Final
First Five-Year Review Report for

RADFORD ARMY AMMUNITION PLANT
NEW RIVER UNIT (RAAP-044)
RADFORD, VIRGINIA
USEPA ID VA1210020730

Prepared For:
U.S. Army Environmental Command
2450 Connell Road, Building 2264
Fort Sam Houston, Texas

May 2018

Prepared By:
U.S. Army Corps of Engineers
Buffalo District
1776 Niagara Street
Buffalo, New York 14207

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Approved by: **Date:**

30 MAY 18

James H. Scott, III
Lieutenant Colonel, US Army
Commanding

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LIST OF ACRONYMS AND ABBREVIATIONS

BDDT	Building Debris Disposal Trench
BLA	Bag Loading Area
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	contaminant of concern
EM-CX	Environmental and Munitions Center of Expertise
HHRA	Human Health Risk Assessment
IAA	Igniter Assembly Area
IC	institutional control
LUC	land use control
LUCIP	Land Use Control Implementation Plan
NCP	National Contingency Plan
NPL	National Priorities List
NRU	New River Unit
PAH	polyaromatic hydrocarbons
PCB	polychlorinated biphenyls
RAB	Restoration Advisory Board
RAL	remedial action limit
RAO	Remedial Action Objective
RFAAP	Radford Army Ammunition Plant
RI	Remedial Investigation
SLERA	Screening Level Ecological Risk Assessment
USACE	United States Army Corps of Engineers
USAEC	United States Army Environmental Command
USEPA	United States Environmental Protection Agency
UU/UE	unlimited use/unrestricted exposure
XRF	x-ray florescence

EXECUTIVE SUMMARY

This is the first five-year review of remedial actions taken at the Radford Army Ammunition Plant (RFAAP) New River Unit (NRU) located in Radford, Virginia. The purpose of this review is to determine if remedial actions implemented at the NRU are and will continue to be protective of human health and the environment.

This Five-Year Review Report was prepared in accordance with the U.S. Environmental Protection Agency's Comprehensive Five-Year Review Guidance (USEPA, 2001). The United States Army prepared this review consistent with applicable requirements of the Comprehensive Environmental Response, Compensation, and Liability Act §121 for National Priorities List sites and the National Contingency Plan. This five-year review is required because hazardous substances, pollutants, or contaminants remain at the NRU site above levels that allow for unlimited use and unrestricted exposure (UU/UE) (40 CFR 300.430(f)(4)(ii)). The methods, findings, and conclusions of the review, identified issues, and recommendations are documented in this report. The triggering action for this five-year review was the Army signing of the Decision Document on 11 April 2013.

The following three areas within the NRU meet the requirements for review:

- Building Debris Disposal Trench (BDDT)
- Bag Loading Area (BLA)
- Igniter Assembly Area (IAA)

The remedies for these areas are as follows:

Table 1 – Summary of Remedies Selected for the NRU

Site	Remedy	Components
BDDT	Institutional controls	• Establish land use controls (LUCs) that would prohibit residential development of the site and/or utilization of the site for schools, child-care facilities and playgrounds. • Annual inspections and long-term management to ensure that the rip-rap liner and downgradient vegetation are maintained in the BDDT to prevent erosion/migration of surface soils.
BLA	Removal of building materials and soil, and institutional controls	• Removal and approved off-site disposal of the conductive flooring material present in the building remnants. • Excavation and approved off-site disposal of surface soils located adjacent to former buildings, so as to reduce risk and hazard levels to those appropriate for commercial/industrial land use. • Establish LUCs that would prohibit residential development of the site and/or utilization of the site for schools, child-care facilities and playgrounds.

Site	Remedy	Components
		The land use controls would also prohibit the occupation or utilization of the building remnants for industrial or commercial purposes.
IAA	Removal of building materials and soil, and institutional controls	• Removal and approved off-site disposal of the conductive flooring material present in the building remnants. • Excavation and approved off-site disposal of surface soils located adjacent to former buildings, so as to reduce risk and hazard levels to those appropriate for commercial/industrial land use. • Establish LUCs that would prohibit the occupation or utilization of the building remnants for industrial or commercial purposes.

The following protectiveness statements were selected for these areas:

BDDT

The remedy for the BDDT is protective of human health and the environment.

Institutional controls have been implemented to prevent residential site use and the use of the site for schools, child-care facilities, and playgrounds. Inspections have confirmed that the rip-rap liner and downgradient vegetation have prevented erosion/migration of surface soils.

BLA

The remedy for the BLA is protective of human health and the environment.

Impacted soil and building material posing a risk to receptors under industrial site use were removed and disposed of offsite. Institutional controls have been implemented to prevent residential site use, use of the site for schools, child-care facilities, and playgrounds, and occupation or utilization of the building remnants for industrial or commercial purposes.

IAA

The remedy for the IAA is protective of human health and the environment.

Impacted soil was removed to levels allowing unlimited use and unrestricted exposure. Impacted building material posing a risk to receptors under industrial and commercial site use was removed and disposed of offsite. Institutional controls have been implemented to prevent occupation or utilization of the building remnants for residential, industrial, or commercial purposes.

Site-wide (NRU)

The remedies implemented at the Radford Army Ammunition Plant New River Unit are protective of human health and the environment.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Radford Army Ammunition Plant, New River Unit (RAAP-044)		
EPA ID: VA1210020730		
Region: 3	**State:** VA	**City/County:** Montgomery

SITE STATUS	
NPL Status: Non-NPL	
Multiple OUs? Yes	**Has the site achieved construction completion?** Yes

REVIEW STATUS
Lead agency: Other Federal Agency **If "Other Federal Agency" was selected above, enter Agency name:** Army
Author name (Federal or State Project Manager): James McKenna
Author affiliation: Installation Restoration Program Manager
Review period: April 2017 – April 2018
Date of site inspection: 31 July 2017
Type of review: Statutory
Review number: 1
Triggering action date: 11 April 2013
Due date *(five years after triggering action date)*: 11 April 2018

Five-Year Review Summary Form (continued)

OU(s) without Issues/Recommendations Identified in the Five-Year Review:
BDDT, BLA, and IAA

Issues and Recommendations Identified in the Five-Year Review:
None

Protectiveness Statement(s)		
Operable Unit: Building Debris Disposal Trench	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* Click here to enter date.
Protectiveness Statement: The remedy for the BDDT is protective of human health and the environment. Institutional controls have been implemented to prevent residential site use and the use of the site for schools, child-care facilities, and playgrounds. Inspections have confirmed that the rip-rap liner and downgradient vegetation have prevented erosion/migration of surface soils.		
Operable Unit: Bag Loading Area	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* Click here to enter date.
Protectiveness Statement: The remedy for the BLA is protective of human health and the environment. Impacted soil and building material posing a risk to receptors under industrial site use were removed and disposed of offsite. Institutional controls have been implemented to prevent residential site use, use of the site for schools, child-care facilities, and playgrounds, and occupation or utilization of the building remnants for industrial or commercial purposes.		
Operable Unit: Igniter Assembly Area	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* Click here to enter date.
Protectiveness Statement: The remedy for the IAA is protective of human health and the environment. Impacted soil was removed to levels allowing unlimited use and unrestricted exposure. Impacted building material posing a risk to receptors under industrial and commercial site use was removed and disposed of offsite. Institutional controls have been implemented to prevent occupation or utilization of the building remnants for industrial or commercial purposes.		

Site-Wide Protectiveness Statement	
Protectiveness Determination: Protective	*Addendum Due Date (if applicable):* Click here to enter date.
Protectiveness Statement: The remedies implemented at the Radford Army Ammunition Plant New River Unit are protective of human health and the environment.	

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1.0 INTRODUCTION

This five-year review of the Radford Army Ammunition Plant (RFAAP) New River Unit (NRU) (RAAP-044) was conducted by the United States Army Corps of Engineers (USACE) Buffalo District on behalf of the United States Army Environmental Command (USAEC). RFAAP is an active government-owned, contractor operated facility located in Radford, Virginia (Figure 1 in Attachment 1). The remedial activities in the NRU subject to this review are located in three distinct areas (Figure 2 in Attachment 1):

- Building Debris Disposal Trench (BDDT)
- Bag Loading Area (BLA)
- Igniter Assembly Area (IAA)

The NRU includes three additional areas identified as the Northern Burning Ground, Rail Yard, and Western Burning Ground, and a groundwater unit. Response actions were not required for the groundwater unit, Northern Burning Ground, or Rail Yard, and the remedy selected for the Western Burning Ground resulted in unlimited use and unrestricted exposure (UU/UE). A five-year review is not required for the Northern Burning Ground, Rail Yard, Western Burning Ground, or NRU groundwater unit.

This is the first five-year review of remedial actions taken at the NRU. The NRU is not on the National Priorities List (NPL) and the review was implemented in general accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This review is required by statute; the United States Army prepared it pursuant to CERCLA §121 and the National Contingency Plan (NCP). CERCLA §121 states:

"If the president selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgement of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews."

The United States Environmental Protection Agency (USEPA) interpreted this requirement further in the NCP; 40 Code of Federal Regulations (CFR) §300.430(f)(4)(ii) states:

"If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action."

A five-year review of the remedial actions at the NRU was triggered by the Army signing of the NRU Decision Document on 11 April 2013. This review was conducted between April 2017 and April 2018. The purpose of the five-year review is to determine whether the site remedies are protective of human health and the environment. The methods, findings, and conclusions of the review are documented in the report.

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2.0 INSTALLATION-WIDE CHRONOLOGY

The following table lists the dates of important events for the NRU sites.

Table 2 – Chronology of New River Unit Sites Events

Event	Date
The NRU was constructed	1940
The NRU was operated as a bag manufacturing and loading plant	1940-1945
The NRU was incorporated into the RFAAP	1945
The Army conducted environmental investigations	1997-2010
Engineering Evaluation/Cost Analysis	July 2009
Remedial Investigation	June 2010
Feasibility Study	September 2010
Proposed Plan	September 2010
Remedy implementation at the BLA and IAA	December 2010 – May 2011
Decision Document	April 2013
Land Use Control Implementation Plan	30 September 2013
Response Action Completion and Closure Report for Bag Loading Area, Igniter Assembly Area, and Western Burning Ground	30 September 2013

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3.0 BACKGROUND

The following sections detail the NRU background. Details of site physical characteristics are repeated here largely from information presented in the NRU Remedial Investigation (ARCADIS 2010a).

3.1 PHYSICAL CHARACTERISTICS

RFAAP occupies 6,900 acres in the mountains of southwest Virginia in Pulaski and Montgomery Counties. RFAAP consists of two noncontiguous units: the main manufacturing area and the NRU (NRU, Figure 1 in Attachment 1). This review has been prepared for the NRU. The NRU is located approximately 6 miles west of the main plant near the town of Dublin.

RFAAP lies in one of a series of narrow valleys typical of the eastern range of the Appalachian Mountains. Oriented in a northeast-southwest direction, the valley is approximately 25 miles long, 8 miles in width at the southeast end, and narrows to 2 miles at the northeast end. RFAAP lies along the New River in the northeast corner of the valley.

3.1.1 Geology

The NRU is underlain by carbonate bedrock of the Cambrian aged Conococheague Formation, overlain by a variably thick veneer of unconsolidated residuum. The residuum is dominantly clay and silt, with occasional sand or gravel components. The thickness is highly variable with common outcrops. The depth to bedrock across the NRU ranges from shallow (10 feet or less below ground surface) to up to 55 feet below ground surface. The Conococheague Formation is principally blue-gray limestone and dolomite, with occasional thin beds of sandstone, siltstone, and shale. The thickness of the stone is unknown regionally but may be many hundreds of feet.

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

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

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

3.1.2 Hydrogeology

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

- Karst solution porosity dominates the facility-wide and valley-scale groundwater system. The very high transmissivity of the bedrock aquifer (imparted by solution porosity) appears to keep regional-scale aquifer groundwater elevations deep, with heads largely controlled by the location and elevation of base-level discharges to the New River or its low-elevation tributaries.
- Lithologic controls influence the vertical interconnections of solution porosity. Contrasts in lithology (likely the presence of insoluble beds) provide localized aquitards that restrict or actually separate flow vertically. This control explains the presence of shallow (potentially perched) groundwater and high-elevation springs in the northern portion of the NRU.
- Structural controls influence the geometry and interconnections of solution porosity. The major fault trending northeast across the NRU truncates the shallow flow system present on the north side of the NRU. The fault trace corresponds with a dramatic change in the shallow potentiometric surface.
- Alignment of sinkholes and stream valleys with fault and bedding trends implies that the karst solution is biased by structural planes of weakness in the bedrock.
- Low permeability surface soil (the clay-rich residuum) appears to inhibit diffuse groundwater recharge. Recharge is concentrated in sinkholes, where flow through the residuum is short-circuited.

Though sporadically saturated, the unconsolidated residuum is not interpreted to be a distinct, laterally extensive aquifer. Saturation within the overburden is localized in bedrock depressions where it functions as storage for flow occurring in the epikarst. In general, hydraulic heads across NRU indicate an extreme downward gradient. The magnitude of observed head differences is indicative of poor hydraulic communication and limited groundwater flux occurring vertically across low permeability. These low permeability beds act as semi-confining or perching beds within the aquifer and likely cause groundwater to flow in the same plane as the layer until a discharge point (spring or seep), or until reaching a structural weakness within the layer that forms a vertical migration pathway.

3.1.3 Surface Water Hydrology

Four springs have been identified at the NRU. These include Wiggins Spring, which is at the head of a pond near the Western Burning Ground; an unnamed spring at the head of the pond near the Western Burning Ground; and two unnamed springs in the northeastern portion of the facility. These springs appear to drain a shallow groundwater system in bedrock and/or epikarst. The elevation of the springs is comparable to shallow groundwater elevations which suggests that the springs discharge groundwater only from a shallow flow system, most likely local recharge occurring within the northern portions of the facility.

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

3.2 LAND AND RESOURCE USE

RFAAP is a government-owned, contractor-operated, industrial facility (currently operated by BAE Systems). Active manufacturing operations at NRU, localized at the BLA and IAA, ended in 1945. The NRU currently serves as a storage facility for operations at the main manufacturing area. The storage facilities consist of bunker-type buildings located primarily throughout the eastern portion of the NRU. Paved surface roads run throughout the facility to provide access to the storage bunkers and areas utilized during historical operations. Railroad tracks and spurs are located in the Rail Yard.

With the exception of storage bunkers and a few maintenance/support buildings, very few active structures remain at NRU. The majority of NRU consists of undeveloped grasslands, heavily forested areas, and agricultural tracts. A portion of the property is adjacent to a military cemetery.

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4.0 FIVE-YEAR REVIEW PROCESS

4.1 ADMINISTRATIVE COMPONENTS

The following activities were performed for this five-year review:

- Community notification of the start of the five-year review.
- Documents and site data review.
- Site inspections.
- Interviews with RFAAP and regulatory staff, and Restoration Advisory Board (RAB) members with insight on decisions made and activities completed at the sites.

This five-year review was conducted and written by staff of the USACE Buffalo and Nashville Districts:

- Holly Akers, PE, Project Engineer
- Laura Allen, Project Engineer
- Michelle Barker, FE, PMP, HTRW Regional Technical Specialist
- Karen Keil, PhD, Environmental Toxicologist
- Lannae Long, Environmental Engineer
- Mick Senus, Project Manager

Staff from RFAAP including the Installation Restoration Program Manager, James McKenna, also provided assistance.

4.2 COMMUNITY NOTIFICATION AND INVOLVEMENT

A public notice was published in the Roanoke Times (09 July 2017) stating that the five-year review process had begun. A copy of the notice is included in Attachment 8.

The five-year review document will be made available to the public once it has been finalized. A copy of the document will be placed in the repositories identified below:

Radford Army Ammunition Plant
Constitution Road, Building 220
Radford, Virginia 24141

Montgomery-Floyd Regional Library
Christiansburg Branch
125 Sheltman Street
Christiansburg, Virginia 24073

A copy will also be placed in the electronic repository located at the web address below:
http://www.radfordaapirp.org/inforepo/online-index.htm

Upon completion of the five-year review, a public notice will be placed in the Roanoke Times to announce the availability of the final five-year review in the document repositories.

RFAAP does interface with a public RAB whose members were invited to participate in the five-year review process. Interview forms completed by RAB members are included in Attachment 6

and discussed in Section 4.4. Copies of RAB meeting minutes and presentation materials are publicly available at the following web address:
http://www.radfordaapirp.org/comminv/rabmin/archives.htm

4.3 DOCUMENT REVIEW

Relevant, site-related documents were reviewed including the decision documents, remedial action completion reports, historical investigations, land use control implementation plan, and recent monitoring/inspection reports. A complete list of documents reviewed is provided in Attachment 2.

4.4 INTERVIEWS

Interview forms were distributed to the following personnel in support of the five-year review:

- James McKenna, RFAAP Installation Restoration Program Manager
- James Cutler, Federal Facilities Project Manager, Virginia Department of Environmental Quality
- David Allbee, RAB Member
- Steve Cole, RAB Member
- Heather Govenor, RAB Member
- Joe Parrish, RAB Member

Interview forms were distributed on 08 August 2017 with follow-up requests issued on 18 August 2017 and 08 September 2017. As of 22 November 2017, four completed forms have been received from James McKenna, James Cutler, Heather Govenor, and Stephen Cole. No information affecting the protectiveness of the remedies was identified in the interview forms nor in conversations had during the site inspection. The following additional information was provided:

- Mr. McKenna indicated that the remedies are performing as intended and that no maintenance or implementation issues were encountered.
- Mr. Cutler suggested that the inspection reports be incorporated into the NRU administrative record. This suggestion was implemented by the installation and the inspection reports were added to the administrative record on 23 August 2017.
- Ms. Govenor indicated that RAB meetings were modified from three times a year to as needed in June 2017. No community concerns were identified.
- Mr. Cole noted community concern over ongoing RCRA activities at the installation but knew of no concern over remedial actions.

A copy of the completed interview records are included in Attachment 6.

5.0 SITE-SPECIFIC DISCUSSIONS

5.1 BUILDING DEBRIS DISPOSAL TRENCH

5.1.1 Background

5.1.1.1 Physical Characteristics/Land and Resource Use

The BDDT encompasses approximately 5 acres near the southern boundary of the NRU and consists of rolling grass-covered hills (Figure 3 in Attachment 1). The BDDT includes what was formerly a natural drainage channel that had eroded into the clay soils between the two hills. This drainage channel directs surface water runoff from the surrounding area toward a small unnamed stream that runs through the southwestern portion of the NRU. The BDDT was historically used for disposal activities.

5.1.1.2 History of Contamination

An approximately 600 foot long section of the natural depression formed by the drainage channel was used for the disposal of miscellaneous building debris derived from the dismantling of various structures at the NRU. The building debris consisted of concrete, wood, and rusted/broken drums of a black, tarry substance believed to be roofing tar. The presence of these drums and other debris in a surface water drainage pathway warranted environmental investigation.

The following investigations were performed to characterize the BDDT:

- 1997 – Preliminary sampling by Alliant Techsystems, Inc.
- 1998 – Independent sampling by Gannett Fleming
- 1998 – Remedial Investigation by ICF Kaiser Engineers, Inc.
- 2002 – Remedial Investigation by Shaw Environmental, Inc.
- 2004 – Additional characterization sampling by Shaw Environmental, Inc.
- 2008 – Remedial Investigation by ARCADIS

The historical investigations are summarized in Attachment 9 in Table 1, *Summary of Historical Investigations Completed at RFAAP-NRU,* extracted from the Decision Document (ARCADIS 2011b).

Benzo(a)pyrene was detected in soil at the BDDT at concentrations ranging from 0.0089 milligrams per kilogram (mg/kg) to 57 mg/kg and a frequency of detection of 45 out of 63 historical samples (See Attachment 9, Table 2 extracted from the Decision Document, *Contaminants of Concern for the BDDT, BLA, IAA, and WBG Study Areas*).

5.1.1.3 Initial Response

The building debris and all visibly stained soil was removed from the site during site investigation and restoration activities completed in 1998. The excavated materials were replaced with clean fill material and the trench was lined with geotextile fabric and filled with riprap to prevent erosion of the underlying soil. The area downgradient of the riprap covered portion of the trench widens into a gently sloping, delta shaped area. Since the completion of the site restoration activities in 1998, a thick grass groundcover has also become established in the downgradient depositional area.

5.1.1.4 Basis for Taking Action

The basis for taking action at the BDDT was established in the Remedial Investigation (RI) Human Health Risk Assessment (HHRA) (ARCADIS 2010a). Elevated concentrations of benzo(a)pyrene were identified in surface and subsurface soil across the BDDT and within the rip rap covered portion of the BDDT that posed unacceptable cancer risk to a future hypothetical resident. Current and future industrial site use do not pose unacceptable risks.

Benzo(a)pyrene was the only contaminant of concern (COC) selected for the BDDT:

Table 3 – COC at the BDDT

COC
Benzo(a)pyrene

A screening level ecological risk assessment (SLERA) and baseline ecological risk assessment (BERA) were completed for the BDDT. The SLERA and BERA concluded that adverse effects are not expected for wildlife at the BDDT.

5.1.2 Remedial Actions

5.1.2.1 Remedy Selection

The remedy for the BDDT was selected in the Decision Document (ARCADIS 2011b). The Decision Document included the following remedial action objectives (RAOs) for the BDDT:

- Minimize the potential for COCs present in soil to migrate to other areas, including the downgradient creek.
- Prevent human exposure to COCs in surface soils that could lead to risks or hazards for the designated use.

The selected remedy was institutional controls (ICs) including the following components:

- Establish LUCs that would prohibit residential development of the site and/or utilization of the site for schools, child-care facilities and playgrounds.
- Annual inspections and long-term management to ensure that the rip-rap liner and downgradient vegetation are maintained in the BDDT to prevent erosion/migration of surface soils.

Because the remedial action results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for UU/UE, statutory five-year reviews are required.

Table 4 summarizes the remedial action level (RAL) for benzo(a)pyrene (ARCADIS 2011b):

Table 4 –Remedial Action Level at the BDDT

COC	RAL Hypothetical Future Resident Scenario[1]
Benzo(a)pyrene	0.025 mg/kg

[1]Although the RAL in the Decision Document was based on the hypothetical future resident, this RAL is also protective of the less restrictive designated use of the site, which is industrial/commercial.

5.1.2.2 Remedy Implementation

The ICs at the BDDT were implemented through a Land Use Control Implementation Plan (LUCIP) (ARCADIS 2013). The LUCIP outlined the following LUC mechanisms already in place:

- The NRU serves as a storage facility for energetic materials manufacturing from the main manufacturing area. A security force, physical control procedures and equipment access restrictions are in place for these operations.
- RFAAP has a personnel security program to ensure employees and subcontractors who are required to be vetted and/or have a background investigation in performance of their duties are properly evaluated and regularly monitored in accordance with Department of Defense security policies.
- Perimeter fencing, guarded gates, and uniformed guards with communication devices are in place to restrict access to the NRU property.
- Construction, excavation, and development of any kind are highly scrutinized by both the Army and RFAAP's commercial operator personnel. Several clearances, passes, permits, and inspections are required before equipment or personnel are allowed to operate on-site.

In addition to existing mechanisms, RFAAP posted a sign at the BDDT reading as follows:

"UNAUTHORIZED PERSONNEL KEEP OUT.
THIS SITE IS SUBJECT TO LAND USE CONTROLS.
MAINTAIN THIS SITE IN ITS CURRENT STATE,
AND PREVENT FUTURE RESIDENTIAL USE.
DO NOT REMOVE RIP-RAP OR VEGETATION FROM THIS AREA.
CONTACT THE ENVIRONMENTAL DEPARTMENT WITH QUESTIONS."

The annual inspection and maintenance activities of the rip rap are discussed in Section 5.1.2.3, below.

5.1.2.3 Operation, Maintenance, and Monitoring

The maintenance and inspection procedures for the BDDT are provided in the LUCIP (ARCADIS 2013). The LUCIP requires the distribution of the LUCIP to regulators and operators of RFAAP and notification of changes in land use. In addition, annual inspections are required to ensure that the BDDT is not used for residential purposes, that the rip rap liner and downgradient vegetation at the BDDT remain in place to prevent erosion/migration of surface soils that contain COCs, and that LUC information signs are properly maintained.

BAE Systems performed inspections for the BDDT on behalf of the Army on the following dates as documented in the annual inspection reports (RFAAP 2014, 2015, 2016, and 2017), and identified the following:

- 25 June 2014: No deficiencies or remedial action noted as required
- 09 November 2015: No deficiencies or remedial action noted as required
- 09 September 2016: Recommendation to address vegetation around LUC signage
- 22 May 2017: Recommendation to address vegetation around LUC signage

Installation staff indicated that vegetation around LUC signage has been addressed.

5.1.3 Data Review

No environmental data has been collected for the BDDT since site characterization.

5.1.4 Site Inspection

A site inspection was conducted on 31 July 2017 to obtain familiarity with the site, record site conditions using photographs, interview staff familiar with the site, and assess protectiveness of the remedy. The inspection was attended by the following staff:

- Michael Senus, PE, Project Manager, USACE
- Laura Allen, Project Engineer, USACE
- James McKenna, Restoration Program Manager, Radford Army Ammunition Depot

The following observations were noted during the site inspection:

- LUC signage was present in the vicinity of the BDDT
- The rip rap liner and downgradient vegetation at the BDDT was observed to be in good condition
- No changes in site use or evidence of intrusive activities were observed at the BDDT
- Access to the NRU was restricted by a perimeter fence with security personnel at the access gate and on roving patrols. The fence was observed to be in good condition.

The site inspection checklist and photographs are provided in Attachments 4 and 5, respectively.

5.1.5 Technical Assessment

5.1.5.1 Question A: Is the Remedy Functioning as Intended by the Decision Document?

Yes, the BDDT remedy is functioning as intended by the decision document. The LUCs have been implemented including administrative components, signage, and inspections. These LUC components effectively prevent residential use and utilization of the site for schools, child-care facilities, and playgrounds, thereby preventing human exposure to COCs in surface soil that could lead to unacceptable risks or hazards. The rip rap liner is maintained as required to minimize the potential for the migration of COCs in soil.

5.1.5.2 Question B: Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Used at the Time of the Remedy Still Valid?

Yes, exposure assumptions, toxicity data, cleanup levels and remedial action objectives are still valid. Exposure assumptions in the decision document are equal to or more conservative than current default assumptions. Toxicity data used to calculate the cleanup goal for benzo(a)pyrene is 7.3 times more conservative than current toxicity data. The remedial action objectives are still valid, and there is no new site information that would change or add to the remedial action objectives.

5.1.5.3 Question C: Has Any Other Information Come to Light That Could Call Into Question the Protectiveness of the Remedy?

No, no other information has come to light that would call into the protectiveness of the BDDT remedy.

5.1.6 Issues

No issues were identified for the BDDT remedy.

5.1.7 Recommendations and Follow-Up Actions

No recommendations and follow-up actions were identified for the BDDT remedy.

5.1.8 Protectiveness Statement

The remedy at the BDDT is protective of human health and the environment.

Institutional controls have been implemented to prevent residential site use and the use of the site for schools, child-care facilities, and playgrounds. Inspections have confirmed that the rip-rap liner and downgradient vegetation have prevented erosion/migration of surface soils.

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5.2 BAG LOADING AREA

5.2.1 Background

5.2.1.1 Physical Characteristics

The BLA is located on a hilltop along the southwestern boundary of the NRU (Figure 4 in Attachment 1). A total of ten buildings were formerly located at the BLA. An unnamed stream is located north of the BLA.

5.2.1.2 Land and Resource Use

The buildings at the BLA were associated with loading, storage, shipping and receiving, and changehouse/canteen operations. Two smokeless powder bag loading lines were operated at the BLA from 1941 to 1943. The propelling charge loaded in the bags consisted of smokeless powder and an igniter charge (black powder). The bags were used for artillery, cannon, and mortar projectiles.

The wooden components of the buildings have been removed from the site. Concrete building foundations and walls remain.

5.2.1.3 History of Contamination

Conductive flooring material was used in areas where energetic materials were handled to prevent the build-up of static charges. The flooring material contained heavy metals and asbestos. Removal of the wooden building materials (roofs and some walls) caused the conductive flooring to weather, break away from the underlying concrete and wash into surrounding soil in some areas. Deterioration of lead-based paint may have also impacted surrounding soil. Impacts at the BLA were first identified during preliminary sampling conducted by Dames and Moore, Inc in 1997 due to observed impacts from the deteriorating conductive flooring around one of the former buildings. The following investigations were performed to characterize the BLA:

- 1997 – Preliminary sampling by Dames and Moore, Inc.
- 1997 and 1998 – Independent sampling by Gannett Fleming
- 2002 – Conductive flooring assessment by USACE
- 2002 – Remedial Investigation by Shaw
- 2005 – Asbestos and lead investigation by Shaw
- 2008 – Remedial Investigation by ARCADIS
- 2009 – Supplemental Remedial Investigation by ARCADIS

The historical investigations are summarized in Attachment 9 in Table 1, *Summary of Historical Investigations Completed at RFAAP-NRU*, extracted from the Decision Document (ARCADIS 2011b).

Polyaromatic hydrocarbons (PAHs), asbestos, and metals were detected in soil at the BLA. In addition, one PCB, Aroclor 1254, was detected in one soil sample. No source for PCBs at the BLA was identified in historical documents. The historical concentration ranges for COCs at the BLA (extracted from the DD [ARCADIS 2011b]) are summarized in Attachment 9, Table 2, *Contaminants of Concern for the BDDT, BLA, IAA, and WBG Study Areas.*

5.2.1.4 Initial Response

No initial response actions were performed for the BLA.

5.2.1.5 Basis for Taking Action

The basis for taking action at the BLA was identified in the RI HHRA (ARCADIS 2010a). The risk drivers include the following:

- Elevated concentrations of copper were present in surface soil that posed risk to the hypothetical future construction worker and future child resident.
- Aroclor 1254 and cobalt concentrations were present in surface soil that posed risk to the hypothetical future child resident.
- Elevated concentrations of benzo(a)pyrene were present that posed risk to the hypothetical future resident in combined surface and subsurface soil.
- Calculated fetal blood lead levels were above the benchmark for acceptable risk in surface soil.
- Soil located adjacent to the buildings had the potential to generate airborne asbestos concentrations that may present an unacceptable risk to human receptors under current and hypothetical future industrial and residential land use scenarios.
- Residual lead-based paint on the concrete walls at BLA or other possible asbestos-containing building materials (i.e., pipe insulation, joint compounds, mastic, etc.) could also present a risk for current and future site workers, construction workers, or residents.

An SLERA and BERA were completed for the BLA. The SLERA and BERA concluded that adverse effects are not expected for wildlife at the BLA.

The following COCs were selected for the BLA (ARCADIS 2011b):

Table 5 – COCs for the BLA

COC
Aroclor 1254 (residential)
Benzo(a)pyrene (residential)
Copper (residential/industrial/commercial)
Lead (residential/industrial/commercial)
Asbestos (residential/industrial/commercial)

5.2.2 Remedial Actions

5.2.2.1 Remedy Selection

The remedy for the BLA was selected in the Decision Document (ARCADIS 2011b). The Decision Document included the following RAOs for the BLA:

- Minimize the potential for future releases of COCs from the conductive flooring to the surrounding environment.
- Prevent human exposure to COCs in soil and the flooring material that would lead to unacceptable risk or hazard for the designated use.

- Minimize the potential for COCs present in surface soils to migrate to other areas.

The remedy was designed to address contaminated building materials and surface soil concentrations of copper, lead, and asbestos that posed an unacceptable risk to site workers and/or construction workers. The remedy included the following components:

- Removal and approved off-site disposal of the conductive flooring material present in the building remnants.
- Excavation and approved off-site disposal of surface soils located adjacent to former buildings to reduce risk and hazard levels to those appropriate for commercial/industrial land use.
- Establish LUCs that would prohibit residential development of the site and/or utilization of the site for schools, child-care facilities and playgrounds. The land use controls would also prohibit the occupation or utilization of the building remnants for residential, industrial, or commercial purposes.

The RALs selected for the BLA are summarized in Table 6, below (ARCADIS 2011b):

Table 6 –Remedial Action Levels at the BLA

COC	**RAL**	
	Hypothetical Future Resident[1]	**Current and Anticipated Future Industrial**
Aroclor 1254	0.23 mg/kg	NA
Benzo(a)pyrene	0.025 mg/kg	NA
Copper	3,044 mg/kg	11,533 mg/kg
Lead	400 mg/kg	624 mg/kg
Asbestos	0.1% by weight	0.1% by weight

[1]Note that although the RAL table listed values for the hypothetical future resident, the selected remedy is excavation to commercial/industrial land use and ICs, preventing residential use. The decision document states: "COCs including lead, copper, Aroclor 1254, and benzo(a)pyrene will remain in place at concentrations that could present unacceptable risks for residential use." The risk and toxicity evaluation (Attachment 7) evaluates the protectiveness for the potential industrial use of the site.

5.2.2.2 Remedy Implementation

The removal of flooring material and surface soil at the BLA was documented in a Response Action Completion and Closure Report (RACR) (ARCADIS 2011a). The dates of remedy implementation were as follows:

- December 2-3, 2010 – Initial mobilization of equipment and personnel
- December 13-17, 2010 – Site clearing and preparation
- February 17 – March 7, 2011 – Conductive flooring removal
- March 8-28, 2011 – Soil removal
- April 7-28, 2011 – Site restoration

- April 29, 2011 – Final demobilization of equipment and personnel
- May 3, 2011 – Final inspection

The Army removed approximately 16,000 square feet of conductive flooring material from seven former buildings at the BLA.

Impacted soil was generally located within one to two feet from the open sides of the buildings where pathways were present for the conductive flooring to migrate from the building pads. The planned excavation areas at the BLA are depicted in Attachment 10 on ARCADIS Figure 3-1, *Planned Response Action Area at the BLA.* Excavations were completed to an initial depth of one foot below ground surface and expanded in areas where visual staining or residue was observed, or where elevated concentrations of lead, copper, and/or asbestos were detected above the industrial/commercial RALs. The field soil confirmation sample locations (selected using x-ray florescence (XRF)) and results are depicted in Attachment 10 on ARCADIS Figure 4-1, *Confirmation Sample Locations*, Figure 4-1A, *XRF Sample Results – Copper*, and Figure 4-1B, *XRF Sample Results - Lead*. The field soil confirmation results are also summarized in Attachment 10 on Table 4-4, *Field XRF Results for BLA Soil Confirmation Samples*. In addition, the summary of the result of laboratory analysis of soil samples is provided in Attachment 10 on Table 4-5, *Summary of Laboratory Analytical Results for BLA Soil Confirmation Soil Samples*.

The RALs presented in Table 6 in Section 5.2.2.1 were compared against area average soil concentrations (95% upper concentration limit (UCL) of the average). The final soil sampling data confirmed that residual concentrations of lead and copper were below the thresholds for industrial/commercial use and largely below the thresholds for residential use. The efficacy of the removal of asbestos was evaluated using both field screening and laboratory confirmation:

- Asbestos was documented to generally be collocated with copper and lead during site characterization. Based on this data, field screening for lead and copper was used during remedy implementation as a surrogate for asbestos. A total of 188 confirmation samples were field screened and the excavation was advanced until compliance was achieved.
- To confirm the field results, 27 of the 188 field-screened samples were submitted for laboratory analysis for asbestos using USEPA Methods 600/M4-82-020 and 600/R-93/116. These methods involve stereomicroscopic examination of samples followed by application of polarized light microscopy. The laboratory report states “ND means no fibers were detected. When detected, the minimum detection and reporting limit is less than 1% unless point counting is performed.” No detections of asbestos were reported in any of the samples submitted indicating that no asbestos fibers were observed. The laboratory reporting limit was 1% based on the definition of friable asbestos material (40 CFR 61.141). The laboratory method employed yields only presence/absence results and does not provide a quantitative result where no detections are identified. Per the ASTM standard: “The point counting method may be used for analysis of samples containing from 0 to 100 percent asbestos. The upper detection limit is 100 percent. The lower detection limit is less than 1 percent.” This laboratory method results in a laboratory reporting limit (<1.0%) higher than the threshold designated for the remedy (0.1%); however the selected method was and remains industry standard.

Based on the combined consideration of both the field screening and laboratory results, the remedy was deemed complete for asbestos to residential thresholds.

The remedy did not address concentrations of benzo(a)pyrene or Aroclor 1254 at concentrations exceeding the residential threshold. For this reason, LUCs are required to prevent residential use of the site. The waste characterization sample results for soil and flooring are summarized in Attachment 10 on Table 4-1, *Waste Characterization Sample Results for the BLA and IAA.*

The impacted soil and building materials were disposed of off-site at First Piedmont located in Ringgold, Virginia. The summaries of waste shipments are provided in Attachment 10 as Table 4-3, *Summary of Conductive Flooring Waste Shipments for the BLA and IAA Removal Actions* and Table 4-8, *Summary of Soil Waste Shipments for the BLA and IAA Removal Actions*. The BLA was backfilled with clean material. The summary of the laboratory analysis of the backfill material is provided in Attachment 10 as Table 4-9, *Summary of Backfill Material Analytical Results for BLA and IAA.*

LUCs were still necessary to address soil concentrations of benzo(a)pyrene and Aroclor 1254 that posed potential risk to future residential development of the site. Lead-based paint and asbestos containing materials within the buildings were also addressed with the LUCs outlined in the BLA CERCLA remedy. The LUCs at the BLA were implemented through a LUCIP (ARCADIS 2013). The LUCIP outlined the following LUC mechanisms already in place:

- The NRU serves as a storage facility for energetic materials manufacturing from the MMA. A security force, physical control procedures and equipment access restrictions are in place for these operations.
- RFAAP has a personnel security program to ensure employees and subcontractors who are required to be vetted and/or have a background investigation in performance of their duties are properly evaluated and regularly monitored in accordance with Department of Defense security policies.
- Perimeter fencing, guarded gates, and uniformed guards with communication devices are in place to restrict access to the NRU property.
- Construction, excavation, and development of any kind are highly scrutinized by both the Army and RFAAP's commercial operator personnel. Several clearances, passes, permits, and inspections are required before equipment or personnel are allowed to operate on-site.

In addition to existing mechanisms, RFAAP posted a sign at the BLA reading as follows:

"UNAUTHORIZED PERSONNEL KEEP OUT.
THIS SITE IS SUBJECT TO LAND USE CONTROLS.
MAINTAIN THIS SITE IN ITS CURRENT STATE,
AND PREVENT FUTURE RESIDENTIAL USE.
CONTACT THE ENVIRONMENTAL DEPARTMENT WITH QUESTIONS."

and

"KEEP OUT OF BUILDING REMNANTS –
ASBESTOS AND LEAD BASED PAINTS.
CONTACT THE ENVIRONMENTAL DEPARTMENT WITH QUESTIONS."

5.2.2.3 Operation, Maintenance, and Monitoring

The maintenance and inspection procedures for the BLA are provided in the LUCIP (ARCADIS 2013). The LUCIP requires the distribution of the LUCIP to regulators and operators of RFAAP

and notification of changes in land use. In addition, annual inspections are required to ensure that the BLA is not used for residential purposes, that building remnants remain unused, and that LUC information signs are properly maintained.

BAE Systems performed inspections on behalf of the Army for the BLA on the following dates as documented in the annual inspection reports (RFAAP 2014, 2015, 2016, and 2017), and identified the following:

- 25 June 2014: No deficiencies or remedial action noted as required
- 09 November 2015: No deficiencies or remedial action noted as required
- 09 September 2016: Recommendation to address vegetation around LUC signage
- 22 May 2017: Recommendation to address vegetation around LUC signage

Installation staff indicated that vegetation around LUC signage has been addressed.

5.2.3 Data Review

No environmental data has been collected for the BLA since remedy selection. Data reviewed in initial remedy implementation are discussed in Section 5.2.2.2.

5.2.4 Site Inspection

A site inspection was conducted on 31 July 2017 to obtain familiarity with the site, record site conditions using photographs, interview staff familiar with the site, and assess protectiveness of the remedy. The inspection was attended by the following staff:

- Michael Senus, PE, Project Manager, USACE
- Laura Allen, Project Engineer, USACE
- James McKenna, Restoration Program Manager, Radford Army Ammunition Depot

The following observations were noted during the site inspection:

- LUC signage was present in the vicinity of the BLA
- No changes in site use or evidence of intrusive activities were observed at the BLA
- Access to the NRU was restricted by a perimeter fence with security personnel at the access gate and on roving patrols. The fence was observed to be in good condition.
- The building remnants were observed open to the elements with no measures in place to prevent weathering of any residual lead-based paint or asbestos containing materials.

The site inspection checklist and photographs are provided in Attachments 4 and 5.

5.2.5 Technical Assessment

5.2.5.1 Question A: Is the Remedy Functioning as Intended by the Decision Document?

Yes, the BLA remedy is functioning as intended by the decision document. The response action implemented in 2010 and 2011 included the removal of all conductive flooring material from the BLA buildings and the excavation of soil removing concentrations of COCs that posed unacceptable risk to industrial/commercial use. The LUCs have been implemented including administrative components, signage, and inspections. These LUC components effectively prevent residential use and utilization of the site for schools, child-care facilities, and playgrounds, thereby preventing human exposure to COCs in surface soil that could lead to

unacceptable risks or hazards. The LUCs also protect against occupation or utilization of the building remnants for residential, industrial, or commercial purposes.

5.2.5.2 Question B: Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Used at the Time of the Remedy Still Valid?

Yes, exposure assumptions, toxicity data, cleanup levels and remedial action objectives are still valid. Exposure assumptions in the decision document are equal to or more conservative than current default assumptions. Toxicity data used to calculate cleanup goals for all COCs have not changed since the RI HHRA (ARCADIS 2010a) except for benzo(a)pyrene. Benzo(a)pyrene toxicity data is 7.3 times more conservative than current toxicity data. The remedial action objectives are still valid, and there is no new site information that would change or add to the remedial action objectives.

5.2.5.3 Question C: Has any Other Information Come to Light That Could Call Into Question the Protectiveness of the Remedy?

No, no other information has come to light that could call into question the protectiveness of the remedy.

5.2.6 Issues

No issues were identified that affect the protectiveness of the BLA remedy.

5.2.7 Recommendations and Follow-Up Actions

No recommendations and follow-up actions were identified relevant to the protectiveness of the BLA remedy.

5.2.8 Protectiveness Statement

The remedy at the BLA is protective of human health and the environment.

Impacted soil and building material posing a risk to receptors under industrial site use were removed and disposed of offsite. Institutional controls have been implemented to prevent residential site use, use of the site for schools, child-care facilities, and playgrounds, and occupation or utilization of the building remnants for industrial or commercial purposes.

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5.3 IGNITER ASSEMBLY AREA

5.3.1 Background

5.3.1.1 Physical Characteristics

The Igniter Assembly Area (IAA) is a 43-acre site located in the western portion of the NRU (Figure 5 in Attachment 1). The IAA was developed with 36 assembly and outparcel buildings. The areas surrounding the buildings are generally flat and vegetated with tall grass, shrubs, and pine trees. Previously maintained grassy areas have reverted to natural conditions. Raised concrete sidewalks connect the assembly buildings with various outbuildings. A change-house/canteen has been removed to its foundation. An engineered drainage system around the IAA consists of a series of culverts to divert water under the sidewalks to ditches which drain to an unnamed creek.

5.3.1.2 Land and Resource Use

Many of the buildings (approximately 29 of the 36 buildings) in the IAA were used for the assembly of igniter charges used for artillery, cannon, and mortar projectiles. The igniter assembly operations included several outparcel buildings used to store and prepare black powder used in the igniters. There were also buildings used for the shipping and receiving of materials related to the IAA as well as offices, change houses, and break rooms.

5.3.1.3 History of Contamination

The main igniter assembly buildings and many of the outparcel buildings that handled the igniter materials contained conductive flooring materials. This conductive flooring was used to prevent the buildup of static electrical charges which could have ignited explosive materials during assembly operations. The flooring material contained heavy metals and asbestos. The materials were exposed to the weather when the wooden roof and walls were removed from the buildings. The conductive flooring degraded into a red powder-like substance, and washed off the concrete pads onto surrounding surface soil. The concrete walls of many buildings were also painted with lead-based paint. Deterioration of the paint may have provided a potential source of lead to the soil immediately surrounding the former building areas. PCB-containing electrical transformers were also historically located at the IAA.

Impacts to the IAA were first confirmed with soil sampling conducted by Dames and Moore, Inc. in 1997 around four former buildings. The following investigations were performed to characterize the IAA:

- 1997 – Preliminary sampling by Dames and Moore, Inc.
- 1998 – Additional characterization sampling by Dames and Moore, Inc.
- 1997 and 1998 – Independent sampling by Gannett Fleming
- 1998 – Remedial Investigation by ICF Kaiser Engineers, Inc.
- 2002 – Conductive flooring assessment by USACE
- 2002 – Remedial Investigation by Shaw
- 2005 – Additional characterization sampling by Shaw
- 2008 – Remedial Investigation by ARCADIS
- 2009 – Supplemental Remedial Investigation by ARCADIS

The historical investigations are summarized in Attachment 9 in Table 1, *Summary of Historical Investigations Completed at RFAAP-NRU*, extracted from the Decision Document (ARCADIS 2011b).

Elevated concentrations of PCBs, metals, and asbestos were detected at the IAA. The historical concentration ranges for COCs at the IAA are summarized in Attachment 9, Table 2 *Contaminants of Concern for the BDDT, BLA, IAA, and WBG Study Areas.*

5.3.1.4 Initial Response

No initial response actions were performed for the IAA.

5.3.1.5 Basis for Taking Action

The basis for taking action at the IAA was identified in the RI HHRA (ARCADIS 2010a). The risk drivers include the following:

- The HHRA identified elevated concentrations of Aroclor 1254 and lead at concentrations that would pose an unacceptable risk to future hypothetical adult and child residents.
- Soil located adjacent to the buildings has the potential to generate airborne asbestos concentrations that may present an unacceptable risk to human receptors under current and hypothetical future industrial and residential land use scenarios.
- Residual lead-based paint on the concrete walls at IAA or other possible asbestos-containing building materials (i.e., pipe insulation, joint compounds, mastic, etc.) could also present a risk for current and future site workers, construction workers, or residents.

An SLERA and BERA were completed for the IAA. The SLERA and BERA concluded that adverse effects are not expected for wildlife at the IAA.

The following COCs were selected for the IAA (ARCADIS 2011b):

Table 7 – COCs for the IAA

COC
Copper
Lead
Aroclor 1254
Asbestos

5.3.2 Remedial Actions

5.3.2.1 Remedy Selection

The remedy for the IAA was selected in the Decision Document (ARCADIS 2011b). The Decision Document included the following RAOs for the IAA:

- Minimize the potential for future releases of COCs from the conductive flooring to the surrounding environment.
- Prevent human exposure to COCs in soil and the flooring material that would lead to unacceptable risk or hazard for the designated use.
- Minimize the potential for COCs present in surface soils to migrate to other areas.

The remedy included the following components:

- Removal and approved off-site disposal of the conductive flooring material present in the building remnants.
- Excavation and approved off-site disposal of surface soils located adjacent to former buildings, so as to reduce risk and hazard levels to those appropriate for commercial/industrial land use.
- Establish LUCs that would prohibit the occupation or utilization of the building remnants for industrial or commercial purposes.

The RALs selected for the IAA soil are presented in Table 8, below (ARCADIS 2011b):

Table 8 –Remedial Action Levels at the IAA

COC	RAL	
	Hypothetical Future Resident[1]	**Current and Anticipated Future Industrial**
Copper	3,043 mg/kg	11,533 mg/kg
Lead	400 mg/kg	624 mg/kg
Aroclor 1254	0.23 mg/kg	NA
Asbestos	0.1% by weight	0.1% by weight

[1]Note that although the RAL table listed values for the current and anticipated future industrial use of the site and the selected remedy included only excavation to commercial/industrial land use, the excavation of soil achieved residential RALs.

5.3.2.2 Remedy Implementation

The removal of flooring material and surface soil at the IAA was documented in a RACR (ARCADIS 2011a). The dates of remedy implementation were as follows:

- December 6-14, 2010 – Site clearing and preparation
- January 3 – March 8, 2011 – Conductive flooring removal
- February 15 – April 9, 2011 – Soil removal
- April 7-28, 2011 – Site restoration
- April 29, 2011 – Final demobilization of equipment and personnel
- May 3, 2011 – Final inspection

The Army removed approximately 29,000 square feet of conductive flooring material from 29 building remnants throughout the IAA.

Impacted soil was generally located within one to two feet from the open sides of the building remnants where pathways were present for the conductive flooring to migrate from the concrete pads. The planned excavation areas at the IAA are depicted in Attachment 10 on ARCADIS Figure 3-2, *Planned Response Action Area at the IAA.* Excavations were completed to an initial depth of one foot below ground surface and expanded in areas where visual staining or residue were observed, or where elevated concentrations of lead, copper, and/or asbestos were detected

above the RALs. Soil on the closed ends of the buildings that were not impacted by the flooring material were not excavated. Discrete soil excavations were also performed in two areas where elevated concentrations of Aroclor 1254 were detected. The field (selected using XRF) soil confirmation sample locations and results are depicted in Attachment 10 on ARCADIS Figure 4-3, *Confirmation Sample Locations,* Figure 4-4A, *XRF Sample Results – Copper,* Figure 4-4B, *XRF Sample Results – Lead* and Figure 4-5, *Aroclor 1254 Excavation Area Confirmation Sampling Results*. The field soil confirmation sample results are also summarized in Attachment 10 on Table 4-6, *Field XRF Results for IAA Soil Confirmation Samples*. In addition, the summary of the result of laboratory analysis of soil samples is provided in Attachment 10 on Table 4-7, *Summary of Laboratory Analytical Results for IAA Soil Confirmation Soil Samples*.

The RALs presented in Table 8 in Section 5.3.2.1 were used as not-to-exceed values when compared against site soil concentrations. The confirmatory soil sampling confirmed that residual concentrations of lead and copper were below the threshold for residential use. Compliance with the remedy objectives for asbestos was confirmed with field screening collocated contaminants and laboratory analysis (see discussion in Section 5.2.2.2 on the laboratory method sensitivity). The impacted soil and building materials were disposed of off-site at First Piedmont located in Ringgold, Virginia. The summaries of waste shipments are provided in Attachment 10 as Table 4-3, *Summary of Conductive Flooring Waste Shipments for the BLA and IAA Removal Actions* and Table 4-8, *Summary of Soil Waste Shipments for the BLA and IAA Removal Actions*. The IAA was backfilled with clean material. The summary of the laboratory analysis of the backfill material is provided in Attachment 10 as Table 4-9, *Summary of Backfill Material Analytical Results for BLA and IAA.*

No restrictions on land use are required for the IAA because the Army removed COCs in soil that contributed to unacceptable health risks. LUCs were applied at the IAA for the purpose of restricting use of the building remnants at the site due to the presence of asbestos containing material and lead-based paint. These LUCs were implemented through a LUCIP (ARCADIS 2013). The LUCIP outlined the following LUC mechanisms already in place:

- The NRU serves as a storage facility for energetic materials manufacturing from the MMA. A security force, physical control procedures and equipment access restrictions are in place for these operations.
- RFAAP has a personnel security program to ensure employees and subcontractors who are required to be vetted and/or have a background investigation in performance of their duties are properly evaluated and regularly monitored in accordance with Department of Defense security policies.
- Perimeter fencing, guarded gates, and uniformed guards with communication devices are in place to restrict access to the NRU property.
- Construction, excavation, and development of any kind are highly scrutinized by both the Army and RFAAP's commercial operator personnel. Several clearances, passes, permits, and inspections are required before equipment or personnel are allowed to operate on-site.

In addition to existing mechanisms, RFAAP posted a sign at the IAA reading as follows:

"KEEP OUT OF BUILDING REMNANTS –
ASBESTOS AND LEAD BASED PAINTS.
CONTACT THE ENVIRONMENTAL DEPARTMENT WITH QUESTIONS."

5.3.2.3 Operation, Maintenance, and Monitoring

The maintenance and inspection procedures for the IAA are provided in the LUCIP (ARCADIS 2013). The LUCIP requires the distribution of the LUCIP to regulators and operators of RFAAP and notification of changes in land use. In addition, annual inspections are required to ensure that the IAA building remnants remain unused and that LUC information signs are properly maintained.

BAE Systems performed inspections on behalf of the Army for the IAA on the following dates as documented in the annual inspection reports (RFAAP 2014, 2015, 2016, and 2017), and identified the following:

- 25 June 2014: No deficiencies or remedial action noted as required
- 09 November 2015: No deficiencies or remedial action noted as required
- 09 September 2016: Recommendation to address vegetation around LUC signage
- 22 May 2017: Recommendation to address vegetation around LUC signage

Installation staff indicated that vegetation around LUC signage has been addressed.

5.3.3 Data Review

No environmental data has been collected for the IAA since remedy selection.

5.3.4 Site Inspection

A site inspection was conducted on 31 July 2017 to obtain familiarity with the site, record site conditions using photographs, interview staff familiar with the site, and assess protectiveness of the remedy. The inspection was attended by the following staff:

- Michael Senus, PE, Project Manager, USACE
- Laura Allen, Project Engineer, USACE
- James McKenna, Restoration Program Manager, Radford Army Ammunition Depot

The following observations were noted during the site inspection:

- LUC signage was present in the vicinity of the IAA
- No changes in site use or evidence of intrusive activities were observed at the IAA
- Access to the NRU was restricted by a perimeter fence with security personnel at the access gate and on roving patrols. The fence was observed to be in good condition.
- The building remnants were observed open to the elements with no measures in place to prevent weathering of any residual lead-based paint or asbestos containing materials.

The site inspection checklist and photographs are provided in Attachments 4 and 5.

5.3.5 Technical Assessment

5.3.5.1 Question A: Is the Remedy Functioning as Intended by the Decision Document?

Yes, the IAA remedy is functioning as intended by the Decision Document. The response action implemented in 2010 and 2011 included the removal of all conductive flooring material from the IAA buildings and the excavation of soil removing concentrations of COCs that would not allow for UU/UE. The LUCs have been implemented including administrative components, signage, and inspections. These components effectively prevent receptor exposure to the conductive

flooring material and contaminated soil, and prevent occupation or utilization of the building remnants.

5.3.5.2 Question B: Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Used at the Time of the Remedy Still Valid?

Yes, exposure assumptions, toxicity data, cleanup levels and remedial action objectives are still valid. Exposure assumptions in the decision document are equal to or more conservative than current default assumptions. Toxicity data used to calculate cleanup goals for all COCs have not changed since the RI HHRA (ARCADIS 2010a). The remedial action objectives are still valid, and there is no new site information that would change or add to the remedial action objectives.

5.3.5.3 Question C: Has any Other Information Come to Light That Could Call Into Question the Protectiveness of the Remedy?

No, no other information has come to light that could call into question the protectiveness of the IAA remedy.

5.3.6 Issues

No issues were identified affecting the protectiveness of the IAA remedy.

5.3.7 Recommendations and Follow-Up Actions

No recommendations and follow-up actions were identified relative to the protectiveness of the IAA remedy.

5.3.8 Protectiveness Statement

The remedy at the IAA is protective of human health and the environment.

Impacted soil was removed to levels allowing unlimited use and unrestricted exposure. Impacted building material posing a risk to receptors under industrial and commercial site use was removed and disposed of offsite. Institutional controls have been implemented to prevent occupation or utilization of the building remnants for residential, industrial, or commercial purposes.

6.0 SUMMARY

6.1 RECOMMENDATIONS FOR FOLLOW-UP ACTIONS

No recommendations for follow-up actions affecting the protectiveness of the remedies at the NRU were identified.

6.2 PROTECTIVENESS STATEMENTS

This review selected the following protectiveness statements for each area of the NRU:

BDDT

The remedy at the BDDT is protective of human health and the environment.

Institutional controls have been implemented to prevent residential site use and the use of the site for schools, child-care facilities, and playgrounds. Inspections have confirmed that the rip-rap liner and downgradient vegetation have prevented erosion/migration of surface soils.

BLA

The remedy at the BLA is protective of human health and the environment.

Impacted soil and building material posing a risk to receptors under industrial site use were removed and disposed of offsite. Institutional controls have been implemented to prevent residential site use, use of the site for schools, child-care facilities, and playgrounds, and occupation or utilization of the building remnants for industrial or commercial purposes.

IAA

The remedy at the IAA is protective of human health and the environment.

Impacted soil was removed to levels allowing unlimited use and unrestricted exposure. Impacted building material posing a risk to receptors under industrial and commercial site use was removed and disposed of offsite. Institutional controls have been implemented to prevent occupation or utilization of the building remnants for residential, industrial, or commercial purposes.

Site-Wide (NRU)

The remedies implemented at the Radford Army Ammunition Plant New River Unit are protective of human health and the environment.

6.3 NEXT REVIEW

The next review for RFAAP NRU will be conducted by 11 April 2023.

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ATTACHMENT 1

Figures

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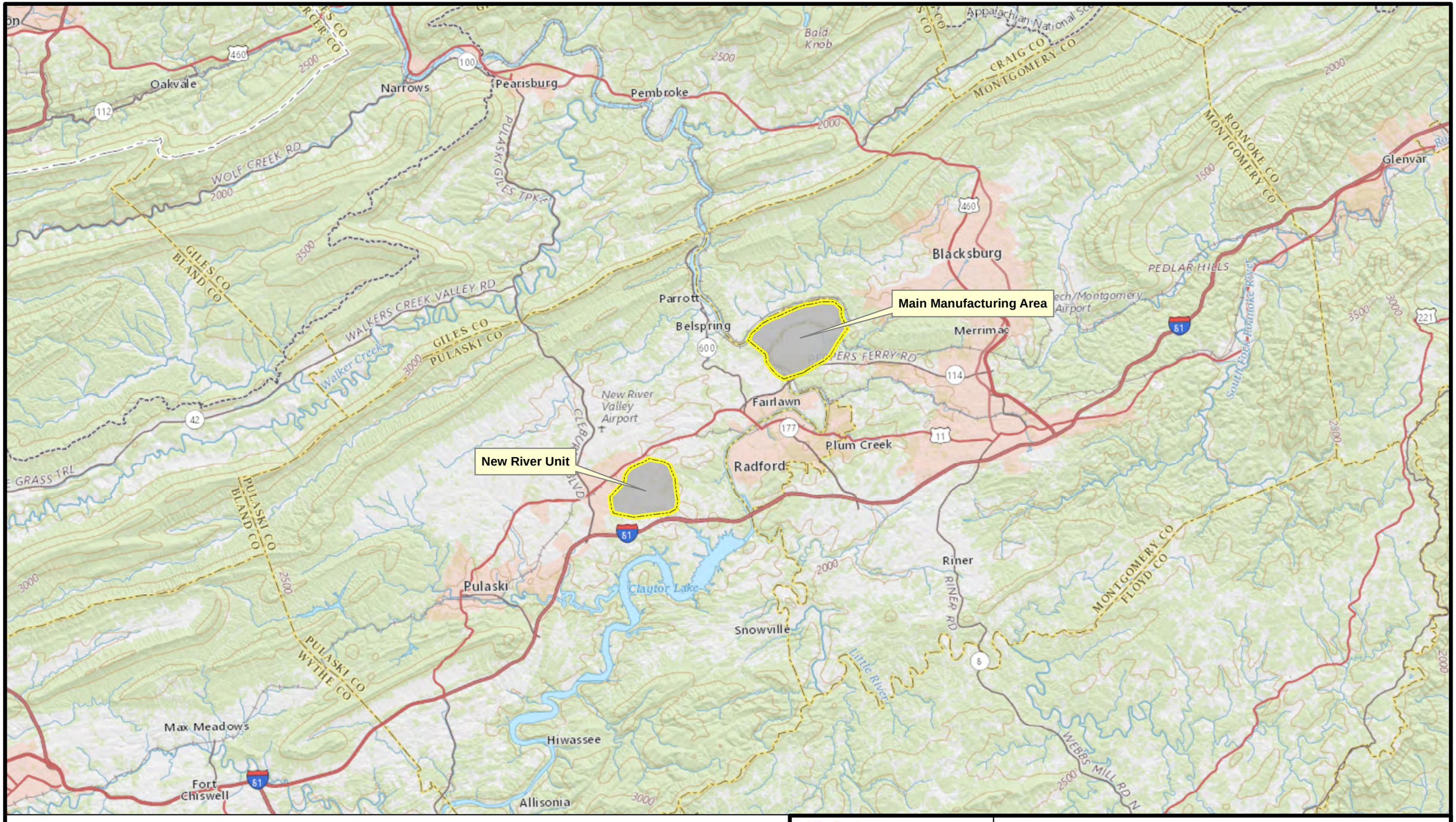

Installation Boundary

N
W E
S

0 0.5 1 2 3 4 5 Miles

U.S. Army Corps of Engineers
US Army Corps of Engineers
Buffalo District
Buffalo, New York

RFAAP - NRU
Facility Location

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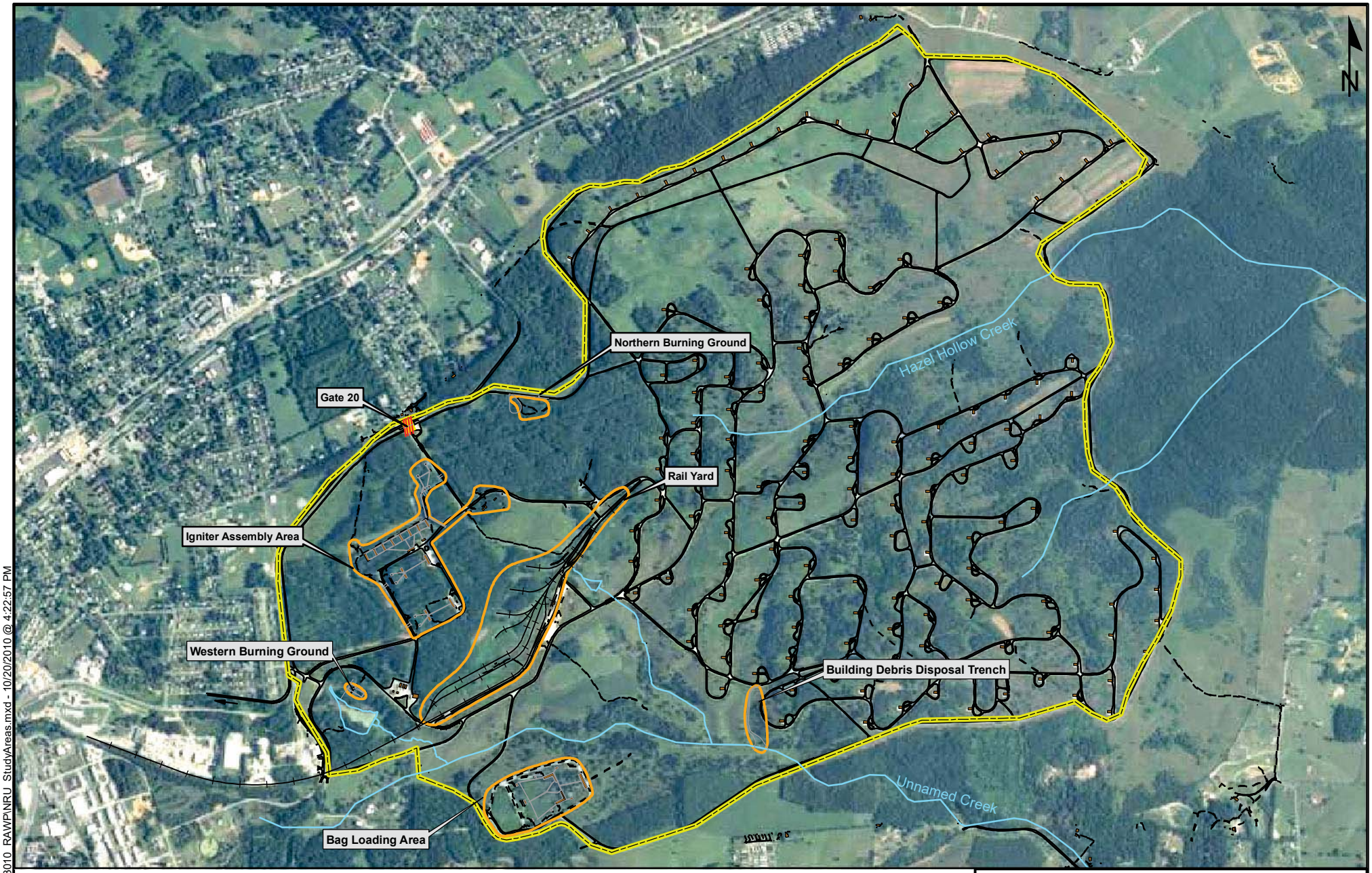
Radford Army Ammuntion Plant
Radford, VA

Figure 1



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LEGEND

- SITE FEATURES
- RAIL SPUR
- SURFACE WATER
- PAVED ROADS
- DIRT ROADS
- STUDY AREA
- NRU BOUNDARY
- FORMER BUILDINGS

NOTES:

1. GIS SPATIAL LAYERS OBTAINED FROM SHAW ENVIRONMENTAL, INC. AS REFERENCED IN THEIR REPORT TITLED NRU ADDITIOANL CHARACTERIZATION SAMPLING & GROUNDWATER INVESTIGATION DATA REPORT IN OCTOBER 2007.

0 900 1,800 Feet

GRAPHIC SCALE

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

RFAAP - NRU STUDY AREAS

US Army Corps of Engineers

FIGURE 2

LEGEND

- SITE FEATURES
- SURFACE WATER
- TRENCH
- PAVED ROADS
- DIRT ROADS
- RIPRAP
- STUDY AREA
- BUILDINGS
- INSTALLATION BOUNDARY

Note: Map is taken from Arcadis report titled Land Use Control Implementation for Radford Army Ammunition Plan - New River Unit, August 2013

0 150 300 Feet

GRAPHIC SCALE

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

BUILDING DEBRIS DISPOSAL TRENCH SITE LAYOUT

US Army Corps of Engineers

FIGURE 3

NYC: SER 4/AIT: DB: TBR LD: TBR PIC: TL
Radford (GP08RAAP 00PM)
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Installation Boundary

Study Area

Former Buildings

No Conductive Flooring

Buildings That Historically Contained Conductive Flooring

N

W E

S

0 75 150 300

Feet

U.S. Army Corps of Engineers

US Army Corps of Engineers
Buffalo District

Buffalo District

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Bag Loading Area Site Layout

Five Year Review
Radford Army Ammunition Plant
Radford, VA

Figure 4

Site Boundary

Former Buildings

No Conductive Flooring

Buildings that Historically Contained Conductive Flooring

N

W E

S

0 150 300 600

Feet

U.S. Army Corps of Engineers

US Army Corps of Engineers
Buffalo District

Buffalo District

Document Name: RAAP_NRU.mxd
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Igniter Assemply Area Site Layout

Five Year Review
Radford Army Ammuniton Plant
Radford, VA

Figure 5

ATTACHMENT 2

List of Documents Reviewed

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DOCUMENTS REVIEWED

ARCADIS 2009. *Supplemental Remedial Investigation Work Plan, New River Unit (RAAP-044), Radford Army Ammunition Plant, Radford, Virginia.* Prepared for Radford Army Ammunition Plant and US Army Corps of Engineers, Baltimore District. June.

ARCADIS 2010a. *Remedial Investigation Report, New River Unit (RAAP-044), BDDT, BLA, IAA, RY, WBG, and Groundwater, Radford Army Ammunition Plant, Radford, Virginia.* Prepared for Radford Army Ammunition Plant and US Army Corps of Engineers, Baltimore District. June.

ARCADIS 2010b. *Response Action Completion and Closure Report for the Northern Burning Ground, New River Unit (RAAP-044), Radford Army Ammunition Plant, Radford, Virginia.* Prepared for Radford Army Ammunition Plant and US Army Corps of Engineers, Baltimore District. October.

ARCADIS 2011a. *Response Action Completion and Closure Report for the Bag Loading Area, Igniter Assembly Area, and Western Burning Ground, New River Unit (RAAP-044), Radford Army Ammunition Plant, Radford, Virginia.* Prepared for Radford Army Ammunition Plant and US Army Corps of Engineers, Baltimore District. September

ARCADIS 2011b. *Final Decision Document for Radford Army Ammunition Plant – New River Unit (RAAP-044), Radford Army Ammunition Plant, Radford, Virginia.* Prepared for Radford Army Ammunition Plant and US Army Corps of Engineers, Baltimore District. November.

ARCADIS 2013. *Final Land Use Control Implementation Plan for Radford Army Ammunition Plant – New River Unit (RAAP-044), Radford Army Ammunition Plant, Radford, Virginia.* Prepared for Radford Army Ammunition Plant and US Army Corps of Engineers, Baltimore District. August.

Radford Army Ammunition Plant (RFAAP) 2014. *Annual Inspection of Closed Installation Restoration Program (IRP) Areas.* June.

RFAAP 2015. *Annual Inspection of Closed Installation Restoration Program (IRP) Areas.* November.

RFAAP 2016. *Annual Inspection of Closed Installation Restoration Program (IRP) Areas.* September.

RFAAP 2017. *Annual Inspection of Closed Installation Restoration Program (IRP) Areas.* May.

US Army Corps of Engineers (USACE), Huntsville Division 1993. *Archives Search Report, New River Ordnance Plant, Radford, Virginia.* Defense Environmental Restoration Program for Formerly Utilized Defense Sites, Ordnance and Explosive Waste, Chemical Warfare Materials. Prepared for USACE St. Louis District. September.

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ATTACHMENT 3

Decision Document Summary

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Table A3-1 Decision Document Summary
Component: Background/Basis for Taking Action RFAAP New River Unit
Sheet 1 of 2

Decision Document Title:	Final Decision Document for Radford Army Ammunition Plant – New River Unit (RAAP-044), Radford Army Ammunition Plant, Radford, Virginia, November 2011
Regulatory Framework:	CERCLA
Remedy Chosen:	BDDT: Institutional controls to prevent residential site use (soil) BLA: Building material and soil removal, and institutional controls to prevent residential site use (soil) and commercial/industrial use (building remnants) IAA: Building material and soil removal, and institutional controls to prevent commercial/industrial use (building remnants)
Media of Concern:	BDDT: Soil BLA: Building materials and soil IAA: Building materials and soil (remedy implementation reached UU/UE for soil)
Chemicals of Concern:	BDDT: Benzo(a)pyrene BLA: Aroclor 1254, benzo(a)pyrene, copper, lead, asbestos IAA: Aroclor 1254, Copper, lead, asbestos
Land Use:	BDDT: Industrial BLA: Industrial IAA: Industrial
Receptors:	BDDT: Hypothetical future resident BLA: Hypothetical construction worker, site worker, resident IAA: Hypothetical construction worker, site worker, resident
Exposure Pathway:	BDDT: Dermal (surface and subsurface soil) BLA: Ingestion, dermal, inhalation (building materials, surface and subsurface soil) IAA: Ingestion, dermal, inhalation (building materials, surface and subsurface soil)
Ecological Risk:	BDDT: None BLA: None IAA: None

Table A3-2 Decision Document Summary
Component: Remedial Action RFAAP New River Unit
Sheet 2 of 2

<table>
<tr><td>Decision Document Title:</td><td>Final Decision Document for Radford Army Ammunition Plant – New River Unit (RAAP-044), Radford Army Ammunition Plant, Radford, Virginia, November 2011</td></tr>
<tr><td>Remedy Chosen:</td><td>BDDT: Institutional controls to prevent residential site use (soil)
BLA: Building material and soil removal, and institutional controls to prevent residential site use (soil) and commercial/industrial use (building remnants)
IAA: Building material and soil removal, and institutional controls to prevent commercial/industrial use (building remnants)</td></tr>
<tr><td>Remedial Action Objectives:</td><td>BDDT: 1) Minimize the potential for COCs present in soil to migrate to other areas, including the downgradient creek. 2) Prevent human exposure to COCs in surface soils that could lead to risks or hazards for the designated use.

BLA and IAA: 1) Minimize the potential for future releases of COCs from the conductive flooring to the surrounding environment. 2) Prevent human exposure to COCs in soil and the flooring material that would lead to an unacceptable risk or hazard for the designated use. 3) Minimize the potential for COCs present in surface soils to migrate to other areas.</td></tr>
<tr><td>Clean-Up Goals:</td><td>
<table>
<tr><th>COC</th><th>Area</th><th>RAL Residential</th><th>RAL Industrial</th></tr>
<tr><td>Aroclor 1254</td><td>BLA, IAA</td><td>0.23 mg/kg</td><td>NA</td></tr>
<tr><td>Benzo(a)pyrene</td><td>BLA</td><td>0.025 mg/kg</td><td>NA</td></tr>
<tr><td>Copper</td><td>BLA, IAA</td><td>3,044 mg/kg</td><td>11,533 mg/kg</td></tr>
<tr><td>Lead</td><td>BLA, IAA</td><td>400 mg/kg</td><td>624 mg/kg</td></tr>
<tr><td>Asbestos</td><td>BLA, IAA</td><td>0.1%</td><td>0.1%</td></tr>
</table>
</td></tr>
<tr><td>Applicable or Relevant and Appropriate Requirements:</td><td>All RALs are risk-based.</td></tr>
</table>

Components of the Remedy:	BDDT • BDDT: Establish LUCs that would prohibit residential development of the site and/or utilization of the site for schools, child-care facilities and playgrounds. • Annual inspections, a 5-year statutory review, and long-term management to ensure that the rip-rap liner and downgradient vegetation are maintained in the BDDT to prevent erosion/migration of surface soils. BLA • Removal and approved off-site disposal of the conductive flooring material present in the building remnants. • Excavation and approved off-site disposal of surface soils located adjacent to former buildings, so as to reduce risk and hazard levels to those appropriate for commercial/industrial land use. • Establish LUCs that would prohibit residential development of the site and/or utilization of the site for schools, child-care facilities and playgrounds. The land use controls would also prohibit the occupation or utilization of the building remnants for industrial or commercial purposes. IAA • Removal and approved off-site disposal of the conductive flooring material present in the building remnants. • Excavation and approved off-site disposal of surface soils located adjacent to former buildings, so as to reduce risk and hazard levels to those appropriate for commercial/industrial land use. • Establish LUCs that would prohibit the occupation or utilization of the building remnants for industrial or commercial purposes.

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ATTACHMENT 4

Site Inspection Checklist

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Five-Year Review Site Inspection Checklist
New River Unit – Building Debris Disposal Trench

I. SITE INFORMATION

Site name: *Radford Army Ammunition Plant, New River Unit (RAAP-044), Building Debris Disposal Trench*	**Date of inspection:** *July 31, 2017*
Location and Region: *Radford, Virginia, Region 3*	**EPA ID:** *VA1210020730*
Agency, office, or company leading the five-year review: *US Army Corps of Engineers, Buffalo District*	**Weather/temperature:** *Low 80's F, clear*

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls
- ☒ Other Rip rap liner and downgradient vegetation to prevent erosion/migration of surface soils

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (See Attachment 6)

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

☐ O&M manual	☐ Readily available	☐ Up to date	☒ N/A
☐ As-built drawings	☐ Readily available	☐ Up to date	☒ N/A
☐ Maintenance logs	☐ Readily available	☐ Up to date	☒ N/A

Remarks: Maintenance and monitoring requirements are provided in *Final Land Use Control Implementation Plan for Radford Army Ammunition Plant – New River Unit (RFAAP-044), August 2013.*

2. **Site-Specific Health and Safety Plan** ☒ Readily available ☐ Up to date ☐ N/A
   ☐ Contingency plan/emergency response plan ☐ Readily available ☐ Up to date ☒ N/A
   Remarks:

3. **O&M and OSHA Training Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks:

4. **Permits and Service Agreements**

☐ Air discharge permit	☐ Readily available	☐ Up to date	☒ N/A
☐ Effluent discharge	☐ Readily available	☐ Up to date	☒ N/A
☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	☒ N/A
☐ Other permits_____	☐ Readily available	☐ Up to date	☒ N/A

Remarks:

Five-Year Review Site Inspection Checklist
New River Unit – Building Debris Disposal Trench

5.	**Gas Generation Records** Remarks: _____	☐ Readily available	☐ Up to date	☒ N/A
6.	**Settlement Monument Records** Remarks: _____	☐ Readily available	☐ Up to date	☒ N/A
7.	**Groundwater Monitoring Records** Remarks: _____	☐ Readily available	☐ Up to date	☒ N/A
8.	**Leachate Extraction Records** Remarks: _____	☐ Readily available	☐ Up to date	☒ N/A
9.	**Discharge Compliance Records** ☐ Air ☐ Water (effluent) Remarks: _____	☐ Readily available ☐ Readily available	☐ Up to date ☐ Up to date	☒ N/A ☒ N/A
10.	**Daily Access/Security Logs** Remarks: _____	☐ Readily available	☐ Up to date	☒ N/A

Five-Year Review Site Inspection Checklist
New River Unit – Building Debris Disposal Trench

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☒ Contractor for Federal Facility
☐ Other: _____

2. **O&M Cost Records**

☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate: _____ ☐ Breakdown attached

Total annual cost by year for review period if available (not available)

From _____ (Date) to _____ (Date) _____ (Total cost) ☐ Breakdown attached
From _____ (Date) to _____ (Date) _____ (Total cost) ☐ Breakdown attached
From _____ (Date) to _____ (Date) _____ (Total cost) ☐ Breakdown attached
From _____ (Date) to _____ (Date) _____ (Total cost) ☐ Breakdown attached
From _____ (Date) to _____ (Date) _____ (Total cost) ☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: Monitoring/inspection costs not available.

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks: The BDDT is located inside a secure U.S. Army installation that is surrounded by a fence. Access to the installation is controlled.

Five-Year Review Site Inspection Checklist
New River Unit – Building Debris Disposal Trench

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

Remarks: A sign indicating the access restrictions and LUCs in place at the BDDT is present and in good condition. The sign also states not to remove the rip-rap or vegetation from the site. Photographs of the signage are provided in Attachment 5.

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☒ No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ☒ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Self-reporting
Frequency Annual
Responsible party/agency Installation

Jim Mckenna	Radford AAP Restoration Program Manager	540-731-5782
Name	Title	Phone no.

Reporting is up-to-date ☒ Yes ☐ No ☐ N/A
Reports are verified by the lead agency ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☒ Yes ☐ No ☐ N/A
Violations have been reported ☐ Yes ☒ No ☐ N/A
Other problems or suggestions: ☐ Report attached
None

2. **Adequacy** ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident
Remarks:

2. **Land use changes on site** ☒ N/A
Remarks:

3. **Land use changes off site** ☒ N/A
Remarks:

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A
Remarks: Gravel roads are adequate for accessing the site for monitoring/maintenance

B. Other Site Conditions

Five-Year Review Site Inspection Checklist
New River Unit – Building Debris Disposal Trench

Remarks:

VII. LANDFILL COVERS ☐ Applicable ☒ N/A

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

Remarks: No issues were observed with rip rap liner or vegetation

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

The remedy at the BDDT was selected to minimize the potential for COCs present in soil to migrate to other areas, including the downgradient creek and to prevent human exposure to COCs in surface soils that could lead to risks or hazards for the designated use. The selected remedy included establishing LUCs that would prohibit residential development of the site and/or utilization of the site for schools, child-care facilities and playgrounds and annual inspections, a 5-year statutory review, and long-term management to ensure that the rip-rap liner and down-gradient vegetation are maintained in the BDDT to prevent erosion/migration of the surface soils.
No issues were observed with the implementation of the remedy during the site inspection. Signage indicates the LUCs. Access to the site is restricted through fencing and security measures. The rip rap liner and vegetation appear to be maintained and in good condition to prevent the erosion of contaminated soils.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

No issues were observed related to the implementation of the O&M procedures. Inspections are sufficient to maintain LUCs and erosion controls.

C. Early Indicators of Potential Remedy Problems

Five-Year Review Site Inspection Checklist
New River Unit – Building Debris Disposal Trench

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

No early indicators of potential remedy problems were noted.

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

No opportunities for optimization were noted.

Five-Year Review Site Inspection Checklist
New River Unit – Bag Loading Area

I. SITE INFORMATION

Site name: *Radford Army Ammunition Plant, New River Unit (RAAP-044), Bag Loading Area*	**Date of inspection:** *July 31, 2017*
Location and Region: *Radford, Virginia, Region 3*	**EPA ID:** *VA1210020730*
Agency, office, or company leading the five-year review: *US Army Corps of Engineers, Buffalo District*	**Weather/temperature:** *Low 80's F, clear*

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls
- ☒ Other Removal of conductive flooring and contaminated soil with site restoration

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (See Attachment 6)

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

☐ O&M manual	☐ Readily available	☐ Up to date	☒ N/A
☐ As-built drawings	☐ Readily available	☐ Up to date	☒ N/A
☐ Maintenance logs	☐ Readily available	☐ Up to date	☒ N/A

Remarks: Maintenance and monitoring requirements are provided in *Final Land Use Control Implementation Plan for Radford Army Ammunition Plant – New River Unit (RFAAP-044), August 2013.*

2. **Site-Specific Health and Safety Plan** ☒ Readily available ☐ Up to date ☐ N/A
   ☐ Contingency plan/emergency response plan ☐ Readily available ☐ Up to date ☒ N/A
   Remarks:

3. **O&M and OSHA Training Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks:

4. **Permits and Service Agreements**

☐ Air discharge permit	☐ Readily available	☐ Up to date	☒ N/A
☐ Effluent discharge	☐ Readily available	☐ Up to date	☒ N/A
☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	☒ N/A
☐ Other permits	☐ Readily available	☐ Up to date	☒ N/A

Remarks:

Five-Year Review Site Inspection Checklist
New River Unit – Bag Loading Area

5.	**Gas Generation Records** Remarks: _____	☐ Readily available	☐ Up to date	☒ N/A
6.	**Settlement Monument Records** Remarks: _____	☐ Readily available	☐ Up to date	☒ N/A
7.	**Groundwater Monitoring Records** Remarks: _____	☐ Readily available	☐ Up to date	☒ N/A
8.	**Leachate Extraction Records** Remarks: _____	☐ Readily available	☐ Up to date	☒ N/A
9.	**Discharge Compliance Records**			
	☐ Air	☐ Readily available	☐ Up to date	☒ N/A
	☐ Water (effluent)	☐ Readily available	☐ Up to date	☒ N/A
	Remarks: _____			
10.	**Daily Access/Security Logs** Remarks: _____	☐ Readily available	☐ Up to date	☒ N/A

Five-Year Review Site Inspection Checklist
New River Unit – Bag Loading Area

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☒ Contractor for Federal Facility
☐ Other: _____

2. **O&M Cost Records**

☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate: _____ ☐ Breakdown attached

Total annual cost by year for review period if available (not available)

From _____ (Date) to _____ (Date) _____ (Total cost) ☐ Breakdown attached
From _____ (Date) to _____ (Date) _____ (Total cost) ☐ Breakdown attached
From _____ (Date) to _____ (Date) _____ (Total cost) ☐ Breakdown attached
From _____ (Date) to _____ (Date) _____ (Total cost) ☐ Breakdown attached
From _____ (Date) to _____ (Date) _____ (Total cost) ☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: Monitoring/inspection costs not available.

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks: The BLA is located inside a secure U.S. Army installation that is surrounded by a fence. Access to the installation is controlled.

Five-Year Review Site Inspection Checklist
New River Unit – Bag Loading Area

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

Remarks: Two signs indicating the access restrictions and LUCs in place at the BLA are present and in good condition. Photographs of the signage are provided in Attachment 5.

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☒ No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ☒ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) self-reporting
Frequency Annual
Responsible party/agency Installation

Jim Mckenna	Radford AAP Restoration Program Manager	540-731-5782
Name	Title	Phone no.

Reporting is up-to-date ☒ Yes ☐ No ☐ N/A
Reports are verified by the lead agency ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☒ Yes ☐ No ☐ N/A
Violations have been reported ☐ Yes ☒ No ☐ N/A
Other problems or suggestions: ☐ Report attached
None

2. **Adequacy** ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident
Remarks:

2. **Land use changes on site** ☒ N/A
Remarks:

3. **Land use changes off site** ☒ N/A
Remarks:

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A
Remarks: Gravel/grass roads are adequate for accessing the site for monitoring/maintenance

B. Other Site Conditions

Five-Year Review Site Inspection Checklist
New River Unit – Bag Loading Area

Remarks: The BLA site has remaining concrete structures from two buildings. LUCs remain in place due to lead-based paint and asbestos contamination in remaining structures. All conductive flooring has been removed.

VII. LANDFILL COVERS ☐ Applicable ☒ N/A

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

Remarks: Removal of conductive flooring and contaminated soil was completed in 2011.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

The remedy at the BLA was intended to minimize the potential for future releases of COCs from the conductive flooring to the surrounding environment, prevent human exposure to COCs in soil and the flooring material that would lead to unacceptable risk or hazard for the designated use, and minimize the potential for COCs present in the surface soils to migrate to other areas. The remedy included the removal and approved off-site disposal of the conductive flooring material present in the building remnants, excavation and approved off-site disposal of surface soils located adjacent to former buildings, so as to reduce risk and hazard levels to those appropriate to commercial/industrial use, and establish LUCs that would prohibit residential development of the site and/or utilization of the site for schools, child-care facilities and playgrounds. The LUCs would also prohibit the occupation or utilization of the building remnants for industrial or commercial purposes.
No issues with the implementation of the remedy were discovered during the site inspection. No conductive flooring was observed remaining at the site. LUCs successfully prevent use of the site; no changes in site use or signs of vandalism/trespassing were observed. Signage was in good condition and describes the LUCs at the site and fencing and security measures keep unauthorized persons from accessing the site.

B. Adequacy of O&M

Five-Year Review Site Inspection Checklist
New River Unit – Bag Loading Area

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

No issues were observed related to the implementation of the O&M procedures. Inspections are sufficient to maintain LUCs.

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

No early indicators of potential remedy problems were noted.

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

No opportunities for optimization were noted.

Five-Year Review Site Inspection Checklist
New River Unit – Igniter Assembly Area

I. SITE INFORMATION

Site name: *Radford Army Ammunition Plant, New River Unit (RAAP-044), Igniter Assembly Area*	**Date of inspection:** *July 31, 2017*
Location and Region: *Radford, Virginia, Region 3*	**EPA ID:** *VA1210020730*
Agency, office, or company leading the five-year review: *US Army Corps of Engineers, Buffalo District*	**Weather/temperature:** *Low 80's F, clear*

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls
- ☒ Other Removal of conductive flooring and soil with site restoration

Attachments: ☒ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (See Attachment 6)

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

☐ O&M manual	☐ Readily available	☐ Up to date	☒ N/A
☐ As-built drawings	☐ Readily available	☐ Up to date	☒ N/A
☐ Maintenance logs	☐ Readily available	☐ Up to date	☒ N/A

Remarks: Maintenance and monitoring requirements are provided in *Final Land Use Control Implementation Plan for Radford Army Ammunition Plant – New River Unit (RFAAP-044), August 2013.*

2. **Site-Specific Health and Safety Plan** ☒ Readily available ☐ Up to date ☐ N/A
   ☐ Contingency plan/emergency response plan ☐ Readily available ☐ Up to date ☒ N/A
   Remarks:

3. **O&M and OSHA Training Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks:

4. **Permits and Service Agreements**

☐ Air discharge permit	☐ Readily available	☐ Up to date	☒ N/A
☐ Effluent discharge	☐ Readily available	☐ Up to date	☒ N/A
☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	☒ N/A
☐ Other permits	☐ Readily available	☐ Up to date	☒ N/A

Remarks:

Five-Year Review Site Inspection Checklist
New River Unit – Igniter Assembly Area

5.	**Gas Generation Records** Remarks:	☐ Readily available	☐ Up to date	☒ N/A
6.	**Settlement Monument Records** Remarks:	☐ Readily available	☐ Up to date	☒ N/A
7.	**Groundwater Monitoring Records** Remarks:	☐ Readily available	☐ Up to date	☒ N/A
8.	**Leachate Extraction Records** Remarks:	☐ Readily available	☐ Up to date	☒ N/A
9.	**Discharge Compliance Records**			
	☐ Air	☐ Readily available	☐ Up to date	☒ N/A
	☐ Water (effluent)	☐ Readily available	☐ Up to date	☒ N/A
	Remarks:			
10.	**Daily Access/Security Logs** Remarks:	☐ Readily available	☐ Up to date	☒ N/A

Five-Year Review Site Inspection Checklist
New River Unit – Igniter Assembly Area

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☒ Contractor for Federal Facility
☐ Other: _____

2. **O&M Cost Records**

☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate: _____ ☐ Breakdown attached

Total annual cost by year for review period if available (not available)

From _____ (Date) to _____ (Date) _____ (Total cost) ☐ Breakdown attached
From _____ (Date) to _____ (Date) _____ (Total cost) ☐ Breakdown attached
From _____ (Date) to _____ (Date) _____ (Total cost) ☐ Breakdown attached
From _____ (Date) to _____ (Date) _____ (Total cost) ☐ Breakdown attached
From _____ (Date) to _____ (Date) _____ (Total cost) ☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: Monitoring/inspection costs not available.

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks: The IIA is located inside a secure U.S. Army installation that is surrounded by a fence. Access to the installation is controlled.

Five-Year Review Site Inspection Checklist
New River Unit – Igniter Assembly Area

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

Remarks: Three signs indicating the access restrictions and LUCs in place at IIA are present and in good condition. Photographs of the signage are provided in Attachment 5.

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☒ No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ☒ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Self-reporting
Frequency Annual
Responsible party/agency Installation

Jim Mckenna	Radford AAP Restoration Program Manager	540-731-5782
Name	Title	Phone no.

Reporting is up-to-date ☒ Yes ☐ No ☐ N/A
Reports are verified by the lead agency ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☒ Yes ☐ No ☐ N/A
Violations have been reported ☐ Yes ☒ No ☐ N/A
Other problems or suggestions: ☐ Report attached
None

2. **Adequacy** ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident
Remarks:

2. **Land use changes on site** ☒ N/A
Remarks:

3. **Land use changes off site** ☒ N/A
Remarks:

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A
Remarks: Gravel roads are adequate for accessing the site for monitoring/maintenance

B. Other Site Conditions

Five-Year Review Site Inspection Checklist
New River Unit – Igniter Assembly Area

Remarks: The IIA site has remaining concrete structures including building foundations and blast walls. LUCs remain in place due to lead-based paint and asbestos contamination in remaining structures. All conductive flooring has been removed.

VII. LANDFILL COVERS ☐ Applicable ☒ N/A

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

Remarks: Removal of conductive flooring and contaminated soil was completed in 2011.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

The remedy at the IIA was intended to minimize the potential for future releases of COCs from the conductive flooring to the surrounding environment, prevent human exposure to COCs in soil and the flooring material that would lead to unacceptable risk or hazard for the designated use, and minimize the potential for COCs present in the surface soils to migrate to other areas. The remedy included the removal and approved off-site disposal of the conductive flooring material present in the building remnants, excavation and approved off-site disposal of surface soils located adjacent to former buildings, so as to reduce risk and hazard levels to those appropriate to commercial/industrial use, and establish LUCs that would prohibit the occupation or utilization of the building remnants for industrial or commercial purposes.
No issues with the implementation of the remedy were discovered during the site inspection. No conductive flooring was observed remaining at the site. LUCs prevent site use and no changes in site use was observed and no signs of vandalism/trespassing were observed. Signage was in good condition and describes the LUCs at the site and fencing and security measures keep unauthorized persons from accessing the site.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

No issues were observed related to the implementation of the O&M procedures. Inspections are sufficient to maintain LUCs.

Five-Year Review Site Inspection Checklist
New River Unit – Igniter Assembly Area

C.	Early Indicators of Potential Remedy Problems
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. No early indicators of potential remedy problems were noted.

D.	Opportunities for Optimization
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. No opportunities for optimization were noted.

ATTACHMENT 5

Photographic Record

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PHOTOGRAPHIC RECORD
Radford Army Ammunition Plant, New River Unit (RAAP-044)

Building Debris Disposal Trench

Photo No. 1
(31-July-2017)

Description: Signage at the BDDT describing LUCs and access restrictions.

Photo No. 2
(31-July-2017)

Description: View of vegetation and rip-rap at the BDDT included in the remedy to prevent erosion.

PHOTOGRAPHIC RECORD
Radford Army Ammunition Plant, New River Unit (RAAP-044)

Bag Loading Area

Photo No. 3
(31-July-2017)

Description: Sign at the northwest entrance to the BLA describing LUCs.

Photo No. 4
(31-July-2017)

Description: Second LUC sign at the BLA at the southwestern edge of the site.

PHOTOGRAPHIC RECORD
Radford Army Ammunition Plant, New River Unit (RAAP-044)

Bag Loading Area

Photo No. 5
(31-July-2017)

Description: Building remnants at the BLA. Conductive flooring was removed in 2010. Lead based paint and asbestos contamination are present on-site.

Photo No. 6
(31-July-2017)

Description: View of remnants of building at the BLA. Red staining on the concrete is from the conductive flooring that was removed in 2011.

PHOTOGRAPHIC RECORD
Radford Army Ammunition Plant, New River Unit (RAAP-044)

Igniter Assembly Area

Photo No. 7
(31-July-2017)

Description: LUC signage at the IAA with concrete remnants of former building in background.

Photo No. 8
(31-July-2017)

Description: Additional LUC signage at the IAA in front of building remnants where conductive flooring was removed. Remnants are contaminated with asbestos and lead based paints.

PHOTOGRAPHIC RECORD
Radford Army Ammunition Plant, New River Unit (RAAP-044)

Bag Loading Area

Photo No. 5
(31-July-2017)

Description: Building remnants at the BLA. Conductive flooring was removed in 2010. Lead based paint and asbestos contamination are present on-site.

Photo No. 6
(31-July-2017)

Description: View of remnants of building at the BLA. Red staining on the concrete is from the conductive flooring that was removed in 2011.

PHOTOGRAPHIC RECORD
Radford Army Ammunition Plant, New River Unit (RAAP-044)

Igniter Assembly Area

Photo No. 7
(31-July-2017)

Description: LUC signage at the IAA with concrete remnants of former building in background.

Photo No. 8
(31-July-2017)

Description: Additional LUC signage at the IAA in front of building remnants where conductive flooring was removed. Remnants are contaminated with asbestos and lead based paints.

PHOTOGRAPHIC RECORD
Radford Army Ammunition Plant, New River Unit (RAAP-044)

Igniter Assembly Area

Photo No. 9
(31-July-2017)

Description: Third LUC sign southwestern corner of the IAA.

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Photograph Location/Direction

Installation Boundary

N
W E
S

0 50 100 200
Feet

U.S. Army Corps of Engineers
US Army Corps of Engineers
Buffalo District
Buffalo, New York

Building Debris Disposal Trench
RFAAP - NRU

Document Name: Photo_FIG1_20170816.mxd
Drawn By: H5TDEEMP
Date Saved: 16 Aug 2017
Time Saved: 1:03:57 PM

Radford Army Ammuntion Plant
Radford, VA

Figure 1

Photograph Location/Direction

Installation Boundary

N
W E
S

0 50 100 200
Feet

U.S. Army Corps of Engineers
Buffalo District

U.S. Army Corps of Engineers
Buffalo, New York

Bag Loading Area
RFAAP - NRU

Document Name: Photo_FIG2_20170816.mxd
Drawn By: H5TDEEMP
Date Saved: 16 Aug 2017
Time Saved: 1:49:56 PM

Radford Army Ammuntion Plant
Radford, VA

Figure 2

Photograph Location/Direction

Installation Boundary

N
W E
S

0 50 100 200
Feet

U.S. Army Corps of Engineers
Buffalo, New York

Igniter Assembly Area
RFAAP - NRU

Document Name: Photo_FIG3_20170817.mxd
Drawn By: H5TDEEMP
Date Saved: 17 Aug 2017
Time Saved: 7:34:12 AM

Radford Army Ammuntion Plant
Radford, VA

Figure 3

ATTACHMENT 6

Interview Forms

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INTERVIEW RECORD

Site Name: Radford Army Ammunition Plant (RFAAP)		**EPA ID No.:** VA1210020730	
Subject: New River Unit		**Time:**	**Date:**
Type: ☐ Telephone ☐ Visit ☒ Other (e-mail) **Location of Visit:**		☐ Incoming ☐ Outgoing	

Contact Made By:

Name: Holly Akers	**Title:** Project Engineer	**Organization:** US Army Corps of Engineers, Buffalo District

Individual Contacted:

Name: James J. McKenna	**Title:** IRP Manager	**Organization:** RFAAP
Telephone No: (540) 731-5782 **Fax No:** **E-Mail Address:** james.j.mckenna16.civ@mail.mil	**Street Address:** **City, State, Zip:**	

Summary Of Conversation

1. How long and in what capacity have you been involved with the New River Unit (NRU) environmental restoration?
   Since August 1998

2. How are contracts for monitoring and inspections at the NRU managed?
   They are executed by the operating contractor through the facility use contract.

3. Other than routine monitoring and inspections, are you aware of any other work completed at the NRU in the last five years? If so, please explain.
   No

4. Are you aware of any changes in land use at the NRU or in the surrounding area?
   No

5. Are you aware of any trespassing at the NRU? If so, please explain.
   No

6. Are you aware of any intrusive activities performed at the NRU? If so, please explain.
   No

INTERVIEW RECORD

Site Name:	Radford Army Ammunition Plant (RFAAP)	**EPA ID No.:** VA1210020730	
Subject:	New River Unit	**Time:**	**Date:**

7. Have you received any complaints or comments from the community or other stakeholders? If so, please explain.
   No

8. Are you aware of any activity at the building foundations at the BLA/IAA?
   No

9. When was the administrative record for the NRU last updated? Are the records up to date?
   September 30, 2013 Yes

10. Are the BDDT rip rap and downgradient vegetation functioning as intended?
    Yes

11. Are the remaining remedies at the NRU functioning as intended?
    Yes

12. Inspection reports note that vegetation should be removed around the LUC signs. Has this work been completed?
    Yes

13. Have there been any changes to the land use control implementation in the last five years (e.g., changes to the use of the NEPA process, etc.)
    No

14. Has any other information come to light that could call into question the protectiveness of the remedies?
    No

15. Do you have any comments, suggestions, or recommendations regarding the NRU management or operation?
    No

INTERVIEW RECORD

Site Name: Radford Army Ammunition Plant (RFAAP)		**EPA ID No.:** VA1210020730	
Subject: New River Unit		**Time:**	**Date:** *8/23/2017*
Type: ☐ Telephone ☐ Visit ☒ Other (e-mail) **Location of Visit:**		☐ Incoming ☐ Outgoing	

Contact Made By:

Name: Holly Akers	**Title:** Project Engineer	**Organization:** US Army Corps of Engineers, Buffalo District

Individual Contacted:

Name: Jim Cutler	**Title:** Federal Facilities PM	**Organization:** VDEQ
Telephone No: **Fax No:** **E-Mail Address:** james.cutler@deq.virginia.gov	**Street Address:** **City, State, Zip:**	

Summary Of Conversation

1. How long and in what capacity have you been involved with the New River Unit (NRU) environmental restoration?
   RPM from 2005 to the present.

2. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the NRU? If so, please give purpose and results.
   Reviewed annual LUC inspection reports and performed annual site visits during RAB meeting.

3. Have there been any complaints, violations, or other incidents related to the NRU requiring a response by your office? If so, please give details of the events and results of the responses.
   No

4. Are you aware of any community concerns regarding the NRU or its operation and administration? If so, please give details.
   No

5. Are you aware of any changes in land use at the NRU or in the surrounding area?
   No

6. Do you feel well informed about the environmental activities and progress at the NRU?
   Yes

INTERVIEW RECORD

Site Name:	Radford Army Ammunition Plant (RFAAP)	**EPA ID No.:** VA1210020730	
Subject:	New River Unit	**Time:**	**Date:** *8/23/2017*

7. Are the remedies at NRU performing as intended?
   Yes

8. Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives used at the site at the time of the remedy still valid?
   Yes

9. Has any other information come to light that could call into question the protectiveness of the remedies?
   No

10. Do you have any comments, suggestions, or recommendations regarding the NRU management or operation?
    This site is secure with limited access and the Radford AAP Environmental office appears to be well informed regarding any activities affecting the NRU. One suggestion would be to post the inspection reports as part of the Admin. Record. At the very least they should be should be included in the Five Year Review.

INTERVIEW RECORD

Site Name:	Radford Army Ammunition Plant (RFAAP)	**EPA ID No.:** VA1210020730	
Subject:	New River Unit	**6:00-~9:00 pm**	**Date:** *June 28, 2017*
Type: **Tour of Facilities**		Incoming	Outgoing
Location of Visit:			

Contact Made By:

Name: Holly Akers	**Title:** Project Engineer	**Organization:** US Army Corps of Engineers, Buffalo District

Individual Contacted:

Name: *Stephen R. Cole*	**Member of RAB**	**resident, Town of Blacksburg**
Telephone No: *(540) 953-0434* **Fax No:** **E-Mail Address:** rpcole@verizon.net	**Street Address:** *1101 Golfview Dr* **City, State, Zip:** *Blacksburg, VA 24060*	

Summary Of Conversation

Note: All questions below are specific to the New River Unit. Work performed at RFAAP under the RCRA permit is not included in this review.

1. How long and in what capacity have you been involved with the New River Unit (NRU) restoration advisory board (RAB)?
   Member since the RAB was established, August 12, 1998)

2. How frequently does the RAB meet? When was the last meeting and is there a future meeting scheduled?
   The frequency of meetings has varied over the years. There have recently been quarterly meetings. The last meeting was on June 28, 2017. The RAB members agreed (June 28, 2017) to meet as needed in the future.

3. Are you aware of any complaints, violations, or other incidents related to the NRU?
   Some residents have attempted to use the RAB to address present actions (e.g. burning of waste product).I do not know of complaints about the restorative actions.

4. Are you aware of any community concerns regarding the NRU or its operation and administration? If so, please give details.
   Some people are concerned about the open air burning.

INTERVIEW RECORD

Site Name:	Radford Army Ammunition Plant (RFAAP)	**EPA ID No.:** VA1210020730	
Subject:	New River Unit	**6:00-~9:00 pm**	**Date:** *June 28, 2017*

5. Do you feel well informed about the environmental activities and progress at the NRU?
   Yes.

6. If you are aware of the remedies for the BLA, IAA, and BDDT, do you have any comments or suggestions on the remedies themselves?

   No

7. If you are aware of the remedies for the BLA, IAA, and BDDT, do you have any concerns on the selection of the remedies, the implementation of the remedies, or the operation and maintenance of the sites?

   No.

8. Has any other information come to light that could call into question the protectiveness of the remedies?

   No

9. Do you have any other information that you would like included in our review?

   No.

INTERVIEW RECORD

Site Name: Radford Army Ammunition Plant (RFAAP)		**EPA ID No.:** VA1210020730	
Subject: New River Unit		**Time:**	**Date:**
Type: ☐ Telephone ☐ Visit ☒ Other (e-mail) **Location of Visit:**		☐ Incoming ☐ Outgoing	

Contact Made By:

Name: Holly Akers	**Title:** Project Engineer	**Organization:** US Army Corps of Engineers, Buffalo District

Individual Contacted:

Name: *Heather Govenor*	**Title:**	**Organization:**
Telephone No: **Fax No:** **E-Mail Address:** *heather.govenor@gmail.com*	**Street Address:** *1212 Federal St* **City, State, Zip:** *Radford VA 24141*	

Summary Of Conversation

Note: All questions below are specific to the New River Unit. Work performed at RFAAP under the RCRA permit is not included in this review.

1. How long and in what capacity have you been involved with the New River Unit (NRU) restoration advisory board (RAB)?
   I joined the RAB June 17, 2011 and have attended public meetings and facility visits to the extent possible from that point forward.

2. How frequently does the RAB meet? When was the last meeting and is there a future meeting scheduled?
   Three times a year. The most recent meeting was a site visit on June 28, 2017. At that point, the RAB voted to change the frequency of meetings to "as needed" based on the limited number of active sites remaining.

3. Are you aware of any complaints, violations, or other incidents related to the NRU?
   No

4. Are you aware of any community concerns regarding the NRU or its operation and administration? If so, please give details.
   My understanding of community concerns is that they focus around the RCRA permit (nitrogen discharge into the New River, Open Burning Ground and area air quality, perchlorate in groundwater) – which is separate from the NRU

5. Do you feel well informed about the environmental activities and progress at the NRU?
   Yes

INTERVIEW RECORD

Site Name:	Radford Army Ammunition Plant (RFAAP)	**EPA ID No.:** VA1210020730	
Subject:	New River Unit	**Time:**	**Date:**

6. If you are aware of the remedies for the BLA, IAA, and BDDT, do you have any comments or suggestions on the remedies themselves?
   No

7. If you are aware of the remedies for the BLA, IAA, and BDDT, do you have any concerns on the selection of the remedies, the implementation of the remedies, or the operation and maintenance of the sites?
   No

8. Has any other information come to light that could call into question the protectiveness of the remedies?
   Not that I am aware of.

9. Do you have any other information that you would like included in our review?
   No

From:	Mckenna, James J CIV (US)
To:	Cutler, Jim (DEQ)
Cc:	Senus, Michael P CIV USARMY CELRB (US); Akers, Holly A CIV USARMY CELRB (US)
Subject:	RE: Five Year Review Interviews for RFAAP New River Unit
Date:	Wednesday, August 23, 2017 2:17:30 PM

Jim,
Forwarded the NRU inspections forms to the contractor for uploading to the IRP website per our conversation today.
Thank you for your support of the Radford AAP Installation Restoration Program,
Jim

-----Original Message-----
From: Cutler, Jim (DEQ) [mailto:James.Cutler@deq.virginia.gov]
Sent: Wednesday, August 23, 2017 11:01 AM
To: Mckenna, James J CIV (US) <james.j.mckenna16.civ@mail.mil>
Cc: Senus, Michael P CIV USARMY CELRB (US) <Michael.P.Senus@usace.army.mil>; Akers, Holly A CIV USARMY CELRB (US) <Holly.A.Akers@usace.army.mil>
Subject: [Non-DoD Source] RE: Five Year Review Interviews for RFAAP New River Unit

Jim,

Interview form attached. Please call me if you have any questions.

Thanks,

Jim

-----Original Message-----
From: Mckenna, James J CIV (US) [mailto:james.j.mckenna16.civ@mail.mil]
Sent: Tuesday, August 08, 2017 8:43 AM
To: Cutler, Jim (DEQ)
Cc: Senus, Michael P CIV USARMY CELRB (US); Akers, Holly A CIV USARMY CELRB (US)
Subject: Five Year Review Interviews for RFAAP New River Unit
Importance: High

Hi Jim,

Please see the attached file for the interview form for completion by August 18, 2017. This is for the 5 Year Review of the New River Unit. I have copied the Corps of Engineers personnel that are assisting Radford AAP in the 5 Year Review effort. Please attach the completed form when you have finished and reply to all on this distribution.

If you have questions or concerns, please do not hesitate to contact me.

Thanks in advance for your support of the Radford AAP Installation Restoration Program.

Jim McKenna
540 731 5782

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ATTACHMENT 7

Risk Assessment and Toxicology Evaluation

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Risk Assessment and Toxicology Evaluation

This evaluation was prepared to address Question B in assessing the protectiveness of the remedy (OSWER No. 9355.7-03B-P), *"Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives (RAOs) used at the time of the remedy selection still valid?"*

This attachment summarizes the exposure assumptions, toxicity data, risk-based cleanup levels, and remedial action objectives at three areas at Radford Army Ammunition Plant (RFAAP) New River Unit (NRU) in Radford, Virginia. The three areas under review are the Building Debris Disposal Trench (BDDT), Igniter Assembly Area (IAA), and Bag Loading Area (BLA). All cleanup levels for chemicals of concern (COCs) are based on the human health endpoint. The environment was evaluated through baseline ecological risk assessments, and no ecological risk-based drivers were identified for ecologically-based cleanup goals. Summaries of cleanup goals are listed in Table A.7-1.

Human Health Risk

EXPOSURE ASSUMPTIONS

The human health risk assessments (HHRA) were conducted at the three review areas, BDDT, IAA and BLA. The scenarios evaluated at all sites were the site worker, hypothetical resident, and hypothetical future construction worker. Exposure parameter values used in the Remedial Investigation (RI) HHRA (ARCADIS 2010a) were compared to current default exposure parameter values. Default exposure parameters had been updated by OSWER Directive 9200.1-120 (USEPA 2014) and are generally consistent with the 2008 exposure parameters used in the RI HHRA (Table A.7-2). Minor changes to dermal exposure parameters resulted in slightly increased exposure to adult residents, but decreased exposure to industrial and construction workers, which are the receptors associated with the selected industrial/commercial remedies at the sites.

The current default standard exposure factors for the hypothetical child resident, site worker, and hypothetical future construction worker result in a calculated exposure and in/uptake less than what was calculated in the RI HHRA. The current default exposure factors for the hypothetical adult resident result in an approximate equivalent calculated exposure and in/uptake to what was calculated in the RI HHRA. The exposure assumptions used at the time of the remedy are therefore still valid.

TOXICITY CRITERIA

COCs were evaluated differently based on current accepted frameworks for toxicity assessment. Toxicity assessment for Aroclor 1254, benzo(a)pyrene, and copper evaluated two categories of toxic effects (carcinogenic and non-carcinogenic). Lead was evaluated using a modeling framework for estimating blood lead levels. Asbestos was evaluated using a framework for estimating airborne asbestos resulting from contaminated soil disturbance.

Aroclor 1254, benzo(a)pyrene, and copper

The toxicity values for Aroclor 1254, benzo(a)pyrene, and copper are listed in Table A.7.3 (cancer) and Table A.7.4 (non-cancer). Chemical-specific toxicity values were determined from available databases and used to calculate potential risks for these two types of toxic effects. For the RI HHRA (2010a), toxicity values were obtained from the following sources in order of priority as recommended by USEPA (2003b):

- USEPA Integrated Risk Information System (IRIS) database (USEPA 2008)
- USEPA's National Center for Environmental Assessment Provisional Peer-Reviewed Toxicity Values as reported in USEPA RSL Tables (USEPA 2009a)
- USEPA's Health Effects Assessment Summary Tables (HEAST; USEPA, 1997)
- Other sources used include the California Environmental Protection Agency (Cal EPA), the Agency for Toxic Substances and Disease Registry (ATSDR), and the World Health Organization (WHO), as referenced by USEPA (2009a).

The carcinogenic oral and dermal slope factors for Aroclor 1254 are current. The non-carcinogenic reference doses for Aroclor 1254 and copper are current. Toxicity data for benzo(a)pyrene have changed since the decision document was published. Benzo(a)pyrene was re-evaluated by the USEPA and has a 2017 IRIS published carcinogenic oral slope factor of 1 $(mg/kg\text{-}day)^{-1}$ (USEPA 2017a), which is 7.3 times less than the slope factor used in the RI HHRA (ARCADIS 2010a). The current slope factor predicts the chemical is 7.3 less carcinogenic than indicated in the RI and an associated cleanup goal would be calculated to be 7.3 times greater (assuming no changes to exposure factors) (Table A.7-3).

The current USEPA screening levels for benzo(a)pyrene using the new slope factor and current exposure factors are 0.11 and 2.1 mg/kg in soil for residential and industrial use, respectively (USEPA 2017b). Although there have been minor changes to exposure factors (see above), the reported toxicity value of benzo(a)pyrene has decreased and the cleanup level for benzo(a)pyrene in soil of 0.025 mg/kg is therefore still protective of human health.

Lead Evaluation

Exposure to lead is evaluated differently than the other constituents. Cancer risk and non-cancer hazard quotients are not estimated from exposure to lead because health effects from exposure to lead are better characterized by estimating the amount of lead that may reach the bloodstream following exposure. In other words, lead exposure risk is evaluated based on predicted blood lead levels (PbB).

The RI HHRA (2010a) used USEPA guidance (USEPA 2003a), USEPA's Adult Lead Methodology (ALM) model and USEPA's Integrated Exposure Uptake Biokinetic Model for Lead in Children (IEUBK; USEPA, 2005) to evaluate the potential for adverse health effects from exposure to lead by adults and children, respectively. The models were used to calculate the 95th percentile blood lead (PbB) concentrations for each receptor, which were compared to the target blood lead concentration of 10 micrograms per deciliter (µg/dL). The ALM is used to evaluate exposure of both industrial and hypothetical future adult resident receptors. The target blood lead concentration of 10 µg/dL is the current benchmark (DOD 2014).

In order to keep remediation goals in line with predicted PbB, baseline blood lead levels (PbB_0) of the receptor population must be monitored and used to adjust predicted PbB based on given exposure assumptions. USEPA continually updates PbB_0 using new data from the National Health and Nutrition Examination Survey (NHANES). The ALM was updated using the latest USEPA parameter values to ensure that remedial action levels (RALs) for the NRU site will continue to protect against lead exposure risk to construction workers, using pregnant adult females as a conservative receptor.

Adult Lead Model Updates
Lead exposure risk at the NRU was last assessed in 2008. A risk-based remediation goal (RBRG) for soil lead concentration of 624 ppm was calculated based on USEPA baseline blood lead levels at the time (USEPA 2002). In May 2017, USEPA updated geometric mean baseline blood-lead levels (PbB_0) and geometric standard deviation of blood-lead levels (GSD_i) based on the latest NHANES data. The 2008 lead risk assessment used ALM parameters based on USEPA 2002 recommendations for non-Hispanic white populations from the South region (USEPA 2002). The current ALM updated the value of PbB_0 from 1.3 to 0.64, and of GSDi from 2.04 to 1.80. While the 2008 lead risk assessment used population-specific parameter values, the USEPA Technical Review Workgroup for Lead currently recommends using a single parameter estimate from a national population (USEPA 2017c). The NHANES data use a national population of non-institutionalized women of child-bearing age.

The derivation of the lead RBRG for construction workers at the NRU (624 ppm) was first validated by entering the input parameter values used in the 2010 risk assessment into the ALM spreadsheet (Table A.7-5). The 2008 model was then updated with the new PbB_0 and GSD_i parameters, resulting in a RBRG for construction workers of 1,046 ppm (Table A.7-6).

The effect of exposure assumptions on calculated RBRGs was assessed by comparing site-specific exposure factors with ALM defaults. Risk calculation for construction workers assumed an exposure frequency ($EF_{S,D}$) of 130 days yr^{-1} and used an averaging time ($AT_{S,D}$) of 182 days yr^{-1}. This averaging time is intended to model a short-term exposure window based on a limited construction season. The calculated RBRG doubled when assuming the ALM default chronic exposure ($AT_{S,D}$ = 365; Table A.7-7). This indicates that even if the short-term assumption is unrealistic within the ALM exposure framework, the lead RAL is conservative in protecting against unacceptable lead exposure risk.

Lead Summary
The latest USEPA adult lead model parameter updates have decreased the baseline blood lead level in non-institutionalized adult women of child-bearing age, resulting in greater exposure requirements for reaching unacceptable childhood blood-lead levels (10 µg dL^{-1}). The RBRG developed in 2008, and the resultant RAL for the NRU, therefore continue to protect against lead exposure risk. If, however, USEPA adopts the 2012 CDC guidelines (CDC 2012a, CDC 2012b) for childhood blood-lead levels (5 µg dL^{-1}) within the Superfund program, then lead exposure risk at the NRU may need to be re-evaluated to prevent unacceptable risk.

Updates to the USEPA adult lead model over the last fifteen years based on NHANES data continue to decrease PbB_0 and increase resultant calculated RBRGs (Table A.7-8). This trend

suggests that the lead RAL is likely to remain protective of human health into the future. Potential increases in the population standard deviation (GSD_i), however, have the potential to lower RBRGs, as occurred between 2015 and 2017 despite a decreased PbB_0.

Asbestos evaluation

Asbestos was evaluated by using the current USEPA framework for evaluating potential risks associated with asbestos in soil (USEPA 2008). This framework addresses the fact that asbestos concentrations in soil are not always good predictors of the level of exposure and risk that may be experienced by individuals who come into contact with that soil. This is because the potential risk experienced by those individuals is not a function of the concentration in the soil but is instead a function of their potential inhalation of asbestos fibers that may become airborne when and if soil is disturbed. Therefore, activity-based sampling was conducted at the site, whereby the soil was disturbed (via raking) and corresponding airborne levels of asbestos were measured. According to the RIR, soil samples were collected at increasing distances from site buildings, and analyzed for asbestos by transmission electron microscopy via USEPA method 600/R-92/116 with sample preparation using California Air Resources Board Method 435 and an analytical sensitivity of 0.1% (ARCADIS 2010a). This combination of activity based sampling and use of transmission electron microscopy analysis is recommended by the EPA as the most economically and technically feasible approach to derive an action level for asbestos in air (USEPA 2008). This remains the current guidance for assessing risks from exposure to asbestos in soil.

The asbestos evaluation included the calculation of air action levels (AALs) by combining the methodology outlined in USEPA's framework document with the scenario-specific exposure parameters (ARCADIS 2010a, Appendix A) and inhalation unit risk factors developed for less than lifetime exposures (USEPA 2008). The AALs were derived to meet a target asbestos cancer risk of 1E-04, which is a goal of the remediation program at the site. The AALs were then compared with airborne asbestos concentrations measured during activity-based air sampling, and the corresponding soil concentrations of asbestos, to determine whether asbestos might pose a potential risk to individuals who come into contact with that soil.

According to the feasibility study, activity based sampling events at the BLA and IAA confirmed that no asbestos fibers were detected in air samples collected in areas where asbestos concentrations in soil were at or below 0.1% by weight, which would meet the AALs derived for all the receptor scenarios (ARCADIS 2010b). Therefore, 0.1% asbestos by weight was utilized as the default remedial goal for all of the receptor scenarios.

REVIEW AREA OUTCOMES

Building Debris Disposal Trench (BDDT)

Benzo(a)pyrene is the only COC identified at BDDT. This area had benzo(a)pyrene in soil that exceeded the RAL of 0.025 mg/kg. The RAL was developed to be protective of residential exposure, and was used to identify areas of the site that were required to be under land use controls to prevent that level of exposure. Current land use in the surrounding areas of the site is industrial. As indicated above, the exposure assumptions used to develop the benzo(a)pyrene RAL are still valid, and the updated toxicity criteria make the RAL more protective than at the

time of the Record of Decision (ROD). The RAOs for BDDT (listed in Section 5.1.2.1 of the main report) are therefore still valid.

Bag Loading Area (BLA)

Aroclor 1254, benzo(a)pyrene, copper, lead, and asbestos were identified as COCs on a human health hypothetical resident basis, and copper, lead, and asbestos were identified as COCs on a human health site worker basis. The evaluation of residential risks and development of residential cleanup goals were performed in order to determine whether or not the cleanup achieved unlimited use and unrestricted exposure (UU/UE). The remedial action was guided by use of industrial-based cleanup goals. Current land use is industrial/commercial.

The cleanup goals for Aroclor 1254, copper, lead, and asbestos are still valid. The toxicity data have not changed and the current USEPA (2014) exposure parameters for industrial site workers are less conservative than in the RI HHRA (ARCADIS 2010a). The cleanup levels listed in Table 6 in Section 5.2.2.1 of the main report are therefore less than or equal to what would be calculated using current exposure parameters.

The RAOs for BLA are listed in Section 5.2.2.1 of this report.

- Minimizing the potential for future releases of COCs from the conductive flooring to the surrounding environment no longer applies. The conductive flooring material has been removed and disposed of off-site. The source of conductive flooring has been removed. This RAO has been achieved.
- Preventing human exposure to COCs in soil and the flooring material that would lead to unacceptable risk or hazard for the designated use no longer applies. The conductive flooring material and surrounding soil impacted from the conductive flooring material has been removed and disposed of off-site. The source of conductive flooring material and secondary source of impacted surface soil have been removed. This RAO has been achieved.
- Minimizing the potential for COCs present in surface soils to migrate to other areas still applies. The conductive flooring material and surrounding soil impacted from the conductive flooring material has been removed and disposed of off-site. The source of conductive flooring material and secondary source of impacted surface soil have been removed. There are soil concentrations of copper, lead, Aroclor 1254, and benzo(a)pyrene that pose potential risk to future residential development of the site, and lead-based paint and asbestos-containing materials within the buildings. This RAO is still valid and LUCs have been implemented as part of the remedy to prevent future residential development of the site, thus mitigating this risk.

Igniter Assembly Area (IAA)

Aroclor 1254, copper, lead, and asbestos were identified as COCs on a human health hypothetical resident basis. At this review site, cleanup goals for soil were based on hypothetical residential exposure. These cleanup goals were met following remedial action. Because no soil COCs remain at levels exceeding the residential standards, no review of soil cleanup goals at the IAA is warranted as part of this Five Year Review.

The RAOs for IAA are listed in Section 5.3.2.1 of this report.

- Removal and approved off-site disposal of the conductive flooring material present in the building remnants. The conductive flooring material has been removed and disposed of off-site. The source of conductive flooring has been removed. This RAO has been fulfilled.
- Excavation and approved off-site disposal of surface soils located adjacent to former buildings, so as to reduce risk and hazard levels to those appropriate for commercial/industrial land use. The surrounding soil impacted from the conductive flooring material has been removed and disposed of off-site. The source of conductive flooring material and secondary source of impacted surface soil have been removed. This RAO has been fulfilled.
- Establish LUCs that would prohibit the occupation or utilization of the building remnants for industrial or commercial purposes. No restrictions on land use are required for the IAA because the Army removed COCs in soil that contributed to unacceptable health risks. LUCs were implemented at the IAA for the purpose of restricting use of the building remnants at the site due to the presence of building remnants with asbestos-containing material and lead based paint. This RAO is being met via the implementation of LUCs (e.g. prevention of residential use and the installation of on-site signage and access controls).

Ecological Risk

A screening level ecological risk assessment (SLERA) and baseline ecological risk assessment (BERA) were completed at each of the three review areas in the RFAAP-NRU (ARCADIS 2010a). The results of the ERAs indicated that there were a few constituents at each of the review areas that had the potential for adverse ecological impacts to individual receptors. However, when the background concentrations and limited spatial distribution of the constituents were taken into consideration, the ERAs concluded that there was no potential for population-level ecological effects to terrestrial or aquatic receptors at any of the review areas. Therefore, no COCs or drivers for remedial action have been identified for RFAAP-NRU from an ecological risk standpoint. There has not been any change in site use which would warrant re-examining ecological management goals for the site.

Significant Findings

Toxicity criteria for COCs at RRAP-NRU have remained the same since the previous HHRA (ARCADIS 2010a), with the exception of benzo(a)pyrene. Benzo(a)pyrene has decreased in

toxicity by a factor of ~7 compared to when the ROD was made. Cleanup goals for review areas impacted by benzo(a)pyrene (BDDT and BLA) are therefore more conservative with regard to that COC than at the time of the ROD. Minor changes to recommended default exposure parameters have not invalidated the cleanup goals in place. This is especially true for receptors associated with current land use at the site (industrial/construction), which now have exposure levels below those used in the RI HHRA (ARCADIS 2010a). Similarly, changes to baseline blood lead levels have increased the exposure level required to reach an unacceptable health risk associated with lead in soil, thus making the lead RAL conservative. Overall, RALs are still valid based on the updates outlined above.

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ARCADIS 2010a. Remedial Investigation Report, New River Unit (RAAP-044), Radford Army Ammunition Plant. Prepared for United States Army Environmental Command. June.

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USEPA 2002. Blood lead concentrations of U.S. adult females: Summary statistics from Phases 1 and 2 of the National Health and Nutrition Evaluation Survey (NHANES III). OSWER #9285.7-52. March.

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USEPA 2009a, USEPA's National Center for Environmental Assessment Provisional Peer-Reviewed Toxicity Values as reported in USEPA RSL Tables.

USEPA 2009b, Risk Assessment Guidance for Superfund (RAGS), Volume I: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment), EPA-540-R-070-002 (January)

USEPA 2014. Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors. OSWER Directive 9200.1-120.

USEPA 2017a. Toxicological Review of Benzo[a]pyrene. Integrated Risk Information System (IRIS), National Center for Environmental Assessment. EPA/635/R-17/003Fa. URL: https://www.epa.gov/iris/

USEPA 2017b. Regional Screening Levels (RSL) Summary Table, June 2017 (table last updated); available via EPA Region web sites, e.g. https://www.epa.gov/risk/regional-screening-levels-rsls

USEPA 2017c. Transmittal of update to the Adult Lead Methodology's default baseline blood lead concentration and geometric standard deviation parameters. OLEM Directive 9285.6-56. May.

Table A.7-1. Cleanup Goals and Associated Toxicity Criteria for Risk-Based Concentrations
New River Unit, Radford Army Ammunition Plant, Radford, Virginia.

Chemical	Cleanup Level	Units	Applicable Study Area	Basis for Cleanup Level	Change in Toxicity Criteria?
Soil Remediation Goals					
Aroclor 1254	0.23	mg/kg	BLA, IAA	human health risk (hypothetical resident carcinogenic endpoint [child 0-6 yrs adult 24 yrs] Remedial Investigation Report New River Unit RAAP-044, June 2010)	No. IRIS 1994 RfD and 1996 SF are current.
Benzo(a)pyrene	0.025	mg/kg	BLA, BDDT	human health risk (hypothetical resident carcinogenic endpoint [child 0-6 yrs adult 24 yrs] Remedial Investigation Report New River Unit RAAP-044, June 2010)	Yes. The SF changed from 7.3/mg/kg-day to 1/mg/kg-day (IRIS 2017)
Copper	residential 3,044 construction worker 11,533	mg/kg	BLA, IAA	human health risk (hypothetical resident carcinogenic endpoint [child 0-6 yrs adult 24 yrs, construction worker 0.5 years] Remedial Investigation Report New River Unit RAAP-044, June 2010)	No the HEAST 1997 RfD is current.
Lead	residential 400, construction worker and industrial worker 624	mg/kg	BLA, IAA	human health risk (hypothetical resident child endpoint is blood lead level of 10 ug/L or less CDC 1991. [child 0-6 yrs, adult 24 yrs, construction worker 0.5 years, industrial site worker 25 yrs] Remedial Investigation Report New River Unit RAAP-044, June 2010)	No. The blood lead level endpoint (10 ug/L or less CDC 1991) is still currently being used in the EPA's Superfund program.
Asbestos	0.1	% by wt	BLA, IAA	human health risk (hypothetical resident carcinogenic endpoint [child 0-6 yrs adult 24 yrs] Remedial Investigation Report New River Unit RAAP-044, June 2010)	No. Carcinogenic risk from inhalation exposure last reviewed in IRIS in 1988 and the inhalation unit risk remains 0.23 per (f/mL). Site risks assessed using unit risk factors for less-than-lifetime exposures developed in USEPA 2008.

mg = milligram
ug = microgram
kg = kilogram
L = liter
BDDT = Building Debris Disposal Trench
BLA = Bag Loading Area
IAA - Igniter Assembly Area
RAAP = Radford Amry Ammunition Plant
RfD = reference dose
SF = carcinogenic slope factor
HEAST = Health Effecxts Assessment Summary Tables
% by wt = percent by weight
CDC = US Department of Health and Human Services, Centers for Disease Control and Prevention
IRIS = USEPA's Integrated Risk Information System

Table A.7-2. Receptor-Specific Exposure Parameters
New River Unit, Radford Army Ammunition Plant, Radford, Virginia.

			Radford Exposure Parameters (RI HHRA 2010)								Current Default Parameters (USEPA 2014)							
			Residential								Residential							
Parameter	**Symbol**	**units**	**child**	**ref**	**adult**	**ref**	**site worker**	**ref**	**construction worker**	**ref**	**child**	**ref**	**adult**	**ref**	**site worker**	**ref**	**construction worker**	**ref**
General Factors																		
Averaging Time (cancer) [a]	ATc	days	25,550	[1, a]	25,550	[1, a]	25,550	[1, a]	25,550	[1, a]	25,550	[1, a]	25,550	[1, a]	25,550	[1, a]	25,550	[1, a]
Averaging Time (noncancer)	ATnc	days	2190 (6 yr)	[2,a]	10950 (30 yr)	[2,a]	9125 (25 yr)	[2,a]	182 (0.5 yr)	[a]	2190 (6 yr)	[2,a]	7300 (20 yr)	[7, a]	9125 (25 yr)	[2,a]	365	[a]
Body Weight	BW	kg	15	[2]	70	[1,2]	70	[1,2]	70	[1,2]	15	[2]	80	7	80	[6]	80	[6]
Exposure Frequency	EF	days/year	350	[2]	350	[2]	250	[2]	130	PJ	350	[2]	350	[2]	250	[2]	130	PJ
Exposure Duration	ED	years	6	[2]	24	[2]	25	[1,2]	1	PJ	6	[2]	20	7	25	[1,2]	1	PJ
Soil - Ingestion (Oral)																		
Incidental Soil Ingestion Rate	IRs	mg/day	200	[2]	100	[2]	100	[5]	330	[5]	200	[7]	100	[2]	100	[2]	330	[5]
Fraction Ingested from Source	FI	unitless	1		1		1		1		1	max	1	max	1	max	1	max
Soil - Dermal Contact																		
Exposed Skin Surface Area	SSAs	cm^2	2,800	[3,c]	5,700	[3,c]	3,300	[3]	3,300	[3]	2,373	[7]	6,032	[7]	3,470	[7]	3,470	[7]
Soil-to-Skin Adherence Rate	SAR	$mg/cm^2/day$	0.2	[3]	0.07	[3]	0.2	[3]	0.3	[5]	0.2	[3]	0.07	[3]	0.12	[7]	0.12	[7]

[1] USEPA (1989) Risk Assessment Guidance for Superfund, Part A
[2] USEPA (1991) Human Health Evaluation Manual
[3] USEPA (2004) Risk Assessement Guidance for Superfund, Part E
[4] USEPA (1997) Exposure Factors Handbook
[5] USEPA (2002) Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites
[6] USEPA (2011) Exposure Factors Handbok, 2011 Edition
[7] USEPA (2014) Human Health Evaluation Manual Supplemental Guidance, Update of Standard Default Exposure Factors
[a] The averaging time for cancer risk is the expected lifespan of 70 years expressed in days. The averaging time for non-cancer hazard is the total exposure duration expressed in days.
cm centimeter
m meter
kg kilogram
mg miligram
yr year
PJ = professional judgement
max = maximum value

Table A.7-3. Comparison of Cancer Slope (Risk) Factors Used in the 2010 HHRA RI with EPA's Current Recommended Toxicity Criteria
New River Unit, Radford Army Ammunition Plant, Radford, Virginia.

Radford RI HHRA (2010) SF and URF

			Oral Cancer Slope Factors			Dermal Slope Factor Derivation			Inhalation Slope Factor			Inhalation Unit Risk Factor	
			SFo				SFd		SFi			URF	
Chemical	**CAS #**	**WOE Class**	**(mg/kg-day)-1**	**Ref**	**Target Organ**	**ABSgi**	**(mg/kg-day)-1**		**(mg/kg-day)-1**	**target organ**	**Ref**	**(ug/m3)-1**	**Ref**
Aroclor 1254	11097-69-1	B2	2.00E+00	(a)	liver	1	2.00E+00		2.00E+00	liver	(a)		
Benzo(a)pyrene	50-32-8	B2	7.30E+00	(a)	stomach	1	7.30E+00		3.10E+00	respiratory	NCEA 2007 provisional		
Copper	7440-50-8	D	NA	IRIS 1988									
Lead	7439-92-1	B2	NA	IRIS 1986									
Asbestos	1332-21-4												

Current EPA Cancer Factors (August 2017)

			Oral Cancer Slope Factors			Dermal Slope Factor Derivation			Inhalation Slope Factor			Inhalation Unit Risk Factor	
			SFo				SFd		SFi			URF	
Chemical	**CAS #**	**WOE Class**	**(mg/kg-day)-1**	**Ref**	**Target Organ**	**ABSgi**	**(mg/kg-day)-1**		**(mg/kg-day)-1**	**target organ**	**Ref**	**(ug/m3)-1**	**Ref**
Aroclor 1254 (generic PCBs)	11097-69-1	B2	2.00E+00	IRIS 1996	liver	1	2.00E+00		4.00E-01		IRIS 1989	1.00E-04	IRIS 1989
Benzo(a)pyrene	50-32-8	A	1.00E+00	IRIS 2017	GI	1	1.00E+00		2.10E+00	GI Respiratory	(b)	6.00E-04	IRIS 2017
Copper	7440-50-8	D	NA	IRIS 1988									
Lead	7439-92-1	B2	NA	IRIS 1986									
Asbestos	1332-21-4	A		IRIS 1988	lung							0.23 fiber/ml air	IRIS 1988

IRIS Integrated Risk Information System
Ref = reference
mg = milligram
ug = microgram
kg = kilogram
ml = milliliter
SFo - Oral Slope Factor
SFd - Dermal Slope Factor
Sfi - inhalation Slope Factor
URF - Inhalation Unit Risk Factor
GI = gastrointestinal tract
ABSgi and ABSd were obtained from Supplemental Guidance to RAGS: Dermal Risk Assessment (EPA, 2004)
IIRIS = Environmental Protection Agency (EPA) Integrated Risk Information System

Table A.7-4. Comparison of Non-Cancer Toxicity Factors Used in the RI HHRA (2010) with EPA's Current Recommended Toxicity Criteria, Non-carcinogens
New River Unit, Radford Army Ammunition Plant, Radford, Virginia.

		Reference Dose Values from the Radford RI HHRA(2010)											
Chemical	CAS No.	Chronic RfDo (mg/kg-day)	Ref	sub-chronic RfD (mg/kg-day)	Ref	oral absorption efficiency	Chronic RfDd (mg/kg-day)	sub-chronic RfDd (mg/kg-day)	target effect	Chronic RfDi (mg/kg-day)	Ref	SubChronic RfDi (mg/kg-day)	Ref
Aroclor 1254		2.00E-05	IRIS 1994	5.00E-05	HEAST 1997	1 USEPA 2004	2.00E-05	5.00E-05	liver blood hair	NA		NA	
Benzo(a)pyrene		NA		NA			NA	NA	kidney	NA		NA	
Copper		4.00E-02		4.00E-02	chronic value	1 USEPA 2004	4.00E-02	4.00E-02	liver	NA		NA	
Lead		NA		NA			NA	NA	CNS	NA		NA	
Asbestos		NA		NA			NA	NA		NA		NA	

		Reference Dose Values Current USEPA Values (August 2017)											
Chemical	CAS No.	Chronic RfDo (mg/kg-day)	Ref	sub-chronic RfD (mg/kg-day)	Ref	oral absorption efficiency	Chronic RfDd (mg/kg-day)	sub-chronic RfDd (mg/kg-day)	target effect	Chronic RfDi (mg/kg-day)	Ref	SubChronic RfDi (mg/kg-day)	Ref
Aroclor 1254		2.00E-05	IRIS 1994	5.00E-05	HEAST 1997	1 USEPA 2004	2.00E-05	5.00E-05	liver blood hair	NA		NA	
Benzo(a)pyrene		3.00E-04	IRIS 2017	NA			NA	NA	kidney	NA		NA	
Copper (a)		4.00E-02	C	4.00E-02	chronic value	1 USEPA 2004	4.00E-02	4.00E-02	GI HEAST 1997	NA		NA	
Lead		NA		NA			NA	NA	CNS	NA		NA	
Asbestos		NA		NA			NA	NA		NA		NA	

(a) Copper HEAST 1997 - 1.3 mg/L Drinking water data inadequate for calculation of an RfD for Copper
IRIS = Environmental Protection Agency (EPA) Itegrated Risk Inforamation System
HEAST = Health Effects Assessment Summary Table
C = California Environmental Protection Agency
GI = gastrointestinal tract
CNS = central nervous system
RfDo = oral reference dose
RfDd = dermal reference dose
RfDi = inhalation reference dose
USEPA = United States Environmental Protection Agency
Ref = reference
mg = milligram
kg = kilogram
NA = nort applicable

Table A.7-5. Adult lead methodology (ALM) used to calculate a risk-based remediation goal (RBRG) for the Radford site in 2008.

Parameter	Description of Parameter	Units	Radford 2008	Reference[a]
$PbB_{fetal,\ 0.95}$	95^{th} percentile PbB in fetus	ug/dL	10	DOD 2014
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9	ALM default
BKSF	Biokinetic Slope Factor	ug/dL per ug/day	0.4	ALM default
GSD_i	Geometric standard deviation PbB	--	2.04	Default for non-Hispanic white populations, South region (USEPA 2002; Table 3a)
PbB_0	Baseline PbB	ug/dL	1.3	Default for non-Hispanic white populations, South region (USEPA 2002; Table 3a)
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.1	TRW recommended value for construction workers (USEPA 2003a)
$AF_{S,\ D}$	Absorption fraction (same for soil and dust)	--	0.12	ALM default
$EF_{S,\ D}$	Exposure frequency (same for soil and dust)	days yr^{-1}	130	based on limited construction season (non-chronic exposure)
$AT_{S,\ D}$	Averaging time (same for soil and dust)	days yr^{-1}	182	based on limited construction season (non-chronic exposure)
RBRG		**ppm**	**624**	

[a] see reference list for Attachment 7

Where:

$$RBRG = \frac{(PbB_{adult,central,goal} - PbB_0) \times AT_{S,D}}{(BKSF \times IR_s \times AF_{S,D} \times EF_{S,D})}$$ (Equation 4 - EPA, 2003)

$$PbB_{adult,central,goal} = \frac{PbB_{fetal,0.95}}{GSD_i^{1.645} \times R_{fetal/maternal}}$$ (Equation 2 - EPA, 2003)

USEPA, 2003. *Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil.* EPA-540-R-03-001, OSWER Dir #9285.7-54. January (with 2009 update).

Table A.7-6. Updated adult lead methodology (ALM) for the Radford site using the latest USEPA baseline blood-lead parameter values. Shaded cells indicate parameters that were updated since the 2008 Radford assessment.

Parameter	Description of Parameter	Units	Radford 2017 Update	Reference[a]
$PbB_{fetal,\ 0.95}$	95th percentile PbB in fetus	ug/dL	10	DOD 2014
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9	ALM default
BKSF	Biokinetic Slope Factor	ug/dL per ug/day	0.4	ALM default
GSD_i	Geometric standard deviation PbB	--	1.8	USEPA 2017c parameter updates
PbB_0	Baseline PbB	ug/dL	0.64	USEPA 2017c parameter updates
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.1	TRW recommended value for construction workers (USEPA 2003a)
$AF_{S,\ D}$	Absorption fraction (same for soil and dust)	--	0.12	ALM default
$EF_{S,\ D}$	Exposure frequency (same for soil and dust)	days yr^{-1}	130	based on limited construction season (non-chronic exposure)
$AT_{S,\ D}$	Averaging time (same for soil and dust)	days yr^{-1}	182	based on limited construction season (non-chronic exposure)
RBRG		**ppm**	**1046**	

[a] see reference list for Attachment 7

Where:

$$RBRG = \frac{(PbB_{adult,central,goal} - PbB_0) \times AT_{S,D}}{(BKSF \times IR_s \times AF_{S,D} \times EF_{S,D})}$$ (Equation 4 - EPA, 2003)

$$PbB_{adult,central,goal} = \frac{PbB_{fetal,0.95}}{GSD_i^{1.645} \times R_{fetal/maternal}}$$ (Equation 2 - EPA, 2003)

USEPA, 2003. *Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil.* EPA-540-R-03-001, OSWER Dir #9285.7-54. January (with 2009 update).

Table A.7-7. Adult lead methodology (ALM) for the Radford site using the latest USEPA parameter values and the default year-long averaging time ($AT_{S,D}$). Shaded cells indicate parameters that were updated since the 2008 Radford ALM.

Parameter	Description of Parameter	Units	Radford 2017 Update	Reference[a]
$PbB_{fetal,\ 0.95}$	95th percentile PbB in fetus	ug/dL	10	DOD 2014
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9	ALM default
BKSF	Biokinetic Slope Factor	ug/dL per ug/day	0.4	ALM default
GSD_i	Geometric standard deviation PbB	--	1.8	USEPA 2017c parameter updates
PbB_0	Baseline PbB	ug/dL	0.64	USEPA 2017c parameter updates
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.1	TRW recommended value for construction workers (USEPA 2003a)
$AF_{S,\ D}$	Absorption fraction (same for soil and dust)	--	0.12	ALM default
$EF_{S,\ D}$	Exposure frequency (same for soil and dust)	days yr^{-1}	130	based on limited construction season (non-chronic exposure)
$AT_{S,\ D}$	Averaging time (same for soil and dust)	days yr^{-1}	365	ALM default
RBRG		**ppm**	**2097**	

[a] see reference list for Attachment 7

Where:

$$RBRG = \frac{(PbB_{adult,central,goal} - PbB_0) \times AT_{S,D}}{(BKSF \times IR_s \times AF_{S,D} \times EF_{S,D})}$$ (Equation 4 - EPA, 2003)

$$PbB_{adult,central,goal} = \frac{PbB_{fetal,0.95}}{GSD_i^{1.645} \times R_{fetal/maternal}}$$ (Equation 2 - EPA, 2003)

USEPA, 2003. *Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil.* EPA-540-R-03-001, OSWER Dir #9285.7-54. January (with 2009 update).

Table A.7-8. Summary of parameter updates to the USEPA adult lead methodology (ALM) and resultant risk-based remediation goal (RBRG) soil concentrations for Radford New River Unit.

	EPA Adult Lead Model Updates			
Parameter	**2002[a]**	**2009[b]**	**2015[b]**	**2017[b]**
PbB_0 (µg dL^{-1})	1.3	1	0.7	0.64
GSD_i	2.04	1.8	1.7	1.8
RBRG (ppm)	**624**	**941**	**1,150**	**1,046**

[a] non-Hispanic white populations, South region; parameters used in the NRU risk assessment drafted in 2008.

[b] non-institutionalized women of child-bearing age, national population

ATTACHMENT 8

Public Notice

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The Roanoke Times

Roanoke, Virginia
Affidavit of Publication

Account Number
6077337

Date
July 09, 2017

US AMRY CORPS OF ENGINEER
1776 NIAGARA ST
BUFFALO, NY 14207

Date	Category	Description	Ad Size	Total Cost
07/15/2017	Legal Notices	NOTICE The U.S. Army announces the 1st five-year Review fc	1 x 113 L	676.81

Publisher of the Roanoke Times

I, (the undersigned) an authorized representative of the Roanoke Times, a daily newspaper published in Roanoke, in the State of Virginia, do certify that the annexed notice NOTICE The U.S. Army ann **was published in said newspapers on the following dates:**

07/09/2017

The First insertion being given ... 07/09/2017

Newspaper reference: 0000563686

Makaili Slater

Billing Representative

Sworn to and subscribed before me this Sunday, July 9, 2017

Tina A McEnheimer

Notary Public

State of Virginia
City/County of Roanoke
My Commission expires Mar 31, 2019

TINA A. McENHEIMER
NOTARY PUBLIC
REG. #332964
MY COMMISSION EXPIRES
03/31/19
COMMONWEALTH OF VIRGINIA

THIS IS NOT A BILL. PLEASE PAY FROM INVOICE. THANK YOU

NOTICE

The U.S. Army announces the 1st five-year Review for the New River Unit, RAAP-044 (NRU), remedies implemented at the Radford Army Ammunition Plant (RFAAP).

Section 121 (c) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Contingency Plan (NCP) state "a remedial action that resulted in hazardous substances, pollutants, or contaminants remaining at the site shall be reviewed no less frequently than every five years." Thus CERCLA requires a statutory five-year review of the selected remedial actions at the RFAAP NRU. The NRU is not on the National Priorities List (NPL).

The U.S. Army Corps of Engineers, Buffalo District (USACE) is conducting the five-year review. The five-year review includes review of new data and information, inspection of the sites, and interviews of stakeholders and interested community members. The objective of the review is to ensure that the completed or on-going remedies are protective of human health and the environment.

As a noncontiguous property of RFAAP, the NRU was investigated under the CERCLA process (non NPL) in which a decision document was produced from the remedial investigation and feasibility study (RI/FS) effort. The decision document was signed in April 2013. The RI/FS documents and the decision document were coordinated with the Virginia Department of Environmental Quality.

The remedies subject to the five-year review were selected in a decision document signed in April 2013:

- Building Debris Disposal Trench: Institutional controls to address benzo(a)pyrene in soil.
- Bag Loading Area and Igniter Assembly Area: Removal and off-site disposal of conductive flooring material; excavation and off-site disposal of surface soil; and, land use controls to address constituents of concern (COCs) including metals, polychlorinated biphenyls, and asbestos in flooring material and soil.
- Western Burning Ground: Excavation and off-site disposal of sediments to address lead and chromium in sediment.

USACE initiated the five-year review process in April 2017 and it will be completed by September 2018. The findings of the five-year review will be available for public review after September 2018 at the document repository listed below. The repository contains detailed information concerning the selected remedies and the contamination addressed by the remedy.

Contact Information: If you have any questions, comments, and/or concerns above the five-year review you may contact the following:
Charles Saks
Public Affairs Officer
Radford Army Ammunition Plant
(540) 731-5785

Commonwealth of Virginia, DEQ
Office of Remediation Programs
ATTN: James L. Cutler, Jr.
Post Office Box 1105
629 East Main Street
Richmond, Virginia 23218

Document Repositories:
Electronic Repository: http://www.radfordaapirp.org/inforepo/online-index.htm
Physical Repositories: Radford Army Ammunition PlantMontgomery-Floyd Regional Library
Constitution Road, Building 220Christiansburg Branch
Radford, Virginia 24141
125 Sheltman Street
Christiansburg, Virginia 24073

(563686)

ATTACHMENT 9

Historical Investigation Summaries and Data

(Extracted from Decision Document, ARCADIS 2011b)

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Table 1
Summary of Historical Investigations Completed at RFAAP-NRU
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Investigation	Date	Author	Activities Performed (1)
Building Debris Disposal Trench			
Preliminary Sampling	1997	Alliant TechSystems	This initial assessment of the site was performed to identify potential impacts associated with the debris disposal area. The assessment included the collection of 1 soil sample, 1 surface water sample from the downgradient stream, and 1 sample of a tarry substance leaking from a drum.
Independent Sampling	1998	Gannett Fleming	This investigation was performed at the direction of the USEPA to evaluate potential impacts to the unnamed stream downgradient of the BDDT area. The investigation included samples of surface water and sediment within the stream.
Remedial Investigation	1998	ICF Kaiser Engineers	The first extensive investigation conducted at the site to identify the extent of impacts associated with the site. The activities completed during this phase of investigation included: a geophysical investigation to identify buried waste; removal of all debris and stained soils from the disposal trench; collection of soil samples from the base of the excavated area and from the downgradient depositional area; co-located surface and sediment samples from the unnamed stream; and placement of clean fill and rip-rap in the former disposal area.
Remedial Investigation	2002	Shaw	This event included the collection of soil samples to delineate the vertical extent of impacts within the depositional area. Sediment and surface water samples were also collected from the downgradient stream to further evaluate the potential for impacts to sediment or surface water quality.
Additional Characterization	2004	Shaw	This sampling event was performed to delineate the extent of PAH's in soil within the depositional area downgradient of the former disposal area.
Remedial Investigation	2008	ARCADIS	This final sampling event was conducted to confirm that the impacts to soil within the depositional area were fully delineated and to confirm the declining trend of PAHs in the stream sediments.

Table 1
Summary of Historical Investigations Completed at RFAAP-NRU
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Investigation	Date	Author	Activities Performed (1)
Bag Loading Area			
Preliminary Sampling	1997	Dames and Moore	Initial assessment of the lateral and vertical distribution of organic and inorganic contamination in surface and subsurface soils around Building 407.
Independent Sampling	1997-1998	Gannett Fleming	This investigation included the collection of soil and conductive flooring samples from Building 405.
Conductive Flooring Assessment	2002	USACE	The United States Army Corp of Engineers completed a conductive flooring assessment to evaluate the composition of the flooring material.
Remedial Investigation	2002	Shaw	This sampling event included the collection of soil samples from the areas surrounding the buildings with conductive flooring, former electrical transformer locations. Sediment and surface water samples were also collected from area drainage ditches and the unnamed stream located to the north of the BLA.
Asbestos & Lead Investigation	2005	Shaw	This investigation was performed to evaluate the extent of asbestos material and lead-based paint in the site buildings.
Remedial Investigation	2008	ARCADIS	The intent of this investigation was to delineate the extent of PAHs, inorganics, and asbestos in surface soil surrounding building with conductive flooring material.
Supplemental Remedial Investigation	2009	ARCADIS	The intent of this investigation was to enhance the delineation of the asbestos in surface soils around buildings containing conductive flooring and to evaluate potential airborne asbestos exposure risks associated with the asbestos in soil.

Table 1
Summary of Historical Investigations Completed at RFAAP-NRU
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Investigation	Date	Author	Activities Performed (1)
Igniter Assembly Area			
Preliminary Sampling	1997	Dames and Moore	Initial assessment of the lateral and veridical distribution of organic and inorganic contamination in surface and subsurface soils around the site.
Independent Sampling	1997-1998	Gannett Fleming	Additional sampling of surface and subsurface soil; in addition, samples of the conductive flooring material were also collected.
Additional Characterization	1998	Dames and Moore	This sampling event was performed to enhance the characterization and delineation of organic and inorganic constituents around Building 8102.7.
Remedial Investigation	1998	ICF Kaiser Engineers	The intent of this investigation was to further characterize the nature and extent of target constituents at the IAA through surface, subsurface, and flooring samples.
Conductive Flooring Assessment	2002	USACE	The United States Army Corp of Engineers completed a conductive flooring assessment to further evaluate the composition of the flooring material.
Remedial Investigation	2002	Shaw	This sampling event was performed to provide additional characterization of soil located adjacent to site buildings, former transformer locations, and in area drainage ditches.
Asbestos & Lead Investigation	2005	Shaw	This investigation was performed to evaluate the extent and impact of asbestos material and lead-based paint in the site buildings.
RI Investigation	2008	ARCADIS	The intent of this investigation was to delineate the extent of PAHs, inorganics, and asbestos in surface soil surrounding building with conductive flooring material and PCBs at former transformer locations.
Supplemental RI Investigation	2009	ARCADIS	The intent of this investigation was to enhance the delineation of the asbestos in surface soils around buildings containing conductive flooring and to evaluate potential airborne asbestos exposure risks associated with the asbestos in soil.

Table 1
Summary of Historical Investigations Completed at RFAAP-NRU
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Investigation	Date	Author	Activities Performed (1)
Northern Burning Ground			
Independent Sampling	1997	Gannett Fleming	
Remedial Investigation	1998 - 1999	ICF Kaiser Engineers	The was the first extensive investigation conducted to identify potential impacts associated with the historical burning operations at the site. The activities completed during this phase of investigation included: a geophysical investigation to identify buried debris and identify the bounds of the former burning area; soil samples from the former burning area and surrounding area to identify the nature and extent of constituents at the site.
Remedial Investigation	2002	Shaw	The intent of this phase of investigation was to further define the nature and extent of constituents at the site. Additional soil samples were collected from the former burning area and surrounding low lying areas. Sediment samples were also collected from the drainage ditch that received surface water runoff from the site.
Additional Delineation Sampling	2004	Shaw	The sampling event was performed to bound the horizontal and vertical extent of elevated metals concentrations in site soils.
Response Action and Confirmation Sampling	2009	ARCADIS	ARCADIS performed a removal action at the NBG in 2009 that included the excavation and off-site disposal of lead and chromium impacted soils. Confirmation samples were collected to document that the removal action successfully achieved the remediation goals that had been established for the site.

Table 1
Summary of Historical Investigations Completed at RFAAP-NRU
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Investigation	Date	Author	Activities Performed (1)
Rail Yard			
Independent Sampling	1997 - 1998	Gannett Fleming	This initial sampling event included the collection of soil samples near the loading platforms and transformer locations, and sediment samples from a crawl space, sewer, and area drainage ditches. The intent of this investigation was to evaluate the potential for contamination resulting from historical operations.
Remedial Investigation	1998	ICF Kaiser Engineers	This phase of investigation included the collection of surface and subsurface soil samples from areas where the historical rail car loading, unloading, and maintenance activities were performed.
Baseline Investigation	2002	Shaw	This sampling event included the collection of multiple surface soil samples across the site to develop an understanding of the existing concentration of constituents in soil. This data would be used to establish baseline conditions so that the effects of possible future uses at the RY can be evaluated.
Remedial Investigation	2002	Shaw	During this phase of investigation surface and subsurface soil samples were collected at former transformer locations and other areas that had previously been uncharacterized. Sediment and surface water samples were collected from the pond and tributaries of the unnamed stream that flows near the RY.

Table 1
Summary of Historical Investigations Completed at RFAAP-NRU
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Investigation	Date	Author	Activities Performed (1)
WBG			
Independent Sampling	1997	Gannett Fleming	Initial investigation to characterize contamination resulting from site activities; surface soil, sediment, and surface water samples were collected.
Remedial Investigation	1998 - 1999	ICF Kaiser Engineers	This was the first extensive investigation conducted at the site to characterize and delineate the extent of impacts associated with the historical burning operations. The first phase of the investigation included a geophysical survey to identify buried debris. Soil sampling was then performed to define the extent of the former burning operations. A test pitting program was then performed throughout the former burn area to remove impacted soils. Confirmation sampling was performed that the test pitting successfully removed the soils containing constituents at concentrations above screening levels. Sediment and surface water samples were also collected from the pond located adjacent to the WBG.
Remedial Investigation	2002	Shaw	This investigation was conducted to further evaluate soil quality north and west of the former burn area, near a former transformer station. In addition, surface water and sediment samples were collected from the pond, downgradient stream, and area drainage ditches.
Additional Characterization	2004	Shaw	This investigation was performed to characterize and delineate constituents present in soil outside the former burning area. The investigation also included an extensive evaluation of potential impacts to the unnamed pond, that included the collection of additional sediment and surface water samples, as well as a fish bioaccumulation study.
Remedial Investigation	2008	ARCADIS	The intent of this sampling was to finalize the characterization and delineation of constituents in pond and stream sediments and surface water.

Table 1
Summary of Historical Investigations Completed at RFAAP-NRU
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Investigation	Date	Author	Activities Performed (1)
Groundwater			
Groundwater Investigation	2007	Shaw	Initial groundwater investigation at the facility. Included the installation and sampling of 11 groundwater monitoring wells.
Remedial Investigation	2008	ARCADIS	This sampling event included the collection of groundwater samples from all eleven groundwater monitoring wells and 4 spring locations. The main purpose of this event was to verify that the metals detected during the initial sampling event were related to elevated turbidity levels and did not reflect dissolved phase concentrations.
Remedial Investigation	2010	ARCADIS	This sampling event also included the collection of groundwater samples from all eleven groundwater monitoring wells and 4 spring locations. Performed at the request of VDEQ to further verify lack of COCs.

(1) A detailed summary of each phase of investigation at the BDDT, BLA, IAA, RY, WBG and Groundwater is provided in the Remedial Investigation Report (ARCADIS 2010c)

(2) A detailed summary of the investigations completed at the NBG is provided in the Engineering Evaluation/Cost Analysis Report (ARCADIS 2009), and a summary of the remedial actions completed at the NBG is provided in the Response Action Completion and Closure Report (ARCADIS 2010a)

Table 2
Contaminants of Concern for the BDDT, BLA, IAA, and WBG Study Areas
New River Unit, Radford Army Ammunition Plant, Radford, Virginia

Exposure Point	Contaminant of Concern	Concentrations Detected		Frequency of Detection	Exposure Point Concentration (mg/kg)	EPC Calculation Method [a]
		Min	Max			
Building Debris Disposal Trench						
BDDT - Soil	Benzo(a)pyrene	0.0089 mg/kg	57 mg/kg	45 / 63	Whole Site: 6.92 Rip Rap Area Only: 5.35	95th UCL
Bag Loading Area						
BLA - Soil	Aroclor 1254	0.0066 mg/kg	8.3 mg/kg	9 / 20	1.869	95th UCL
	Benzo(a)pyrene	0.0049 mg/kg	39 mg/kg	39 / 44	16.14	95th UCL
	Copper	21 mg/kg	72,000mg/kg	47 / 47	19,489	95th UCL
	Lead	9.82 mg/kg	58,000mg/kg	47 / 47	2,020	Average
	Asbestos	0.1%	9.4%	10 / 29	NA	NA
Igniter Assembly Area						
Exposure Point	**Contaminant of Concern**	**Concentrations Detected**		**Frequency of Detection**	**Exposure Point Concentration (mg/kg)**	**EPC Calculation Method [a]**
		Min	**Max**			
IAA - Soil	Aroclor 1254	0.0049 mg/kg	12 mg/kg	18 / 61	3.697	95th UCL
	Copper	5.13 mg/kg	56,500mg/kg	139 / 139	9,523	95th UCL
	Lead	6.4 mg/kg	16,200mg/kg	139 / 139	642	Average
	Asbestos	0.10%	17.20%	7 / 22	NA	NA
Western Burning Ground						
Exposure Point	**Chemical of Concern**	**Concentrations Detected**		**Frequency of Detection**	**Exposure Point Concentration (mg/kg)**	**EPC Calculation Method [a]**
		Min	**Max**			
WBG - Sediment	Chromium	5.17 mg/kg	15,400mg/kg	28 / 28	6,048	95th UCL
	Lead	5.61 mg/kg	109,000mg/kg	32 / 32	3,610	Average

mg/kg: milligrams per kilogram

[a] The exposure point concentration (EPC) was the upper confidence level on the mean (UCL) or the maximum concentration where the UCL was incalculable.

Exposure to lead is evaluated by predicting resultant blood lead levels using the arithmetic average (avg).

The UCLs were calculated using ProUCL 4.0. The UCL used is the one recommended by ProUCL 4.0.

Asbestos exposure is not evaluated by exposure point concentration

ATTACHMENT 10

Remedy Implementation Documentation

(Extracted from Response Action Completion and Closure Report, ARCADIS 2011a)

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Table 4-3
Summary of Conductive Flooring Waste Shipments for the BLA and IAA Removal Actions
January through April 2011
Radford Army Ammunition Plant - New River Unit

Manifest #	Waste Shipment Date	Facility Receipt Date	Facility Receipt ID	Disposal Company/Site	Load Weight (tons)
FPC4232-01-11	1/20/2011	1/21/2011	291188	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	10.60
FPC4232-02-11	1/25/2011	1/25/2011	291621	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	14.75
FPC4232-03-11	2/3/2011	2/3/2011	292656	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	13.80
FPC4232-04-11	2/8/2011	2/9/2011	293130	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	13.31
FPC4232-05-11	2/9/2011	2/9/2011	293305	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	12.48
FPC4232-06-11	2/17/2011	2/17/2011	294291	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	14.98
FPC4232-10-11	2/22/2011	2/22/2011	294869	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	14.00
FPC4232-11-11	2/23/2011	2/23/2011	295030	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	7.17
FPC4232-12-11	3/8/2011	3/8/2011	296533	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	16.32
FPC4232-13-11	3/23/2011	3/23/2011	298522	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	14.60
FPC4232-14-11	4/18/2011	4/18/2011	301583	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	7.32
				Total	**139.33**

Table 4-4
Field XRF Results for BLA Soil Confirmation Samples
March 2011
Radford Army Ammunition Plant - New River Unit

Sample ID	Sample Type	Sample Date	Sample Depth	Distance from Edge of Building	Copper	Lead	Did Result Require Expansion of Excavation Area	Sample ID at Expanded Excavation Border
			ft bgs	ft	(mg/kg)	(mg/kg)	(Y/N)	
Remedial Action Level for BLA Soils					**11,533**	**624**		
Building 404								
404-1B	Base	23-Mar-11	1 - 1.5	1	49	61	N	-
404-1NW	Perimeter	23-Mar-11	0 - 0.5	2.5	50	72	N	-
404-2B	Base	23-Mar-11	1 - 1.5	1	89	141	N	-
404-2N	Perimeter	23-Mar-11	0 - 0.5	2.5	133	23	N	-
404-3B	Base	23-Mar-11	1 - 1.5	1	34	20	N	-
404-3N	Perimeter	23-Mar-11	0 - 0.5	2.5	39	29	N	-
404-4B	Base	23-Mar-11	1 - 1.5	1	50	38	N	-
404-4N	Perimeter	23-Mar-11	0 - 0.5	2.5	66	34	N	-
404-5B	Base	23-Mar-11	1 - 1.5	1	101	38	N	-
404-5N	Perimeter	23-Mar-11	0 - 0.5	2.5	72	136	N	-
404-6B	Base	23-Mar-11	1 - 1.5	1	38	19	N	-
404-6N	Perimeter	23-Mar-11	0 - 0.5	2.5	93	39	N	-
404-7B	Base	23-Mar-11	1 - 1.5	1	45	19	N	-
404-7N	Perimeter	23-Mar-11	0 - 0.5	2.5	105	58	N	-
404-8B	Base	23-Mar-11	1 - 1.5	1	81	40	N	-
404-8N	Perimeter	23-Mar-11	0 - 0.5	2.5	108	53	N	-
404-9B	Base	23-Mar-11	1 - 1.5	1	32	218	N	-
404-9N	Perimeter	23-Mar-11	0 - 0.5	5.75	92	160	N	-
404-10B	Base	23-Mar-11	1 - 1.5	1	33	32	N	-
404-10W	Perimeter	23-Mar-11	0 - 0.5	2.5	65	124	N	-
404-11B	Base	23-Mar-11	1 - 1.5	1	43	31	N	-
404-11W	Perimeter	23-Mar-11	0 - 0.5	2.5	75	44	N	-
404-12B	Base	23-Mar-11	1 - 1.5	1	37	20	N	-
404-12W	Perimeter	23-Mar-11	0 - 0.5	2.5	50	20	N	-
404-13B	Base	23-Mar-11	1 - 1.5	1	123	69	N	-
404-13W	Perimeter	23-Mar-11	0 - 0.5	2.5	151	67	N	-
404-14B	Base	23-Mar-11	1 - 1.5	1	51	38	N	-
404-14W	Perimeter	23-Mar-11	0 - 0.5	2.5	140	131	N	-
404-15B	Base	23-Mar-11	1 - 1.5	1	201	56	N	-
404-15W	Perimeter	23-Mar-11	0 - 0.5	2.5	45	31	N	-
404-16B	Base	24-Mar-11	1 - 1.5	1	53	25	N	-
404-16E	Perimeter	24-Mar-11	0 - 0.5	2.5	81	106	N	-
404-17B	Base	24-Mar-11	1 - 1.5	1	41	35	N	-
404-17E	Perimeter	24-Mar-11	0 - 0.5	2.5	46	43	N	-
404-18B	Base	24-Mar-11	1 - 1.5	1	43	63	N	-
404-18E	Perimeter	24-Mar-11	0 - 0.5	2.5	60	32	N	-
404-19B	Base	24-Mar-11	1 - 1.5	1	52	28	N	-
404-19E	Perimeter	24-Mar-11	0 - 0.5	2.5	49	19	N	-
404-20B	Base	24-Mar-11	1 - 1.5	1	49	17	N	-
404-20E	Perimeter	24-Mar-11	0 - 0.5	2.5	49	32	N	-
404-21B	Base	24-Mar-11	1 - 1.5	1	36	19	N	-
404-21E	Perimeter	24-Mar-11	0 - 0.5	2.5	35	35	N	-
404-22B	Base	24-Mar-11	1 - 1.5	1	42	24	N	-
404-22E	Perimeter	24-Mar-11	0 - 0.5	2.5	78	24	N	-
404-23B	Base	24-Mar-11	1 - 1.5	1	<5	17	N	-
404-23E	Perimeter	24-Mar-11	0 - 0.5	2.5	47	21	N	-
404-24B	Base	24-Mar-11	1 - 1.5	1	30	20	N	-
404-24E	Perimeter	24-Mar-11	0 - 0.5	2.5	38	34	N	-
404-25B	Base	24-Mar-11	1 - 1.5	1	77	52	N	-
404-25E	Perimeter	24-Mar-11	0 - 0.5	2.5	434	134	N	-
404-26B	Base	24-Mar-11	1 - 1.5	1	31	23	N	-
404-26S	Perimeter	24-Mar-11	0 - 0.5	2.5	66	27	N	-
404-27B	Base	24-Mar-11	1 - 1.5	1	43	31	N	-
404-27S	Perimeter	24-Mar-11	0 - 0.5	2.5	102	45	N	-
404-28B	Base	24-Mar-11	1 - 1.5	1	<5	37	N	-
404-28S	Perimeter	24-Mar-11	0 - 0.5	2.5	61	35	N	-
404-29B	Base	24-Mar-11	1 - 1.5	1	62	91	N	-
404-29S	Perimeter	24-Mar-11	0 - 0.5	2.5	40	22	N	-
404-30B	Base	24-Mar-11	1 - 1.5	1	44	38	N	-
404-30S	Perimeter	24-Mar-11	0 - 0.5	2.5	40	29	N	-
404-31B	Base	24-Mar-11	1 - 1.5	1	<5	32	N	-
404-31S	Perimeter	24-Mar-11	0 - 0.5	2.5	54	22	N	-
404-32B	Base	24-Mar-11	1 - 1.5	1	34	39	N	-

Table 4-4
Field XRF Results for BLA Soil Confirmation Samples
March 2011
Radford Army Ammunition Plant - New River Unit

Sample ID	Sample Type	Sample Date	Sample Depth	Distance from Edge of Building	Copper	Lead	Did Result Require Expansion of Excavation Area	Sample ID at Expanded Excavation Border
			ft bgs	ft	(mg/kg)	(mg/kg)	(Y/N)	
Remedial Action Level for BLA Soils					**11,533**	**624**		
404-32S	Perimeter	24-Mar-11	0 - 0.5	2.5	69	77	N	-
404-33B	Base	24-Mar-11	1 - 1.5	1	<5	29	N	-
404-33S	Perimeter	24-Mar-11	0 - 0.5	5.5	432	170	N	-
404-34B	Base	24-Mar-11	1 - 1.5	1	45	34	N	-
404-34S	Perimeter	24-Mar-11	0 - 0.5	2.5	40	27	N	-
404-35B	Base	24-Mar-11	1 - 1.5	1	<5	55	N	-
404-35S	Perimeter	24-Mar-11	0 - 0.5	2.5	39	105	N	-
Building 405								
405-1B	Base	13-Mar-11	1 - 1.5	1	84	94	N	-
405-1N	Perimeter	13-Mar-11	0 - 0.5	2.5	201	44	N	-
405-2B	Base	13-Mar-11	1 - 1.5	1	43	21	N	-
405-2N	Perimeter	13-Mar-11	0 - 0.5	2.5	27	22	N	-
405-3B	Base	13-Mar-11	1 - 1.5	1	<5	22	N	-
405-3N	Perimeter	13-Mar-11	0 - 0.5	2.5	126	474	N	-
405-4B	Base	13-Mar-11	1 - 1.5	1	43	20	N	-
405-4N	Perimeter	13-Mar-11	0 - 0.5	2.5	42	25	N	-
405-5B	Base	13-Mar-11	1 - 1.5	1	<5	20	N	-
405-5N	Perimeter	13-Mar-11	0 - 0.5	2.5	36	28	N	-
405-6B	Base	13-Mar-11	1 - 1.5	1	42	16	N	-
405-6N	Perimeter	13-Mar-11	0 - 0.5	2.5	66	29	N	-
405-7B	Base	13-Mar-11	1 - 1.5	1	46	25	N	-
405-7N	Perimeter	13-Mar-11	0 - 0.5	2.5	57	27	N	-
405-8B	Base	13-Mar-11	1 - 1.5	1	38	19	N	-
405-8N	Perimeter	13-Mar-11	0 - 0.5	2.5	40	26	N	-
405-9B	Base	13-Mar-11	1 - 1.5	1	32	21	N	-
405-9N	Perimeter	13-Mar-11	0 - 0.5	2.5	26	25	N	-
405-10B	Base	13-Mar-11	1 - 1.5	1	119	24	N	-
405-10N	Perimeter	13-Mar-11	0 - 0.5	2.5	39	14	N	-
405-11B	Base	13-Mar-11	1 - 1.5	1	573	468	N	-
405-11E	Perimeter	13-Mar-11	0 - 0.5	2.5	764	299	N	-
405-12B	Base	13-Mar-11	1 - 1.5	1	75	21	N	-
405-12E	Perimeter	13-Mar-11	0 - 0.5	2.5	95	163	N	-
405-13B	Base	13-Mar-11	1 - 1.5	1	39	<5	N	-
405-13E	Perimeter	13-Mar-11	0 - 0.5	2.5	49	29	N	-
405-14B	Base	13-Mar-11	1 - 1.5	1	30	20	N	-
405-14E	Perimeter	13-Mar-11	0 - 0.5	2.5	61	50	N	-
405-15B	Base	13-Mar-11	1 - 1.5	1	27	21	N	-
405-15E	Perimeter	13-Mar-11	0 - 0.5	2.5	<5	27	N	-
405-16B	Base	13-Mar-11	1 - 1.5	1	35	28	N	-
405-16E	Perimeter	13-Mar-11	0 - 0.5	2.5	30	20	N	-
405-17B	Base	13-Mar-11	1 - 1.5	1	47	21	N	-
405-17E	Perimeter	13-Mar-11	0 - 0.5	2.5	108	40	N	-
405-18B	Base	13-Mar-11	1 - 1.5	1	38	43	N	-
405-18E	Perimeter	13-Mar-11	0 - 0.5	2.5	30	18	N	-
405-19B	Base	13-Mar-11	1 - 1.5	1	40	20	N	-
405-19E	Perimeter	13-Mar-11	0 - 0.5	2.5	29	21	N	-
405-20B	Base	13-Mar-11	1 - 1.5	1	435	1101	Y	405-36SE
405-20E	Perimeter	13-Mar-11	0 - 0.5	2.5	283	786	Y	405-36B
405-21B	Base	13-Mar-11	1 - 1.5	1	54	139	N	-
405-21W	Perimeter	13-Mar-11	0 - 0.5	2.5	58	181	N	-
405-22B	Base	13-Mar-11	1 - 1.5	1	74	64	N	-
405-22W	Perimeter	13-Mar-11	0 - 0.5	2.5	97	150	N	-
405-23B	Base	13-Mar-11	1 - 1.5	1	74	39	N	-
405-23W	Perimeter	13-Mar-11	0 - 0.5	2.5	67	78	N	-
405-24B	Base	13-Mar-11	1 - 1.5	1	43	25	N	-
405-24W	Perimeter	13-Mar-11	0 - 0.5	2.5	47	32	N	-
405-25B	Base	13-Mar-11	1 - 1.5	1	78	43	N	-
405-25W	Perimeter	13-Mar-11	0 - 0.5	2.5	267	217	N	-
405-26B	Base	13-Mar-11	1 - 1.5	1	<5	21	N	-
405-26W	Perimeter	13-Mar-11	0 - 0.5	2.5	<5	25	N	-
405-27B	Base	13-Mar-11	1 - 1.5	1	220	187	N	-
405-27W	Perimeter	13-Mar-11	0 - 0.5	2.5	120	120	N	-
405-28B	Base	13-Mar-11	1 - 1.5	1	33	27	N	-
405-28S	Perimeter	13-Mar-11	0 - 0.5	2.5	155	84	N	-

Table 4-4
Field XRF Results for BLA Soil Confirmation Samples
March 2011
Radford Army Ammunition Plant - New River Unit

Sample ID	Sample Type	Sample Date	Sample Depth	Distance from Edge of Building	Copper	Lead	Did Result Require Expansion of Excavation Area	Sample ID at Expanded Excavation Border
			ft bgs	ft	(mg/kg)	(mg/kg)	(Y/N)	
Remedial Action Level for BLA Soils					**11,533**	**624**		
405-29B	Base	13-Mar-11	1 - 1.5	1	31	14	N	-
405-29S	Perimeter	13-Mar-11	0 - 0.5	2.5	425	475	N	-
405-30B	Base	13-Mar-11	1 - 1.5	1	43	22	N	-
405-30S	Perimeter	13-Mar-11	0 - 0.5	2.5	312	87	N	-
405-31B	Base	13-Mar-11	1 - 1.5	1	<5	23	N	-
405-31S	Perimeter	13-Mar-11	0 - 0.5	2.5	72	46	N	-
405-32B	Base	13-Mar-11	1 - 1.5	1	66	224	N	-
405-32S	Perimeter	13-Mar-11	0 - 0.5	2.5	40	53	N	-
405-33B	Base	13-Mar-11	1 - 1.5	1	61	114	N	-
405-33S	Perimeter	13-Mar-11	0 - 0.5	2.5	106	75	N	-
405-34B	Base	13-Mar-11	1 - 1.5	1	64	26	N	-
405-34S	Perimeter	13-Mar-11	0 - 0.5	2.5	170	244	N	-
405-35B	Base	13-Mar-11	1 - 1.5	1	49	22	N	-
405-35S	Perimeter	13-Mar-11	0 - 0.5	2.5	33	24	N	-
405-36SE	Perimeter	28-Mar-11	0 - 0.5	5	465	37	N	-
405-36B	Base	28-Mar-11	2 - 2.5	2	317	24	N	-
Building 406								
406-1B	Base	24-Mar-11	1 - 1.5	1	69	35	N	-
406-1E	Perimeter	24-Mar-11	0 - 0.5	2.5	375	457	N	-
406-2B	Base	25-Mar-11	1 - 1.5	3.5	49	64	N	-
406-2E	Perimeter	25-Mar-11	0 - 0.5	4.5	67	124	N	-
Building 407								
407-1B	Base	13-Mar-11	1 - 1.5	1	76	27	N	-
407-1E	Perimeter	13-Mar-11	0 - 0.5	4	462	222	N	-
Building 411								
411-1NW	Perimeter	25-Mar-11	0 - 0.5	1	83	16	N	-
411-1B	Base	25-Mar-11	1 - 1.5	2.5	37	22	N	-
411-2B	Base	25-Mar-11	1 - 1.5	1	30	13	N	-
411-2N	Perimeter	25-Mar-11	0 - 0.5	2.5	64	29	N	-
411-3B	Base	25-Mar-11	1 - 1.5	1	33	<5	N	-
411-3E	Perimeter	25-Mar-11	0 - 0.5	2.5	30	14	N	-
411-4B	Base	25-Mar-11	1 - 1.5	1	<5	20	N	-
411-4E	Perimeter	25-Mar-11	0 - 0.5	2.5	39	43	N	-
411-5B	Base	25-Mar-11	1 - 1.5	1	32	14	N	-
411-5E	Perimeter	25-Mar-11	0 - 0.5	2.5	33	<5	N	-
411-6B	Base	25-Mar-11	1 - 1.5	1	38	46	N	-
411-6S	Perimeter	25-Mar-11	0 - 0.5	2.5	<5	278	N	-
411-7B	Base	25-Mar-11	1 - 1.5	1	31	37	N	-
411-7SW	Perimeter	25-Mar-11	0 - 0.5	2.5	<5	17	N	-
411-8B	Base	25-Mar-11	1 - 1.5	1	460	319	N	-
411-8W	Perimeter	25-Mar-11	0 - 0.5	2.5	698	516	N	-
Building 412								
412-1B	Base	26-Mar-11	1 - 1.5	1	205	53	N	-
412-1NW	Perimeter	26-Mar-11	0 - 0.5	2.5	487	15	N	-
412-2B	Base	26-Mar-11	1 - 1.5	1	45	20	N	-
412-2N	Perimeter	26-Mar-11	0 - 0.5	2.5	45	45	N	-
412-3B	Base	26-Mar-11	1 - 1.5	1	<5	24	N	-
412-3E	Perimeter	26-Mar-11	0 - 0.5	2.5	44	17	N	-
412-4B	Base	26-Mar-11	1 - 1.5	1	39	17	N	-
412-4E	Perimeter	26-Mar-11	0 - 0.5	2.5	30	<5	N	-
412-5B	Base	26-Mar-11	1 - 1.5	1	90	22	N	-
412-5E	Perimeter	26-Mar-11	0 - 0.5	2.5	77	19	N	-
412-6B	Base	26-Mar-11	1 - 1.5	1	94	24	N	-
412-6E	Perimeter	26-Mar-11	0 - 0.5	2.5	108	25	N	-
412-7B	Base	28-Mar-11	1 - 1.5	1	56	19	N	-
412-7E	Perimeter	28-Mar-11	0 - 0.5	2.5	65	16	N	-
412-8B	Base	28-Mar-11	1 - 1.5	1	155	13	N	-
412-8S	Perimeter	28-Mar-11	0 - 0.5	2.5	357	15	N	-
412-9B	Base	28-Mar-11	1 - 1.5	1	83	16	N	-
412-9W	Perimeter	28-Mar-11	0 - 0.5	2.5	45	62	N	-
412-10B	Base	28-Mar-11	1 - 1.5	1	142	17	N	-
412-10W	Perimeter	28-Mar-11	0 - 0.5	2.5	304	20	N	-
Building 413								
413-1B	Base	28-Mar-11	1 - 1.5	1	34	17	N	-

Table 4-4
Field XRF Results for BLA Soil Confirmation Samples
March 2011
Radford Army Ammunition Plant - New River Unit

Sample ID	Sample Type	Sample Date	Sample Depth	Distance from Edge of Building	Copper	Lead	Did Result Require Expansion of Excavation Area	Sample ID at Expanded Excavation Border
			ft bgs	ft	(mg/kg)	(mg/kg)	(Y/N)	
Remedial Action Level for BLA Soils					**11,533**	**624**		
413-1NW	Perimeter	28-Mar-11	0 - 0.5	2.5	28	18	N	-
413-2B	Base	28-Mar-11	1 - 1.5	1	136	20	N	-
413-2N	Perimeter	28-Mar-11	0 - 0.5	2.5	93	22	N	-
413-3B	Base	28-Mar-11	1 - 1.5	1	32	15	N	-
413-3E	Perimeter	28-Mar-11	0 - 0.5	2.5	32	14	N	-
413-4B	Base	28-Mar-11	1 - 1.5	1	69	14	N	-
413-4E	Perimeter	28-Mar-11	0 - 0.5	2.5	70	17	N	-
413-5B	Base	28-Mar-11	1 - 1.5	1	49	14	N	-
413-5S	Perimeter	28-Mar-11	0 - 0.5	2.5	508	23	N	-
413-6B	Base	28-Mar-11	1 - 1.5	1	47	26	N	-
413-6W	Perimeter	28-Mar-11	0 - 0.5	2.5	88	148	N	-
413-7B	Base	28-Mar-11	1 - 1.5	1	42	18	N	-
413-7W	Perimeter	28-Mar-11	0 - 0.5	2.5	131	67	N	-

Notes:

1101 Highlighted cell indicates constituent concentration is higher than the established industrial RAL for the BLA.

Note that if an XRF field reading indicated that lead or copper were detected above the listed RALs, the excavation was expanded until a sample result below the RAL was achieved. All samples collected from the final excavation boundaries and base were below the target RALs.

Table 4-6
Field XRF Results for IAA Soil Confirmation Samples
February - April 2011
Radford Army Ammunition Plant - New River Unit

Sample ID	Sample Type	Sample Date	Sample Depth	Distance from Edge of Building	Copper	Lead	Did Result Require Expansion of Excavation Area	Sample ID at Expanded Excavation Border
			ft bgs	ft	(mg/kg)	(mg/kg)	(Y/N)	
Remedial Action Level for IAA Soils					**3,043**	**400**		
Building 1								
1-1B	Base	22-Feb-11	1 - 1.5	1	40	19	N	-
1-1N	Perimeter	15-Feb-11	0 - 0.5	4	89	103	N	-
1-2B	Base	22-Feb-11	1 - 1.5	1	32	30	N	-
1-2E	Perimeter	15-Feb-11	0 - 0.5	3.5	89	103	N	-
Building 2								
2-1B	Base	22-Feb-11	1 - 1.5	1	229	49	N	-
2-1E	Perimeter	17-Feb-11	0 - 0.5	2.5	763	65	N	-
2-2B	Base	22-Feb-11	1 - 1.5	1	71	62	N	-
2-2S	Perimeter	17-Feb-11	0 - 0.5	2.5	2083	49	N	-
2-3B	Base	22-Feb-11	1 - 1.5	1	73	28	N	-
2-3W	Perimeter	17-Feb-11	0 - 0.5	2.5	192	99	N	-
2-4B	Base	22-Feb-11	1 - 1.5	1	69	70	N	-
2-4W	Perimeter	17-Feb-11	0 - 0.5	2.5	304	82	N	-
2-5B	Base	22-Feb-11	1 - 1.5	1	48	21	N	-
2-5W	Perimeter	17-Feb-11	0 - 0.5	2.5	55	39	N	-
Building 4								
4-1B	Base	23-Feb-11	1 - 1.5	1	198	<5	N	-
4-1N	Perimeter	22-Feb-11	0 - 0.5	2.5	45	16	N	-
4-2B	Base	23-Feb-11	1 - 1.5	1	37	118	N	-
4-2NE	Perimeter	22-Feb-11	0 - 0.5	3.5	42	76	N	-
4-3B	Base	23-Feb-11	1 - 1.5	1	51	16	N	-
4-3S	Perimeter	22-Feb-11	0 - 0.5	2.5	54	32	N	-
4-4B	Base	23-Feb-11	1 - 1.5	1	245	133	N	-
4-4SE	Perimeter	22-Feb-11	0 - 0.5	2.5	170	48	N	-
4-5S	Perimeter	22-Feb-11	0 - 0.5	2.4	51	23	N	-
4-6E	Perimeter	22-Feb-11	0 - 0.5	2.5	284	18	N	-
Building 5								
5-1B	Base	22-Feb-11	1 - 1.5	1	63	71	N	-
5-1N	Perimeter	17-Feb-11	0 - 0.5	2.5	81	60	N	-
5-2B	Base	22-Feb-11	1 - 1.5	1	39	39	N	-
5-2N	Perimeter	17-Feb-11	0 - 0.5	2.5	57	36	N	-
5-3B	Base	22-Feb-11	1 - 1.5	1	86	120	N	-
5-3S	Perimeter	17-Feb-11	0 - 0.5	2.5	291	185	N	-
5-4B	Base	22-Feb-11	1 - 1.5	1	98	56	N	-
5-4S	Perimeter	17-Feb-11	0 - 0.5	2.5	3890	770	Y	5-6S
5-5B	Base	22-Feb-11	1 - 1.5	1	47	66	N	-
5-5S	Perimeter	17-Feb-11	0 - 0.5	2.5	132	120	N	-
5-6B	Base	22-Feb-11	1 - 1.5	1	40	40	N	-
5-6S	Perimeter	17-Feb-11	0 - 0.5	5	184	166	N	-
Building 6								
6-1B	Base	8-Apr-11	1 - 1.5	1	41	24	N	-
6-1NW	Perimeter	8-Apr-11	0 - 0.5	2.5	31	28	N	-
6-2B	Base	8-Apr-11	1 - 1.5	1	<5	20	N	-
6-2N	Perimeter	8-Apr-11	0 - 0.5	2.5	<5	13	N	-
6-3B	Base	8-Apr-11	1 - 1.5	1	<5	16	N	-
6-3E	Perimeter	8-Apr-11	0 - 0.5	2.5	<5	34	N	-
6-4B	Base	8-Apr-11	1 - 1.5	1	47	25	N	-
6-4S	Perimeter	8-Apr-11	0 - 0.5	2.5	<5	89	N	-
Building 502								
502-1B	Base	9-Apr-11	1 - 1.5	1	373	199	N	-
502-1NW	Perimeter	3-Mar-11	0 - 0.5	2.5	573	335	N	-
502-2B	Base	9-Apr-11	1 - 1.5	1	73	245	N	-
502-2N	Perimeter	3-Mar-11	0 - 0.5	2.5	1244	191	N	-
502-3B	Base	9-Apr-11	1 - 1.5	1	68	65	N	-
502-3N	Perimeter	3-Mar-11	0 - 0.5	2.5	54	46	N	-
502-4B	Base	9-Apr-11	1 - 1.5	1	164	89	N	-
502-4NE	Perimeter	3-Mar-11	0 - 0.5	2.5	53	114	N	-
502-5B	Base	9-Apr-11	1 - 1.5	1	53	29	N	-
502-5E	Perimeter	3-Mar-11	0 - 0.5	2.5	281	463	Y	502-15E
502-6B	Base	9-Apr-11	1 - 1.5	1	35	42	N	-
502-6E	Perimeter	3-Mar-11	0 - 0.5	2.5	35	78	N	-
502-7B	Base	9-Apr-11	1 - 1.5	1	32	27	N	-
502-7E	Perimeter	3-Mar-11	0 - 0.5	2.5	56	66	N	-
502-8B	Base	9-Apr-11	1 - 1.5	1	43	74	N	-
502-8SE	Perimeter	3-Mar-11	0 - 0.5	2.5	72	537	N	502-16SE
502-9B	Base	9-Apr-11	1 - 1.5	1	31	25	N	-
502-9S	Perimeter	3-Mar-11	0 - 0.5	2.5	48	342	N	-

Table 4-6
Field XRF Results for IAA Soil Confirmation Samples
February - April 2011
Radford Army Ammunition Plant - New River Unit

Sample ID	Sample Type	Sample Date	Sample Depth	Distance from Edge of Building	Copper	Lead	Did Result Require Expansion of Excavation Area	Sample ID at Expanded Excavation Border
			ft bgs	ft	(mg/kg)	(mg/kg)	(Y/N)	
Remedial Action Level for IAA Soils					**3,043**	**400**		
502-10B	Base	9-Apr-11	1 - 1.5	1	30	52	N	-
502-10S	Perimeter	3-Mar-11	0 - 0.5	2.5	211	236	N	-
502-11B	Base	9-Apr-11	1 - 1.5	1	64	58	N	-
502-11SW	Perimeter	3-Mar-11	0 - 0.5	2.5	90	3160	Y	502-18SW
502-12B	Base	9-Apr-11	1 - 1.5	1	47	98	N	-
502-12W	Perimeter	3-Mar-11	0 - 0.5	2.5	104	410	Y	502-19W
502-13B	Base	9-Apr-11	1 - 1.5	1	160	283	N	-
502-13W	Perimeter	3-Mar-11	0 - 0.5	2.5	36	72	N	-
502-14B	Base	9-Apr-11	1 - 1.5	1	102	84	N	-
502-14W	Perimeter	3-Mar-11	0 - 0.5	2.5	54	60	N	-
502-15B	Base	28-Mar-11	1 - 1.5	2.5	57	54	N	-
502-15E	Perimeter	28-Mar-11	0 - 0.5	3.5	58	126	N	-
502-16B	Base	28-Mar-11	1 - 1.5	2.5	<5	38	N	-
502-16SE	Perimeter	28-Mar-11	0 - 0.5	3.5	<5	27	N	-
502-17B	Base	28-Mar-11	1 - 1.5	2.5	<5	57	N	-
502-17S	Perimeter	28-Mar-11	0 - 0.5	3.5	<5	65	N	-
502-18B	Base	28-Mar-11	1 - 1.5	2.5	<5	54	N	-
502-18SW	Perimeter	28-Mar-11	0 - 0.5	3.5	34	60	N	-
502-19B	Base	28-Mar-11	1 - 1.5	2.5	<5	37	N	-
502-19W	Perimeter	28-Mar-11	0 - 0.5	3.5	<5	21	N	-
Building 504								
504-1B	Base	8-Apr-11	1 - 1.5	1	188	186	N	-
504-1NW	Perimeter	3-Mar-11	0 - 0.5	2.5	275	409	Y	504-18W
504-2B	Base	8-Apr-11	1 - 1.5	1	57	75	N	-
504-2N	Perimeter	3-Mar-11	0 - 0.5	2.5	440	1259	Y	504-19N
504-3B	Base	8-Apr-11	1 - 1.5	1	42	241	N	-
504-3N	Perimeter	3-Mar-11	0 - 0.5	2.5	41	53	N	-
504-4B	Base	8-Apr-11	1 - 1.5	1	<5	53	N	-
504-4N	Perimeter	3-Mar-11	0 - 0.5	2.5	56	707	Y	504-20N
504-5B	Base	8-Apr-11	1 - 1.5	1	28	28	N	-
504-5NE	Perimeter	3-Mar-11	0 - 0.5	2.5	76	1229	Y	504-21NE
504-6B	Base	8-Apr-11	1 - 1.5	19.5	<5	51	N	-
504-6E	Perimeter	3-Mar-11	0 - 0.5	20.5	113	1660	Y	504-22E
504-7B	Base	8-Apr-11	1 - 1.5	20.5	28	27	N	-
504-7E	Perimeter	3-Mar-11	0 - 0.5	21	36	506	Y	504-23E
504-8B	Base	8-Apr-11	1 - 1.5	10.5	27	38	N	-
504-8E	Perimeter	3-Mar-11	0 - 0.5	11	86	1732	Y	504-24E
504-9B	Base	8-Apr-11	1 - 1.5	1	287	269	N	-
504-9E	Perimeter	3-Mar-11	0 - 0.5	2.5	244	3864	Y	504-25E
504-10B	Base	8-Apr-11	1 - 1.5	1	<5	42	N	-
504-10E	Perimeter	3-Mar-11	0 - 0.5	2.5	50	184	N	-
504-11B	Base	8-Apr-11	1 - 1.5	1	39	38	N	-
504-11E	Perimeter	3-Mar-11	0 - 0.5	2.5	91	669	Y	504-26E
504-12B	Base	8-Apr-11	1 - 1.5	1	49	29	N	-
504-12S	Perimeter	3-Mar-11	0 - 0.5	2.5	61	99	N	-
504-13B	Base	8-Apr-11	1 - 1.5	1	34	21	N	-
504-13S	Perimeter	3-Mar-11	0 - 0.5	2.5	336	498	Y	504-27S
504-14B	Base	8-Apr-11	1 - 1.5	1	59	25	N	-
504-14SW	Perimeter	3-Mar-11	0 - 0.5	2.5	185	295	N	-
504-15B	Base	8-Apr-11	1 - 1.5	1	122	71	N	-
504-15W	Perimeter	3-Mar-11	0 - 0.5	2.5	102	199	N	-
504-16B	Base	8-Apr-11	1 - 1.5	1	55	49	N	-
504-16W	Perimeter	3-Mar-11	0 - 0.5	2.5	52	217	N	-
504-17B	Base	8-Apr-11	1 - 1.5	1	40	30	N	-
504-17W	Perimeter	3-Mar-11	0 - 0.5	2.5	73	159	N	-
504-18W	Perimeter	9-Apr-11	0 - 0.5	3.5	53	33	N	-
504-19N	Perimeter	9-Apr-11	0 - 0.5	3.5	30	56	N	-
504-20N	Base	9-Apr-11	1 - 1.5	1.5	40	24	N	-
504-21NE	Perimeter	9-Apr-11	0 - 0.5	1.5	43	107	N	-
504-22E	Perimeter	9-Apr-11	0 - 0.5	24.5	34	63	N	-
504-23E	Perimeter	9-Apr-11	0 - 0.5	24.5	40	39	N	-
504-24E	Perimeter	9-Apr-11	0 - 0.5	10.5	26	46	N	-
504-25E	Perimeter	9-Apr-11	0 - 0.5	4.5	25	92	N	-
504-26E	Perimeter	9-Apr-11	0 - 0.5	3.5	28	42	N	-
504-27S	Perimeter	9-Apr-11	0 - 0.5	3.5	67	64	N	-
Building 508								
508-1B	Base	4-Mar-11	1 - 1.5	1	549	182	N	-
508-1S	Perimeter	4-Mar-11	0 - 0.5	2.5	346	189	N	-

Table 4-6
Field XRF Results for IAA Soil Confirmation Samples
February - April 2011
Radford Army Ammunition Plant - New River Unit

Sample ID	Sample Type	Sample Date	Sample Depth	Distance from Edge of Building	Copper	Lead	Did Result Require Expansion of Excavation Area	Sample ID at Expanded Excavation Border
			ft bgs	ft	(mg/kg)	(mg/kg)	(Y/N)	
Remedial Action Level for IAA Soils					**3,043**	**400**		
508-2B	Base	4-Mar-11	1 - 1.5	1	75	36	N	-
508-2SW	Perimeter	4-Mar-11	0 - 0.5	2.5	55	58	N	-
Building 509								
509-1B	Base	4-Mar-11	1 - 1.5	1	110	42	N	-
509-1NW	Perimeter	4-Mar-11	0 - 0.5	2.5	699	77	N	-
509-2B	Base	4-Mar-11	1 - 1.5	1	160	267	N	-
509-2N	Perimeter	4-Mar-11	0 - 0.5	2.5	92	51	N	-
Building 522								
522-1B	Base	8-Apr-11	1 - 1.5	1	128	37	N	-
522-1NW	Perimeter	25-Feb-11	0 - 0.5	2.5	129	76	N	-
522-2B	Base	8-Apr-11	1 - 1.5	1	26	34	N	-
522-2NE	Perimeter	25-Feb-11	0 - 0.5	2.5	40	49	N	-
522-3B	Base	8-Apr-11	1 - 1.5	1	42	39	N	-
522-3E	Perimeter	25-Feb-11	0 - 0.5	2.5	84	434	Y	522-11E
522-4B	Base	8-Apr-11	1 - 1.5	1	39	20	N	-
522-4E	Perimeter	25-Feb-11	0 - 0.5	2.5	158	7273	Y	522-13E
522-5B	Base	8-Apr-11	1 - 1.5	1	169	88	N	-
522-5E	Perimeter	25-Feb-11	0 - 0.5	2.5	56	139	N	-
522-6B	Base	8-Apr-11	1 - 1.5	1	44	40	N	-
522-6SE	Perimeter	25-Feb-11	0 - 0.5	2.5	109	780	Y	522-14E
522-7B	Base	8-Apr-11	1 - 1.5	1	137	31	N	-
522-7SW	Perimeter	25-Feb-11	0 - 0.5	2.5	87	181	N	-
522-8B	Base	8-Apr-11	1 - 1.5	1	<5	18	N	-
522-8W	Perimeter	28-Feb-11	0 - 0.5	2.5	62	31	N	-
522-9B	Base	8-Apr-11	1 - 1.5	1	128	43	N	-
522-9W	Perimeter	28-Feb-11	0 - 0.5	2.5	114	96	N	-
522-10B	Base	8-Apr-11	1 - 1.5	1	157	36	N	-
522-10W	Perimeter	28-Feb-11	0 - 0.5	2.5	37	18	N	-
522-11B	Base	28-Mar-11	1 - 1.5	2.5	188	28	N	-
522-11E	Perimeter	28-Mar-11	0 - 0.5	3.5	33	41	N	-
522-12B	Base	28-Mar-11	1 - 1.5	2.5	85	39	N	-
522-12E	Perimeter	28-Mar-11	0 - 0.5	3.5	29	23	N	-
522-13B	Base	28-Mar-11	1 - 1.5	2.5	43	59	N	-
522-13E	Perimeter	28-Mar-11	0 - 0.5	3.5	46	57	N	-
522-14B	Base	28-Mar-11	1 - 1.5	2.5	49	52	N	-
522-14E	Perimeter	28-Mar-11	0 - 0.5	3.5	43	32	N	-
Building 522A								
522A-1B	Base	26-Mar-11	1 - 1.5	1	135	239	N	-
522A-1NW	Perimeter	26-Mar-11	0 - 0.5	2.5	98	183	N	-
522A-2B	Base	26-Mar-11	1 - 1.5	1	57	192	N	-
522A-2NE	Perimeter	26-Mar-11	0 - 0.5	2.5	37	101	N	-
522A-3B	Base	26-Mar-11	1 - 1.5	1	302	236	N	-
522A-3E	Perimeter	26-Mar-11	0 - 0.5	2.5	122	184	N	-
522A-4B	Base	26-Mar-11	1 - 1.5	1	65	55	N	-
522A-4E	Perimeter	26-Mar-11	0 - 0.5	2.5	49	46	N	-
522A-5B	Base	26-Mar-11	1 - 1.5	1	50	32	N	-
522A-5E	Perimeter	26-Mar-11	0 - 0.5	2.5	142	107	N	-
522A-6B	Base	26-Mar-11	1 - 1.5	1	37	25	N	-
522A-6SE	Perimeter	26-Mar-11	0 - 0.5	2.5	32	19	N	-
522A-7B	Base	26-Mar-11	1 - 1.5	1	96	92	N	-
522A-7SW	Perimeter	26-Mar-11	0 - 0.5	2.5	<5	29	N	-
522A-8B	Base	26-Mar-11	1 - 1.5	1	102	38	N	-
522A-8W	Perimeter	26-Mar-11	0 - 0.5	2.5	50	32	N	-
522A-9B	Base	26-Mar-11	1 - 1.5	1	87	49	N	-
522A-9W	Perimeter	26-Mar-11	0 - 0.5	2.5	62	28	N	-
522A-10B	Base	26-Mar-11	1 - 1.5	1	145	91	N	-
522A-10W	Perimeter	26-Mar-11	0 - 0.5	2.5	59	60	Y - Lab Result (see Table 4-7)	522A-11W
522-11W	Perimeter	10-Apr-11	0 - 0.5	4.5	22	40	N	-
Building 528								
528-1B	Base	23-Feb-11	1 - 1.5	1	109	28	N	-
528-1SW	Perimeter	23-Feb-11	0 - 0.5	2.5	40	29	N	-
Building 529								
529-1B	Base	23-Feb-11	1 - 1.5	1	67	57	N	-
529-1NW	Perimeter	23-Feb-11	0 - 0.5	2.5	48	31	N	-
Building XXX								
XXXX-1B	Base	23-Feb-11	1 - 1.5	1	783	31	N	-
XXXX-1SE	Perimeter	23-Feb-11	0 - 0.5	2.5	141	31	N	-

Table 4-6
Field XRF Results for IAA Soil Confirmation Samples
February - April 2011
Radford Army Ammunition Plant - New River Unit

Sample ID	Sample Type	Sample Date	Sample Depth	Distance from Edge of Building	Copper	Lead	Did Result Require Expansion of Excavation Area	Sample ID at Expanded Excavation Border
			ft bgs	ft	(mg/kg)	(mg/kg)	(Y/N)	
Remedial Action Level for IAA Soils					**3,043**	**400**		
XXXX-2B	Base	23-Feb-11	1 - 1.5	1	37	34	N	-
XXXX-2W	Perimeter	23-Feb-11	0 - 0.5	2.5	104	24	N	-
Building YYYY								
YYYY-1B	Base	8-Apr-11	1 - 1.5	1	82	22	N	-
YYYY-1S	Perimeter	3-Mar-11	0 - 0.5	2.5	114	26	N	-
YYYY-2B	Base	8-Apr-11	1 - 1.5	1	52	21	N	-
YYYY-2W	Perimeter	3-Mar-11	0 - 0.5	2.5	99	16	N	-
YYYY-3B	Base	8-Apr-11	1 - 1.5	1	167	36	N	-
YYYY-3W	Perimeter	3-Mar-11	0 - 0.5	2.5	99	27	N	-
Building 562								
562-1B	Base	4-Mar-11	1 - 1.5	1	54	<5	N	-
562-1NW	Perimeter	4-Mar-11	0 - 0.5	2.5	26	17	N	-
562-2B	Base	4-Mar-11	1 - 1.5	1	152	59	N	-
562-2N	Perimeter	4-Mar-11	0 - 0.5	2.5	146	42	N	-
562-3B	Base	4-Mar-11	1 - 1.5	1	609	120	N	-
562-3NE	Perimeter	4-Mar-11	0 - 0.5	2.5	85	362	N	-
562-4B	Base	4-Mar-11	1 - 1.5	1	31	19	N	-
562-4SE	Perimeter	4-Mar-11	0 - 0.5	2.5	109	45	N	-
562-5B	Base	4-Mar-11	1 - 1.5	1	35	35	N	-
562-5S	Perimeter	4-Mar-11	0 - 0.5	2.5	68	23	N	-
562-6B	Base	4-Mar-11	1 - 1.5	1	105	52	N	-
562-6SW	Perimeter	4-Mar-11	0 - 0.5	3.5	86	21	N	-
562-7B	Base	4-Mar-11	1 - 1.5	1	62	68	N	-
562-7W	Perimeter	4-Mar-11	0 - 0.5	2.5	207	18	N	-
Building 565								
565-1B	Base	4-Mar-11	1 - 1.5	1	51	25	N	-
565-1NW	Perimeter	4-Mar-11	0 - 0.5	2.5	131	35	N	-
565-2B	Base	4-Mar-11	1 - 1.5	1	198	25	N	-
565-2B	Perimeter	4-Mar-11	0 - 0.5	2.5	144	31	N	-
565-3B	Base	4-Mar-11	1 - 1.5	1	511	247	N	-
565-3N	Perimeter	4-Mar-11	0 - 0.5	2.5	37	54	N	-
565-4B	Base	4-Mar-11	1 - 1.5	1	54	22	N	-
565-4NE	Perimeter	4-Mar-11	0 - 0.5	2.5	177	41	N	-
565-5B	Base	4-Mar-11	1 - 1.5	1	141	29	N	-
565-5SE	Perimeter	4-Mar-11	0 - 0.5	2.5	135	21	N	-
565-6B	Base	4-Mar-11	1 - 1.5	1	130	120	N	-
565-6S	Perimeter	4-Mar-11	0 - 0.5	2.5	<5	24	N	-
565-7B	Base	4-Mar-11	1 - 1.5	1	26	15	N	-
565-7S	Perimeter	4-Mar-11	0 - 0.5	2.5	135	67	N	-
565-8B	Base	4-Mar-11	1 - 1.5	1	68	46	N	-
565-8SW	Perimeter	4-Mar-11	0 - 0.5	2.5	26	21	N	-
565B-1B	Base	4-Mar-11	1 - 1.5	1	51	18	N	-
565B-1N	Perimeter	4-Mar-11	0 - 0.5	2.5	4901	48	N	-
Building 570								
570-1B	Base	4-Mar-11	1 - 1.5	1	<5	18	N	-
570-1N	Perimeter	4-Mar-11	0 - 0.5	2.5	65	<5	N	-
571-1B	Base	4-Mar-11	1 - 1.5	1	72	12	N	-
571-1W	Perimeter	4-Mar-11	0 - 0.5	2.5	167	17	N	-
Building 8102-1								
8102-1-1B	Base	24-Mar-11	1 - 1.5	1	69	17	N	-
8102-1-1NW	Perimeter	24-Mar-11	0 - 0.5	2.5	518	71	N	-
8102-1-2B	Base	24-Mar-11	1 - 1.5	1	88	22	N	-
8102-1-2NE	Perimeter	24-Mar-11	0 - 0.5	2.5	845	209	N	-
8102-1-3B	Base	8-Apr-11	1 - 1.5	1	127	31	N	-
8102-1-3E	Perimeter	24-Mar-11	0 - 0.5	2.5	48	37	N	-
8102-1-4B	Base	8-Apr-11	1 - 1.5	1	281	30	N	-
8102-1-4E	Perimeter	24-Mar-11	0 - 0.5	2.5	428	31	N	-
8102-1-5B	Base	8-Apr-11	1 - 1.5	1	67	17	N	-
8102-1-5E	Perimeter	24-Mar-11	0 - 0.5	2.5	205	69	N	-
8102-1-6B	Base	8-Apr-11	1 - 1.5	1	182	17	N	-
8102-1-6E	Perimeter	24-Mar-11	0 - 0.5	2.5	125	43	N	-
8102-1-7B	Base	8-Apr-11	1 - 1.5	1	871	44	N	-
8102-1-7E	Perimeter	24-Mar-11	0 - 0.5	5	78	15	N	-
8102-1-8B	Base	24-Mar-11	1 - 1.5	1	157	17	N	-
8102-1-8W	Perimeter	24-Mar-11	0 - 0.5	2.5	918	143	N	-
8102-1-9B	Base	24-Mar-11	1 - 1.5	1	224	34	N	-
8102-1-9W	Perimeter	24-Mar-11	0 - 0.5	2.5	189	47	N	-
8102-1-10B	Base	24-Mar-11	1 - 1.5	1	158	19	N	-

Table 4-6
Field XRF Results for IAA Soil Confirmation Samples
February - April 2011
Radford Army Ammunition Plant - New River Unit

Sample ID	Sample Type	Sample Date	Sample Depth	Distance from Edge of Building	Copper	Lead	Did Result Require Expansion of Excavation Area	Sample ID at Expanded Excavation Border
			ft bgs	ft	(mg/kg)	(mg/kg)	(Y/N)	
Remedial Action Level for IAA Soils					**3,043**	**400**		
8102-1-10W	Perimeter	24-Mar-11	0 - 0.5	2.5	673	109	N	-
8102-1-11B	Base	24-Mar-11	1 - 1.5	1	127	28	N	-
8102-1-11W	Perimeter	24-Mar-11	0 - 0.5	2.5	901	95	N	-
8102-1-12B	Base	24-Mar-11	1 - 1.5	1	58	19	N	-
8102-1-12W	Perimeter	24-Mar-11	0 - 0.5	2.5	780	99	N	-
Building 8102-2								
8102-2-1B	Base	25-Mar-11	1 - 1.5	1	337	18	N	-
8102-2-1NW	Perimeter	25-Mar-11	0 - 0.5	2.5	213	58	N	-
8102-2-2B	Base	25-Mar-11	1 - 1.5	1	38	19	N	-
8102-2-2N	Perimeter	25-Mar-11	0 - 0.5	2.5	46	14	N	-
8102-2-3B	Base	25-Mar-11	1 - 1.5	1	134	25	N	-
8102-2-3NE	Perimeter	25-Mar-11	0 - 0.5	2.5	159	36	N	-
8102-2-4B	Base	25-Mar-11	1 - 1.5	1	30	15	N	-
8102-2-4E	Perimeter	25-Mar-11	0 - 0.5	2.5	53	26	N	-
8102-2-5B	Base	25-Mar-11	1 - 1.5	1	92	19	N	-
8102-2-5E	Perimeter	25-Mar-11	0 - 0.5	2.5	411	43	N	-
8102-2-6B	Base	25-Mar-11	1 - 1.5	1	29	19	N	-
8102-2-6E	Perimeter	25-Mar-11	0 - 0.5	2.5	96	24	N	-
8102-2-7B	Base	25-Mar-11	1 - 1.5	1	36	16	N	-
8102-2-7E	Perimeter	25-Mar-11	0 - 0.5	2.5	162	34	N	-
8102-2-8B	Base	25-Mar-11	1 - 1.5	1	133	20	N	-
8102-2-8E	Perimeter	25-Mar-11	0 - 0.5	2.5	102	28	N	-
8102-2-9B	Base	25-Mar-11	1 - 1.5	1	29	<5	N	-
8102-2-9W	Perimeter	25-Mar-11	0 - 0.5	2.5	196	39	N	-
8102-2-10B	Base	25-Mar-11	1 - 1.5	1	<5	15	N	-
8102-2-10W	Perimeter	25-Mar-11	0 - 0.5	2.5	795	139	N	-
8102-2-11B	Base	25-Mar-11	1 - 1.5	1	82	26	N	-
8102-2-11W	Perimeter	25-Mar-11	0 - 0.5	2.5	134	33	N	-
8102-2-12B	Base	25-Mar-11	1 - 1.5	1	135	21	N	-
8102-2-12W	Perimeter	25-Mar-11	0 - 0.5	2.5	276	112	N	-
8102-2-13B	Base	25-Mar-11	1 - 1.5	1	<5	17	N	-
8102-2-13W	Perimeter	25-Mar-11	0 - 0.5	2.5	503	64	N	-
Building 8102-3								
8102-3-1B	Base	25-Mar-11	1 - 1.5	1	50	18	N	-
8102-3-1NW	Perimeter	25-Mar-11	0 - 0.5	2.5	244	16	N	-
8102-3-2B	Base	25-Mar-11	1 - 1.5	1	69	17	N	-
8102-3-2NE	Perimeter	25-Mar-11	0 - 0.5	2.5	349	76	N	-
8102-3-3B	Base	25-Mar-11	1 - 1.5	1	89	15	N	-
8102-3-3E	Perimeter	25-Mar-11	0 - 0.5	2.5	73	41	N	-
8102-3-4B	Base	25-Mar-11	1 - 1.5	1	45	<5	N	-
8102-3-4E	Perimeter	25-Mar-11	0 - 0.5	2.5	156	39	N	-
8102-3-5B	Base	25-Mar-11	1 - 1.5	1	258	23	N	-
8102-3-5E	Perimeter	25-Mar-11	0 - 0.5	2.5	28	16	N	-
8102-3-6B	Base	25-Mar-11	1 - 1.5	1	60	20	N	-
8102-3-6E	Perimeter	25-Mar-11	0 - 0.5	2.5	1464	124	N	-
8102-3-7B	Base	25-Mar-11	1 - 1.5	1	<5	18	N	-
8102-3-7E	Perimeter	25-Mar-11	0 - 0.5	2.5	236	91	N	-
8102-3-8B	Base	25-Mar-11	1 - 1.5	1	36	19	N	-
8102-3-8W	Perimeter	25-Mar-11	0 - 0.5	2.5	266	68	N	-
8102-3-9B	Base	25-Mar-11	1 - 1.5	1	58	29	N	-
8102-3-9W	Perimeter	25-Mar-11	0 - 0.5	2.5	526	122	N	-
8102-3-10B	Base	25-Mar-11	1 - 1.5	1	218	33	N	-
8102-3-10W	Perimeter	25-Mar-11	0 - 0.5	2.5	86	34	Y - Lab Result (see Table 4-7)	8102-3-13W
8102-3-11B	Base	25-Mar-11	1 - 1.5	1	259	53	N	-
8102-3-11W	Perimeter	25-Mar-11	0 - 0.5	2.5	90	21	N	-
8102-3-12B	Base	25-Mar-11	1 - 1.5	1	<5	11	N	-
8102-3-12W	Perimeter	25-Mar-11	0 - 0.5	2.5	27	11	N	-
8102-3-13B	Base	10-Apr-11	1 - 1.5	2.5	33	25	N	-
8102-3-13W	Perimeter	10-Apr-11	0 - 0.5	3.5	40	22	N	-
Building 8102-4								
8102-4-1B	Base	25-Mar-11	1 - 1.5	1	119	46	N	-
8102-4-1NW	Perimeter	25-Mar-11	0 - 0.5	2.5	380	112	N	-
8102-4-2B	Base	25-Mar-11	1 - 1.5	1	155	28	N	-
8102-4-2E	Perimeter	25-Mar-11	0 - 0.5	2.5	284	81	N	-
8102-4-3B	Base	25-Mar-11	1 - 1.5	1	28	16	N	-
8102-4-3E	Perimeter	25-Mar-11	0 - 0.5	2.5	67	22	N	-
8102-4-4B	Base	25-Mar-11	1 - 1.5	1	25	24	N	-

Table 4-6
Field XRF Results for IAA Soil Confirmation Samples
February - April 2011
Radford Army Ammunition Plant - New River Unit

Sample ID	Sample Type	Sample Date	Sample Depth	Distance from Edge of Building	Copper	Lead	Did Result Require Expansion of Excavation Area	Sample ID at Expanded Excavation Border
			ft bgs	ft	(mg/kg)	(mg/kg)	(Y/N)	
Remedial Action Level for IAA Soils					**3,043**	**400**		
8102-4-4E	Perimeter	25-Mar-11	0 - 0.5	2.5	65	71	N	-
8102-4-5B	Base	25-Mar-11	1 - 1.5	1	128	29	N	-
8102-4-5E	Perimeter	25-Mar-11	0 - 0.5	2.5	243	69	N	-
8102-4-6B	Base	25-Mar-11	1 - 1.5	1	117	18	N	-
8102-4-6E	Perimeter	25-Mar-11	0 - 0.5	2.5	760	58	N	-
8102-4-7B	Base	25-Mar-11	1 - 1.5	1	28	17	N	-
8102-4-7E	Perimeter	25-Mar-11	0 - 0.5	2.5	45	35	N	-
8102-4-8B	Base	25-Mar-11	1 - 1.5	1	43	38	N	-
8102-4-8W	Perimeter	25-Mar-11	0 - 0.5	2.5	209	72	N	-
8102-4-9B	Base	25-Mar-11	1 - 1.5	1	37	32	N	-
8102-4-9W	Perimeter	25-Mar-11	0 - 0.5	2.5	171	143	N	-
8102-4-10B	Base	25-Mar-11	1 - 1.5	1	62	133	N	-
8102-4-10W	Perimeter	25-Mar-11	0 - 0.5	2.5	232	75	N	-
8102-4-11B	Base	25-Mar-11	1 - 1.5	1	54	25	N	-
8102-4-11W	Perimeter	25-Mar-11	0 - 0.5	2.5	132	41	N	-
8102-4-12B	Base	25-Mar-11	1 - 1.5	1	86	20	N	-
8102-4-12W	Perimeter	25-Mar-11	0 - 0.5	2.5	127	79	N	-
Building 8102-5								
8102-5-1B	Base	6-Apr-11	1 - 1.5	1	43	37	N	-
8102-5-1NW	Perimeter	6-Apr-11	0 - 0.5	2.5	34	28	N	-
8102-5-2B	Base	6-Apr-11	1 - 1.5	1	337	129	N	-
8102-5-2E	Perimeter	6-Apr-11	0 - 0.5	2.5	161	85	N	-
8102-5-3B	Base	6-Apr-11	1 - 1.5	1	70	24	N	-
8102-5-3E	Perimeter	6-Apr-11	0 - 0.5	2.5	67	36	N	-
8102-5-4B	Base	6-Apr-11	1 - 1.5	1	60	33	N	-
8102-5-4E	Perimeter	6-Apr-11	0 - 0.5	2.5	57	40	N	-
8102-5-5B	Base	6-Apr-11	1 - 1.5	1	49	31	N	-
8102-5-5E	Perimeter	6-Apr-11	0 - 0.5	2.5	78	55	N	-
8102-5-6B	Base	6-Apr-11	1 - 1.5	1	203	49	N	-
8102-5-6E	Perimeter	6-Apr-11	0 - 0.5	2.5	160	133	N	-
8102-5-7B	Base	6-Apr-11	1 - 1.5	1	28	28	N	-
8102-5-7E	Perimeter	6-Apr-11	0 - 0.5	2.5	147	73	N	-
8102-5-8B	Base	6-Apr-11	1 - 1.5	1	32	30	N	-
8102-5-8W	Perimeter	6-Apr-11	0 - 0.5	2.5	40	28	N	-
8102-5-9B	Base	6-Apr-11	1 - 1.5	1	59	23	N	-
8102-5-9W	Perimeter	6-Apr-11	0 - 0.5	2.5	52	27	N	-
8102-5-10B	Base	6-Apr-11	1 - 1.5	1	50	30	N	-
8102-5-10W	Perimeter	6-Apr-11	0 - 0.5	2.5	77	39	N	-
8102-5-11B	Base	6-Apr-11	1 - 1.5	1	40	38	N	-
8102-5-11W	Perimeter	6-Apr-11	0 - 0.5	2.5	29	43	N	-
8102-5-12B	Base	6-Apr-11	1 - 1.5	1	29	31	N	-
8102-5-12W	Perimeter	6-Apr-11	0 - 0.5	2.5	87	31	N	-
Building 8102-6								
8102-6-1B	Base	6-Apr-11	1 - 1.5	1	162	36	N	-
8102-6-1NW	Perimeter	6-Apr-11	0 - 0.5	2.5	238	86	N	-
8102-6-2B	Base	6-Apr-11	1 - 1.5	1	53	28	N	-
8102-6-2E	Perimeter	6-Apr-11	0 - 0.5	2.5	661	64	N	-
8102-6-3B	Base	6-Apr-11	1 - 1.5	1	97	19	N	-
8102-6-3E	Perimeter	6-Apr-11	0 - 0.5	2.5	164	29	N	-
8102-6-4B	Base	6-Apr-11	1 - 1.5	1	182	32	N	-
8102-6-4E	Perimeter	6-Apr-11	0 - 0.5	2.5	87	28	N	-
8102-6-5B	Base	6-Apr-11	1 - 1.5	1	99	20	N	-
8102-6-5E	Perimeter	6-Apr-11	0 - 0.5	2.5	38	20	N	-
8102-6-6B	Base	6-Apr-11	1 - 1.5	1	54	18	N	-
8102-6-6E	Perimeter	6-Apr-11	0 - 0.5	2.5	53	20	N	-
8102-6-7B	Base	6-Apr-11	1 - 1.5	1	33	19	N	-
8102-6-7E	Perimeter	6-Apr-11	0 - 0.5	2.5	112	72	N	-
8102-6-8B	Base	6-Apr-11	1 - 1.5	1	276	28	N	-
8102-6-8W	Perimeter	6-Apr-11	0 - 0.5	2.5	334	22	N	-
8102-6-9B	Base	6-Apr-11	1 - 1.5	1	252	34	N	-
8102-6-9W	Perimeter	6-Apr-11	0 - 0.5	2.5	60	27	N	-
8102-6-10B	Base	6-Apr-11	1 - 1.5	1	51	26	N	-
8102-6-10W	Perimeter	6-Apr-11	0 - 0.5	2.5	124	33	N	-
8102-6-11B	Base	6-Apr-11	1 - 1.5	1	78	24	N	-
8102-6-11W	Perimeter	6-Apr-11	0 - 0.5	2.5	298	66	N	-
8102-6-12B	Base	6-Apr-11	1 - 1.5	1	145	22	N	-
8102-6-12W	Perimeter	6-Apr-11	0 - 0.5	2.5	105	37	N	-
Building 8102-7								

Table 4-6
Field XRF Results for IAA Soil Confirmation Samples
February - April 2011
Radford Army Ammunition Plant - New River Unit

Sample ID	Sample Type	Sample Date	Sample Depth	Distance from Edge of Building	Copper	Lead	Did Result Require Expansion of Excavation Area	Sample ID at Expanded Excavation Border
			ft bgs	ft	(mg/kg)	(mg/kg)	(Y/N)	
Remedial Action Level for IAA Soils					**3,043**	**400**		
8102-7-1B	Base	6-Apr-11	1 - 1.5	1	<5	17	N	-
8102-7-1NW	Perimeter	6-Apr-11	0 - 0.5	2.5	158	30	N	-
8102-7-2B	Base	6-Apr-11	1 - 1.5	1	142	63	N	-
8102-7-2E	Perimeter	6-Apr-11	0 - 0.5	2.5	206	73	N	-
8102-7-3B	Base	6-Apr-11	1 - 1.5	1	70	31	N	-
8102-7-3E	Perimeter	6-Apr-11	0 - 0.5	2.5	40	30	N	-
8102-7-4B	Base	6-Apr-11	1 - 1.5	1	33	38	N	-
8102-7-4E	Perimeter	6-Apr-11	0 - 0.5	2.5	193	64	N	-
8102-7-5B	Base	6-Apr-11	1 - 1.5	1	108	28	N	-
8102-7-5E	Perimeter	6-Apr-11	0 - 0.5	2.5	59	37	N	-
8102-7-6B	Base	6-Apr-11	1 - 1.5	1	95	33	N	-
8102-7-6E	Perimeter	6-Apr-11	0 - 0.5	2.5	214	48	N	-
8102-7-7B	Base	6-Apr-11	1 - 1.5	1	54	17	N	-
8102-7-7E	Perimeter	6-Apr-11	0 - 0.5	2.5	89	35	N	-
8102-7-8B	Base	6-Apr-11	1 - 1.5	1	47	45	N	-
8102-7-8W	Perimeter	6-Apr-11	0 - 0.5	2.5	203	65	N	-
8102-7-9B	Base	6-Apr-11	1 - 1.5	1	115	46	N	-
8102-7-9W	Perimeter	6-Apr-11	0 - 0.5	2.5	76	41	N	-
8102-7-10B	Base	6-Apr-11	1 - 1.5	1	54	29	N	-
8102-7-10W	Perimeter	6-Apr-11	0 - 0.5	2.5	48	39	N	-
8102-7-11B	Base	6-Apr-11	1 - 1.5	1	<5	<5	N	-
8102-7-11W	Perimeter	6-Apr-11	0 - 0.5	2.5	212	57	N	-
8102-7-12B	Base	6-Apr-11	1 - 1.5	1	38	12	N	-
8102-7-12W	Perimeter	6-Apr-11	0 - 0.5	2.5	30	13	N	-
Building 8102-8								
8102-8-1B	Base	6-Apr-11	1 - 1.5	1	200	29	N	-
8102-8-1NW	Perimeter	6-Apr-11	0 - 0.5	2.5	41	30	N	-
8102-8-2B	Base	6-Apr-11	1 - 1.5	1	655	24	N	-
8102-8-2E	Perimeter	6-Apr-11	0 - 0.5	2.5	194	50	N	-
8102-8-3B	Base	6-Apr-11	1 - 1.5	1	69	33	N	-
8102-8-3E	Perimeter	6-Apr-11	0 - 0.5	2.5	58	35	N	-
8102-8-4B	Base	6-Apr-11	1 - 1.5	1	170	26	N	-
8102-8-4E	Perimeter	6-Apr-11	0 - 0.5	2.5	163	60	N	-
8102-8-5B	Base	6-Apr-11	1 - 1.5	1	46	17	N	-
8102-8-5E	Perimeter	6-Apr-11	0 - 0.5	2.5	178	69	N	-
8102-8-6B	Base	6-Apr-11	1 - 1.5	1	110	66	N	-
8102-8-6E	Perimeter	6-Apr-11	0 - 0.5	2.5	372	87	N	-
8102-8-7B	Base	6-Apr-11	1 - 1.5	1	73	19	N	-
8102-8-7E	Perimeter	6-Apr-11	0 - 0.5	2.5	98	43	N	-
8102-8-8B	Base	6-Apr-11	1 - 1.5	1	114	23	N	-
8102-8-8E	Perimeter	6-Apr-11	0 - 0.5	2.5	42	18	N	-
8102-8-9B	Base	6-Apr-11	1 - 1.5	1	61	47	N	-
8102-8-9W	Perimeter	6-Apr-11	0 - 0.5	2.5	96	53	N	-
8102-8-10B	Base	6-Apr-11	1 - 1.5	1	180	56	N	-
8102-8-10W	Perimeter	6-Apr-11	0 - 0.5	2.5	85	37	N	-
8102-8-11B	Base	6-Apr-11	1 - 1.5	1	255	31	N	-
8102-8-11W	Perimeter	6-Apr-11	0 - 0.5	2.5	102	59	N	-
8102-8-12B	Base	6-Apr-11	1 - 1.5	1	105	42	N	-
8102-8-12W	Perimeter	6-Apr-11	0 - 0.5	2.5	146	40	N	-
8102-8-13B	Base	6-Apr-11	1 - 1.5	1	35	24	N	-
8102-8-13W	Perimeter	6-Apr-11	0 - 0.5	2.5	139	39	N	-
8102-8-14B	Base	6-Apr-11	1 - 1.5	1	130	28	N	-
8102-8-14W	Perimeter	6-Apr-11	0 - 0.5	2.5	54	22	N	-
Building 8102-A								
8102-A-1B	Base	7-Apr-11	1 - 1.5	1	71	26	N	-
8102-A-1NW	Perimeter	7-Apr-11	0 - 0.5	2.5	58	27	N	-

Notes:

1101 Highlighted cell indicates constituent concentration is higher than the established residental RAL for the IAA.

Note that if an XRF field reading indicated that lead or copper were detected above the listed RALs, the excavation was expanded until a sample result below the RAL was achieved. All samples collected from the final excavation boundaries and base were below the target RALs.

Table 4-5
Summary of Laboratory Analytical Results for BLA Soil Confirmation Soil Samples
March 2011
Radford Army Ammunition Plant - New River Unit

Location ID: Sample Depth(Feet): Date Collected: Sample Name:	Industrial RAL for BLA Soil	Facility Wide Background Concentration	Units	404-2N 0 - 0.5 03/24/11 404-2N (20110324)	404-6B 1 - 1.5 03/24/11 404-6B (20110324)	404-6N 0 - 0.5 03/24/11 404-6N (20110324)	404-10W 0 - 0.5 03/24/11 404-10W (20110324)	404-14W 0 - 0.5 03/24/11 404-14W (20110324)	404-17E 0 - 0.5 03/24/11 404-17E (20110324)	404-22E 0 - 0.5 03/24/11 404-22E (20110324)	404-25B 1 - 1.5 03/24/11 404-25B (20110324)	404-29S 0 - 0.5 03/24/11 404-29S (20110324)
Inorganics												
Copper	11,533	**53.5**	mg/kg	40.3	39.4	**95.3**	47.1	**126**	**77.2**	29.5	**72.1**	36
Lead	624	**26.8**	mg/kg	**27.1**	15.9	**41.2**	**153**	**140**	**58.6**	26.3	**55**	26.9
Asbestos												
Asbestos weight percent	0.1	- -	%	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
XRF Metals												
Copper	11,533	**53.5**	mg/kg	**133**	38	**93**	**65**	**140**	46	**78**	**76**	39
Lead	624	**26.8**	mg/kg	23	19	**39**	**124**	**131**	**43**	24	**52**	22

Location ID: Sample Depth(Feet): Date Collected: Sample Name:	Industrial RAL for BLA Soil	Facility Wide Background Concentration	Units	404-32S 0 - 0.5 03/24/11 404-32S (20110324)	405-1N 0 - 0.5 03/24/11 405-1N (20110324)	405-4N 0 - 0.5 03/24/11 405-4N (20110324)	405-9N 0 - 0.5 03/24/11 405-9N (20110324)	405-11E 0 - 0.5 03/24/11 405-11E (20110324)	405-16B 1 - 1.5 03/24/11 405-16B (20110324)	405-21W 0 - 0.5 03/24/11 405-21W (20110324)	405-24B 1 - 1.5 03/24/11 405-24B (20110324)	405-27W 0 - 0.5 03/24/11 405-27W (20110324)
Inorganics												
Copper	11,533	**53.5**	mg/kg	**83**	**62.1**	**56**	22.1	**82**	18.8	**55.1**	29.4	**101**
Lead	624	**26.8**	mg/kg	**60.3**	**71.1**	**29.6**	19.7	**40.6**	22.8	**220**	18.4	**123**
Asbestos												
Asbestos weight percent	0.1	- -	%	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
XRF Metals												
Copper	11,533	**53.5**	mg/kg	**69**	**201**	42	26	**764**	35	**58**	43	**120**
Lead	624	**26.8**	mg/kg	**77**	**44**	25	25	**299**	**28**	**181**	25	**120**

Location ID: Sample Depth(Feet): Date Collected: Sample Name:	Industrial RAL for BLA Soil	Facility Wide Background Concentration	Units	405-31S 0 - 0.5 03/24/11 405-31S (20110324)	405-33B 1 - 1.5 03/24/11 405-33B (20110324)	406-2E 0 - 0.5 03/25/11 406-2E (20110325)	411-2N 0 - 0.5 03/29/11 411-2N (20110329)	411-4B 1 - 1.5 03/29/11 411-4B (20110329)	411-7SW 0 - 0.5 03/29/11 411-7SW (20110329)	412-1B 1 - 1.5 03/29/11 412-1B (20110329)	413-3E 0 - 0.5 03/29/11 413-3E (20110329)	413-7W 0 - 0.5 03/29/11 413-7W (20110329)
Inorganics												
Copper	11,533	**53.5**	mg/kg	**70.5**	**204**	51.9	53.1	30.3	32	**99.7**	31.2	**126**
Lead	624	**26.8**	mg/kg	79.3	54.3	221	42.3	10.7	15.1	28.5	12.2	90.1
Asbestos												
Asbestos weight percent	0.1	- -	%	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
XRF Metals												
Copper	11,533	**53.5**	mg/kg	72	49	67	64	<5	<5	205	32	131
Lead	624	**26.8**	mg/kg	46	22	124	29	20	17	53	14	67

Notes:
U - The compound was analyzed for but not detected. The associated value is the compound quantitation limit.

700	Highlighted cell indicates constituent concentration exceeds the industrial RAL established for the BLA.
29	Bolded value indicates concentration exceeds 95% UTL fir facility-wide background estimate.

Table 4-7
Summary of Laboratory Analytical Results for IAA Soil Confirmation Samples
February and March 2011
Radford Army Ammunition Plant - New River Unit

Location ID: Sample Depth(Feet): Date Collected: Sample Name:	Residential RAL for IAA Soil	Facility Wide Background Concentration	Units	1-1N 0 - 0.5 02/15/11 1-1N (20110215)	2-2B 1 - 1.5 03/05/11 2-2B (20110305)	2-3W 0 - 0.5 03/05/11 2-3W (20110305)	4-5S 0 - 0.5 03/05/11 4-5S (20110305)	5-5S 0 - 0.5 02/17/11 5-5S (20110215)	6-1NW 0 - 0.5 04/11/11 6-1NW(20110411)	502-4NE 0 - 0.5 03/05/11 502-4NE (20110305)	502-15B 1 - 1.5 03/29/11 502-15B (20110329)	502-19W 0 - 0.5 03/29/11 502-19W (20110329)
PCBs												
Aroclor-1254	210	- -	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA
Inorganics												
Copper	3,043	**53.5**	mg/kg	24.3	49.4	34.4	14.1	**66.8**	20.2	47.4	**114**	19.4
Lead	400	**26.8**	mg/kg	**35.8**	**33.5**	26.5	19.6	**151**	18.5	**79.1**	**158**	20.1
Asbestos												
Asbestos weight percent	0.1	- -	%	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
XRF Metals												
Copper	3,043	**53.5**	mg/kg	**89**	**71**	**192**	51	**132**	41	53	**57**	<5
Lead	400	**26.8**	mg/kg	**103**	**62**	**99**	23	**120**	24	**114**	**54**	21

Location ID: Sample Depth(Feet): Date Collected: Sample Name:	Residential RAL for IAA Soil	Facility Wide Background Concentration	Units	504-20N 0 - 0.5 04/11/11 504-20N(20110411)	504-22E 0 - 0.5 04/11/11 504-22E(20110411)	508-1S 0 - 0.5 03/05/11 508-1S (20110305)	509-1B 1 - 1.5 03/05/11 509-1B (20110305)	522-9W 0 - 0.5 03/05/11 522-9W (20110305)	522-12E 0 - 0.5 03/29/11 522-12E (20110329)	522A-2NE 0 - 0.5 03/29/11 522A-2NE (20110329)	522A-4E 0 - 0.5 03/29/11 522A-4E (20110329)	522A-6B 1 - 1.5 03/29/11 522A-6B (20110329)
PCBs												
Aroclor-1254	210	- -	ug/kg	21 U	22 U	NA	NA	NA	NA	NA	NA	NA
Inorganics												
Copper	3,043	**53.5**	mg/kg	46	25	**208**	**98.4**	**62.8**	22.1	17.5	55.1	18.9
Lead	400	**26.8**	mg/kg	23.5	**56.2**	**185**	**41.1**	**84.9**	22	**233**	**33.8**	26.4
Asbestos												
Asbestos weight percent	0.1	- -	%	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
XRF Metals												
Copper	3,043	**53.5**	mg/kg	40	34	**346**	**110**	**114**	29	37	49	37
Lead	400	**26.8**	mg/kg	24	**63**	**189**	**42**	**96**	23	**101**	**46**	25

Location ID: Sample Depth(Feet): Date Collected: Sample Name:	Residential RAL for IAA Soil	Facility Wide Background Concentration	Units	522A-10W ** 0 - 0.5 03/29/11 522A-10W (20110329)	528-1B 1 - 1.5 03/05/11 528-1B (20110305)	529-1NW 0 - 0.5 03/05/11 529-1NW (20110305)	562-7W 0 - 0.5 03/05/11 562-7W (20110305)	565-3N 0 - 0.5 03/05/11 565-3N (20110305)	565-7S 0 - 0.5 03/05/11 565-7S (20110305)	565B-1B 1 - 1.5 03/05/11 565B-1B (20110305)	570-1B 1 - 1.5 03/05/11 570-1B (20110305)	571-1B 1 - 1.5 03/05/11 571-1B (20110305)
PCBs												
Aroclor-1254	210	- -	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA
Inorganics												
Copper	3,043	**53.5**	mg/kg	47.5	**97.9**	42.1	**107**	31.1	**56.6**	**55.7**	26.1	24.7
Lead	400	**26.8**	mg/kg	**1,540**	**38.5**	**27.2**	13.2	26.5	**52.4**	14.7	13.5	9.89
Asbestos												
Asbestos weight percent	0.1	- -	%	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
XRF Metals												
Copper	3,043	**53.5**	mg/kg	**59**	**109**	48	**207**	37	**135**	51	<5	**72**
Lead	400	**26.8**	mg/kg	**60**	**28**	**31**	18	**54**	**67**	25	18	12

Location ID: Sample Depth(Feet): Date Collected: Sample Name:	Residential RAL for IAA Soil	Facility Wide Background Concentration	Units	8102-1-1NW 0 - 0.5 03/24/11 8102(1)-1NW- (20110324)	8102-1-3E 03/24/11 8102(1)-3E- (20110324)	8102-1-10W 0 - 0.5 03/24/11 8102(1)-10W- (20110324)	8102-2-2N 0 - 0.5 03/25/11 8102(2)-2N (20110325)	8102-2-5E 0 - 0.5 03/25/11 8102(2)-5E (20110325)	8102-2-9W 0 - 0.5 03/25/11 8102(2)-9W (20110325)	8102-2-12W 0 - 0.5 03/25/11 8102(2)-12W (20110325)	8102-3-3E 0 - 0.5 03/25/11 8102(3)-3E (20110325)	8102-3-6E 0 - 0.5 03/25/11 8102(3)-6E (20110325)
PCBs												
Aroclor-1254	210	- -	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA
Inorganics												
Copper	3,043	**53.5**	mg/kg	**286**	14.8	**386**	38.1	**351**	**106**	**114**	**60.3**	**188**
Lead	400	**26.8**	mg/kg	**131**	18.3	**74.9**	22.8	**96.2**	**36.5**	**59.5**	**89.4**	**104**
Asbestos												
Asbestos weight percent	0.1	- -	%	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
XRF Metals												
Copper	3,043	**53.5**	mg/kg	**518**	48	**673**	46	**411**	**196**	**276**	**73**	**1464**
Lead	400	**26.8**	mg/kg	**70**	**37**	**109**	14	**43**	**39**	**112**	**41**	**124**

footnotes on last page.

Table 4-7
Summary of Laboratory Analytical Results for IAA Soil Confirmation Samples
February and March 2011
Radford Army Ammunition Plant - New River Unit

Location ID: Sample Depth(Feet): Date Collected: Sample Name:	Residential RAL for IAA Soil	Facility Wide Background Concentration	Units	8102-3-10W ** 0 - 0.5 03/25/11 8102(3)-10W (20110325)	8102-3-13W 0 - 0.5 04/11/11 8102(3)-13W(20110411)	8102-4-2E 0 - 0.5 03/29/11 8102(4)-2E (20110329)	8102-4-6E 0 - 0.5 03/29/11 8102(4)-6E (20110329)	8102-4-10W 0 - 0.5 03/29/11 8102(4)-10W (20110329)	8102-5-3E 0 - 0.5 04/06/11 8102 (5)-3E (20110406)	8102-6-3E 0 - 0.5 04/06/11 8102 (6)-3E (20110406)	8102-6-6E 0 - 0.5 04/06/11 8102 (6)-6E (20110406)	8102-6-8W 0 - 0.5 04/06/11 8102 (6)-8W (20110406)
PCBs												
Aroclor-1254	210	- -	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA
Inorganics												
Copper	3,043	**53.5**	mg/kg	**449**	28	**111**	**232**	**262**	47.5	**169**	**72.7**	**313**
Lead	400	**26.8**	mg/kg	**603**	25.9	**35.7**	**56**	**116**	26.2	**33.1**	19.8	**27.9**
Asbestos												
Asbestos weight percent	0.1	- -	%	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
XRF Metals												
Copper	3,043	**53.5**	mg/kg	**86**	40	**284**	**760**	**232**	**67**	**164**	53	**334**
Lead	400	**26.8**	mg/kg	**34**	22	**81**	**58**	**75**	**36**	**29**	20	22

Location ID: Sample Depth(Feet): Date Collected: Sample Name:	Residential RAL for IAA Soil	Facility Wide Background Concentration	Units	8102-7-3E 0 - 0.5 04/06/11 8102 (7)-3E (20110406)	8102-7-11W 0 - 0.5 04/06/11 8102 (7)-11W (20110406)	8102-8-2E 0 - 0.5 04/06/11 8102 (8)-2E (20110406)	8102-8-5E 0 - 0.5 04/06/11 8102 (8)-5E (20110406)	8102-8-13W 0 - 0.5 04/06/11 8102 (8)-13W (20110406)	8102-a-1NW 04/11/11 8102A-1NW(20110411)	XXXX-2W 0 - 0.5 03/05/11 XXXX-2W (20110305)	YYYY-2SW 0 - 0.5 03/05/11 YYYY-2SW (20110305)	8101-1W ** 0 - 0.5 03/25/11 8101-1W (20110325)
PCBs												
Aroclor-1254	210	- -	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	590
Inorganics												
Copper	3,043	**53.5**	mg/kg	23.4	**85.7**	**76.1**	**311**	**107**	48.9	**123**	**68.7**	NA
Lead	400	**26.8**	mg/kg	14.9	26.3	**41.1**	**99.1**	**56.5**	**31**	**31.5**	26.5	NA
Asbestos												
Asbestos weight percent	0.1	- -	%	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA
XRF Metals												
Copper	3,043	**53.5**	mg/kg	40	**212**	**194**	**178**	**139**	**58**	**104**	**99**	NA
Lead	400	**26.8**	mg/kg	**30**	**57**	**50**	**69**	**39**	**27**	24	16	NA

Location ID: Sample Depth(Feet): Date Collected: Sample Name:	Residential RAL for IAA Soil	Facility Wide Background Concentration	Units	8101-2N ** 0 - 0.5 03/25/11 8101-2N (20110325)	8101-3N 0 - 0.5 03/25/11 8101-3N (20110325)	8101-4B 1 - 1.5 03/25/11 8101-4B (20110325)	8101-5W 0 - 0.5 04/07/11 8101-5W (20110407)	8101-6N 0 - 0.5 04/07/11 8101-6N (20110407)
PCBs								
Aroclor-1254	210	- -	ug/kg	1,100 D	84	25 U	53	160
Inorganics								
Copper	3,043	**53.5**	mg/kg	NA	NA	NA	NA	NA
Lead	400	**26.8**	mg/kg	NA	NA	NA	NA	NA
Asbestos								
Asbestos weight percent	0.1	- -	%	NA	NA	NA	NA	NA
XRF Metals								
Copper	3,043	**53.5**	mg/kg	NA	NA	NA	NA	NA
Lead	400	**26.8**	mg/kg	NA	NA	NA	NA	NA

Notes:
U - The compound was analyzed for but not detected. The associated value is the compound quantitation limit.
D - Denotes that the sample was analyzed after dilution because the concentration in an initial run exceeded the concentration on the standard curve
NA - The compound was not analyzed for.

700	Highlighted cell indicates constituent concentration exceeds the residential RAL established for the IAA.
29	Bolded value indicates concentration exceeds 95% UTL fir facility-wide background estimate.

** Note the the excavation boundaries were expanded at all of the locations where constituents were detected above their respective RALs. All samples collected from the final excavation boundaries were below their respective RALs.

Table 4-1
Waste Characterization Sample Results for BLA and IAA
November 2010
Radford Army Ammunition Plant - New River Unit

Sample ID:	IAA Soil - 20101116	BLA Soil - 20101116	Flooring - 20101116
Sample Date:	11/16/2010	11/16/2010	11/16/2010
Analyses			
TCLP-Metals (mg/L)			
Mercury	<0.002	<0.002	<0.002
Arsenic	<0.1	<0.1	<0.1
Barium	2.44	1.72	2.9
Cadmium	0.0227	0.0849	0.0192
Chromium	<0.1	<0.1	<0.1
Lead	0.276	0.858	<0.03
Selenium	0.037	<0.06	0.0483
Silver	<0.1	<0.1	<0.1
Asbestos Content (%)			
Chrysotile	**5%**	**3%**	**5%**
PCBs (µg/Kg)			
Aroclor-1254	<23.7	733	<25.0
Aroclor-1260	103	<27.4	<25.0
Aroclor-1268	<23.7	<27.4	25.5

Table 4-8
Summary of Soil Waste Shipments for the BLA and IAA Removal Actions
February through April 2011
Radford Army Ammunition Plant - New River Unit

Manifest #	Waste Shipment Date	Facility Receipt Date	Facility Receipt ID	Disposal Company/Site	Load Weight (tons)
FPC4233-01-11	2/21/2011	2/21/2011	294706	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	14.49
FPC4233-02-11	2/21/2011	2/21/2011	294705	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	13.44
FPC4233-03-11	2/22/2011	2/22/2011	294868	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	15.78
FPC4233-04-11	2/23/2011	2/23/2011	295031	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	16.75
FPC4233-05-11	2/24/2011	3/1/2011	295198	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	14.62
FPC4233-06-11	2/28/2011	3/1/2011	295522	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	18.28
FPC4233-08-11	3/1/2011	3/1/2011	295656	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	17.72
FPC4233-09-11	3/1/2011	3/1/2011	295657	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	18.05
FPC4233-10-11	3/2/2011	3/2/2011	295802	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	15.77
FPC4233-11-11	3/2/2011	3/2/2011	295804	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	16.96
FPC4233-12-11	3/3/2011	3/3/2011	295964	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	10.56
FPC4233-13-11	3/3/2011	3/3/2011	295965	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	12.99
FPC4233-14-11	3/3/2011	3/3/2011	295966	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	16.51
FPC4233-15-11	3/4/2011	3/4/2011	296120	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	11.59
FPC4233-16-11	3/4/2011	3/4/2011	296118	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	11.96
FPC4233-17-11	3/5/2011	3/5/2011	296178	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	14.05

Table 4-8
Summary of Soil Waste Shipments for the BLA and IAA Removal Actions
February through April 2011
Radford Army Ammunition Plant - New River Unit

Manifest #	Waste Shipment Date	Facility Receipt Date	Facility Receipt ID	Disposal Company/Site	Load Weight (tons)
FPC4233-18-11	3/5/2011	3/5/2011	296139	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	16.20
FPC4233-19-11	3/7/2011	3/7/2011	296341	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	14.89
FPC4233-20-11	3/8/2011	3/9/2011	296534	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	13.00
FPC4233-21-11	3/8/2011	3/9/2011	296536	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	12.12
FPC4233-22-11	3/9/2011	3/10/2011	296696	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	12.29
FPC4233-23-11	3/9/2011	3/10/2011	296694	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	11.86
FPC4233-24-11	3/10/2011	3/10/2011	296851	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	12.35
FPC4233-25-11	3/10/2011	3/10/2011	296850	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	17.78
FPC4233-26-11	3/11/2011	3/11/2011	297012	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	16.66
FPC4233-27-11	3/11/2011	3/11/2011	297011	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	13.99
FPC4233-28-11	3/12/2011	3/12/2011	297458	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	14.19
FPC4233-29-11	3/12/2011	3/12/2011	297455	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	13.94
FPC4233-30-11	3/14/2011	3/14/2011	297222	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	15.73
FPC4233-31-11	3/14/2011	3/14/2011	297221	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	14.40
FPC4233-32-11	3/15/2011	3/15/2011	297323	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	11.35
FPC4233-33-11	3/15/2011	3/15/2011	297380	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	10.04

Table 4-8
Summary of Soil Waste Shipments for the BLA and IAA Removal Actions
February through April 2011
Radford Army Ammunition Plant - New River Unit

Manifest #	Waste Shipment Date	Facility Receipt Date	Facility Receipt ID	Disposal Company/Site	Load Weight (tons)
FPC4233-34-11	3/15/2011	3/16/2011	297427	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	14.44
FPC4233-35-11	3/16/2011	3/16/2011	297576	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	17.66
FPC4233-36-11	3/16/2011	3/16/2011	297577	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	13.49
FPC4233-37-11	3/17/2011	3/17/2011	297675	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	10.83
FPC4233-38-11	3/17/2011	3/17/2011	297776	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	9.13
FPC4233-40-11	3/21/2011	3/22/2011	298204	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	12.52
FPC4233-41-11	3/21/2011	3/22/2011	298207	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	12.47
FPC4233-42-11	3/21/2011	3/22/2011	298195	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	12.00
FPC4233-43-11	3/21/2011	3/22/2011	298209	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	13.84
FPC4233-44-11	3/22/2011	3/22/2011	298362	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	20.54
FPC4233-45-11	3/22/2011	3/23/2011	298364	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	14.35
FPC4233-46-11	3/22/2011	3/23/2011	298363	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	12.44
FPC4233-47-11	3/24/2011	3/24/2011	298696	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	13.70
FPC4233-48-11	3/24/2011	3/24/2011	298695	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	16.45
FPC4233-49-11	3/25/2011	3/25/2011	298872	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	10.64
FPC4233-50-11	3/25/2011	3/25/2011	298873	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	11.87

Table 4-8
Summary of Soil Waste Shipments for the BLA and IAA Removal Actions
February through April 2011
Radford Army Ammunition Plant - New River Unit

Manifest #	Waste Shipment Date	Facility Receipt Date	Facility Receipt ID	Disposal Company/Site	Load Weight (tons)
FPC4233-51-11	3/28/2011	3/28/2011	299044	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	13.45
FPC4233-52-11	3/28/2011	3/28/2011	299045	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	13.75
FPC4233-53-11	4/4/2011	4/5/2011	299870	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	13.27
FPC4233-54-11	4/4/2011	4/5/2011	299876	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	12.93
FPC4233-55-11	4/13/2011	4/13/2011	301022	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	21.09
FPC4233-56-11	4/13/2011	4/13/2011	301023	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	15.33
FPC4233-57-11	4/27/2011	4/27/2011	302774	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	19.94
FPC4233-59-11	4/18/2011	4/18/2011	301682	First Piedmont Corporation 1224 Clarks Mill Road, Ringold, Virginia 24531	12.41
				Total	798.85

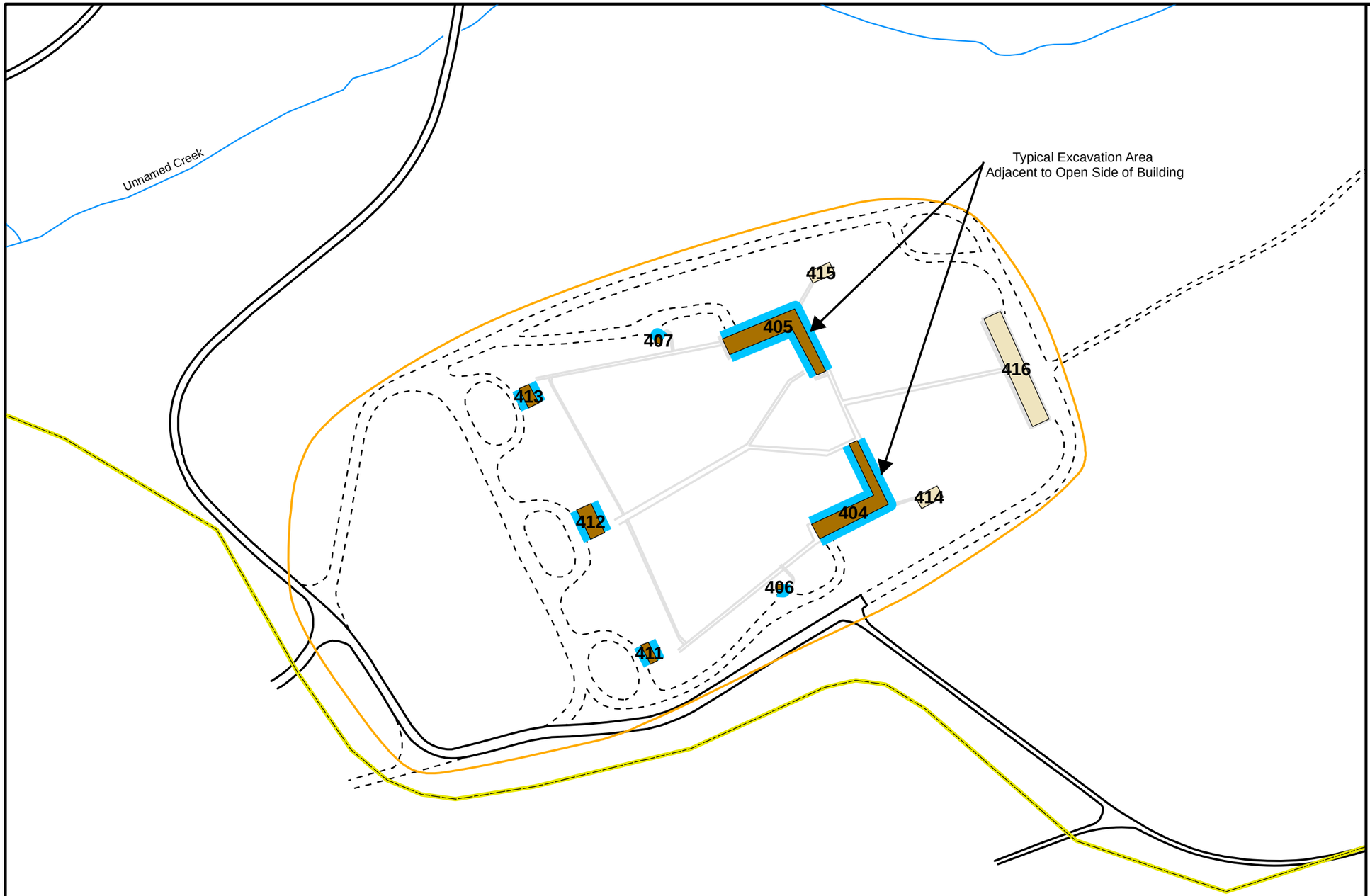
Table 4-9
Summary of Backfill Material Analytical Results for BLA and IAA
Radford Army Ammunition Plant - New River Unit

Location ID: Sample Depth(Feet): Date Collected: Sample Name:	USEPA Regional Screening Levels - Residential Soil	Facility Wide Background Concentration	Backfill 02/18/11 Backfilll (20110218)
Herbicides			
None Detected	--	--	--
Organochlorine Pesticides			
Endosulfan Sulfate	--	--	0.667
PCBs			
None Detected	--	--	--
Volatile Organics			
Bromofluorobenzene	--	--	39
Dibromofluoromethane	--	--	41
Semivolatile Organics			
None Detected	**--**	**--**	--
Inorganics			
Aluminum	77,000	40,041	23,600
Arsenic	0.39	15.8	9.54
Barium	15,000	209	60.6
Beryllium	160	1.02	**2.03**
Calcium	--	--	817
Chromium	230	65.3	39.0
Cobalt	23	72.3	16.2
Copper	3,100	53.5	30.0
Iron	55,000	50,962	40,600
Lead	400	26.8	21.6
Magnesium	--	--	3,980
Manganese	1,800	2,543	524
Mercury	3.1 {sat}	0.13	0.0569
Nickel	1500	62.8	25.3
Potassium	--	--	1,960
Selenium	390	--	0.504 J
Vanadium	390	108	69.0
Zinc	23,000	202	60.7

Notes:
J - The presence of a J to the right indicates that the reported result is estimated

23,600	Highlighted cell indicates constituent concentration above the USEPA Residential Regional Screening Value (RSL)
2.03	Bolded Value indicates constituent concentration above the facility-wide background concentration

{sat} Screening level may exceed saturation limit



NOTES:

1. REMOVAL OF CONDUCTIVE FLOORING WILL OCCUR AT THE BUILDINGS AS INDICATED BY THIS FIGURE.
2. EXCAVATION OF SOIL WILL PRIMARILY OCCUR ON THE OPEN SIDES OF THE BUILDINGS WHERE THERE ARE PATHWAYS FOR THE CONDUCTIVE FLOORING TO HAVE WASHED OFF OF THE BUILDING PADS ONTO THE ADJACENT SOIL AS DEPICTED IN THIS DRAWING, OR AS DETERMINED BY THE ENGINEER.
3. THE INITIAL EXCAVATION EXTENT WILL EXTEND HORIZONTALLY 2 FEET FROM THE BASE OF AFFECTED BUILDINGS, AND PROCEED VERTICALLY TO A DEPTH OF 1 FOOT. HOWEVER, THE FINAL EXCAVATION EXTENT WILL BE FIELD DETERMINED BY THE ENGINEER BASED UPON FIELD ANALYSIS, LABORATORY ANALYSIS, AND VISUAL CONFIRMATION.
4. UPON RECEIPT OF CONFIRMATION SAMPLING RESULTS INDICATING THAT THE FINAL EXCAVATION EXTENT HAS BEEN ACHIEVED, THE EXCAVATION AREAS SHALL BE BACKFILLED AND GRADED TO MATCH THE EXISTING GRADE.

Remedial Action Levels for Soil at the BLA	
Driver	**PRG**
Copper	11,533 mg/kg
Lead	624 mg/kg
Asbestos	0.1% by weight

0 200 400 Feet

GRAPHIC SCALE

LEGEND

- OPEN SIDE OF BUILDING, ADJACENT SOILS TO BE EXCAVATED
- PAVED ROADS
- DIRT ROADS
- SITE FEATURES
- SURFACE WATER
- FORMER RAISED WALKWAY PLATFORMS
- STUDY AREA
- INSTALLATION BOUNDARY
- FORMER BUILDINGS
  - NO CONDUCTIVE FLOORING
  - BUILDINGS THAT HISTORICALLY CONTAINED CONDUCTIVE FLOORING

NOTE:
BUILDINGS 404 AND 405 ARE TWO STORY BUILDINGS

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

PLANNED RESPONSE ACTION AREA AT THE BLA

ARCADIS

FIGURE
3-1

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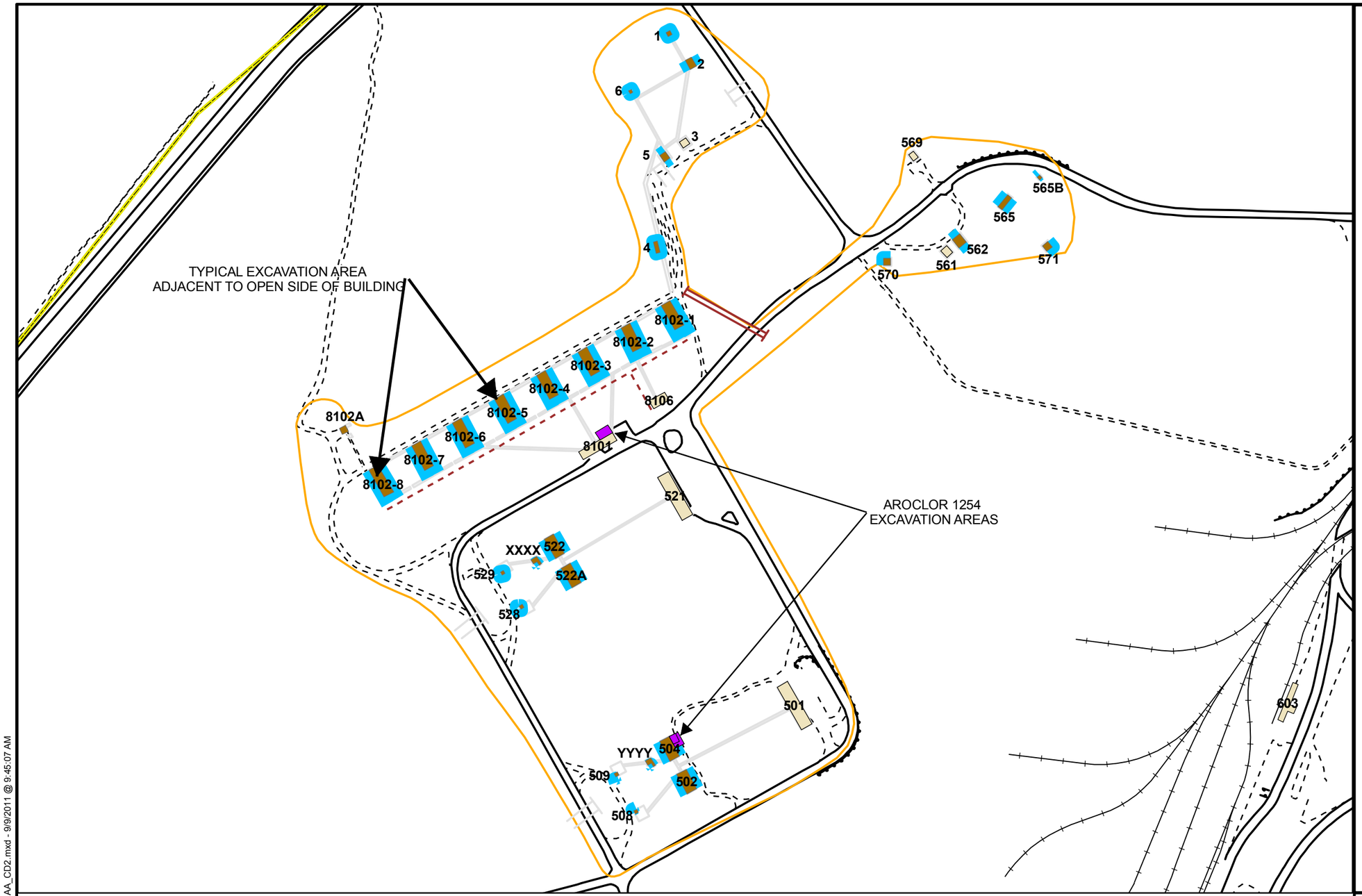

NOTES:

1. REMOVAL OF CONDUCTIVE FLOORING WILL OCCUR AT THE BUILDINGS AS INDICATED BY THIS FIGURE.
2. EXCAVATION OF SOIL WILL PRIMARILY OCCUR ON THE OPEN SIDES OF THE BUILDINGS WHERE THERE ARE PATHWAYS FOR THE CONDUCTIVE FLOORING TO HAVE WASHED OFF OF THE BUILDING PADS ONTO THE ADJACENT SOIL AS DEPICTED IN THIS DRAWING, OR AS DETERMINED BY THE ENGINEER.
3. SOILS THAT EXCEED THE REMEDIAL ACTION LEVEL FOR AROCLOR 1254 WILL REQUIRE EXCAVATION, AS INDICATED ON THIS DRAWING. THE EXCAVATION AREAS FOR AROCLOR 1254 ARE NOT TO SCALE AS DEPICTED ON THIS DRAWING FOR ILLUSTRATION PURPOSES. THE ACTUAL EXCAVATION EXTENT FOR AROCLOR 1254 WILL BE FIELD DETERMINED BY THE ENGINEER.
4. THE INITIAL EXCAVATION EXTENT WILL EXTEND HORIZONTALLY 2 FEET FROM THE BASE OF AFFECTED BUILDINGS, AND PROCEED VERTICALLY TO A DEPTH OF 1 FOOT. HOWEVER, THE FINAL EXCAVATION EXTENT WILL BE FIELD DETERMINED BY THE ENGINEER BASED UPON FIELD ANALYSIS, LABORATORY ANALYSIS, AND VISUAL CONFIRMATION.
5. UPON RECEIPT OF CONFIRMATION SAMPLING RESULTS INDICATING THAT THE FINAL EXCAVATION EXTENT HAS BEEN ACHIEVED, THE EXCAVATION AREAS SHALL BE BACKFILLED AND GRADED TO MATCH THE EXISTING GRADE.

Remedial Action Levels for Soil at the IAA

Driver	PRG
Copper	3,043 mg/kg
Lead	400 mg/kg
Aroclor 1254	0.21 mg/kg
Asbestos	0.1% by weight

N

0 300 600 Feet

GRAPHIC SCALE

LEGEND

- AROCLOR 1254 EXCAVATION AREAS
- OPEN SIDE OF BUILDING, ADJACENT SOILS TO BE EXCAVATED
- PAVED ROADS
- DIRT ROADS
- SITE FEATURES
- RAIL SPUR
- SURFACE WATER
- CULVERT
- SEWER LINE
- STUDY AREA
- INSTALLATION BOUNDARY

FORMER BUILDINGS

- NO CONDUCTIVE FLOORING
- BUILDINGS THAT HISTORICALLY CONTAINED CONDUCTIVE FLOORING

RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

PLANNED RESPONSE ACTION AREA AT THE IAA

ARCADIS

FIGURE 3-2

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