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RFI Work Plan

RAAP-031: Area of Concern A – Nitrocellulose Rainwater Ditch

Prepared for:
Radford Army Ammunition Plant

June 2008

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

www.atk.com

June 23, 2008

Mr. William Geiger
RCRA General Operations Branch, Mail Code: 3WC23
Waste and Chemicals Management Division
U. S. Environmental Protection Agency, Region III
1650 Arch Street
Philadelphia, PA 19103-2029

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

Subject: With Certification, Radford Army Ammunition Plant,
Draft RFI Work Plan
RAAP 031: Area of Concern A – Nitrocellulose Rainwater Ditch June 2008
EPA ID# VA1 210020730

Dear Mr. Geiger and Mr. Cutler:

Enclosed is the certification for the subject document that was sent to you on June 19, 2008. Also enclosed is a copy of the transmittal email message.

Please coordinate with and provide any questions or comments to myself at (540) 639-8658, Jerry Redder of my staff (540) 639-7536 or Jim McKenna, ACO Staff (540) 639-8641.

Sincerely,

P.W. Holt, Environmental Manager
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08-815-103
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From: McKenna, Jim J Mr CIV USA AMC [jim.mckenna@us.army.mil]
Sent: Thursday, June 19, 2008 9:03 AM
To: anne.greene@atk.com; beth lohman; dennis.druck@us.army.mil; Wisbeck, Diane; durwood willis2; Geiger.William@epamail.epa.gov; jerome.redder@atk.com; jim spencer; jlcutler@deq.virginia.gov; Llewellyn, Tim; Mendoza, Richard R Mr CIV USA IMCOM; Parks, Jeffrey N; Timothy.Leahy@shawgrp.com; Tina_Devine@URSCorp.com; Tom.Meyer@nab02.usace.army.mil
Subject: Draft Work Plan Addendum #26, RAAP-031 (AOC A) Fed Ex Tracking Numbers-Radford (UNCLASSIFIED)

Importance: High

Classification: UNCLASSIFIED
Caveats: NONE

All:

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

Jim McKenna

Classification: UNCLASSIFIED
Caveats: NONE

Concerning the following:

Draft RFI Work Plan
RAAP-031: Area of Concern A-Nitrocellulose Rainwater Ditch
June 2008

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

SIGNATURE:
PRINTED NAME: for Jon R. Drushal
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Commanding

SIGNATURE:
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TITLE: Vice President and General Manager
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08-815-103
JMcKenna

DEPARTMENT OF THE ARMY
US ARMY CENTER FOR HEALTH PROMOTION AND PREVENTIVE MEDICINE
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MCHB-TS-REH

2 JUL 2008

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

SUBJECT: Document Titled: "Draft RFI Work Plan, RAAP-031: Area of Concern A – Nitrocellulose Rainwater Ditch, Radford Army Ammunition Plant, Virginia, June 2008"

1. The U.S. Army Center for Health Promotion and Preventive Medicine reviewed without comment the subject document on behalf of the Office of The Surgeon General pursuant to Army Regulation 200-1 (Environmental Protection and Enhancement). We appreciate the opportunity to review this work plan.

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

FOR THE COMMANDER:

JEFFREY S. KIRKPATRICK
Director, Health Risk Management

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

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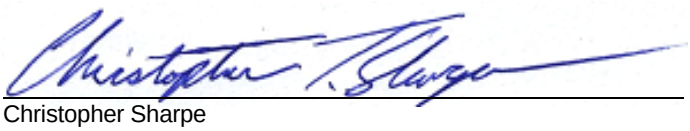
Work Plan Addendum 26
RFI Work Plan
Radford Army Ammunition Plant

RAAP-031: Area of Concern A – Nitrocellulose Rainwater Ditch

June 2008



Christopher Sharpe
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Diane D. Wisbeck
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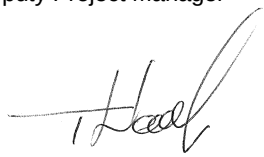

Tim Llewellyn
Project Manager

DRAFT
Radford Army Ammunition Plant
RFI Work Plan

RAAP-031:
Area of Concern A -
Nitrocellulose Rainwater Ditch

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Our Ref.:
GP08RAAP.0031

Date:
June 2008

Table of Contents

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List of Acronyms and Abbreviations

AEC	Army Environmental Command
ARCADIS	ARCADIS U.S., Inc.
bgs	below ground surface
COPCs	constituents of potential concern
CSM	Conceptual Site Model
DNT	Dinitrotolulene
FSP	Field Sampling Plan
Ft	feet
HSPA	Health and Safety Plan Addendum
IDM	Investigation derived materials
IRP	Installation Restoration Program
MMA	Main Manufacturing Area
MWP	Master Work Plan
NRU	New River Unit
PBC	Performance Based Contract
PCBs	Polychlorinated biphenyls
QA/QC	Quality control/quality assurance
QAPA	Quality Assurance Plan Addendum
RBC	Risk-Based Concentration
RCRA	Resource Conservation and Recovery Act
RFAAP	Radford Army Ammunition Plant
RFI	RCRA Facility Investigation
RFI/CMS	RCRA Facility Investigation/ Corrective Measures Study
SOP	Standard operating procedure
SSL	Soil Screening Level
SSP	Site Screening Process
SWMU	Solid Waste Management Unit
SVOC	Semivolatile organic compound
TAL	Target Analyte List
TCL	Target Compound List
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound

1. Introduction

ARCADIS U.S, Inc. (ARCADIS) has been retained by the United States Army Environmental Command (AEC) to perform Installation Restoration Program (IRP) activities at Radford Army Ammunition Plant (RFAAP), located in Radford Virginia (Figure 1). This work in being conducted under a Performance Based Contract (PBC) that encompasses the New River Unit (NRU), two Solid Waste Management Units (SWMUs), and one Hazardous Waste Management Unit (HWMU) currently under Resource Conservation and Recovery Act (RCRA) Part II Permit.

This site-specific RCRA Facility Investigation and Corrective Measures Study (RFI/CMS) Work Plan addresses potential soil and groundwater impacts relating to Area of Concern (AOC) A, also identified as RAAP-31, located within the installation's Main Manufacturing Area (MMA) (Figure 2). This plan incorporates by reference applicable Standard Operating Procedures (SOPs) included in the RFAAP Master Work Plan (MWP) (URS, 2003). This work plan is being submitted as Addendum 26 to the Master Work Plan.

1.1 Purpose and Objectives

The purpose of the RFI Work Plan for RAAP-031 is to facilitate the collection and analysis of the data necessary to evaluate the nature and extent of potential impacts to soil and complete a Human health Risk Assessment. Potential ecological risks will not be evaluated because the area is highly industrial in nature and there isn't any suitable habitat available. The results of previous sampling identified the presence of arsenic, 2, 4-dinitrotoluene, and Aroclor-1254 at concentrations greater than the screening levels. Based on these results, an RFI was recommended to delineate impacted soil. This Work Plan details the collection of additional soil data for the purpose of:

- Confirming the presence of 2,4-dinitrotoluene (DNT) and 2,6-DNT in surface soil at previously sampled locations ASB5A and ASB3A;

- Delineate the horizontal and vertical extent of impacted soil.

No groundwater samples have been collected at RAAP-031. The results of previously collected soil samples do not indicate the potential for groundwater to be impacted. Although shallow soil samples contained compounds at concentrations greater than screening levels, concentrations detected in deeper soil sample are less than USEPA Region 3 Soil Screening Levels (SSLs) (USEPA, 2007) indicating that contamination is

not sufficient to have a deleterious impact on groundwater. Therefore, no groundwater investigation is warranted.

1.2 Site Background

RAAP-031 (AOC A) is referred to as the nitrocellulose rainwater ditch (Figure 2). The AOC was identified by the United States Environmental Protection Agency (USEPA) in 1987 as a visually impacted one-foot deep soil-lined ditch adjacent to a nitrocellulose process building. At some point the ditch was converted to an open concrete culvert (see photograph). The former ditch lies between a grassy slope with overhead process lines, and a flat paved driveway used to access the adjacent building.

1.3 Geology and Hydrogeology

RAAP-031 is underlain by alluvial terrace deposits, residual and weathered dolomite rock (i.e., epikarst), and dolomite bedrock of the Elbrook Formation. The borings installed as part of the site screening investigation identified the following stratigraphy:

- 9 to 15 feet of fine grained alluvial terrace deposits consisting of sand, silt and clay,
- 2 to 5 feet coarse basal terrace deposits of silty gravel, and
- Residuum (silt and clay), of undetermined thickness.
- Bedrock was not encountered (i.e., surface is greater than 32 feet below grade).

Groundwater was encountered at depths of 23 to 28 ft bgs, within the residuum. No groundwater samples were collected or analyzed. Surface water is expected to move northward within the ditch to an adjacent grassy area.

1.4 Previous Investigation Results

RAAP-031 was investigated in 2003 as part of a RCRA Site Screening Process (SSP) (URS, 2007). Five soil borings were completed by hand-auger and direct-push to a maximum depth of 32 feet below ground surface (ft bgs). Soil samples were collected from each boring from the surface, intermediate and terminal depths, where feasible and submitted to an analytical laboratory for analysis. Samples were analyzed for Target Compound List (TCL) volatile organic compounds (VOCs), TCL semivolatile organic compounds (SVOCs), TCL pesticides, TCL herbicides, TCL Polychlorinated

Biphenyls (PCBs), Target Analyte List (TAL) inorganics, and explosives. Results were compared to USEPA Region 3 Risk-Based Concentrations (RBCs) for industrial soil (USEPA, 2007) and Facility-Wide Background Point Estimates (IT, 2001). A summary of the results and screening levels is presented on Table 1. The sample locations are presented on Figure 3. A summary of the investigation results is provided below.

- Metals: arsenic was detected at a concentration (20 mg/kg) greater than the background point estimate (15 mg/kg) at one location (ASB5 0-1). Iron was detected in two samples (ASB4 0-1 and ASB4 20) at concentrations (55,000 to 66,000 mg/kg) slightly greater than the background point estimate (50,000 mg/kg). However, iron concentrations were less than the industrial RBC (715,000 mg/kg).

- PCBs: Aroclor 1254 was detected (2.4 mg/kg) in one shallow soil sample (ASB5 0-1) in excess of its industrial soil RBC (1.4 mg/kg). The concentration of Aroclor 1254 in the sample collected at 7 ft bgs was less than both the industrial soil RBC and the SSL.

- SVOCs: Although the concentrations of 2, 4 and 2, 6-dinitrotoluene (DNT) were less than their screening levels, the concentration of the sum of 2, 4-DNT and 2, 6-DNT was greater than the industrial soil RBC for DNT mix in two samples. However, the DNTs were detected by two analytical methods (8330 and 8270), and the results are significantly different for both samples. At ASB5A, the explosives analytical method does not indicate an exceedance. At location ADB3A the explosives method did not indicate the presence of 2, 6-DNT while it was detected by the SVOC method. Neither 2, 4- and 2, 6-DNT were detected in the deeper samples collected at both locations ASB3 and ASB5. Lastly, the 2, 6-DNT concentration at ASB5A reported by URS (2007) was incorrect and should be 490 ug/kg according to the analytical laboratory report and validation documentation.

2. Field Sampling Plan

This site-specific Field Sampling Plan (FSP) describes the sampling activities that will be performed as part of the RFI for RAAP-031. Table 2 summarizes the field investigations described below.

2.1 Soil Sampling

Surface soil samples will be collected from 0 to 1 ft bgs at previously sampled locations ASB3 and ASB5 to confirm previous results. In addition, four borings will be advanced using a hand auger in the vicinity of ASB3 and ASB5 to delineate potentially impacted soil. Soil samples will be collected from 0 to 1 ft bgs and from 5 to 6 ft bgs. Soil sampling will be conducted following the surface soil sampling procedures described in MWP SOP 30.1. Proposed soil sampling locations are presented on Figure 3. Soil samples will be analyzed for TCL SVOCs, PCBs, and TAL metals. The compounds 2, 4- and 2, 6-DNT previously detected in soil samples collected at the site will be reported by the SVOC analysis which provides lower reporting limits and more reliable detection method.

2.2 Preliminary Site Inspection and Utility Mark-Out

Prior to any subsurface investigation, a preliminary site inspection and utility mark-out will be completed as follows:

- Call Miss Utility 48 hours prior to any intrusive activities (1-800-552-7001);
- Consult with installation personnel about the location of above and below ground utilities, tanks, foundations or process lines that may form drilling hazards;
- If appropriate, supervise a professional utility locator for the mark-out of the anticipated investigation locations; and
- Obtain any necessary site-specific work permits.

2.3 Investigation Derived Materials

Investigation derived materials (IDM) will be managed in accordance with SOP 70.1 in the Master Work Plan. Investigation derived materials include disposable Personal Protective Equipment (PPE) and supplies that have contacted impacted media.

3. Quality Control

Quality control/quality assurance (QA/QC) for this investigation will be handled in accordance with the Master QAPP (URS, 2003) as amended by the project QAPA, provided in Appendix A. This section describes the site-specific quality measures and protocol that will be utilized for the RFI for RAAP-031.

3.1 Data Quality Objectives for Measurement Data

Data Quality Objectives (DQOs) for RAAP-031 have been designed to allow for an evaluation of prior data collected at the site and to delineate both horizontal and vertical extent of potential impacts to soil. Results of the soil samples will be compared to industrial soil RBCs and SSLs.

The data sampling points described in Section 2 were selected to correspond to the prior sample locations and sample media. The types of analyses have also been chosen to correspond with the previous data. Although the general analyses types will be consistent with prior analyses, the specific methodologies used for this effort will be in accordance with Appendix A.

3.2 Measurement/Data Acquisition

Field, laboratory, and data handling procedures relating to activities performed at RAAP-031 will conform to the specific requirements detailed in the MWP (URS, 2003) and Appendix A. Quality control (QC) samples to be collected at RAAP-031 are specified in Table 2. In accordance with the project requirements, duplicate samples will be collected at a rate of one sample per 20 for each sample matrix. Rinse blanks will be collected at a rate of one per 20 samples collected using non-dedicated sampling equipment and specified in Table 2 also. Trip blanks will be not analyzed as samples will not be analyzed for VOCs. Note, soil samples will be analyzed for 2,4- and 2,6 DNT using USEPA SW-846 Method 8270 because the reporting limits are less than screening levels and the compound identification method (mass spectrometry) is more reliable than the Method 8330 which relies solely on retention time.

3.3 Assessment/Oversight

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

Activity	Standard Operating Procedure
Field logbook recordkeeping	10.1
Decontamination	80.1
Soil sampling	30.1
Sample labeling	50.1
Sample packaging	50.2
Management of investigation derived materials	70.1

3.4 Data Validation and Usability

Data validation for samples collected and analyzed from RAAP-031 will be conducted in accordance with Section 9 of Appendix A.

4. Reporting

The results of the field investigations and Human Health Risk Assessment will be presented in a RFI Report that will serve as the basis for corrective action decisions at this site. Dependent on the results of the investigation, the RFI report will detail the next steps necessary to achieve closure under the RCRA process for this site.

5. References

IT. 2001. Final Facility Wide Background Study Report. Radford Army Ammunition Plant. December.

URS. 2003. Final Master Work Plan, Radford Army Ammunition Plant.

URS. 2007. Site Screening Process Report for Solid Waste Management Units 13, 37, 38, 46, 57, 68, 69 and Areas of Concern A, F, Q. Radford Army Ammunition Plant, Radford, Virginia, May.

U.S. Environmental Protection Agency (USEPA). 2007. Region 3 Risk-Based Concentration Table. October.

Tables

Table 1
Summary of Previous Investigation Analytical Results
RAAP-031 AOC A - Nitrocellulose Rainwater Ditch
Radford Army Ammunition Plant, Radford, Virginia

Location ID: Sample Depth(Feet): Date Collected: Sample Name:	Industrial RBC With Background Substitution	Units	ASB1 0 - 1 10/11/03 ASB1A	ASB1 10 - 12 10/11/03 ASB1B	ASB1 26 - 28 10/11/03 ASB1C	ASB2 0 - 1 10/11/03 ASB2A	ASB2 10 - 12 10/11/03 ASB2B	ASB2 21 - 23 10/11/03 ASB2C	ASB3 0 - 1 10/11/03 ASB3A	ASB3 6 - 8 10/11/03 ASB3B	ASB3 13 - 14.7 10/11/03 ASB3C	ASB4 0 - 1 04/20/06 ASB4-A	ASB4 10 - 11 04/20/06 ASB4-B	ASB4 20 04/20/06 ASB4-C	ASB5 0 - 1 04/20/06 ASB5-A	ASB5 7 04/20/06 ASB5-B
Compound type/ Name																
Explosives																
2,4-Dinitrotoluene	200 {N}	mg/kg	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U [0.5 U]	0.2 J	20	0.5 U	0.5 U	0.5 U [0.5 U]	0.5 U	0.5 U	1.3	0.5 U
2,6-Dinitrotoluene	100 {N}	mg/kg	1 U	1 U	1 U	1 U	1 U [1 U]	1 U	1 U	1 U	1 U	1 U [1 U]	1 U	1 U	0.25 J,J	1 U
Dinitrotoluene Mix	4.2 {C}	mg/kg	1 U	1 U	1 U	1 U	1 U [1 U]	0.2	20	1 U	1 U	1 U [1 U]	1 U	1 U	1.55	1 U
Organochlorine Pesticides																
Aroclor-1254	1.4 {C}	mg/kg	NA	NA	NA	0.0099 J	NA	NA	NA	NA	NA	0.00014 [0.03 J]	0.041 J	0.049 U	2.4	0.16
Dieldrin	0.18 {C}	mg/kg	NA	NA	NA	0.025 U	NA	NA	NA	NA	NA	0.014 J,J [0.0032 J,J]	0.0046 J,J	0.03 U	0.51 U	0.027 U
PAHs																
Benzo(a)anthracene	3.9 {C}	mg/kg	0.026 U	0.027 U	0.027 U	0.0036 J	0.028 U [0.029 U]	0.065 U	0.026 U	0.026 U,UL	0.025 U	NA	NA	NA	NA	NA
Chrysene	390 {C}	mg/kg	0.005 J	0.027 U	0.027 U	0.0037 J	0.028 U [0.029 U]	0.065 U	0.026 U	0.026 U,UL	0.0018 J	NA	NA	NA	NA	NA
Fluoranthene	4,100 {N}	mg/kg	0.017 J,J	0.027 U	0.027 U	0.0077 J	0.028 U [0.029 U]	0.065 U	0.026 U	0.026 U,UL	0.0087 J	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	3.9 {C}	mg/kg	0.026 U	0.027 U	0.027 U	0.0062 J	0.028 U [0.029 U]	0.065 U	0.026 U	0.026 U,UL	0.025 U	NA	NA	NA	NA	NA
Phenanthrene	3,100 {N}	mg/kg	0.0031 J	0.027 U	0.027 U	0.004 J	0.028 U [0.029 U]	0.065 U	0.0019 J	0.026 U,UL	0.003 J	NA	NA	NA	NA	NA
Pyrene	3,100 {N}	mg/kg	0.011 J	0.027 U	0.027 U	0.021 J	0.028 U [0.029 U]	0.065 U	0.026 U	0.026 U,UL	0.0099 J	NA	NA	NA	NA	NA
SVOCs-TIC																
(Z)-9-Octadecenamide	- -	mg/kg	NA	1.6 E,NJ	NA	0.19 E,NJ	0.23 E,NJ [0.094 E,NJ]	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Benzenedicarboxylic acid, butyl 2-e	- -	mg/kg	NA	NA	NA	NA	NA	NA	0.56 E,NJ	NA	NA	NA	NA	NA	NA	NA
1,2-Benzenedicarboxylic acid, butyl 2-me	- -	mg/kg	0.06 E,NJ	NA	NA	NA	NA	NA	NA	0.42 E,NJ	0.34 E,NJ	NA	NA	NA	NA	NA
1,2-Benzenedicarboxylicacid, bis(2-methy	- -	mg/kg	NA	0.11 E,B	0.2 E,NJ	0.49 E,NJ	0.51 E,NJ	0.5 E,NJ	0.17 E,NJ	NA	NA	NA	NA	NA	NA	NA
1-Dodecanol	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	0.047 E,NJ	NA	NA	NA	NA	NA	NA
1-Heptadecanol	- -	mg/kg	NA	NA	NA	NA	NA	0.26 E,NJ	NA	NA	NA	NA	NA	NA	NA	NA
1-Pentadecanol	- -	mg/kg	NA	NA	NA	NA	NA	NA	NA	0.04 E,NJ	NA	NA	NA	NA	NA	NA
2(5H)-Furanone, 5,5-dimethyl-	- -	mg/kg	NA	NA	0.049 E,NJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-Triallyloxy-1,3,5-triazine	- -	mg/kg	NA	NA	NA	NA	0.087 E,B [0.069 E,B]	NA	NA	0.094 E,B	0.065 E,B	NA	NA	NA	NA	NA
2-Ethyl-1-Hexanol	- -	mg/kg	NA	0.033 E,NJ	NA	NA	NA	NA	NA	NA	0.03 E,NJ	NA	NA	NA	NA	NA
Benzenamine, 4-nitro-N-phenyl-	- -	mg/kg	NA	NA	NA	NA	NA	NA	0.31 E,NJ	NA	NA	NA	NA	NA	NA	NA
Benzeneamine, 2-nitro-N-phenyl-	- -	mg/kg	0.14 E,NJ	NA	NA	NA	NA	NA	0.52 E,NJ	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl)maleate	- -	mg/kg	NA	NA	NA	NA	NA	0.076 E,NJ	NA	NA	NA	NA	NA	NA	NA	NA
Erucylamide	- -	mg/kg	1.5 E,B	NA	NA	1.1 E,B	NA	NA	NA	NA	0.95 E,B	NA	NA	NA	NA	NA
Phosphonic acid, dioctadecyl ester	- -	mg/kg	NA	0.024 E,NJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Volatile Organics																
Acetone	92,000 {N}	mg/kg	0.015 J,B	0.019 J,B	0.029 ,B	0.016 J,B	0.023 J,B [0.024 J,B]	0.023 J,B	0.012 J,B	0.019 J,B	0.018 J,B	0.38 J,B [0.38 J,B]	0.39 J,B	0.46 J,B	0.42 J,B	0.37 J,B
Benzene	52 {C}	mg/kg	0.0061 U	0.0064 U	0.0065 U	0.0062 U	0.0066 U [0.0069 U]	0.0068 U	0.0062 U	0.0062 U	0.0060 U	0.013 J [0.065 U]	0.064 U	0.075 U	0.063 U	0.068 U
Ethylbenzene	10,000 {N}	mg/kg	0.0061 U	0.0064 U	0.0065 U	0.0062 U	0.0066 U [0.0069 U]	0.0068 U	0.0062 U	0.0062 U	0.0060 U	0.015 J [0.065 U]	0.064 U	0.075 U	0.063 U	0.068 U
Methyl acetate	100,000 {N}	mg/kg	0.024 U	0.026 U	0.026 U,UJ	0.025 U	0.026 U [0.028 U]	0.027 U	0.025 U	0.025 U	0.024 U	0.085 J [0.089 J]	0.19 J	0.081 J	0.14 J	0.076 J
Methylene Chloride	380 {C}	mg/kg	0.0049 J	0.0059 J	0.0066 J,B	0.0045 J	0.0077 J [0.0070 J]	0.011 J	0.0053 J	0.0066 J	0.0037 J	0.094 JB,B [0.097 JB,B]	0.099 JB,B	0.11 JB,B	0.094 JB,B	0.10 JB,B
Toluene	8,200 {N}	mg/kg	0.0061 U	0.0064 U	0.0065 U	0.0062 U	0.0066 U [0.0069 U]	0.0068 U	0.0062 U	0.0062 U	0.0060 U	0.081 [0.065 U]	0.064 U	0.075 U	0.063 U	0.068 U
Xylenes (total)	20,000 {N}	mg/kg	0.0061 U	0.0064 U	0.0065 U	0.0062 U	0.0066 U [0.0069 U]	0.0068 U	0.0062 U	0.0062 U	0.0060 U	0.10 J [0.19 U]	0.19 U	0.22 U	0.19 U	0.21 U
Semivolatile Organics																
1,1'-Biphenyl	5,100 {N}	mg/kg	0.21 U	0.22 U	0.22 U	0.21 U	0.22 U [0.22 U]	0.23 U	0.21 U	0.21 U	0.20 U	0.022 U [0.022 U]	0.022 U	0.025 U	0.0022 J	0.023 U
2,4-Dinitrotoluene	200 {N}	mg/kg	0.85 J	0.22 U	0.22 U	1.0 U	0.22 U [0.22 U]	0.23 U	28 J	0.023 J	0.20 U	0.044 U [0.044 U]	0.044 U	0.051 U	11	0.047 U
2,6-Dinitrotoluene	100 {N}	mg/kg	0.082 J	0.22 U	0.22 U	0.10 J	0.22 U [0.22 U]	0.23 U	3.3 E,J	0.21 U	0.20 U	0.022 U [0.022 U]	0.022 U	0.025 U	0.49	0.023 U
2-Methylnaphthalene	410 {N}	mg/kg	0.21 U	0.22 U	0.22 U	0.21 U	0.22 U [0.22 U]	0.23 U	0.21 U	0.21 U	0.20 U	0.022 U [0.022 U]	0.022 U	0.025 U	0.0049 J	0.023 U
Acenaphthene	6,100 {N}	mg/kg	0.21 U	0.22 U	0.22 U	0.21 U	0.22 U [0.22 U]	0.23 U	0.21 U	0.21 U	0.20 U	0.022 U [0.022 U]	0.022 U	0.025 U	0.0066 J	0.023 U
Acenaphthylene	3,100 {N}	mg/kg	0.21 U	0.22 U	0.22 U	0.21 U	0.22 U [0.22 U]	0.23 U	0.21 U	0.21 U	0.20 U	0.022 U [0.022 U]	0.022 U	0.025 U	0.021 J	0.023 U
Anthracene	31,000 {N}	mg/kg	0.21 U	0.22 U	0.22 U	0.21 U	0.22 U [0.22 U]	0.23 U	0.21 U	0.21 U	0.20 U	0.022 U [0.022 U]	0.022 U	0.025 U	0.021 J	0.023 U
Benzo(a)anthracene	3.9 {C}	mg/kg	0.21 U	0.22 U	0.22 U	0.21 U	0.22 U [0.22 U]	0.23 U	0.21 U	0.21 U	0.20 U	0.022 U [0.022 U]	0.022 U	0.025 U	0.072	0.023 U
Benzo(a)pyrene	0.39 {C}	mg/kg	0.0090 J	0.22 U	0.22 U	0.21 U	0.22 U [0.22 U]	0.23 U	0.010 J,J	0.21 U	0.20 U	0.022 U [0.022 U]	0.022 U	0.025 U	0.022	0.023 U
Benzo(b)fluoranthene	3.9 {C}	mg/kg	0.016 J,J	0.22 U	0.22 U	0.21 U	0.22 U [0.22 U]	0.23 U	0.21 U,UJ	0.21 U	0.20 U	0.022 U [0.022 U]	0.022 U	0.025 U	0.12	0.023 U
Benzo(k)fluoranthene	39 {C}	mg/kg	0.21 U	0.22 U	0.22 U	0.21 U	0.22 U [0.22 U]	0.23 U	0.21 U,UJ	0.21 U	0.20 U	0.022 U [0.022 U]	0.022 U	0.025 U	0.036	0.023 U
bis(2-Ethylhexyl)phthalate	200 {C}	mg/kg	1.4	0.022 J	0.017 J	0.11 J	0.022 J [0.016 J]	0.034 J	1.2 E,J	0.020 J	0.022 J	0.16 ,J [0.31 ,J]	0.42	0.038 J	5.7	0.13
Butylbenzylphthalate	20,000 {N}	mg/kg	0.21 U	0.22 U	0.22 U	0.21 U	0.22 U [0.22 U]	0.0090 J	0.24	0.21 U	0.20 U	0.087 U [0.088 U]	0.087 U	0.10 U	0.16	0.093 U
Chrysene	390 {C}	mg/kg	0.015 J	0.22 U	0.22 U	0.21 U	0.22 U [0.22 U]	0.23 U	0.21 U	0.21 U	0.20 J	0.022 U [0.022 U]	0.022 U	0.025 U	0.087	0.023 U
Diethylphthalate	82,000 {N}	mg/kg	0.014 J	0.0080 J	0.010 J	0.010 J	0.010 J [0.22 U]	0.0080 J	0.014 J	0.010 J	0.0080 J	0.026 [0.0068 J]	0.0084 J	0.0077 J	0.024	0.0039 J
Dimethylphthalate	- -	mg/kg	0.21	0.22 U	0.22 U	0.21 U	0.22 U [0.22 U]	0.23 U	0.21 U	0.21 U	0.20 U	0.022 U [0.022 U]	0.022 U	0.025 U	0.21	0.023 U
Di-n-Butylphthalate	10,000 {N}	mg/kg	5.1	0.093 J	0.13 J	4.3	0.59 [0.64]	0.60	130	0.32	0.32	0.15 [0.10]	0.47	0.0098 J	62	0.089
Dinitrotoluene Mix	4.2 {C}	mg/kg	0.93	0.22 U	0.22 U	1.1	0.22 U [0.22 U]	0.23 U	31	0.023	0.20 U	0.022 U [0.022 U]	0.022 U	0.025 U	12	0.023 U
Di-n-Octylphthalate	- -	mg/kg	0.21 U	0.22 U	0.22 U	0.21 U	0.22 U [0.22 U]	0.23 U	0.038 J	0.21 U	0.20 U	0.014 J [0.012 J]	0.013 J	0.025 U	0.055	0.023 U
Fluoranthene	4,100 {N}	mg/kg	0.030 J	0.22 U	0.22 U	0.0030 J	0.22 U [0.22 U]	0.23 U	0.0088 J	0.21 U	0.20 J	0.022 U [0.022 U]	0.022 U	0.025 U	0.43	0.023 U
Fluorene	4,100 {N}	mg/kg	0.21 U	0.22 U	0.22 U	0.21 U	0.22 U [0.22 U]	0.23 U	0.21 U	0.21 U	0.20 U	0.022 U [0.022 U]	0.022 U	0.025 U	0.014 J	0.023 U
Indeno(1,2,3-cd)pyrene	3.9 {C}	mg/kg	0.0060 J	0.22 U	0.22 U	0.21 U	0.22 U [0.22 U]	0.23 U	0.21 UJ,UJ	0.21 U	0.20 U	0.087 U [0.088 U]	0.087 U	0.10 U	0.086 U	0.093 U

Table 1
Summary of Previous Investigation Analytical Results
RAAP-031 AOC A - Nitrocellulose Rainwater Ditch
Radford Army Ammunition Plant, Radford, Virginia

Location ID: Sample Depth(Feet): Date Collected: Sample Name:	Industrial RBC With Background Substitution	Units	ASB1 0 - 1 10/11/03 ASB1A	ASB1 10 - 12 10/11/03 ASB1B	ASB1 26 - 28 10/11/03 ASB1C	ASB2 0 - 1 10/11/03 ASB2A	ASB2 10 - 12 10/11/03 ASB2B	ASB2 21 - 23 10/11/03 ASB2C	ASB3 0 - 1 10/11/03 ASB3A	ASB3 6 - 8 10/11/03 ASB3B	ASB3 13 - 14.7 10/11/03 ASB3C	ASB4 0 - 1 04/20/06 ASB4-A	ASB4 10 - 11 04/20/06 ASB4-B	ASB4 20 04/20/06 ASB4-C	ASB5 0 - 1 04/20/06 ASB5-A	ASB5 7 04/20/06 ASB5-B
N-Nitrosodiphenylamine	580 {C}	mg/kg	1.0	0.22 U	0.22 U	0.12 J	0.22 U [0.22 U]	0.23 U	4.7 J	0.0080 J	0.20 U	1.0 ,J [0.34 ,J]	0.15	0.025 U	2.9	0.0052 J
Pentachlorophenol	24 {C}	mg/kg	0.40 U	0.42 U	0.43 U	0.41 U	0.43 U [0.43 U]	0.45 U	0.41 U	0.41 U	0.39 U	0.044 U [0.044 U]	0.044 U	0.051 U	0.10	0.047 U
Phenanthrene	3,100 {N}	mg/kg	0.011 J	0.22 U	0.22 U	0.21 U	0.22 U [0.22 U]	0.23 U	0.0038 J	0.21 U	0.20 J	0.022 U [0.022 U]	0.022 U	0.025 U	0.16	0.023 U
Pyrene	3,100 {N}	mg/kg	0.026 J	0.22 U	0.22 U	0.0030 J	0.22 U [0.22 U]	0.23 U	0.0067 J	0.21 U	0.20 J	0.022 U [0.022 U]	0.022 U	0.025 U	0.24	0.023 U
Inorganics																
Aluminum	- -	mg/kg	32,000	30,800	36,300	28,500	32,300 [34,800]	35,000	32,100	28,300	24,500	33,000 ,J [28,000 ,J]	26,000 ,J	27,000 ,J	21,000 ,J	36,000 ,J
Antimony	40.88 {N}	mg/kg	0.0860 J	0.500 U	0.180 J	0.0710 J	0.500 U [0.0680 J]	0.500 U	0.500 U	0.500 U	0.500 U	0.100 J,J [0.240 J,J]	0.500 U,UJ	0.140 J,J	0.630 ,J	0.500 U,UJ
Arsenic	15.8 {bgrnd}	mg/kg	3.00	1.80	8.10	2.90	3.40 [4.70]	4.50	1.90	1.60	2.20	2.00 ,J [1.70 ,J]	1.60 ,J	4.20 ,J	20.0 ,J	1.80 ,J
Barium	20,440 {N}	mg/kg	86.0	99.0	115	61.0	77.0 [98.0]	88.0	114	63.0	50.0	67.0 ,J [57.0 ,J]	50.0 ,J	86.0 ,J	150 ,J	94.0 ,J
Beryllium	204.4 {N}	mg/kg	0.530 J	0.900 J	1.80	0.550 J	1.30 [0.860 J]	0.590 J	0.620 J	0.570 J	0.640 J	0.550 J,J [0.640 J,J]	0.590 J,J	1.10 ,J	0.590 J,J	0.840 J,J
Cadmium	51.1 {N}	mg/kg	0.940 J	1.00 U	0.460 J	0.260 J	0.360 J [1.00 U]	1.00 U	1.00 U	0.750 J	1.00 U	0.0760 J,J [0.170 J,J]	0.0360 J,J	0.150 J,J	1.30 ,J	0.0720 J,J
Calcium	- -	mg/kg	2,570	408	126 J	6,100	867 [380]	310	3,910	644	293	2,200 ,J [2,100 ,J]	710 ,J	320 ,J	18,000 ,J	220 J,J
Chromium	306.6 {N}	mg/kg	38.0 ,J	31.0 ,J	40.0 ,J	36.0 ,J	39.0 ,J [41.0 ,J]	52.0 ,J	33.0 ,J	30.0 ,J	41.0 ,J	29.0 ,J [43.0 ,J]	28.0 ,J	21.0 ,J	100 ,J	30.0 ,J
Cobalt	- -	mg/kg	8.80 ,J	24.0 ,J	15.0 ,J	9.30 ,J	14.0 ,J [22.0 ,J]	20.0 ,J	24.0 ,J	12.0 ,J	11.0 ,J	6.20 ,J [6.20 ,J]	6.30 ,J	33.0 ,J	6.90 ,J	22.0 ,J
Copper	4,088 {N}	mg/kg	155	20.0	43.0	57.0	19.0 [23.0]	22.0	36.0	17.0	14.0	460 ,J [560 ,J]	15.0 ,J	30.0 ,J	150 ,J	21.0 ,J
Cyanide	2,044 {N}	mg/kg	0.0600 J	0.500 U	0.470 J	0.230 J	0.180 J [0.140 J]	0.500 U	0.150 J	0.500 U	0.500 U	0.260 U [0.260 U]	0.260 U	0.720	0.210 j	0.600
Iron	50,962 {bgrnd}	mg/kg	41,600	37,500	42,200	38,100	40,300 [38,000]	40,200	38,300	36,500	33,600	40,000 ,J [66,000 ,J]	33,000 ,J	55,000 ,J	33,000 ,J	47,000 ,J
Lead	750	mg/kg	76.0	26.0	19.0	25.0	8.80 ,J [13.0 ,J]	12.0	34.0	11.0	12.0	30.0 ,J [34.0 ,J]	13.0 ,J	25.0 ,J	330 ,J	24.0 ,J
Magnesium	- -	mg/kg	2,450	2,050	5,870	3,180	5,220 ,J [2,800 ,J]	2,120	2,090	1,980	1,160	2,600 ,J [2,400 ,J]	1,300 ,J	3,900 ,J	10,000 ,J	2,700 ,J
Manganese	2,543 {bgrnd}	mg/kg	315	1,750	1,170	426	648 [859]	704	2,400	483	330	290 ,J [350 ,J]	260 ,J	1,700 ,J	310 ,J	950 ,J
Mercury	30.66	mg/kg	0.0670 J	0.0190 J	0.0750 J	0.0450 J	0.0140 J [0.0220 J]	0.0200 J	0.0520 J	0.0300 J	0.0250 J	0.0410 J,J [0.0350 J,J]	0.0330 J,J	0.0250 J,J	0.140 ,J	0.0620 J,J
Nickel	2,044 {N}	mg/kg	13.0	16.0	28.0	13.0	36.0 ,J [21.0 ,J]	20.0	12.0	13.0	14.0	16.0 ,J [13.0 ,J]	12.0 ,J	32.0 ,J	13.0 ,J	19.0 ,J
Potassium	- -	mg/kg	1,540	1,840	3,780	1,220	2,750 ,J [1,560 ,J]	1,260	1,410	1,670	1,010	1,600 ,J [1,500 ,J]	1,200 ,J	2,600 ,J	1,100 ,J	2,600 ,J
Selenium	511 {N}	mg/kg	0.560 J	0.520 J	0.990 J	0.470 J	0.600 J [0.500 J]	0.450 J	0.300 J	0.400 J	0.400 J	1.00 U,UJ [0.0700 J,J]	0.0700 J,J	0.100 J,J	0.320 J,J	0.160 J,J
Silver	511 {N}	mg/kg	0.0700 J	0.0610 J	0.110 J	0.0720 J	0.0930 J [0.0940 J]	0.0750 J	0.0540 J	0.0480 J	0.0740 J	0.100 J,J [0.0650 J,J]	0.0450 J,J	0.190 J,J	0.180 J,J	0.0640 J,J
Sodium	- -	mg/kg	95.0 J	122	54.0 J	77.0 J	77.0 J [50.0 J]	50.0 J	207	237	131	120 ,J [49.0 J,J]	330 ,J	100 U,UJ	41.0 J,J	100 U,J
Thallium	7.154 {N}	mg/kg	0.240 J,B	0.430 J	0.450 J	0.230 J,B	0.230 J,B [0.220 J,B]	0.210 J,B	0.480 J	0.200 J,B	0.150 J,B	0.320 J,J [0.240 J,J]	0.190 J,J	0.370 J,J	0.210 J,J	0.390 J,J
Vanadium	108 {bgrnd}	mg/kg	68.0 ,L	66.0 ,L	56.0 ,L	63.0 ,L	55.0 ,L [49.0 ,L]	54.0 ,L	68.0 ,L	66.0 ,L	42.0 ,L	91.0 ,J [75.0 ,J]	71.0 ,J	77.0 ,J	56.0 ,J	96.0 ,J
Zinc	30,660 {N}	mg/kg	78.0	56.0	109	58.0	45.0 [37.0]	40.0	56.0	46.0	44.0	76.0 ,J [140 ,J]	47.0 ,J	37.0 ,J	1,400 ,J	69.0 ,J
Miscellaneous																
Percent Solids	- -	%	82	78	77	80	76 [72]	73	80	80	84	78 [77]	78	67	79	73

Notes:

CAS = Chemical Abstracts Service
mg/kg = Milligram Per Kilogram
PCB = Polychlorinated Biphenyl
VOC = Volatile Organic Compound
SVOC = Semivolatile Organic Compound
PAH = Polynuclear Aromatic Compound
TIC = Tentatively Identified Compound
Duplicate results shown in brakets [66,000 ,J)
bgrnd = Facility wide background level substituted for RBC where background level is greater.
As reported in the Facility-Wide Background Study Report (IT 2001a)

MDL = Method Detection Limit
RL = Reporting Limit
NT = Not Tested
NI = Not Identified
NA = Not Applicable

RBC = USEPA Region III Risk-Based Concentration
Adjusted RBCs = a Hazard Quotient (HQ) of 0.1 applied to non-carcinoc
C = Carcinogenic per EPA RBC Table (October 2006)
N = Noncarcinogenic per EPA RBC Table (October 2006)
SSL DAF20 = Soil Screening Level at a Dilution Attenuation Factor of 2(

= Concentration Exceeds RBC/or Background

Laboratory Qualifiers (preceed comma)

U The compound was analyzed for but not detected. The reporting limit will be adjusted to reflect any dilution, and for soil, the percent moisture.
J Estimated value.
B Analyte found in associated blank as well as in the sample.
E Concentration exceeded the upper level of the calibration range of the instrument for that specific analysis. For TICs, compound not present in calibration standard, calculated using total peak areas ion chromatographs and response factor of 1.

Validation Qualifiers (follow comma)

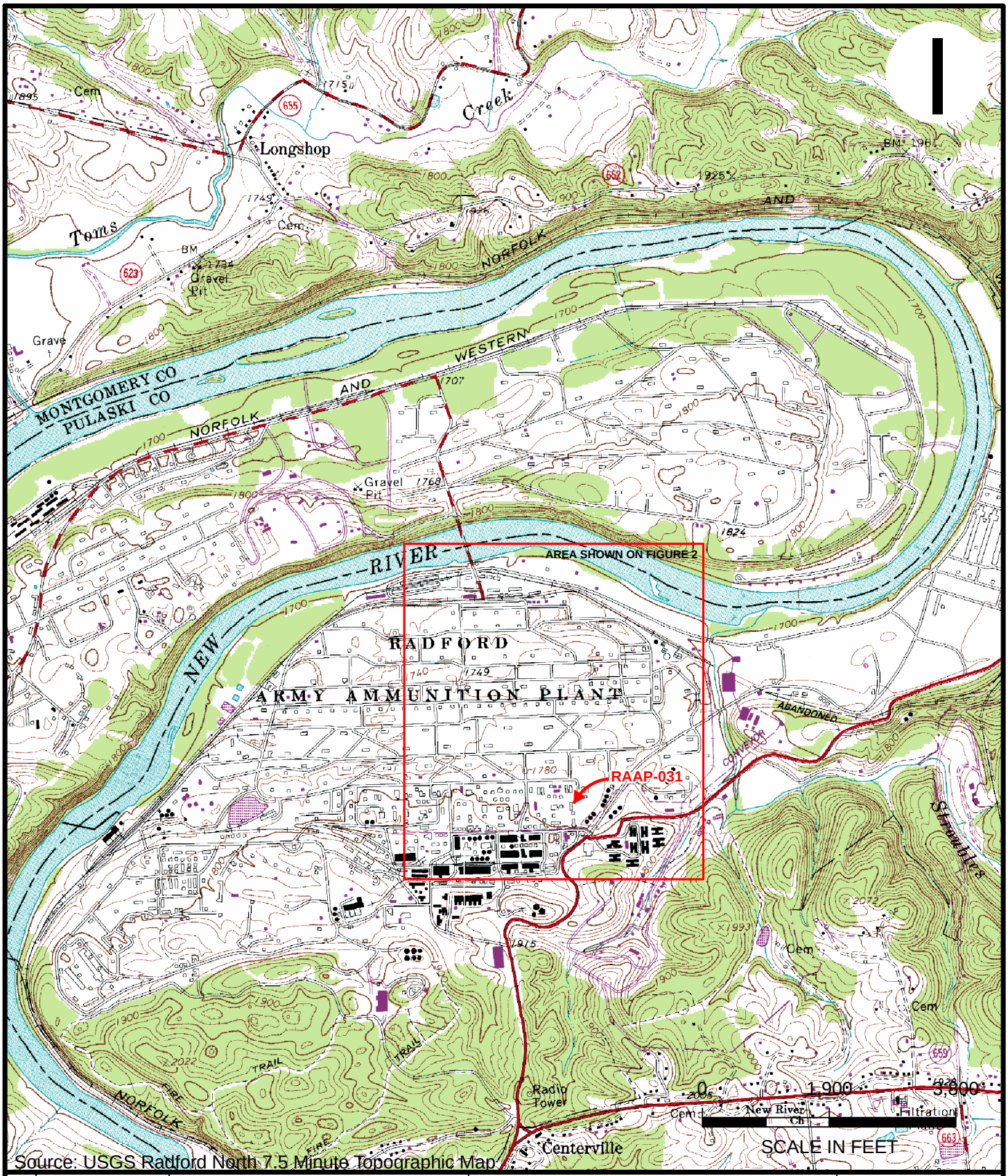
B Not detected substantially above the level reported in laboratory or field blanks.
N Tentative Identification. Consider present. Special methods may be needed to confirm its presence or absence in future sampling efforts.
J Analyte present. Reported value may not be accurate or precise.
K Analyte present. Reported value may be biased high. Actual value is expected to be lower.
L Analyte present. Reported value may be biased low. Actual value is expected to be higher.
UJ Not detected, quantitation limit may be inaccurate or imprecise.
UL Not detected, quantitation limit is probably higher.

Table 2
Field Investigation Summary
RAAP-031: AOC A – Nitrocellulose Rainwater Ditch
Radford Army Ammunition Plant, Radford, Virginia

Field Investigation	Investigation Methodology	Number of Samples (Planned/QC)	Sample Media	Analysis	Sample Numbering
Confirmation Soil Sampling	Collect confirmation soil samples at two previously sampled locations (ASB3 and ASB5)	2	Soil	SVOCs, PCBs, Metals	ASB3(DEPTH) ASB5(DEPTH)
Delineation Soil Sampling	Install 4 borings in the vicinity of ASB3 and ASB5 and collected two samples per boring (0 to 1 ft bgs and 5 to 6 ft bgs)	8	Soil	SVOCs, PCBs, Metals	ASB6(DEPTH) ASB7(DEPTH) ASB8(DEPTH) ASB9(DEPTH)
QC Samples: 1. Field Duplicate 2. Rinsate	Duplicate sample sent blind to laboratory One rinsate for non-dedicated soil sampling equipment	1 1	Soil NA	SVOCs, PCB, Metals SVOCs, PCB, Metals	DUP1(DEPTH) EB(DATE)

NOTES:
Ft bgs – feet below ground surface
NA – Not applicable
PCBs – Polychlorinated Biphenyls
SVOCs – Semi-Volatile organic compounds

Figures



Source: USGS Radford North 7.5 Minute Topographic Map

DRAFT

Area Manager	
Project Director	
Task Manager	
Technical Review	

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RADFORD ARMY AMMUNITION PLANT

SITE LOCATION
MAIN MANUFACTURING AREA

RADFORD, VIRGINIA

Project Number	GP08RAAP.0047
Date	12-MAR-2008
Figure Number	1

Area Manager

Project Director

DRAFT

Task Manager

Technical Review

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RADFORD ARMY AMMUNITION PLANT

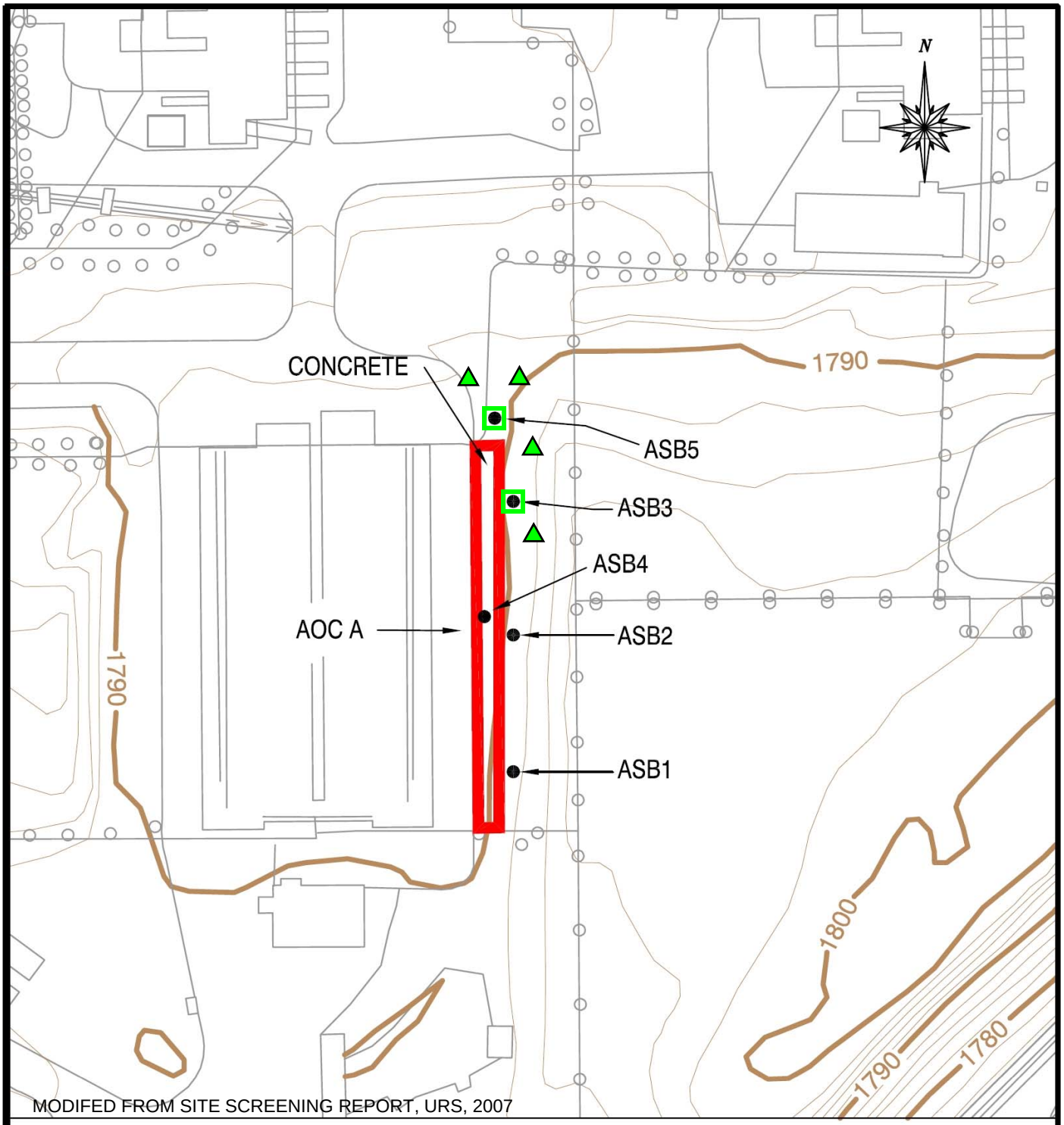
RAAP-31 LOCATION

RADFORD, VIRGINIA

Project Number
GP08RAAP.0047

Date
12-MAR-2008

Figure Number
2



MODIFED FROM SITE SCREENING REPORT, URS, 2007

LEGEND

- AOC A APPROXIMATE BOUNDARY
- ABOVE-GROUND PIPING
- SSP BORING LOCATION
- PROPOSED CONFIRMATION SAMPLE LOCATION
- PROPOSED DELINEATION SAMPLE LOCATION

0 50'

1 inch = 50 feet

Area Manager

DRAFT

Project Director

Task Manager

Technical Review

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RADFORD ARMY AMMUNITION PLANT

RAAP-31 PROPOSED SAMPLE LOCATIONS

RADFORD, VIRGINIA

Project Number
GP08RAAP0047

Date
15 APRIL 2008

Figure Number
3

Appendix A

Quality Assurance Project Addendum

(Provided on CD)