Each lot/batch	Must meet criteria as defined in Tables 8-7 through 8-13
Surrogates	A	Entire	Organic fractions, including QC samples	Must meet criteria as defined in Tables 8-7 through 8-13
Serial dilution and Post Digestion Spike	A	Metals	Inorganic Fractions, Each lot/batch	Must meet criteria as defined in Table 8-10

Legend: A = Accuracy C = Comparability R = Representativeness P = Precision

Table 8-11
Quality Control Method Criteria for Volatile Organic Compounds by USEPA SW-846 8260B
Radford Army Ammunition Plant
Radford, Virginia

Procedure	Frequency	Acceptance Criteria		Corrective Action
Initial Calibration 5-pt curve (linear) 6-pt curve (2^o order)	Set-up, major maintenance, or for drift correction	RRF > 0.10/0.30 for SPCCs RSD < 30% for CCCs response factors RSD for analytes < 15% or r>0.995 (linear) or r^2>0.99 (2^o order)		Sample analysis cannot begin until this criterion is met. Data reviewer should review and judge each target compound against the acceptance criteria.
Initial Calibration Verification	Immediately following initial calibration	A second source full compliment target list with a percent recovery = 75-125%		Sample analysis cannot begin until this criterion is met.
Continuing Calibration Check	Every 12 hours	RRF > 0.10/0.30 for SPCCs %Difference for RF of CCCs ±30% from initial calibration. Mean for analytes < 20% as no individual target exceeds 40%D		Sample analysis cannot begin until this criterion is met. Data reviewer should review and judge each target compound against the acceptance criteria.
Method Blank	Every day/batch.	No target analytes greater than one half of the RL		Document source of contamination. Re-analysis is required for positive results associated with blank contamination.
Tuning BFB	Prior to calibration and every 12 hours	Must meet tuning criteria		Re-tune, re-calibrate, and re-analyze affected sample analyses.
Laboratory Control Spike	Every batch	Standards Full compliment target list	Laboratory generated control limits not to exceed recovery limits listed in the current version of the DOD QSM	Recoveries indicating a low bias require a re-extraction/reanalysis. Recoveries indicating a high bias require a re-extraction/re-analysis for associated positive field samples. Qualify associated data biased high or biased low as appropriate.
Internal Standards	Every sample	Recommended Standards fluorobenzene chlorobenzene-d5 1,4-dichlorobenzene-d4	Retention time ±30 seconds of mid point of initial calibration Area changes within a factor of two (-50% to +100%)	Inspect for malfunction. Demonstrate that system is functioning properly. Reanalyze samples associated with standards outside criteria. A third analytical run may be required at a dilution.

Table 8-11
Quality Control Method Criteria for Volatile Organic Compounds by USEPA SW-846 8260B
Radford Army Ammunition Plant
Radford, Virginia

Procedure	Frequency	Acceptance Criteria		Corrective Action
Surrogate	Every sample	Recommended Standards Toluene-d8 4-Bromofluorobenzene 1,2-Dichloroethane-d4	Laboratory generated control limits not to exceed those listed in the current version of the DOD QSM	If surrogate compounds do not meet criteria, there should be a re-analysis to confirm that the non-compliance is due to the sample matrix effects rather than laboratory deficiencies.
Matrix Spike and Duplicate	1 per 20 per matrix	Standards Full compliment target list	Laboratory generated control limits not to exceed recovery	If MS/MSD results do not meet criteria, the reviewer should review the data in

Table 8-12
Quality Control Method Criteria for Semi-volatile Organic Compounds by USEPA SW-846 8270C
Radford Army Ammunition Plant
Radford, Virginia

Procedure	Frequency	Acceptance Criteria		Corrective Action
Initial calibration 5-pt curve (linear) 6-pt curve (2^o order)	Set-up, major maintenance, or for drift correction	RRF > 0.05 for SPCCs RSD <30% for CCC compounds RSD for target analytes < 15% or r>0.995 (linear) or r^2>0.99 (2^o order)		Sample analysis cannot begin until this criterion is met. Data reviewer should review and judge each target compound against the acceptance criteria.
Initial Calibration Verification	Immediately following every initial calibration	A second source full compliment target list with a 80-120%		Sample analysis cannot begin until this criterion is met.
Continuing Calibration Check	12 hours	RRF > 0.05 for SPCCs %Difference for RF of CCCs ±30% from initial calibration Mean for analytes < 20% as no individual target exceeds 40%D		Sample analysis cannot begin until this criterion is met. Data reviewer should review and judge each target compound against the acceptance criteria.
Internal standards	Every sample	Retention time ±30 seconds from mid point of initial calibration Area changes by a factor of two (-50% to +100%)		Inspect for malfunction. Demonstrate that system is functioning properly. Reanalyze samples with internal standards outside criteria.
Tuning DFTPP	12 hours	Must meet tuning criteria.		Re-tune, re-calibrate, and re-analyze affected sample analyses.
Method Blank	Per extraction batch	No target analytes greater than one half of the RL		Document source of contamination. Re-extraction/re-analysis is required for positive results associated with blank contamination.
Laboratory Control Spike	Every batch	Standards Full compliment target list	Laboratory generated control limits not to exceed recovery limits listed in the current version of the DoD QSM	Recoveries indicating a low bias require a re-extraction/reanalysis. Recoveries indicating a high bias require a re-extraction/re-analysis for associated positive field samples. Qualify associated data biased high or biased low as appropriate.

Table 8-12
Quality Control Method Criteria for Semi-volatile Organic Compounds by USEPA SW-846 8270C
Radford Army Ammunition Plant
Radford, Virginia

Procedure	Frequency	Acceptance Criteria		Corrective Action
Internal Standards	Every sample	Recommended Standards phenanthrene-d10 chrysene-d12 perylene-d12 1,4-dichlorobenzene-d4 naphthalene-d8 acenaphthalene-d10	Retention time ±30 seconds of mid point of initial calibration Area changes within a factor of two (-50% to +100%)	Inspect for malfunction. Demonstrate that system is functioning properly. Reanalyze samples associated with standards outside criteria. A third analytical run may be required at a dilution.
Surrogate Spikes	Every sample	Recommended Standards nitrobenzene-d5 2-fluorobiphenyl p-terphenyl-d14 phenol-d5 2,4,6-tribromophenol 2-fluorophenol	Laboratory generated control limits not to exceed limits listed in the current version of the DoD QSM	If two base/neutral or acid surrogates are out of specification, or if one base/neutral or acid extractable surrogate has a recovery of less than 10%, then there should be a re-extraction and re-analysis to confirm that the non-compliance is due to sample matrix effects rather than laboratory deficiencies.
Matrix Spike and Duplicate	1 per 20 samples per matrix	Standards Full compliment target list	Laboratory generated control limits not to exceed recovery limits listed in the current version of the DoD QSM	If MS/MSD results do not meet criteria, the reviewer should review the data in conjunction with other QC results to identify whether the problem is specific to the QC samples or systematic.

Table 8-13
Quality Control Method Criteria for Explosives by USEPA SW-846 8330 and 8332
Radford Army Ammunition Plant
Radford, Virginia

Procedure	Frequency of QC Procedure	Acceptance Criteria	Corrective Action
Initial Calibration Curve 5-pt curve (linear) 6-pt curve (2^o order)	Set-up, major maintenance, or for drift correction for each column used for analysis	%RSD <20% or r>0.995 (linear) or r2>0.99 (2o order)	Sample analysis cannot begin until this criterion is met.
Initial Calibration Verification	Immediately following every initial calibration	A second source full compliment of target list with recovery = 80-120%	Sample analysis cannot begin until this criterion is met.
Continuing Calibration Check	Every ten samples or twelve hours	%D ± 15% of the response factor from the initial curve. The mean may be used as long as no individual target exceeds 30%D	Sample analysis cannot begin until this criterion is met. If criteria are not met, reanalyze the daily standard. If the daily standard fails a second time, initial calibration must be repeated. Data reviewer should review and judge each target compound against the acceptance criteria.
Method Blank	1 per batch	No target analytes detected greater than one half of the RL	Document source of contamination. Re-extraction/re-analysis is required for positive results associated with blank contamination.

Table 8-13
Quality Control Method Criteria for Explosives by USEPA SW-846 8330 and 8332
Radford Army Ammunition Plant
Radford, Virginia

Procedure	Frequency of QC Procedure	Acceptance Criteria		Corrective Action
Laboratory Control Spike	1 per batch	Standards Full compliment target list	Laboratory generated control limits not to exceed recovery limits listed in the current version of the DOD QSM	Recoveries indicating a low bias require a re-extraction/reanalysis. Recoveries indicating a high bias require a re-extraction/re-analysis for associated positive field samples. Qualify associated data biased high or biased low as appropriate.
Surrogate Spikes	Every sample	Standards A similar compound that is not expected to be found at the site	Laboratory generated control limits not to exceed limits listed in the current version of the DOD QSM	If surrogate compounds do not meet criteria, there should be a re-extraction and re-analysis to confirm that the non-compliance is due to the sample matrix effects rather than laboratory deficiencies.
Matrix Spike and Duplicate	1 per 20 samples per matrix	Standards Full compliment target list	Laboratory generated control limits not to exceed recovery limits listed in the current version of the DOD QSM	If MS/MSD results do not meet criteria, the reviewer should review the data in conjunction with other QC results to identify whether the problem is specific to the QC samples or systematic.

Table 8-13
Quality Control Method Criteria for Explosives by USEPA SW-846 8330 and 8332
Radford Army Ammunition Plant
Radford, Virginia

Procedure	Frequency of QC Procedure	Acceptance Criteria	Corrective Action
Target Analyte Confirmation	Every positive detection	RPD < 40%	Report the higher of the two concentrations unless a positive bias is apparent and qualify.

Table 8-14
Quality Control Method Criteria for Target Analyte List Metals by USEAP SW-846 6020/6010B/7471A/7470A/9010C/9012A
Radford Army Ammunition Plant
Radford, Virginia

Procedure	Frequency of QC Procedure	Acceptance Criteria		Corrective Action
Tune (MS) [6020]	Daily	Analyzed a minimum of four times with RSD < 5% for analytes in the solution.		Sample analysis cannot begin until this criterion is met.
Mass Calibration (MS) [6020]	Daily	Difference < 0.1 amu from true value.		Adjust to the correct value.
Resolution Check (MS) [6020]	Daily	Peak width <0.9 amu at 10% peak height		Sample analysis cannot begin until this criterion is met.
Initial Calibration Curve (MS, ICP, Hg, & CN)	Daily, major maintenance, or to correct drift.	MS & ICP Option 1: 1-standard and a blank with a low level standard at RL.	Low level check standard + 20%.	The standards for that element must be re-prepared and re-analyzed again.
		MS & ICP Option 2: 3-standards and a blank	r > 0.995 for each element	
		Hg - 5-standards and a blank	r > 0.995	
		CN - 6 standards and a blank	r > 0.995	
Distilled Standards (CN)	Once per calibration	One high and one low distilled standard within + 10% of the true value		Sample analysis cannot begin until this criterion is met.

Table 8-14
Quality Control Method Criteria for Target Analyte List Metals by USEAP SW-846 6020/6010B/7471A/7470A/9010C/9012A
Radford Army Ammunition Plant
Radford, Virginia

Procedure	Frequency of QC Procedure	Acceptance Criteria	Corrective Action
Initial Calibration Verification (MS, ICP, Hg, & CN)		MS & ICP - A second source full compliment of target list with a percent recovery = 90-110%	Sample analysis cannot begin until this criterion is met.
	Immediately following initial calibration.	Hg - A second source full compliment of target list with a percent recovery = 80-120%	
		CN - A second source full compliment of target list with a percent recovery = 85-115%	
Initial Calibration Blank (MS, ICP, Hg, & CN)	Immediately following initial calibration verification.	No target analytes detected at concentration above 2 X MDL.	Sample analysis cannot proceed until this criterion is met.
Interference Check (MS & ICP)	Beginning of each sample analytical run.	Recovery ±20% of true value.	Terminate the analysis, correct the problem, re-calibrate, re-verify the calibration, and reanalyze associated samples.
Continuing Calibration Check (MS, ICP, Hg, & CN)	Every 10 samples and end of analytical run.	MS & ICP - Recovery ±10%.	Reanalyze; if the CCV fails again, stop analysis, the problem corrected, the instrument recalibrated, and the calibration re-verified prior to continuing sample analyses.
		Hg - Recovery ±20%.	
		CN - Recovery ±15%.	

Table 8-14
Quality Control Method Criteria for Target Analyte List Metals by USEAP SW-846 6020/6010B/7471A/7470A/9010C/9012A
Radford Army Ammunition Plant
Radford, Virginia

Procedure	Frequency of QC Procedure	Acceptance Criteria		Corrective Action
Continuing Calibration Blank (MS, ICP, Hg, & CN)	Every 10 samples and end of analytical run.	No target analytes detected at concentration above 2 X MDL.		Sample sequence should not continue until this criterion is met. Demonstrate "clean". Affected samples will be reanalyzed.
Preparation Blank (MS, ICP, Hg, & CN)	1 per batch per matrix	No target analytes detected at concentration above one half of the RL.		Document source of contamination. Re-digestion/re-analysis is required for positive results associated with blank contamination, unless DQOs are still met.
Laboratory Control Sample (MS, ICP, Hg, & CN)	1 per batch per matrix	Standards Full compliment target list.	80-120% recovery Soil use generated limits	Recoveries indicating a low bias require a redigestion/ reanalysis. Recoveries indicating a high bias require a redigestion/ reanalysis for associated positive field samples. Qualify data biased high or biased low as appropriate.

Table 8-14
Quality Control Method Criteria for Target Analyte List Metals by USEAP SW-846 6020/6010B/7471A/7470A/9010C/9012A
Radford Army Ammunition Plant
Radford, Virginia

Procedure	Frequency of QC Procedure	Acceptance Criteria		Corrective Action
Matrix Spike and Duplicate or Sample Duplicate (MS, ICP, Hg, & CN)	1 per 20 samples per matrix	Standards Full compliment target list.	75-125% recovery; ICP & Hg: RPD<25%; CN: RPD<20%; MS: [analyte]>100xIDL - RPD<20%; Soil use generated limits	Qualify associated data biased high or biased low as appropriate.
Post Digestion Spike (PDS) (MS & ICP)	1 per 20 samples per matrix	Standards Full compliment target list.	75-125% recovery	
Serial Dilution (MS & ICP)	1 per 20 samples per matrix	Used to assess new matrices	For sample results > 5x RL for ICP or > 20x RL for MS, %D between diluted and undiluted sample result <10%.	Chemical or physical interference indicated. Investigate to identify cause.
Internal Standards (MS)	Every Analytical Sequence	Standards & Blanks	80-120% of initial calibration intensity	Terminate the analysis, correct the problem, re-calibrate, re-verify the calibration, and reanalyze associated samples.
		Samples	30-120% of initial calibration intensity	Reanalyze at consecutive five fold dilutions until criteria is met.

Table 8-15
Quality Control Method Criteria for Pesticides, Herbicides, and PCBs by USEPA SW-846 8081A, 8082 and 8151A
Radford Army Ammunition Plant
Radford, Virginia

Procedure	Frequency of QC Procedure	Acceptance Criteria	Corrective Action
Initial calibration curve 5-pt curve (linear) 6-pt curve (2o order)	Set-up, major maintenance	%RSD<20% or r>0.995 (linear) or r2>0.99 (2o order)	Sample analysis cannot begin until this criterion is met.
Initial Calibration Verification	Immediately following every initial calibration	A second source full compliment of target list with a percent recovery = 85-115%	Sample analysis cannot begin until this criterion is met.
Continuing Calibration Check	Bracketing samples	%D recovery ± 15% of the response factor from the initial curve or mean with no individual peak >30%	Sample analysis cannot begin until this criterion is met. If criteria are not met, reanalyze the daily standard. If the daily standard fails a second time, initial calibration must be repeated. Data reviewer should review and judge each target compound against the acceptance criteria.
Endrin/4,4-DDT Breakdown	Bracketing samples	endrin degradation <15%. 4,4-DDT degradation <15%.	If criterion is not met, system must be deactivated and the affected samples reanalyzed.
Instrument Blank	After continuing calibration and highly contaminated samples.	No target analytes detected greater than one half the RL.	Demonstrate "clean". Affected samples will be reanalyzed.
Method Blank	Per extraction batch	No target analytes detected greater than one half the RL.	Document source of contamination. Re-extraction/re-analysis is required for positive results associated with blank contamination.

Table 8-15
Quality Control Method Criteria for Pesticides, Herbicides, and PCBs by USEPA SW-846 8081A, 8082 and 8151A
Radford Army Ammunition Plant
Radford, Virginia

Procedure	Frequency of QC Procedure	Acceptance Criteria		Corrective Action
Laboratory Control Spike	Per extraction batch	Standards Full target list for 8081A and a mix of 1016 & 1260 for 8082	Laboratory generated control limits not to exceed limits listed in the current version of	Recoveries indicating a low bias require a re-extraction/reanalysis. Recoveries indicating a high bias require a re-extraction/re-analysis for associated positive field samples. Qualify associated data biased high or biased low as appropriate.
Surrogate Spikes	Every sample	Standards TCMX and DCB	Laboratory generated control limits not to exceed limits listed in the current version of DOD QSM	Investigate to assess cause, correct the problem, and document actions taken; re-extract and re-analyze sample. Specific method cleanups may be used to eliminate or minimize sample matrix effects. If still out, qualify.
Matrix Spike and Duplicate	1 per 20 samples per matrix	Standards Full target list for 8081A and a mix of 1016 & 1260 for 8082	Laboratory generated control limits	If MS/MSD results do not meet criteria, the reviewer should review the data in conjunction with other QC results to identify whether the problem is specific to
Target Analyte Confirmation	Every positive detection	RPD < 40%		Report the higher of the two concentrations unless a positive bias is apparent and qualify.

Table 8-16
Quality Control Method Criteria for Total Organic Carbon by Walkley-Black Method (Argonomy, Methods of Soil Analysis 29-3.5.2)
Radford Army Ammunition Plant
Radford, Virginia

Procedure	Frequency of QC Procedure	Acceptance Criteria	Corrective Action
Calibration (Titration Method)	Before Processing Samples a titration blank must be analyzed	0.5+/- 0.05N	If the titrant normality is not within the QC limit, clean the burette and remake the titrant solution and/or the 1N K2Cr2O7.
Laboratory Duplicate	1 per 20 samples or batch per matrix	RPD = 20%	If the RPD is out side the QC limit, it should be noted in the lab narrative.
Method Blank	1 per 20 samples or batch per matrix	No target analytes detected greater than the RL.	Document source of contamination. Re-extraction/re-analysis is required for positive results associated with blank contamination.
Laboratory Control Sample	1 per 20 samples per matrix	Laboratory generated control limits not to exceed recovery limits of 64-128%	Recoveries indicating a low bias require a re-extraction/reanalysis. Recoveries indicating a high bias require a re-extraction/re-analysis for associated positive field samples. Qualify associated data biased high or biased low as appropriate.
Matrix Spike and Duplicate	1 per 20 samples per batch, per matrix	Laboratory generated control limits not to exceed recovery limits of 68-142%	If MS/MSD results do not meet criteria, the reviewer should review the data in conjunction with other QC results to identify whether the problem is specific to the QC samples or systematic.

Table 8-17
Quality Control Method Criteria for General Chemistry Methods
Radford Army Ammunition Plant
Radford, Virginia

Procedure	Frequency of QC Procedure	Acceptance Criteria	Corrective Action
Initial calibration curve 5-pt curve	Major maintenance, instrument modification, per manufacturer's specifications	r>0.995 (linear) or r>0.99 (2^{o} order)	Sample analysis cannot begin until this criterion is met.
Initial Calibration Verification	Immediately following every initial calibration	Recovery ±10% of true value	Sample analysis cannot begin until this criterion is met. If criteria are not met, reanalyze the daily standards. If the ICV fails a second time, initial calibration must be repeated.
Continuing Calibration Check	Every 10 samples, end of analytical run	Recovery ±10% of true value	Sample analysis cannot proceed until this criterion is met. Reanalyze CCC. If the CCC fails second time, the analysis must be terminated, the problem corrected, the instrument re-calibrated, and the calibration re-verified prior to continuing sample analyses.
Continuing Calibration Blank	Every 10 samples, end of analytical run	No target analytes detected greater than the RL.	If not within criteria, terminate the analysis, correct the problem, re-calibrate, and reanalyze each sample analyzed since the last acceptable CCB.

Table 8-17
Quality Control Method Criteria for General Chemistry Methods
Radford Army Ammunition Plant
Radford, Virginia

Procedure	Frequency of QC Procedure	Acceptance Criteria	Corrective Action
Method Blank	1 per 20 samples or batch per matrix	No target analytes detected greater than the RL.	Document source of contamination. Re-extraction/re-analysis is required for positive results associated with blank contamination.
Laboratory Control Sample	1 per 20 samples per matrix	Laboratory generated control limits not to exceed recovery limits of 75-125% or RPD of 30%	Recoveries indicating a low bias require a re-extraction/reanalysis. Recoveries indicating a high bias require a re-extraction/re-analysis for associated positive field samples. Qualify associated data biased high or biased low as appropriate.
Matrix Spike and Duplicate	1 per 20 samples per batch, per matrix	Laboratory generated control limits not to exceed recovery limits of 60-140% or RPD of 30%	If MS/MSD results do not meet criteria, the reviewer should review the data in conjunction with other QC results to identify whether the problem is specific to the QC samples or systematic.

Figures

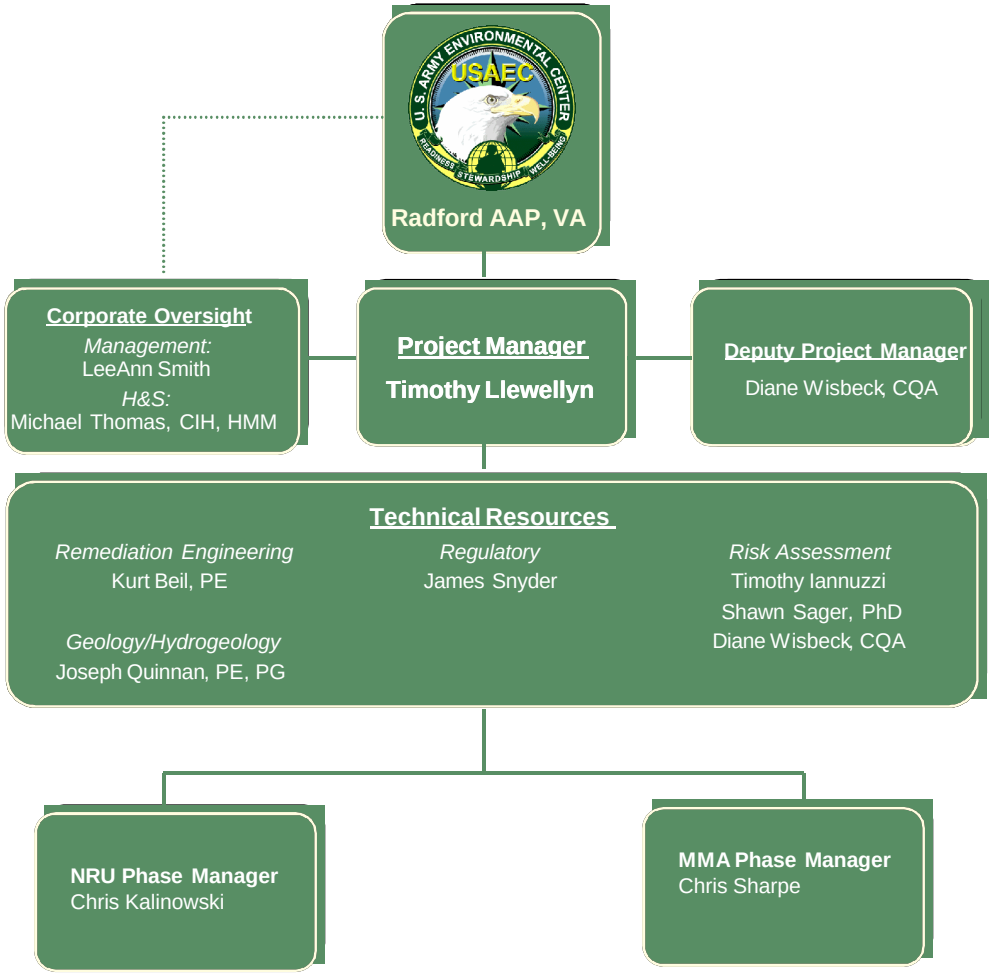


Figure 4-1
Project Organization Chart
Radford Army Ammunition Plant
Radford, Virginia

Appendix B

Quality Assurance Manual
Air Toxics Laboratory

(Provided on CD)

Table B-1
Historical Soil Sampling Results, Northern Burning Ground
New River Unit, Radford Army Ammunition Plant, Radford Virginia

Location ID:	Regional Screening Level (Residential)	Regional Screening Level (Industrial)	Facility-Wide Background	TCLP Standards	Units	NBGDW1	NBGDW2	NBGDW3	NBGDW4	NBGDW5	NBGDW6	NBGDW7	NBGDW8	NBGDW9	NBGDW10	NBGDW11	NBGDW12	NBGDW13	NBGSB1	NBGSB1	NBGSB1	NBGSB2	NBGSB2	NBGSB3	NBGSB3
Sample Depth(Feet):						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	0.5 - 1.5	8 - 10	53 - 55	0 - 2	5 - 6	0.5 - 1.5	5 - 6
Date Collected:						05/26/99	05/26/99	08/18/99	08/17/99	08/19/99	08/19/99	08/19/99	08/19/99	08/19/99	08/19/99	08/19/99	08/19/99	08/19/99	08/04/98	08/04/98	08/04/98	08/04/98	08/04/98	08/04/98	08/04/98
Dioxin/Furan																									
1,2,3,4,6,7,8-HpCDD [a]	0.00039	0.0016	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8-HpCDF [b]	0.00032	0.0011	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8,9-HpCDF [b]	0.00032	0.0011	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-HxCDD [c]	0.000039	0.00016	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-HxCDF [d]	0.000032	0.00011	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-HxCDD [c]	0.000039	0.00016	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-HxCDF [d]	0.000032	0.00011	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-HxCDD [c]	0.000039	0.00016	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-HxCDF [d]	0.000032	0.00011	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-PeCDD [e]	0.0000039	0.000016	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-PeCDF	0.00011	0.00038	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,6,7,8-HxCDF [d]	0.000032	0.00011	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,7,8-PeCDF	0.000011	0.000038	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-TCDD	0.0000045	0.000018	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-TCDF	0.000032	0.00011	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
OCDD	0.013	0.053	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
OCDF	0.011	0.038	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total HpCDDs	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total HpCDFs	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total HxCDDs	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total HxCDFs	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total PeCDDs	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total PeCDFs	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total TCDDs	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total TCDFs	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Explosives																									
None Detected	- -	- -	- -	- -	- -	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	- -	- - [- -]	- -	- -	- -	- -	- -
Herbicides																									
2,4,5-T	610	6,200	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-D	690	7,700	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-DB	490	4,900	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dalapon	1,800	18,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dicamba	1,800	18,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MCPP	61	620	- -	- -	mg/kg	NA	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	7.2	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDE	1.4	5.1	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDT	1.7	7	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dieldrin	0.03	0.11	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan II [f]	370	3,700	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endrin Aldehyde [g]	18	180	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PAHs																									
2-Methylnaphthalene	310	4,100	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	3,400	33,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene [h]	3,400	33,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	17,000	170,000	- -	- -	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	2.1	- -	- -	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	0.21	- -	- -	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	2.1	- -	- -	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 [i]	1,700	17,000	- -	- -	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	21	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	15	210	- -	- -	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	0.21	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	2,300	22,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	2,300	22,000	- -	- -	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	2.1	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	150	670	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene [j]	17,000	170,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	1,700	17,000	- -	- -	mg/kg	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	0.74	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Volatile Organics																									
1,1-Dichloroethene	250	1,100	- -	- -	mg/kg	<0.0024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0020	<0.0030 [<0.0020]	<0.0030	<0.0020	<0.0020	<0.0020	<0.0020
1,2,4-Trimethylbenzene	67	280	- -	- -	mg/kg	<0.0020	0.0056	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0020	<0.0020 [<0.0020]	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
2-Butanone	28,000	190,000	- -	- -	mg/kg	R	R	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0060 J	<0.0070 [<0.0060]	<0.0070	<0.0060 J	<0.0060	R	<0.0060
Acetone	61,000	610,000	- -	- -	mg/kg	R	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0060 J	<0.0070 [<0.0060]	<0.0070	<0.0060 J	<0.0060	<0.0060	<0.0060
Benzene	1.1	5.6	- -	- -	mg/kg	<0.0012	<0.0012	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0010	<0.0010 [<0.0010]	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Carbon Disulfide	670	3,000	- -	- -	mg/kg	<0.0062	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0060	<0.0070 [<0.0060]	<0.0070	<0.0060	<0.0060	<0.0060	<0.0060
Chlorobenzene	310	1,500	- -	- -	mg/kg	<0.0014	<0.0013	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0010	<0.0020 [<0.0010]	<0.0020	<0.0010	<0.0010	<0.0010	<0.0010
d-Limonene	- -	- -	- -	- -	mg/kg	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	<0.0012 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0010	<0.0010 [<0.0010]	<0.0010	0.0030	<0.0010	0.0030	<0.0010
tert-Butylbenzene	- -	- -	- -	- -	mg/kg	<0.0015	0.0030	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0010	<0.0020 [<0.0010]	<0.0020	<0.0010	<0.0020	<0.0010	<0.0010
Toluene	5,000	46,000	- -	- -	mg/kg	<0.0015	<0.0015	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0020	<0.0020 [<0.0010]	<0.0020	<0.0010	<0.0020	<0.0010	<0.0020
Trichloroethene	2.8	14	- -	- -	mg/kg	<0.0032	<0.0031	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0030	<0.0040 [<0.0030]	<0.0040	<0.0030	<0.0030	<0.0030	<0.0030

Table B-1
Historical Soil Sampling Results, Northern Burning Ground
New River Unit, Radford Army Ammunition Plant, Radford Virginia

Location ID:	Regional Screening Level (Residential)	Regional Screening Level (Industrial)	Facility-Wide Background	TCLP Standards	Units	NBGDW1	NBGDW2	NBGDW3	NBGDW4	NBGDW5	NBGDW6	NBGDW7	NBGDW8	NBGDW9	NBGDW10	NBGDW11	NBGDW12	NBGDW13	NBGSB1	NBGSB1	NBGSB1	NBGSB2	NBGSB2	NBGSB3	NBGSB3
Sample Depth(Feet):						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	0.5 - 1.5	8 - 10	53 - 55	0 - 2	5 - 6	0.5 - 1.5	5 - 6
Date Collected:						05/26/99	05/26/99	08/18/99	08/17/99	08/19/99	08/19/99	08/19/99	08/19/99	08/19/99	08/19/99	08/19/99	08/19/99	08/19/99	08/04/98	08/04/98	08/04/98	08/04/98	08/04/98	08/04/98	08/04/98
Semivolatile Organics																									
Acenaphthylene [h]	3,400	33,000	- -	- -	mg/kg	<0.37	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.39	<0.46 [<0.38]	<0.46	<0.38	<0.43	<0.37	<0.40
Anthracene	17,000	170,000	- -	- -	mg/kg	<0.37	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.39	<0.46 [<0.38]	<0.46	<0.38	<0.43	<0.37	<0.40
Benzo(a)anthracene	0.15	2.1	- -	- -	mg/kg	<0.37	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.39	<0.46 [<0.38]	<0.46	<0.38	<0.43	<0.37	<0.40
Benzo(a)pyrene	0.015	0.21	- -	- -	mg/kg	<0.37	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.39	<0.46 [<0.38]	<0.46	<0.38	<0.43	<0.37	<0.40
Benzo(b)fluoranthene	0.15	2.1	- -	- -	mg/kg	<0.37	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.39	<0.46 [<0.38]	<0.46	<0.38	<0.43	<0.37	<0.40
Benzo(g,h,i)perylene [i]	1,700	17,000	- -	- -	mg/kg	<0.37 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.39	<0.46 [<0.38]	<0.46	<0.38	<0.43	<0.37	<0.40
Benzo(k)fluoranthene	1.5	21	- -	- -	mg/kg	<0.37 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.39	<0.46 [<0.38]	<0.46	<0.38	<0.43	<0.37	<0.40
bis(2-Ethylhexyl)phthalate	35	120	- -	- -	mg/kg	0.040 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.39	<0.46 [<0.38]	<0.46	0.070 J	<0.43	<0.37	<0.40
Carbazole	24	86	- -	- -	mg/kg	<0.37 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.39	<0.46 [<0.38]	<0.46	<0.38	<0.43	<0.37	<0.40
Chrysene	15	210	- -	- -	mg/kg	<0.37	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.39	<0.46 [<0.38]	<0.46	<0.38	<0.43	<0.37	<0.40
Diethylphthalate	49,000	490,000	- -	- -	mg/kg	<0.37	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.39	<0.46 [<0.38]	<0.46	<0.38	<0.43	<0.37	<0.40
Di-n-Butylphthalate	6,100	62,000	- -	- -	mg/kg	0.080 B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.39	<0.46 [<0.38]	<0.46	<0.38	<0.43	<0.37	<0.40
Fluoranthene	2,300	22,000	- -	- -	mg/kg	<0.37	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.39	<0.46 [<0.38]	<0.46	<0.38	<0.43	<0.37	<0.40
Fluorene	2,300	22,000	- -	- -	mg/kg	<0.37	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.39	<0.46 [<0.38]	<0.46	<0.38	<0.43	<0.37	<0.40
Indeno(1,2,3-cd)pyrene	0.15	2.1	- -	- -	mg/kg	<0.37 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.39	<0.46 [<0.38]	<0.46	<0.38	<0.43	<0.37	<0.40
Phenanthrene [j]	17,000	170,000	- -	- -	mg/kg	<0.37	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.39	<0.46 [<0.38]	<0.46	<0.38	<0.43	<0.37	<0.40
Pyrene	1,700	17,000	- -	- -	mg/kg	<0.37	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.39	<0.46 [<0.38]	<0.46	<0.38	<0.43	<0.37	<0.40
Inorganics																									
Aluminum	77,000	990,000	**40,041**	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	37,000	NA	NA	25,200	10,800	27,400 [22,700]	13,100	8,270	27,500	9,810	15,800
Antimony	31	410	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.30 B	NA	NA	2.40 B	<0.580	<0.690 [<0.560]	<0.670	<0.560	<0.620	<0.540	<0.590
Arsenic	0.39	1.6	**15.8**	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	14.5 K	NA	NA	8.70 K	4.20 K	7.00 K [7.30 K]	9.20 K	8.50 K	10.5 K	3.20 K	4.30 K
Barium	15,000	190,000	**209**	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	25.0 J	NA	NA	66.4	41.0 K	18.7 B [14.0 B]	30.5 K	81.9 K	18.1 B	38.9 K	9.60 B
Beryllium	160	2,000	**1.02**	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.370 J	NA	NA	0.390 J	<0.120	0.230 J [0.190 J]	**1.90**	<0.110	0.330 J	0.110 J	<0.120
Cadmium	70	810	**0.69**	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.130	NA	NA	0.210 J	<0.120	<0.140 [<0.110]	0.220 J	**0.920**	<0.120	<0.110	<0.120
Calcium	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,190	NA	NA	3,650	1,580 B	928 B [526 B]	857 B	4,040 B	840 B	2,570 B	371 B
Chromium [k]	230	1,460	**65.3**	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	54.2	NA	NA	**94.5**	31.8	**75.3 [53.7]**	35.0	**1,620**	53.4	20.2	21.9
Cobalt	- -	- -	**72.3**	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.40 J	NA	NA	6.80	4.50 K	3.50 K [3.60 K]	9.80 K	23.9 K	3.10 K	4.20 K	2.10 K
Copper	3,100	41,000	**53.5**	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	26.4	NA	NA	24.5	5.50 B	18.4 K [15.1 B]	21.0 K	52.7	12.9 B	9.20 B	6.20 B
Iron	55,000	720,000	**50,962**	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	**51,100**	NA	NA	29,100	18,500	45,900 [36,800]	29,700	12,900	**52,000**	12,100	19,200
Lead	400	750	**26.8**	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	20.7	NA	NA	**707**	**127**	**226 [155]**	**29.5**	**23,400**	19.5	**104**	10.8
Magnesium	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	953	NA	NA	2,110	605 B	719 B [557 B]	11,900	1,520 B	1,010 B	1,350 B	278 B
Manganese	1,800	23,000	**2,543**	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	95.5	NA	NA	281	204	68.1 [55.1]	594	158	58.9	182	21.8 K
Mercury	6.7	28	**0.13**	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.270**	NA	NA	<0.120	<0.120	<0.140 [<0.110]	<0.140	<0.110	**0.570**	<0.110	<0.120
Nickel	1,600	20,000	**62.8**	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.2	NA	NA	10.7	3.80 B	8.90 K [8.30 K]	30.4 K	5.60 B	8.50 K	4.50 B	3.80 B
Potassium	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	964	NA	NA	812	352 B	601 B [516 B]	3,240 K	324 B	873 K	473 B	489 B
Selenium	390	5,100	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.640	NA	NA	<0.610	<0.580	<0.690 [<0.560]	<0.670	<0.560	<0.620	0.560 K	<0.590
Silver	390	5,100	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.130	NA	NA	<0.120	<0.230 L	<0.280 L [<0.220 L]	<0.270 L	0.230 B	<0.250 L	<0.220 L	<0.240 L
Sodium	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	88.7 B	NA	NA	133 J	136 B	146 B [116 B]	103 B	113 B	104 B	125 B	106 B
Thallium	5.1	66	**2.11**	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.890 J	NA	NA	<0.850 J	0.420 B	1.50 B [<0.220 L]	<0.270 L	0.460 B	<0.250 L	<0.220 L	<0.240 L
Vanadium [l]	390	5,200	**108**	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	97.4	NA	NA	57.6	33.1 J	83.1 J [66.8 J]	49.5 J	23.4 J	79.1 J	21.9 J	32.1 J
Zinc	23,000	310,000	**202**	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	35.4	NA	NA	**706**	61.0 B	67.4 B [50.2 B]	60.4 B	**3,760**	22.8 B	132 B	15.4 B
Inorganics-TCLP																									
Arsenic	- -	- -	- -	5.0	mg/L	0.0088	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	0.0068	<0.006	<0.006	<0.006	<0.006	<0.006	NA	NA	NA	NA	NA	NA	NA
Barium	- -	- -	- -	100	mg/L	0.601	0.146	0.233	0.219	0.272	0.18	0.238	0.181	0.239	0.118	0.564	0.14	0.474	NA	NA	NA	NA	NA	NA	NA
Cadmium	- -	- -	- -	1.0	mg/L	0.0207	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0115	<0.001	0.0052	NA	NA	NA	NA	NA	NA	NA
Chromium [k]	- -	- -	- -	5.0	mg/L	0.0068	0.0356	<0.001	0.0023	0.0174	<0.001	0.0232	0.0241	0.0286	0.0013	0.0695	0.0192	0.133	NA	NA	NA	NA	NA	NA	NA
Lead	- -	- -	- -	5.0	mg/L	6.4	0.0434	0.0112	0.0933	0.0343	0.035	1.92	0.387	1.21	0.0299	63.3	0.384	5.1	NA	NA	NA	NA	NA	NA	NA
Selenium	- -	- -	- -	1.0	mg/L	<0.004	0.0049	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0057	<0.005	<0.005	<0.005	<0.005	NA	NA	NA	NA	NA	NA	NA
Silver	- -	- -	- -	5.0	mg/L	0.0012	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	NA	NA	NA	NA	NA	NA	NA
Miscellaneous																									
Percent Solids	- -	- -	- -	- -	%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH	- -	- -	- -	- -	pH Units	NA	NA	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	NA	NA

Notes

[a]	RSL unavailable; RSL for Total HpCDD used as a surrogate.
[b]	RSL unavailable; RSL for Total HpCDF used as a surrogate.
[c]	RSL unavailable; RSL for Total HxCDD used as a surrogate.
[d]	RSL unavailable; RSL for Total HxCDF used as a surrogate.
[e]	RSL unavailable; RSL for Total PeCDD used as a surrogate.
[f]	RSL unavailable; RSL for Endosulfan used as a surrogate.
[g]	RSL unavailable; RSL for Endrin used as a surrogate.
[h]	RSL unavailable; RSL for Acenaphthalene used as a surrogate.
[i]	RSL unavailable; RSL for Pyrene used as a surrogate.
[j]	RSL unavailable; RSL for Anthracene used as a surrogate.
[k]	RSL for Chromium VI (particulates).
[l]	RSL for Vanadium and compounds.
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.
R	Constituent concentration rejected.
NA	Not Analyzed.
ND	Not Detected (no detection limit given).
24,400	Highlighted cell indicates constituent concentration exceeds Soil RSL (Residential).
10.6 J	Highlighted cell indicates constituent concentration exceeds Soil RSL (Industrial).
127	Bolded value indicates constituent concentration exceeds 95% UTLs developed for facility-wide background estimate
6.4	Highlighted cell indicates constituent concentration exceeds TCLP standard.

Note: Inorganics Facility-Wide Background Point Estimate taken from *Facility-Wide Background Study Report*, IT Corporation, 2001.

Table B-1
Historical Soil Sampling Results, Northern Burning Ground
New River Unit, Radford Army Ammunition Plant, Radford Virginia

Location ID:	Regional Screening Level (Residential)	Regional Screening Level (Industrial)	Facility-Wide Background	TCLP Standards	Units	NBGSB4	NBGSB4	NBGSB5	NBGSB5	NBGSB6	NBGSB6	NBGSB7	NBGSB7	NBGSB8	NBGSB8	NBGSB9	NBGSB10	NBGSB10	NBGSB10	NBGSB10	NBGSB10	NBGSB11	NBGSB11	NBGSB11
Sample Depth(Feet):						0.5 - 1.5	5 - 6	0.5 - 1.5	5 - 6	0 - 0.5	3.5 - 4	0 - 0.5	3.5 - 4	0 - 0.5	3.5 - 4	0 - 0.5	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	0 - 0.5	1 - 3	3 - 5
Date Collected:						08/04/98	08/04/98	08/04/98	08/04/98	05/27/99	05/27/99	05/27/99	05/27/99	05/27/99	05/27/99	05/27/99	05/26/99	05/26/99	05/26/99	05/26/99	05/26/99	06/12/02	06/19/02	06/19/02
Dioxin/Furan																								
1,2,3,4,6,7,8-HpCDD [a]	0.00039	0.0016	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00008921 J	0.00003037	0.00000328 J
1,2,3,4,6,7,8-HpCDF [b]	0.00032	0.0011	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00002183 J	<0.0000001	0.00000044 J
1,2,3,4,7,8,9-HpCDF [b]	0.00032	0.0011	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00000219	<0.00000013	<0.00000006
1,2,3,4,7,8-HxCDD [c]	0.000039	0.00016	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00000302	<0.00000018	<0.00000009
1,2,3,4,7,8-HxCDF [d]	0.000032	0.00011	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00002445 J	<0.00000009	0.00000047 J
1,2,3,6,7,8-HxCDD [c]	0.000039	0.00016	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00000236	<0.00000014	<0.00000007
1,2,3,6,7,8-HxCDF [d]	0.000032	0.00011	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0000096 J	<0.00000009	0.00000025 J
1,2,3,7,8,9-HxCDD [c]	0.000039	0.00016	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00000229	0.0000005	<0.00000008
1,2,3,7,8,9-HxCDF [d]	0.000032	0.00011	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00000216	<0.0000001	<0.00000007
1,2,3,7,8-PeCDD [e]	0.0000039	0.000016	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00000463	<0.00000014	<0.00000016
1,2,3,7,8-PeCDF	0.00011	0.00038	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00001225 J	<0.00000007	0.00000016 J
2,3,4,6,7,8-HxCDF [d]	0.000032	0.00011	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00000257 J	<0.0000001	0.00000009 J
2,3,4,7,8-PeCDF	0.000011	0.000038	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0000169 J	<0.00000007	0.00000038 J
2,3,7,8-TCDD	0.0000045	0.000018	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00000165	<0.00000012	<0.00000006
2,3,7,8-TCDF	0.000032	0.00011	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0001246 J	<0.0000001	0.00000234 J
OCDD	0.013	0.053	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00224 J	0.004805 J	0.0005022 J
OCDF	0.011	0.038	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00008762 J	<0.00000025 J	0.00000142 B
Total HpCDDs	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0001613 J	0.00005671	0.00000744 J
Total HpCDFs	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00007406 J	<0.0000001	0.0000009 J
Total HxCDDs	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00000229	0.00000176	<0.00000007
Total HxCDFs	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00005829 J	<0.00000009	0.00000123 J
Total PeCDDs	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00000463	<0.00000014	<0.00000016
Total PeCDFs	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0001008 J	<0.00000007	0.00000202 J
Total TCDDs	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00000165	<0.00000012	<0.00000006
Total TCDFs	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0003194 J	<0.0000001	0.00001017 J
Explosives																								
None Detected	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- - [- -]	- -	- -	- -	- -	- -	- -	- -	NA	NA	NA
Herbicides																								
2,4,5-T	610	6,200	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00719 J	NA	NA
2,4-D	690	7,700	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.195	NA	NA
2,4-DB	490	4,900	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0596 B	NA	NA
Dalapon	1,800	18,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.12	NA	NA
Dicamba	1,800	18,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00321 K	NA	NA
MCPP	61	620	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<12	NA	NA
Organochlorine Pesticides																								
4,4'-DDD	2	7.2	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00933 J	NA	NA
4,4'-DDE	1.4	5.1	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.07	NA	NA
4,4'-DDT	1.7	7	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.24	NA	NA
Dieldrin	0.03	0.11	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00798 L	NA	NA
Endosulfan II [f]	370	3,700	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00798	NA	NA
Endrin Aldehyde [g]	18	180	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00798 L	NA	NA
PAHs																								
2-Methylnaphthalene	310	4,100	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	3,400	33,000	- -	- -	mg/kg	NA	NA	NA	NA	<0.03 J	<0.03 J	<0.03 J	<0.03 J	<0.03 J [<0.03 J]	<0.03 J	<0.03 J	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene [h]	3,400	33,000	- -	- -	mg/kg	NA	NA	NA	NA	<0.03	<0.03	<0.03	<0.03	<0.03 [<0.03]	<0.03	<0.03	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	17,000	170,000	- -	- -	mg/kg	NA	NA	NA	NA	<0.02	<0.02	<0.02	<0.02	<0.02 [<0.02]	<0.02	<0.02	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	0.15	2.1	- -	- -	mg/kg	NA	NA	NA	NA	<0.02	<0.02	<0.02	<0.02	<0.02 [<0.02]	<0.02	<0.02	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.015	0.21	- -	- -	mg/kg	NA	NA	NA	NA	<0.02	<0.03	<0.02	<0.02	<0.02 [<0.02]	<0.02	<0.02	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	0.15	2.1	- -	- -	mg/kg	NA	NA	NA	NA	<0.01	<0.03	<0.03	<0.03	<0.03 [<0.03]	<0.03	<0.03	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene [i]	1,700	17,000	- -	- -	mg/kg	NA	NA	NA	NA	<0.02	<0.03	0.04	<0.03	<0.03 [<0.03]	<0.03	<0.03	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	1.5	21	- -	- -	mg/kg	NA	NA	NA	NA	<0.03	<0.03	<0.03	<0.02	<0.02 [<0.03]	<0.02	<0.03	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	15	210	- -	- -	mg/kg	NA	NA	NA	NA	<0.02	<0.02	<0.02	<0.02	<0.02 [<0.02]	<0.02	<0.02	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	0.015	0.21	- -	- -	mg/kg	NA	NA	NA	NA	<0.02	<0.03	<0.02	<0.02	<0.02 [<0.02]	<0.02	<0.03	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	2,300	22,000	- -	- -	mg/kg	NA	NA	NA	NA	<0.02	<0.02	<0.02	<0.02	<0.02 [<0.02]	<0.02	<0.02	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	2,300	22,000	- -	- -	mg/kg	NA	NA	NA	NA	<0.03	<0.03	<0.03	<0.03	<0.03 [<0.03]	<0.03	<0.03	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.15	2.1	- -	- -	mg/kg	NA	NA	NA	NA	<0.02	<0.02	<0.01	<0.01	<0.01 [<0.01]	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	150	670	- -	- -	mg/kg	NA	NA	NA	NA	<0.04	<0.04	<0.04	<0.04	<0.04 [<0.04]	<0.04	<0.04	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene [j]	17,000	170,000	- -	- -	mg/kg	NA	NA	NA	NA	<0.02	<0.02	<0.02	<0.02	<0.02 [<0.02]	<0.02	<0.02	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	1,700	17,000	- -	- -	mg/kg	NA	NA	NA	NA	<0.02	<0.02	<0.02	<0.02	<0.02 [<0.02]	<0.02	<0.02	NA	NA	NA	NA	NA	NA	NA	NA
PCBs																								
Aroclor-1254	0.22	0.74	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.4	0.020 J	0.070
Volatile Organics																								
1,1-Dichloroethene	250	1,100	- -	- -	mg/kg	<0.0020	<0.0030	<0.0020 J	<0.0030	NA	<0.0025	<0.0024	<0.0023	NA	<0.0023	<0.0025	<0.0026	<0.0028	<0.0028	<0.0029	<0.0028	NA	NA	NA
1,2,4-Trimethylbenzene	67	280	- -	- -	mg/kg	<0.0020	<0.0020	<0.0020 J	<0.0020	NA	<0.0021	<0.0020	<0.0020	NA	<0.0020	<0.0021	<0.0022	<0.0024	<0.0023	<0.0024	<0.0024	NA	NA	NA
2-Butanone	28,000	190,000	- -	- -	mg/kg	<0.0060	<0.0070	R	R	NA	R	R	<0.0061	NA	R	<0.0064	R	R	R	R	R	NA	NA	NA
Acetone	61,000	610,000	- -	- -	mg/kg	<0.0060	<0.0070	<0.0060 J	<0.0070	NA	R	R	<0.0061	NA	<0.0061	<0.0064	R	R	R	R	R	NA	NA	NA
Benzene	1.1	5.6	- -	- -	mg/kg	<0.0010	<0.0010	<0.0010 J	<0.0010	NA	<0.0013	<0.0013	<0.0012	NA	<0.0012	<0.0013	<0.0014	<0.0015	<0.0014	<0.0015	<0.0015	NA	NA	NA
Carbon Disulfide	670	3,000	- -	- -	mg/kg	<0.0060	<0.0070	<0.0060 J	<0.0070	NA	<0.0066	<0.0063	<0.0061	NA	R	<0.0064	<0.0068	<0.0074	<0.0072	<0.0075	<0.0074	NA	NA	NA
Chlorobenzene	310	1,500	- -	- -	mg/kg	<0.0010	<0.0020	<0.0010 J	<0.0020	NA	<0.0014	<0.0014	<0.0013	NA	<0.0013	<0.0014	<0.0015	<0.0016	<0.0016	<0.0016	<0.0016	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	NA
Methylene Chloride	11	54	- -	- -	mg/kg	<0.0010	0.0050	0.0030 J	0.0040	NA	<0.0013 J	<0.0013 J	<0.0012	NA	<0.0012 J	<0.0013 J	<0.0014	<0.0015	<0.0014	<0.0015	<0.0015	NA	NA	NA
tert-Butylbenzene	- -	- -	- -	- -	mg/kg	<0.0010	<0.0020	<0.0010 J	<0.0020	NA	<0.0016	<0.0015	<0.0015	NA	<0.0015	<0.0015	<0.0016	<0.0018	<0.0017	<0.0018	<0.0018	NA	NA	NA
Toluene	5,000	46,000	- -	- -	mg/kg	<0.0010	<0.0020	<0.0010 J	<0.0020	NA	<0.0016	<0.0016	<0.0015	NA	<0.0015	<0.0016	<0.0017	<0.0018	<0.0018	<0.0019	<0.0018	NA	NA	NA
Trichloroethene	2.8	14	- -	- -	mg/kg	<0.0030	<0.0040	<0.0030 J	<0.0040	NA	<0.0034	<0.0032	<0.0031	NA	<0.0031	<0.0033	<0.0035	<0.0038	<0.0037	<0.0039	<0.0038	NA	NA	NA

Table B-1
Historical Soil Sampling Results, Northern Burning Ground
New River Unit, Radford Army Ammunition Plant, Radford Virginia

Location ID: / Sample Depth(Feet): / Date Collected:	Regional Screening Level (Residential)	Regional Screening Level (Industrial)	Facility-Wide Background	TCLP Standards	Units	NBGSB4 0.5 - 1.5 08/04/98	NBGSB4 5 - 6 08/04/98	NBGSB5 0.5 - 1.5 08/04/98	NBGSB5 5 - 6 08/04/98	NBGSB6 0 - 0.5 05/27/99	NBGSB6 3.5 - 4 05/27/99	NBGSB7 0 - 0.5 05/27/99	NBGSB7 3.5 - 4 05/27/99	NBGSB8 0 - 0.5 05/27/99	NBGSB8 3.5 - 4 05/27/99	NBGSB9 0 - 0.5 05/27/99	NBGSB10 2 - 4 05/26/99	NBGSB10 4 - 6 05/26/99	NBGSB10 6 - 8 05/26/99	NBGSB10 8 - 10 05/26/99	NBGSB10 10 - 12 05/26/99	NBGSB11 0 - 0.5 06/12/02	NBGSB11 1 - 3 06/19/02	NBGSB11 3 - 5 06/19/02
Semivolatile Organics																								
Acenaphthylene [h]	3,400	33,000	- -	- -	mg/kg	<0.38	<0.45	<0.38	<0.47	NA	NA	NA	NA	NA	NA	NA	<0.40	<0.44	<0.43	<0.44	<0.44	NA	NA	NA
Anthracene	17,000	170,000	- -	- -	mg/kg	<0.38	<0.45	<0.38	<0.47	NA	NA	NA	NA	NA	NA	NA	<0.40	<0.44	<0.43	<0.44	<0.44	NA	NA	NA
Benzo(a)anthracene	0.15	2.1	- -	- -	mg/kg	<0.38	<0.45	<0.38	<0.47	NA	NA	NA	NA	NA	NA	NA	<0.40	<0.44	<0.43	<0.44	<0.44	NA	NA	NA
Benzo(a)pyrene	0.015	0.21	- -	- -	mg/kg	<0.38	<0.45	<0.38	<0.47	NA	NA	NA	NA	NA	NA	NA	<0.40	<0.44	<0.43	<0.44	<0.44	NA	NA	NA
Benzo(b)fluoranthene	0.15	2.1	- -	- -	mg/kg	<0.38	<0.45	<0.38	<0.47	NA	NA	NA	NA	NA	NA	NA	<0.40	<0.44	<0.43	<0.44	<0.44	NA	NA	NA
Benzo(g,h,i)perylene [i]	1,700	17,000	- -	- -	mg/kg	<0.38	<0.45	<0.38	<0.47	NA	NA	NA	NA	NA	NA	NA	<0.40 J	<0.44 J	<0.43 J	<0.44 J	<0.44 J	NA	NA	NA
Benzo(k)fluoranthene	1.5	21	- -	- -	mg/kg	<0.38	<0.45	<0.38	<0.47	NA	NA	NA	NA	NA	NA	NA	<0.40 J	<0.44 J	<0.43 J	<0.44 J	<0.44 J	NA	NA	NA
bis(2-Ethylhexyl)phthalate	35	120	- -	- -	mg/kg	<0.38	<0.45	<0.38	<0.47	0.060 J	<0.39	0.050	<0.36	<0.37 [<0.38]	<0.36	0.13	<0.40	<0.44	<0.43	<0.44	<0.44	NA	NA	NA
Carbazole	24	86	- -	- -	mg/kg	<0.38	<0.45	<0.38	<0.47	<0.37	<0.39	<0.37	<0.36	<0.37 [<0.38]	<0.36	<0.38	<0.40 J	<0.44 J	<0.43 J	<0.44 J	<0.44 J	NA	NA	NA
Chrysene	15	210	- -	- -	mg/kg	<0.38	<0.45	<0.38	<0.47	NA	NA	NA	NA	NA	NA	NA	<0.40	<0.44	<0.43	<0.44	<0.44	NA	NA	NA
Diethylphthalate	49,000	490,000	- -	- -	mg/kg	<0.38	<0.45	<0.38	0.10 J	0.060 B	0.050 B	0.070 B	0.13 B	0.24 [<0.38]	<0.36	<0.38	<0.40	<0.44	<0.43	<0.44	<0.44	NA	NA	NA
Di-n-Butylphthalate	6,100	62,000	- -	- -	mg/kg	0.090 J	<0.45	<0.38	<0.47	<0.37	<0.39	<0.37	<0.36	<0.37 [<0.38]	<0.36	<0.38	0.060 B	0.080 B	0.060 B	0.090 B	0.050 J	NA	NA	NA
Fluoranthene	2,300	22,000	- -	- -	mg/kg	<0.38	<0.45	<0.38	<0.47	NA	NA	NA	NA	NA	NA	NA	<0.40	<0.44	<0.43	<0.44	<0.44	NA	NA	NA
Fluorene	2,300	22,000	- -	- -	mg/kg	<0.38	<0.45	<0.38	<0.47	NA	NA	NA	NA	NA	NA	NA	<0.40	<0.44	<0.43	<0.44	<0.44	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.15	2.1	- -	- -	mg/kg	<0.38	<0.45	<0.38	<0.47	NA	NA	NA	NA	NA	NA	NA	<0.40 J	<0.44 J	<0.43 J	<0.44 J	<0.44 J	NA	NA	NA
Phenanthrene [j]	17,000	170,000	- -	- -	mg/kg	<0.38	<0.45	<0.38	<0.47	NA	NA	NA	NA	NA	NA	NA	<0.40	<0.44	<0.43	<0.44	<0.44	NA	NA	NA
Pyrene	1,700	17,000	- -	- -	mg/kg	<0.38	<0.45	<0.38	<0.47	NA	NA	NA	NA	NA	NA	NA	<0.40	<0.44	<0.43	<0.44	<0.44	NA	NA	NA
Inorganics																								
Aluminum	77,000	990,000	**40,041**	- -	mg/kg	18,400	28,400	10,400	30,400	4,670	9,420	7,800	5,930	6,150 [7,260]	5,680	5,980	22,200	31,200	26,700	30,600	29,800	13,900	15,400	34,900
Antimony	31	410	**- -**	- -	mg/kg	<0.560	<0.660	<0.560	<0.680	<0.620	<0.660	<0.620	<0.590	<0.590 [<0.610]	<0.610	<0.620	<0.650	<0.700	0.800 B	<0.740	<0.740	41.8 L	<0.590 L	0.320 B
Arsenic	0.39	1.6	**15.8**	- -	mg/kg	6.00 K	8.10 K	4.50 K	**17.0 K**	2.20 B	5.40 B	7.00 B	6.50 B	5.40 B [7.90]	6.00 B	5.60 B	10.6	15.1	**16.3**	14.5	**17.5**	**64.1**	2.61 L	14.1 L
Barium	15,000	190,000	**209**	- -	mg/kg	41.7 K	21.7 B	34.0 K	13.2 B	40.8	19.0	23.0	10.5	39.5 [39.3]	32.6	45.6	22.5 J	15.7 J	16.4	19.2 J	20.7 J	**562**	44.5	20.7
Beryllium	160	2,000	**1.02**	- -	mg/kg	0.260 J	0.290 J	0.190 J	0.460 J	0.280 B	0.380 B	0.430 B	0.460 B	0.580 B [0.800 B]	0.400 B	0.570 B	0.350 B	0.560 B	0.530 B	0.510 B	0.600 B	<0.590	<0.590	0.420 B
Cadmium	70	810	**0.69**	- -	mg/kg	<0.110	<0.130	<0.110	<0.140	<0.120	<0.130	<0.120	<0.120	<0.120 [0.160]	<0.120	<0.120	0.380	0.620 J	0.660 J	0.500 J	0.620 J	**11.4**	<0.110	<0.130
Calcium	- -	- -	**- -**	- -	mg/kg	1,780 B	673 B	2,800 B	469 B	637	635 J	684	529 J	1,330 [1,180]	974	1,420	1,500	343 J	826	301 J	266 J	28,500 J	557	684
Chromium [k]	230	1,460	**65.3**	- -	mg/kg	30.0	42.3	16.4	52.4	7.10	22.3	22.3	19.6	15.4 [20.3]	14.8	16.0	43.9	58.1	64.8	57.3	**69.3**	**25,700 J**	25.4 L	**172 L**
Cobalt	- -	- -	**72.3**	- -	mg/kg	4.90 K	4.20 K	6.70 K	4.00 K	4.60 K	23.0	21.7	24.3	26.6 [28.1]	22.3	28.0	2.30 K	5.00 K	3.50 K	3.90 K	4.10 K	**190 J**	6.20	4.00 J
Copper	3,100	41,000	**53.5**	- -	mg/kg	11.4 B	15.6 B	4.90 B	24.2 K	8.80 K	20.9	18.2	19.3	18.7 [20.6]	15.5	17.5	23.5	36.3	40.4	34.4	38.2	**569 L**	4.63	29.0
Iron	55,000	720,000	**50,962**	- -	mg/kg	23,300	41,900	16,100	**60,600**	8,270	28,800	30,100	29,600	21,200 [27,900]	21,800	21,300	39,500	**56,500**	**63,100**	**54,500**	**62,300**	**59,800 J**	14,500 J	50,500 J
Lead	400	750	**26.8**	- -	mg/kg	**76.2**	20.0	19.3	20.2	16.5	13.8	17.7	12.3	24.3 [22.8]	17.6	**28.4**	10.4	19.6	**30.3**	**31.2**	**30.9**	**91,400 K**	**63.6**	**903**
Magnesium	- -	- -	**- -**	- -	mg/kg	977 B	661 B	1,300 B	382 B	193 J	472 J	285 J	214 J	395 J [409 J]	299 J	402 J	670	488 J	479 J	488 J	364 J	12,100	648	655
Manganese	1,800	23,000	**2,543**	- -	mg/kg	317	53.3	393	73.5	410	89.9	470	380	710 [709]	401	926	35.3	62.9	71.4	79.6	99.2	855 J	323	62.9
Mercury	6.7	28	**0.13**	- -	mg/kg	<0.120	<0.130	<0.110	**0.620**	<0.120	<0.130	<0.120	<0.120	**0.170 [<0.130]**	<0.120	<0.120	**0.260**	**0.220**	**0.350**	**0.220**	<0.150	<0.0500	0.0300 J	**0.200**
Nickel	1,600	20,000	**62.8**	- -	mg/kg	7.60 K	12.5 K	4.10 B	14.4 K	3.50 K	14.3 K	11.0 K	13.6 K	12.5 K [17.4]	12.7 K	12.4 K	6.80 K	20.6	14.2 K	11.9 K	14.6 K	39.6	8.16	15.3
Potassium	- -	- -	**- -**	- -	mg/kg	635 K	1,300 K	425 B	1,030 K	149 J	307 J	362 J	199 J	385 J [393 J]	178 J	378 J	684	758	861	723 J	583 J	1,270	476	798
Selenium	390	5,100	**- -**	- -	mg/kg	<0.560	<0.660	<0.560	<0.680	0.550 K	<0.530	<0.500	<0.470	<0.470 [<0.490]	<0.490	<0.490	1.30 K	<0.560	<0.580	<0.590	<0.590	<1.20 L	<1.19 L	<1.34 L
Silver	390	5,100	**- -**	- -	mg/kg	<0.220 L	<0.260 L	<0.220 L	<0.270 L	<0.120	<0.130	<0.120	<0.120	<0.120 [<0.120]	<0.120	<0.120	0.270 K	0.480 K	0.490 K	0.660 K	0.640 K	2.74 L	<1.19	<1.34
Sodium	- -	- -	**- -**	- -	mg/kg	115 B	137 B	94.1 B	111 B	100 B	105 B	102 B	106 B	100 B [98.9 B]	101 B	112 J	189	183 J	198 J	165 J	177 J	273	14.0 B	11.0 B
Thallium	5.1	66	**2.11**	- -	mg/kg	1.10 B	<0.260 L	0.280 B	<0.270 L	<0.860 J	<0.920 J	<0.870 J	<0.830 J	<0.830 J [<0.860 J]	0.920 J	<0.860 J	<0.910 J	<0.990 J	<1.00 J	<1.00 J	<1.00 J	0.270 J	0.110 J	0.230 J
Vanadium [l]	390	5,200	**108**	- -	mg/kg	39.7 J	76.4 J	27.9 J	91.0 J	14.9	37.4	51.9	45.1	36.5 [44.2]	34.7	36.9	77.9	**112**	**127**	**118**	**125**	**121 J**	29.2 L	74.7 L
Zinc	23,000	310,000	**202**	- -	mg/kg	67.8 B	28.3 B	22.1 B	45.0 B	18.1	24.7	29.3	29.2	37.6 [47.6]	27.2	45.8	19.1	37.6	37.6	29.9	31.8	**39,000 J**	22.8 J	**211 J**
Inorganics-TCLP																								
Arsenic	- -	- -	- -	5.0	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	- -	- -	- -	100	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	- -	- -	- -	1.0	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium [k]	- -	- -	- -	5.0	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	- -	- -	- -	5.0	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	- -	- -	- -	1.0	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	- -	- -	- -	5.0	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Miscellaneous																								
Percent Solids	- -	- -	- -	- -	%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH	- -	- -	- -	- -	pH Units	NA	NA	NA	NA	6.5	7.4	6.85	7.55	6.05 [7.15]	6.75	7.25	NA	NA	NA	NA	NA	NA	NA	NA
Total Organic Carbon	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	1,799	2,376	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes

[a]	RSL unavailable; RSL for Total HpCDD used as a surrogate.
[b]	RSL unavailable; RSL for Total HpCDF used as a surrogate.
[c]	RSL unavailable; RSL for Total HxCDD used as a surrogate.
[d]	RSL unavailable; RSL for Total HxCDF used as a surrogate.
[e]	RSL unavailable; RSL for Total PeCDD used as a surrogate.
[f]	RSL unavailable; RSL for Endosulfan used as a surrogate.
[g]	RSL unavailable; RSL for Endrin used as a surrogate.
[h]	RSL unavailable; RSL for Acenaphthalene used as a surrogate.
[i]	RSL unavailable; RSL for Pyrene used as a surrogate.
[j]	RSL unavailable; RSL for Anthracene used as a surrogate.
[k]	RSL for Chromium VI (particulates).
[l]	RSL for Vanadium and compounds.
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.
R	Constituent concentration rejected.
NA	Not Analyzed.
ND	Not Detected (no detection limit given).
24,400	Highlighted cell indicates constituent concentration exceeds Soil RSL (Residential).
10.6 J	Highlighted cell indicates constituent concentration exceeds Soil RSL (Industrial).
127	Bolded value indicates constituent concentration exceeds 95% UTLs developed for facil
6.4	Highlighted cell indicates constituent concentration exceeds TCLP standard.

Note: Inorganics Facility-Wide Background Point Estimate taken from *Facility-Wide Background Study Report*, IT Corporation, 2001.

Table B-1
Historical Soil Sampling Results, Northern Burning Ground
New River Unit, Radford Army Ammunition Plant, Radford Virginia

Location ID:	Regional Screening Level (Residential)	Regional Screening Level (Industrial)	Facility-Wide Background	TCLP Standards	Units	NBGSB12	NBGSB12	NBGSB12	NBGSB13	NBGSB13	NBGSB14	NBGSB14	NBGSB15	NBGSB15	NBGSB16	NBGSB16	NBGSB16	NBGSB16	NBGSB17	NBGSB17	NBGSB18
Sample Depth(Feet):						0 - 0.5	1 - 3	3 - 5	0 - 0.5	1 - 3	0 - 0.5	1 - 3	0 - 0.5	1 - 3	0 - 0.5	2	6	10 - 12	0 - 0.5	1 - 3	0 - 0.5
Date Collected:						06/12/02	06/19/02	06/19/02	06/12/02	06/19/02	06/12/02	06/19/02	06/12/02	06/19/02	06/12/02	06/19/02	06/19/02	06/19/02	06/12/02	06/19/02	06/12/02
Dioxin/Furan																					
1,2,3,4,6,7,8-HpCDD [a]	0.00039	0.0016	- -	- -	mg/kg	0.0000481	0.00001449	0.00000379	0.00004898 J	0.00003946	0.00008469	0.00009242 J	0.00004404	0.00004759 J	0.00003343	0.00000222	0.00000219	0.00000528	0.00001618	0.00000501	0.00002162
1,2,3,4,6,7,8-HpCDF [b]	0.00032	0.0011	- -	- -	mg/kg	<0.00000097	<0.00000009	<0.00000011	0.00001327 J	0.00000035	0.00000812	0.00000018 J	0.00000475	0.00000795 J	0.00000304	<0.00000009	<0.00000009	<0.00000013	<0.00000109	0.00000012	<0.00000114
1,2,3,4,7,8,9-HpCDF [b]	0.00032	0.0011	- -	- -	mg/kg	<0.00000125	<0.00000012	<0.00000015	<0.00000274	<0.00000016	<0.00000195	<0.00000005	<0.00000184	0.00000071 J	<0.00000118	<0.00000011	<0.00000012	<0.00000017	<0.00000141	<0.00000004	<0.00000148
1,2,3,4,7,8-HxCDD [c]	0.000039	0.00016	- -	- -	mg/kg	<0.00000206	<0.00000019	<0.0000002	<0.00000301	0.00000053	<0.00000216	<0.00000009	<0.00000231	0.00000118 J	<0.00000171	<0.00000017	<0.00000018	<0.00000023	<0.00000174	<0.00000008	<0.00000174
1,2,3,4,7,8-HxCDF [d]	0.000032	0.00011	- -	- -	mg/kg	<0.00000135	<0.00000008	<0.00000009	0.0000226 J	<0.00000008	<0.00000156	<0.00000004	<0.00000127	0.00000205 J	<0.00000092	<0.00000006	<0.00000008	<0.00000007	<0.00000101	<0.00000003	<0.0000012
1,2,3,6,7,8-HxCDD [c]	0.000039	0.00016	- -	- -	mg/kg	<0.00000162	<0.00000015	<0.00000016	<0.00000236	0.00000083	<0.00000169	<0.00000007	<0.00000181	0.00000237 J	<0.00000134	<0.00000013	<0.00000014	<0.00000018	<0.00000136	<0.00000006	<0.00000136
1,2,3,6,7,8-HxCDF [d]	0.000032	0.00011	- -	- -	mg/kg	<0.00000131	<0.00000007	<0.00000008	0.00000948 J	<0.00000008	<0.00000151	<0.00000004	<0.00000124	0.00000271 J	<0.0000009	<0.00000006	<0.00000007	<0.00000007	<0.00000099	<0.00000003	<0.00000117
1,2,3,7,8,9-HxCDD [c]	0.000039	0.00016	- -	- -	mg/kg	<0.00000157	<0.00000014	<0.00000015	<0.00000229	0.00000093	<0.00000164	0.00000077 J	<0.00000175	0.000003 J	<0.0000013	<0.00000012	<0.00000013	<0.00000018	<0.00000132	<0.00000006	<0.00000132
1,2,3,7,8,9-HxCDF [d]	0.000032	0.00011	- -	- -	mg/kg	<0.00000155	<0.00000009	<0.0000001	0.00000179	<0.00000009	<0.00000178	<0.00000006	<0.00000146	0.00000034 J	<0.00000106	<0.00000008	<0.00000009	<0.00000008	<0.00000116	<0.00000004	<0.00000138
1,2,3,7,8-PeCDD [e]	0.0000039	0.000016	- -	- -	mg/kg	<0.0000027	<0.00000011	<0.00000017	<0.00000432	<0.00000021	<0.00000199	<0.00000008	<0.00000185	0.00000058 J	<0.0000014	<0.0000001	<0.0000001	<0.00000013	<0.00000153	<0.00000007	<0.0000013
1,2,3,7,8-PeCDF	0.00011	0.00038	- -	- -	mg/kg	<0.00000111	<0.00000007	<0.00000008	0.00000714 J	<0.00000008	<0.000001	<0.00000004	<0.000001	0.00000029 J	<0.0000007	<0.00000006	<0.00000007	<0.00000009	<0.00000083	<0.00000003	<0.00000076
2,3,4,6,7,8-HxCDF [d]	0.000032	0.00011	- -	- -	mg/kg	<0.00000154	<0.00000009	<0.0000001	0.00000294 J	<0.00000009	<0.00000177	<0.00000005	<0.00000145	0.00000108 J	<0.00000105	<0.00000007	<0.00000009	<0.00000008	<0.00000116	<0.00000004	<0.00000137
2,3,4,7,8-PeCDF	0.000011	0.000038	- -	- -	mg/kg	<0.00000116	<0.00000007	<0.00000008	0.0000101 J	<0.00000008	<0.00000104	<0.00000005	<0.00000104	0.00000061 J	<0.00000074	<0.00000006	<0.00000007	<0.00000009	<0.00000087	<0.00000003	<0.00000079
2,3,7,8-TCDD	0.0000045	0.000018	- -	- -	mg/kg	<0.00000141	<0.00000013	<0.00000014	<0.00000181	<0.00000006	<0.00000151	<0.00000006	<0.00000162	<0.00000005	<0.00000128	<0.0000001	<0.00000013	<0.00000014	<0.00000146	<0.00000005	<0.00000133
2,3,7,8-TCDF	0.000032	0.00011	- -	- -	mg/kg	<0.00000197	<0.0000001	<0.00000011	0.00006188 J	<0.00000008	0.00000725	<0.00000004	<0.00000151	<0.00000016 J	<0.00000119	<0.00000008	<0.0000001	<0.00000011	<0.00000129	<0.00000003	<0.00000107
OCDD	0.013	0.053	- -	- -	mg/kg	0.002977	0.003495 J	0.0008244 J	0.002165 J	0.0033 J	0.003884	0.01645 J	0.002064	0.004063 J	0.002352	0.0004363 J	0.0004122 J	0.0008114 J	0.00172	0.0009594 J	0.003185
OCDF	0.011	0.038	- -	- -	mg/kg	<0.00000225	0.00000266 J	0.0000021 J	0.0000191 B	0.00000114 J	0.00002918 B	0.00000863 J	<0.00000386	0.00000529 J	<0.00000178	<0.00000029 J	0.00000128 J	0.0000022 J	<0.00000289	0.00000102 B	<0.00000292
Total HpCDDs	- -	- -	- -	- -	mg/kg	0.0001243	0.0000262	0.00000941	0.0001208 J	0.00009885	0.000178	0.0001458 J	0.0001053	0.0001147 J	0.00007269	0.00000508	0.00000513	0.00001071	0.00003714	0.00001344	0.00002162
Total HpCDFs	- -	- -	- -	- -	mg/kg	<0.00000097	<0.00000009	<0.00000011	0.00002477 J	0.00000035	0.00003418	0.00000053 J	0.00000475	0.00001225 J	0.00000304	<0.00000009	<0.00000009	0.00000076	<0.00000109	0.00000012	<0.00000114
Total HxCDDs	- -	- -	- -	- -	mg/kg	<0.00000157	0.00000047	<0.00000015	<0.00000229	0.00000719	0.00000983	0.00000188 J	0.00001125	0.00002469 J	<0.0000013	<0.00000012	<0.00000013	<0.00000018	<0.00000132	<0.00000006	<0.00000132
Total HxCDFs	- -	- -	- -	- -	mg/kg	<0.00000131	<0.00000007	<0.00000008	0.00006751 J	<0.00000008	<0.00000151	<0.00000004	<0.00000124	0.00001394 J	<0.0000009	<0.00000006	<0.00000007	<0.00000007	<0.00000099	<0.00000003	<0.00000117
Total PeCDDs	- -	- -	- -	- -	mg/kg	<0.0000027	<0.00000011	<0.00000017	<0.00000432	<0.00000021	<0.00000199	<0.00000008	<0.00000185	0.00000199 J	<0.0000014	<0.0000001	<0.0000001	<0.00000013	<0.00000153	<0.00000007	<0.0000013
Total PeCDFs	- -	- -	- -	- -	mg/kg	<0.00000111	<0.00000007	<0.00000008	0.00007985 J	<0.00000008	<0.000001	<0.00000004	<0.000001	0.00000838 J	<0.0000007	<0.00000006	<0.00000007	<0.00000009	<0.00000083	<0.00000003	<0.00000076
Total TCDDs	- -	- -	- -	- -	mg/kg	<0.00000141	<0.00000013	<0.00000014	<0.00000181	<0.00000006	<0.00000151	<0.00000006	0.00000468	0.00000047 J	<0.00000128	<0.0000001	<0.00000013	<0.00000014	<0.00000146	<0.00000005	<0.00000133
Total TCDFs	- -	- -	- -	- -	mg/kg	<0.00000197	<0.0000001	<0.00000011	0.0001714 J	<0.00000008	0.00000725	<0.00000004	<0.00000151	0.00000731 J	<0.00000119	<0.00000008	<0.0000001	<0.00000011	<0.00000129	<0.00000003	<0.00000107
Explosives																					
None Detected	- -	- -	- -	- -	- -	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Herbicides																					
2,4,5-T	610	6,200	- -	- -	mg/kg	<0.0121	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0116	NA	NA
2,4-D	690	7,700	- -	- -	mg/kg	0.146	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0232	NA	NA
2,4-DB	490	4,900	- -	- -	mg/kg	<0.121	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.116	NA	NA
Dalapon	1,800	18,000	- -	- -	mg/kg	0.0814 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0759 J	NA	NA
Dicamba	1,800	18,000	- -	- -	mg/kg	<0.0241	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0232	NA	NA
MCPP	61	620	- -	- -	mg/kg	<12.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.3 J	NA	NA
Organochlorine Pesticides																					
4,4'-DDD	2	7.2	- -	- -	mg/kg	0.00495 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00773	NA	NA
4,4'-DDE	1.4	5.1	- -	- -	mg/kg	0.0289	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00773	NA	NA
4,4'-DDT	1.7	7	- -	- -	mg/kg	0.0854	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00773	NA	NA
Dieldrin	0.03	0.11	- -	- -	mg/kg	<0.00805 L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00773 L	NA	NA
Endosulfan II [f]	370	3,700	- -	- -	mg/kg	<0.00805	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00773	NA	NA
Endrin Aldehyde [g]	18	180	- -	- -	mg/kg	0.00645 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.00773 L	NA	NA
PAHs																					
2-Methylnaphthalene	310	4,100	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	3,400	33,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene [h]	3,400	33,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	17,000	170,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	0.15	2.1	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.015	0.21	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	0.15	2.1	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene [i]	1,700	17,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	1.5	21	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	15	210	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	0.015	0.21	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	2,300	22,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	2,300	22,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.15	2.1	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	150	670	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene [j]	17,000	170,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	1,700	17,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCBs																					
Aroclor-1254	0.22	0.74	- -	- -	mg/kg	2.5	<0.030	<0.040	3.4	0.060	0.97	<0.040	<0.030	<0.030	<0.030	<0.030	<0.040	<0.040	<0.030	<0.040	<0.040
Volatile Organics																					
1,1-Dichloroethene	250	1,100	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0046	<0.0054	<0.0064
1,2,4-Trimethylbenzene	67	280	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone	28,000	190,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0046	<0.0054	0.011 K
Acetone	61,000	610,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0046	<0.0054	0.12 B
Benzene	1.1	5.6	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0046	<0.0054	<0.0064
Carbon Disulfide	670	3,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0046	0.00044 B	<0.0064
Chlorobenzene	310	1,500	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0046	<0.0054	<0.0064
d-Limonene	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.023 J
Methylene Chloride	11	54	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0046	<0.0054	<0.0064
tert-Butylbenzene	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	5,000	46,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0046	<0.0054	<0.0064
Trichloroethene	2.8	14	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0046	<0.0054	<0.0064

Table B-1
Historical Soil Sampling Results, Northern Burning Ground
New River Unit, Radford Army Ammunition Plant, Radford Virginia

Location ID: / Sample Depth(Feet): / Date Collected:	Regional Screening Level (Residential)	Regional Screening Level (Industrial)	Facility-Wide Background	TCLP Standards	Units	NBGSB12 0 - 0.5 06/12/02	NBGSB12 1 - 3 06/19/02	NBGSB12 3 - 5 06/19/02	NBGSB13 0 - 0.5 06/12/02	NBGSB13 1 - 3 06/19/02	NBGSB14 0 - 0.5 06/12/02	NBGSB14 1 - 3 06/19/02	NBGSB15 0 - 0.5 06/12/02	NBGSB15 1 - 3 06/19/02	NBGSB16 0 - 0.5 06/12/02	NBGSB16 2 06/19/02	NBGSB16 6 06/19/02	NBGSB16 10 - 12 06/19/02	NBGSB17 0 - 0.5 06/12/02	NBGSB17 1 - 3 06/19/02	NBGSB18 0 - 0.5 06/12/02
Semivolatile Organics																					
Acenaphthylene [h]	3,400	33,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	17,000	170,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	0.15	2.1	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.015	0.21	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	0.15	2.1	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene [i]	1,700	17,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	1.5	21	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	35	120	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole	24	86	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	15	210	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diethylphthalate	49,000	490,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-Butylphthalate	6,100	62,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	2,300	22,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	2,300	22,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.15	2.1	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene [j]	17,000	170,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	1,700	17,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Inorganics																					
Aluminum	77,000	990,000	**40,041**	- -	mg/kg	12,700	24,200	26,400	14,400	12,700	26,100	23,600	15,100	13,900	15,500	13,900	24,400	36,500	19,700	18,800	35,500
Antimony	31	410	- -	- -	mg/kg	0.780 L	<0.590 L	<0.670 L	22.0 L	0.220 B	2.46 L	<0.610 L	1.33 L	0.450 L	0.470 L	<0.570 L	<0.600 L	<0.690 L	0.370 B	0.270 B	<0.630 L
Arsenic	0.39	1.6	**15.8**	- -	mg/kg	3.31	5.87 L	11.3 L	**24.1**	2.35 L	9.97	5.69 L	3.78	4.14 L	2.25	5.38 L	6.28 L	7.75 L	5.92	8.20 L	8.37
Barium	15,000	190,000	**209**	- -	mg/kg	67.1	31.9	15.4	**342**	49.7	89.4	29.6	**295**	95.4	52.5	20.9	28.3	32.5	65.9	15.7	21.4
Beryllium	160	2,000	**1.02**	- -	mg/kg	0.450 B	<0.590	0.430 B	0.590 B	0.380 B	0.560 B	<0.610	0.640 K	0.440 B	0.480 B	<0.570	<0.600	<0.690	<0.570	<0.600	0.490 B
Cadmium	70	810	**0.69**	- -	mg/kg	0.580	<0.110	<0.130	**5.72**	0.0900 J	**0.870**	<0.120	**2.89**	0.160	0.140	<0.110	<0.120	<0.140	<0.110	<0.120	<0.120
Calcium	- -	- -	- -	- -	mg/kg	5,420 J	731	371	17,000 J	745	9,810 J	1,190	57,800 J	46,600	41,600 J	228	358	164	75,100 J	649	670 J
Chromium [k]	230	1,460	**65.3**	- -	mg/kg	**253 J**	28.1 L	38.5 L	**10,700 J**	30.8 L	**3,110 J**	33.1 L	**123 J**	22.7 L	**118 J**	21.9 L	32.4 L	58.4 L	29.3 J	**68.8 L**	44.5 J
Cobalt	- -	- -	**72.3**	- -	mg/kg	6.95 J	3.90 J	4.60 J	**80.4 J**	5.90 J	26.1 J	2.20 J	8.85 J	7.61	7.01 J	1.90 J	2.10 J	3.60 J	7.34 J	2.60 J	3.40 J
Copper	3,100	41,000	**53.5**	- -	mg/kg	43.6 L	10.8	25.7	**307 L**	6.21	**218 L**	12.7	**58.7 L**	36.2	13.2 L	4.44	10.9	23.8	14.8 L	11.1	22.0 L
Iron	55,000	720,000	**50,962**	- -	mg/kg	15,200 J	24,300 J	38,900 J	24,900 J	13,200 J	31,600 J	27,100 J	17,500 J	14,300 J	13,300 J	13,400 J	25,200 J	40,800 J	17,600 J	29,800 J	44,800 J
Lead	400	750	**26.8**	- -	mg/kg	**3,640 K**	12.0	20.9	**65,300 K**	**82.7**	**20,500 K**	**30.4**	**1,200 K**	**82.0**	**931 K**	13.5	14.0	25.7	**38.9 K**	16.2	21.5 K
Magnesium	- -	- -	- -	- -	mg/kg	3,220	794	801	9,500	545	5,650	708	30,700	25,200	29,200	347	529	1,450	38,100	492	723
Manganese	1,800	23,000	**2,543**	- -	mg/kg	328 J	50.4	61.2	469 J	203	168 J	55.2	264 J	316	250 J	19.5	23.0	50.4	144 J	148	64.3 J
Mercury	6.7	28	**0.13**	- -	mg/kg	0.0400 J	0.0700	**0.220**	0.0400 J	0.0300 J	0.0500 J	0.0700	0.0700	0.0200 J	0.0400 J	0.0400 J	0.0800	0.0700	0.0400 J	0.0900	0.130
Nickel	1,600	20,000	**62.8**	- -	mg/kg	7.12	10.4	20.8	16.7	7.24	17.8	7.78	11.9	10.6	11.1	3.20 J	8.47	15.0	11.1	4.93	17.9
Potassium	- -	- -	- -	- -	mg/kg	663	865	981	1,010	400	1,790	607	2,060	1,830	1,990	416	579	1,250	2,930	496	835
Selenium	390	5,100	- -	- -	mg/kg	<1.21 L	<1.19 L	<1.35 L	<1.19 L	<1.22 L	<1.20 L	<1.22 L	<1.15 L	<1.17 L	<1.16 L	<1.15 L	<1.21 L	<1.40 L	<1.16 L	<1.20 L	<1.28 L
Silver	390	5,100	- -	- -	mg/kg	<1.21 L	<1.19	<1.35	1.27 L	<1.22	<1.20 L	<1.22	<1.15 L	<1.17	<1.16 L	<1.15	<1.21	<1.40	<1.16 L	<1.20	<1.28 L
Sodium	- -	- -	- -	- -	mg/kg	33.5	18.0 B	11.0 B	117	12.0 B	55.0	11.0 B	87.8	66.3	89.2	7.50 B	16.0 B	22.0 B	115	9.30 B	23.0 B
Thallium	5.1	66	**2.11**	- -	mg/kg	0.180 J	0.140 J	0.220 J	0.220 J	0.140 J	0.190 J	0.170 J	0.150 J	0.130 J	0.150 J	0.100 J	0.200 J	0.230 J	0.140 J	0.110 J	0.210 J
Vanadium [l]	390	5,200	**108**	- -	mg/kg	29.1 J	44.8 L	69.0 L	70.4 J	28.5 L	62.0 J	48.8 L	34.4 J	29.6 L	27.1 J	24.7 L	42.3 L	78.2 L	36.7 J	50.4 L	76.0 J
Zinc	23,000	310,000	**202**	- -	mg/kg	**1,280 J**	18.2 J	32.0 J	**19,600 J**	64.8 J	**3,570 J**	18.5 J	**3,820 J**	129 J	**464 J**	7.87 J	16.7 J	26.0 J	143 J	19.2 J	34.9 J
Inorganics-TCLP																					
Arsenic	- -	- -	- -	5.0	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	- -	- -	- -	100	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	- -	- -	- -	1.0	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium [k]	- -	- -	- -	5.0	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	- -	- -	- -	5.0	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	- -	- -	- -	1.0	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	- -	- -	- -	5.0	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Miscellaneous																					
Percent Solids	- -	- -	- -	- -	%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH	- -	- -	- -	- -	pH Units	6.82 J	NA	4.68 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Organic Carbon	- -	- -	- -	- -	mg/kg	29,100 K	NA	1,200 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes

[a]	RSL unavailable; RSL for Total HpCDD used as a surrogate.
[b]	RSL unavailable; RSL for Total HpCDF used as a surrogate.
[c]	RSL unavailable; RSL for Total HxCDD used as a surrogate.
[d]	RSL unavailable; RSL for Total HxCDF used as a surrogate.
[e]	RSL unavailable; RSL for Total PeCDD used as a surrogate.
[f]	RSL unavailable; RSL for Endosulfan used as a surrogate.
[g]	RSL unavailable; RSL for Endrin used as a surrogate.
[h]	RSL unavailable; RSL for Acenaphthalene used as a surrogate.
[i]	RSL unavailable; RSL for Pyrene used as a surrogate.
[j]	RSL unavailable; RSL for Anthracene used as a surrogate.
[k]	RSL for Chromium VI (particulates).
[l]	RSL for Vanadium and compounds.
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.
R	Constituent concentration rejected.
NA	Not Analyzed.
ND	Not Detected (no detection limit given).
24,400	Highlighted cell indicates constituent concentration exceeds Soil RSL (Residential).
10.6 J	Highlighted cell indicates constituent concentration exceeds Soil RSL (Industrial).
127	Bolded value indicates constituent concentration exceeds 95% UTLs developed for facil
6.4	Highlighted cell indicates constituent concentration exceeds TCLP standard.

Note: Inorganics Facility-Wide Background Point Estimate taken from *Facility-Wide Background Study Report*, IT Corporation, 2001.

Table B-1
Historical Soil Sampling Results, Northern Burning Ground
New River Unit, Radford Army Ammunition Plant, Radford Virginia

Location ID:	Regional	Regional	Facility-Wide	TCLP		NBGSB18	NBGSB19	NBGSB19	NBGSB20	NBGSB20	NBGSB20	NBGSB20	NBGSB21	NBGSB21	NBGSB21	NBGSB21	NBGSB22	NBGSB22	NBGSB22	NBGSB22	NBGSB23	NBGSB23
Sample Depth(Feet):	Screening Level	Screening Level	Background	Standards		1 - 3	0 - 0.5	1 - 3	0 - 0.5	1 - 3	3 - 5	5 - 7	0 - 0.5	1 - 3	3 - 5	5 - 7	0 - 0.5	1 - 3	3 - 5	5 - 7	0 - 0.5	1 - 3
Date Collected:	(Residential)	(Industrial)			Units	06/19/02	06/12/02	06/19/02	07/20/04	07/20/04	07/20/04	07/20/04	07/20/04	07/20/04	07/20/04	07/20/04	07/20/04	07/20/04	07/20/04	07/20/04	07/20/04	07/20/04
Dioxin/Furan																						
1,2,3,4,6,7,8-HpCDD [a]	0.00039	0.0016	- -	- -	mg/kg	0.00000852 J	0.0001025 [0.00005895]	0.00000466	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8-HpCDF [b]	0.00032	0.0011	- -	- -	mg/kg	0.00000016 J	0.00000244 [<0.00000153]	0.00000015 B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8,9-HpCDF [b]	0.00032	0.0011	- -	- -	mg/kg	<0.00000004	<0.00000161 [<0.00000198]	<0.00000005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-HxCDD [c]	0.000039	0.00016	- -	- -	mg/kg	<0.00000007	<0.00000158 [<0.0000023]	<0.00000008	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-HxCDF [d]	0.000032	0.00011	- -	- -	mg/kg	<0.00000004	<0.00000106 [<0.00000119]	<0.00000005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-HxCDD [c]	0.000039	0.00016	- -	- -	mg/kg	<0.00000006	<0.00000123 [<0.0000018]	<0.00000006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-HxCDF [d]	0.000032	0.00011	- -	- -	mg/kg	<0.00000004	<0.00000103 [<0.00000116]	<0.00000005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-HxCDD [c]	0.000039	0.00016	- -	- -	mg/kg	0.00000028 J	<0.0000012 [<0.00000174]	<0.00000007	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-HxCDF [d]	0.000032	0.00011	- -	- -	mg/kg	<0.00000006	<0.00000121 [<0.00000137]	<0.00000007	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-PeCDD [e]	0.0000039	0.000016	- -	- -	mg/kg	<0.00000007	<0.00000132 [<0.00000161]	<0.00000006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-PeCDF	0.00011	0.00038	- -	- -	mg/kg	<0.00000004	<0.00000076 [<0.00000094]	<0.00000004	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,6,7,8-HxCDF [d]	0.000032	0.00011	- -	- -	mg/kg	<0.00000005	<0.00000121 [<0.00000136]	<0.00000006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,7,8-PeCDF	0.000011	0.000038	- -	- -	mg/kg	<0.00000004	<0.0000008 [<0.00000098]	<0.00000005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-TCDD	0.0000045	0.000018	- -	- -	mg/kg	<0.00000005	<0.00000128 [<0.00000152]	<0.00000005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-TCDF	0.000032	0.00011	- -	- -	mg/kg	<0.00000003	<0.00000119 [<0.00000128]	<0.00000003	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
OCDD	0.013	0.053	- -	- -	mg/kg	0.002096 J	0.01964 [0.01094]	0.0008243 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
OCDF	0.011	0.038	- -	- -	mg/kg	0.00000096 B	0.00001394 B [<0.00000316]	0.00000137 B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total HpCDDs	- -	- -	- -	- -	mg/kg	0.00001799 J	0.0002014 [0.0001255]	0.00001208	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total HpCDFs	- -	- -	- -	- -	mg/kg	0.0000003 J	0.00000244 [<0.00000153]	0.00000063	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total HxCDDs	- -	- -	- -	- -	mg/kg	0.00000028 J	0.0000063 [<0.00000174]	<0.00000006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total HxCDFs	- -	- -	- -	- -	mg/kg	<0.00000004	<0.00000103 [<0.00000116]	<0.00000005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total PeCDDs	- -	- -	- -	- -	mg/kg	<0.00000007	<0.00000132 [<0.00000161]	<0.00000006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total PeCDFs	- -	- -	- -	- -	mg/kg	<0.00000004	<0.00000076 [<0.00000094]	0.00000027	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total TCDDs	- -	- -	- -	- -	mg/kg	<0.00000005	<0.00000128 [<0.00000152]	<0.00000005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total TCDFs	- -	- -	- -	- -	mg/kg	<0.00000003	<0.00000119 [<0.00000128]	<0.00000003	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Explosives																						
None Detected	- -	- -	- -	- -	- -	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Herbicides																						
2,4,5-T	610	6,200	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-D	690	7,700	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-DB	490	4,900	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dalapon	1,800	18,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dicamba	1,800	18,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MCPP	61	620	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Organochlorine Pesticides																						
4,4'-DDD	2	7.2	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDE	1.4	5.1	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDT	1.7	7	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dieldrin	0.03	0.11	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan II [f]	370	3,700	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endrin Aldehyde [g]	18	180	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PAHs																						
2-Methylnaphthalene	310	4,100	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	3,400	33,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene [h]	3,400	33,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	17,000	170,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	0.15	2.1	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.015	0.21	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	0.15	2.1	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene [i]	1,700	17,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	1.5	21	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	15	210	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	0.015	0.21	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	2,300	22,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	2,300	22,000	- -	- -	mg/kg	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	2.1	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	150	670	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene [j]	17,000	170,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	1,700	17,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCBs																						
Aroclor-1254	0.22	0.74	- -	- -	mg/kg	<0.040	<0.040 [<0.030]	<0.040	0.23	<0.043	<0.046 [<0.046]	<0.048	1.3	<0.041	0.18	<0.044	4.6	<0.039 [<0.039]	<0.041	<0.046	<0.039	<0.040
Volatile Organics																						
1,1-Dichloroethene	250	1,100	- -	- -	mg/kg	<0.0067	<0.0054 [<0.0050]	<0.0066	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trimethylbenzene	67	280	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone	28,000	190,000	- -	- -	mg/kg	<0.0067	<0.0054 [<0.0050]	<0.0066	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone	61,000	610,000	- -	- -	mg/kg	<0.0067	<0.0054 [<0.0050]	<0.0066	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	1.1	5.6	- -	- -	mg/kg	<0.0067	<0.0054 [<0.0050]	<0.0066	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	670	3,000	- -	- -	mg/kg	0.00052 B	<0.0054 [<0.0050]	<0.0066	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	310	1,500	- -	- -	mg/kg	<0.0067	<0.0054 [<0.0050]	<0.0066	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	NA	NA	NA	NA
Methylene Chloride	11	54	- -	- -	mg/kg	<0.0067	<0.0054 [<0.0050]	<0.0066	NA	NA	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	NA	NA	NA	NA	NA
Toluene	5,000	46,000	- -	- -	mg/kg	<0.0067	<0.0054 [<0.0050]	<0.0066	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	2.8	14	- -	- -	mg/kg	<0.0067	<0.0054 [<0.0050]	<0.0066	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table B-1
Historical Soil Sampling Results, Northern Burning Ground
New River Unit, Radford Army Ammunition Plant, Radford Virginia

Location ID:	Regional	Regional	Facility-Wide	TCLP		NBGSB18	NBGSB19	NBGSB19	NBGSB20	NBGSB20	NBGSB20	NBGSB20	NBGSB21	NBGSB21	NBGSB21	NBGSB21	NBGSB22	NBGSB22	NBGSB22	NBGSB22	NBGSB23	NBGSB23
Sample Depth(Feet):	Screening Level	Screening Level	Background	Standards		1 - 3	0 - 0.5	1 - 3	0 - 0.5	1 - 3	3 - 5	5 - 7	0 - 0.5	1 - 3	3 - 5	5 - 7	0 - 0.5	1 - 3	3 - 5	5 - 7	0 - 0.5	1 - 3
Date Collected:	(Residential)	(Industrial)			Units	06/19/02	06/12/02	06/19/02	07/20/04	07/20/04	07/20/04	07/20/04	07/20/04	07/20/04	07/20/04	07/20/04	07/20/04	07/20/04	07/20/04	07/20/04	07/20/04	07/20/04
Semivolatile Organics																						
Acenaphthylene [h]	3,400	33,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	17,000	170,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	0.15	2.1	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.015	0.21	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	0.15	2.1	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene [i]	1,700	17,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	1.5	21	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	35	120	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole	24	86	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	15	210	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diethylphthalate	49,000	490,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-Butylphthalate	6,100	62,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	2,300	22,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	2,300	22,000	- -	- -	mg/kg	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	2.1	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene [j]	17,000	170,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	1,700	17,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Inorganics																						
Aluminum	77,000	990,000	**40,041**	- -	mg/kg	**59,500**	21,300 [16,600]	**47,600**	15,000	33,000	**51,400 [56,300]**	**48,800**	17,000	15,500	16,400	36,900	12,700	13,700 [15,100]	33,400	**54,900**	17,300	26,400
Antimony	31	410	**- -**	- -	mg/kg	<0.670 L	<0.600 L [<0.550 L]	0.410 B	<3.30 L	<0.320	0.820 J [<0.660]	<0.670	<5.70	0.390 J	0.880 J	0.960 J	25.5 B	0.370 J [0.270 J]	0.710 J	0.680 L	0.860 B	0.530 J
Arsenic	0.39	1.6	**15.8**	- -	mg/kg	10.4 L	4.73 [3.45]	**16.5 J**	6.80 J	10.4	**16.1 [15.7]**	**17.5**	<6.60	6.50	4.90	13.3	**36.6 J**	4.10 [3.70]	10.2	10.1	6.30	7.80
Barium	15,000	190,000	**209**	- -	mg/kg	31.3	58.0 [46.0]	26.3	90.6	20.6	22.8 [23.9]	20.6	176	46.5	41.6	25.9	**618**	25.9 [27.1]	23.8	24.1	36.6	21.1
Beryllium	160	2,000	**1.02**	- -	mg/kg	0.520 B	0.460 B [0.500 B]	<0.650	0.540	0.450	0.720 [0.740]	0.780	0.540	0.470	0.260	0.590	0.470	0.290 [0.300]	0.580	**1.20**	0.360	0.370
Cadmium	70	810	**0.69**	- -	mg/kg	<0.130	<0.120 [<0.110]	<0.130	**0.760**	0.450 J	**0.780 [0.650 J]**	**0.750 J**	**2.40**	0.270 J	0.370 J	0.580 J	**10.6**	0.190 J [0.190 J]	<0.0290	<0.0390	<0.0300	<0.0310
Calcium	- -	- -	**- -**	- -	mg/kg	344	39,300 J [98,900 J]	690 J	14,600	545	277 [453]	79.2 J	21,800	774	766	347	15,000	820 [891]	996	76.1 B	1,930	440
Chromium [k]	230	1,460	**65.3**	- -	mg/kg	54.9 L	28.4 J [19.7 J]	51.2	**1,000**	42.6	54.8 [60.8]	55.8	**1,090**	32.9	**352**	53.1	**9,690**	23.0 [18.0]	53.6	41.3	50.8	54.3
Cobalt	- -	- -	**72.3**	- -	mg/kg	5.20 J	5.60 J [4.70 J]	3.80 J	14.6	3.00	6.80 [5.90]	6.60	17.8	4.50	4.60	3.50	**85.2**	4.10 [3.10]	3.30	6.50	3.90	3.70
Copper	3,100	41,000	**53.5**	- -	mg/kg	27.5	16.3 L [11.1 L]	23.6	43.0	17.3	30.8 [28.6]	29.0	**69.5**	9.10	16.1	17.6	**567**	4.00 [4.70]	16.2	30.0	10.8	10.6
Iron	55,000	720,000	**50,962**	- -	mg/kg	**52,300 J**	21,200 J [16,100 J]	45,500	19,500	39,400	**55,200 [58,400]**	**55,600**	20,300	19,700	17,700	46,400	40,400	16,700 [16,700]	38,500	45,400	20,400	27,400
Lead	400	750	**26.8**	- -	mg/kg	25.1	**36.2 K [32.7 K]**	23.2	**11,200**	15.9	**34.0 [33.3]**	**40.1**	**16,500**	**30.4**	**4,090**	24.7	**111,000**	**27.6 [16.6]**	**143 J**	**34.9 J**	**348 J**	**147 J**
Magnesium	- -	- -	**- -**	- -	mg/kg	800	29,700 [8,370]	659	5,530 J	690 J	755 J [836 J]	669 J	11,300 J	547 J	878 J	864 J	8,340 J	575 J [580 J]	1,100	1,120	1,330	683
Manganese	1,800	23,000	**2,543**	- -	mg/kg	83.8	161 J [136 J]	74.1	499	55.1	135 [125]	156	422	621	47.7	62.1	435	182 [167]	63.4	74.6	110	39.2
Mercury	6.7	28	**0.13**	- -	mg/kg	**0.270**	0.0400 J [0.0400 J]	**0.170 K**	0.0450	**0.170**	**0.160 [0.230]**	0.130	0.0390	0.0290 J	0.0400	**0.250**	0.0310 J	0.0390 [0.0280 J]	**0.200 J**	0.100 J	0.0350 J	0.0890 J
Nickel	1,600	20,000	**62.8**	- -	mg/kg	27.0	12.9 [8.76]	22.2	11.0	11.3	24.2 [22.3]	25.5	10.8	7.90	5.50	13.9	21.0	4.20 [5.20]	12.7	23.2	7.50	9.70
Potassium	- -	- -	**- -**	- -	mg/kg	1,400	2,140 [1,080]	1,190	827 K	878	1,250 [1,260]	969	1,050	405	608	939	1,190	514 [535]	1,080	1,080	691	864
Selenium	390	5,100	**- -**	- -	mg/kg	<1.34 L	<1.20 L [<1.11 L]	<1.32 L	<0.630	1.20 J	1.30 J [1.90 J]	<1.30	<0.560	0.720 J	0.560 J	1.40 J	<0.570	0.680 J [0.710 J]	<0.530	<0.710	<0.540	0.680 J
Silver	390	5,100	**- -**	- -	mg/kg	<1.34	<1.20 L [<1.11 L]	<1.32	<0.130	<0.130	<0.140 [<0.130]	<0.260	<0.110	<0.110	<0.110	0.130 B	0.990	<0.120 [<0.100]	<0.110	<0.140	<0.110	<0.120
Sodium	- -	- -	**- -**	- -	mg/kg	24.0 B	85.4 [34.8]	22.0 B	390 B	70.2 B	72.1 B [76.8 B]	79.1 B	937 B	77.0 B	<141	84.7 B	2,020 B	73.7 B [57.6 B]	52.1 B	60.4 B	104 B	65.5 B
Thallium	5.1	66	**2.11**	- -	mg/kg	0.210 J	0.190 J [0.160 J]	0.300 J	0.630 J	<0.380	<0.420 [<0.780]	<0.790	<6.80	<0.330	0.460 J	<0.400	<17.2	<0.360 [<0.310]	1.20 B	0.710 B	<0.330	<0.350
Vanadium [l]	390	5,200	**108**	- -	mg/kg	94.8 L	41.5 J [30.9 J]	81.1 J	34.6	78.1	**103 [109]**	96.6	35.9	38.6	37.5	86.5	40.5 J	35.3 [33.6]	76.8	84.9	42.9	56.1
Zinc	23,000	310,000	**202**	- -	mg/kg	40.8 J	78.6 J [51.8 J]	40.3 J	**1,700**	19.7	31.9 [32.9]	31.1	**6,090**	29.6	**647**	23.1	**15,800**	14.2 [12.3]	45.5	31.0	159	31.1
Inorganics-TCLP																						
Arsenic	- -	- -	- -	5.0	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	- -	- -	- -	100	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	- -	- -	- -	1.0	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium [k]	- -	- -	- -	5.0	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	- -	- -	- -	5.0	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	- -	- -	- -	1.0	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	- -	- -	- -	5.0	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Miscellaneous																						
Percent Solids	- -	- -	- -	- -	%	NA	NA	NA	84	78	72 [72]	70	83	81	84	76	83	85 [85]	81	72	86	84
pH	- -	- -	- -	- -	pH Units	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

Notes

[a]	RSL unavailable; RSL for Total HpCDD used as a surrogate.
[b]	RSL unavailable; RSL for Total HpCDF used as a surrogate.
[c]	RSL unavailable; RSL for Total HxCDD used as a surrogate.
[d]	RSL unavailable; RSL for Total HxCDF used as a surrogate.
[e]	RSL unavailable; RSL for Total PeCDD used as a surrogate.
[f]	RSL unavailable; RSL for Endosulfan used as a surrogate.
[g]	RSL unavailable; RSL for Endrin used as a surrogate.
[h]	RSL unavailable; RSL for Acenaphthalene used as a surrogate.
[i]	RSL unavailable; RSL for Pyrene used as a surrogate.
[j]	RSL unavailable; RSL for Anthracene used as a surrogate.
[k]	RSL for Chromium VI (particulates).
[l]	RSL for Vanadium and compounds.
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.
R	Constituent concentration rejected.
NA	Not Analyzed.
ND	Not Detected (no detection limit given).
24,400	Highlighted cell indicates constituent concentration exceeds Soil RSL (Residential).
10.6 J	Highlighted cell indicates constituent concentration exceeds Soil RSL (Industrial).
127	Bolded value indicates constituent concentration exceeds 95% UTLs developed for facil
6.4	Highlighted cell indicates constituent concentration exceeds TCLP standard.

Note: Inorganics Facility-Wide Background Point Estimate taken from *Facility-Wide Background Study Report*, IT Corporation, 2001.

Table B-1
Historical Soil Sampling Results, Northern Burning Ground
New River Unit, Radford Army Ammunition Plant, Radford Virginia

Location ID:						NBGSB23	NBGSB23	NBGSB24	NBGSB24	NBGSB24	NBGSB24	NBGSB25	NBGSB25	NBGSB25	NBGSB25	NBGSB26	NBGSB27	NBGSB28	NBGSB29	NBGSB30	NBGSB31	NBGSB32	NBGSB33
Sample Depth(Feet):	Regional Screening Level (Residential)	Regional Screening Level (Industrial)	Facility-Wide Background	TCLP Standards	Units	3 - 5	5 - 7	0 - 0.5	1 - 3	3 - 5	5 - 7	0 - 0.5	1 - 3	3 - 5	5 - 7	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:						07/20/04	07/20/04	07/20/04	07/20/04	07/20/04	07/20/04	07/20/04	07/20/04	07/20/04	07/20/04	07/20/04	07/22/04	07/21/04	07/20/04	07/21/04	07/22/04	07/19/04	07/21/04
Dioxin/Furan																							
1,2,3,4,6,7,8-HpCDD [a]	0.00039	0.0016	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8-HpCDF [b]	0.00032	0.0011	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8,9-HpCDF [b]	0.00032	0.0011	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-HxCDD [c]	0.000039	0.00016	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-HxCDF [d]	0.000032	0.00011	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-HxCDD [c]	0.000039	0.00016	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-HxCDF [d]	0.000032	0.00011	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-HxCDD [c]	0.000039	0.00016	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-HxCDF [d]	0.000032	0.00011	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-PeCDD [e]	0.0000039	0.000016	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-PeCDF	0.00011	0.00038	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,6,7,8-HxCDF [d]	0.000032	0.00011	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,7,8-PeCDF	0.000011	0.000038	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-TCDD	0.0000045	0.000018	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-TCDF	0.000032	0.00011	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
OCDD	0.013	0.053	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
OCDF	0.011	0.038	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total HpCDDs	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total HpCDFs	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total HxCDDs	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total HxCDFs	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total PeCDDs	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total PeCDFs	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total TCDDs	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total TCDFs	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Explosives																							
None Detected	- -	- -	- -	- -	- -	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Herbicides																							
2,4,5-T	610	6,200	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-D	690	7,700	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-DB	490	4,900	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dalapon	1,800	18,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dicamba	1,800	18,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MCPP	61	620	- -	- -	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	7.2	- -	- -	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	5.1	- -	- -	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	7	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dieldrin	0.03	0.11	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan II [f]	370	3,700	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endrin Aldehyde [g]	18	180	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PAHs																							
2-Methylnaphthalene	310	4,100	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	3,400	33,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene [h]	3,400	33,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	17,000	170,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	0.15	2.1	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.015	0.21	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	0.15	2.1	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene [i]	1,700	17,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	1.5	21	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	15	210	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	0.015	0.21	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	2,300	22,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	2,300	22,000	- -	- -	mg/kg	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	2.1	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	150	670	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene [j]	17,000	170,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	1,700	17,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCBs																							
Aroclor-1254	0.22	0.74	- -	- -	mg/kg	<0.040	<0.040	0.14	<0.040 [<0.039]	<0.039	<0.039	0.56	<0.037	<0.040	<0.040	<0.039	<0.043 [<0.043]	<0.042	<0.040	<0.041	<0.044	<0.042	<0.039
Volatile Organics																							
1,1-Dichloroethene	250	1,100	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trimethylbenzene	67	280	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone	28,000	190,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone	61,000	610,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	1.1	5.6	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	670	3,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	310	1,500	- -	- -	mg/kg	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	NA	NA	NA	NA	NA
Methylene Chloride	11	54	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	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	NA	NA	NA	NA	NA	NA
Toluene	5,000	46,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	2.8	14	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table B-1
Historical Soil Sampling Results, Northern Burning Ground
New River Unit, Radford Army Ammunition Plant, Radford Virginia

Location ID:						NBGSB23	NBGSB23	NBGSB24	NBGSB24	NBGSB24	NBGSB24	NBGSB25	NBGSB25	NBGSB25	NBGSB25	NBGSB26	NBGSB27	NBGSB28	NBGSB29	NBGSB30	NBGSB31	NBGSB32	NBGSB33
Sample Depth(Feet):	Regional Screening Level (Residential)	Regional Screening Level (Industrial)	Facility-Wide Background	TCLP Standards	Units	3 - 5	5 - 7	0 - 0.5	1 - 3	3 - 5	5 - 7	0 - 0.5	1 - 3	3 - 5	5 - 7	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:						07/20/04	07/20/04	07/20/04	07/20/04	07/20/04	07/20/04	07/20/04	07/20/04	07/20/04	07/20/04	07/20/04	07/22/04	07/21/04	07/20/04	07/21/04	07/22/04	07/19/04	07/21/04
Semivolatile Organics																							
Acenaphthylene [h]	3,400	33,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	17,000	170,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	0.15	2.1	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.015	0.21	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	0.15	2.1	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene [i]	1,700	17,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	1.5	21	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	35	120	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole	24	86	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	15	210	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diethylphthalate	49,000	490,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-Butylphthalate	6,100	62,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	2,300	22,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	2,300	22,000	- -	- -	mg/kg	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	2.1	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene [j]	17,000	170,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	1,700	17,000	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Inorganics																							
Aluminum	77,000	990,000	**40,041**	- -	mg/kg	21,000	18,000	13,000	13,500 [14,100]	13,200	16,000	17,100	11,500	11,600	20,300	14,500	10,500 [11,000]	17,700	15,000	26,600	16,500	22,800	17,500
Antimony	31	410	**- -**	- -	mg/kg	0.510 J	0.330 J	0.750 B	0.530 J [<0.280]	<0.280	0.410 J	2.60 B	<0.280	0.420 J	0.430 J	0.790 B	<0.360 L [0.410 B]	0.830 B	0.370 B	0.650 B	0.410 B	0.680 B	0.390 B
Arsenic	0.39	1.6	**15.8**	- -	mg/kg	7.30	4.50	5.60	7.20 [5.70]	3.90	3.60	6.50	4.30	12.7	6.10	5.20	4.00 [3.80]	4.30	2.40 B	11.0	5.90	8.90	8.10
Barium	15,000	190,000	**209**	- -	mg/kg	16.2	14.6	97.1	48.1 [50.1]	52.4	27.3	202	73.8	27.4	26.0	52.9	52.8 K [55.7 K]	126	158	35.1	40.6	47.0	34.1
Beryllium	160	2,000	**1.02**	- -	mg/kg	0.300	0.250	0.470	0.540 [0.520]	0.630	0.290	0.530	0.510	0.400	0.390	0.530	0.470 [0.480]	0.570	0.740	0.710	0.390	0.680	0.450
Cadmium	70	810	**0.69**	- -	mg/kg	<0.0310	<0.0320	0.280 J	<0.0320 [<0.0300]	<0.0300	<0.0300	**1.40**	**0.860**	0.440 J	0.260 J	0.240 J	0.0860 J [0.150 J]	0.520 J	0.420 J	0.190 J	0.240 J	0.290 J	0.150 J
Calcium	- -	- -	**- -**	- -	mg/kg	122	27.1 B	9,580	777 [804]	608	414	37,700	4,170	941	1,010	978	1,450 [1,420]	81,900	129,000	1,370	22,500	2,640	2,790
Chromium [k]	230	1,460	**65.3**	- -	mg/kg	31.8	26.9	**174**	26.0 [20.4]	16.1	18.0	**494**	14.9	29.6	24.0	24.8	21.7 [31.8]	25.8	26.4	36.8	23.6	39.9	28.0
Cobalt	- -	- -	**72.3**	- -	mg/kg	3.30	2.80	6.80	5.90 [5.90]	10.6	3.30	9.70	13.4	4.00	2.80	5.20	7.50 [7.90]	6.70	8.30	5.10	3.20	6.80	4.00
Copper	3,100	41,000	**53.5**	- -	mg/kg	8.50	6.70	37.9	8.50 [8.90]	5.10	5.80	**95.4**	**313**	8.60	12.0	10.2	8.90 [8.90]	26.9	39.7	16.9	11.0	22.8	11.3
Iron	55,000	720,000	**50,962**	- -	mg/kg	25,700	16,900	13,700	23,400 [16,600]	12,500	15,100	19,900	38,600	42,300	23,400	17,900 J	11,700 J [11,400 J]	16,800 J	16,100 J	34,300 J	19,100 J	31,400 J	23,200 J
Lead	400	750	**26.8**	- -	mg/kg	**50.1 J**	10.0 J	**1,710 J**	**27.4 J [29.2 J]**	23.2 J	10.0 J	**5,610 J**	**63.5**	24.1	11.1	**80.1**	**110 [172]**	**124**	**79.5**	**51.0**	**53.9**	**159**	20.8
Magnesium	- -	- -	**- -**	- -	mg/kg	372	296	4,850	526 [552]	688	646	19,700	2,800 J	658 J	779 J	908	983 K [950 K]	39,900	58,500	1,220	11,800	1,840	2,150
Manganese	1,800	23,000	**2,543**	- -	mg/kg	63.7	36.2	407	471 [474]	501	110	290	675	221	63.9	409	252 K [280 K]	221	204	116	122	211	137
Mercury	6.7	28	**0.13**	- -	mg/kg	0.0410 J	0.0400 J	0.0360 J	0.0380 J [0.0380 J]	0.0580 J	0.0310 J	0.0400 J	0.0210 J	0.0600	0.0780	0.0310 J	0.0480 [0.0390]	0.0410	0.0450	0.0700	0.0610	0.0970	0.0490
Nickel	1,600	20,000	**62.8**	- -	mg/kg	8.00	6.70	8.10	7.70 [8.30]	6.60	6.10	13.8	7.30	4.80	8.70	8.20	7.20 [7.30]	13.1	15.4	13.8	7.80	14.8	8.90
Potassium	- -	- -	**- -**	- -	mg/kg	580	369	604	444 [466]	507	649	1,430	701	469	793	458	509 K [523 K]	2,210	3,680	732	856	764	1,010
Selenium	390	5,100	**- -**	- -	mg/kg	0.650 J	<0.580	<0.530	<0.590 [<0.550]	<0.540	<0.560	<0.530	1.40 J	1.50 J	<0.570	<0.620	<0.710 [<0.590]	<0.630	<0.560	0.940 J	<0.600	<0.660	0.580 J
Silver	390	5,100	**- -**	- -	mg/kg	<0.110	<0.120	<0.540	<0.120 [<0.220]	<0.110	<0.110	<0.110	<0.110	<0.110	<0.120	<0.130	<0.140 [<0.120]	<0.130	<0.110	<0.120	<0.120	<0.130	<0.120
Sodium	- -	- -	**- -**	- -	mg/kg	41.3 B	56.8 B	137 B	74.5 B [46.4 B]	52.9 B	47.3 B	404 B	142 B	69.7 B	77.4 B	69.3 B	79.9 B [65.0 B]	187 B	210 B	65.0 B	126 B	99.0 B	59.4 B
Thallium	5.1	66	**2.11**	- -	mg/kg	<0.340	<0.350	<0.320	<0.360 [<0.330]	<0.330	<0.340	<0.330	<0.330	<0.330	<0.350	<0.380	<0.430 [<0.360]	<0.390	<0.340	<0.370	<0.370	<0.400	<0.350
Vanadium [l]	390	5,200	**108**	- -	mg/kg	48.2	34.0	29.2	42.3 [34.2]	28.1	32.8	35.4	23.9	62.1	46.3	37.6	23.8 [24.0]	35.7	35.5	66.2	40.4	59.1	46.3
Zinc	23,000	310,000	**202**	- -	mg/kg	23.0	8.90	**875**	34.8 [39.8]	20.1	11.1	**4,040**	**650**	20.7	17.8	95.4	99.5 [107]	199	158	34.8	143	**204**	38.3
Inorganics-TCLP																							
Arsenic	- -	- -	- -	5.0	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	- -	- -	- -	100	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	- -	- -	- -	1.0	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium [k]	- -	- -	- -	5.0	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	- -	- -	- -	5.0	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	- -	- -	- -	1.0	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	- -	- -	- -	5.0	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Miscellaneous																							
Percent Solids	- -	- -	- -	- -	%	84	84	88	84 [86]	85	87	91	89	84	83	85	77 [78]	80	84	81	77	80	87
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

Notes

[a]	RSL unavailable; RSL for Total HpCDD used as a surrogate.
[b]	RSL unavailable; RSL for Total HpCDF used as a surrogate.
[c]	RSL unavailable; RSL for Total HxCDD used as a surrogate.
[d]	RSL unavailable; RSL for Total HxCDF used as a surrogate.
[e]	RSL unavailable; RSL for Total PeCDD used as a surrogate.
[f]	RSL unavailable; RSL for Endosulfan used as a surrogate.
[g]	RSL unavailable; RSL for Endrin used as a surrogate.
[h]	RSL unavailable; RSL for Acenaphthalene used as a surrogate.
[i]	RSL unavailable; RSL for Pyrene used as a surrogate.
[j]	RSL unavailable; RSL for Anthracene used as a surrogate.
[k]	RSL for Chromium VI (particulates).
[l]	RSL for Vanadium and compounds.
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.
R	Constituent concentration rejected.
NA	Not Analyzed.
ND	Not Detected (no detection limit given).
24,400	Highlighted cell indicates constituent concentration exceeds Soil RSL (Residential).
10.6 J	Highlighted cell indicates constituent concentration exceeds Soil RSL (Industrial).
127	Bolded value indicates constituent concentration exceeds 95% UTLs developed for facil
6.4	Highlighted cell indicates constituent concentration exceeds TCLP standard.

Note: Inorganics Facility-Wide Background Point Estimate taken from *Facility-Wide Background Study Report*, IT Corporation, 2001.

Table B-1
Historical Soil Sampling Results, Northern Burning Ground
New River Unit, Radford Army Ammunition Plant, Radford Virginia

Location ID: Sample Depth(Feet): Date Collected:	Regional Screening Level (Residential)	Regional Screening Level (Industrial)	Facility-Wide Background	TCLP Standards	Units	NBGSD01 0 - 0.5 06/18/02	NBGSD02 0 - 0.5 07/14/04	NBGSD03 0 - 0.5 07/16/04	NBGSD04 0 - 0.5 07/16/04	SS-01 0.5 - 0.7 06/03/97	SS-02 0.5 - 0.7 06/03/97
Dioxin/Furan											
1,2,3,4,6,7,8-HpCDD [a]	0.00039	0.0016	- -	- -	mg/kg	0.00004075 [0.00004256]	NA	NA	NA	NA	NA
1,2,3,4,6,7,8-HpCDF [b]	0.00032	0.0011	- -	- -	mg/kg	0.00000464 [0.00000474]	NA	NA	NA	NA	NA
1,2,3,4,7,8,9-HpCDF [b]	0.00032	0.0011	- -	- -	mg/kg	0.00000041 [<0.00000016]	NA	NA	NA	NA	NA
1,2,3,4,7,8-HxCDD [c]	0.000039	0.00016	- -	- -	mg/kg	0.00000053 [<0.0000004]	NA	NA	NA	NA	NA
1,2,3,4,7,8-HxCDF [d]	0.000032	0.00011	- -	- -	mg/kg	0.00000071 [0.00000073]	NA	NA	NA	NA	NA
1,2,3,6,7,8-HxCDD [c]	0.000039	0.00016	- -	- -	mg/kg	0.00000141 [0.00000124]	NA	NA	NA	NA	NA
1,2,3,6,7,8-HxCDF [d]	0.000032	0.00011	- -	- -	mg/kg	0.00000162 J [0.00000151 J]	NA	NA	NA	NA	NA
1,2,3,7,8,9-HxCDD [c]	0.000039	0.00016	- -	- -	mg/kg	0.00000136 [0.00000142]	NA	NA	NA	NA	NA
1,2,3,7,8,9-HxCDF [d]	0.000032	0.00011	- -	- -	mg/kg	<0.00000014 [<0.00000021]	NA	NA	NA	NA	NA
1,2,3,7,8-PeCDD [e]	0.0000039	0.000016	- -	- -	mg/kg	<0.00000014 [<0.00000028]	NA	NA	NA	NA	NA
1,2,3,7,8-PeCDF	0.00011	0.00038	- -	- -	mg/kg	0.00000021 [<0.00000024]	NA	NA	NA	NA	NA
2,3,4,6,7,8-HxCDF [d]	0.000032	0.00011	- -	- -	mg/kg	0.00000029 [0.00000036]	NA	NA	NA	NA	NA
2,3,4,7,8-PeCDF	0.000011	0.000038	- -	- -	mg/kg	0.00000024 [<0.00000025]	NA	NA	NA	NA	NA
2,3,7,8-TCDD	0.0000045	0.000018	- -	- -	mg/kg	0.00000047 J [<0.00000015]	NA	NA	NA	NA	NA
2,3,7,8-TCDF	0.000032	0.00011	- -	- -	mg/kg	0.00000038 [0.00000022 J]	NA	NA	NA	NA	NA
OCDD	0.013	0.053	- -	- -	mg/kg	0.002629 J [0.003003 J]	NA	NA	NA	NA	NA
OCDF	0.011	0.038	- -	- -	mg/kg	0.0000342 J [0.00003042 J]	NA	NA	NA	NA	NA
Total HpCDDs	- -	- -	- -	- -	mg/kg	0.00008126 [0.00008569]	NA	NA	NA	NA	NA
Total HpCDFs	- -	- -	- -	- -	mg/kg	0.00002337 [0.00002231]	NA	NA	NA	NA	NA
Total HxCDDs	- -	- -	- -	- -	mg/kg	0.00000802 [0.00000717]	NA	NA	NA	NA	NA
Total HxCDFs	- -	- -	- -	- -	mg/kg	0.00000747 [0.00000747]	NA	NA	NA	NA	NA
Total PeCDDs	- -	- -	- -	- -	mg/kg	<0.00000014 [<0.00000028]	NA	NA	NA	NA	NA
Total PeCDFs	- -	- -	- -	- -	mg/kg	0.00000336 [0.00000191]	NA	NA	NA	NA	NA
Total TCDDs	- -	- -	- -	- -	mg/kg	0.00000114 [0.00000118]	NA	NA	NA	NA	NA
Total TCDFs	- -	- -	- -	- -	mg/kg	0.00000151 [0.00000034]	NA	NA	NA	NA	NA
Explosives											
None Detected	- -	- -	- -	- -	- -	- - [- -]	NA	NA	NA	NA	NA
Herbicides											
2,4,5-T	610	6,200	- -	- -	mg/kg	<0.121 [<0.121]	NA	NA	NA	NA	NA
2,4-D	690	7,700	- -	- -	mg/kg	<0.242 [<0.242]	NA	NA	NA	NA	NA
2,4-DB	490	4,900	- -	- -	mg/kg	<1.21 [<1.21]	NA	NA	NA	NA	NA
Dalapon	1,800	18,000	- -	- -	mg/kg	<1.21 [<1.21]	NA	NA	NA	NA	NA
Dicamba	1,800	18,000	- -	- -	mg/kg	<0.242 [<0.242]	NA	NA	NA	NA	NA
MCPP	61	620	- -	- -	mg/kg	<121 [<121]	NA	NA	NA	NA	NA
Organochlorine Pesticides											
4,4'-DDD	2	7.2	- -	- -	mg/kg	0.00244 [0.00034 J]	NA	NA	NA	NA	NA
4,4'-DDE	1.4	5.1	- -	- -	mg/kg	0.00085 B [<0.0008]	NA	NA	NA	NA	NA
4,4'-DDT	1.7	7	- -	- -	mg/kg	0.00421 [0.00072 B]	NA	NA	NA	NA	NA
Dieldrin	0.03	0.11	- -	- -	mg/kg	0.00185 [<0.0008]	NA	NA	NA	NA	NA
Endosulfan II [f]	370	3,700	- -	- -	mg/kg	0.00176 [<0.0008]	NA	NA	NA	NA	NA
Endrin Aldehyde [g]	18	180	- -	- -	mg/kg	<0.0008 [<0.0008]	NA	NA	NA	NA	NA
PAHs											
2-Methylnaphthalene	310	4,100	- -	- -	mg/kg	<0.0025 [0.0037 B]	NA	NA	NA	NA	NA
Acenaphthene	3,400	33,000	- -	- -	mg/kg	0.0086 B [0.0052 B]	NA	NA	NA	NA	NA
Acenaphthylene [h]	3,400	33,000	- -	- -	mg/kg	0.052 [0.083]	NA	NA	NA	NA	NA
Anthracene	17,000	170,000	- -	- -	mg/kg	0.029 [0.032]	NA	NA	NA	NA	NA
Benzo(a)anthracene	0.15	2.1	- -	- -	mg/kg	0.19 [0.49]	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.015	0.21	- -	- -	mg/kg	0.21 [0.53]	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	0.15	2.1	- -	- -	mg/kg	0.31 [0.73]	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene [i]	1,700	17,000	- -	- -	mg/kg	0.18 [0.37]	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	1.5	21	- -	- -	mg/kg	0.11 [0.24]	NA	NA	NA	NA	NA
Chrysene	15	210	- -	- -	mg/kg	0.16 [0.37]	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	0.015	0.21	- -	- -	mg/kg	0.036 [0.084]	NA	NA	NA	NA	NA
Fluoranthene	2,300	22,000	- -	- -	mg/kg	0.33 [0.53]	NA	NA	NA	NA	NA
Fluorene	2,300	22,000	- -	- -	mg/kg	0.01 [0.01]	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.15	2.1	- -	- -	mg/kg	0.18 [0.4]	NA	NA	NA	NA	NA
Naphthalene	150	670	- -	- -	mg/kg	0.0053 B [0.0085]	NA	NA	NA	NA	NA
Phenanthrene [j]	17,000	170,000	- -	- -	mg/kg	0.15 [0.15]	NA	NA	NA	NA	NA
Pyrene	1,700	17,000	- -	- -	mg/kg	0.25 [0.5]	NA	NA	NA	NA	NA
PCBs											
Aroclor-1254	0.22	0.74	- -	- -	mg/kg	0.14 [<0.040]	0.068	<0.039	0.15	NA	NA
Volatile Organics											
1,1-Dichloroethene	250	1,100	- -	- -	mg/kg	<0.0061 [<0.0060]	NA	NA	NA	0.0020 J	ND
1,2,4-Trimethylbenzene	67	280	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA
2-Butanone	28,000	190,000	- -	- -	mg/kg	<0.0061 [<0.0060]	NA	NA	NA	NA	NA
Acetone	61,000	610,000	- -	- -	mg/kg	<0.0061 [<0.0060]	NA	NA	NA	0.0030 B	ND
Benzene	1.1	5.6	- -	- -	mg/kg	<0.0061 [<0.0060]	NA	NA	NA	0.0010 J	ND
Carbon Disulfide	670	3,000	- -	- -	mg/kg	<0.0061 [<0.0060]	NA	NA	NA	NA	NA
Chlorobenzene	310	1,500	- -	- -	mg/kg	<0.0061 [<0.0060]	NA	NA	NA	0.0010 J	ND
d-Limonene	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA
Methylene Chloride	11	54	- -	- -	mg/kg	<0.0061 [<0.0060]	NA	NA	NA	0.0020 B	0.0020 B
tert-Butylbenzene	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA
Toluene	5,000	46,000	- -	- -	mg/kg	<0.0061 [<0.0060]	NA	NA	NA	0.0010 J	ND
Trichloroethene	2.8	14	- -	- -	mg/kg	<0.0061 [<0.0060]	NA	NA	NA	0.0010 J	ND

Table B-1
Historical Soil Sampling Results, Northern Burning Ground
New River Unit, Radford Army Ammunition Plant, Radford Virginia

Location ID: Sample Depth(Feet): Date Collected:	Regional Screening Level (Residential)	Regional Screening Level (Industrial)	Facility-Wide Background	TCLP Standards	Units	NBGSD01 0 - 0.5 06/18/02	NBGSD02 0 - 0.5 07/14/04	NBGSD03 0 - 0.5 07/16/04	NBGSD04 0 - 0.5 07/16/04	SS-01 0.5 - 0.7 06/03/97	SS-02 0.5 - 0.7 06/03/97
Semivolatile Organics											
Acenaphthylene [h]	3,400	33,000	- -	- -	mg/kg	0.040 J [0.035 J]	NA	NA	NA	NA	NA
Anthracene	17,000	170,000	- -	- -	mg/kg	0.018 J [0.028 J]	NA	NA	NA	NA	NA
Benzo(a)anthracene	0.15	2.1	- -	- -	mg/kg	0.22 [0.21]	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.015	0.21	- -	- -	mg/kg	0.28 [0.25]	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	0.15	2.1	- -	- -	mg/kg	0.37 [0.31]	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene [i]	1,700	17,000	- -	- -	mg/kg	0.16 J [0.22]	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	1.5	21	- -	- -	mg/kg	0.13 J [0.12 J]	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	35	120	- -	- -	mg/kg	0.18 B [0.12 B]	NA	NA	NA	0.20 J	0.10 J
Carbazole	24	86	- -	- -	mg/kg	0.022 J [0.021 J]	NA	NA	NA	NA	NA
Chrysene	15	210	- -	- -	mg/kg	0.23 [0.22]	NA	NA	NA	NA	NA
Diethylphthalate	49,000	490,000	- -	- -	mg/kg	<0.21 [<0.21]	NA	NA	NA	NA	NA
Di-n-Butylphthalate	6,100	62,000	- -	- -	mg/kg	<0.21 [<0.21]	NA	NA	NA	ND	0.040 J
Fluoranthene	2,300	22,000	- -	- -	mg/kg	0.37 [0.38]	NA	NA	NA	NA	NA
Fluorene	2,300	22,000	- -	- -	mg/kg	<0.21 [0.010 J]	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.15	2.1	- -	- -	mg/kg	0.17 J [0.21]	NA	NA	NA	NA	NA
Phenanthrene [j]	17,000	170,000	- -	- -	mg/kg	0.12 J [0.16 J]	NA	NA	NA	NA	NA
Pyrene	1,700	17,000	- -	- -	mg/kg	0.34 [0.32]	NA	NA	NA	NA	NA
Inorganics											
Aluminum	77,000	990,000	**40,041**	- -	mg/kg	17,900 [16,600]	21,400	19,500	13,200	18,200	28,900
Antimony	31	410	**- -**	- -	mg/kg	0.360 B [0.480 L]	0.380 B	1.60 B	2.10 B	NA	NA
Arsenic	0.39	1.6	**15.8**	- -	mg/kg	5.56 J [5.75 J]	8.90	6.80	5.10	7.60	6.30
Barium	15,000	190,000	**209**	- -	mg/kg	55.4 [53.0]	44.2	123	142	79.3 J	80.3 J
Beryllium	160	2,000	**1.02**	- -	mg/kg	0.500 B [0.530 B]	0.670 J	0.640 J	0.480 J	0.500	0.600
Cadmium	70	810	**0.69**	- -	mg/kg	0.270 [0.290]	0.0830 J	**1.70**	**1.10**	ND	**0.800**
Calcium	- -	- -	**- -**	- -	mg/kg	3,300 J [11,600 J]	2,680	35,700	12,200	62,700	55,700
Chromium [k]	230	1,460	**65.3**	- -	mg/kg	41.1 J [35.3 J]	38.3	**397**	**151**	32.2	44.2
Cobalt	- -	- -	**72.3**	- -	mg/kg	5.60 J [5.10 J]	6.20	8.90	7.50	7.70	7.50
Copper	3,100	41,000	**53.5**	- -	mg/kg	22.1 L [26.2 L]	20.5	41.5	46.7	18.4	38.6
Iron	55,000	720,000	**50,962**	- -	mg/kg	22,600 J [22,200 J]	31,700	24,800	14,500	28,000	26,700
Lead	400	750	**26.8**	- -	mg/kg	**159 [132]**	**146**	**3,500**	**2,200**	**55.4**	**199**
Magnesium	- -	- -	**- -**	- -	mg/kg	2,570 J [7,410 J]	1,820	19,000	7,930	28,300	26,000
Manganese	1,800	23,000	**2,543**	- -	mg/kg	204 J [201 J]	215	334	319	208	156
Mercury	6.7	28	**0.13**	- -	mg/kg	0.0700 J [0.0600 J]	0.100	0.0480	0.0510	NA	NA
Nickel	1,600	20,000	**62.8**	- -	mg/kg	10.3 [9.19]	14.3	13.1	10.0	13.8	17.3
Potassium	- -	- -	**- -**	- -	mg/kg	999 [901]	655	1,530	899	2,060	2,310
Selenium	390	5,100	**- -**	- -	mg/kg	<1.21 L [<1.21 L]	0.840 J	<0.550	<0.520	NA	NA
Silver	390	5,100	**- -**	- -	mg/kg	<1.21 [<1.21]	<0.120	<0.110	<0.110	NA	NA
Sodium	- -	- -	**- -**	- -	mg/kg	15.0 B [19.0 B]	79.9 B	<560	345 B	NA	NA
Thallium	5.1	66	**2.11**	- -	mg/kg	0.180 J [0.170 J]	<0.360	<0.340	<0.320	0.200	0.200
Vanadium [l]	390	5,200	**108**	- -	mg/kg	40.6 J [39.5 J]	55.8	46.3	29.0	64.6	70.0
Zinc	23,000	310,000	**202**	- -	mg/kg	**473 J [405 J]**	**208**	**4,220**	**2,630**	**294**	**1,210**
Inorganics-TCLP											
Arsenic	- -	- -	- -	5.0	mg/L	NA	NA	NA	NA	NA	NA
Barium	- -	- -	- -	100	mg/L	NA	NA	NA	NA	NA	NA
Cadmium	- -	- -	- -	1.0	mg/L	NA	NA	NA	NA	NA	NA
Chromium [k]	- -	- -	- -	5.0	mg/L	NA	NA	NA	NA	NA	NA
Lead	- -	- -	- -	5.0	mg/L	NA	NA	NA	NA	NA	NA
Selenium	- -	- -	- -	1.0	mg/L	NA	NA	NA	NA	NA	NA
Silver	- -	- -	- -	5.0	mg/L	NA	NA	NA	NA	NA	NA
Miscellaneous											
Percent Solids	- -	- -	- -	- -	%	NA	81	87	82	NA	NA
pH	- -	- -	- -	- -	pH Units	NA	NA	NA	NA	NA	NA
Total Organic Carbon	- -	- -	- -	- -	mg/kg	NA	NA	NA	NA	NA	NA

Notes

[a]	RSL unavailable; RSL for Total HpCDD used as a surrogate.
[b]	RSL unavailable; RSL for Total HpCDF used as a surrogate.
[c]	RSL unavailable; RSL for Total HxCDD used as a surrogate.
[d]	RSL unavailable; RSL for Total HxCDF used as a surrogate.
[e]	RSL unavailable; RSL for Total PeCDD used as a surrogate.
[f]	RSL unavailable; RSL for Endosulfan used as a surrogate.
[g]	RSL unavailable; RSL for Endrin used as a surrogate.
[h]	RSL unavailable; RSL for Acenaphthalene used as a surrogate.
[i]	RSL unavailable; RSL for Pyrene used as a surrogate.
[j]	RSL unavailable; RSL for Anthracene used as a surrogate.
[k]	RSL for Chromium VI (particulates).
[l]	RSL for Vanadium and compounds.
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.
R	Constituent concentration rejected.
NA	Not Analyzed.
ND	Not Detected (no detection limit given).
24,400	Highlighted cell indicates constituent concentration exceeds Soil RSL (Residential).
10.6 J	Highlighted cell indicates constituent concentration exceeds Soil RSL (Industrial).
127	Bolded value indicates constituent concentration exceeds 95% UTLs developed for facil
6.4	Highlighted cell indicates constituent concentration exceeds TCLP standard.

Note: Inorganics Facility-Wide Background Point Estimate taken from *Facility-Wide Background Study Report*, IT Corporation, 2001.

Appendix B

NBG Historical Data

Table B-2
XRF Field Screening Results, Northern Burning Ground
New River Unit, Radford Army Ammunition Plant, Radford Virginia

Row ID	Sample_ID	XRF Lead Concentration (mg/kg)
Row 2N	2N0W	2900
	2N1E	295
	2N1W	408
	2N2E	160
	2N2W	281
	2N3E	137
	2N4W	136
	2N5W	339
	2N6W	179
	2N7W	152
	2N8W	140
	2N9W	118
Row 1N	1N11W	126
	1N14W	83.2
	1N1E	1040
	1N1W	1930
	1N3E	86.6
	1N4W	308
	1N5E	70.2
	1N7W	558
	1N8W	238
	1N9W	305
Row 0	0S11W	124
	0S13W	83.4
	0S1E	2660
	0S1W	2630
	0S3E	476
	0S4E	214
	0S5E	90.8
	0S8W	205
	0S9W	126
Row 1S	1S10E	145
	1S10W	164
	1S12W	76.2
	1S1W	5430
	1S4W	1420
	1S5E	1210
	1S7E	228
	1S8E	126
	1S9W	188
Row 2S	2S10E	130
	2S10W	168
	2S11E	132
	2S13E	89.5
	2S14W	140
	2S1E	2130
	2S1W	1690
	2S5E	2350
	2S7E	255
	2S7W	300
	2S8E	329
	2S8W	450
	2S9E	72.7
	2S9W	314

Row ID	Sample_ID	XRF Lead Concentration (mg/kg)
Row 3S	3S10W	82.1
	3S11E	550
	3S11W	116
	3S12E	83.7
	3S12W	117
	3S15W	93
	3S1W	3890
	3S7E	218
	3S8E	223
	3S9E	264
	3S9W	372
Row 4S	4S10E	715
	4S10W	234
	4S11E	161
	4S11W	340
	4S12E	110
	4S12W	51.8
	4S13W	95
	4S14W	68.8
	4S15W	85.1
	4S1E	177
	4S1W	3420
	4S9E	130
	4S9W	471
Row 5S	5S10E	139
	5S10W	207
	5S11E	130
	5S11W	205
	5S12E	85.6
	5S12W	218
	5S13W	198
	5S14W	159
	5S15W	75
	5S16W	72.3
	5S1E	692
	5S1W	1020
	5S3E	685
	5S5E	299
	5S7E	312
	5S8E	85.1
	5S8W	2990
	5S9E	122
	5S9W	274
Row 6S	6S10W	70.7
	6S12W	93.6
	6S13W	208
	6S14W	181
	6S15W	89
	6S17W	63.3
	6S1E	538
	6S1W	499
	6S2E	889
	6S3E	185
	6S6E	314

Row ID	Sample_ID	XRF Lead Concentration (mg/kg)
Row 6S (cont'd)	6S7E	329
	6S8E	133
	6S8W	382
	6S9E	94.6
	6S9W	72.1
Row 7S	7S10W	110
	7S12W	89.8
	7S15W	105
	7S17W	120
	7S4E	180
	7S5E	185
	7S6E	346
	7S7E	225
	7S8E	190
	7S9E	144
Row 8S	8S17W	80.4
	8S19W	102
	8S1E	2630
	8S21W	216
	8S22W	128
	8S2E	283
	8S2W	1400
	8S4E	266
	8S4W	247
	8S5E	784
	8S6E	226
	8S6W	850
	8S7E	425
	8S8E	242
	8S8W	689
	8S9E	140
	8S9W	269
Row 9S	9S0W	11000
	9S10W	94.4
	9S18W	59.4
	9S19W	145
	9S1E	1490
	9S1W	115
	9S20W	211
	9S21W	110
	9S22W	134
	9S2E	118
	9S2W	149
	9S3W	181
	9S4E	207
	9S4W	149
	9S5E	236
	9S5W	173
	9S6E	196
	9S6W	209
	9S7W	323
	9S8E	1820
	9S8W	284
	9S9E	128
	9S9W	301

Row ID	Sample_ID	XRF Lead Concentration (mg/kg)
Row 10S	10S0W	300
	10S10W	244
	10S11W	69.3
	10S16W	121
	10S17W	98.4
	10S18W	124
	10S19W	160
	10S1E	243
	10S1W	92.9
	10S20W	268
	10S2E	174
	10S2W	125
	10S3W	221
	10S4E	90.9
	10S4W	336
	10S5E	165
	10S5W	392
	10S6W	162
	10S7E	330
	10S7W	264
	10S8E	254
	10S8W	243
	10S9E	105
	10S9W	510
Row 11S	11S0W	64
	11S10W	95.4
	11S11W	246
	11S12W	110
	11S13W	159
	11S16W	144
	11S17W	188
	11S18W	182
	11S1E	59.7
	11S2W	76.8
	11S3E	96.8
	11S4E	327
	11S4W	369
	11S5E	264
	11S5W	285
	11S6E	75.3
	11S6W	251
	11S7E	90.1
	11S7W	172
	11S8E	113
	11S8W	134
	11S9E	68.4
	11S9W	402
Row 12S	12S10W	418
	12S11W	275
	12S12W	304
	12S13W	541
	12S14W	123
	12S15W	138
	12S17W	107
	12S19W	180

Row ID	Sample_ID	XRF Lead Concentration (mg/kg)
Row 12S (cont'd)	12S3E	81.1
	12S3W	119
	12S4E	170
	12S4W	102
	12S5W	137
	12S6E	91.6
	12S6W	244
	12S9W	178
Row 13S	13S10W	113
	13S11W	70.7
	13S12W	380
	13S13W	354
	13S14W	200
	13S15W	125
	13S17W	80.6
	13S18W	112
	13S3E	118
	13S4E	62.6
	13S4W	81.1
	13S5E	82.4
	13S5W	76.1
	13S6W	69.3
	13S7W	94.1
	13S8W	81.9
	13S9W	215
Row 14S	14S10W	78.6
	14S11W	95.4
	14S12W	245
	14S13W	106
	14S14W	102
	14S15W	105
	14S8W	80.8
	14S9W	79.9
Row 15S	15S11W	115
	15S12W	137
	15S13W	136
	15S14W	144
	15S15W	82.6
	15S16W	90.3
	15S18W	147
	15S19W	79.7
	15S21W	76.1
Row 16S	16S12W	147
	16S14W	159
	16S16W	217
	16S17W	166
	16S19W	199
	16S20W	57
	16S20W	240
	16S21W	119
Row 17S	17S12W	82.3
	17S13W	263
	17S14W	286
	17S15W	151
	17S16W	129

Row ID	Sample_ID	XRF Lead Concentration (mg/kg)
Row 17S (cont'd)	17S17W	298
	17S18W	185
	17S19W	243
	17S20W	210
	17S21W	148
Row 18S	18S12W	121
	18S14W	146
	18S15W	90.5
	18S16W	122
	18S17W	153
	18S18W	81.9
	18S19W	117
	18S20W	70.5
	18S21W	93.5
	19S17W	148

Appendix C

Health and Safety Materials

Table 1: Emergency Contact List

Emergency Contact	Phone Number
Local Police - Dublin Police Department	410-674-5167
Local Ambulance	911 (if appropriate)
Radford Army Ammunition Plant Fire Department	540.639.7323
Local Fire Department	911 (from cell phone); 9911 (from plant phone)
New River Unit Security Post	540.674.4988
Local Hospital (Carilion New River Valley Medical Center)	540.731.2000
Poison Control	800.332.3073
National Response Center (all spills in reportable quantities)	800.424.8802
U.S Coast Guard (spills to water)	800.424.8802
ARCADIS Project Manager - Diane Wisbeck	410.987.0032 (office); 410.963.0050 (cell)
ARCADIS Site Manager - Chris Kalinowski	919.854.1282 (office); 919.656.7731 (cell)
ARCADIS H&S Manager - Chuck Webster	315.671.9297
Client Contact - James McKenna	540.731.5782
Client Contact - Jerry Redder	540.639.7536 (office); 540.239.2990 (cell)
Client Contact - Matt Alberts	540.639.8722 (office); 540.230.3294 (cell)
Emergency Coordinator - Diane Wisbeck	410.987.0032 (office); 410.963.0050 (cell)

Emergency Notification Procedure for Project:

Step 1: Field Personnel must contact Chuck Webster or Diane Wisbeck.

Step 2: Diane Wisbeck will contact Site Manager and Client Contacts

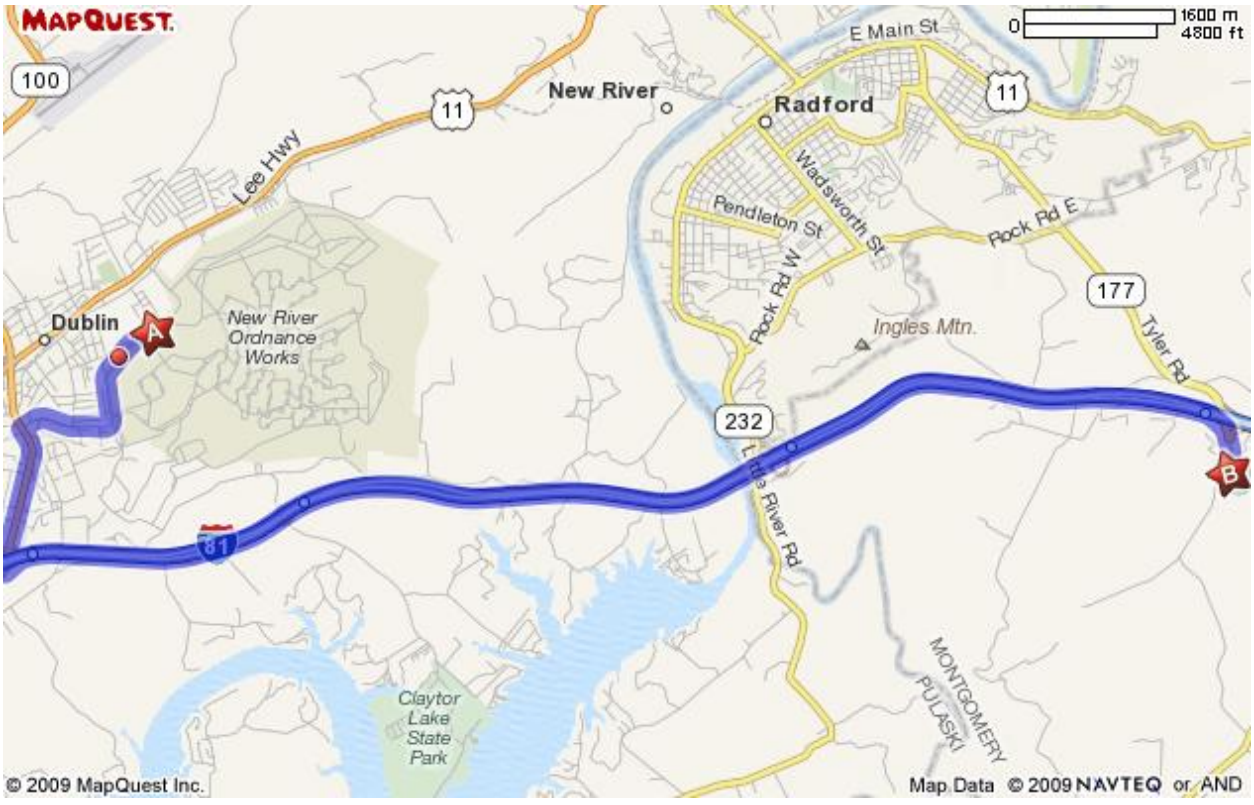
Step 3: If field personnel cannot locate Diane Wisbeck or Chuck Webster, then field personnel may contact client contacts

In the event of a medical emergency, field personnel will call 911 and then the RAAP Fire Department

Route to Hospital from Radford Army Ammunition Plant – New River Unit,

Dublin Virginia

1. From Front Gate of RAAP-NRU take LEFT on Bagging Plant Road. Go 1.7 miles.
2. Turn LEFT on Cleburne Blvd/VA-100S. Go 1.2 miles.
3. Turn LEFT to merge onto I-81N. Go 10.4 miles.
4. Take Exit 109 for Radford (Tyler Road). Go 0.3 miles.
5. Take RIGHT on Tyler Road. Go 0.4 miles.
6. Turn LEFT at Lamb Circle.
7. End at 2900 Lamb Circle, Carilion New River Valley Medical Center



Northern Burning Ground Removal Action

Primary Health Hazards

The two primary constituents of concern (COCs) at the Radford-NRU Northern Burning Ground (NBG) are **lead** and **chromium** in surface soil. The presence of these two COCs in surface soil is the driver for the removal action being conducted at the site.

The following table provides chemical hazard information for the identified COCs.

Substance	Routes of Entry	Symptoms of Exposure	Treatment	8-hrTWA	IDLH (NIOSH)
Chromium	Inhalation Ingestion	Irritates skin and eyes	Remove to fresh air if inhaled; flush eyes and skin with water	0.5 mg/m^3	25 mg/m^3
Lead	Inhalation Ingestion	Irritates skin and eyes, hypotension, weakness, anemia, kidney disease	Remove to fresh air if inhaled; flush eyes and skin with water	0.05 mg/m^3	100 mg/m^3

Precautions to minimize exposure:

- PPE including safety glasses, boots, long pants, long sleeve shirts, gloves to be worn while on-site to minimize dermal contact. Tyvek suits also available to minimize soil contact with clothing.
- No eating or drinking while in the work zones. Wash hands with soap and water prior to eating or drinking off-site.
- Dust monitor will be utilized to evaluate particulates in breathing air. If necessary, the excavation will be watered to minimize dust generation. Dust masks will also be worn during the excavation activities.

ARCADIS

JOB SAFETY ANALYSIS

SECTION 1	
JSA Type:	Field Work
JSA No:	JSA001406
Date:	4/11/2008
Work Type:	Environmental - Decontamination of Small Sampling Equipment
Work Activity:	Decontamination of Field Equipment
Project No.:	GP08RAAPC000 - AEC/ RADFORD ARMY AMMUNITION PLANT PBC (AEC/ RADFORD ARMY AMMUNITION PLANT PBC)

SECTION 2

Development Team	Position/Title	PC	Reviewed By	Position/Title	Date

SECTION 3

Job Steps	Potential Hazard (s)	Critical Action(s)	SOP Reference
Prepare decontamination area	Selection of appropriate decontamination area; site hazards; back strains; slips, trips, and falls	Situate decontamination area in a location designated by the site supervisor or health and safety supervisor; check the decontamination area for uneven surfaces. Utilize appropriate PPE including work boots and leather work gloves.	
Decontamination of small, non-disposable, sampling equipment (e.g., parastaltic pump, YSI, submersible pump, turbidy meter, hand auger, trowels, etc.)	Ingestion, inhalation, and absorption of decontamination fluids; slips, trips, and falls; hand, eye, and foot injuries (cuts); lifting hazards; sprains and strains	Perform decontamination activities in an area designed to prevent spillage or leakage of decontamination fluids. Utilize appropriate PPE. Handle equipment carefully using correct bending and lifting techniques. Use proper decontamination techniques as per the sampling task. Use caution if walking on wet plastic sheeting. Establish decontamination boundaries to keep unauthorized personnel away from area.	
Decontamination of large sampling equipment	Ingestion, inhalation, and absorption of decontamination fluids; slips, trips, and falls; hand, eye, and foot injuries (cuts); lifting hazards; sprains and strains	Perform decontamination activities in an area designed to prevent spillage or leakage of decontamination fluids. Utilize appropriate PPE with a splash shield. Handle equipment carefully using correct bending and lifting techniques. Use proper decontamination techniques as per the sampling task. Use caution while working with high pressure washing equipment including avoiding the hot surfaces of steam cleaners and water jet blast of sprayers. Use caution if walking on wet plastic sheeting. Establish decontamination boundaries to keep unauthorized personnel away from area.	

Collection of decontamination fluids	Spillage of decontamination fluids	Utilize nitrile gloves. Handle equipment and containers carefully. Material Safety Data Sheets, absorbent materials, an eye wash station, and a first aid kit will be available.	

SECTION 4
Personal Protective Equipment (PPE):
Hard Hat
Level D
Protective Gloves - nitrile, leather
Safety Glasses
Safety Shoes
Required and/or Recommended Equipment and Supplies: Company identification card and FRA Training card must be kept on site at all times CSXT Contractor handbook must be kept on site at all times DI water, Isopropyl alcohol, Water/Liquinox mixture ANSI Level II Vest Sunscreen Insect repellant 2-way radio/cell phones First Aid Kit Rain gear/ inclement weather clothing

Initial - In Progress - 04/14/2008 12:06 PM EST

ARCADIS

JOB SAFETY ANALYSIS

SECTION 1	
JSA Type:	Field Work
JSA No:	JSA001405
Date:	4/11/2008
Work Type:	Environmental - Decontamination of Large Equipment
Work Activity:	
Project No.:	GP08RAAPC000 - AEC/ RADFORD ARMY AMMUNITION PLANT PBC (AEC/ RADFORD ARMY AMMUNITION PLANT PBC)

SECTION 2

Development Team	Position/Title	PC	Reviewed By	Position/Title	Date

SECTION 3

Job Steps	Potential Hazard (s)	Critical Action(s)	SOP Reference
Decontamination procedures will be implemented for all non-disposal equipment (e.g., Macro core sampler, hand trowels, splitspoons, etc.).	Inhalation and absorption of decon fluids, slips/trips/falls, hand/eye/foot injuries (cuts), lifting hazards (sprains/strains).	Utilize appropriate PPE. Handle equipment carefully. Use proper decontamination techniques as per the sampling task (soil, surface water, groundwater investigations). Use squirt bottles instead of spray bottles to eliminate mists from solvents. Use caution if walking on wet plastic sheeting and establish decontamination boundaries to keep unauthorized personnel away from area.	
Decontamination of large equipment and vehicles.	Inhalation and absorption of wash fluids, slips/trips/falls, hand/eye/foot injuries (cuts), lifting hazards (sprains/strains).	Utilize appropriate PPE with splash shield. Handle equipment carefully. Use proper decontamination techniques as per the sampling task. Caution using high pressure washing equipment and steam cleaners with the hot surfaces and water jet blast of sprayer. Check decon. area for uneven surfaces and keep eye contact with drivers when moving vehicles in and out of the decon. pad. Use caution if walking on wet plastic sheeting and establish decontamination boundaries to keep unauthorized personnel away from area.	

SECTION 4
Personal Protective Equipment (PPE):
Hard Hat
Level D
Protective Gloves - Type dependent on job-specific requirements
Safety Glasses
Safety Shoes
Required and/or Recommended Equipment and Supplies:

Initial - In Progress - 04/14/2008 12:03 PM EST

ARCADIS

JOB SAFETY ANALYSIS

SECTION 1	
JSA Type:	Field Work
JSA No:	JSA001404
Date:	4/11/2008
Work Type:	Environmental - Excavation
Work Activity:	Excavation and Trenching
Project No.:	GP08RAAPC000 - AEC/ RADFORD ARMY AMMUNITION PLANT PBC (AEC/ RADFORD ARMY AMMUNITION PLANT PBC)

SECTION 2

Development Team	Position/Title	PC	Reviewed By	Position/Title	Date

SECTION 3

Job Steps	Potential Hazard(s)	Critical Action(s)	SOP Reference
Evaluate work area prior to initiating excavation activities and identify overhead and underground utility.	Overhead and underground utilities can be encountered during excavation activities causing injury to personnel and/or damage to equipment and property.	Follow the ARCADIS Utility Location H&S Procedure, and complete the Underground/Overhead Utilities Checklist. Use local site contacts to assist with utility location.	ARCHSFS019
Start up excavation equipment.	Malfunctioning or damaged equipment could cause an incident if the equipment were to malfunction during work activities.	Require the subcontractor to conduct a safety inspection of all heavy equipment prior to use each day. Review pertinent operating information with the subcontractor (i.e. hand signals, site traffic flow, equipment kill switches, etc.)	
Traffic control	Exacavators, dump trucks and support vehicles can cause congestion on work sites, which could cause motor vehicle accidents	Develop a traffic control plan for the site and inform operators/drivers the appropriate enter/egress routes for the site. Review emergency action plans in the event vehicles need to leave the site quickly	
Excavation of soils	Slip, trip and fall hazards can arise from stockpiling of soil, staging of construction materials and general housekeeping of tools and equipment. Exposure to COCs can occur during excavation of impacted soils. Excavation/trench side walls can collapse. Heavy equipment hazards from pinch	-Maintain work area to minimize clutter near the excavation including placing excavated material several feet away from the edge of the excavation. Maintain a 3 foot distance from the edge of the excavation. - Excavations or trenchs should not be entered unless side wall protection is in place and/or it has been certified as safe by a competent person. If possible perform task remotely without entering the excavation. - Conduct daily excavation inspections and after significant weather events. -Backfill trenches as soon as possible and fence off any excavation not	

	points on equipment, swinging arms of backhoes, and moving equipment can strike employees causing injury.	backfilled at the end of the work day. -Maintain distance from excavation equipment in excess of the swing radious. No personnel are permitted to stand underneath suspended loads. Maintain eye contact with equipment operators.	

SECTION 4
Personal Protective Equipment (PPE):
Hard Hat
Hearing Protection
Level D
orange traffic safety vest
Safety Glasses
Safety Shoes
Required and/or Recommended Equipment and Supplies:

Initial - In Progress - 04/14/2008 11:59 AM EST

Job Loss Analysis

General

Client Name	U.S. ARMY ENVIRONMENTAL CENTER
JSA ID	1129
Job Name	Construction-Heavy equipment operation
Task Description	Heavy Equipment Operation for Soil Excavation
Project Number	GP08RAAP4NBG
Project Name	RAAP-044 NBG INTERIM REMOVAL ACTION
PIC Name	TALELE, TUSHAR
Project Manager	WISBECK, DIANE
Status Name	(3) Completed
Cretaion Date	11/12/2009 08:44:30 AM

User Roles

Role	Employee	Due Date	Completed	Approve	Supervisor	Active
Created By	Kalinowski, Christopher	12/3/2009	11/12/2009		Bertz, Charles	True

Job Steps

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
1	Loading and Unloading Equipment from transport vehicles.	1	Stake or impact hazards from moving equipment	Stand clear of equipment loading or unloading form transport vehicles	FHSHB Section IV (E); ARCHSF019, FHSHB Section III(MM)
		2	Equipment damage from improper removal or placement on vehicle	Ensure any ramps used are rated for weight and properly placed and secure prior to moving equipment across, ensure trailers being loaded or unloaded are properly secured against movement.	FHSHB Section IV (E); ARCHSF019, FHSHB Section III(MM)
		3	Overhead utility contact for equipment with booms or extensions	Plan position of transport vehicle to maintain safe distance (>20 ft) from all overhead lines and structures, Use spotters since operator focus may be on vehicle alignment with ramps or other ground level distractions.	FHSHB Section IV (E); ARCHSF019, FHSHB Section III(MM)
		4	Ascending/Descending equipment cab.	Do not hurry through task, wear footwear with good tread and ankle support, maintain 3 points of contact while accessing or egress equipment, no jumping off trailers or truck beds.	FHSHB Section IV (E); ARCHSF019, FHSHB Section III(MM)
2	Pre-operation inspection	1	Pinch hazards to hands	Wear gloves appropriate for hazard while maintaining dexterity. Keep hand in field of vision and watch for and keep hands clear of obvious hazards like door or cover closures. Do not hurry during the removal or placement of covers or equipment components.	
		2	Head injury from striking equipment covers or components	Wear hard hat, stay focused on surroundings, avoid standing or raising up suddenly especially if door cover is overhead.	

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
		3	Exposure to engine fluids or lubricants	Wear protective gloves, ensure MSDS is available for engine fluids and lubricants, promptly wash exposed skin, contact WorkCare immediately for any situation where diesel is injected under the skin.	
		4	Awkward body positions and twisting	Plan inspection activity and do not hurry through task, stretch before crawling or squatting. Avoid overreaching.	
		5	Entanglement in equipment components.	Do not circumvent protective guards or shields, ensure equipment is not operational (LOTO if necessary) when accessing engine compartment if intrusion required.	
3	Equipment operation	1	Strike or impact hazards with other workers, equipment or structures.	Keep eyes moving and watch for unanticipated worker movement. Keep workers 15 ft from any extendable area of the equipment, Maintain 360 degrees of awareness and ensure adequate communication method with other workers. All workers to know emergency STOP hand signals. all back up alarms to be functional.	
		2	Utility contact (subsurface or above ground)	Follow utility clearance procedure prior to any intrusive work with equipment. Immediately stop work if any unusual or unanticipated condition encountered.	
		3	Rollovers on slopes or from improper usage	Follow equipment manufacturer instructions for use on slopes or load capacities, wear seatbelt at all times, Ensure all outriggers, if equipped are properly deployed on stable surface.	
		4	Noise from engine or work activity	Wear hearing protection as required, keep equipment well maintained.	
		5	Slips and falls from accessing or egress from equipment	Maintain 3 points of contact when access or egress equipment, keep any ladder or steps on equipment clean and dry to extent practical, ensure equipment doors, if present, are in good working order.	
		6	Exposure to tools and metal edges and damaged metal resulting in cuts lacerations to hands during maintenance	Wear protective gloves that allow for good dexterity. Mitigate sharp surfaces to extent practical.	
		7	Pinch/crush hazards to hands from doors or covers	wear gloves appropriate for hazard while maintaining dexterity, Watch for and keep hands clear of obvious hazards like door or cover closures. Do not hurry during the removal or placement of covers or equipment components.	

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
		8	Contact stress to knees and hands	Use padding or knee pads if kneeling on hard surfaces for an extended period of time. Avoid placing weight on hands for extended periods of time.	
4	Maintenance	1	Awkward body positions and twisting	Plan inspection activity and do not hurry through task, stretch before crawling or squatting. Avoid overreaching.	
		2	Excessive force turning bolts or lifting heavy components, decontamination activities.	Use automated methods to loosen tight bolts, do not use excessive force or torque when using hand tools. Do not use "cheater bars"	
		3	Contact with engine fluids or lubricants	Wear protective gloves, ensure MSDS is available for engine fluids and lubricants, promptly wash exposed skin, contact WorkCare immediately for any situation where diesel is injected under the skin.	
		4	Flying debris during gross decontamination or cleaning activities	Wear adequate eye and face protection when removing soils or solid media form tracks, buckets, or other component of equipment using pressure washer.	
		5	Entanglement in equipment components.	Do not circumvent protective guards or shields, ensure equipment is not operational (LOTO if necessary) when accessing engine compartment if intrusion required.	
		6	Exposure of hands and arms to hot engine components	Take the time to allow the engine to cool, wear protective gloves and forearm protection.	
		7	Struck by moving equipment or boom extensions	Keep at least 15 ft from any extendable area of the equipment, if entering within 15 ft, establish and maintain contact with equipment operator, ear high visibility clothing or work vest.	
5	Working in proximity to heavy equipment	1	Equipment damage from moving equipment	Keep other equipment not required for work outside of heavy equipment work area in all directions. Flag or mark with high visibility markings, cones, etc., any required equipment near the ground	
		2	Noise hazards from equipment operation	Wear hearing protection and increase distance if work activity permits.	

Personal Protective Equipment

Type	Personal Protective Equipment	Description	Required
Eye Protection	safety glasses		Required
Foot Protection	steel-toe boots		Required
Hand Protection	work gloves (specify type)		Required
Head Protection	hard hat		Required
Hearing Protection	ear plugs	as needed	Recommended

Supplies

Type	Supply	Description	Required
Miscellaneous	fire extinguisher		Required
Miscellaneous	first aid kit		Required
Personal	eye wash (specify type)		Required

Job Loss Analysis

General

Client Name	U.S. ARMY ENVIRONMENTAL CENTER
JSA ID	1134
Task Description	Silt Fence Installation
Project Number	GP08RAAP4NBG
Project Name	RAAP-044 NBG INTERIM REMOVAL ACTION
PIC Name	TALELE, TUSHAR
Project Manager	WISBECK, DIANE
Status Name	(3) Completed
Cretaion Date	11/12/2009 08:56:20 AM

User Roles

Role	Employee	Due Date	Completed	Approve	Supervisor	Active
Created By	Kalinowski, Christopher	12/3/2009	11/12/2009		Bertz, Charles	True

Job Steps

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
1	Survey Area on Proposed Installation of Fencing and Posts	1	Tripping can occur from uneven walking/working surfaces	Identify and control any trip hazards. Setup work area with least interference to public and surrounding activities.	Employee Field H&S Handbook; Utility Location (ARCHSFS019); H&S Procedure ARCHSFS017
		2	Underground utilities can be hit when doing intrusive work	Follow utility locate H&S Policy	Employee Field H&S Handbook; Utility Location (ARCHSFS019); H&S Procedure ARCHSFS017
		3	Staff can be hit by vehicular traffic, and pedestrians can enter work area	Wear Class II traffic vest when working proximal to vehicular traffic. Use traffic cones to keep pedestrians away.	Employee Field H&S Handbook; Utility Location (ARCHSFS019); H&S Procedure ARCHSFS017
2	Fence Post Installation	1	Injury can occur when using hand and power tools	Always inspect hand tools prior to starting task. Wear leather work gloves. Use GFCIs for any power tools. Do not use in wet work areas.	
		2	Rotating parts on gas powered augers can cause bodily injury, and this equipment can be unstable to operate.	A two person operated machine is preferred for better stability. Keep all unnecessary staff clear of augering. Do not wear loose clothing or jewelry	
		3	Fuel spills can occur with refueling equipment	Use approved gas cans for all refueling of equipment. Allow ample time for motor to cool before refueling.	
		4	Sharp edges can cause cuts, and equipment has pinch point hazards	Always secure the equipment when transporting them in vehicles with ratchet straps. Use heavy work gloves while handling and team lift when moving equipment.	
		5	Mixing and pouring concrete can generate dust	Wear safety glasses or goggles.	

3	Silt Fence Installation - Manual	1	Muscle strains can occur from heavy lifting of materials, or when pounding stakes.	Team lift rolls of silts fence off trucks or trailers. Take breaks when using slide hammer (fence post driver) to drive stakes into ground. Muscles can cramp easily from use of this tool. Stretch muscles as necessary. Keep back straight while lifting hammer as well.	
		2	Hands can be cut from splinters on stakes	Wear leather work gloves.	
		3	Excessive noise can be generated when pounding in stakes.	Use hearing protection as necessary.	
		4	Hand injury can occur when pounding stakes, or surrounding staff can be hit.	Make sure surrounding is clear, and keep in communication with staff. Use the right tool for the job, and wear leather work gloves. When using hammer, keep hands clear of post top. If hands are needed to hold stake to get it started, use heavy type work gloves.	
4	Silt Fence Installation - Powered Equipment	1	Powered equipment can pull in or strike body parts causing injury	Do not stand in front of powered equipment as it sets the silt fence in the ground. Stand where operator can see you and where you can see the line of silt fence being installed. Stay in communication with the equipment operator.	
		2	Fuel spills can occur with refueling equipment	Use approved gas cans for all refueling of equipment. Allow ample time for motor to cool before refueling.	
		3	Use of powered and pressurized tools can cause flying parts or hand injuries.	If using air stapler to connect silt fence to stakes, make sure to keep hands clear during use of stapler. During travel to next stake, keep air stapler pointed away from body and toward the ground.	

Personal Protective Equipment

Type	Personal Protective Equipment	Description	Required
Eye Protection	safety glasses		Required
Foot Protection	boots	steel toe	Required
Hand Protection	work gloves (specify type)	leather work gloves	Required
Head Protection	hard hat		Required
Hearing Protection	ear plugs		Recommended
Miscellaneous PPE	traffic vest--Class II or III	when working proximal to traffic	Recommended

Supplies

Type	Supply	Description	Required
Miscellaneous	first aid kit		Required
Personal	eye wash (specify type)		Required
Traffic Control	traffic cones		Required

Job Loss Analysis

General

Client Name	U.S. ARMY ENVIRONMENTAL CENTER
JSA ID	1131
Job Name	General Industry-Site clearing (tree/brush/vegetation) removal
Task Description	Site Clearing Prior to Excavation
Project Number	GP08RAAP4NBG
Project Name	RAAP-044 NBG INTERIM REMOVAL ACTION
PIC Name	TALELE, TUSHAR
Project Manager	WISBECK, DIANE
Status Name	(3) Completed
Cretaion Date	11/12/2009 08:54:05 AM

User Roles

Role	Employee	Due Date	Completed	Approve	Supervisor	Active
Created By	Kalinowski, Christopher	12/3/2009	11/12/2009		Bertz, Charles	True

Job Steps

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
1	Prepping equipment for clearing activities	1	Improperly maintained tools and equipment increase risk for injury to workers using tools/equipment	Maintain tools and equipment according to manufacturer recommendations, including proper oiling and inspection of tool/equipment. Ensure cutting blades are sharp.	
		2	Cuts to hands, fingers, forearms from sharpening tool/equipment blades	Wear protective gloves suitable for the tool/device being sharpened, use proper sharpening techniques and do not hurry through the sharpening process.	
		3	Falls accessing from egressing from large equipment like tractors or bulldozers	Always use 3 points of contact when access/egressing large heavy equipment. Never attempt to access/egress form moving equipment, wear footwear with good anti-slip tread and ankle support, keep mud off of stepping surfaces. Promptly affix seatbelt when sitting in seat.	
		4	Exposure to fuel during refueling activities	Wear protective gloves during refueling activities, avoid breathing fuel vapors by standing in up wind position when practical, promptly wash exposed skin or clothing.	
2	Clearing large brush/trees with heavy equipment	1	Struck by vegetation under tension during clearing	Stand at least 100 ft from clearing activity. Keep unnecessary workers away from clearing activity in all directions.	

		2	Trip fall hazards on uneven ground surfaces	Plan route and avoid walking over down trees and into vegetation where ground surface can not be seen. Wear footwear with good tread and ankle support, don't carry tools in a manner that can obstruct vision of ground	
		3	Slip or trip on muddy or sloped surfaces	Plan route, wear footwear as above, keep hands out of pockets to balance and brace falls,	
		4	Contact with poisonous or physically damaging plants	Identify and avoid contact, if brush containing poisonous plants being burned, do not stand down wind and inhale smoke, wear long pants and long sleeve shirt, in heavy briar infested areas requiring walking, wear briar chaps.	
		5	Contact with poisonous or biting insects	Watch for and avoid hazardous insects, keep cab doors closed, if equipped, to reduce exposure potential.	
		6	Struck by falling trees or large brush	Keep clear of planned fall direction, assume tree can fall in any direction and keep clear in all fall directions	
3	Clearing large brush/trees with hand tools/chainsaws	1	Cuts to arms, legs, hands from cutting tools or chainsaw	Wear protective gloves. When using chainsaw, using chainsaw chaps and helmet equipped with face shield. When using manual tools cut away form body, maintain large distance between workers using hand tools or chainsaw. When using chainsaws, don't reach over running saw, saw over head height, use saw in low visibility situations, use chainsaws on ladders or use one handed.	
		2	Physical stresses from repetitive motion or excessive push/pulling during clearing	Use job or task rotation or frequent rest breaks. Don't use excessive force pulling or pushing on vegetation.	
		3	Scrapes, cuts to skin from vegetation	Wear protective gloves, long pants and long sleeve shirt. Wear briar chaps in thorny vegetation.	
		4	Noise form chainsaws	Wear hearing protection, keep unnecessary workers away form sawing activity	
4	Clearing small brush/tall grass with mowers/bush hogs	1	Struck by flying debris form mowing activity	Keep unnecessary worker 100 ft form mowing activities	
		2	Foot hazards from slipping into cutting blades using walk behind mowers	Do not remove and promptly repair guards that reduce potential for foot entry into blade housing of mowers. Plan mowing to reduce situations that increase risk of foot slippage towards mower housing, wear steel toe boots with good tread	
		3	Noise from mowing activitie	Wear hearing protection	

5	Using wood chippers	1	Struck by debris being chipped or chips emanating form the chipper	Stand clear of material being drawn into the chipper, stand to the side of the chipper table during vegetation entry. Maintain swinging baffles that prevent throwback of material.	
		2	Cuts/amputation of hands/arm inserting brush into chipper	Only use chippers with a 36 inch or more feed throw at from the cutting knives. Never place hand, feet on top the feed table of the chipper wear protective gloves.	
		3	Noise from chipping activity.	Wear hearting protection	
		4	Injury caused form unplanned movement of chipper.	Chock tires of chipper when operating.	
6	Using herbicides	1	Worker exposure to herbicide during mixing or application.	Follow manufacturer mixing and application instructions, review product MSDS for additional hazards or PPE requirements, wear impermeable gloves and clothing during mixing and application, promptly wash any skin exposed to herbicide, wear safety goggles and face shield during mixing and application	
		2	Fatigue and physical stresses form carrying hand applicator for prolonged period of time.	Use job or task rotation to reduce fatigue. For applicators carried by hand, switch hands periodically, opt for backpack versions of applicators when possible.	

Personal Protective Equipment

Type	Personal Protective Equipment	Description	Required
Dermal Protection	coveralls	when using herbicides	Required
Eye Protection	faceshield	when using herbicides	Required
Eye Protection	safety glasses		Required
Eye Protection	safety goggles	when using herbicides	Required
Foot Protection	steel-toe boots		Required
Hand Protection	work gloves (specify type)	leather	Required
Head Protection	hard hat		Required
Hearing Protection	ear plugs		Required
Miscellaneous PPE	other	chainsaw chaps	Required

Supplies

Type	Supply	Description	Required
Communication Devices	mobile phone		Required
Miscellaneous	fire extinguisher		Required
Miscellaneous	first aid kit		Required

Job Loss Analysis

General

Client Name	U.S. ARMY ENVIRONMENTAL CENTER
JSA ID	1187
Job Name	Environmental-Soil sampling/well installation - manual
Task Description	Colleting Surface Soil Samples During Excavation Project
Project Number	GP08RAAP4NBG
Project Name	RAAP-044 NBG INTERIM REMOVAL ACTION
PIC Name	TALELE, TUSHAR
Project Manager	WISBECK, DIANE
Status Name	(2) Review
Cretaion Date	12/2/2009 07:37:52 AM

User Roles

Role	Employee	Due Date	Completed	Approve	Supervisor	Active
Created By	Kalinowski, Christopher	12/2/2009	12/2/2009		Bertz, Charles	True
Developer (Primary Contact)	Kalinowski, Christopher	12/2/2009	12/2/2009		Bertz, Charles	True
HASP Reviewer	Powell, Jace'que	12/16/2009			Mosher, Tyler	True

Job Steps

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
1	Sampling set-up	1	Underground utilities could be encountered during hand augering or shoveling	Follow the utility location policy and procedure.	Utility Location Policy ARCHSF019
		2	Muscle strains can occur from lifting heavy equipment in and out of vehicle	Park as close as possible to the sampling locations. Use lifting techniques as outlined in the Field H&S Handbook.	Utility Location Policy ARCHSF019
		3	slips/trips/falls could occur from uneven walking and working surfaces	Remove any gravel or debris from sample location. Take careful note of footing.	Utility Location Policy ARCHSF019
2	Installation of hand auger borings	1	Muscle Strains from pulling/pushing could occur when installing the boring, and when removing the auger from the hole	Stretch out Arms/Back/Shoulder Muscles prior to beginning. Using firm grip on handle, slowly turn auger and progress downward in 6" increments.Slowly pull auger from hole, use legs to pull auger out of hole. If water is encountered, a suction will be created when trying to remove the auger. Ask for assistance from another worker if you can't remove safely on your own.	
		2	Hand strain and blisters could develop from prolonged hand augering	Select proper gloves for task, usually leather type work gloves or mechanics style gloves. If hot spots develop on hands (Hot Spots are where blisters start to form) readjust gloves or change to better padded glove. If blisters begin to form, stop work so as not to worsen blistering.	

		3	Over-exertion could occur when trying to force an auger forward if there is refusal.	If refusal occurs, Stop Work. Remove Auger from hole and check hole with flashlight if possible. DO NOT overexert by using excessive force	
		4	Fatigue can occur due to strenuous nature of hand augering activities	Take rest breaks as needed or switch out task with another employee.	
3	Collect Surface Soil Sample	1	Staff can come into contact with impacted soils	Wear chemical protective gloves as outlined in the HASP, and wear safety glasses, long pants and long sleeve shirts.	
		2	Sharp edges and broken glassware can cause lacerations	Discard any broken sample containers or glass. Do not overtighten sample containers.	
		3	Leg/Back strain while collecting samples	Use proper body positioning when collecting samples. Do not bend at back. Use knee pads or knee board to allow staff to kneel on ground when collecting samples.	
		4	Hit by heavy equipment performing excavation	Do not sample in areas where heavy equipment or trucks are operating. Make sure equipment operators are aware of your presence and stop work while sampling is on-going.	
		5	Entering Deep Excavations for Soil Sampling	Do not enter excavations without proper slope, step, sidewall protections. If excavations are shallow enough (<3 ft) use hand augers or long shovels to collect samples from outside the excavation.	
4	Decon Sampling Equipment	1	Exposure to COCs while deconing equipment.	Wear chemical protective gloves as outlined in the HASP, and wear safety glasses.	
		2	Cleaning solutions can splash while deconing equipment	Use PPE as outlined in the HASP, and try to minimize splashing.	
		3	The ends of the hand augers and shovels have sharp edges, and lacerations can occur	Use brush to scrub off soils and not hands.	
5	Fill in Sample Location	1	Open boreholes are a trip hazard	Fill in shallow holes with surrounding soils, sand, or approved backfill material.	
		2	Muscle strain can occur from lifting bags of sand and/or bentonite.	Use proper lifting techniques as detailed in the Field H&S handbook	

Personal Protective Equipment

Type	Personal Protective Equipment	Description	Required
Eye Protection	safety glasses		Required
Foot Protection	steel-toe boots		Required
Hand Protection	chemical resistant gloves (specify type)		Required

Hand Protection	work gloves (specify type)		Required
Head Protection	hard hat		Required
Hearing Protection	ear plugs		Required
Miscellaneous PPE	traffic vest--Class II or III		Required
Respiratory Protection	dust mask		Recommended

Supplies

Type	Supply	Description	Required
Decontamination	Decon supplies (specify type)		Required
Miscellaneous	first aid kit		Required
Personal	eye wash (specify type)	bottle	Required
Traffic Control	traffic cones		Required

Job Loss Analysis

General

Client Name	U.S. ARMY ENVIRONMENTAL CENTER
JSA ID	1191
Job Name	Construction-Excavation and trenching
Task Description	Truck Loading for Radford NBG Removal Action
Project Number	GP08RAAP4NBG
Project Name	RAAP-044 NBG INTERIM REMOVAL ACTION
PIC Name	TALELE, TUSHAR
Project Manager	WISBECK, DIANE
Status Name	(2) Review
Cretaion Date	12/2/2009 08:28:58 AM

User Roles

Role	Employee	Due Date	Completed	Approve	Supervisor	Activ
Created By	Kalinowski, Christopher	12/2/2009	12/2/2009		Bertz, Charles	True
Developer (Primary Contact)	Kalinowski, Christopher	12/2/2009	12/2/2009		Bertz, Charles	True
HASP Reviewer	Powell, Jace'que	12/16/2009			Mosher, Tyler	True

Job Steps

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
1	Evaluate work area prior to initiating excavation or truck loading activities and identify overhead and underground utilities.	1	Ovehead and underground utilities can be encountered during excavation or truck loading activities causing injury to personnel and/or damage to equipment and property.	Follow the ARCADIS Utility Location H&S procedure and complete the Underground /Overhead Utilities Checklist. use Local site contacts to assist with utility location.	ARCHSFS019
2	Set up truck loading and decontamination areas.	1	Damage to excavation equipment, dump trucks or other property.	Make sure loading area is free of obstructions and that the loading area is secured to prevent unauthorized access. Make sure excavation equipment can easily place load in trucks.	
		2	Contamination of unimpacted areas.	If possible set up truck decontamination pad within or close to excavation. Lay down plastic to prevent debris falling off truck from contacting unimpacted areas. Remove all loose debris from trucks and equipment prior to leaving decontamiation area.	
3	Perform excavation activities and direct load trucks using mechanical equipment.	1	Contamination of unimpacted areas.	Direct load the excavation material onto dump trucks for off-site disposal. Do not stockpile soil in areas outside the excavation footprint.	

		2	Workers could be exposed to dust during excavation activities.	Use a dust monitor to evaluate dust levels. If necessary wet the soils to prevent dust from blowing. Workers should wear dust masks to minimize dust inhalation. Safety glasses should be worn per HASP.	
4	Decontaminate trucks and equipment.	1	Contaminants could be spread to unimpacted areas on-site or off-site.	Remove all loose debris on trucks and equipment in specified decontamination area. Cover load prior to departing site.	
		2	Moving trucks and equipment.	Make sure trucks and equipment are in park with parking break on during decontamination to prevent risk of decon workers being hit by moving vehicles.	
5	Transport waste to off site disposal facility.	1	Traffic hazards	utilize safe driving practices and follow all traffic regulations.	
		2	Spills/Releases during transport.	In the event of a spill or release during transport to the disposal facility, follow transporters spill contingency plan. follow all notification requirements.	

Personal Protective Equipment

Type	Personal Protective Equipment	Description	Required
Dermal Protection	coveralls		Recommended
Dermal Protection	long sleeve shirt/pants		Recommended
Eye Protection	safety glasses		Required
Eye Protection	safety goggles		Recommended
Foot Protection	boots		Required
Foot Protection	steel-toe boots		Required
Hand Protection	chemical resistant gloves (specify type)	Nitrile	Required
Hand Protection	work gloves (specify type)	Leather	Recommended
Head Protection	hard hat		Required
Respiratory Protection	dust mask		Recommended

Supplies

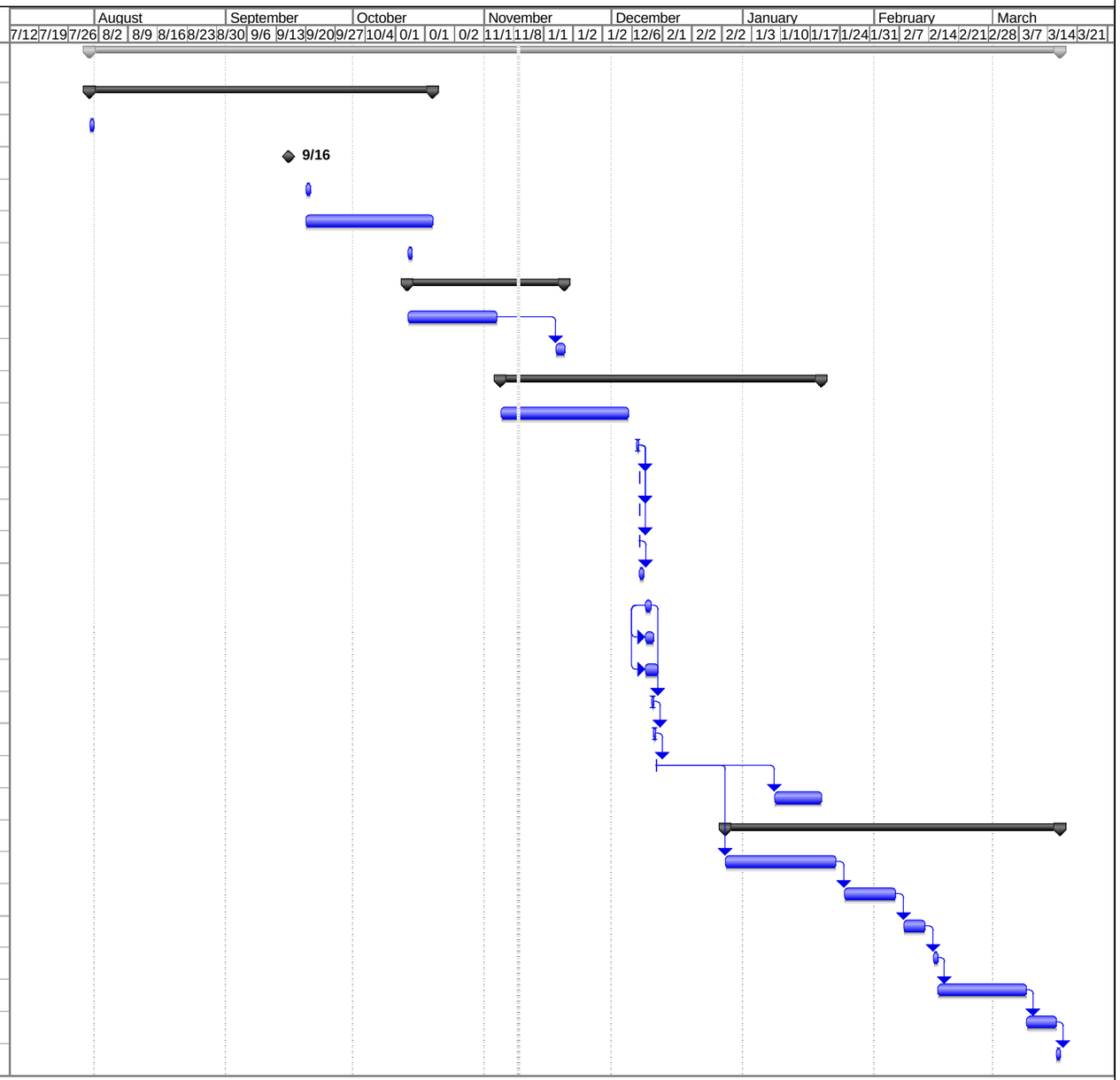
Type	Supply	Description	Required
Communication Devices	mobile phone		Required
Decontamination	Decon supplies (specify type)		Required
Miscellaneous	fire extinguisher		Required
Miscellaneous	first aid kit		Required
Personal	insect repellant		Recommended
Personal	sunscreen		Recommended

Appendix D

Schedule for Removal Action

Project Schedule for Northern Burning Ground Removal Action

ID	Task Name	Duration	Start	Finish	Predecessors
0	**NBG Removal Action**	**164 days**	**Fri 7/31/09**	**Tue 3/16/10**	
1	**EE/CA for Removal Action**	**58 days**	**Fri 7/31/09**	**Tue 10/20/09**	
2	Submit Final EE/CA to VDEQ	1 day	Fri 7/31/09	Fri 7/31/09	
3	VDEQ Approves EE/CA	0 days	Wed 9/16/09	Wed 9/16/09	
4	Publish Notice of Availability for EE/CA	1 day	Sun 9/20/09	Sun 9/20/09	
5	Public Comment Period	30 edays	Sun 9/20/09	Tue 10/20/09	
6	Public Meeting	1 day	Wed 10/14/09	Wed 10/14/09	
7	**Action Memo for Removal Action**	**27 days**	**Wed 10/14/09**	**Thu 11/19/09**	
8	ARCADIS Prepares Draft Action Memo for Army	3 wks	Wed 10/14/09	Tue 11/3/09	
9	Submit Final Action Memo	2 days	Wed 11/18/09	Thu 11/19/09	8FS+2 wks
10	**Conduct Removal Actiion**	**53.75 days**	**Wed 11/4/09**	**Tue 1/19/10**	
11	Pre-Mobilization Coordination	30 edays	Wed 11/4/09	Fri 12/4/09	
12	Personnel and Equipment Mobilization to Site	0.5 days	Mon 12/7/09	Mon 12/7/09	
13	Update Badges and Obtain Work Permits	0.25 days	Mon 12/7/09	Mon 12/7/09	12
14	Utility Clearance	0.25 days	Mon 12/7/09	Mon 12/7/09	12
15	Mark Boundaries of Exacavation Area	0.25 days	Mon 12/7/09	Mon 12/7/09	12
16	Clear Vegetation and Prep Work Areas	1 day	Mon 12/7/09	Tue 12/8/09	15
17	Perform Excavation Activities	1.5 days	Wed 12/9/09	Thu 12/10/09	
18	Confirmation Sampling	2 days	Wed 12/9/09	Thu 12/10/09	17SS
19	Transport Waste to Michigan Disposal	3 days	Wed 12/9/09	Fri 12/11/09	17SS
20	Backfill Excavation	0.5 days	Thu 12/10/09	Thu 12/10/09	17
21	Site Restoration (seeding)	0.5 days	Fri 12/11/09	Fri 12/11/09	20
22	Demobilization (Equipment and Personnel)	0.25 days	Fri 12/11/09	Fri 12/11/09	21
23	Dispose of Decontamination Materials	7 days	Fri 1/8/10	Tue 1/19/10	22FS+20 days
24	**Removal Action Completion Report**	**57 days**	**Mon 12/28/09**	**Tue 3/16/10**	
25	Prepare Internal Draft Completion of Completion Report	4 wks	Mon 12/28/09	Fri 1/22/10	22FS+2 wks
26	Army Review	2 wks	Mon 1/25/10	Fri 2/5/10	25
27	Response to Comments	5 days	Mon 2/8/10	Fri 2/12/10	26
28	Submit Draft Report to VDEQ	1 day	Mon 2/15/10	Mon 2/15/10	27
29	VDEQ Review	3 wks	Tue 2/16/10	Mon 3/8/10	28
30	Response to Comments	5 days	Tue 3/9/10	Mon 3/15/10	29
31	Finalize Completion Report	1 day	Tue 3/16/10	Tue 3/16/10	30



Project: NBG Removal Action
Date: Mon 11/9/09

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone