VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

FINAL HAZARDOUS WASTE PERMIT FOR THERMAL TREATMENT OF HAZARDOUS WASTE BY OPEN BURNING
RADFORD ARMY AMMUNITION PLANT
RADFORD, VIRGINIA
EPA I.D. #: VA1210020730
AUGUST 18, 2021

Commonwealth of Virginia

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

1111 E. Main Street, Suite 1400, Richmond, Virginia 23219
P.O. Box 1105, Richmond, Virginia 23218
(800) 592-5482 FAX (804) 698-4178
www.deq.virginia.gov

Matthew J. Strickler
Secretary of Natural and Historic Resources

David K. Paylor
Director
(804) 698-4000

PERMIT FOR THE THERMAL TREATMENT OF HAZARDOUS WASTE BY OPEN BURNING

Permittee: Radford Army Ammunition Plant and BAE Systems, Inc.
4050 Peppers Ferry Road
Radford, VA 24143

EPA I.D. #: VA1210020730

Pursuant to Chapter 14, Article 4, Title 10.1, Code of Virginia (1950), as amended, and regulations promulgated thereunder by the Virginia Department of Environmental Quality, a Hazardous Waste Management Permit is issued to the United States Army and to BAE Systems, Inc. at Radford, Virginia (hereinafter referred to as the Permit and the Permittee), to treat hazardous waste by open burning, located in Montgomery County, Virginia at latitude 37°11' North and longitude 80°30' West.

The Permittee shall comply with all terms and conditions set forth in this Permit including all Permit Attachments II.A through VI.D. If the Permit and the Permit Attachments conflict, the wording of the Permit shall prevail. The Permittee shall also comply with all applicable regulations contained in the Virginia Hazardous Waste Management Regulations (VHWMR) as codified in Title 9 of the Virginia Administrative Code, Agency 20, Chapter 60 (9 VAC 20-60), and the *Resource Conservation and Recovery Act (RCRA)* Regulations under 40 CFR Parts 124, 260, 261, 262, 264, 265, 268, and 270 as adopted by reference in the VHWMR. (For convenience, wherever the RCRA regulations are adopted by reference and cited in this Permit and the Permit Attachments, the regulatory citations will be only those from 40 CFR).

The Commonwealth of Virginia has received authorization for its hazardous waste management program under Section 3006(b) of the RCRA, 42 U.S.C. § 6926(b), to administer and enforce the RCRA under the VHWMR in lieu of the federal hazardous waste management program. Applicable regulations are those under the VHWMR (9 VAC 20-60) and the RCRA which are in effect on the date of final administrative action on this Permit and as well as any self-implementing statutory provisions and related regulations which are automatically applicable to the Permittee's hazardous waste management activities, notwithstanding the conditions of this Permit

This Permit is based on the administrative record and the assumption that the information submitted by the Permittee and contained in the administrative record is complete and accurate. The Permittee's failure in the application, or during the permit issuance process, to fully disclose all relevant facts, or the Permittee's misrepresentation of any relevant facts at any time, shall be grounds for the modification or termination of this Permit pursuant to 40 CFR § 124.5, § 270.41, §270.42, and §270.43, and shall also be grounds for initiation of an enforcement action. The Permittee shall inform the Department of any deviations from Permit Conditions or changes in the information provided in the application. In particular, the Permittee shall inform the Department of any proposed changes that might affect the ability of the Permittee to comply with applicable regulations and/or Permit Conditions, or which alter any of the conditions of the Permit in any way.

This Permit is effective as of **September 17, 2021**, and shall remain in effect until **September 17, 2031** unless revoked and reissued in accordance with 40 CFR §124.5 and § 270.41, terminated in accordance with 40 CFR §270.43, or continued in accordance with 9 VAC 20-60-270.B.15.

August 18, 2021
____
Date Signed

Leslie A. Romanchik
Leslie A. Romanchik
Hazardous Waste Program Manager
Office of Financial Responsibility and Waste Programs

TABLE OF CONTENTS

LIST OF ATTACHMENTS

The following Attachments are incorporated, in their entirety, by reference into this Permit. These incorporated attachments are enforceable conditions of this Permit. Some of the documents contain excerpts from the Permittee' Hazardous Waste Permit Application. The Department has, as deemed necessary, modified specific language excerpted from the permit application. Additional modifications are prescribed in the Permit Conditions (Modules I through VI), and thereby supersede the language of the attachments. Facility operations shall be in accordance with the contents of the Attachments and this Permit.

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDCIES

DEFINITIONS

All definitions contained in 40 CFR Sections 124.2, 260.10, 270.2, 264.141, 264.1031, 264.1051, 264.1081, and 9 VAC 20-60 are hereby incorporated, in their entirety, by reference into this Permit. Any of the definitions used below, (a) through (l), shall supersede any definition of the same term given in 40 CFR Sections 124.2, 260.10, 270.2, 264.141, 264.1031, 264.1051,264.1081, and 9 VAC 20-60. Where terms are not defined in the regulations or the Permit, the meaning associated with such terms shall be defined by a standard dictionary reference or the generally accepted scientific or industrial meaning of the term.

Throughout the permit, all references to 40 CFR parts 261-266, 268, 270, 273, 279, are as adopted by reference in the Virginia Hazardous Waste Management Regulations, 9 VAC 20-60.

a. The term **“Days”** shall mean calendar days except as otherwise provided herein.

b. The term “**Department**” shall mean the Virginia Department of Environmental Quality, (with the address as specified in Permit Condition I.I.2.).

c. The term “**Director**” shall mean the Director of the Department of Environmental Quality or his designated representative.

d. The term "**EPA**" shall mean the United States Environmental Protection Agency.

e. The term "**Facility**" or **“Site”** shall mean all contiguous land, and structures, other appurtenances, and improvements on the land, used for treating, storing, or disposing of hazardous waste under the control of either the United States Army or BAE Systems Ordnance Systems Inc. as identified in the physical description of the property (including structures, appurtenances, and improvements) set forth in Attachment II.A (see Module II) of this Permit.

f. The term "**Hazardous waste**" shall mean a hazardous waste as defined in 40 CFR 261.3.

g. The term **“Hazardous Constituent”** shall include constituents identified in 40 CFR Part 264, Appendix IX in addition to those in 40 CFR Part 261, Appendix VIII, as defined in 9 VAC 20-60-264.B.6.

h. The term "**Operating record**" shall mean written or electronic records of all maintenance, monitoring, inspection, calibration, or performance testing or other data as may be required to demonstrate compliance with this Permit, document noncompliance with this Permit, or document actions taken to remedy noncompliance with this Permit. Minimum lists of documents that must be included in the operating record are identified at 40 CFR Part 264.73(b).

i. The term "**Permittee**" shall mean the owner/operator of the facility to which the Permit is issued and refers to both the U. S. Army and BAE Systems Ordnance Systems Inc.

j. The term “**RCRA**” shall mean the Resource Conservation and Recovery Act of 1980 as amended by HSWA in 1984.

k. The term “**RCRA Permit**" shall mean the full permit, with RCRA and HSWA portions.

l. The acronym “**TEQ**” shall mean toxicity equivalent quotient, the international method of relating the toxicity of various dioxin/furan congeners to the toxicity of 2,3,7,8-TCDD

ABBREVIATIONS AND ACRONYMS

For the purposes of this Permit, the following abbreviations and acronyms shall apply:

acfm	actual cubic feet per minute
APC	air pollution control
AWFCO	automatic waste feed cutoff
BAE	BAE Systems Inc. (operator)
Btu	British thermal unit
CFR	Code of Federal Regulations
Cl2	chlorine gas
DEQ	Virginia Department of Environmental Quality
DRE	destruction and removal efficiency
EPA	United States Environmental Protection Agency
HCl	hydrogen chloride
HW	hazardous waste
lbs/hr	pounds per hour
mg/dscm	milligrams per dry standard cubic meter
MMBtu	million British thermal units
O2	molecular oxygen
OBG	Open Burning Ground
PCB	polychlorinated biphenyl
PCDD	polychlorinated dibenzo-p-dioxins
PCDF	polychlorinated dibenzofurans

POHC	principal organic hazardous constituent
ppm	parts per million
ppmv	parts per million by volume
psig	pounds per square inch gage
RCRA	Resource Conservation and Recovery Act
RFAAP	Radford Army Ammunition Plant
TEQ	toxicity equivalent quotient
ºF	degrees Fahrenheit
U.S. Army	United States Army (owner)

If, subsequent to the issuance of this Permit, regulations are promulgated which redefine any of the above terms, the Department may, at its discretion, apply the new definition, abbreviation, and acronyms to this Permit.

MODULE I- STANDARD CONDITIONS

I.A. EFFECT OF PERMIT

This Permit, issued by the Director pursuant to 40 CFR § 270.1(c)(4), authorizes only the management of hazardous waste expressly described in this Permit and in accordance with the conditions of this Permit and with the applicable provisions of the VHWMR under 9 VAC 20-60. Any management of hazardous waste by the Permittee which is not authorized by this Permit or 9 VAC 20-60, and for which a permit is required under Chapter 14, Article 4, Title 10.1, Code of Virginia (1950), as amended, is prohibited. (40 CFR §§ 270.30(g) and 270.4(b) and (c)) Compliance with this Permit generally constitutes compliance, for the purposes of enforcement, with Chapter 14, Article 4, Title 10.1-1426, Code of Virginia (1950), as amended. This Permit does not convey any property rights of any sort, or any exclusive privilege. Possession of a permit does not authorize any injury to persons or property or invasion of other private rights, or any infringement of Commonwealth or local laws or regulations. Compliance with the terms of this Permit may not constitute a defense to any action brought under Chapter 14, Article 8, Code of Virginia (1950), as amended, or any other Commonwealth law governing protection of the public or the environment.

I.B. PERMIT ACTIONS

I.B.1. This Permit may be modified, revoked and reissued, or terminated for cause as specified in 40 CFR §§ 124.5, 270.30(f), 270.41, and 270.43. The filing of a request by the Permittee for a permit modification, revocation and reissuance, or termination, or the notification of planned changes or anticipated noncompliance does not stay the applicability or enforceability of any permit condition. (40 CFR § 270.30(f))

I.B.2. Permit modifications at the request of the Permittee shall be done as specified by 40 CFR § 270.42.

I.B.3. This Permit may be renewed as specified in 9 VAC 20-60-270.B.6 and 40 CFR § 270.10(h), and Permit Condition I.D.2. Review of any application for a permit renewal shall consider improvements in the state of control and measurement technology, as well as changes in applicable regulations.

I.C. SEVERABILITY

I.C.1. The provisions of this Permit are severable, and if any provision of this Permit or the application of any provision of this Permit to any circumstance is held invalid, the application of such provision to other circumstances and the remainder of this Permit shall not be affected thereby. Invalidation of any Commonwealth or Federal statutory or regulatory provision which forms the basis for any condition of this Permit does not affect the validity of any other Commonwealth or Federal statutory or regulatory basis for said condition. (40 CFR § 124.16(a)(2))

I.C.2. In the event that any condition of this Permit is stayed for any reason, the Permittee shall continue to comply with the conditions of the existing permit which correspond to the stayed conditions until final resolution of the stayed condition unless the Director determines compliance with the existing conditions would be technologically incompatible with compliance with other conditions of this Permit which have not been stayed. (40 CFR §124.16(c)(2))

I.D. DUTIES AND REQUIREMENTS

I.D.1. Duty to Comply

The Permittee shall comply with all conditions of this Permit, except that the Permittee need not comply with the conditions of this Permit to the extent and for the duration such noncompliance is authorized by an emergency permit under 40 CFR § 270.61. Any other noncompliance with the Permit constitutes a violation of Title 10.1 Code of Virginia (1950), as amended and regulations promulgated thereunder is grounds for enforcement action; for Permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application. (40 CFR § 270.30(a))

I.D.2. Duty to Reapply

If the Permittee wishes to or is required to continue an activity regulated by this Permit after the expiration date of this Permit, the Permittee shall apply for and obtain a new permit as specified below.

a. The Permittee shall submit a new application at least 180 days before the expiration date of the Permit, unless a later date has been granted by the Director. (40 CFR § 270.30(b))

b. Pursuant to 40 CFR § 270.10(h), the Director shall not grant permission for an application to be submitted later than the expiration date of the existing permit.

I.D.3. Need to Halt or Reduce Activity Not a Defense

It shall not be a defense for the Permittee in an enforcement action to argue that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this Permit. (40 CFR § 270.30(c))

I.D.4. Duty to Mitigate

In the event of noncompliance with the Permit, the Permittee shall take all reasonable steps to minimize releases to the environment, and shall carry out such measures as are reasonable to prevent significant adverse impacts on human health or the environment. (40 CFR § 270.30(d))

I.D.5. Proper Operation and Maintenance

The Permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the Permittee to achieve compliance with the conditions of this Permit. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of this Permit. (40 CFR § 270.30(e))

I.D.6. Duty to Provide Information

The Permittee shall furnish to the Director within a reasonable time, any pertinent information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this Permit; or to determine compliance with this Permit. The Permittee shall also furnish to the Director, upon request, copies of records required to be kept by this Permit. (40 CFR § 270.30(h))

I.D.7. Inspection and Entry

The Permittee shall allow the Director or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:

a. Enter at reasonable times upon the Permittee' premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this Permit;

b. Have access to and copy, at reasonable times, any records that must be kept under conditions of this Permit;

c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Permit; and

d. Sample or monitor at reasonable times for the purposes of assuring permit compliance or as otherwise authorized by the VHWMR, any substances or parameters at any location. (40 CFR § 270.30(i))

I.D.8. Reporting Planned Changes

The Permittee shall give notice to the Director as soon as possible of any planned physical alterations or additions to the permitted facility (40 CFR § 270.30(l)). This notice shall include a description of all incidents of noncompliance reasonably expected to result from the proposed changes.

I.D.9. Anticipated Noncompliance

The Permittee shall give advance written notice to the Director of any planned changes in the permitted facility or activity that may result in noncompliance with Permit requirements. (40 CFR § 270.30(l)(2))

I.D.10. Twenty-four Hour Reporting

The Permittee shall report to the Director any noncompliance which may endanger human health or the environment. Information shall be provided orally within twenty-four (24) hours from the time the Permittee become aware of the circumstances. The information specified in (a), (b) and (c) below shall be included as information that shall be reported orally within 24 hours.

a. Information concerning the release of any hazardous waste that may cause an endangerment to public drinking water supplies shall be reported.

b. Any information of a release or discharge of hazardous waste, or of a fire or explosion at the facility, which could threaten the environment or human health outside the facility shall be reported.

c. The description of the occurrence and its cause shall include:

   i. Name, address, and telephone number of the owner or operator;

   ii. Name, address, and telephone number of the facility;

   iii. Date, time, and type of incident;

   iv. Names and quantities of material(s) involved;

   v. The extent of injuries, if any;

   vi. An assessment of actual or potential hazard to the environment and human health outside the facility, where this is applicable; and

   vii. Estimated quantity and disposition of recovered material that resulted from the incident. (40 CFR § 270.30(l)(6)

d. A written submission shall also be provided to the Director within five (5) days of the time the Permittee become aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the periods of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance. The Director may waive the 5-day notice requirement in favor of a written report within fifteen (15) days prepared pursuant to Permit Condition II.H.5. (40 CFR § 270.30(1)(6))

I.D.11. Other Noncompliance

The Permittee shall report all other instances of noncompliance not otherwise reported pursuant to Permit Conditions I.D.10, I.D.12, and I.E.1 at the time monitoring reports are submitted. The reports shall contain the information listed in Permit Condition I.D.10. (40 CFR § 270.30(l)(10)

I.D.12. Other Information

Whenever the Permittee become aware that it failed to submit any relevant facts in the permit application, or submitted incorrect information in a permit application or in any report to the Director, the Permittee shall promptly submit such facts or information to the Director. (40 CFR § 270.30(l)(11)

I.E. MONITORING AND RECORDS

I.E.1. Monitoring Reports

Monitoring shall be performed and results shall be reported at the intervals specified in the Permit.

I.E.2. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity. (40 CFR §270.30(j)(1)) The method used to obtain a representative sample of the waste to be analyzed must be the appropriate method specified in 40 § CFR 261, Appendix I, an equivalent method approved by the EPA, or a method specified in this Permit. Laboratory methods must be those specified in *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods* (SW-846, 3rd ed., November, 1986, as updated), *Standard Methods of Wastewater Analysis* (16th ed., 1985, as updated), or an equivalent method approved by the EPA, or RFAAP Laboratory methods specified in this Permit. Additionally, the laboratory must be accredited for the analytical method, matrix, and target analyte (where applicable) by the Virginia Environmental Laboratory Accreditation Program (VELAP).

I.E.3. The Permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this Permit, all certifications required by 40 CFR § 264.73(b)(9), and records of all data used to complete the application for this Permit, for a period of at least 3 years (or longer if specified elsewhere in this Permit) from the date of the sample collection, measurement, report, certification, or application. These retention periods may be extended by the request of the Director at any time and are automatically extended during the course of any unresolved enforcement actions regarding this facility. The Permittee shall maintain records from all ground-water monitoring wells and associated ground-water surface elevations for the active life of the facility.

Records of monitoring information shall include at a minimum:

a. The date, exact place, and time of sampling or measurements;

b. The individual(s) who performed the sampling or measurements;

c. The date(s) analyses were performed;

d. The individual(s) who performed the analyses;

e. The analytical techniques or test methods used; and

f. The results of such analyses. (40 CFR § 270.30(j)

I.F. COMPLIANCE NOT CONSTITUTING DEFENSE

Compliance with the terms of this Permit does not constitute a defense to any action brought under Chapter 14, Article 8 of Title 10.1, Code of Virginia (1950) as amended or any other Commonwealth law governing protection of the public or the environment.

I.G. TRANSFER OF PERMITS

This Permit is not transferable to any person except after notice to the Director. (40 CFR § 270.30(l)(3)). The Director may require modification or revocation and reissuance pursuant to 40 CFR §§ 124.5, 270.40, 270.41, 270.42, and 270.43 to change the name of the Permittee and incorporate such other requirements as may be necessary. Before transferring ownership or operation of the facility during its operating life, the Permittee shall notify the new owner or operator in writing of the requirements of 9 VAC 20-60-264 and 40 CFR Part 264 and shall at the same time shall send a copy of such notice to the Director (40 CFR § 264.12(c)).

I.H. PERMIT EXPIRATION AND CONTINUATION

Pursuant to 9 VAC 20-60-270.B.15 this Permit will remain in force until the effective date of a new permit if the Permittee has submitted a timely, complete application pursuant to Permit Condition I.D.2.a and through no fault of the Permittee, the Director has not issued a new permit with an effective date on or before the expiration date of this Permit. All conditions of the continued Permit shall remain fully effective and enforceable.

I.I. REPORTS, NOTIFICATIONS, AND SUBMISSIONS TO THE DEPARTMENT

I.I.1. Biennial Report

The Permittee shall submit a biennial report to the Department by March 1st of every even-numbered year which covers facility activities during the previous year. At a minimum this report will include:

a. The generator biennial report pursuant to 40 CFR § 262.41; and

b. The hazardous waste management facility biennial report pursuant to 40 CFR §270.30(1)(9) and § 264.75.

I.I.2. All reports, notifications or other submissions which are required by this Permit are to be sent electronically, by postal mail or hand delivered to:

For Corrective Action and Groundwater:

Department of Environmental Quality
Groundwater/Corrective Action Program Team Leader
Office of Remediation Program
P. O. Box 1105
Richmond, VA 23218

For Permit Modifications:
Department of Environmental Quality
Hazardous Waste Program Manager
Office of Financial Responsibility and Waste Programs
P. O. Box 1105
Richmond, VA 23218

And one (1) copy of all such correspondence, report and submission shall also be sent to:

Land Program Manager, Blue Ridge Regional Office
Department of Environmental Quality
901 Russell Drive
Salem, VA 24153

Virginia Program Manager (3CL50)
Environmental Protection Agency, Region III
1650 Arch Street
Philadelphia, PA 19103-2029

I.I.3. Signatory Requirements

All applications, reports, or information submitted to the Director shall be signed and certified as specified by 40 CFR § 270.11.

I.J. DOCUMENTS TO BE MAINTAINED AT THE FACILITY SITE

I.J.1. Current copies of the following documents, as amended, revised, and modified, shall be maintained at the facility. These documents shall be maintained until post-closure care is completed and certified by the Permittee and by an independent, Virginia-registered professional engineer, unless a lesser time is specified in the Permit.

a. The Permit, including all attachments;

b. All Part B Permit Applications supporting the Permit;

c. The facility operating record required by 40 CFR § 264.73, Permit Condition II.I.2.;

d. Waste Analysis Plan required by 40 CFR § 264.13 and this Permit;

e. Inspection schedules and logs required by 40 CFR § 264.15(b)(2) and § 264.15(d);

f. Personnel training documents and records required by 40 CFR § 264.16 and this Permit;

g. Contingency Plan as required by 40 CFR § 264.53(a) and this Permit;

h. Closure Plans, as required by 40 CFR § 264.112(a) and this Permit;

i. Post-Closure Plans, as required by 40 CFR § 264.118(a) and this Permit.

j. All other documents required by Permit Conditions I.D.8 through I.D.12 and I.E.

I.K. TRADE SECRET PROTECTION

In accordance with §10.1-1458 of the Code of Virginia (1950, as amended), the permittee may claim any information this permit requires, or is otherwise submitted to the Director as trade secret. In doing so, the permittee shall: 1) assert any such claim at the time of submittal, 2) identify the data or materials for which protection is being sought, and 3) state the reasons why protection is necessary. Further information regarding trade secret protection, the basis for submittal of such a request, the Department's decision process and handling of trade secret protected information is available on the Virginia Regulatory Town Hall website (http://townhall.virginia.gov/L/ViewGDoc.cfm?gdid=5322). If no claim is made at the time of submittal, the Director may make the information available to the public without further notice. The permittee has the burden of substantiating that the claimed information is trade secret, and the Department may request further information regarding such claim, and may reasonably determine which such information to treat as trade secret. The Department may disclose trade secret information to the appropriate officials of the Environmental Protection Agency pursuant to the requirements of the federal Solid Waste Disposal Act, 42 U.S.C. § 3251, *et seq*., or as otherwise required by law.

I.L. APPROVAL/DISAPPROVAL OF SUBMISSIONS

I.L.1. The Department will review the plans, reports, schedules and other documents (hereinafter collectively referred to as "submissions") submitted which require the Director's or Department's approval. The Department will notify the Permittee in writing of the Department's approval, conditional approval, or disapproval of each submission.

I.L.2. Each submission required by this Permit, upon approval by the Director, is incorporated into this Permit. Any noncompliance with a Department-approved submission shall be deemed as noncompliance with this Permit. A conditionally approved submission, including any terms of such conditional approval set forth in Department's decision, shall constitute the Department-approved submission and shall be incorporated into this Permit.

I.L.3. In the event of the Department's conditional approval of submission, the Department shall specify in writing any deficiencies in the submission and the terms upon which approval of the submission is conditioned. If the Permittee disputes any term upon which approval of the submission was conditioned, the Permittee may initiate Dispute Resolution pursuant to permit condition I.M.

I.L.4. In the event of the Department's disapproval of a submission, the Director or the Department shall specify the deficiencies in writing. Such disapproval shall not be subject to the Dispute Resolution provision set forth in Permit Condition I.M. The

Permittee shall modify the submission to correct/address the specified deficiencies within a reasonable time period established by the Department taking into account the tasks to be performed, and submit the revised submission to the Department for approval.

I.L.5. If the revised submission is disapproved, the Director or the Department will notify the Permittee of the deficiencies in writing and specify a schedule for the Permittee to correct the deficiencies and resubmit the submission to the Department. The Permittee shall correct the deficiencies as directed by the Department, and forward the revised submission within the time period specified by Department. In the event the Permittee disagrees with the Department's disapproval of the revised submission, the Permittee shall notify the Department in writing and the disagreement shall be resolved in accordance with the Dispute Resolution provision in permit condition I.M of this Permit.

I.M. DISPUTE RESOLUTION

I.M.1. Except as otherwise provided in this Permit, in the event the Permittee disagrees, in whole or in part, with Department disapproval of any submission required by this Permit, the Permittee shall notify the Department in writing of its objections, and the basis thereof, within fourteen (14) days of receipt of the Department's disapproval. Such notice shall set forth the specific matters in dispute, the position(s) the Permittee asserts which should be adopted as consistent with the requirements of the Permit, the basis for the Permittee's position, and supporting documentation considered necessary for the Department's determination.

I.M.2. The Department and the Permittee shall have an additional fourteen (14) days from the Department's receipt of the notification to meet or confer to resolve any disagreement/dispute. In the event agreement is reached, the Permittee shall submit the revised submission and implement the same in accordance with such agreement.

I.M.3. In the event the Permittee and the Department are not able to reach an agreement on the dispute items within the additional 14-day period, the Department will notify the Permittee in writing of its decision on the dispute and the Permittee shall comply with the terms and conditions of the Department's decision in the dispute. The Permittee does not waive its right to assert any and all available defenses in a proceeding to enforce this Permit.

I.M.4. In the event the Permittee disagrees with Department's disapproval of a submission or revised submission and the Department's written decision regarding dispute items, the Permittee may file an appeal with the Director within 30 days of the disapproval (as provided for in Rule 2A:2 of the Supreme Court of Virginia).

MODULE II- GENERAL FACILITY CONDITIONS

II.A. DESIGN AND OPERATION OF FACILITY

The Permittee shall construct, maintain and operate the facility to minimize the possibility of a fire, explosion, or any unplanned release of hazardous waste constituents to air, soil, or surface water which could threaten human health or the environment as required by 40 CFR § 264.31.

II.B. WASTE ANALYSIS

II.B.1. General Waste Analysis

The Permittee shall follow the waste analysis procedures required by 40 CFR § 264.13 as described in the Waste Analysis Plan, Attachment II.B. Waste analysis shall require, at a minimum, the maintenance of proper functional instruments, use of approved sampling and analytical methods, verification of the validity of sampling and analytical procedures, and correct calculations. If the Permittee does not have sufficient capability for analysis, then the Permittee shall inform the laboratory performing the analysis that the laboratory must operate under the waste analysis conditions placed on the Permittee. Additionally, the laboratory must be accredited for the analytical method, matrix and target analyte (where applicable) by the Virginia Environmental Laboratory Accreditation Program (VELAP).

II.C. SECURITY

The Permittee shall comply with the security provisions of 40 CFR § 264.14. The security provisions shall follow the outline in Attachment II.H.

II.D. GENERAL INSPECTION REQUIREMENTS

The Permittee shall follow the inspection schedule set out in the Inspection Schedule, Attachment II.D. The Permittee shall remedy any deterioration or malfunction discovered during an inspection as required by 40 CFR§ 264.15(c). Records of inspections shall be kept as required by 40 CFR § 264.15(d) and Permit Condition II.I.2.d.v.

II.E. PERSONNEL TRAINING

The Permittee shall conduct personnel training as required by 40 CFR § 264.16. This training program shall follow Personnel Training, Attachment II.E. The

Permittee shall maintain training documents and records as required by 40 CFR § 264.16(d)(4) and § 264.16(e) as well as Permit Conditions II.I.2.b.vi and II.I.2.d.iii.

II.F. GENERAL REQUIREMENTS FOR REACTIVE WASTE

The Permittee shall comply with the requirements of 40 CFR § 264.17.

II.G. FLOODPLAIN STANDARD

The Permittees shall comply with the requirements of 40 CFR 264.18(b). The Permittees shall follow the flood plan in Attachment II.I.

II.H. PREPAREDNESS AND PREVENTION

II.H.1. Preventive Procedures, Structures, and Equipment

The facility shall maintain appropriate procedures and necessary equipment to help prevent hazards from unloading operations, pursuant to 40 CFR § 264.30 through § 264.37. This shall, at a minimum, include procedures for ensuring that all waste cans are maintained at or below weights suitable for manual lifting or movement and, when appropriate, the use of powered lift-gates on vehicles used to transport waste from the accumulation facilities to the OBG.

II.H.2. Required Equipment

At a minimum, the Permittee shall equip the facility with the equipment set forth in the Contingency Plan, Attachment II.F, as required by 40 CFR § 264.32.

II.H.3. Testing and Maintenance of Equipment

The Permittee shall test and maintain the equipment specified in Permit Condition II.H.2 and in Attachment II.F as necessary to assure its proper operation in time of emergency as required by 40 CFR §264.33 .

II.H.4. Access to Communications or Alarm System

The Permittee shall maintain access to the communication or alarm system as required by 40 CFR § 264.34.

II.H.5. Arrangements with Local Authorities

The Permittee shall maintain arrangements with State and local authorities as required by 40 CFR § 264.37. If State and local officials refuse to enter into or renew existing preparedness and prevention arrangements with the Permittee, the Permittee shall document this refusal in the operating record pursuant to Permit Condition II.I.2.e.iv.

II.I. CONTINGENCY PLAN

II.I.1. Implementation of Plan

The Permittee shall immediately carry out the provisions of the Contingency Plan, Attachment II.F, and follow the emergency procedures described by 40 CFR § 264.56, whenever there is an imminent or actual fire, explosion, or release of hazardous waste or constituents which threaten or could threaten human health or the environment.

II.I.2. Copies of Plan

The Permittee shall comply with the requirements of 40 CFR § 264.53.

II.I.3. Amendments to Plan

The Permittee shall review and immediately amend, if necessary, the Contingency Plan, as required by 40 CFR § 264.54.

II.I.4. Emergency Coordinator

A trained Emergency Coordinator shall be available at all times in case of an emergency as required by 40 CFR § 264.55. In addition, the Permittee shall comply with the requirements of 40 CFR § 264.52(d).

II.I.5. Emergency Procedures

The Permittee shall comply with the requirements of 40 CFR § 264.56 including the recordkeeping and reporting requirements specified in Permit Condition II.J.2.a.iv.

II.J. RECORDKEEPING AND REPORTING

II.J.1. Notification, Certification, and Recordkeeping Requirements

In addition to the recordkeeping and reporting requirements specified elsewhere in this Permit, the Permittee shall comply with all the applicable notification, certification, and recordkeeping requirements described in 40 CFR § 264.73(b)(12) and 268.7.

II.J.2. Operating Record

The Permittee shall maintain a written operating record at the facility, consisting of records kept for the lengths of time specified below. The record can be a compilation of various documents. The operating record shall include; but not be limited to, the information listed below:

a. The following records shall be maintained until closure is complete and certified:

   i. A current map showing the location of hazardous waste management units and non-regulated units within the facility;

   ii. A map showing all locations of past hazardous waste management units if different from present locations;

   iii. Pursuant to 40 CFR § 264.73(b)(1), a description and the quantity of each hazardous waste received, and the method(s) and date(s) of its treatment, storage, or disposal at the facility;

   iv. The time, date, and details of any incident that requires implementation of the contingency plan, including copies of all reports prepared pursuant to 40 CFR § 264.56(i) and Permit Condition II.I.5. or I.D.10.c.;

   v. All submittals prepared pursuant to Permit Condition I.D.12;

   vi. Records and results of waste analyses required by 40 CFR § 264.13, pursuant to 40 CFR § 264.73(b)(3), which shall include at a minimum:

      A. The date(s), exact place, and times of sampling or measurements;

      B. The name of the individual(s) who performed the sampling or measurements;

      C. The date(s) analyses were performed, demonstrating that holding times for the methods specified in the Waste Analysis Plan, Attachment II.B were satisfied;

      D. The name of the individual(s) who performed the analyses;

      E. The analytical techniques or method used;

F. The analytical results;

G. The QA/QC summary; and

H. The type and model number of the equipment used for analysis.

vii. All waste determinations, waste profiles, and waste feed composition determinations made pursuant to the Waste Analysis Plan, Attachment II.B.

viii. Certifications pursuant to 40 CFR § 264.73(b)(9) (Waste Minimization Plan); and

ix. The notice and certification required by a generator under 40 CFR § 268.7 (Land Disposal Restrictions).

b. The following records shall be maintained until post-closure is complete and certified:

i. Records of spills and releases required by existing environmental laws, including, but not limited to Chapter 103 of the Comprehensive Environmental Response, Compensation and Liability Act;

ii. Written reports and records of verbal notification to the Director and the Administrator to 'address releases, fires, and explosions;

iii. All reports of noncompliance pursuant to Permit Condition I.D.11.;

iv. All reports prepared pursuant to Permit Condition I.D.10.;

v. Records of all monitoring information pursuant to Permit Condition I.E.; and

vi. Training records of current facility personnel.

c. The following records shall be maintained for a minimum of 5 years. This time period may be extended by the Department in the event of enforcement action or notification by the Department that an investigation is ongoing.

i. Facility operation and maintenance records and reports prepared pursuant to this Permit; and

ii. Progress reports and any required notifications prepared pursuant to this Permit.

d. The following records shall be maintained for a minimum of 3 years. This time period may be extended by the Department in the event of enforcement action or notification by the Department that an investigation is ongoing.

i. Generator biennial reports submitted in compliance with 40 CFR § 262.41;

ii. Facility biennial reports submitted in compliance with 40 CFR § 264.75;

iii. Training records of former facility personnel;

iv. Records of all monitoring information pursuant to Permit Condition I.E.3.; and

v. Records of all inspections, pursuant to 40 CFR § 264.15(d), which shall include at a minimum:

A. The date and time of the inspection;

B. The name of the person performing the inspection;

C. A notation of the observations made; and

D. The date and nature of any repairs or remedial actions.

e. Current copies of the following documents as amended, revised, and modified shall be maintained at the facility until closure and corrective action are complete and certified:

i. Contingency Plan;

ii. Personnel Training;

iii. Waste Analysis Plan;

iv. Documentation of arrangements made with local authorities pursuant to 40 CFR § 264.37;

v. Closure Plan; and

vi. Documentation pertaining to the storage of ignitable and reactive wastes required pursuant to 40 CFR § 264.17.

vii. Copies of any software programs and manuals utilized to ensure or document compliance with any portion of this permit. If at any point the owner or operator becomes aware of errors in such software programs, they shall notify the Director within 30 days.

II.J.3. Treatment Record Annual Report

The Permittee shall submit a report of the information required pursuant to 40 CFR § 264.73(b)(1), as detailed in Condition II.J.2.a.iii, to the Director, at least annually, no later than March 1 of each year. The report shall cover the previous calendar year.

II.K. CLOSURE

II.K.1 Performance Standard

The Permittee shall close the permitted treatment area as required by 40 CFR § 264.111 and § 264.118, and in accordance with the Closure Plan, Attachment II.G.

II.K.2 Amendments to Closure Plan

The Permittee shall amend the closure plan in accordance with 40 CFR § 264.112(c) whenever necessary.

II.K.3 Notification of Closure

The Permittee shall notify the Director at least 45 days prior to the date it expects to begin closure as required by 40 CFR § 264.112(d). With this notification, the permittee shall also include an amended closure plan for review and approval that details the specific steps, actions, criteria and procedures that will be followed to demonstrate “clean closure” for both soils and ground water and shall include a post-closure plan that will be implemented in the event “clean closure” cannot be achieved for soils and/or groundwater. The closure plan amendment shall be processed in accordance with the permit modification procedures under 40 CFR § 270. 41 or 42.

II.K.4 Time Allowed for Closure

After receiving the final volume of hazardous waste, the Permittee shall treat or remove from the permitted treatment area all hazardous waste and shall complete closure activities in accordance with the schedules specified in the Closure Plan, Attachment II.G.

II.K.5 Disposal or Decontamination of Equipment

The Permittee shall decontaminate and/or dispose of all facility equipment as required by 40 CFR § 264.114 and the Closure Plan, Attachment II.G.

II.K.6 Certification of Closure

The Permittee shall certify that the permitted treatment and storage area has been closed in accordance with the specifications in the closure plan as required by 40 CFR § 264.115 and the Closure Plan, Attachment II.G.

II.K.7 Post-Closure Plan

If the Permittee cannot demonstrate “clean” closure of soils and/or groundwater, the requirements of 40 CFR § 264.118 shall become applicable.

MODULE II - LIST OF ATTACHMENTS

The following Attachments are incorporated, in their entirety, by reference into this Permit. These incorporated attachments are enforceable conditions of this Permit. Some of the documents contain excerpts from the Permittee's Hazardous Waste Permit Application. The Department has, as deemed necessary, modified specific language excerpted from the permit application. Additional modifications are prescribed in the Permit Conditions (Modules I through VII), and thereby supersede the language of the attachments. Facility operations shall be in accordance with the contents of the Attachments and this Permit.

Attachment II.A – Facility Description

Attachment II.B – Waste Analysis Plan

Attachment II.C – Soil Monitoring Program

Attachment II.D – Inspection Schedule

Attachment II.E – Personnel Training

Attachment II.F – Contingency Plan

Attachment II.G – Closure Plan

Attachment II.H – Security Provisions

Attachment II.I – 100-Year Floodplain Protection Plan

ATTACHMENT II.A – FACILITY DESCRIPTION

II.A.1. Facility

The Radford Army Ammunition Plant (RFAAP) encompasses approximately 4,104 acres of land and is located in southwest Virginia in Pulaski and Montgomery Counties as shown on Figure II.A-1. The New River separates Pulaski and Montgomery Counties and also divides the RFAAP into two (2) portions commonly known as the Horseshoe Area and the Main Manufacturing Area. These areas, and the approximate outline of the RFAAP boundary, are shown on the topographic map in Figure II.A-2.

For the purposes of this Permit, the facility consists of all contiguous portions of the RFAAP owned by the United States Army (US Army). The facility specifically includes both the Horseshoe Area and the Main Manufacturing Area.

II.A.2. Permitted Open Burning Ground

Pursuant to 40 CFR § 270.1(c)(4), this Permit is effective for only a portion of the facility. The “permitted treatment area,” henceforth referred to as the open burning ground (OBG), is located in the southeast portion of the Horseshoe Area (in the loop of the river) on the northern bank of the New River. Figures II.A-2 and II.A-3 provide the topographic characteristics of the area, demonstrate the facility boundary, and specify the location of the OBG and surrounding structures. Figure II.A-4 depicts the land use within 1,000 feet of the RFAAP property line. Figure II.A-5 depicts the 100-year flood elevation as it relates to the location of the burning ground. As shown on the figure, the OBG is located within the 100-year flood plain. Flood Proofing/Protection Plans and Specifications and 100-year Flood Response Procedures are in Attachment II.I of Module II.

The location of the OBG in relation to the rest of the RFAAP can be seen in Figure II.A-2. Open burning operations are conducted in an area approximately 100 feet by 1,500 feet. Open burning operations are conducted on 6-ft by 18-ft pans situated on raised pads about 250 sq. ft. in size. There are 8 pads at the OBG, each containing 2 burn pans for a total of 16 pans. A plan-view of the OBG is shown in Figure II.A-6.

On a routine daily basis, the pans on alternate pads are loaded with wastes designated for open burning. The criteria for selecting wastes to be burned are the accumulation start date and the theoretical burn rate of the material. The theoretical burn rate is used to ensure that fast burning material is not covered by slower burning material. The waste capacity of each pan is 1,000 pounds. The operator may burn considerably less material to prevent untreated material from landing on the soil.

Some of the wastes received at the OBG require an aid to burning. These wastes are placed on pallets to allow air circulation under the waste. The pallets are covered with cardboard that is soaked with diesel fuel. The waste is spread onto the cardboard and soaked with diesel fuel.

Factors considered in determining whether to burn waste on a specific day are:

- Precipitation forecast;
- Wind speed;
- River level; and
- In the event of a high river level, rainfall amounts in the headwaters of the New River in North Carolina.

If there is a 50% or higher chance of precipitation in the afternoon hours, ignition of the pans may occur in the morning hours. If there is a 50% or higher chance of precipitation in the morning hours, ignition of the pans may occur in the afternoon. If winds are less than 20 miles per hour and there is no precipitation at the time of ignition, burning operations will commence. Once a pan is loaded with waste, the waste cannot be safely removed from the pan. If the pans are loaded and the wind exceeds 20 mph, burning may commence only with the acknowledgement of the Safety or Environmental Manager or their designee. No ignition will occur if precipitation is falling or if there is a thunderstorm in the local vicinity.

II.A.3. Land Use Analysis

Figure II.A-4 provides a map of the land use within 1,000 feet of the property boundary. The land use surrounding the OBG is largely rural, with a large portion of the area being covered in deciduous forest. Subtracting out those developed areas occupied by the RFAAP property, the next highest percentage of land use is represented as pasture or hay regions. The majority of development exists to the southeast of the main gate, along Peppers Ferry Road, and across the river opposite the Horseshoe Area northwest of the plant. Nearby towns include:

- Radford, which is approximately 4 miles south of the RFAAP;
- Christiansburg, which is approximately 9 miles southeast of the RFAAP; and
- Blacksburg, which is located approximately 7 miles to the northeast of the RFAAP.

The nearest schools to the OBG include Belview Elementary School, Kipps Elementary School, and Prices Fork Elementary School, all of which are at least 1.5 miles from the permitted storage and treatment area.

II.A.4. Traffic Information

Signage, routes and speed limits are illustrated in Figure II.A-7.

FIGURE II.A-1: LOCATION MAP

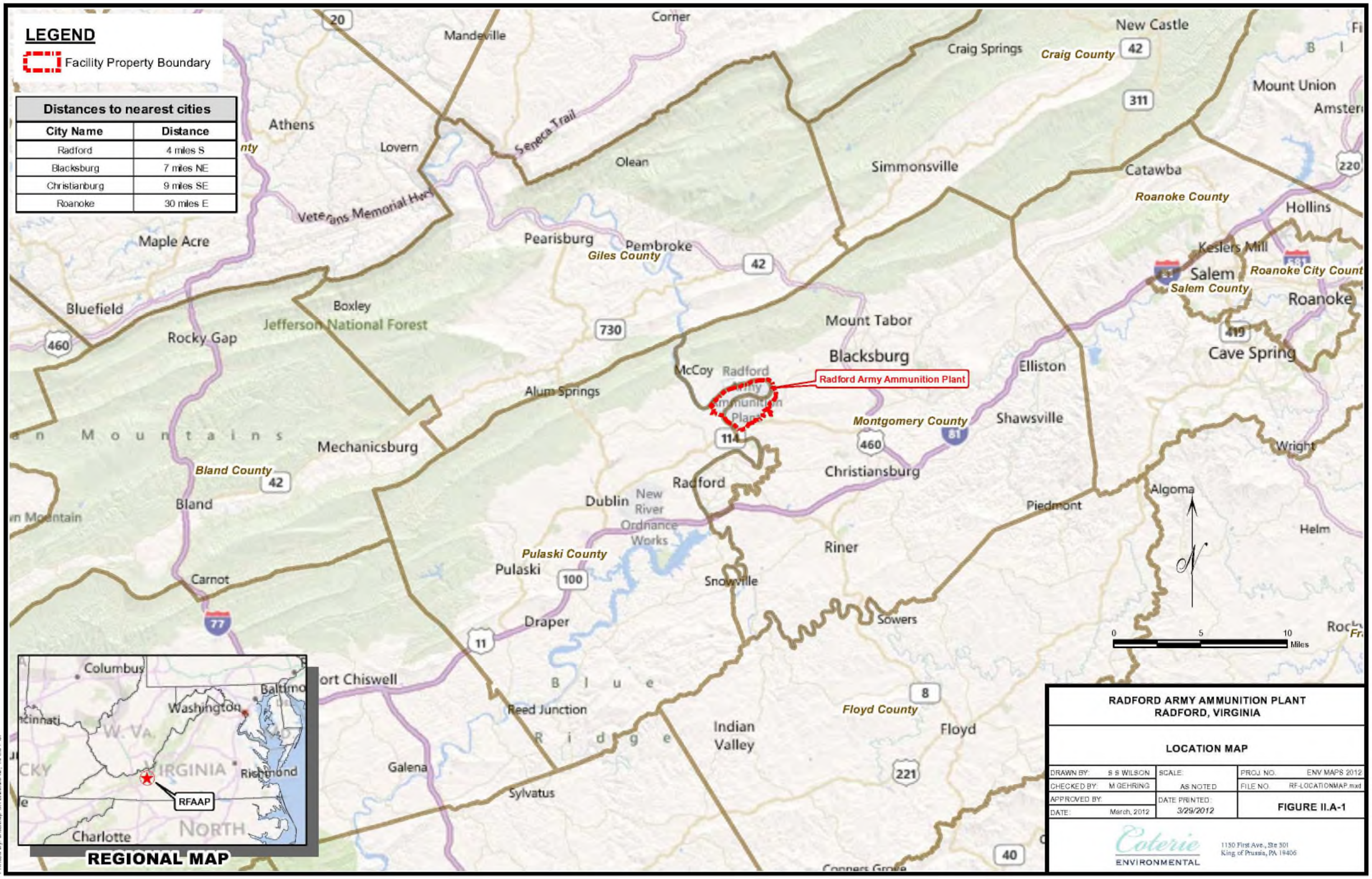


FIGURE II.A-2: TOPOGRAPHIC MAP

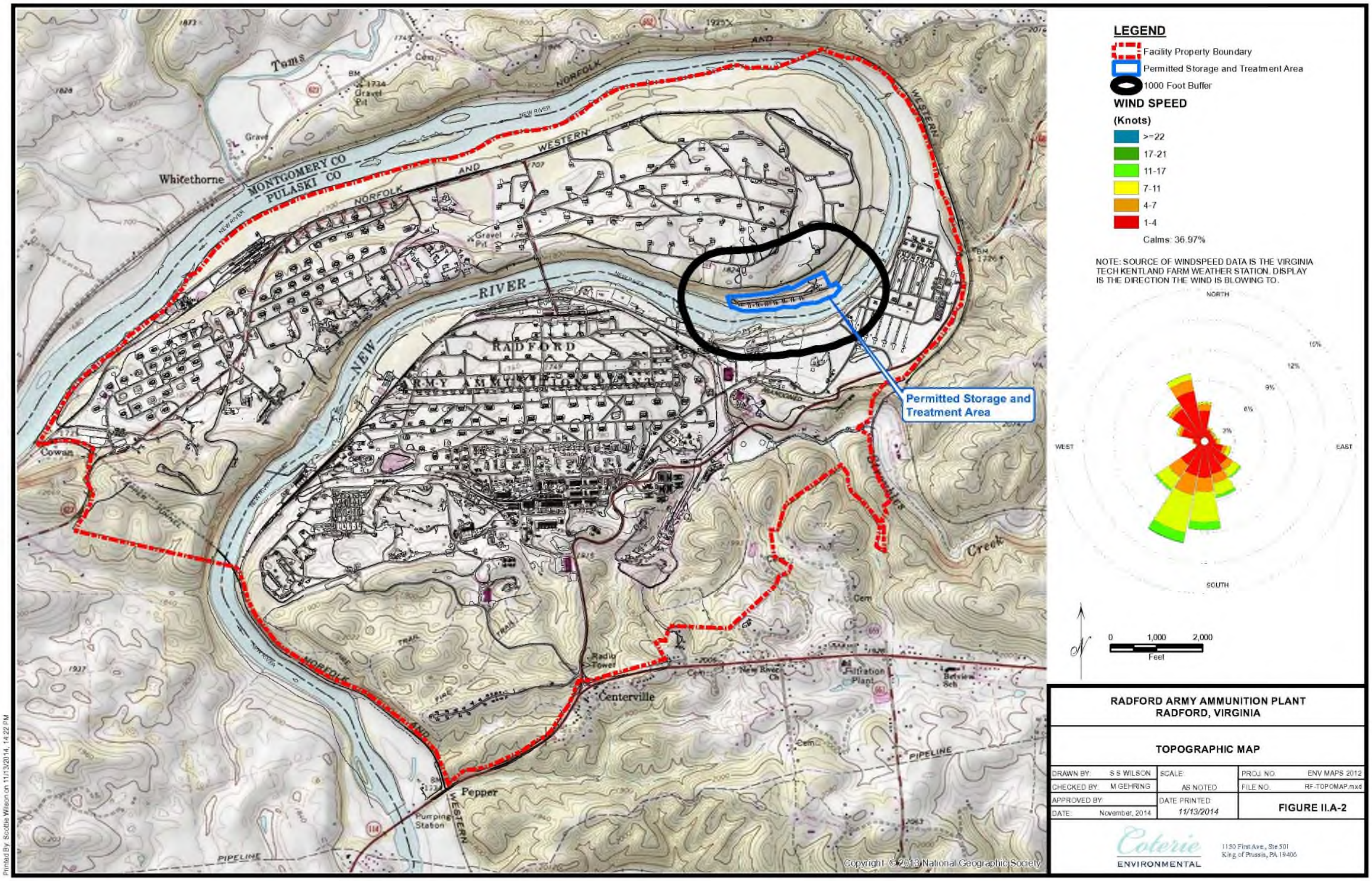


FIGURE II.A-3: OBG AREA MAP

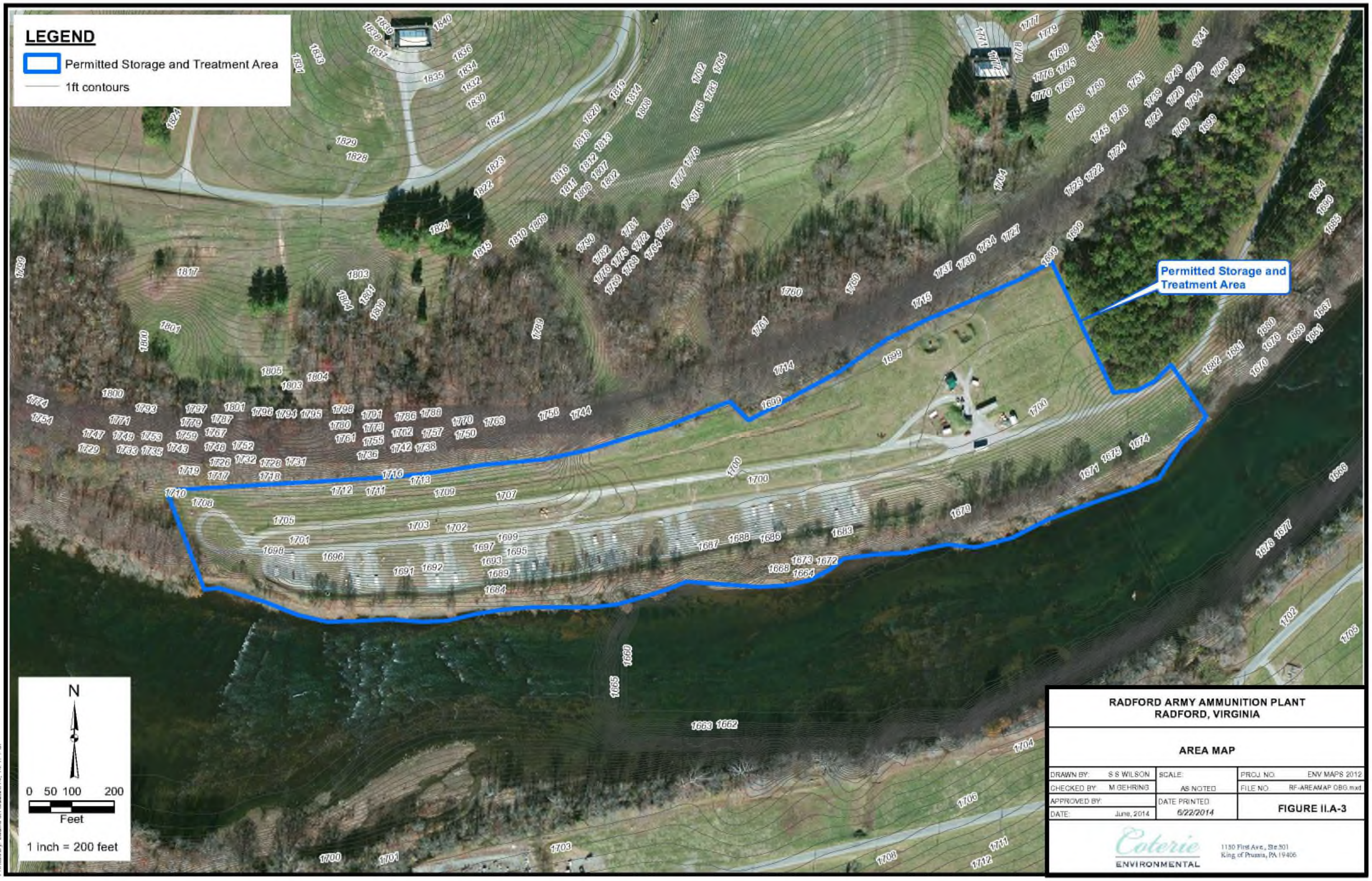


FIGURE II.A-4: LAND USE MAP

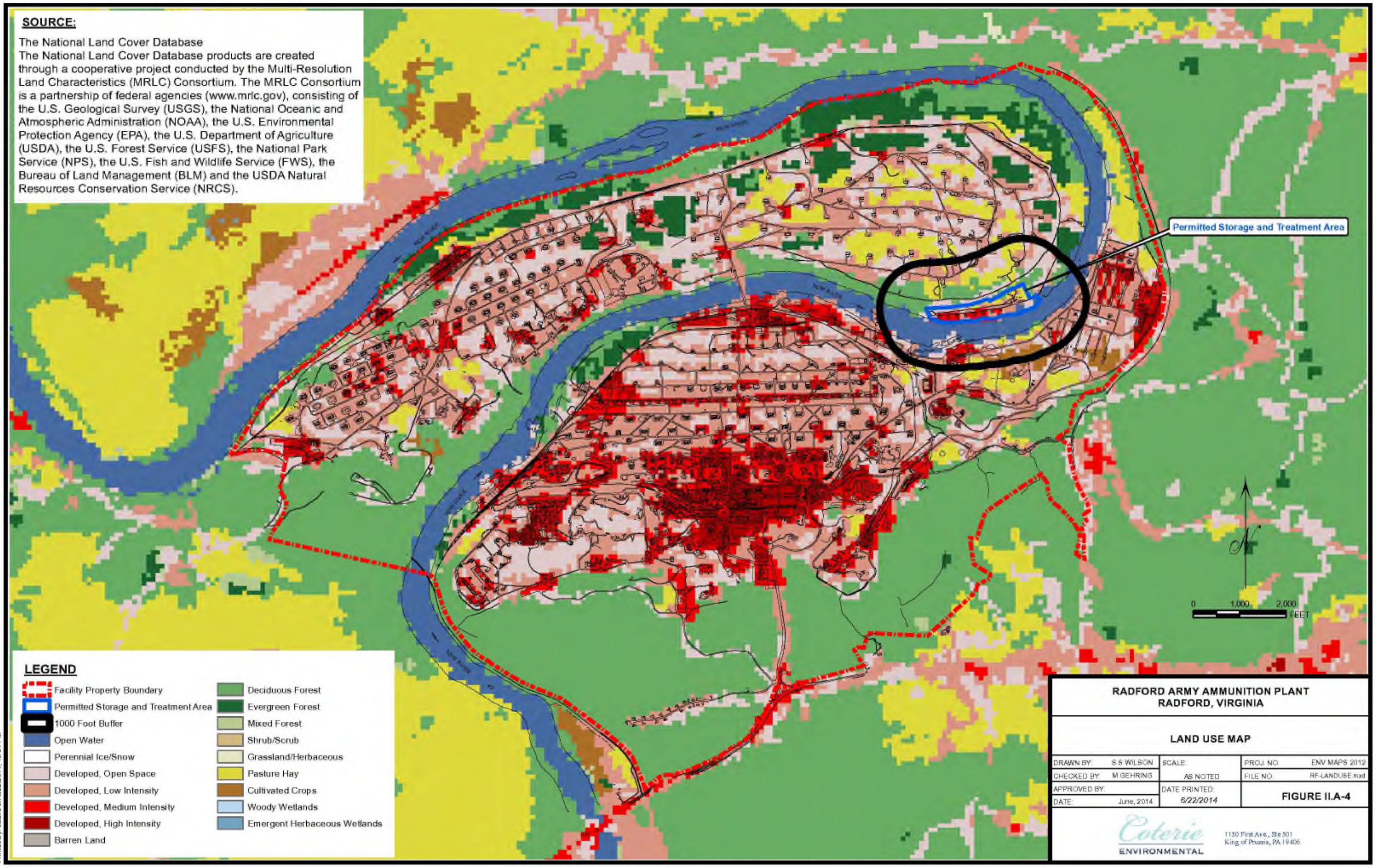


FIGURE II.A-5: FEMA 100 YEAR FLOOD PLAIN

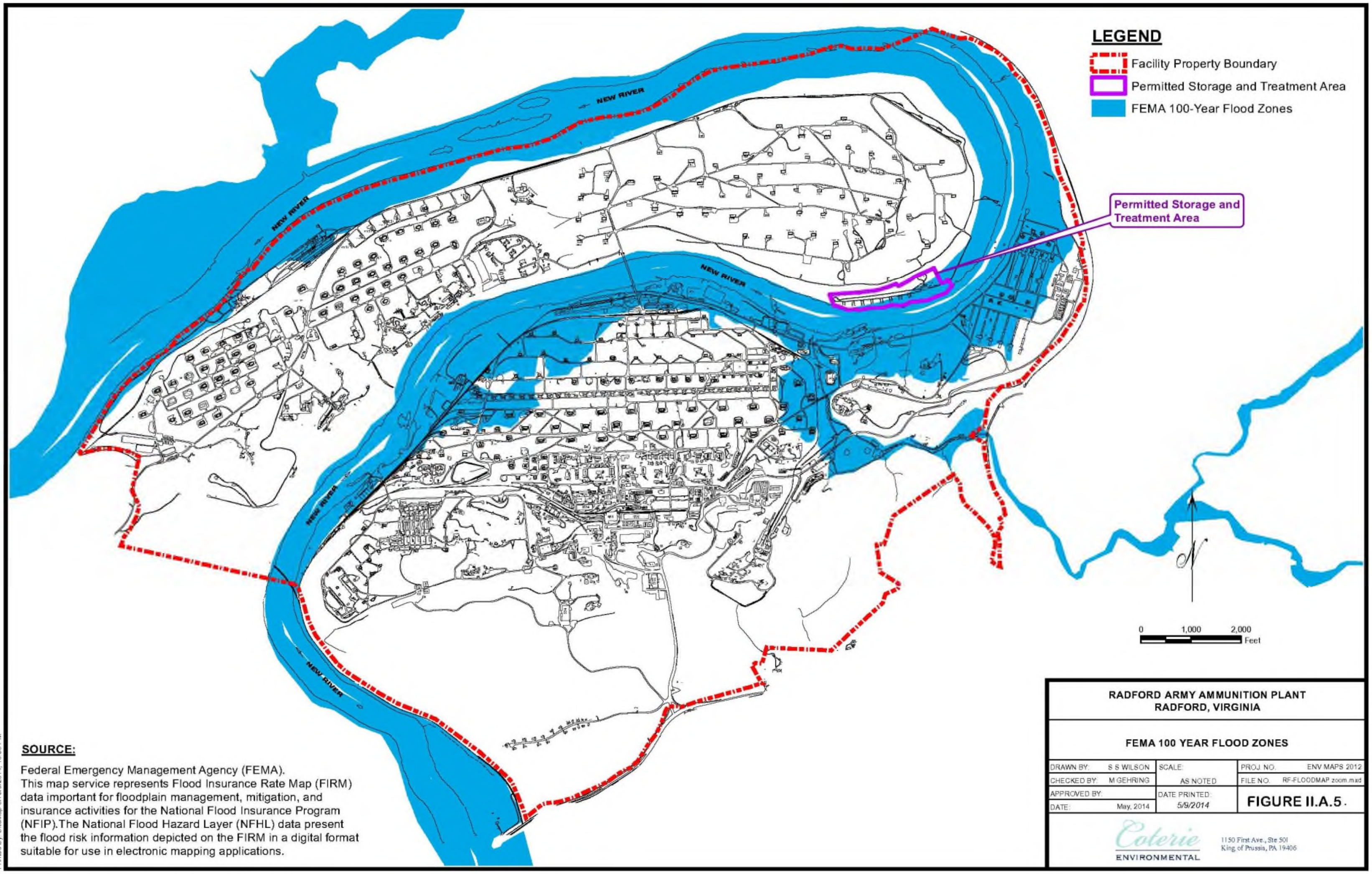


FIGURE II.A-6: PLAN VIEW OF OBG

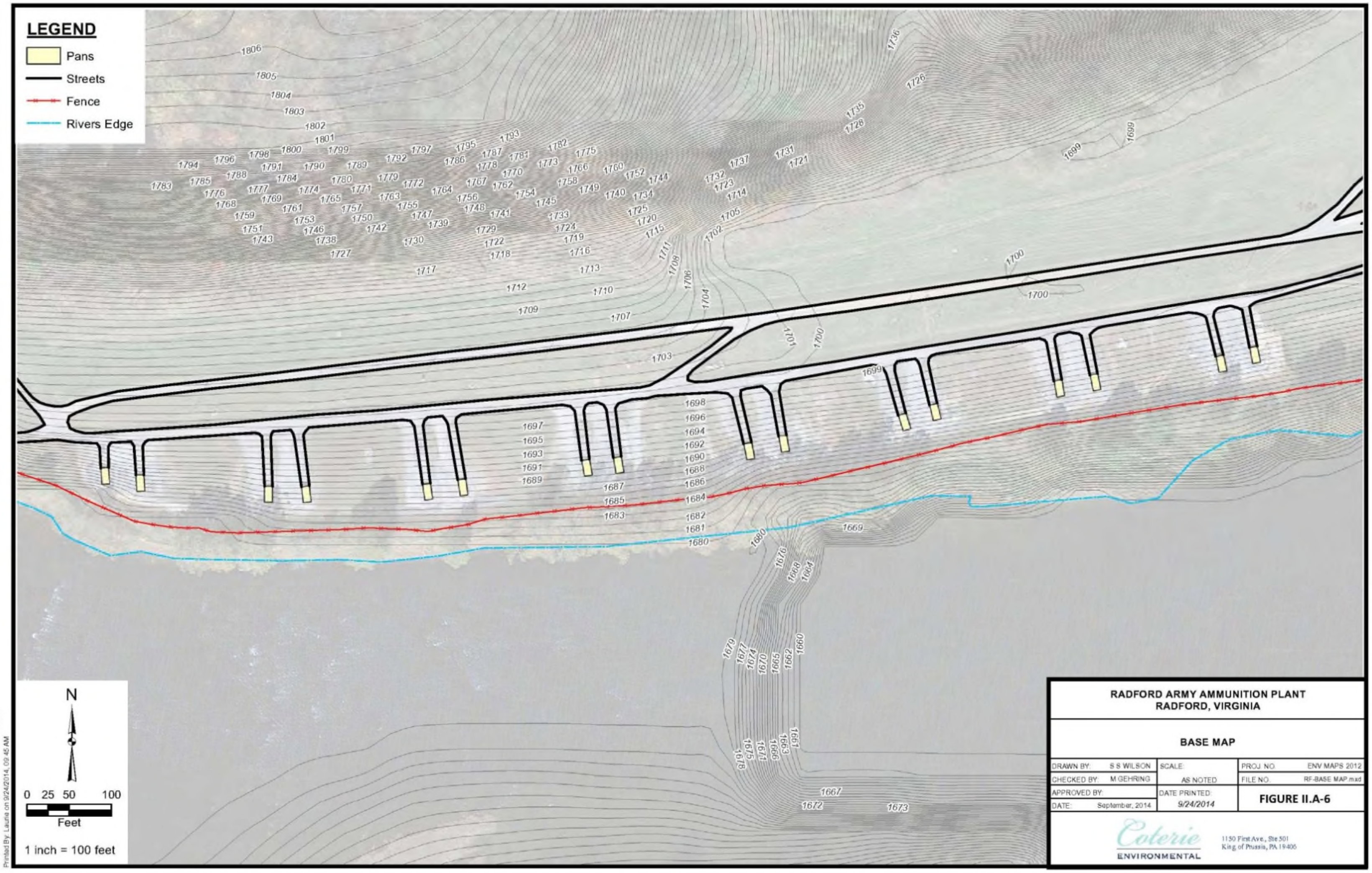
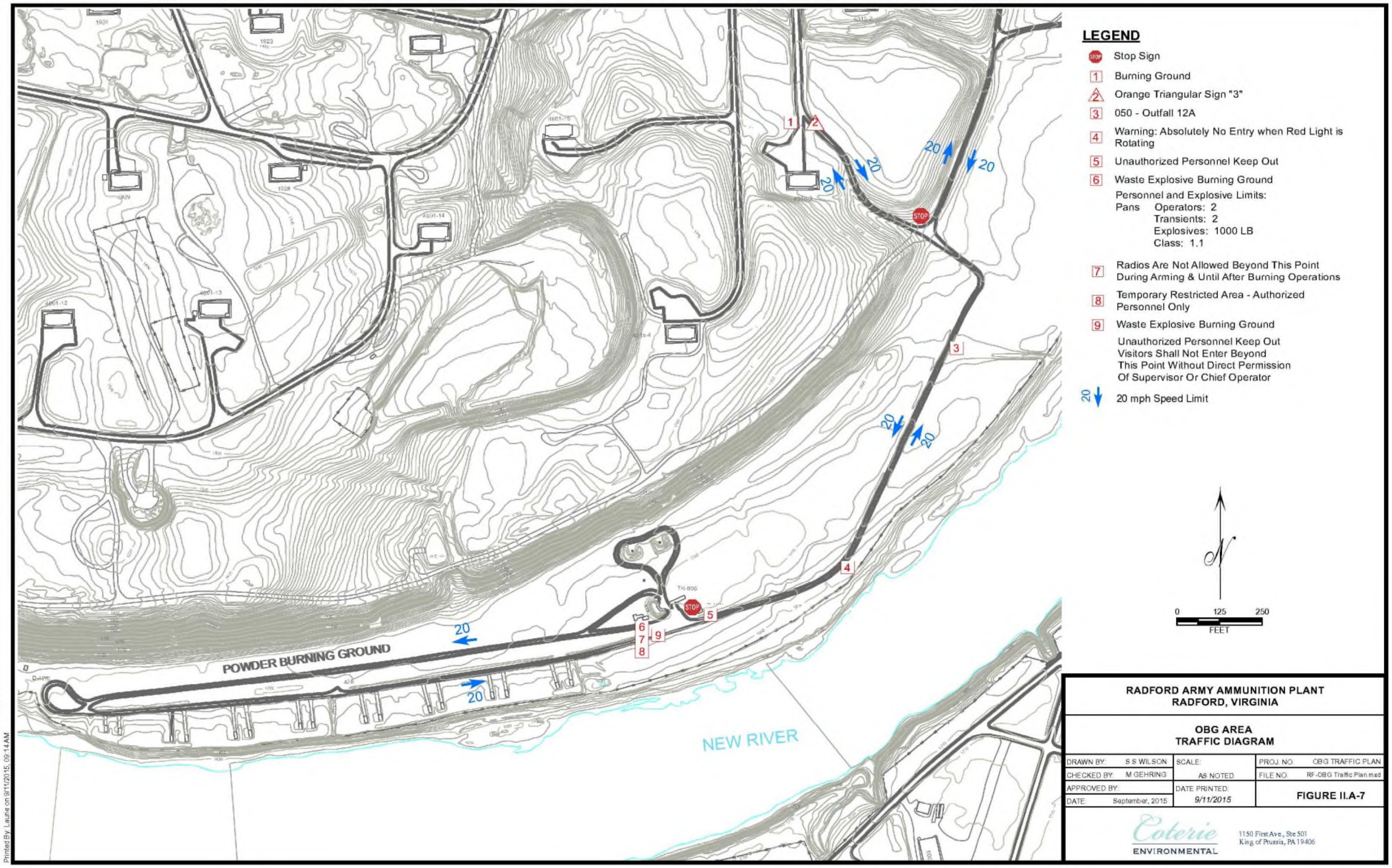


FIGURE II.A-7: OBG AREA TRAFFIC MAP



ATTACHMENT II.B – WASTE ANALYSIS PLAN

II.B.1. Waste Characteristics

Those hazardous wastes that may be managed at the permitted open burning ground (OBG) are waste energetic materials and spill "clean-up" residues generated at the Radford Army Ammunition Plant (RFAAP) by either the contracted operator (the Permittees) or one of the RFAAP tenant organizations. No wastes generated outside of the RFAAP will be received, stored, or treated at the permitted treatment area. No waste materials are stored at the OB site. They are transported to the site directly from the production plant or from established <90-day accumulation areas.

The waste streams treated at the OBG include the same raw material as the production materials generated at the RFAAP but they fail to meet some performance specification either due to operational upsets, misformulations, etc. As a result, production records and formulation data can usually be used to determine whether the waste is suitable for treatment at the OBG. However, when this information is not sufficient to make that conclusion, other data may be gathered to resolve the issue. In some cases, a small test burn of this material may provide adequate information on the suitability of this waste for the OBG.

In general, the managed wastes include wastes that exhibit the following hazardous characteristic(s):

i. Reactivity (hazardous waste number D003) as specified in 9 VAC 20-60-261, incorporating 40 CFR § 261.23 by reference; and

ii. Toxicity, as specified in 9 VAC 20-60-261, incorporating 40 CFR § 261.24 by reference, for one or more of the following contaminants;

a) Arsenic (hazardous waste number D004);

b) Barium (hazardous waste number D005);

c) Cadmium (hazardous waste number D006);

d) Chromium (hazardous waste number D007);

e) Lead (hazardous waste number D008);

f) Mercury (hazardous waste number D009);

g) Selenium (hazardous waste number D010);

h) Silver (hazardous waste number D011); and

i) 2,4-Dinitrotoluene (hazardous waste number D030).

iii. Ignitability (hazardous waste number D001) as specified in 9 VAC 20-60-261, incorporating 40 CFR § 261.21 by reference.

Under no circumstances will the following materials be managed at the OBG:

i. Radioactive wastes, or mixed radioactive and hazardous wastes;

ii. Wastes that are listed pursuant to 9 VA 20-60-261, incorporating 40 CFR §§ 261.31,32, and 33, by reference, will be managed at the permitted treatment area.

iii. Any material contaminated with or suspected of being contaminated with military warfare agents accepted for thermal treatment at the OB unit. Examples of such chemical warfare agents are:

- Choking agents;
- Nerve agents;
- Blood agents;
- Blister agents;
- Incapacitating agents;
- Vomiting compounds;
- Tear producing compounds; and
- Herbicides.

iv. Smoke and incendiary devices, as these materials are not suitable for treatment at the OBG for a variety of reasons.

Only those hazardous wastes that are within the specifications of the facility's RCRA Permit and this Waste Analysis Plan will be open burned. A specific list of those wastes permitted for burning at the OBG is provided in Table II.B-1 of Appendix II.B-1. As shown in the table, the wastes are classified into one of 20 different waste groups that are described in detail in Section II.B.2. These group numbers were assigned as the information on the waste groups was collected. There is no significance to the order of the discussion in Section II.B.2 below or the group numbers in Table II.B-1 of Appendix II.B-1.

II.B.2. Waste Composition and Characterization

The composition of the energetic waste mixtures generated and sent to the OBG varies due to changes in the production schedule. However, all of the wastes can be categorized into one of the 20 Groups of waste identified in Table II.B-1 of Appendix II.B-1. This table identifies each waste by group number and specifies the RCRA hazardous waste codes that may be applicable to that group. Information on the 40 CFR Part 261 Appendix VIII constituents that may be present in each group is provided in Table II.B-2 of Appendix II.B-1. If the Permittees wish to manage waste whose formulation is not consistent with one of the groups identified in Table II.B-1 of Appendix II.B-1, the Permittees will submit a request for permit modification.

Wastes from all groups except Groups 2, 3, 5, and 6 may be treated by open burning when any of the following conditions are satisfied:

i. The material cannot be safely put through the waste feed preparation system at the hazardous waste incinerators. This may include material that may be contaminated with tramp metal objects, rocks, and similar debris that will damage the grinder. Such items include, but are not limited to, press heels and rocket grains that are too long or large to fit into the Grinder.

ii. The material cannot be safely treated at the incinerators. Certain propellants, intermediate products, and essential materials cannot be ground or mixed with water due to their reactive nature, geometry, or specific hazard. If the waste is not in slurry form or cannot be mixed into slurry form it is not possible to feed the material to the incinerators. Such items include, but are not limited to, primers, flashtubes, and projectiles from Group 15 that have been tested and proven not to detonate when burned but that contain metal that render them not suitable for treatment in the incinerator. In addition, this may include non-listed wastes generated from floor cleaning, spills, and production pit cleanups in operating areas that contain foreign object debris (FOD) and ample energetic material such that the wastes are reactive.

iii. The incinerators are down for maintenance or are inoperable because of mechanical failure and the reactive waste accumulation areas are not capable of handling any additional material in accordance with Army and/or Permittee policies on building capacity.

Prior to initial treatment, a hazards analysis of any new waste stream will be performed and the results of that analysis will placed in the operating record. The material will then be burned at the OBG rather than at the incinerators because of an undue risk of an incident. All of the waste accepted for treatment at the OBG is considered hazardous prior to treatment because of its explosive, reactive, or flammable nature or because it meets RCRA toxicity thresholds for certain compounds. Full hazard characteristics analyses are not performed prior to open burning to avoid danger associated with excess handling of such materials and to eliminate costly and potentially dangerous time delays. The waste is visually inspected prior to treatment to ensure that only appropriate wastes are subjected to thermal treatment.

Information to ensure safe handling of materials to be treated at the OBG is available in historical data and ordnance publications. In the case of materials that have no such information, chemical and physical analyses are performed to determine its reactivity, stability, and ignitability characteristics.

II.B.2.a. Off-Specification Propellant and Propellant Production Intermediates

Table 1 of Appendix II.B-1 identifies nine groups that contain single, double, or triple base propellants and propellant intermediates. These three categories of propellant that differ in their primary energetic constituents, as follows:

- Single base propellants contain nitrocellulose;

- Double base propellants contain two energetics, typically nitrocellulose and nitroglycerin; and

- Triple base propellants contain three energetics, typically nitrocellulose, nitroglycerin, and nitroguanidine.

These nine groups have been divided based on the primary propellant category and the other waste constituents that distinguish them from each other. The nine groups are as shown in Table II.B-1 in Attachment II.B, Appendix II.B-1.

Propellant contaminated materials will be identified using the group associated with the specific propellant that contaminates the item unless the material requires an aid to burn or is contaminated with multiple waste groups. In these cases, the material will be identified as Group 20.

II.B.2.b. Liquid Wastes with Glycol

The waste streams containing diethylene glycol (DEG) and triethylene glycol (TEG) are generated from the washing of nitroglycerin (NG) and diethylene glycol dinitrate (DEGDN) with water to remove the desensitizing agents DEG and TEG from the NG and DEGDN. These waste streams are non-hazardous. They contain water (80-85%) and glycol (15-20%) and may be used in the production of slurry batches for incineration in Tanks T-1A and T-1B. The waste groups for these streams are identified in Table II.B-1 of Appendix II.B-1 as Group 5 (TEG Water) and Group 6 (DEG Water).

The Group 5 and Group 6 wastes may not be treated at the OBG.

II.B.2.c. Load, Assemble, and Pack Waste

The load, assemble, and pack waste consists of energetic wastes and energetic contaminated waste generated when ammunition cartridges are assembled. The waste consists of materials that are placed in the cartridges such as HMX, RDX, and propellants or items contaminated with these materials. These wastes are identified in Appendix II.B-1, Table II.B-1 as Group 15.

The finished products from the load, assemble, and pack operations, including the off-specification projectiles that contain energetic materials and cases with primers, may not be burned at the OBG.

II.B.2.d. Specialty Products Waste

The specialty products waste groups (17, 18, and 19) contain energetic materials such as nitrocellulose, nitrate esters, nitroguanidine, solid explosives, and 40 CFR 261, Appendix VIII constituents or wastes that are contaminated with them and are generated in small quantities. The specialty products wastes identified as Group 18 on Table II.B-1 of Appendix II.B-1 also contain chlorides or perchlorates. The specialty products wastes identified as Group 19 on Table II.B-1 of Appendix II.B-1contain metals in addition to the other materials contained in specialty product wastes.

II.B.2.e. Miscellaneous Wastes

The miscellaneous wastes permitted to be treated at the OBG and listed in Table II.B-1 of Appendix II.B-1 include:

a) Ignitable and reactive liquids in sawdust; and

b) Dinitrotoluene, trinitrotoluene, and isotriol wastes from manufacturing that are not listed wastes.

The term ignitable and reactive liquids in sawdust refers to wastes containing a nitrate ester (any liquid explosive, *i.e.*, nitroglycerin, diethylene glycol dinitrate), triacetin, acetone, alcohol, or ether, and sawdust. The ignitable or reactive liquids with sawdust typically originate from cleaning operations or spills in the production area. These wastes are identified as Group 1 wastes.

II.B.2.f. Screening, Floor Wastes, and Propellant Contaminated Wastes

The wastes in Group 20 are a combination of materials from Groups 1 through 19, excluding Groups 2, 3, 5, and 6. These include solids screening pit waste from production building wash downs, floor sweepings from production buildings that could potentially be contaminated with metal, rocks or other foreign object debris (FOD) that could cause an explosion at the Incinerator Grinder building, and/or other materials that are contaminated with sufficient propellant or energetics such that they are characterized as reactive or ignitable. Generally, this group requires an aid to burn.

Because these wastes are a combination of many different waste groups, there is not one simple characterization that adequately describes them. Therefore, they are not included on Table II.B-2 of Appendix II.B-1. The Group 20 wastes do not include any listed wastes nor does it carry any RCRA codes not authorized by this Permit.

II.B.3. Waste Accumulation and Handling

Waste materials from the 20 waste groups that are to be treated at the OBG are managed in less than 90-day accumulation buildings throughout the RFAAP in 20 gallon tubs. These tubs of waste are transported to the OBG, where they are prepared for open burning. The frequency of pickup varies according to production schedules, occurring as often as daily, however in most cases weekly. All hazardous waste is retrieved or burned, at a minimum, before the 90-day accumulation period expires.

Each container of waste managed at the OBG is accompanied by an internal manifest sheet that documents the generator of the waste (the Permittee or a RFAAP tenant organization), the point of origin of the waste, the specific type of waste (*e.g.*, type of energetic or waste mixture), and the date on which the waste was generated. Prior to transporting the waste to the OBG, the waste handler inspects the waste to ensure that it matches the characterization provided on the internal manifest form and to make sure that it fits into one of the waste groups permitted for treatment at the OBG.

II.B.4. Waste and Residue Sampling

Two types of sampling are conducted to comply with this Permit: waste sampling and residue sampling. This section provides a description of the techniques employed for both.

II.B.4.a. Waste Sampling

Samples for characterizing the managed wastes are collected as needed to conduct the waste profiling analyses discussed in II.B.5.a. When collected, samples are taken from waste tubs of each waste group that is included in the sampling event. Each sample container is labeled with the day, month, and year that it is collected, as well as the group number or propellant type, and the sampler's initials. The operator completes a sample card that is used to document the custody of the sample and the analyses required. A sample number is then affixed to each container and the samples are sent to the laboratory for analysis as required to comply with this Permit.

Sample results are then entered into a software program that documents the historical analysis of the waste stream for evaluation of compliance with limits in this Permit. Sampling results are retained for three years as per Condition I.E.3.

To ensure that proper sampling technique is employed, all operators that collect samples of the waste streams will be trained in the sample collection procedure during their initial on-the-job training.

II.B.4.b. Residue Sampling

The primary hazard characteristic of the waste residue after thermal treatment will originate from heavy metals and possible traces of the waste material. All of the waste residues from burning, cleaning of the burn pans and collection of precipitation that collects in the burn pans are containerized and handled as hazardous waste. Wastes that are verified as being hazardous are then disposed of in a permitted hazardous waste disposal facility. After treatment, the immediate area surrounding the unit is inspected and unburned explosives are collected and held until the next scheduled burn. This procedure ensures that any waste treatment residues collected for analysis and disposal are not of an explosive nature.

II.B.5. Waste Analysis Requirements

All hazardous wastes managed in accordance with the facility’s Permit will be subjected to waste analysis pursuant to the Permit and this Waste Analysis Plan prior to being treated at the OBG. The Permittee maintains the responsibility for sampling and analyzing all wastes managed at the OBG regardless of whether it was generated by the Permittee or a RFAAP tenant organization.

For each hazardous waste that may be open burned (see Section II.B.2.), a hazardous waste determination will be made in accordance with 9 VAC 20-60-262, adopting 40 CFR § 262.11 by reference. At a minimum, the determination will identify:

i. Whether the waste is radioactive;

ii. Whether the waste is listed under 9 VAC 20-60-261, adopting 40 CFR § 261 Subpart D by reference; and

iii. Whether the waste is a characteristic hazardous waste in accordance with 9 VAC-20-60-261, adopting 40 CFR § 261.20 through 261.24 by reference.

This determination may be made through a combination of process knowledge and laboratory analysis. The results of all hazardous waste determinations will be maintained in the facility operating record.

In addition to the hazardous waste determination for each waste group, all wastes managed at the facility are tested for compatibility with nitroglycerin (NG) and nitratability prior to the raw ingredients of that waste being used onsite.

The compatibility testing is performed utilizing a multi-test apparatus methodology, which, when completed, provides the data necessary to determine the compatibility of waste groups. Compatibility is based on the amount of gas produced by the mixture of explosive and contact material that is in excess of the amount of gas produced by the materials themselves. The wastes are deemed "incompatible" if a mixed sample of the wastes generates a specific volume of gas more than the sum of the associated unmixed specimens. Compatibility tests are performed by the onsite laboratory.

Once this initial compatibility testing is completed, no further compatibility analysis is performed while the wastes is being generated.

II.B.5.a. Analysis of Waste Groups

All waste groups are analyzed at least once per year to properly characterize them for management under this Permit. Analysis may include evaluation of process knowledge or actual sampling and laboratory analysis.

At all times an accurate profile of every hazardous waste open burned at the RFAAP will be maintained in the facility operating record. A hazardous waste profile will identify the hazardous constituents and characteristics necessary for proper designation and management of the waste stream. The profile will also include concentrations of all 40 CFR § 261 Appendix VIII (adopted by reference in 9 VAC 20-60-261) constituents in that waste, determined via either process knowledge or actual sampling and analysis.

Each hazardous waste profile will include or consist of:

a. Existing published or documented data on the hazardous waste or on waste generated from similar processes. The use of existing published or documented data will include confirmation by the generator that the process generating the hazardous waste has not significantly changed; and/or

b. Laboratory analysis of the waste stream consisting of chemical, physical, and/or biological analyses using appropriate methods from the EPA document SW-846 Test Methods for Evaluating Solid Waste, 3rd Edition, 1986, as updated, or by facility standard operating methods that have been approved via the Virginia Environmental Laboratory Accreditation Program.

Every waste profile will be reviewed at least annually in order to confirm that it still accurately represents the waste stream. A waste stream will be re-profiled whenever the Permittees have reason to believe that the process or operation generating the hazardous waste has changed.

II.B.5.b. Analysis of Waste Residues and Other Materials

After completion of each burn, any ash left in the burn pan is placed in a 55-gallon drum located at the OBG. Composite samples of the ash from each drum are collected as the ash is generated and are analyzed onsite prior to offsite shipment to determine if it exhibits the hazardous characteristics of reactivity. Reactivity analysis are conducted using the procedures provided in Appendix II-B.2. In addition, on an annual basis, SW-846 Method 1311 is used to determine if the waste meets the toxicity criteria via the Toxicity Characteristic Leaching Procedure (TCLP).

If the ash exhibits the characteristic of reactivity it will be removed from the container and placed back on the pans at the OBG for further treatment. If the ash does not exhibit the characteristic of reactivity but is otherwise determined to be a hazardous waste according to 9 VAC 20-60-261.24, then it will be managed as a hazardous waste in accordance with all applicable requirements of 9 VAC 20-60. If the ash is not determined to be a hazardous waste it will be managed as a solid waste in accordance with all applicable requirements of 9 VAC 20-80-10 *et seq*.

In addition to satisfying requirements for disposal and shipping of the waste, the results of the reactivity analyses are maintained to demonstrate compliance with 9 VAC 20-60-1010.K.8, which requires the facility to provide a demonstration of the effectiveness of the thermal treatment process.

II.B.5.c. Quality Assurance and Quality Control

All sampling and analyses performed in accordance with this Waste Analysis Plan will, at a minimum, achieve all performance specifications specified in the VELAP-approved site-specific analytical method and quality assurance manual. Records of the specific analytical method used and appropriate QA/QC documentation will be maintained at RFAAP with the results of all analyses.

APPENDIX II.B-1: WASTE GROUP COMPOSITION DATA

TABLE II.B-1: WASTE GROUPS MANAGED AT THE RFAAP [1]

Group No.	Description	Defining Characteristics	RCRA Waste Codes [2]
1	Miscellaneous Waste	Ignitable and reactive liquids in sawdust	D001, D003
2	Miscellaneous Waste	Propellant Laboratory Waste (Not allowed to be treated at the OBG)	D001, D003, D004-D011, D030
3	Miscellaneous Waste	Waste Nitrocellulose Solid Waste (Not allowed to be treated at the OBG)	N/A
4	Miscellaneous Waste	Dinitrotoluene and Trinitrotoluene Wastes from manufacturing or wastes contaminated with these materials that are not listed wastes	D003, D030
5	Liquid Waste	Water Containing Triethylene Glycol Solid Waste (Not allowed to be treated at the OBG)	N/A
6	Liquid Waste	Water Containing Diethylene Glycol Solid Waste (Not allowed to be treated at the OBG)	N/A
7	Single Base Propellants	Propellant with Nitrocellulose and Lead or wastes contaminated with these materials	D001, D003, D008
8	Single Base Propellants	Propellant with Nitrocellulose or wastes contaminated with these materials	D001, D003
9	Single Base Propellants	Propellant with Nitrocellulose and Dinitrotoluene or wastes contaminated with these materials	D001, D003, D030
10	Double Base Propellants	Propellant with Nitrocellulose and Nitrate Esters or wastes contaminated with these materials	D001, D003
11	Double Base Propellants	Propellant with Nitrocellulose, Nitrate Esters and Perchlorate salts or wastes contaminated with these materials	D001, D003
12	Double Base Propellants	Propellant with Nitrocellulose, Nitrate Esters and Lead or wastes contaminated with these materials	D001, D003, D008
13	Energetics with solid explosives	Propellant with Nitrocellulose, Nitrate Esters or Solid Explosives or wastes contaminated with these materials	D001, D003
14	Triple Base Propellants	Propellant with Nitrocellulose, Nitrate Esters and Nitroguanidine or wastes contaminated with these materials	D001, D003

15	Load, Assemble, & Pack Waste	Energetic materials from manufacturing cartridges or wastes contaminated with these materials	D001, D003
16	Single Base Propellants	Propellant with Nitrocellulose, Dinitrotoluene, and/or Lead or wastes contaminated with these materials	D001, D003, D008, D030
17	Specialty Products Waste	Energetics with Nitrocellulose, Nitrate Esters, Nitroguanidine, Solid Explosives, or Appendix VIII[3] Constituents or wastes contaminated with these materials	D001, D003, D004-D010, D030
18	Specialty Products Waste	Energetics with Nitrocellulose, Nitrate Esters, Nitroguanidine, Solid Explosives, and Appendix VIII Constituents, Chlorides, or Perchlorates or wastes contaminated with these materials	D001, D003, D004-D010, D030
19	Specialty Products Waste	Energetics with Nitrocellulose, Nitrate Esters, Nitroguanidine, Solid Explosives, and Appendix VIII Constituents, or Metals or wastes contaminated with these materials	D001, D003, D004-D010, D030
20	Screening and Floor Wastes	Energetic or energetic contaminated items that may require an aid to burn or a wastes contaminated with a mixture of wastes from different waste groups	D001, D003, D004-D011, D030

1. Note that those wastes from Groups 2, 3, 5, and 6 are not treated at the OBG.
2. Codes shown represent those RCRA waste codes that the waste **may** exhibit. Not all of the specified codes may apply to every canister of waste treated within this group.
3. 40 CFR 261, Appendix VIII

TABLE II.B-2: APPENDIX VIII CONSTITUENTS PRESENT IN RFAAP WASTES

Constituent	Chemical Abstracts Service (CAS) No.
Antimony Compounds N.O.S.	7440-36-0 (Antimony)
Arsenic	7440-38-2
Barium N.O.S.	7440-39-3 (Barium)
Chromium compounds N.O.S.	7440-47-3 (Chromium)
Copper chromite	12053-18-8
Dibutyl phthalate	84-74-2
Diethyl phthalate	117-81-7
2,4-Dinitrotoluene	121-14-2
Diphenylamine	122-39-4
Lead compounds N.O.S.	7439-92-1 (Lead)
Mercury	7439-97-6
Mercuric Compounds N.O.S	7439-97-6 (Mercury)
Nitroglycerin	55-63-0
2-Nitrosodiphenylamine (2-NDPA)	119-75-5
N-Nitrosodiphenylamine (N-NDPA)	311432-60-7
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0
Silver	7440-22-4
Toluene	108-88-3
1,3,5-Trinitroperhydro-1,3,5-triazine (RDX)	121-82-4

APPENDIX II.B-2: REACTIVITY TEST METHOD

Three methods are used to determine reactivity of residue from thermal treatment of reactive wastes.

The first method is performed by the on-site laboratory. A composite sample of the residue is analyzed for the presence of propellant. This method provides results to within a detection limit of less than 1%. Hazards Analysis has a proprietary report that tested explosives in soil. If there is less than 10% explosives in a soil matrix the soil will not be reactive for the Gap test or DDT test. Hazards Analysis uses the data from the on-site laboratory to make the determination whether the residue is reactive or not reactive.

The second method is to analyze the composite sample using SW 846 Method 8330. Again using the proprietary report Hazards Analysis uses the data to make the determination whether the residue is reactive or not reactive.

The third method is to use the GAP test or DDT test. These tests are described on the next three pages.

The first method is used for waste characterization residue. This testing is Quality checked by using the second method every 4 ash samples. The third method is done annually to confirm the Hazards Analysis report.

REACTIVITY TEST PROCEDURES
DESCRIPTION OF TESTS

GAP TEST FOR SOLID MATERIALS

The experimental arrangement used for the gap test is shown in Figure B1. The test sample is contained in a cylinder consisting of a 40.6 cm (16-inch) length of cold-drawn seamless carbon steel "mechanical" tubing 4.76 cm (1.875 inches) in outside diameter with a wall thickness of 0.56 cm (0.219 inch) and an inside diameter of 3.65 cm (1.438 inch). The sample in this test is normally either a gel or a granular solid at room temperature that is loaded to the density attained by tapping the cylinder until further settling becomes imperceptible. The bottom of the cylinder is closed with two layers of 0.0076-cm (0.003-inch) thick polyethylene sheet tied on with gum rubber bands and polyvinyl chloride electrical insulating tape. The sample is subjected to the shock wave generated by the detonation of two cast pentolite density 1.65 g/cm^3 (50/50 pentaerythritol tetranitrate PETN/TNT) pellet 5.08 cm (2 inches) in diameter and 2.54 cm (1 inch) thick. The pellets will be in direct contact with the bottom of the sample tube ("zero gap"). The pentolite pellets are initiated by a U.S. Army Engineers special detonator having a base charge of 0.935 gram (14.4 grains) of the PETN and a primary charge of 0.35 gram (5.4 grains) of diazo dinitrophenol which is butted against the bottom surface of the pentolite pellets and held in place by a cylinder or cork. Instrumentation consists of a continuous rate probe made of a thin aluminum tube with an inner diameter of 0.051 cm (0.02 inch) and a wall thickness of 0.0038 cm (0.0015 inch) with an axial enamel-coated resistance wire of 0.0078-cm (0.0031-inch) diameter, having a resistance of 3.0 ohms/cm (7.52 ohms/inch). The outer tubing is crimped against the inner wire at the lower end, forming a resistor. When this assembly is inserted in a medium that transmits a shock wave, the outer wall crushes against the inner wire as the wave moves up the tubing, shortening the effective length and changing the resistance. If a constant current (usually 0.06 ampere) is made to flow between the outer and inner conductors, the voltage between them is proportional to the effective length and can be recorded as a function of time using an oscilloscope. The slope of the oscilloscope trace is thus proportional to the velocity of the shock wave.

Criteria

Results of this test are considered to be positive if a stable propagation velocity greater than 1.5 km/sec is observed. Additional diagnostic information is provided by a mild steel witness plate 15.24 cm (6 inches) square and 0.3175 cm (0.125 inch) thick, mounted at the upper end of the sample tubing and separated from it by spacers 0.16 cm (0.063 inch) thick. A hole punched cleanly through the plate is an indication for a positive result.

A third source of diagnostic information is the fragmentation of the sample tube. The results of the test are considered to be positive only if the tube is fragmented along its entire length. The fragments range, depending on the material tested, from a few long strips to nearly a hundred small fragments; bulging, cracking, or "banana-peeling" of the acceptor is not considered a positive result.

In most cases, the results of the above three diagnostic methods agree. In some they do not, particularly with low-energy, low-density materials, e.g., benzoyl peroxide, in which the witness plate is not punched through, but the tube is fragmented; also with certain propellants, the witness plate is punched, but little damage is done to the tube, evidently indicating a localized explosion at the upper end of the tube. In such cases, since there are essentially three criteria (witness plate, tube fragmentation, and rate probe), the result is assessed on the basis of the two criteria that agree; i.e., if any two criteria indicate a detonation, the result is considered positive, but not so if only one indicates a detonation. Some case of doubtful propagation can also be resolved by using a longer sample tube.

Deflagration/Detonation Transition (DDT) Test

The experimental arrangement for the DDT test is shown in FigureB2. The sample of the material to be tested is contained in a 45.7-cm (18-inch) length of 3-inch diameter schedule 80 carbon steel pipe with inside diameter of 7.37 cm (2.9 inches) and wall thickness of 0.75 cm (0.30 inch) , capped at both ends with "3000 pound" forged steel pipe caps.

The sample is subjected to the thermal and pressure stimulus generated by an igniter consisting of a mixture of 50 percent RDX and 50 percent grade FFF_g black powder located at the center of the sample vessel. The igniter assembly consists of a cylindrical container 2.06 cm (0.81 inch) in diameter and of variable length, which is made from 0.0254 cm (0.01 inch) thick cellulose acetate held together by two layers of nylon-filament-reinforced cellulose acetate tape. The length of the igniter capsule is 0.32 cm (0.125 inch) for each gram of igniter material. The igniter capsule contains a small loop formed from a 2.54 cm (1-inch) length of nickel-chromium alloy resistance wire 0.03 cm (0.012 inch) in diameter having a resistance of 0.343 ohms. This loop is attached to two insulating copper tinned lead wires 0.066 cm (0.026 inch) in diameter; the overall wire diameter including insulation is 0.127 cm (0.05 inch). These lead wires are fed through small holes in a brass disc approximately 1 cm (0.4 inch) in diameter and 0.08 cm (0.03 inch) thick, which is soldered to the end of a 23-cm (9-inch) length of "1/8-inch" steel pipe having a diameter of 1.03 cm (0.405 inch); this pipe is threaded to the other end and screwed into a threaded hole on the inside of one of the pipe caps. This pipe supports the igniter capsule and serves as channel for the igniter wires. The igniter is fired by a current of 15 amperes obtained from a 20-volt transformer.

Criteria.

The criterion currently used in the interpretation of this test is that for a positive result either the pipe or at least one of the end caps be fragmented into at least two distinct pieces, i.e., results in which the pipe is merely split or laid open or in which the pipe or caps are distorted to the point at which the caps are blown off are considered to be negative results. Although it may be argued that a small number of fragments does not indicate the development of a detonation, it at least indicates a very rapidly rising pressure which in a larger sample could lead to development of detonation.

FIGURE II.B-1: EXPERIMENTAL ARRANGEMENT FOR ZERO GAP TEST

Source: U.S. Bureau of Mines, Department of the Interior

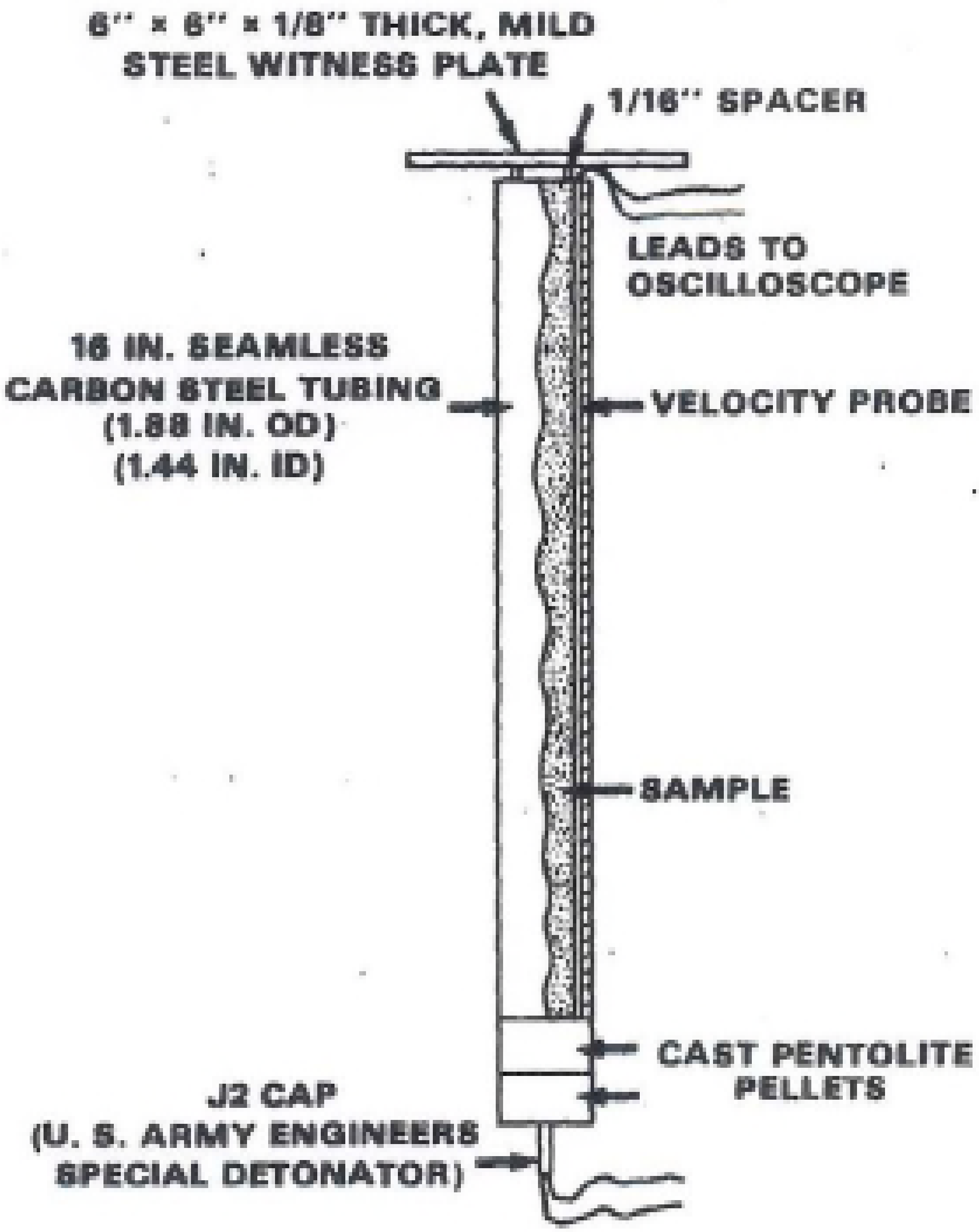
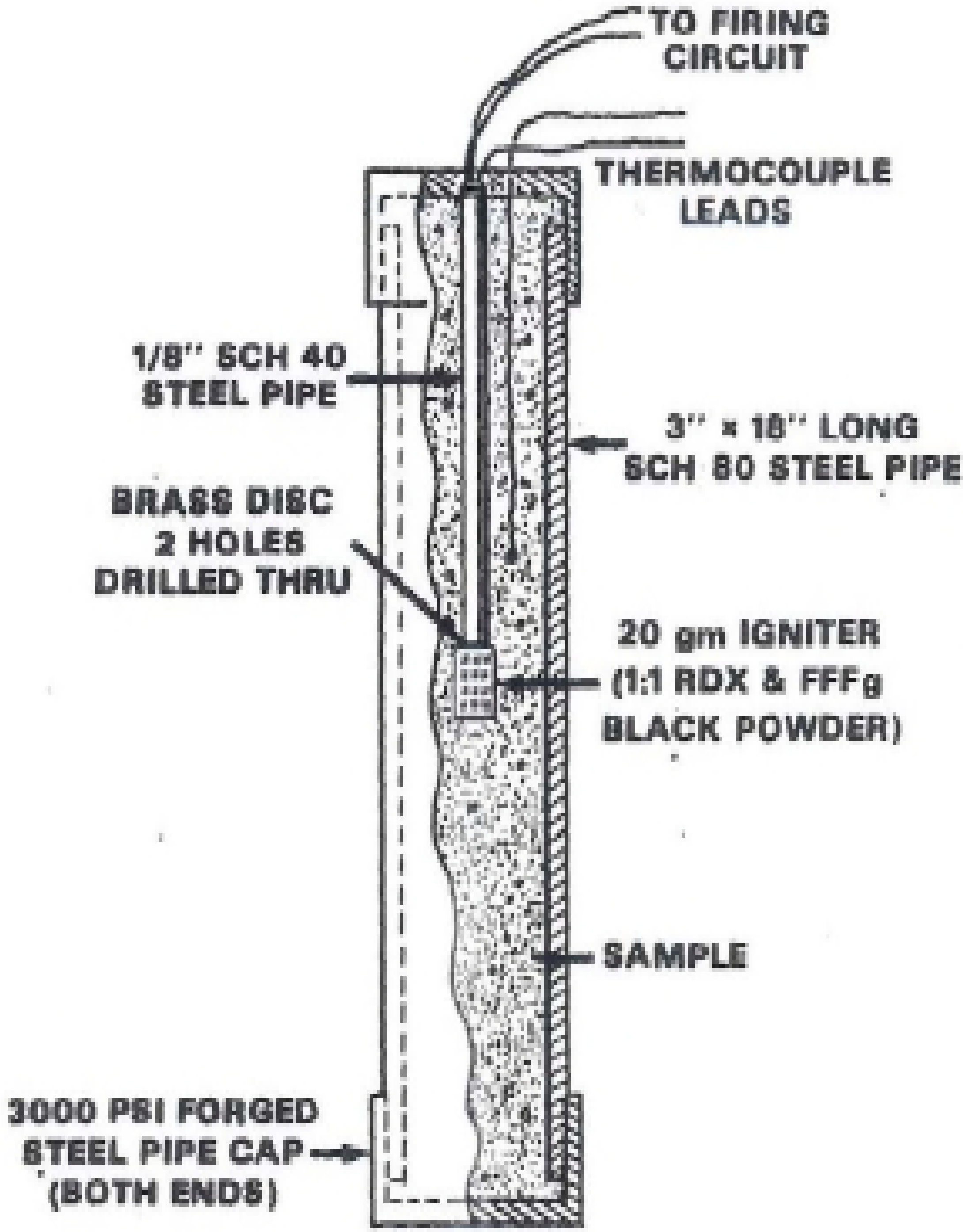


FIGURE II.B-2: EXPERIMENTAL ARRANGEMENT FOR DEFLAGRATION-DETONATION TRANSITION TEST

Source: Hercules Incorporated (Radford Army Ammunition Plant)



ATTACHMENT II.C - SOIL MONITORING PROGRAM

SOIL MONITORING PROGRAM
FOR THE
OPEN BURNING GROUND (OBG)
RADFORD ARMY AMMUNITION PLANT
RADFORD, VIRGINIA

Submitted to:

Virginia Department of Environmental Quality
1111 East Main Street, Suite 1400
Richmond, Virginia 23218
(800) 592-5482

Prepared for:
BAE Systems, Ordnance Systems Inc.
Radford Army Ammunition Plant
Radford, Virginia

Prepared by:

Draper Aden Associates
2206 South Main Street
Blacksburg, Virginia 24060
(540)552-0444

February 2017

DAA Job No. B03204-142

TABLE OF CONTENTS

CERTIFICATION SHEET

Virginia Professional Certification:

I certify that I have supervised preparation of the attached report, that it has been prepared in general accordance with industry standards and practices, and that the information contained herein is truthful and accurate to the best of my knowledge.

Name:____

Signature:____

Virginia Professional Certification Type and Number: ______________________________

Company:____

Address:____

City/State/Zip:____

II.C.1. Introduction

This Soil Monitoring Program (SMP) was developed to monitor for potential impacts to surface soils resulting from the operation of the Open Burning Ground (OBG) at the Radford Army Ammunition Plant (RFAAP) in Radford, Virginia. The duration of the program will be over the lifetime of the RCRA Operating Permit. The SMP outlines the procedures and techniques for soil sample collection, sample preservation and shipment, chain-of-custody (COC) control, and laboratory analyses that will be utilized. The SMP also documents how quality assurance and quality control (QA/QC) activities will be implemented to ensure data are of sufficient quality. The results of the SMP will be used to detect the presence of a release of hazardous constituents from the OBG to the surface soils comprising the Unit.

The purpose of this SMP is to evaluate the potential for surface soil impacts from the operation of the OBG by providing an accurate representation of surface soils. This will be accomplished by collecting an adequate number of representative samples, QA/QC samples, and background samples. The SMP outlines the methods and procedures to be used to establish representative background concentrations of explosives and other compounds of potential concern (COPC), identify the protocols for soil sampling, sample handling, preservation, COC and shipping, and decontamination procedures of sampling equipment. The SMP was based on the original 2005 SMP prepared for the facility.

In addition, this program description addresses the procedures to be taken for the evaluation of "hotspots" (i.e., areas of significant concentration), should they be detected, and the protocol for interim measures that may be required to remediate any hotspots.

As the facility is within the 100-year floodplain, a major consideration in the design of this program was to comply with the requirements set forth in 40 CFR § 264.18 (b) pertaining to floodplains, as follows:

(a) *Floodplains.* (1) A facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of any hazardous waste by a 100-year flood, *unless* the owner or operator can demonstrate to the Regional Administrator's satisfaction that:

  (i) Procedures are in effect which will cause the waste to be removed safely, before flood waters can reach the facility, to a location where the wastes will not be vulnerable to flood waters;

  (ii) For existing surface impoundments, waste piles, land treatment units, landfills, and miscellaneous units, no adverse effects on human health or the environment will result if washout occurs, considering:

(A) The volume and physical and chemical characteristics of the waste in the facility;

(B) The concentration of hazardous constituents that would potentially affect surface waters as a result of washout;

(C) The impact of such concentrations on the current or potential uses of and water quality standards established for the affected surface waters; and

(D) The impact of hazardous constituents on the sediments of affected surface waters or the soils of the 100- year floodplain that could result from washout.

The analysis of soil samples and subsequent provisions for remediation will, in effect, serve as the procedures which will cause the waste to be removed safely, before flood waters can reach the facility, to a location where the wastes will not be vulnerable to flood waters.

This work will be in accordance with the following documents that are incorporated in part into this program by reference. They are:

- *Draft Final Open Burning Ground/Open Detonation Permitting Guidelines, VDEQ, February 2002*

- *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846), as updated.*

- *Draft Guidance Manual for Closure Plans and Post-Closure Plans September 28, 2001*

- *Superfund Program Representative Sampling Guidance, Volume 1: Soil, Interim Final, OSWER Directive 9360. 4-10, EPA 540/R-95/141, PB96-963207, December 1995*

- *ASTM Standard Guide for Soil Sampling in the Vadose Zone, Designation D 4700-15, July 15, 1991 (revised 2015)*

- *Facility-Wide Background Study Report, IT Corporation, January 2001*

II.C.1.1. Site Description

The RFAAP is located in the mountains of southwestern Virginia within Pulaski and Montgomery Counties. A Site Location Maps are presented as Figure II.C -1 and Figure II.C-2. The facility is situated in one of a series of narrow valleys typical of the Valley and Ridge physiographic province of the Appalachian Highland Region of North America. Oriented in a northeast-southwest direction, the valley is approximately 25 miles long. The valley has a width of approximately eight miles at the southwest end and narrows to approximately two miles at the northeast end. RFAAP lies along the New River in the relatively narrow northeast corner of the valley. The maximum elevation at RFAAP is 2,225 feet above mean sea level (MSL) in the southeast corner and the minimum elevation is approximately 1,675 feet above MSL along the New River at the northern property boundary. RFAAP is divided by the New River into two sections. The southern section, which comprises approximately two-thirds of RFAAP, is called the "Main Plant." The remaining northern one-third section is called the "Horseshoe Area." The OBG is located in the Horseshoe Area.

The OBG is the waste propellant burning ground. A Site Plan for the Unit is included as Figure II.C-3. Material that cannot be burned in the Explosive Waste Incinerators is open burned at this Unit. As shown on the Site Location Map (Figure II.C-2), the OBG is located within the 100-year flood plain of the New River at the southeastern end of the Horseshoe Area. The Unit is located approximately 70 to 150 feet north of the river at an approximate elevation of 1,695 feet MSL (Site Plan, Figure II.C-3). The topography across the Unit is relatively flat; however, approximately 75 to 100 feet north of the Unit the ground surface slopes steeply upward. The elevation of the New River at the western end of the OBG is approximately 1,690 feet MSL; the elevation of the New River at the eastern end of the Unit is approximately 1,686 feet MSL. Past improvements to the area included a stormwater management design that provides protection from run-on and run-off during 25-year flooding events.

II.C.1.2. Definitions

The following definitions apply to this document:

Hazardous Constituents. Constituents specified in a facility's permit for which the surface soils must be monitored. Hazardous constituents are constituents identified in 40 CFR Part 261 Appendix VIII that are reasonably expected to be in or derived from waste contained in a regulated unit.

II.C.2. Geologic Setting

The Valley and Ridge physiographic province consists of folded and thrust-faulted Paleozoic sedimentary rocks ranging in age from Cambrian to Mississippian. Post-deformation weathering of these thrust-faulted and overturned Paleozoic rocks has resulted in the formation of resistant sandstone and dolomite ridges separated by valleys underlain by more easily eroded shale and limestone. Well developed karst features such as sinkholes and caves are common in the Valley and Ridge.

The general geology at RFAAP consists of limestone/dolomite bedrock covered by weathered residual deposits and/or alluvial deposits. The alluvial deposits consist of typical fluvial deposits of interbedded clay, silt, and sand/gravel deposits with cobble lenses. The thickness of the alluvial deposits ranges from a few feet to approximately 50 feet, with an average thickness of 20 feet. The residual deposits consist of clay, silt, and clasts resulting from the physical and chemical weathering of the parent bedrock. The residual deposits typically underlie the alluvium, except in locations where the residuum has been eroded to bedrock and replaced by alluvium. The thickness of the residual deposits ranges from a few feet to approximately 40 feet. Underlying the alluvium and residuum throughout most of RFAAP is a series of dolomite, limestone and shale strata known as the Cambrian-aged Elbrook Formation. The Elbrook Formation is the major outcropping formation as well as the predominant karstic formation below the facility. Sinkholes, solution channels, pinnacled surfaces, and springs are common to the Elbrook Formation.

The OBG is underlain by an approximately 13-20 feet thick alluvial deposit. Based on a review of boring logs for monitoring wells that were installed at the OBG, the alluvial deposit consists of clay and silt overlying sand and gravel. The alluvium appears to be laterally continuous across most of the site, although the thickness, composition, and texture vary between monitoring well locations. The alluvium is underlain by Middle Cambrian Age carbonate bedrock of the Elbrook Formation. The Elbrook Formation is comprised of dolomite and limestone with lesser shale and siltstone.

In 1992, the USEPA reviewed and compared historical aerial photography to assess sinkhole presence and development, and to analyze apparent photo-lineaments. A fracture trace/sinkhole location map of RFAAP was prepared (USEPA, 1992). The fracture trace map illustrates a northwest-trending lineament passing through the OBG to the east of monitoring well 13MW2. Furthermore, a geologic map of the area illustrates a splay of the Pulaski Thrust Fault trending to the northwest through the western portion of the Unit (Schultz, VDMR open file in preparation).

II.C.2.1. Soils Occurrence and Properties

According to the *Facility-Wide Background Report (Section 1.0)* the OBG is underlain by Wheeling sandy loam (see Figure II.C-4). The Wheeling unit comprises about 11% of the soils at the Radford Plant site. The Wheeling is characterized by low slopes (0-2%). The unit is described as a surface layer of 10.inches of dark brown sandy loam underlain by 50.inches of dark brown gravely sandy loam subsoil. At depths greater than 60.inches below ground surface the soil is predominantly a mixture of silt and sand with minor amounts of clay. Depth to bedrock is at least 60.inches.

The permeability and water capacity of the Wheeling is moderate. Surface runoff is slow. The organic matter content is moderately low, and the soil is moderately to strongly acidic. The hazard of erosion from the Wheeling soil unit is characterized as slight.

II.C.2.2. Hydrogeology

The general hydrogeologic setting for RFAAP is characterized by porous alluvial sediments overlying weathered and unweathered dolomite and limestone. In areas where the porous alluvial sediments are the uppermost water-bearing zone, groundwater flow is generally from topographically high areas to topographically low areas. In some areas of RFAAP, the uppermost water-bearing zone is within the limestone and dolomite bedrock. The karst features within the bedrock aquifer can provide conduits for rapid transport of groundwater to the New River, which is the discharge area for regional groundwater flow.

Seasonal variations in precipitation can affect the direction of groundwater flow within the bedrock aquifer at RFAAP. During wet seasons (high flow conditions), groundwater flow may occur in higher elevation conduits that are not normally saturated during dry seasons (low flow conditions). As a result, flow directions may change significantly as different conduits are accessed. Additionally, flow may short-circuit the predominant flow paths and be redirected, discharging in unexpected areas.

In addition to seasonal variations, groundwater levels within the bedrock aquifer may fluctuate dramatically during heavy precipitation events. Groundwater levels in the karst bedrock aquifer generally respond to heavy precipitation within approximately 14 hours, and may rise several feet in a short time. This condition exists throughout RFAAP, especially in areas where surface water infiltrates through sinkholes. Stormwater that flows into the sinkholes travels downward rapidly through conduits into the bedrock aquifer. Because groundwater may flow very quickly through these conduits, stormwater which infiltrates in the uplands of the facility may discharge to the New River in a matter of a few days following a storm event. The turbulent flow created by these conditions aerates the infiltrating water. The increased dissolved oxygen content can significantly affect the chemistry of the groundwater, increasing the concentration of many commonly occurring inorganic analytes. It is this direct connection between surface water and groundwater and the rapid movement of groundwater through the aquifer that is vital to interpreting the migration of both naturally occurring and released constituents in the groundwater at RFAAP.

II.C.3. Soil Monitoring Program

The SMP will be used to monitor for the presence of a release of hazardous constituents from the operation of the OBG to the surface soils of the Unit. The zone of monitoring is defined as the uppermost surface soils (zero to six-inches below ground surface) at selected locations located within the operating unit. The objective of the SMP is to obtain representative data to evaluate potential impacts to the surface soils over time. Soil samples will be collected and compared to specific regulatory limits and background values which will function as action levels. If specific action levels are exceeded, interim measures will be implemented.

II.C.3.1. Sample Locations

The soil sample locations are based on a judgment and knowledge of the site. Figure II.C-3 presents the proposed sample locations. Sample matrices will be limited to the uppermost soil horizon. The sampling of surface water runoff from the site is addressed by the site Virginia Pollutant Discharge Elimination System (VPDES) permit. Outfall 017 is included in the plant-wide permit. Groundwater samples are collected semiannually as part of the RCRA groundwater monitoring program. As the objective of the SMP is to evaluate the potential for contamination to leave the site via airborne deposition to the soils, the uppermost soil horizon has been targeted. Vertical delineation of the soil is not proposed as impacts to soil below the uppermost horizon are not subject to site erosion and vertical migration is addressed by the groundwater monitoring program.

The proposed sample locations are based on the observation that the "worse case" impacts will be within the immediate vicinity of the burn pans and within the overlapping ejecta zone of the pans. These locations were selected to represent the areas of greatest potential for impacts. The rationale that supports the selection of the sample locations is that soils will be transported by erosion and the worst case areas of deposition serve as the primary source area for the migration of impacted soils.

In addition to the samples adjacent to the burn pans, two discrete grab soil samples will be collected randomly along the southern border boundary of the OBG (SB-1 and SB-2) and two discrete grab soil sample will be collected randomly along the northern border boundary of the OBGs (NB-1 and NB-2). Also, one grab soil sample will be collected at the southeast corner of the OBG inside the berm (Berm-1) and one grab soil sample from the center-bottom of the sediment basin (Pond-1).

The soil sample locations presented in **Figure II.C-3** are functionally in between the burn pans of each burn pad location. Each impervious concrete burn *pad* is defined as the area of raised topography that houses the location of two individual burn *pans*. Burn *pans* are the ceramic or clay lined vessels that hold the waste propellant before and during the process of open burning. The sample locations represent an area that will be subject to overlapping zones of ejecta from each pan. The ejecta zone for each pan is conservatively defined as twenty (20) feet in all directions. This ejecta zone delineation is based on repeated observation of the open burning operations by plant personnel and evaluation of slow motion videos of the operation by graduate researchers from Virginia Tech. As presented in **Figure II.C-3,** there will be a total of eight grab soil samples collected from designated sample locations during each sampling event. The location of the random samples, the sample before the berm and the center of the pond are not depicted, as those locations may vary between events. In an effort to accurately measure the temporal variation (change over time) of constituent concentrations at the designated sample locations, it is proposed to collect samples within a zone of 10 feet in diameter at each location during each subsequent sampling event. In practice this would entail recording a triangulated location each event that could be reproduced each subsequent sampling event. The actual sampling location will correspond to an area of low topography between each pan that functions as the runoff conduit for the pad. These areas are erosion channels that flow towards the river-side berm and ultimately to the sedimentation basin that precedes Outfall 017. These channels are not vegetated and are comprised of open soils. **Figure II.C-5** presents photographs of a typical sample location.

Background soil samples were collected at a location on the far side of the Horseshoe area of the plant in the same soils group, the Wheeling Unit, as the soil at the OBG. Background soil samples were collected for analysis of volatile and semivolatile constituents, monitored at the time of the initial permit implementation, by SW 846 Methods 8260 and 8270. **Figure II.C-4** presents the background sample location and Table II.C-4 presents the background sampling results Background soil samples for energetics and nitroglycerin (SW-846 Methods 8330 and 8332, respectively) were not and will not be collected due to the high degree of false positives associated with those analytical methods. Background soil samples were not collected for inorganics as adequate data was collected for these constituents as part of the Facility-Wide Background Study. Table II.C-5 provides the background values for inorganics detected during the Facility-Wide Background Study. Future background samples may be collected to establish site specific background concentration limits. Future background sampling efforts will be based on sufficient independent samples. Additional background sampling will be completed at the discretion of the Permittee or as requested by DEQ.

II.C.3.2. Soil Monitoring Analyte List and Detection Determination

The hazardous constituents for which the OBG will be monitored are listed in **Table II.C-1**. This list is derived from the significant amount of analysis applied to selecting COPCs that was conducted in the *Detection Groundwater Monitoring Program – Open Burning Ground, Draper Aden Associat*es and other site assessments conducted for the OBG and other units at the facility, such as human health or ecological risk assessments. The constituents presented in **Table II.C-1** are reasonably expected to be in, or derived from, the wastes treated at the OBG and represent a reliable indication of potential hazardous constituents in the soil. The list includes hazardous constituents that were expected to be potentially present at the RFAAP based on project Safety Data Sheets (SDSs) and proprietary formulation data. In developing the list, special attention was paid to the list of hazardous constituents provided in 40 CFR Part 261 Appendix VIII. Also included in **Table II.C-1** are energetic compounds (SW-846 Method 8330), as well as Total Petroleum Hydrocarbons-Diesel Range Organics (TPH-DRO). Soil samples will be collected for TPH-DRO analyses at Pads 1, 4 and 7 as diesel and kerosene is occasionally used as an accelerant at those locations.

Non burn pad sampling locations which include; the two discrete grab soil samples collected randomly along the southern and northern border boundaries of the OBGs (SB-1, SB-2, and NB-1, and NB-2), the one grab soil sample collected at the southeast corner of the OBG inside the berm (Berm-1), and the one soil sample from the center-bottom of the sediment basin (Pond-1) will only be analyzed for the following constituents:

- Arsenic
- Barium
- Cadmium
- Chromium (Total)
- Chromium (Hexavalent)
- Chromium (Trivalent, by difference)
- Lead
- Selenium
- Bromomethane
- Trichloroethene
- Bis(2-Ethylexyl) phthalate
- Diethyl phthalate
- Dimethyl phthalate
- Di-n-butyl phthalate
- 2,4- Dinitrotoluene
- N-Nitrosodiphenylamine
- Dioxins/furans
- 2,4,6-Trinitrotoluene

- 2-Amino-4, 6-dinitrotoluene
- 4-Amino-2, 6-dinitrotoluene
- HMX
- Nitroglycerin

The analytes listed in **Table II.C-1** will serve as the constituent list for the SMP. Detection will be defined as an analytical result above the laboratory Method Detection Limit (MDL). If an MDL for a constituent is above the current RSL value, the constituent will be reported at ½ of the MDL. The laboratory Reporting Limit (RL) is analogous to the Limit of Quantitation/Quantitation Limit (LOQ/QL) for each constituent. RLs for each constituent are presented in **Table II.C-1**. Constituents not detected above the MDL will be reported as Not Detected (ND). RFAAP will list each constituent detected above the MDL.. Additionally, RFAAP will also list on the table the laboratory specific Method Detection Limit (MDL) for each constituent. If the laboratory reports an estimated concentration between the MDL and the RL, that estimated concentration will be J-flagged on the table. It is important to note; however, that the definition of a detection for this program will be an exceedance of the MDL, not the RL. As shown on **Table II.C-1**, the MDLs and RLs for each of the constituents are well below the respective designated action levels (benchmarks).

The Program Action levels (primarily the USEPA Regional Screening Levels (RSLs) are in Table II.C.1 and are current as the effective date of this permit. Action Levels must be updated to the latest USEPA RSL for Industrial Sites using 1e-6/HQ1 for the annual soil monitoring program. RSLs will be updated on a bi-annual basis (every two years). This will be done in the form of a Class I Permit modification. The rationale for this approach is due to the fact that the SMP will be part of a RCRA Operating Permit; therefore, effectively changing the Action Levels on a non-routine basis could result in violations that are out of the control of both the permittee and the VDEQ.

4-Nitrophenol has no USEPA RSL value. RFAAP will analyze for this compound, and if detected above the RL, the result will be compared to ecological screening level for 4-nitrophenol in soil listed in the June 23, 2000 USEPA memorandum Entitled *Amended Guidance on Ecological Risk Assessment at Military Bases: Process Considerations, Timing of Activities, and Inclusion of Stakeholders*. This document recommends 7.0E+00 mg/kg as an ecological screening level for 4-nitrophenol in soil. The memorandum can be reviewed in its entirety at: http://www.epa.gov/region4/waste/fedfac/ecoproc2.pdf.

Tables II.C-1 and II.C-2 present the dioxin/furan (D/F) “action level”. The AL will be the USEPA RSL for 2,3,7,8 TCDD equivalent (Toxicity Equivalent Quotient [TEQ]). The procedure for calculating the 2,3,7,8 TCDD equivalent (TEQ) will be to multiply all detections above the MDL of those compounds listed in **Table II.C-2** by their respective toxicity equivalent factors (TEFs). The multiplication products will be summed and the resulting total sum will be compared to the AL. Additional information can be found in the USEPA Mid-Atlantic Risk Assessment User's Guide, Toxicity Equivalence Factors.

II.C.3.3. Monitoring Frequency

The SMP will be performed annually and the analysis will be conducted for the constituents listed in **Table II.C-1**. RFAAP will re-evaluate the SMP every three years and at that time may request to modify the monitoring and sampling locations and/or constituent list in accordance with 40 CFR § 270.42.

II.C.4. Sampling and Analysis Plan

The Sampling and Analysis Plan (SAP) for the SMP is based on the following reference documents:

- *Draft Final Open Burning Ground/Open Detonation Permitting Guidelines, VDEQ, February 2002*
- *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846), Chapters 1 and 9, US EPA, Revision 5, April 1998 and updates*
- *Draft Guidance Manual for Closure Plans and Post-Closure Plans September 28, 2001*
- *Superfund Program Representative Sampling Guidance, Volume 1: Soil, Interim Final, OSWER Directive 9360. 4-10, EPA 540/R-95/141, PB96-963207, December 1995*
- *ASTM Standard Guide for Soil Sampling in the Vadose Zone, Designation D 4700-15, July 15, 1991 (revised 2015)*
- *ASTM Standard Guide for Decontamination of Field Equipment Used at Waste Sites, Designation D 5088-15a, 2015*
- *EEE Consulting (EEE), 2005. Soil Monitoring Program for the Open Burning Ground (OBG). Radford Army Ammunition Plant, Radford, Virginia, Dated April, 2005.*

Procedures and techniques for soil sample collection, sample preservation and handling (shipment), COC control, analytical procedures, and field and laboratory quality assurance/quality control (QA/QC) are included in the SAP. Soil sample collection shall be conducted in accordance with the protocols described in this section.

II.C.4.1. Sample Collection Order

In order to minimize the potential for cross-contamination, soil samples will be collected in the order from least contaminated location to the most contaminated. The suggested sampling order is noted below but should be evaluated prior to the annual sampling event The suggested sampling order based on the 2014 annual soil monitoring event is:

- NB-1, NB-2, SB-1, SB-2, Berm-1, Pond-1, PAD-8 , PAD-3, PAD-2, PAD-1, PAD-5, PAD-7, PAD-6, PAD-4

II.C.4.2. Field Log Book/Laboratory Logbook

A field log book is used to record field information and activities at each sample location. The field log book will include the following information:

- Sample Location Designation Identification
- Weather conditions and relative moisture of soil
- Sampling date, time, and equipment used
- Sample identifications (by constituents or method)
- Preservatives used, if any
- Constituents or method to be analyzed
- Sampler's and sample preparers' names

The contract laboratory will keep records to document the processing steps that are applied to the sample. All sample preparation techniques and instrumental methods must be identified in the laboratory records. The results of the analysis of all quality control samples should be identified specific to each batch of groundwater samples analyzed. The laboratory records should also include the time, date, and name of person (and company affiliation if subcontracted) who performed each processing step.

It should be noted that these are minimum requirements for the laboratory. The analytical laboratory must develop, implement and maintain a quality system program to generate data of known and documented quality based on national performance standards adopted under the National Environmental Laboratory Accreditation Program (NELAP). Analytical laboratories producing compliance data must be VELAP accredited under 1VAC30-46, also called the Virginia Environmental Laboratory Accreditation Program (VELAP). VELAP accreditation under 1VAC30-46 incorporates TNI standards and its quality system requirements.

II.C.4.3. Soil Sample Collection Procedures

Soils will be collected from the uppermost six inches of soil using dedicated stainless steel sampler capable of collecting an undisturbed soil sample, as described in *ASTM Standard Guide for Soil Sampling in the Vadose Zone, Designation D 4700-15, 2015.* Each sampler will be marked with a permanent marker on the wooden handle with the sample location (See **Figure II.C-3).** The sample location will be located using a method of triangulation as described below:

- Using a plastic measuring tape, at each burn pad the location of the pad sampling point will be located by measuring the midpoints of the lengths of both pans at the pad, and then triangulating the lowest point between the two pans from the measured midpoints.
- This sample location will be recorded in the field logbook with the measurements noted.
- This triangulation process will be repeated during each subsequent sampling event.
- A horizontal separation of approximately 2-feet will be established for each subsequent future sampling point.

The procedures to be used at each location are as follows:

1. Samplers will wear a new pair of nitrile gloves at each location. Level D Personal Protective Equipment (PPE) will be worn (steel toed boots, eye protection and gloves).
2. The sample location will be triangulated and recorded in field logbook.
3. A sheet of plastic sheeting will be laid out to accommodate sample vessels and equipment.
4. Using the dedicated stainless steel sampler, samplers will advance a boring in native soils to a depth of six-inches below ground surface. A disposable, high-density polyethylene (HDPE) sampling device is required for the collection of the soil aliquot to be submitted for hexavalent chromium. Samples will be placed in the respective laboratory provided sample container and placed on ice in designated coolers for transport. Should additional soil be required, borings directly adjacent to the first boring can be advanced.

5. Remove the larger rocks, and then homogenize soil before transferring into the laboratory supplied sample containers with a stainless steel lab spoon or equivalent.

6. Soil material directly adjacent to the sampling location will be manually re-graded to fill in any borings.

7. Decontaminate the stainless steel sampler in a designated location as described in **Section 4.3.1.** Once the sampler is completely dry, place the sampler in a one-gallon zip-lock plastic bag for storage until the next sampling event.

8. Remove plastic sheeting and proceed to the next sampling location.

II.C.4.3.1. Equipment Decontamination

The dedicated sampling equipment will be decontaminated prior to use at the site, and after use at each sampling location. Decontamination will be performed in accordance with *ASTM Standard Guide for Decontamination of Field Equipment Used at Waste Sites, Designation D 5088-15a, 2015* a manner such that the decontamination solutions may be captured. The dedicated sampling equipment will be decontaminated as follows:

- Wash equipment with phosphate-free detergent.

- Rinse equipment with deionized water.

- Rinse equipment with isopropanol.

- Rinse equipment with deionized water.

Following decontamination, the equipment will be allowed to air dry or dried using clean disposable wipes. In accordance with ASTM guidance, distilled water may be used in place of deionized water if supported by QA/QC objectives.

II.C.4.4. Sample Preservation and Handling

Sample analysis will be performed by a VELAP accredited laboratory. Samples will be preserved with the proper preservatives in accordance with USEPA SW-846 (Test Methods for Evaluating Solid Waste, latest edition). Prior to sample collection, sample containers will be prepared by the analyzing laboratory. Preservatives (as required by analytical methods) will be added to samples immediately after they are collected if the sample containers are not pre-preserved by the laboratory. Sample preservation information is provided in **Table II.C-3**.

All sample containers shall be packed in a cooler with ice as soon as they are collected. Upon the completion of activities at the Unit, the coolers will be packed with additional ice for transport to the laboratory. The samples will be relinquished directly from the samplers to representatives from the contract analytical laboratory for transport to the laboratory, or the samples will be shipped to the laboratory by common carrier.

In the event that final receipt by the laboratory of any shipping container or sample bottle indicates evidence of compromised sample integrity, the laboratory QA/QC officer or his/her representative shall notify the operator within 24 hours of receipt. Subsequent to notification, sample integrity will be evaluated and appropriate actions will be taken to assure representative samples. Sample integrity determinations and needs for additional actions will be conducted according to QA/QC guidance from USEPA SW-846 (Test Methods for Evaluating Solid Waste, latest edition). Resampling will be conducted if determined necessary.

II.C.4.5. Chain-of-Custody (COC) Documentation

The soil monitoring program incorporates a COC program to track the custody of the samples from time of collection to shipment to and receipt at the laboratory. The monitoring of sample possession from field sampling to laboratory analysis is important in the event that unexpected laboratory results occur and the documentation of sample possession can be evaluated. This documentation contains several records and logs that assist in the quality control of the program.

Sample labels are used to prevent misidentification of samples. The labels are completed and affixed to the sample containers prior to field sampling. The labels contain the following information:

- Sample identification number
- Name of sampler (initials)
- Date and time of sample collection
- Sampling location
- Constituents to be analyzed

Additionally, sample custody seals should be affixed over each shipping cooler when a common carrier transports the sample shipment to the laboratory. These seals ensure that the samples have not been disturbed during transportation. The sample identification and date will be included on the sample custody seal.

COC control for all samples will consist of the following:

1. Labels will be placed on individual sample containers while sampling indicating the sampler's initials, date and time of sample collection, place of collection, and preservation method used for the sample.

2. A custody seal should be placed on the shipping container or on the individual sample bottles. Custody seals provide prevention or easy detection of sample tampering. The custody seal should bear the signature of the collector and the date signed. The custody seal can be placed on the front and back of a cooler, around the opening of a polyethylene overpack bag or on the lid of each sample container.

3. No sample should be brought back to the laboratory for preservation. It is recommended that two polyethylene overpack bags be used in shipping. The first will contain the sample bottles, the second the ice needed to keep the samples at less than or equal to 6 degrees Celsius (C). A temperature history of the samples should be maintained as a QC measure. Upon receipt of the shipment, the laboratory should record the temperature on the COC. The method holding time is defined by the analytical method and listed in Table II.C-3. Holding time refers to the period from sample collection to sample extraction and/or analysis.

4. A COC record should be completed and should accompany every sample shipment. The COC record should contain enough copies so that each person possessing the shipment receives his/her own and should be designed to allow the Permittee to reconstruct how and under what circumstances a sample was collected, including any problems encountered. An example of a COC form that includes the necessary information is included as Appendix II.C-A.

5. Samples will be packaged and labeled for shipment in compliance with current U.S. Department of Transportation regulations. All samples will be shipped priority/overnight via commercial carrier or hand delivered to the laboratory.

6. Samples will arrive at the laboratory via the overnight delivery service or hand delivery. Upon delivery to the laboratory, the ice chests will be checked for intact custody seals and the samples will be unpacked and the information on the accompanying COC records will be examined. If the samples shipped match those described on the COC form, the laboratory sample coordinator will sign the form and assume responsibility for the samples. If problems are found with the sample shipment, the laboratory sample custodian will sign the form and record the problems in the "remarks" section.

7. Any missing samples, missing sample tags, broken sample bottles, or unpreserved samples will be noted on the COC record. If there are problems with individual samples, the sample custodian will inform the laboratory coordinator of such

problems. The laboratory custodian will then contact the Permittee to determine a viable solution to the problem.

8. All information relevant to the sample will be secured at the end of each business day. All samples will be stored in a designated sample storage refrigerator, access to which will be limited to laboratory employees.

The chain-of-custody record is filled out for each Unit and accompanies the samples to the laboratory. The completed form is returned to RFAAP with the analyses for each Unit. An example COC form is included in Attachment II.C-A. The sample possession is established from time of collection to the time of analysis. This record contains the following information:

- Sample identification and location
- Signature of sampler
- Date and time of sampling
- Sample type
- Identification
- Number of containers
- Required analysis
- Signatures of person(s) involved in possession
- Times and dates of possession
- Method of transportation
- Tracking number from transporter
- Statement for packing on ice
- Temperature upon arrival at the laboratory

A sample analysis request sheet can further clarify the samples for each requested constituent. This additional check sheet will be utilized when necessary (i.e., beginning of a new contract with a new laboratory). This sheet sent along with the samples will contain the following information:

- Name of person receiving samples
- Laboratory sample number
- Date of sample receipt
- Analysis to be performed

The above information represents minimum requirements. The analytical laboratory must develop, implement and maintain a quality system program to generate data of known and documented quality based on national performance standards adopted under the National Environmental Laboratory Accreditation Program (NELAP). Analytical laboratories producing compliance data must be VELAP accredited under 1VAC30-46, also called the Virginia Environmental Laboratory Accreditation Program (VELAP). VELAP accreditation under 1VAC30-46 incorporates TNI standards and its quality system requirements.

II.C.4.6. Disposition of Decontamination Waste Water/Investigation Derived Wastes

All decontamination water that is generated during sampling activities will be collected in containers and subsequently emptied into the Biological Wastewater Treatment Plant at RFAAP.

The investigation derived sampling materials will be drummed onsite and will be analyzed for hazardous characteristics by RFAAP. The materials will be disposed of as hazardous waste if the results indicate that characteristic criteria are met, or as a solid waste if the data indicate that the wastes are not hazardous. The appropriately licensed and permitted disposal contractor will be selected by RFAAP. The location where hazardous wastes are transported will be a facility permitted by EPA under 40 CFR § Part 270.

II.C.5. Analytical Procedures

The analytical methods set forth in USEPA SW-846 (Test Methods for Evaluating Solid Waste, latest edition) will be used to analyze all constituents. Recommended analytical methods and associated RLs are listed in **Table II.C-1**. The laboratory must be accredited for the analytical method, matrix and target analyte (where applicable) by the Virginia Environmental Laboratory Accreditation Program (VELAP).

All records of analysis will be distributed to the VDEQ as specified in **Section 8.0**, as well as maintained on site.

II.C.6. Quality Assurance/Quality Control

II.C.6.1. Field QA/QC Program

The field QA/QC program is designed to ensure the reliability and validity of the field data gathered as part of the overall soil monitoring program. The field QA/QC program consists of regular inspection and decontamination of field instruments, and routine collection and analysis of trip and equipment blanks and blind duplicates.

For each sampling event, one trip blank shall be filled with laboratory-grade reagent water in the laboratory that has been selected to conduct the soil analyses. The trip blank shall be analyzed only for the same volatile organic compounds for which the samples will be analyzed. The trip blank shall accompany the sampling kit, in the transport cooler, at all times.

Equipment blanks will be collected to monitor the decontamination of randomly selected equipment that may be used in the sampling process. The equipment blank shall be prepared by rinsing the decontaminated sampling device with laboratory-grade reagent water or distilled and transferring the water from the sampling device to the sample containers. The equipment blank will be returned to the laboratory for analysis for the maximum number of constituents being analyzed in soil. One equipment blank will be collected during each sampling event at the OBG if required. The equipment blank will be analyzed for site-specific constituents.

One blind field duplicate sample will also be collected during each sampling event. The blind field duplicate will be analyzed for the same constituents as all other samples. The soil sampling location from which the blind duplicate is collected will be noted on the Field Log for that soil sampling location.

The occurrence of constituents in blank samples may serve to invalidate the analytical results of the affected constituents. Additional blanks or duplicate samples may be prepared and analyzed to address specific, unanticipated conditions at t the discretion of the Permittee.

II.C.6.2. Laboratory QA/QC Program

The analytical laboratory must develop, implement and maintain a quality system program to generate data of known and documented quality based on national performance standards adopted under the National Environmental Laboratory Accreditation Program (NELAP). Analytical laboratories producing compliance data must be accredited under 1VAC30-46, also called the Virginia Environmental Laboratory Accreditation Program (VELAP). VELAP accreditation under 1VAC30-46 incorporates The NELAC Institute (TNI) standards and its quality system requirements. The QA/QC plan for each VELAP accredited laboratory can be provided for review, if requested.

In addition to the trip and equipment blanks and blind field duplicates collected for the field QA/QC program, the VELAP accredited laboratory shall prepare and analyze matrix spikes, matrix spike duplicates, laboratory control samples and/or other QA/QC samples as specified in their laboratory quality manual. Sufficient sample volume shall be collected in the field so that the laboratory can prepare the requisite QA/QC samples.

II.C.7. Soil Data Evaluation

II.C.7.1. Laboratory Analytical Data Validation

Laboratory analytical data will be validated in accordance with the following guidance documents:

- *Test Methods for Evaluating Solid Wastes - Physical and Chemical Methods*, USEPA SW-846, 3rd edition - Final Update I, II/IIA and III), as updated;
- *USEPA National Functional Guidelines for Superfund Organic Methods Data Review*, January 2017, where applicable and as updated.
- *USEPA National Functional Guidelines for Inorganic Superfund Data Review*, January 2017, where applicable and as updated.

Analytical laboratory QA/QC data will be evaluated for conformance with and adherence to prescribed data quality objectives.

The evaluation of the analytical laboratory's compliance with the analytical methods and validation of the results will be based on a limited review of the following items: QC deliverables package, QC history documentation, technical holding times, preservation requirements, instrument performance (tune) check, instrument calibrations, blank sample analyses, surrogate spike recoveries, laboratory control samples, matrix spike, matrix spike duplicate, or sample duplicate analyses, interference check sample results, and internal standard requirements where appropriate. The review will be limited mainly to summary sheets provided by the laboratory, unless a notable discrepancy in the data package requires review of the instrument data.

II.C.7.2. Evaluation of Laboratory Analytical Data and Data Management

The analytical results of each sampling event conducted at the OBG must be assessed on a case-specific basis. The probability of elevated constituent concentrations must be weighed against the evidence of natural geochemical variations, and field or laboratory error. A review of the analytical data obtained from each sampling event will be conducted.

In general the evaluation of the analytical data for this program involves the direct comparison of validated results to the Action Levels presented on **Table II.C- 1**. If a result is in excess of the proposed action level for a given constituent, RFAAP may choose to verify the result in accordance with the procedure outlined in this section. Should the process of verification confirm impacts greater than the Action Levels, and an alternative source demonstration is not pursued, then Interim Measure Corrective Actions will be proposed in accordance with **Section 9.0** of this document.

II.C.7.2.1. Data Management

Chemical analytical data will be managed as both non-qualified data and interpreted data. Non-qualified data refers to concentration values as they appear on the laboratory Certificate of Analysis. Interpretation of the non-qualified data may include, but is not necessarily limited to, the treatment of low and zero values, missing data, and outliers. Each report shall identify interpreted data.

II.C.7.2.2. Treatment of Missing Data Values

If a sampling event results in a missing data value, an attempt to resample for the missing value shall be made within two weeks of notification by the analytical laboratory of the missing data value.

II.C.7.2.3. Treatment of Data Outliers

All data will be investigated to verify outliers. An outlier refers to a data point which is an inconsistently large or small value. The facility may resample (in an area near the initial sample) if an extreme value is noticed in the compliance dataset. Re-samples will occur during the compliance period of the initial soil sampling event as warranted. An outlier can be observed due to sampling, laboratory, transportation, or transcription errors. At the discretion of the Permittee, the historical background data should be screened for outliers (USEPA 1992 section 6.2) using the method described by Dixon (1953).

RFAAP may correct outliers of any data set under circumstances where such correction can be justified. Any elimination of an outlier must be properly documented and justified and approved by the Department.

II.C.7.2.4. Evaluation of Data Above Reporting Limits

Data that meets or exceeds the proposed Method Detection Limits (MDLs) presented in **Table II.C-1** will be considered a detected constituent. Data results below the MDL will be reported as non-detected. Event specific MDLs, RLs and Action Levels (ALs) for dioxin and furan constituents will be calculated and presented in a format similar to the example presented in **Table II.C- 2.** Results below the MDLs will be reported as non-detected and will not be used in the calculation of the dioxin/furan TEFs in **Table II.C-2**.

.

II.C.7.2.5. Selection of Statistical Method

RFAAP shall provide direct comparison of the analytical results to the proposed Action Levels on **Table II.C-1**.

II.C.7.3. Verification Sampling

The verification sample is considered as a part of the evaluation to confirm an exceedance of the proposed Action Levels. Verification samples must be collected at the earliest time possible (within 60 days of receipt of the laboratory data) or as approved by the VDEQ. The VDEQ will be informed in advance of any planned verification re-sampling.

II.C.8. Reporting Requirements

The analytical results for each sampling event will be compiled, evaluated, and interpreted upon receipt from the analyzing laboratory to determine whether any soil contamination exists at the OBG above the designated Action Levels. The results of .the data evaluation will be summarized annually and kept in the operating record for the facility. The data will be submitted to the VDEQ annually in an Annual Soil Monitoring Report for the Unit.

If it is determined during the course of the SMP that there is evidence of soil contamination in excess of the designated Action Levels at any sampling point, RFAAP may demonstrate that a source other than the OBG is the cause of the contamination, or that the detection is an artifact caused by error in sampling, analysis, or evaluation. To make such a demonstration, RFAAP shall:

- Notify the VDEQ in writing within seven days that they intend to make a demonstration.

- Within 60 days of receipt of the validated data, submit a report to the VDEQ demonstrating that a source other than the OBG caused the contamination or that the contamination resulted from error in sampling, analysis, or evaluation.

- Within 60 days of receipt of the validated data, submit a permit modification application to the VDEQ to make any appropriate changes to the SMP.

- Continue to monitor in accordance with SMP.

If evidence of contamination in excess of the designated action levels is detected at any sampling point, and RFAAP does *not* make a demonstration that a source other than the OBG is the cause of the contamination, RFAAP shall:

- Notify the VDEQ in writing within seven (7) days. The notification must indicate which chemical parameters or hazardous constituents have shown evidence of contamination.

- RFAAP will sample at those sampling points for the constituents detected and confirm which constituents are present and at what concentration within 30 days of receipt of validated data. Sampling will also include a determination of horizontal extent by trending out in all four compass directions (north, south, east and west) at a distance as close as practicable to twenty (20) feet in each direction from the point of original detection. Figure II.C-3 presents a typical array of confirmation samples to determine horizontal extent of impacts.

- Within 60 days, if the contamination is confirmed, RFAAP will submit a proposed interim measure corrective action work plan in accordance with Section II.C.9 of this plan.

If RFAAP or the Director determines during the course of the SMP that the program no longer satisfies the requirements of the facility operating permit, RFAAP must submit a permit modification application in accordance with 40 CFR § 270.42, to make appropriate changes to the program within 90 days. As stated in Section 3.3, RFAAP will re-evaluate the OBG Soil Monitoring Program every 3 years and at that time may request to modify the monitoring and sampling locations and/or constituent list in accordance with 40 CFR § 270.42.

II.C.9. Interim Measures

Should the data indicate that an exceedance of the proposed Action Level of a constituent listed in Table II.C-1, an interim measure corrective action work plan will be submitted to the VDEQ within 90 days of the notice to VDEQ. Notification will be in accordance with Section II.C.8 of this plan. Interim Measures that may be conducted at the OBG are described in the following sections.

II.C.9.1. Hot-Spot Evaluation and Soil Removal

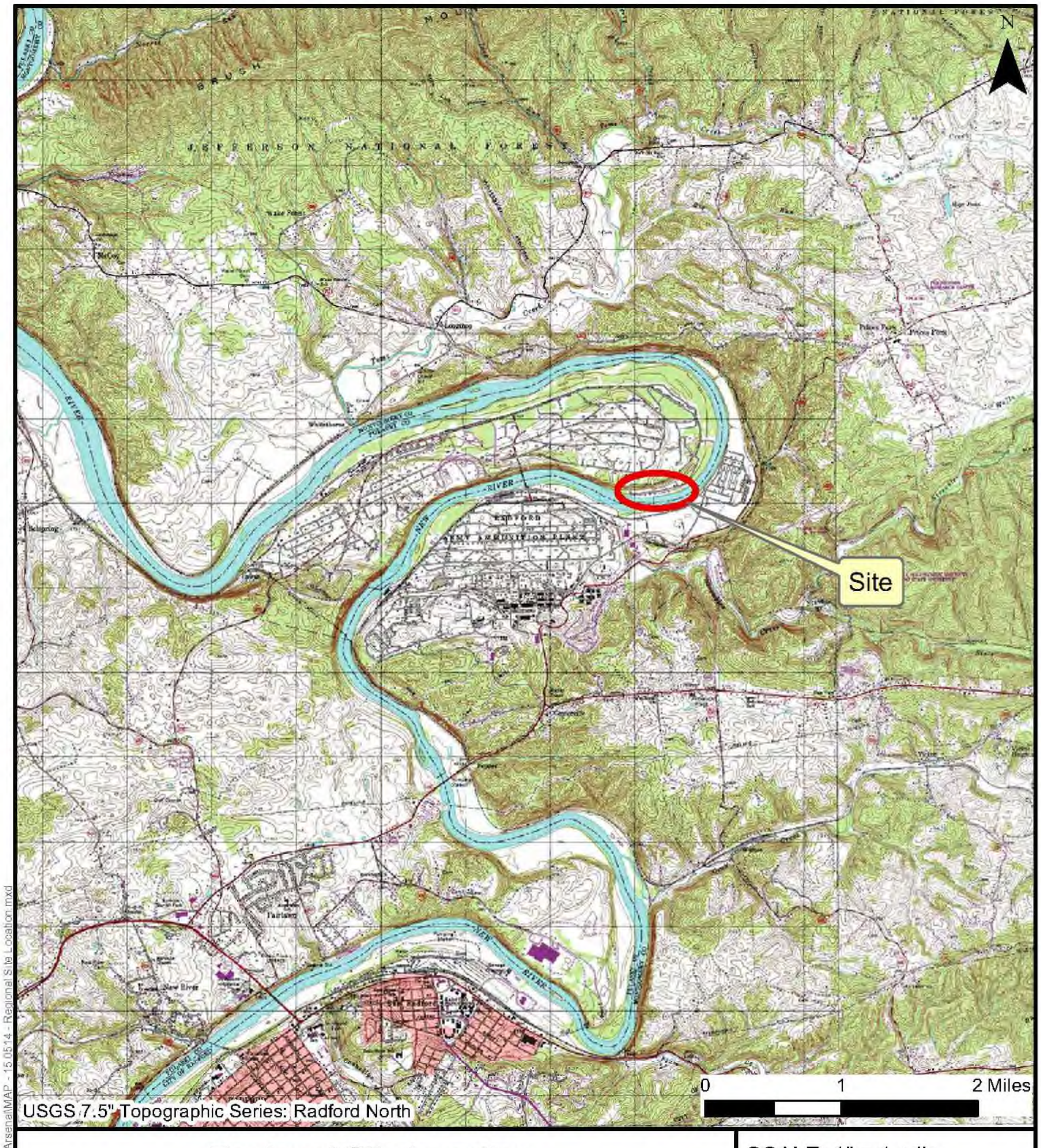
If a constituent is detected above the proposed Action Level, a hot spot determination will be conducted. If contamination is detected at concentrations that exceed the designated action levels, RFAAP will collect a total of four samples as close as practicable to twenty (20) feet in all directions (north, south, east and west) of the original detection. The samples will be analyzed for those constituents that have exceeded the action levels. This action will ensure that the nature and extent of the exceedance will be delineated in all horizontal directions.

In addition to the sampling described above, a sampling grid will be established in a five-foot radius of the sample collection point. Four randomly selected sample points will be selected within the diameter of the grid. Each sample point will be sampled to a terminal depth of 24 inches below ground surface by advancing a pre-cleaned stainless steel auger. Samples will be collected every six-inches to the terminal depth of 24-inches. The auger will be decontaminated in accordance with Section 4.3.1 between every six-inch interval. The aliquots from each six-inch interval will be composited with the same corresponding interval from each of the four borings. The aliquots will be homogenized in a pre-cleaned stainless steel bowl using a pre-cleaned stainless steel spoon or trowel (unless sampling for hexavalent chromium). The analyses from each six-inch interval will be evaluated by comparing the results to the Action Levels for the constituent.

If the Action Levels are exceeded in any given layer, a soil removal work plan will be prepared. The work plan will define the volume of soils to be removed by designating the horizontal and vertical extent of removal. The work plan will be submitted to the VDEQ for review and approval. Upon approval of the work plan, the soils will be excavated with a mechanical backhoe under the supervision of designated representative of RFAAP. Soils will be placed in a DOT approved covered roll-off container and transported offsite for disposal at an approved facility for disposal and/or treatment. Upon completion of the excavation confirmatory samples will be collected to confirm complete removal of the contaminated media. Confirmatory samples will include four randomly selected aliquots from the base of the excavation and two from the sidewalls of the excavation to be composited for a single analysis.

The excavation will be immediately backfilled with soils to be collected from a designated borrow area within the RFAAP facility, or prewashed and graded gravel. Soils or gravel will be re-graded to match existing contours. Soils will be seeded with natural vegetation that matches the existing ground cover of the site. The process of immediately backfilling the excavation will allow for normal operations to resume at the OBG. Should the confirmatory samples indicate that there are contaminated media in excess of the Action Levels beneath the backfilled material, the backfilled material will be removed and an additional volume of soils will be removed. Confirmatory samples will be collected from the secondary excavation as well. The secondary excavation will be backfilled immediately. The process of excavation and confirmation will proceed until the Action Levels are no longer exceeded or bedrock or groundwater is encountered. A complete report of the removal actions will be prepared and submitted to the VDEQ within 30-days of completion of the Interim Measures.

FIGURE II.C-1: REGIONAL SITE LOCATION MAP



Regional Site Location

Open Burning Ground (OBG), RFAAP, Radford, VA

SCALE: 1" = 1 mile

PLAN NO. B03204-142

Draper Aden Associates
Engineering • Surveying • Environmental Services

2206 South Main Street
Blacksburg, VA 24060
540-552-0444 Fax: 540-552-0291

Richmond, VA
Charlottesville, VA
Hampton Roads, VA
Coats, NC

DESIGNED	KMW
DRAWN	WMD
CHECKED	JCF
DATE	5/14/15

FIGURE II.C-1

FIGURE II.C-2: SITE LOCATION AND TOPOGRAPHY

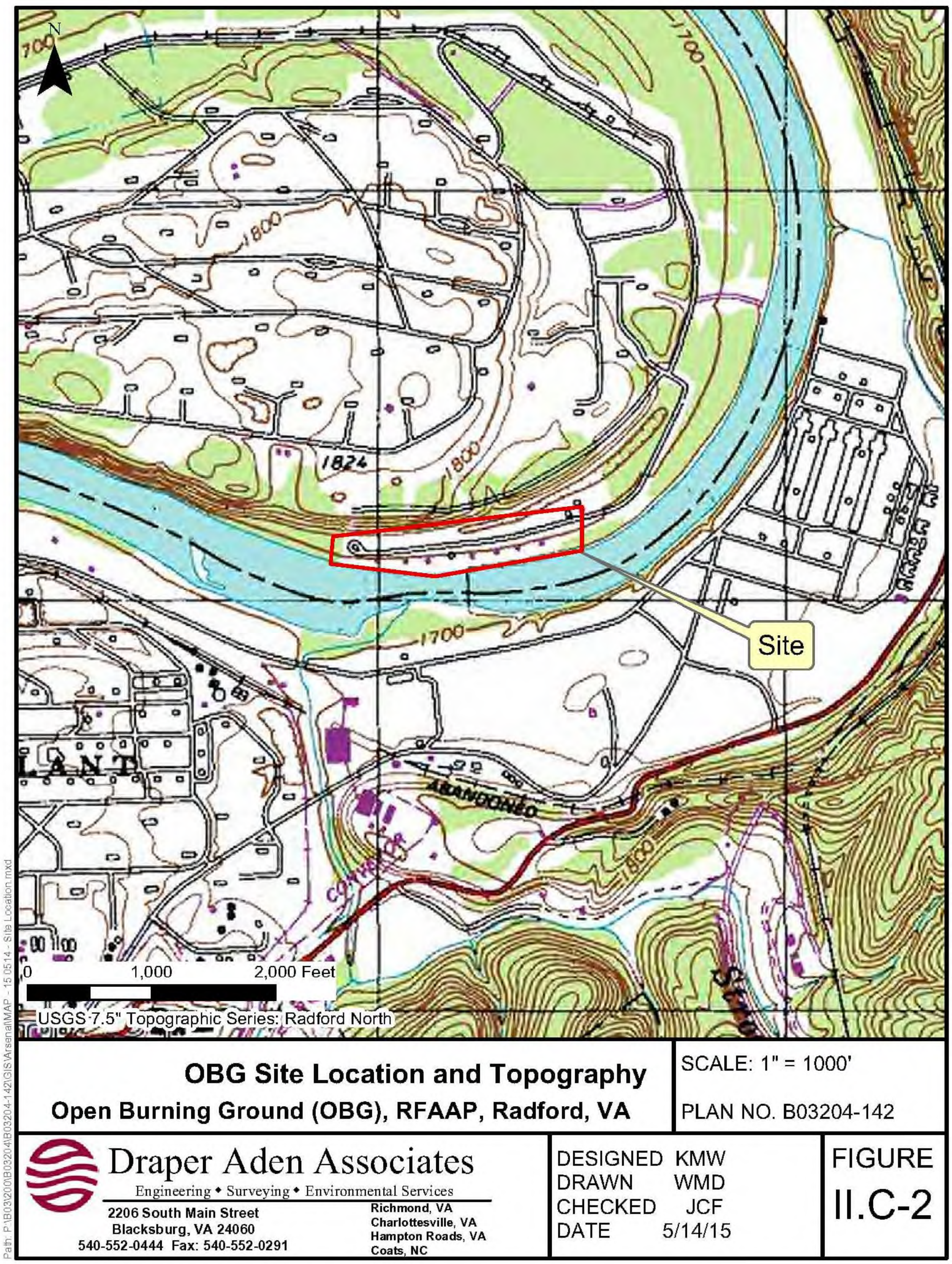


FIGURE II.C-3: SITE LAYOUT AND PROPOSED SAMPLE LOCATIONS

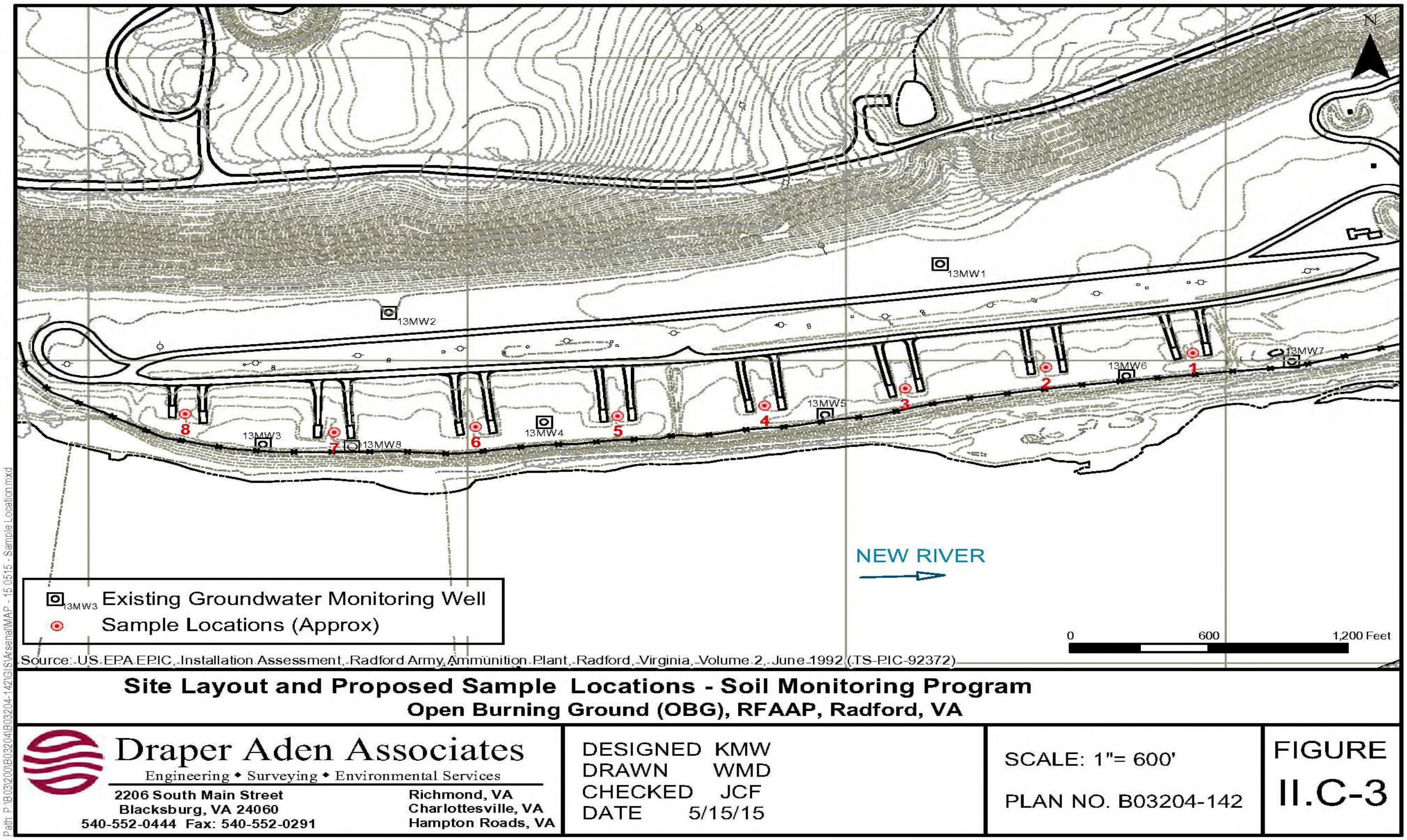


FIGURE II.C-4: SITE SOILS AND BACKGROUND SAMPLING LOCATIONS

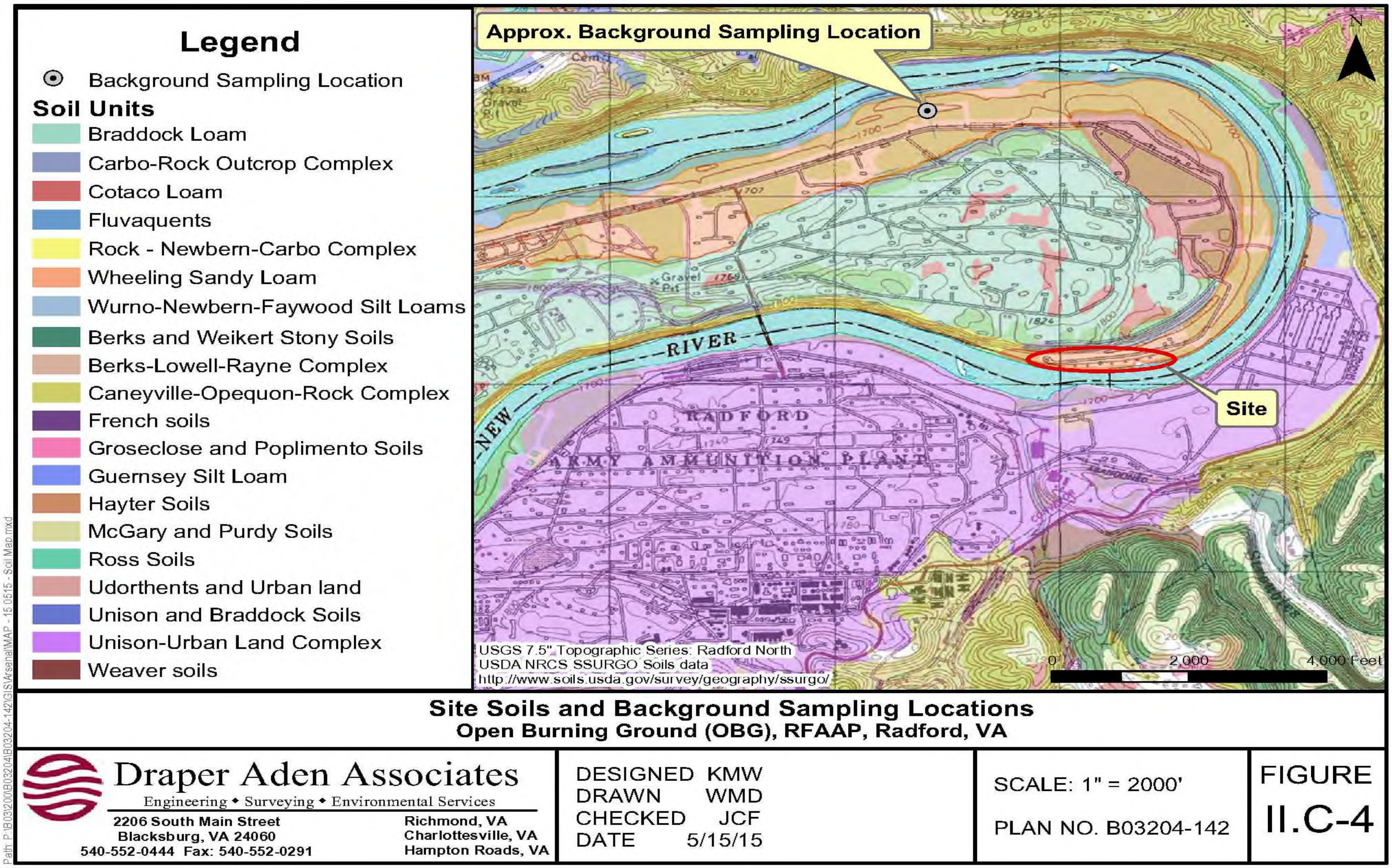


FIGURE II.C-5: PHOTOGRAPHS OF TYPICAL SAMPLE LOCATION CONDITIONS

PHOTOGRAPH 1. View towards the north of a typical soil swale between two pans. Soil samples will be collected within the swale. Note the edge of the pan track in upper left hand corner.

PHOTOGRAPH 2. View of the south of two pans comprising one pad.

Draper Aden Associates
Engineering • Surveying • Environmental Services
2206 South Main Street
Blacksburg, VA 24060
540-552-0444 Fax: 540-552-0291
Richmond, VA
Charlottesville, VA
Hampton Roads, VA

Figure II.C-5 -
Photographs of Typical Sample Location Conditions
Radford Army Ammunition Plant Open Burning Ground
Draper Aden Associates JN: B03204-142

TABLE II.C-1: IDENTIFICATION OF CONSTITUENTS OF POTENTIAL CONCERN

Constituent	**CASRN**	**Type of Constituent**	**In Waste?**	**Reported in Bang Box Database?**	**On GW List**	**To be Sampled?**	**SW-846 Method**	**RL mg/kg**	**Action Level Nov 2020 mg/kg**	**Source of Updated Action Level**
1,3,5-Trinitrobenzene	99-35-4	PIC		Yes		*Yes*	8330	0.25	32,000	RSL Ind
2,4,6-Trinitrotoluene	118-96-7	ENER				*Yes*	8330	0.25	96	RSL Ind
2-amino-4,6-dinitrotoluene	35572-78-2	ENER				*Yes*	8330	0.25	110	RSL Ind
4-amino-2,6-dinitrotoluene	19406-51-0	ENER				*Yes*	8330	0.25	110	RSL Ind
1,3-Dinitrobenzene	99-65-0	ENER				*Yes*	8330	0.25	82	RSL Ind
2,4-Dinitrotoluene	121-14-2	ENER	Yes		Yes	*Yes*	8330	0.25	7.4	RSL Ind
2,6-Dinitrotoluene	606-20-2	ENER		Yes	Yes	*Yes*	8330	0.25	1.5	RSL Ind
2-Nitrotoluene (ortho)	88-72-2	ENER				*Yes*	8330	0.25	15	RSL Ind
4-Nitrotoluene (para)	99-99-0	ENER				*Yes*	8330	0.25	140	RSL Ind
3,3-Dimethylbenzidine	119-93-7	ENER		Yes		*Yes*	8270	1.6	0.21	RSL Ind
Arsenic	7440-38-2	ENER	Yes		Yes	*Yes*	6010	1	15.8	FWB
Barium	7440-39-3	ENER	Yes	Yes	Yes	*Yes*	6010	20	220,000	RSL Ind

Constituent	**CASRN**	**Type of Constituent**	**In Waste?**	**Reported in Bang Box Database?**	**On GW List**	**To be Sampled?**	**SW-846 Method**	**RL mg/kg**	**Action Level Nov 2020 mg/kg**	**Source of Updated Action Level**
Benz(a)anthracene	56-55-3	ENER		Yes		*Yes*	8270	0.33	21	RSL Ind
Benzene	71-43-2	ENER	Yes		Yes	*Yes*	8260	0.005	5.1	RSL Ind
Benzo(a)pyrene	50-32-8	ENER		Yes		*Yes*	8270	0.02	2.1	RSL Ind
Benzo(b)fluoranthene	205-99-2	ENER		Yes		*Yes*	8270	0.33	21	RSL Ind
Benzo(k)fluoranthene	207-08-9	ENER		Yes		*Yes*	8270	0.33	210	RSL Ind
Benzyl chloride	100-44-7	ENER		Yes		*Yes*	8260	0.005	4.8	RSL Ind
bis(2-Ethylhexyl)phthalate	117-81-7	ENER		Yes		*Yes*	8270	0.33	160	RSL Ind
Butylbenzylphthalate	85-68-7	ENER		Yes		*Yes*	8270	0.33	1,200	RSL Ind
Cadmium	7440-43-9	ENER		Yes		*Yes*	6010	0.5	980	RSL Ind
Carbon tetrachloride	56-23-5	ENER		Yes	Yes	*Yes*	8260	0.005	2.9	RSL Ind
Chloroform	67-66-3	ENER		Yes		*Yes*	8260	0.005	1.4	RSL Ind
Chromium, Hexavalent	18540-29-9	ENER		Yes		*Yes*	7196	1	6.3	RSL Ind

Constituent	**CASRN**	**Type of Constituent**	**In Waste?**	**Reported in Bang Box Database?**	**On GW List**	**To be Sampled?**	**SW-846 Method**	**RL mg/kg**	**Action Level Nov 2020 mg/kg**	**Source of Updated Action Level**
Chromium, Total	7740-47-3	ENER		Yes	Yes	*Yes*	6010	1	NA	NA
Dibenz(a,h)anthracene	53-70-3	ENER		Yes		*Yes*	8270	0.02	2.1	RSL Ind
Diethylphthalate	84-66-2	ENER	Yes			*Yes*	8270	0.33	660,000	RSL Ind
Dimethyl phthalate	131-11-3	ENER		Yes		*Yes*	8270	0.33	10,000,000	RSL Ind*
Di-n-butyl phthalate	84-74-2	ENER		Yes	Yes	*Yes*	8270	0.33	82,000	RSL Ind
Diphenylamine	122-39-4	ENER	Yes	Yes	Yes	*Yes*	8270	1.6	82,000	RSL Ind
Ethanol	64-17-5	ENER	Yes				NCA			
Fluoranthene	206-44-0	ENER		Yes		*Yes*	8270	0.33	30,000	RSL Ind
HMX	2691-41-0	ENER				*Yes*	8330	2.2	57,000	RSL Ind
Indeno(1,2,3-cd)pyrene	193-39-5	ENER		Yes		*Yes*	8270	0.33	21	RSL Ind
Lead	7439-92-1	ENER		Yes	Yes	*Yes*	6010	0.1	800	RSL Ind
Mercury	7439-97-6	ENER	Yes		Yes	*Yes*	7471	0.1	46	RSL Ind

Constituent	**CASRN**	**Type of Constituent**	**In Waste?**	**Reported in Bang Box Database?**	**On GW List**	**To be Sampled?**	**SW-846 Method**	**RL mg/kg**	**Action Level Nov 2020 mg/kg**	**Source of Updated Action Level**
Methyl bromide (Bromomethane)	74-83-9	ENER		Yes		*Yes*	8260	0.005	30	RSL Ind
Methyl chloride (Chloromethane)	74-87-3	ENER	Yes	Yes	Yes	*Yes*	8260	0.005	460	RSL Ind
Methylene chloride	75-09-2	ENER	Yes	Yes	Yes	*Yes*	8260	0.005	1,000	RSL Ind
Naphthalene	91-20-3	ENER		Yes		*Yes*	8270	0.33	86	RSL Ind
Nitrogen dioxide (peroxide)	10102-44-0	ENER		Yes			NCA			
Nitroglycerin	55-63-0	ENER	Yes		Yes	**** Yes***	8330	0.25	82	RSL Ind
Perchlorate	14797-73-0	ENER	Yes		Yes	***Yes***	314 or 6850	0.002	820	RSL Ind
RDX	121-82-4	ENER				*Yes*	8330	1	38	RSL Ind
Silver	7440-22-4	ENER	Yes		Yes	*Yes*	6010	1	5,800	RSL Ind
Selenium	7782-49-2	ENER				*Yes*	6010	2	5,800	RSL Ind
Total Petroleum Hydrocarbons - DRO		Site Accelerant				***Yes***	8015	20	11,000	DEQ gd
Trichloroethylene	79-01-6	PIC		Yes		***Yes***	8260	0.005	6	RSL Ind

Constituent	**CASRN**	**Type of Constituent**	**In Waste?**	**Reported in Bang Box Database?**	**On GW List**	**To be Sampled?**	**SW-846 Method**	**RL mg/kg**	**Action Level Nov 2020 mg/kg**	**Source of Updated Action Level**
Polychlorinated Dibenzo(p)dioxins and furans										
1,2,3,4,5,7,8,9-Octachlorodibenzo(p)dioxin (OCDD)	3268-87-9	PIC		Yes		***Yes***	8290	See Note 5		
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	39001-02-0	PIC		Yes		***Yes***	8290	See Note 5		
1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin (HpCDD)	35822-46-9	PIC		Yes		***Yes***	8290	See Note 5		
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	67562-39-4	PIC		Yes		***Yes***	8290	See Note 5		
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	55673-89-7	PIC		Yes		***Yes***	8290	See Note 5		
1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin (HxCDD)	39227-28-6	PIC		Yes		***Yes***	8290	See Note 5		
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	70648-26-9	PIC		Yes		***Yes***	8290	See Note 5		
1,2,3,6,7,8-Hexachlorodibenzo(p)dioxin (HxCDD)	57653-85-7	PIC		Yes		***Yes***	8290	See Note 5		
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	57117-44-9	PIC		Yes		***Yes***	8290	See Note 5		
1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin (HxCDD)	19408-74-3	PIC		Yes		***Yes***	8290	See Note 5		

Constituent	CASRN	Type of Constituent	In Waste?	Reported in Bang Box Database?	On GW List	To be Sampled?	SW-846 Method	RL mg/kg	Action Level Nov 2020 mg/kg	Source of Updated Action Level
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	72918-21-9	PIC		Yes		***Yes***	8290	See Note 5		
1,2,3,7,8-Pentachlorodibenzo(p)dioxin (PeCDD)	40321-76-4	PIC		Yes		***Yes***	8290	See Note 5		
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	57117-31-4	PIC		Yes		***Yes***	8290	See Note 5		
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	60851-34-5	PIC		Yes		***Yes***	8290	See Note 5		
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	57117-31-4	PIC		Yes		***Yes***	8290	See Note 5		
2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	1746-01-6	PIC		Yes		***Yes***	8290	See Note 5		
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	51207-31-9	PIC		Yes		***Yes***	8290	See Note 5		
2,3,7,8-TCDD Toxicity Equivalence Quotient(TEQ)									22 ng/kg	RSL Ind

NOTES:

1. Updated Action Level	AL changed as part of update of USEPA Regional Screening Levels (RSL) for Industrial Sites.
2. Type of Constituent	"Propellant Ingredient" = Ingredient in propellant compound.
	"PIC" Product of Incomplete Combustion": means that it was reported in the Bangbox Database (see Appendix A-2).
	"Both" Both PIC and Propellant Ingredient.
	"ENER" - Energetic on SW-846 Method 8330 parameter List.
3. In Waste	"Yes" - means it was reported in Radford AAP's waste characterization.
4. **BOLD** Constituent	Constituent not in 40 CFR 261 Appendix VIII List of Hazardous Constituents.

5. Dioxins	Reporting Limit and Action Level will be calculated for each sample and detection, respectively. See Table 2 for example reporting format.
6. NCA	Constituent is not analyzed by commercial laboratories.
7. Source of Updated Action Levels	**" RSL Ind" -** United States Environmental Protection. Regional Screening Levels for Chemical Contaminants at Superfund Sites. November 2020. https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables (TR=1E-06 and THQ=1.0) **"R9 PRG Ind"** - Region IX Preliminary Remediation Goals for Industrial Soils - Dated October 2004. **"RSL Ind*" -** These constituents were removed from the September 12, 2008 RBC table. The previous AL (Region III RBC for Industrial Sites from October 2004) is listed. **"DEQ gd"** - Table 5-11 Soil Saturation Values, Page 5-69 of VDEQ Storage Tank Program Technical Manual, Fourth Edition, May 10, 2011. **"FWB"** - Facility Wide Background Study. **"NA"** - Not applicable. See 9/27/2011 correspondence from DEQ to Alliant Techsystems, Inc, Approval of Class 3 Permit Modifications, Comment Response Summary, Comment 96.
8. RL and AL	**"RL"** is the laboratory reporting limit and is analogous to the Limit of Quantitation (LOQ). "AL" is the Action Level based on published risk based values.
-	
9. Non-pad Sample Locations** (SB-1, SB-2, NB-1, NB-2 Berm-1, and Pond-1)	**Soil samples collected from non burn pad locations only require analysis for the following constituents: Arsenic, Barium, Cadmium, Chromium, Hexavalent Chromium, Trivalent Chromium (by calculation), Lead, Selenium, Bromomethane, Trichloroethene, Bis(2-Ethylexyl) phthalate, Diethyl phthalate, Dimethyl phthalate, Di-n-butyl phthalate, N-Nitrosodiphenylamine, Dioxins/furans, 2,4,6-Trinitrotoluene, 2-Amino-4, 6-dinitrotoluene, 4-Amino-2, 6-dinitrotoluene, HMX, Nitroglycerin and 2,4-Dinitrotoluene.**

TABLE II.C-2: EXAMPLE PRESENTATION AND CALCULATION OF DIOXIN/FURAN RESULTS

Sample Location ID			**OBG Pad 1**		**OBG Pad 2**		**OBG Pad 3**		**OBG Pad 4**	
Depth			**0-6 Inches**		**0-6 Inches**		**0-6 Inches**		**0-6 Inches**	
		LOQ								
Constituent	**TEF* (WHO 2005)**		**Result**	**TEQ**	**Result**	**TEQ**	**Result**	**TEQ**	**Result**	**TEQ**
1,2,3,4,5,7,8,9-Octachlorodibenzo(p)dioxin (OCDD)	0.0003									
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	0.0003									
1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin (HpCDD)	0.01									
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	0.01									
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	0.01									
1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin (HxCDD)	0.1									
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	0.1									
1,2,3,6,7,8-Hexachlorodibenzo(p)dioxin (HxCDD)	0.1									
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.1									
1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin (HxCDD)	0.1									
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	0.1									
1,2,3,7,8-Pentachlorodibenzo(p)dioxin (PeCDD)	1									
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	0.03									
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.1									
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	0.3									
2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	1									
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	0.1									
2,3,7,8 -TCDD Toxicity Equivalence Quotient (TEQ) (ng/kg)	**22 ng/kg**									

Sample Location ID			**OBG Pad 5**		**OBG Pad 6**		**OBG Pad 7**		**OBG Pad 8**	
Depth			**0-6 Inches**		**0-6 Inches**		**0-6 Inches**		**0-6 Inches**	
		LOQ								
Constituent	**Updated TEF* (WHO 2005)**		**TEQ**	**Result**	**TEQ**	**Result**	**TEQ**	**Result**	**TEQ**	**Result**
1,2,3,4,5,7,8,9-Octachlorodibenzo(p)dioxin (OCDD)	0.0003									
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	0.0003									
1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin (HpCDD)	0.01									
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	0.01									
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	0.01									
1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin (HxCDD)	0.1									
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	0.1									
1,2,3,6,7,8-Hexachlorodibenzo(p)dioxin (HxCDD)	0.1									
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.1									
1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin (HxCDD)	0.1									
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	0.1									
1,2,3,7,8-Pentachlorodibenzo(p)dioxin (PeCDD)	1									
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	0.03									
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.1									
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	0.3									
2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	1									
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	0.1									
2,3,7,8 -TCDD Toxicity Equivalence Quotient (TEQ) (ng/kg)	**22 ng/kg**									

NOTE: 2,3,7,8 TCDD TEQ = 22 ng/kg United States Environmental Protection Agency, Regional Screening Levels for Chemical Contaminants at Superfund Sites, November 2020. https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables (TR=1E-06 and THQ=1.0)

TEF* - Toxic Equivalency Factors based on World Health Organization (WHO) 2005

The procedure for calculating the 2,3,7,8 TCDD equivalent (TEQ) will be to multiply all detections **above the MDL** of those compounds listed in **Table II.C-2** by their respective toxicity equivalent factors (TEFs). The multiplication products will be summed and the resulting total sum will be compared to the **AL**.

TABLE II.C-3: SAMPLING AND PRESERVATION PROCEDURES

Parameter (Method)	**Recommended Container**[a]	**Preservative**	**Maximum** Holding Time	**Min. Amount Required for Analysis**
SOIL				
Metals (6010, 6020, 7471)	G, 4-ounce. clear	**Cool (less than or equal to 6°C)**	6 months (28 days for mercury)	**6 grams**
Hexavalent chromium (7196)	G, 4-ounce. clear	**Cool (less than or equal to 6°C) Collect without stainless steel sampling device. HDPE recommended**	30 days to extraction/7 days (268 hours) from extraction to analysis,	**5 grams**
Volatile Organics (8260/5035)	**3) 40-ml vials, clear**	**Methanol and sodium bisulfate; Cool (less than or equal to 6°C), no headspace** [3]	14 days	**30 grams**
Semivolatile Organics (8270)	G, 4-ounce clear	**Cool (less than or equal to 6°C)**	14 days until extraction; 40 days after extraction	**30 grams**
Nitroglycerine (8332)	G, 4-ounce clear	**Cool (less than or equal to 6°C)**	14 days until extraction; 40 days after extraction	**30 grams**
Explosives (8330)	G, 4-ounce clear	**Cool (less than or equal to 6°C)**	14 days until extraction; 40 days after extraction	**30 grams**
Dioxins and Furans (8290)	G, 4-ounce amber	**Cool (less than or equal to 6°C)**	None	**30 grams**
TPH – DRO (8015)	G, 4-ounce clear	**Cool (less than or equal to 6°C)**	14 days	**30 grams**
Perchlorate	G, 4-ounce amber	**Cool (less than or equal to 6°C), collected with headspace**	28 days	**6 grams**
WATER (Equipment Blank, as needed)				
Metals (6010, 6020, 7470)	P – 500 ml	**pH<2, HNO3**	6 months (28 days for mercury)	**60 ml (mercury) 100 ml. (other)**
Volatile Organics	3- 40 ml vials, clear	**pH<2, HCl, Cool (less than or equal to 6°C)**	14 days	**40 mls**

Parameter (Method)	**Recommended Container**[a]	**Preservative**	**Maximum** Holding Time	**Min. Amount Required for Analysis**
Semivolatile Organics (8270)	AG, 2- 250 ml	**Cool (less than or equal to 6°C)**	7 days until extraction; 40 days after extraction	**250 ml**
Explosives/ Nitroglycerine (8330)	2 -1 L AG	**Cool (less than or equal to 6°C)**	7 days until extraction; 40 days after extraction	**1 L**
Dioxins and Furans (8290)	2-1L AG	**Cool (less than or equal to 6°C)**	None	**2-1L**
TPH – DRO (8015)	2 -1 L AG [4]	**Cool (less than or equal to 6°C)**	7 days until extraction; 40 days after extraction	**1 L**
Perchlorate	250 ml P	**Cool (less than or equal to 6°C), collected with headspace; 0.2 micron filter – field filtered**	28 days	**250 ml**

Notes: All methods listed for soil unless noted.

[a] Container Types: G denotes Glass, HDPE Denotes High Density Polyethylene.

1. Current method updates are represented with suffixes on each method (e.g., SW-846-Method 6020A). The laboratory performing the analysis must be VELAP accredited, where applicable for a current method update.
2. The laboratory performing the analysis must be VELAP accredited, where applicable, for the matrix, method and analyte.

3.Distilled water (DI) may be used as an alternative, particularly if effervescence is observed at the time of sample collection. Samples require freezing or analysis within 24 hours.

4.2-250-mL AG acceptable if the laboratory utilizes reduced volume extraction (RVE).

TABLE II.C-4: SUMMARY OF BACKGROUND DATA

Radford Army Ammunition Plant
Attachment II-C

Table II.C-4

Permit No. VA1210020730
Revision Date: June 2016

Summary of Analytical Results - Background
Radford Army Ammunition Plant - Open Burning Ground - Soil Monitoring Program

All Results Reported on a Dry Weight Basis

Event Date	BG-1A Q	BG-1B Q	BG-1C Q	BG-1D Q	BG-2A Q	BG-2B Q	BG-2C Q	BG-2D Q	RL	Method	Unit
1,1-Dichloroethene			*CAS #:* 75-35-4								
11/17/2005	U	U	U	U	U	U	U	U	0.005	SW846 8260B	mg/kg
1,2-Dichloroethane			*CAS #:* 107-06-2								
11/17/2005	U	U	U	U	U	U	U	U	0.005	SW846 8260B	mg/kg
2,4-Dichlorophenol			*CAS #:* 120-83-2								
11/17/2005	U	U	U	U	U	U	U	U	0.33	SW846 8270C	mg/kg
2-Chlorophenol			*CAS #:* 95-57-8								
11/17/2005	U	U	U	U	U	U	U	U	0.33	SW846 8270C	mg/kg
3-Methylphenol			*CAS #:* 108-39-4								
11/17/2005	U	U	U	U	U	U	U	U	0.33	SW846 8270C	mg/kg
4-Methylphenol			*CAS #:* 106-44-5								
11/17/2005	U	U	U	U	U	U	U	U	0.33	SW846 8270C	mg/kg
4-Nitrophenol			*CAS #:* 100-02-7								
11/17/2005	U	U	U	U	U	U	U	U	1.6	SW846 8270C	mg/kg
Acetophenone			*CAS #:* 98-86-2								
11/17/2005	U	U	U	U	U	U	U	U	0.33	SW846 8270C	mg/kg
Benzene			*CAS #:* 71-43-2								
11/17/2005	U	U	U	U	U	U	U	U	0.005	SW846 8260B	mg/kg
Benzo(a)anthracene			*CAS #:* 56-55-3								
11/17/2005	U	U	U	U	U	U	U	U	0.33	SW846 8270C	mg/kg
Benzo(a)pyrene			*CAS #:* 50-32-8								
11/17/2005	U	U	U	U	U	U	U	U	0.02	SW846 8270C	mg/kg
Benzo(b)fluoranthene			*CAS #:* 205-99-2								
11/17/2005	U	U	U	U	U	U	U	U	0.33	SW846 8270C	mg/kg
Benzo(k)fluoranthene			*CAS #:* 207-08-9								
11/17/2005	U	U	U	U	U	U	U	U	0.33	SW846 8270C	mg/kg
Benzoic acid			*CAS #:* 65-85-0								
11/17/2005	U	U	U	U	U	U	U	U		SW846 8270C	mg/kg
bis(2-Ethylhexyl) phthalate			*CAS #:* 117-81-7								
11/17/2005	U	U	U	U	U	U	U	U	0.33	SW846 8270C	mg/kg
Bromomethane			*CAS #:* 74-83-9								
11/17/2005	U	U	U	U	U	U	U	U	0.005	SW846 8260B	mg/kg
Butyl benzyl phthalate			*CAS #:* 85-68-7								
11/17/2005	U	U	U	U	U	U	U	U	0.33	SW846 8270C	mg/kg
Carbon tetrachloride			*CAS #:* 56-23-5								
11/17/2005	U	U	U	U	U	U	U	U	0.005	SW846 8260B	mg/kg

See last page of this report for definitions.

Draper Aden Associates
Engineering ♦ Surveying ♦ Environmental Services

Table II.C-4

Summary of Analytical Results - Background
Radford Army Ammunition Plant - Open Burning Ground - Soil Monitoring Program

All Results Reported on a Dry Weight Basis

Event Date	BG-1A	Q	BG-1B	Q	BG-1C	Q	BG-1D	Q	BG-2A	Q	BG-2B	Q	BG-2C	Q	BG-2D	Q	RL	Method	Unit
Chlorobenzene					CAS #: 108-90-7														
11/17/2005	U		U		U		U		U		U		U		U		0.005	SW846 8260B	mg/kg
Chloroform					CAS #: 67-66-3														
11/17/2005	U		U		U		U		U		U		U		U		0.005	SW846 8260B	mg/kg
Chloromethane					CAS #: 74-87-3														
11/17/2005	U		U		U		U		U		U		U		U		0.005	SW846 8260B	mg/kg
Chromium, hexavalent					CAS #: 18540-29-9														
4/5/2012	1.1		0.57	J	0.63	J	1		0.71	J	0.7	J	0.89	J	1.9		1	7196A	mg/Kg
Dibenz(a,h)anthracene					CAS #: 53-70-3														
11/17/2005	U		U		U		U		U		U		U		U		0.02	SW846 8270C	mg/kg
Dibenzofuran					CAS #: 132-64-9														
11/17/2005	U		U		U		U		U		U		U		U			SW846 8270C	mg/kg
Diethyl phthalate					CAS #: 84-66-2														
11/17/2005	U		U		U		U		U		U		U		U		0.33	SW846 8270C	mg/kg
Dimethyl phthalate					CAS #: 131-11-3														
11/17/2005	U		U		U		U		U		U		U		U		0.33	SW846 8270C	mg/kg
Di-n-butyl phthalate					CAS #: 84-74-2														
11/17/2005	U		U		U		U		U		U		U		U		0.33	SW846 8270C	mg/kg
Di-n-octyl phthalate					CAS #: 117-84-0														
11/17/2005	U		U		U		U		U		U		U		U			SW846 8270C	mg/kg
Fluoranthene					CAS #: 206-44-0														
11/17/2005	U		U		U		U		U		U		U		U		0.33	SW846 8270C	mg/kg
Hexachloroethane					CAS #: 67-72-1														
11/17/2005	U		U		U		U		U		U		U		U		0.33	SW846 8270C	mg/kg
Indeno(1,2,3-cd)pyrene					CAS #: 193-39-5														
11/17/2005	U		U		U		U		U		U		U		U		0.33	SW846 8270C	mg/kg
Methylene chloride					CAS #: 75-09-2														
11/17/2005	U		U		U		U		U		U		U		U		0.005	SW846 8260B	mg/kg
Naphthalene					CAS #: 91-20-3														
11/17/2005	U		U		U		U		U		U		U		U		0.33	SW846 8270C	mg/kg
Perchlorate					CAS #: 14797-73-0														
4/5/2012	U		U		U		U		U		U		U		U		0.002	6850	mg/kg
Phenol					CAS #: 108-95-2														
11/17/2005	U		U		U		U		U		U		U		U		0.33	SW846 8270C	mg/kg
Pyrene					CAS #: 129-00-0														
11/17/2005	U		U		U		U		U		U		U		U			SW846 8270C	mg/kg

See last page of this report for definitions.

Draper Aden Associates
Engineering ◆ Surveying ◆ Environmental Services

Table II.C-4

Summary of Analytical Results - Background
Radford Army Ammunition Plant - Open Burning Ground - Soil Monitoring Program

All Results Reported on a Dry Weight Basis

Event Date	BG-1A	Q	BG-1B	Q	BG-1C	Q	BG-1D	Q	BG-2A	Q	BG-2B	Q	BG-2C	Q	BG-2D	Q	RL	Method	Unit
Tetrachloroethene					*CAS #: 127-18-4*														
11/17/2005	U		U		U		U		U		U		U		U		0.005	SW846 8260B	mg/kg
Toluene					*CAS #: 108-88-3*														
11/17/2005	U		U		U		U		U		U		U		U		0.005	SW846 8260B	mg/kg
Trichloroethene					*CAS #: 79-01-6*														
11/17/2005	U		U		U		U		U		U		U		U		0.005	SW846 8260B	mg/kg
Vinyl chloride					*CAS #: 75-01-4*														
11/17/2005	U		U		U		U		U		U		U		U		0.005	SW846 8260B	mg/kg

Definitions: RL Denotes reporting limit. Q Denotes data validation qualifier. **U** Denotes analyte not detected at or above DL. AL Denotes permit Action limit.
J Denotes result is estimated. **UJ** Denotes analyte was analyzed for but not detected at or above the DL and estimated due to data validation.
A Denotes laboratory QL and laboratory DL above permit Action limit (see data validation report).
R Denotes result rejected. (-) Denotes not sampled. **AL and RL** obtained from permit modification – Table 1 Attachment II.C-23-24, updated June 2014, Class I Permit Mod

NOTES:

Laboratory QL at or below the RL and AL unless noted (see data validation report). In these cases, the result is evaluated to the method detection limit (MDL/DL). MDL is less than the RL and AL unless noted.

TABLE II.C-5: FACILITY WIDE BACKGROUND STUDY

Attachment II.C
Table II.C-5

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

January 29, 2002

Mr. James McKenna
Radford Army Ammunition Plant
SIORF-SE-EQ
P.O. Box 2
Radford, VA 24141-0099

RE: Final Facility-Wide Background Study Report (Report)

Dear Mr. McKenna:

This office has reviewed the referenced final document and concurs with the Report. No revisions to the document are required.

If you have any questions, please call me at 804.698.4308.

Sincerely,

Mark S. Leeper
Remedial Project Manager

cc: Norman L. Auldridge – WCRO, DEQ
Durwood Willis – DEQ
Robert Thompson, Region III, U.S.EPA, 3HS13

Att. II.C-31

Attachment II.C
Table II.C-5

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

Date: February 14, 2002

In reply
Refer to 3HS13

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Commander,
Radford Army Ammunition Plant
Attn: SIORF-SE-EQ (Jim McKenna)
P.O. Box 2
Radford, VA 24141-0099

C.A. Jake
Environmental Manager
Alliant Techsystems, Inc.
Radford Army Ammunition Plant
P.O. Box 1
Radford, VA 24141-0100

Re: Radford Army Ammunition Plant
Facility-Wide Background Study Report
Document submittal and review

Dear Mr. McKenna and Ms. Jake:

The U.S. Environmental Protection Agency (EPA) has reviewed the Army's December, 2001 *Facility-Wide Background Study Report* for use at the Radford Army Ammunition Plant (RFAAP) and the New River Ammunition Storage Depot (NRASD). Based upon our review, the *Facility-Wide Background Study Report* is approved. In accordance with Part II. (E)(5) of RFAAP's Corrective Action Permit, the *Facility-Wide Background Study Report* is now final. EPA expects that future site-specific *Work Plans* and *Reports* for the investigation of areas at the RFAAP and NRASD will reference the final *Facility-Wide Background Study Report*.

Celebrating 25 Years of Environmental Progress

Att. II.C-32

Attachment II.C
Table II.C-5

If you have any questions, please call me at 215-814-3357.

Sincerely,

Robert Thomson

Robert Thomson, PE
Federal Facilities Branch

cc: Russell Fish, EPA
Leslie Romanchik, VDEQ-RCRA
Sharon Wilcox, VDEQ-CERCLA
Mark Leeper, VDEQ-CERCLA

Celebrating 25 Years of Environmental Progress

Att. II.C-33

Delivery Order No. 0008
Environmental Services
Program Support
DACA31-94-D-0064

RADFORD ARMY AMMUNITION PLANT, VIRGINIA

Facility-Wide Background Study Report

Prepared for:
USACE Baltimore District
10 S. Howard St.
Baltimore, MD 21201

Prepared by:
IT Corporation
2113 Emmorton Park Rd.
Edgewood, MD 21040

Final Document

December 2001

EXECUTIVE SUMMARY

A Facility-Wide Background Study was conducted at the Main Manufacturing Area and the New River Unit of RFAAP in accordance with Work Plan Addendum No. 10. Task objectives were to characterize naturally occurring background soil inorganic concentrations within the MMA and the NRU. Scope of work activities included the collection of background soil samples to establish a baseline for inorganic compounds of concern at RFAAP. Background sample locations were selected based on soil types and collected in areas not impacted by installation activities. Associated soils were evaluated based on formation properties and chemical and physical characteristics.

Explosives were selected as primary background markers, and semivolatile and volatile organic compounds were selected as secondary markers to discern potential contamination associated with selected background sample locations. Explosives and organic compound results confirmed the selected background locations had not been impacted by facility operations and were indicative of natural background conditions.

Statistical performance objectives designated for the background study were designed to ensure study data were scientifically based and statistically valid. Data were evaluated across soil types, soil horizons, and study areas to assess the potential for developing a universal background data set. Statistical tests demonstrated that surface soil data for both the MMA and NRU could be combined into one facility-wide data set. Similarly, subsurface soil data were also combined from both areas to obtain a facility-wide subsurface data set.

Point estimate values were subsequently developed to represent background concentrations for future site comparisons. The 95% upper confidence limit was selected as the statistic to assess background point estimates for surface and subsurface soil samples. Results from the previously attempted background study (Parsons 1996) were evaluated, and it was demonstrated that inclusion of the prior data set would compromise the statistical validity of the current background study.

Further work was performed in response to review comments from the USEPA and VDEQ. As a result of subsequent discussions with the agencies, this Final Facility-Wide Background Study reflects two major revisions: 1) facility-wide point estimates for background soil data are calculated as tolerance limits rather than confidence limits, and 2) background data for soil (surface and subsurface, MMA and NRU) are combined into a single data set. The final set of point estimates for the background data set, therefore, are based on calculated 95% UTLs for a single facility-wide data set that represents surface and subsurface soil from the MMA and NRU areas. These values are included in the Facility-Wide Background Study as a point of reference for point-by-point comparisons for site screening.

5.0 Conclusions

5.1 BACKGROUND SAMPLE LOCATIONS

Pre-selected background sample locations were positioned in the MMA and NRU in areas that had not been impacted by previous site operations. Explosives were selected as primary background markers given the history of installation propellant manufacturing activities. Field screening immunoassays were processed for RDX and TNT to evaluate potential explosive contamination. Explosives results were negative, indicating background sampling locations had not been impacted by RFAAP operations. Additionally, semivolatile and volatile organic compounds were evaluated as secondary markers to substantiate the selection of true background locations. Analytical results demonstrated that organic contaminants had not impacted the selected locations, indicating that sample locations represented background conditions.

5.2 STATISTICAL EVALUATION

Background sample results were validated in accordance with Work Plan Addendum No. 10, to assess analytical data limitations and report scientifically based and statistically valid data. Elements were eliminated from statistical testing that did not result in significant contributions to background evaluation. For example, macronutrients (calcium, potassium, magnesium, and sodium) were not evaluated statistically because they are not chemicals that drive remedial decisions. Non-detects greater than 80% were also eliminated because there was not enough data to perform statistical analysis.

Statistical testing was performed on the remaining elements to assess data distributions and evaluate the potential for combining the data into one data set. Testing results indicated that surface soils from both the MMA and NRU could be combined into one data set and subsurface soils from both areas could be combined into one data set.

Point estimates were then evaluated against the previously attempted background study (Parsons 1996) to assess the integration of prior data into the existing data set. Shortcomings identified in the previous data set, as specified in Section 4.4, precluded its use because of the high potential for compromising the current (year 2000) data.

As a result of subsequent discussions with USEPA and VDEQ, this Final Facility-Wide Background Study reflects two major revisions: 1) facility-wide point estimates for background soil data are calculated as tolerance limits rather than confidence limits, and 2) background data for soil (surface and subsurface, MMA and NRU) are combined into a single data set. The final set of point estimates for the background data set, therefore, are based on calculated 95% UTLs for a single facility-wide data set that represents surface and subsurface soil from the MMA and NRU areas. These values are included as a point of reference for point-by-point comparisons for site screening. These point estimates are summarized in Table 5-1.

Table 5-1
Facility-Wide Point Estimates for Radford AAP Soil

[Units in mg/kg]

Chemical Name	Range of data (mg/kg)	Background Concentration 95 % UTL (mg/kg)
Aluminum	3,620 - 47,900	40,041
Arsenic	1.2 - 35.9	15.8
Barium	23.4 - 174	209
Beryllium	0.61 - 5.4	1.02
Cadmium	0.62 - 2.5	0.69
Chromium	6.3 - 75.8	65.3
Cobalt	5.9 - 130	72.3
Copper	1.6 - 38.7	53.5
Iron	7,250 - 67,700	50,962
Lead	2.1 - 256	26.8
Manganese	16.7 - 2,040	2,543
Mercury	0.038 - 1.2	0.13
Nickel	4.6 - 94.2	62.8
Thallium	1.3 - 5.0	2.11
Vanadium	12.2 - 114	108
Zinc	4.7 - 598	202

APPENDIX II.C-A: EXAMPLE CHAIN-OF-CUSTODY FORM

CHAIN OF CUSTODY RECORD

Laboratory:

Client: **Attn:** **Address:** **Phone:** **Fax:** **Fax:**	**Consultant:** **Attn:** **Address:** **Phone:** **Fax:**	**Sample Site:** RFAAP, Radford, Virginia **Location:** HWMU-13 (Open Burning Ground) **Event:** Annual Soil Monitoring **DAA JN:** **Lab JN:**	**Project Specific (PS) or Batch (B) QC:** **Sample Collection for Project Complete?** *YES* **Carrier:** ____ **Tracking Number:** ____
Box 1: Matrix SW Surface Water GW Groundwater L Leachate S Soil T Trip Blank E Equipment Blank P Product O Other	**Box 2: Preservative** A HCL B HNO_3 C H_2SO_4 D $Na_2S_2O_3$ E NaOH F ZnAc G Other (<4 deg C) H None	**Box 3: Filtered/Unfiltered** F Filtered U Unfiltered **Box 5: Sample Container Type** P Plastic V VOA AG Amber Glass CG Clear Glass **Box 4: Sample Type** G Grab C Composite	**Invoice** **Copy to Consultant:** *YES* **Bill:** *CLIENT* *OTHER* ____ **Preserved and shipped on ice:** *YES*

Sample ID	Date:	Time	Box 1: Matrix	Number of Bottles											GENERAL NOTES:
Box 4 - Sample Type															
Box 3 - Filtered/Unfiltered															
Required pH of Sample															
Box 2 - Preservative															
Box 5 - Sample Container Type															

Clients Special Instructions:

Received by lab in Good Condition ____ Yes ____ No Custody Seal Intact ____ Yes ____ No Temperature upon arrival ____ Received on Ice ____ Yes ____ No
Describe problems, if any:

Sampler Name (Print):	Date:	#1 Relinquished by (Signature):	Date:	#2 Relinquished by (Signature):	Date:	Sample Storage Time Requested:
Sampler Signature:	Time:	Company Name:	Time:	Company Name:	Time:	
Sampler Name (Print):	Date:	#1 Received by (Signature):	Date:	#2 Received by (Signature):	Date:	30 DYS ORG/6 MTHS INORG
Sampler Signature:	Time:	Company Name:	Time:	Company Name:	Time:	

Appendix II.C-A

ATTACHMENT II.D – INSPECTION SCHEDULE

II.D.1. General Inspection Requirements

Inspections function as a preventative measure to help ensure safe operations and to identify potential problems before they can become serious problems. Inspections are performed by trained personnel to identify equipment malfunctions, structural deterioration, and leaks or discharges that could release hazardous constituents to the environment or threaten human health. Only personnel who have completed appropriate training and are approved for the task shall conduct inspections pursuant to this Inspection Schedule.

II.D.2. Open Burning Ground

Inspections function as a preventive measure to help ensure safe operations and to identify potential problems before they can become serious problems. The permitted OBG will be inspected as specified in this Inspection Schedule. In general, three types of inspections are performed:

a. Weather Conditions
The OBG operator collects information on the weather forecast from the local weather service in Blacksburg, VA. Internet sources may also be referenced for gathering weather information.

b. Environmental Management, Open Burn Ground
This inspection is performed daily when the OBG is in operation and covers the basic inspections required at the OBG. The operator checks for waste out of place, and cleans it up immediately if it is noted. Prior to loading the pans, the pans are checked to insure that the pans are in good condition and that there are no holes in the pan.

c. Burning Ground Area Checklist
This inspection is performed daily when the OBG is in operation. It covers the inspection of the equipment prior to loading the pans. It also requires that the firing circuit is inspected and that all of the safety items are in place and in operating order.

II.D.3. Inspection Schedule

All inspections will be performed daily at the OBG when in operation. No inspections are required under this Permit on days when waste is not being treated at the OBG. In these instances, RFAAP must document that no waste is being burned in the inspection records. In addition, if the OBG cannot operate due to weather or equipment malfunctions, such as holes in the burning pans, it must be noted on the daily inspections logs.

During the daily inspections, the operators shall inspect the area for material spilled while loading the pans and material blown out of the pans during a burn. Any material that is found during these inspections must be picked up immediately and placed into a hazardous waste storage container. In addition, the operators shall perform a general visual inspection of the pans, noting any areas where refractory is missing or damaged.

II.D.4. Remedial Action

Should any problems or deficiencies be observed during an inspection, that observation will be recorded on the appropriate inspection form. Any necessary remedial actions will also be noted on the form and the problem or deficiency will be brought to the attention of the appropriate supervisor. When repairs or remedial actions have been completed, the date and nature of the repairs will be recorded on the inspection form on which the problem or deficiency was originally noted or in the facility's maintenance tracking system.

Should any problems or deficiencies be observed that could lead to a release of hazardous waste or that could threaten personnel safety, operations will cease until the problem or deficiency is rectified. In no case will operations resume until all spill and emergency response equipment is operable and adequately stocked.

II.D.5. Inspection Recordkeeping

All inspection results will be recorded on an inspection form by the individual who performs the inspection at the time that the inspection is performed. These records include, at a minimum, the date and time of the inspection, the name of the inspector, a notation of the observations made, and any abnormalities that were found. Any necessary repairs resulting from the inspection are tracked through the facility’s work order/preventative maintenance system. The individual performing the inspection will also sign and date each completed inspection form. Any problem that is noted should also be noted on the Waste Propellant Area, Foreman's Daily Log. If the foreman or OBG operator believes that the inspection warrants immediate action to correct an identified problem, they are to stop the process and get the item repaired before proceeding (unless otherwise determined safe to do so).

The trained operators performing the inspections will record each inspection on a paper inspection form or in a computer-based program for inspections, if appropriate. The completed inspection forms will be maintained as a part of the facility operating record for at least three years from the date of inspection.

II.D.6. Emergency Equipment

Emergency equipment used at the OBG includes emergency communication equipment, fire protection equipment, and spill control equipment. This equipment is tested and maintained as necessary to assure proper operation during an emergency situation.

As no liquid wastes are managed at the OBG, no liquid spill containment materials are necessary. However, sawdust and spill-sorb materials are kept onsite at the OBG for any diesel fuel spills that may occur while loading the pans and preparing for burns.

Fire protection equipment is provided as required. Three 2 ½- gallon pressurized water fire extinguishers are provided in the ignition bunker for immediate fire response at the OBG in the event of fire on the facility. When the possibility of brush fires is increased because of environmental conditions (windy and/or dry), fire trucks are requested to stand by on site when active burning operations are taking place. Other available emergency equipment at the plant is listed in the Contingency Plan (Attachment II.E) of this Permit.

Should larger scale fire control be necessary, the New River is used as the source of water for firefighting efforts. All larger scale firefighting measures will be handled by the RFAAP Fire Department or by outside resources if required.

TABLE II.D-1: INSPECTION SCHEDULE – EMERGENCY EQUIPMENT

Inspection Item	Types of Problems	Frequency of Inspection
Absorbent material, booms	Out of stock	Quarterly or as used
Fire extinguishers	Seal, hose, pressure, and condition	Monthly or as used
Personal protective equipment for fire and spill response and decontamination activities	Condition of equipment	As used
Internal alarm system (horn)	Operational	Daily
Communication systems	Operational	Daily

ATTACHMENT II.E– PERSONNEL TRAINING

II.E.1. Appropriate training shall be completed by all persons at RAAP who are or may be involved in a task associated with the OBG. The Permittee shall insure that those individuals responsible for operating and inspecting the permitted systems are appropriately trained. New employees who have as part of their job responsibility tasks that are associated with or may be associated with the OBG shall not work unsupervised until the training required in accordance with this permit is completed. Such new employees shall complete the required training within six months of their employment date.

II.E.2. All training of personnel shall be documented at the time of each completed session and such documentation shall be maintained in the facility operating log for at least three years from the date on which the training was completed. Such documentation shall include the name of each trainee and trainer, date of instruction, and a summary or outline of the training session.

II.E.3. All training under this permit shall be reviewed at least annually and updated as necessary. All personnel who are subject to the training requirements under this permit shall be required to review their training at least annually.

II.E.4. In general, all personnel who are actively associated with or may be associated with the proper operation, inspection, and maintenance of the OBG are required to read the standard operating or maintenance procedure for the area and those pertaining to emergency response that are associated with the Contingency Plan. In addition, the personnel shall be trained to properly perform their assigned duties including, but not limited to, loading the pans, initiating at burn, and conducting inspections as required by this Permit.

II.E.5. The personnel noted above shall be required under this permit to fully understand the techniques of proper maintenance and operation of the unit, including those techniques and operations described and required in the unit standard operating procedure, and shall maintain appropriate documentation required under this permit. Supervisory staff shall be trained to review and to provide appropriate guidance and/or liaison with the Permittees' management. The Permittee shall provide sufficient opportunity for personnel to acquire a full understanding of maintenance and operation techniques by providing sufficient instruction and/or sponsoring sufficient instruction by professionals who are qualified to provide such instruction.

II.E.6. All operating contractor personnel who are or may be exposed to the hazards associated with the OBG operations shall receive general plant orientation and training in area-specific procedures. Employees then receive on-the-job training in all of the procedures that specifically pertain to their area of employment.

II.E.7. Standing Operating Procedures (SOPs) are developed and used for open burning of waste at RFAAP. The SOPs specify the procedures involved at the burn pads to minimize the possibility of fire, explosion, or any unplanned release of hazardous waste constituents. The SOPs for the burn area are listed underSOP No. RAD-OBG 300-306. The supervisor for open burning operations is responsible for reviewing and updating SOPs annually for operating and training personnel in the safe, efficient, and environmentally acceptable thermal treatment of waste propellant received at the OB Ground. Controlled copies of the SOP are maintained onsite and are readily available for inspection and review by authorized individuals. The personnel involved in the actual operation of the permitted storage and treatment area will be trained in the proper procedures for operation of the OBG, including those delineated in the unit standard operating procedures. These procedures have been designed to ensure continued safe operation and maintenance and compliance with applicable environmental regulations. This includes training required to properly operate and maintain any software programs used track the waste being loaded into each burn pan to ensure compliance with this Permit.

II.E.8. The facility operating contractor will be responsible for the overall training program, scheduling and documentation of such training and shall serve as the RCRA Training Director.

II.E.9. It shall be the responsibility of the training director to make sure that all personnel required under this permit to receive training are, at minimum, instructed in the following areas:

a. Area specific management practices regarding the OBG;

b. Security and safety;

c. General and area specific inspections and recordkeeping;

d. Regulatory updates that affect operations and activities; and

e. Job function and procedural descriptions of each employee’s respective role in the permitted storage and treatment operations.

II.E.10. A complete outline of the training program is provided in Appendix II.D-1.

II.E.11. Job titles and descriptions for personnel involved in the permitted storage and treatment operations are summarized in Table II.D-1. These job titles and the name of the current person filling that position are kept on file at the RFAAP.

TABLE II.E-1 – JOB TITLES AND RESPONSIBILITIES

Job Title	Job Description	Training Required
RCRA Compliance Coordinator	Responsible for overall administration of hazardous waste management program as directed by the US Army under the terms of the operating contract for the installation.	Trained in all aspects of hazardous waste management.
Emergency Response Coordinator	Assist in preparation and presentation of training program, maintain pre-fire plan for the area, and respond to fire alarms.	Trained in hazardous waste emergency procedures.
Firemen	Respond to hazardous waste emergencies.	Trained in all aspects of hazardous waste emergency response. Training conducted with regular fire training and not hazardous waste program.
Medical Staff	Responds to all health emergencies.	Trained in emergency medical procedures.
Safety Manager	Provide health, safety and toxicological data on handling hazardous materials.	Occasional training program to keep current.
Production Technologist	Conduct weekly inspections, supervise hazardous waste handling operations at HWM facility, and supervise minor spill cleanup. Responsible for on-the-job training of employees.	Trained in hazardous waste handling procedures, including chemical hazards, personnel protection, and explosive reactions.
Open Burning Ground Operators	Responsible for loading, initiating, and generally operating the OBG, coordinating maintenance activities, and performing inspections. Unloading, placing, and loading of hazardous wastes at a HWM facility.	Trained in hazardous waste handling procedures, including chemical hazards, personnel protection, and explosive reactions.
Waste Handlers	Responsible for managing wastes stored in temporary (less than 90 day) storage areas throughout the RFAAP, and, when necessary, transferring wastes from those storage areas to the OBG's temporary (less than 90 day) storage area	Trained in proper hazardous waste handling and management procedures
Environmental Manager	Functions as alternate to RCRA Coordinator. Responsible for overall plant environmental management.	Trained in all aspects of manufacturing and hazardous waste disposal operations.

[1] Names of individuals fulfilling this positions are withheld to protect National security in accordance with Department of Defense (DoD) Directive 5400.11-R, Office of Management and Budget (OMB) Memorandum M-07-16, and Army Regulation 340-21. These names are available for review and inspection upon request.

APPENDIX II.E-1: TRAINING OUTLINE

II.E-1.1. PERSONNEL TRAINING

The purpose of the introductory and continuing hazardous waste training program is to educate the employees who are responsible for handling hazardous wastes and any permit related tasks. The program makes known to the employee the hazards of those wastes and the proper procedures to follow in the event of an emergency The employee training has been and will be completed through formal classes, electronic training, and/or through on-the-job training administered by the Training Department.

II.E-1.2. OVERVIEW OF THE TRAINING PROGRAM

The training program at the facility consists of a general orientation, instruction for area-specific procedures, on-the-job training, and a general and continuing training program.

II.E-1.3. TRAINING CONTENT, FREQUENCY, AND TECHNIQUES

Introductory training for all facility employees consists of a general orientation that is provided by the facility training department. Training in operating procedures is given on-the-job by area supervision. The operating procedures cover subjects such as cleaning equipment and materials, operating equipment and materials, safety rules and precautions, and a step-by-step description of the designated task. Appropriate changes in facility operating procedures are implemented as a result of training.

Facility personnel have or will successfully complete the required training program within six (6) months after the effective date of their employment or assignment to the OBG, or to a new position at the OBG, whichever is later. Employees will not work in unsupervised positions until they have completed the training requirements described in this section. Facility personnel will also participate in an annual review of the introductory training program.

II.E-1.4. RCRA COMPLIANCE COORDINATOR

The RCRA Compliance Coordinator conducts or oversees all hazardous waste management training and maintenance of personnel training records. The responsibilities for this position include compiling the hazardous waste biennial report, notifying health, safety, security, operations, and fire departments of changes in facility status, and reviewing operating procedures.

II.E-1.5. TRAINING RECORDS

Training records are maintained for all facility employees by the training department. Training records of all employees involved with hazardous waste management will be reviewed annually in order to ensure that employee training is current and that appropriate and relevant training is coordinated with employee job functions. Current training records of employees involved with hazardous waste management and former employees will be kept as required by this Permit.

Contractor employee training records will be maintained by the contractor and supplied to the operating contractor on an annual basis for recordkeeping.

II.E-1.6. TRAINING FOR EMERGENCY RESPONSE

The training program at RFAAP includes on-the-job training to cover effective response to emergencies. Additionally, it is imperative that adequate fire prevention and protection is provided by the facility's fire department due to the reactive wastes at the facility.

The Fire Prevention and Protection Training Program includes drills, exercises, and hands-on training sessions. Each fireman receives minimum of four hours training each week. A training schedule is prepared and a training record is maintained on each fireman and retained in the fire station. New firemen receive formal and on-the-job training and respond with the fire company to all fires. The basic training period usually covers at least 18 months depending on prior qualification and experience of the new fireman.

Training of other employees is conducted during drills and safety meetings. Fire department personnel are available to other people on request to conduct classes, demonstrations and drills.

II.E-1.7. IMPLEMENTATION OF THE TRAINING PROGRAM

There exists at RFAAP, an extensive system and computer program to ensure that required on-the-job training has been conducted with each employee. Based on the job title/description, each employee is assigned two sets of training programs and procedures. The first set is a general plant training set that each new employee gets and the second set of training is an area and job specific set. These training sets have a deadline by which they have to be completed. On-the-job training and area specific procedure training is usually performed by the employee's foreman/supervisor. When the training is complete, the foreman/supervisor and employee verify the training with a sign-off sheet.

The computer training program is maintained by the training department. The computer training program is designed to notify supervision when training is required.

ATTACHMENT II.F - CONTINGENCY PLAN

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

II.F.1. INTRODUCTION AND GENERAL INFORMATION

This Contingency Plan (Plan) has been prepared for the Open Burning Ground (OBG) unit, at the Radford Army Ammunition Plant (RFAAP). This Plan has been compiled as a stand-alone document for the permitted treatment area and has been structured to be consistent with other plans and procedures in use at the RFAAP.

II.F.1.a. Purpose

In accordance with Subpart D of 40 CFR Part 264, this document describes the Contingency Plan that will be activated in the event of a fire, explosion, or release of hazardous waste or hazardous waste constituents that could threaten human health or the environment. A current copy of the Plan will be maintained in the RFAAP facility operating record as well as in the Environmental Manager's files.

The overall objective of this Contingency Plan is to minimize hazards to human health or the environment from fires, explosions, or any unplanned sudden or non-sudden release of hazardous waste or hazardous waste constituents to air, soil, or surface water. This plan defines the actions to be taken in the event of an emergency within the permitted treatment area.

II.F.1.b. Plan Contents

This Contingency Plan contains pertinent information to be used during an emergency situation. The various sections and content of the plan are listed below.

- Section II.F.2 describes facility operations and the types of hazardous wastes managed at the OBG;
- Section II.F.3 identifies the RFAAP Emergency Coordinator and alternates;
- Section II.F.4 discusses Contingency Plan implementation;
- Section II.F.5 presents a description of release prevention measures;
- Section II.F.6 describes emergency response procedures;
- Section II.F.7 describes coordination agreements between RFAAP and surrounding communities;
- Section II.F.8 presents the permitted treatment area evacuation plan;
- Section II.F.9 outlines release-reporting requirements; and
- Section II.F.10 includes requirements for Contingency Plan modifications.

II.F.2. FACILITY LOCATION, OPERATIONS, AND WASTES MANAGED

This section provides background information that may be useful as part of an emergency situation. This information includes the location of the facility, operations performed at the facility, types of wastes managed, and potential emergency situations that could be encountered.

II.F.2.a. Facility Location

The RFAAP is located in southwest Virginia within Pulaski and Montgomery Counties as shown in Figure II.F-1. The RFAAP is located approximately 4 miles north of the City of Radford, 7 miles southwest of Blacksburg, 9 miles northwest of Christiansburg, and 30 miles southwest of Roanoke. The main entrance to the RFAAP is located on Virginia Route 114 between the Towns of Christiansburg and Radford. The RFAAP address is as follows:

Radford Army Ammunition Plant
Route 114
P.O. Box 1
Radford, Virginia 24141-0100

The RFAAP encompasses approximately 4,104 acres. The New River separates Pulaski and Montgomery counties and also divides the RFAAP into two portions commonly known as the Horseshoe Area and the Main Manufacturing Area. These two areas and the approximate boundary of the RFAAP are shown on Figure II.F-1.

The OBG is located in the southeast section of the Horseshoe Area on the northern bank of the New River as shown in Figure II.F-1 and is used for the open burning of energetic wastes that cannot be safely treated in the RFAAP's hazardous waste incinerators. Figure II.F-2 shows the OBG boundary and the locations of the actual structures.

II.F.2.b. Facility Operations

General operations performed at the RFAAP and at the permitted treatment and storage area are described in the following sections.

i) RFAAP Operations

RFAAP is a government-owned, contractor-operated (GOCO) industrial installation responsible to the U.S. Army. The RFAAP's mission is to manufacture propellants, explosives, and chemical materials as assigned. As a GOCO operation, RFAAP has both Government and Contractor organizations. For the purpose of this permit application, the facility consists of all contiguous portions of the RFAAP. The facility specifically includes both the Horseshoe Area and the Main Manufacturing area. Wastes from onsite activities (including those of both the operating contractor and tenants) are managed in the permitted treatment area. Additionally, wastes from the nearby New River Unit (NRU) may be handled at the site in limited situations.

The facility was first constructed in 1940 and began operations producing smokeless powder (single base, double base, and triple base propellants) in 1941. Since that time various processes/products have been added to the facility including production of cast propellants, trinitrotoluene (TNT), commercial propellants, and load, assemble and pack facilities. Specific operations vary based upon contracted capacity and products from the Department of Defense and U.S. allies.

ii) OBG Operations

Operations included in the permitted treatment area include the propellant waste treatment operations at the OBG. The following equipment included in this operation is:

- Burning Pans and Covers
- Remote Ignition System

Specific operations that are performed at the OBG are listed below.

1. Waste materials are transported from production areas 20 gallon containers to the OBG. The waste is then loaded into the burning pans.
2. The burning pans are prepared for ignition by spreading the waste out and adding diesel and materials as necessary to support combustion (pallets, cardboard, *etc*.).
3. The burning pans are remotely ignited.
4. Ash from the burning pans is collected and staged on-site pending sample analysis and transferred to an offsite permitted disposal facility.

II.F.2.c. Wastes Managed

The hazardous wastes that are managed at the permitted facility include waste energetic materials and spill “cleanup” residues generated at the facility. These wastes are hazardous due to their ignitability (D001) or reactivity (D003). Additionally, some of the wastes may exhibit the toxicity characteristic for certain metals and/or 2,4-dinitrotoluene. A detailed description of the wastes is provided in the Waste Analysis Plan in Attachment II.B of this Permit. In summary, however, these include wastes that exhibit the following hazardous characteristic(s):

1. Reactivity (hazardous waste number D003) as specified in 9 VAC 20-60-261, incorporating 40 CFR § 261.23 by reference; and

2. Toxicity, as specified in 9 VAC 20-60-261, incorporating 40 CFR § 261.24 by reference, for one or more of the following contaminants;

    a) Arsenic (hazardous waste number D004);

    b) Barium (hazardous waste number D005);

    c) Cadmium (hazardous waste number D006);

    d) Chromium (hazardous waste number D007);

    e) Lead (hazardous waste number D008);

    f) Mercury (hazardous waste number D009);

    g) Selenium (hazardous waste number D010);

    h) Silver (hazardous waste number D011); and

    i) 2,4-Dinitrotoluene (hazardous waste number D030).

3. Ignitability (hazardous waste number D001) as specified in 9 VAC 20-60-261, incorporating 40 CFR § 261.21 by reference.

Under no circumstances will the managed wastes include any of the following:

i. Radioactive wastes, or mixed radioactive and hazardous wastes;

ii. Wastes that are listed pursuant to 9 VA 20-60-261, incorporating 40 CFR § 261.31, 32, and 33, by reference, will be managed at the permitted treatment area.

iii. Any material contaminated with or suspected of being contaminated with military warfare agents accepted for thermal treatment at the OB unit. Examples of such chemical warfare agents are:

    Choking agents;

    Nerve agents;

Blood agents;

Blister agents;

Incapacitating agents;

Vomiting compounds;

Tear producing compounds; and

Herbicides;

iv. Smoke and incendiary devices, as these materials are not suitable for treatment at the OBG for a variety of reasons.

i) Composition of Waste

The composition of the wastes burned at the OBG varies over time due to changes in the production schedule at the RFAAP. Generally, these wastes include miscellaneous energetic waste materials that cannot be otherwise treated at the onsite hazardous waste incinerator. The wastes may be hazardous due to the ignitability, reactivity, or toxicity characteristics. Of those wastes identified in the Waste Analysis Plan, all except those from Groups 2, 3, 5, and 6 may be treated at the OBG. No liquid wastes may be treated.

These waste streams are processed as described in Sections 2.2.2 and 2.2.3 and are handled in accordance with the Waste Analysis Plan. There are no wastes managed in the facility that are incompatible with one another.

ii) Identification and Quantity of Waste

The specific identification of wastes to be treated in the permitted area is recorded on an internal tracking record that accompanies the waste from the generation area. This permits easy identification of any material that is released.

Wastes brought to the OBG are treated (burned) the same day as received; there is no long-term storage of materials at the OBG. The largest quantity of materials that could be treated at one time at the OBGs is 5,600 pounds of energetic waste, spread in 1,000-pound increments across six burning pans. The resulting ash from the burning pans is collected after each burn and staged on-site in a less than 90 day storage area pending sample analysis. The ash is managed as hazardous waste.

II.F.2.d. Potential Emergency Situations

There are several situations at the OBG that would require implementation of the Contingency Plan. The most common scenarios would include releases from a fire or an explosion of reactive wastes during processing or handling. In addition, if the flood protection plan failed to be implemented properly, releases may be possible during flooding scenarios.

The most serious situation at the OBG would be an explosion, as such an incident would pose an immediate danger to facility personnel and could allow for the release of a significant quantity of material to the environment. A non-explosive release of waste at the OBG presents less of an immediate danger to personnel and may not always require implementation of the Contingency Plan, as these types of releases may not have a potential to have offsite impacts.

II.F.3. EMERGENCY COORDINATORS

The primary Emergency Coordinator (EC) for all environmental emergencies is the on-call representative from the Environmental Department. Additionally, the facility/incident Site Commander (ISC) will provide coordination of emergency response such as fire protection, medical attention, *etc.* The EC has the authority to determine and implement this Contingency Plan and commit the necessary resources to do so. The EC will receive assistance in these duties from the ISC where appropriate.

The facility has an on-site Fire Department. Environmental emergencies are primarily communicated to and handled by the Environmental Manager and the Environmental Staff in accordance with applicable regulations. The Environmental Manager coordinates all pollution control and remediation activities including monitoring, containment, control, countermeasures, clean-up, and disposal activities.

Other facility employees are designated as alternate EC and are qualified to act as EC in event the primary EC is unavailable. A (primary or alternate) EC will be available or on call at all times. The facility personnel who are designated as ECs are listed in Table II.F-1 (the Notification Action Summary sheet). The alternate ECs are called on to act as the EC in the event of an emergency in the order listed in the table.

Table II.F-1 also provides contact information for the ECs and alternate ECs. Additional contact information for these parties (home addresses and phone numbers, *etc*.) are protected for security reasons. This information is maintained by the security department and/or human resources department and can be utilized to contact ECs and alternate ECs if necessary. Each of the persons identified on Table II.F-1 are qualified by experience and training to act as the EC. All of these persons hold management positions at the facility, have been trained to respond to emergencies dealing with hazardous waste management, and have extensive experience in the propellant manufacturing environment.

II.F.4. IMPLEMENTATION

The Contingency Plan will be implemented whenever there is a fire, explosion, or release of hazardous waste or hazardous waste constituents that could threaten human health or the environment. The EC will be responsible for evaluation of any situation to determine if the Contingency Plan will be implemented.

It shall be the duty of all facility personnel to follow the direction of the EC when the decision has been made to implement the Contingency Plan.

The person observing an emergency situation at the OBG will most likely be someone other than the EC. That person is to take the following actions to involve the EC as soon as possible:

1. Ensure his/her personal safety.

2. Telephone, radio, or otherwise notify the Security Dispatcher and the Foreman of any observed releases (e.g., spills, fires, or explosions) and report: his/her name, location, and nature and extent of the release. All operators carry an intrinsically safe cellular phone and/or radio with them at all times. Unassigned radios are located on-site at the trailer and bunker (Figure II.F-3). The Security Dispatcher will immediately notify the EC via the Environmental on-call phone.

3. Remain available to assist the EC with information about initial observations of the incident.

In addition, the facility has installed and operates a mass notification system at the RFAAP. This system provides plant-wide notification of emergencies and signifies both emergent situations and all clear signals as they are available.

II.F.5. RELEASE PREVENTION MEASURES AND CONTROL PROCEDURES

RFAAP has general facility-wide control procedures to minimize the potential for fires, explosions, and chemical releases as part of overall facility operations. Additional measures have been implemented at the OBG to prevent and/or control the propagation of such incidents.

II.F.5.a. RFAAP Control Procedures

The RFAAP is designed so that process, raw material storage and product storage facilities present a minimal threat of fire, explosion or material release. These process and storage operations are not subject to RCRA regulation. However, in the course of normal operation and maintenance, hazardous wastes are generated. Because safeguards exist for the non-RCRA regulated processing operations, this also protects against hazards once the waste is generated in the plant.

Procedures for operator response in the event of an emergency are dictated by standard protocols and are provided for fires, electrical storms, floods, and other unusual conditions. In addition, procedures are in place to help prevent routine operations from creating emergency situations. This include procedures that limit the time period in which highly reactive materials (*e.g.*, unstable Class 1.1 materials) must be burned, procedures that direct waste storage safety, powder van safety, and general housekeeping and cleaning.

All emergencies that result in activation of this Contingency Plan will be managed by the EC, with assistance from the onsite fire department and security services as necessary. In the event of a fire, explosion or spill involving hazardous waste, the EC will notify the area foreman to direct personnel to contain, absorb, package, or redirect spilled materials as deemed necessary to protect human health or the environment. For this purpose, the plant maintains an adequate supply of hand and motorized tools and clean, empty containers for recovering hazardous wastes.

The EC has the authority to direct trained fire crews to contain and control fires and cool affected areas to prevent further spread of hazard. This direction shall be coordinated through the onsite plant fire chief and the onsite fire department. Initial response for all out of control pan fires or other fires at the burning ground will be performed by the fire department, who is trained in managing fires from reactive materials. Personnel safety during these events is of utmost importance and the procedures therefore limit personnel entry into the fire zone unless absolutely necessary. If outside assistance becomes necessary, such assistance will be coordinated by the EC.

II.F.5.b. Prevention of Recurrence or Spread of Fires, Explosions or Releases

Numerous precautions are taken at the OBG in order to reduce the likelihood that fires, explosions, or other unsafe conditions occur. These precautions are incorporated into the standard operating procedures for the area and include procedures for responding to fires at the OBG. Area personnel are instructed via this procedure to evacuate the area immediately to their assigned emergency assembly point and report the incident to the Fire Department. The assembly point for the OBG is the OBG office.

In addition to the fire response procedures, additional procedures are provided to help prevent fires and unsafe conditions from occurring. The primary mechanism for prevention of fires, explosions, and/or releases is the proper training of OBG personnel in energetic safety and area procedures. In addition, written procedures are provided that address the safe management of moving the waste from storage to the OBG and special instructions for the burning of specific propellants that may be more likely to cause fires or other emergency situations (*e.g,* Class 1.1 materials).

Physical safeguards for fires, explosions and/or accidental releases are also provided by the design and layout of the OBG itself. As shown in Figure II.F-7, the actual burning ground pans are located in areas free of vegetation. The pads on which each pan is located is kept free of combustible materials and vegetation and the pads are elevated from the nearby ground. The area immediately surrounding the pads is also kept free of vegetation, limiting the chance of vegetation igniting due to unplanned material ejection. Trees are kept trimmed, and the grass is mowed as required.

Should there be a fire, explosion, or release of hazardous materials at the OBG, the EC and other environmental and operational personnel will review the incident after response and clean-up activities are completed. Based on this review, the cause will be determined, if possible, facility operating procedures or design will be revised as necessary, and other corrective actions will be taken in order to help prevent a reoccurrence. The Contingency Plan will also be revised as necessary to improve facility response to future incidents.

II.F.6. EMERGENCY RESPONSE PROCEDURES

This section outlines procedures to be followed during an emergency. Information on the EC responsibilities, the required notifications, control cleanup, and mitigation procedures is presented.

II.F.6.a. Emergency Coordinator's Responsibilities

When the decision has been made to implement the Contingency Plan, the EC's responsibilities will include, but will not be limited to, the following:

1. Identifying hazardous materials and assessing hazards;
2. Accounting for facility personnel;
3. Implementing internal notifications;
4. Coordinating first-aid activities;
5. Activating the Evacuation Plan, if required; and
6. Notifying appropriate State and local authorities (coordinated with the Environmental Department);
7. Coordinating the storage, treatment, and disposal of released material; and
8. Providing post-emergency management.

II.F.6.b. Notifications

Procedures for the notification of RFAAP personnel and appropriate federal, state and local agencies are included in this section. The Notification Action Summary is provided in Table II.F-1 of this Contingency Plan. Should the EC be offsite at the time of the emergency, these notifications shall be made by the designated alternate EC or another onsite designee.

i) Internal RFAAP Notifications

Internal communication systems (telephone, two-way radios, or the plant alarm system) will be used to notify RFAAP personnel. The appropriate notifications will be made, the necessary alarms will be activated, and the EC will be notified in an effort to implement the Contingency Plan as outlined in Section II.F-4.

ii) Notification of Federal, State, and Local Agencies

The Environmental Manager (or a designated alternate) will notify appropriate state and local agencies as outlined in this plan and as listed below. In the event that a release occurs that could threaten human health or the environment outside the facility, the EC shall report his/her findings as follows pursuant to 40 CFR § 264.56(d). Accordingly, the EC shall notify:

- The National Response Center at (800) 424-8802;
- The Virginia Department of Environmental Quality at (540) 562-6814 or (540) 562-6700;
- The local emergency planning committee offices as follows:
    - The Montgomery Country Local Emergency Planning Committee at (540) 382-2951 if the emergency is within Montgomery County; or
    - The Pulaski County Emergency Management Coordinator at (540) 980-7705 if the emergency is within Pulaski County.

This report will include the following information pursuant to 40 CFR § 264.56(d)(2):

- The name and telephone number of the reporter;
- The name and address of the facility;
- The time and type of incident (*e.g.*, release, fire);
- The name and quantity of material(s) involved, to the extent known;

- The extent of injuries, if any; and
- The possible hazards to human health, or the environment, outside the facility.

Additionally, as required by 40 CFR § 264.56(d)(1), if the EC determines that an evacuation of local areas may be advisable, he/she shall immediately notify appropriate local authorities. The EC shall be available to help appropriate officials decide whether local areas should be evacuated.

In addition to these required notifications, RFAAP will note in the operating record the time, date, and details of any incident that requires implementing the Contingency Plan. Within 15 days after the incident, RFAAP will submit a written report on the incident to the Regional Administrator pursuant to 40 CFR § 256(h)(2)(i). This report will include:

- The name, address, and telephone number of the owner and operator;
- The name, address, and telephone number of the facility;
- The date, time, and type of incident (*e.g.*, fire, explosion);
- The name and quantity of material(s) involved;
- The extent of injuries, if any;
- An assessment of actual or potential hazards to human health or the environment, where this is applicable; and
- The estimated quantity and disposition of recovered material that resulted from the incident.

II.F.6.c. Emergency Equipment Available

The emergency equipment available and "on-call" for use at the unit is summarized in Table II.F-2 and Figure II.F-4. The numbers (1-12) in Table II.F-2 indicate the different physical locations and Figure II.F-4 shows these locations within the facility.

In addition to the equipment listed in Table II.F-2, other fire, personnel protection, and cleaning equipment is available as follows. Fire protection equipment includes portable fire extinguishers, a mobile carbon dioxide extinguishing system, and fire hydrants at various locations within the plant. Additional spill cleanup equipment is located in the Roads and Grounds Building (Building 7217).

II.F.6.d. Containment, Countermeasures, Clean-Up and Disposal

General response measures that will be implemented during an emergency situation at the OBG are presented below.

1. Ensure Personal Safety, Sound Alarm and Notify Emergency Coordinator: Upon identification of a fire, explosion, or other release personnel shall ensure their personal safety and then activate the alarm system and notify the EC. The alarm system consists of radio and telephone. Both forms of alarm are accessible at the OBG. The alarms will be used to contact the Security Dispatcher, which is staffed 24 hours a day, 7 days a week.

2. Evacuation: Personnel will evacuate the area as outlined in the Evacuation Plan in Section II.F-8 and as directed by the EC.

3. Identify the Material(s) Involved: The specific identification of wastes will be determined from the internal manifest forms, which identify the materials that are sent to the OBG. Copies of the manifests are carried in the transport vehicles carrying the waste. Upon delivery to the treatment facility, the manifests are transferred from the transport vehicles and kept at the OBG Trailer

4. Assessment: Upon arrival at the scene the EC (or the designated alternate) will take control of the affected area including all resources necessary to deal with the emergency. The EC will maintain this authority and control until the emergency has been eliminated and cleanup is complete.

After taking control of the affected area, the EC will determine the source, extent and nature of the involved hazardous waste and assess any primary and secondary hazards. Waste generation, source and analytical data are to be used to make this determination. These records shall be kept on-site. The evaluation criteria used to determine if the Contingency Plan is to be implemented are presented in Table II.F-3. A logic diagram representing the evaluation process is shown as Figure II.F-5.

5. ***Alert Local Authorities for Assistance*****:** Should the situation require resources beyond those available at the RFAAP, local fire, police, and/or medical support will be requested as described in Section II.F-7.

6. ***Implement Spill Response Measures*****:** Spill response measures will be implemented as outlined in Table II.F-4 using spill response equipment available at the facility as listed in Table II.F-2 and materials provided by supporting communities as needed. Response measures include evaluation of safety issues, containment of the release, regulatory notifications, waste treatment, and monitoring. Response measure will be performed by the RFAAP Fire Department and Emergency Response Team under the direction of the EC with assistance from other local agencies as needed.

7. ***Storage and Treatment of Released Material*:** If hazardous waste is released to the ground applicable spill response measures outlined in Table II.F-4 will be followed. Recovered energetic waste will be treated at the OBG, if appropriate.

Ash from fires will be treated similar to incinerator ash. The ash will be analyzed for reactivity, TCLP toxicity, and other constituents as specified in the Waste Analysis Plan in Attachment II.B of this Permit. If the ash fails for either or both characteristics or is a listed hazardous waste, it will be taken to a RCRA permitted facility. If it is not determined to be a hazardous waste, it will be disposed in an appropriately permitted solid waste landfill.

As RFAAP has no permitted storage areas for hazardous waste containers (all hazardous waste storage is classified as < 90-day accumulation areas), no hazardous waste containers will be stored onsite past the 90-day accumulation period. The containerized waste will either be treated onsite as described above or packaged, labeled, and shipped for offsite disposal.

8. ***Incompatible Wastes*:** There are no wastes managed in the permitted area that are incompatible with one another. Therefore, the danger of the mixing of incompatible wastes during cleanup procedures is very unlikely.

II.F.6.e. Disposal of Miscellaneous Waste and Debris

Wastes generated as part of a response action will be collected and contained. Those materials that cannot be treated in the incinerator or the open burning area will be characterized and disposed of off-site in accordance with state and federal laws. Such wastes may include but are not limited to the following:

- Personal protective equipment;
- Plastic sheeting used for decontamination or containment;
- Absorbent materials; and
- Soil and/or water.

II.F.6.f. Post-Emergency Equipment Maintenance

Post-emergency provisions are designed to prevent recurrence, to clean up and dispose of residuals, to decontaminate equipment, and to provide for personnel debriefing.

The EC will take all necessary steps to ensure that a secondary release, fire or explosion does not occur after the initial incident. Procedures that will be carried out in the affected area include:

1. Inspection for any leaks or cracks in pipes, valves, tanks, and incinerators;

2. Inspection for excess heat generation at the incident area; and

3. Isolation of residual waste materials.

All waste energetics and other cleanup residues will be tested for RCRA characteristics and other parameters as necessary to meet waste profiling requirements. The material will then be transported to a RCRA permitted facility should it be determined to be a hazardous waste. If the residues are determined to be non-hazardous, they will be disposed in a permitted solid waste landfill.

All equipment used during the cleanup will be decontaminated on-site and readied for future use. Site personnel will remove and properly dispose of contaminated clothing as necessary. Fire extinguishers will be recharged, personnel protective equipment will be replaced and tools will be restocked. Before operations are resumed, all safety equipment will be inspected.

II.F.7. COORDINATION AGREEMENTS

Mutual assistance agreements have been made with the communities identified in Table 1 of Appendix II.F-1. Copies of the Mutual Assistance Agreements and Supplemental Agreements are maintained onsite in the facility operating record. These mutual assistance agreements pertain to the local fire departments. Furthermore, there is close cooperation between local law enforcement officials and RFAAP Security personnel for traffic control in the plant area if a significant disaster should occur.

Facility staff will contact selected local and regional entities and authorities that may be involved in an emergency situation according to the anticipated needs at the plant. Personnel from these organizations may be asked to support RFAAP personnel in response to fires, explosions, or chemical releases if RFAAP personnel cannot adequately address the situation internally. Personnel from these agencies will act under the direction of the EC and will be directed and escorted by plant personnel.

Arrangements with local hospitals have also been made through agreements between RFAAP and surrounding medical facilities. Copies of these agreements are maintained onsite in the facility operating record. In addition, the RFAAP medical staff is familiar with the properties of the hazardous wastes handled at the facility and the types of injuries or illnesses that could result from fires, explosions or releases at the facility, and RFAAP firemen are state-certified emergency medical technicians.

Due to RFAAP's in-house fire department, medical staff, and security force, and the unique wastes to be dealt with, the facility EC will act as the primary authority during emergency situations. RFAAP security personnel are responsible for escorting local fire department and emergency response teams to any emergency site within the plant. Emergency units from offsite will not be allowed to respond inside RFAAP without an escort. For incidents in the horseshoe area, units from Dublin, Fairlawn, Blacksburg, Riner, Longshop/McCoy, or Radford may be asked to assemble at Gate 10 or the main gate on Route 114. For incidents in the Main Plant Area and larger incidents in the Horseshoe Area, units from Radford, Christiansburg and Blacksburg may be asked to assemble at the Main Gate on Route 114. Entry to the manufacturing area will usually be through Gate 1.

II.F.8. EVACUATION PLAN

The OBG is located in the southeast section of the Horseshoe Area on the northern bank of the New River. This area is an isolated location as shown on Figure II.F-1. The New River acts as a protective barrier on the southern exposure of this area. Approximately 75 to 100 feet north of the OBG, the ground surface slopes steeply upward, with an elevation change of approximately 50 to 100 feet. Thus, if an emergency situation should develop at this area, evacuation of the entire facility is not likely to be necessary. The OBG operating personnel should be the only persons immediately endangered during an emergency situation at the OBG.

Evacuation of any personnel in the immediate area of the OBG will occur in the event of the fires or explosions. Two signals are used to notify area personnel. The loud voice system is activated first followed by the system that sends out phone calls, text and emails. The area supervision immediately receives the notification(s) and contacts the OBG area to take corrective action as directed depending on the emergency situation. Should the operating personnel encounter an unusual condition, the operation shall be stopped immediately and supervision notified for corrective action. The evacuation routes from the OBG are shown in Figure II.F-6.

II.F.9. REQUIRED REPORTS

Pursuant to 9 VAC 20-60-264; 40 CFR § 264.56(i), the time, date, and details of any incident that requires implementation of the Contingency Plan, will be noted in the facility operating record. In addition, within 15 days after the incident, a written report will be submitted to the Director of the Virginia Department of Environmental Quality. The report will include:

1. Name, address and telephone number of the owner or operator;
2. Name, address and telephone number of the facility;
3. Date, time and type of incident;
4. Name and quantity of material(s) involved;

5. The extent of injuries, if any;

6. An assessment of actual or potential hazards to human health or the environment, where this is applicable;

7. Estimated quantity and disposition of recovered material from the incident; and,

8. Such other information specifically requested by the Director that is reasonably necessary and relevant to the purpose of an operating record.

II.F.10. MODIFICATION OF PLAN

Pursuant to 9 VAC 20-60-264; 40 CFR § 264.54, this Contingency Plan is subject to review and amendment, if:

- The plan fails in an emergency;
- The facility permit is revised;
- The facility changes in design, construction, operation, maintenance, or other circumstances; in a way that materially increases the potential for fires, explosions, or releases of hazardous waste constituents; or alters the necessary emergency response;
- The list of emergency coordinators changes; or
- The list of emergency equipment changes.

When the contingency plan is amended for any reason the Permittees will request a permit modification pursuant to 40 CFR § 270.42.

FIGURE II.F-1: LOCATION OF THE RFAAP

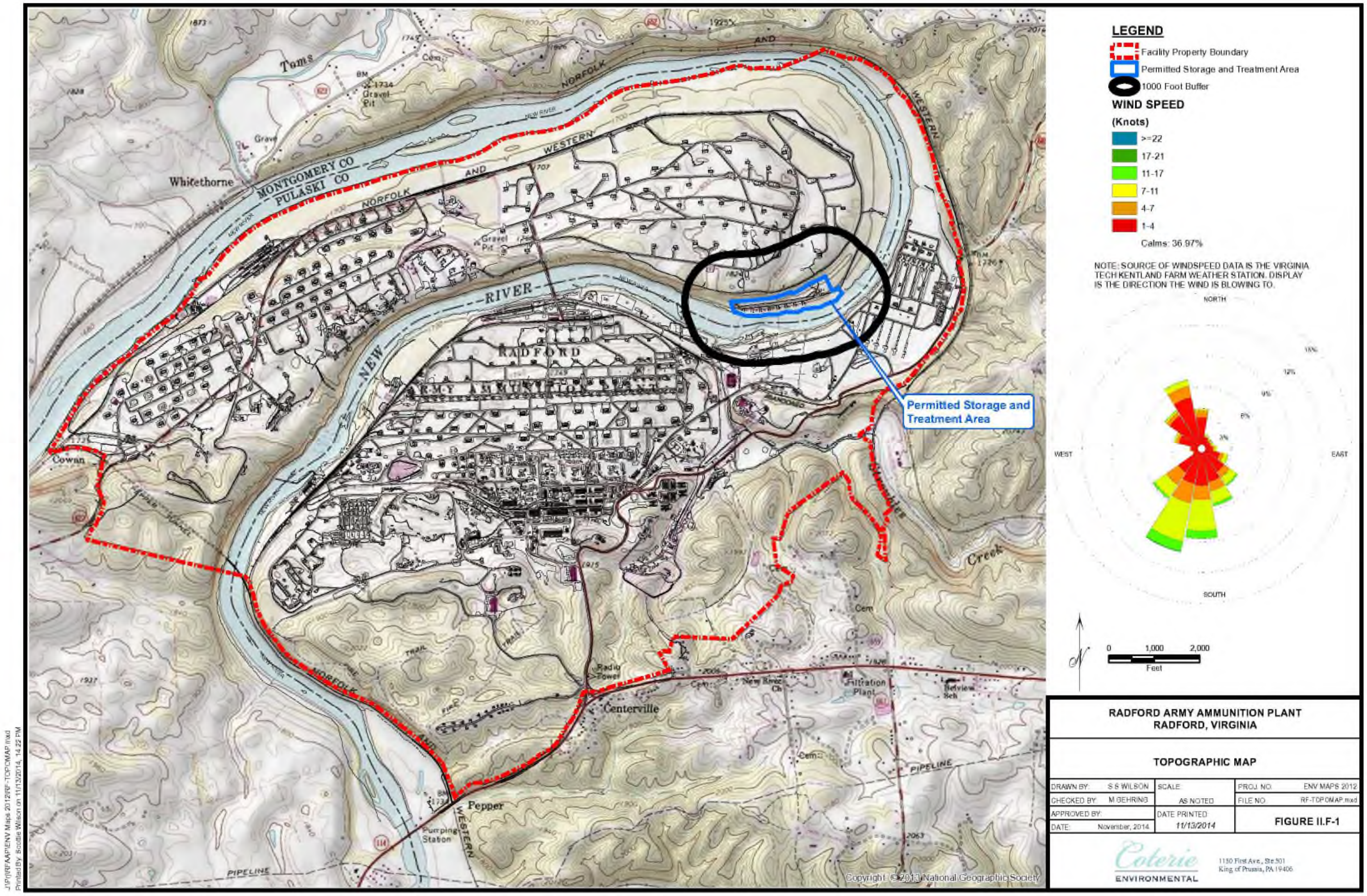


FIGURE II.F-2: LAYOUT OF BURNING GROUND STRUCTURES

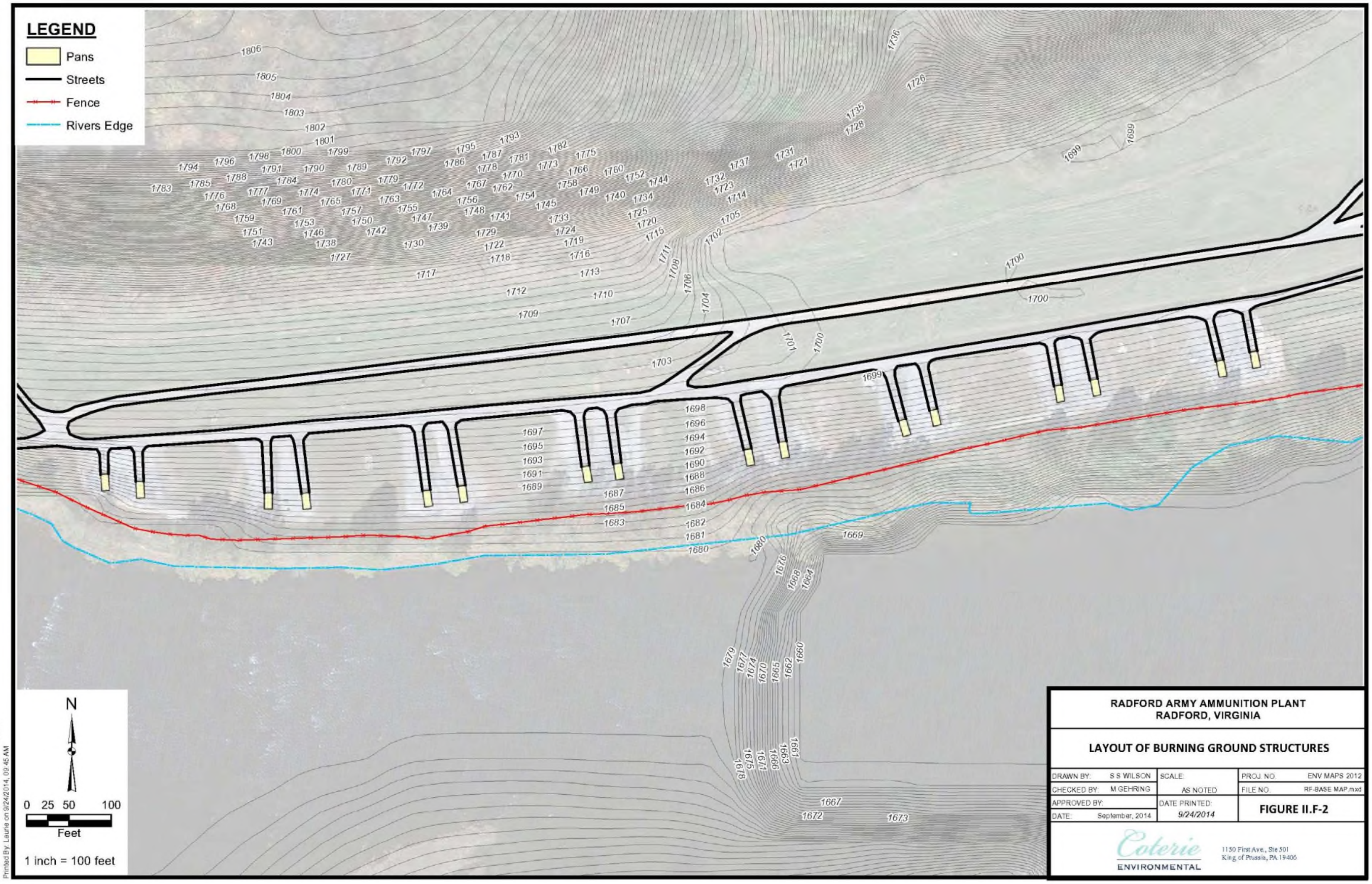


FIGURE II.F-3: LOCATION OF COMMUNICATION EQUIPMENT

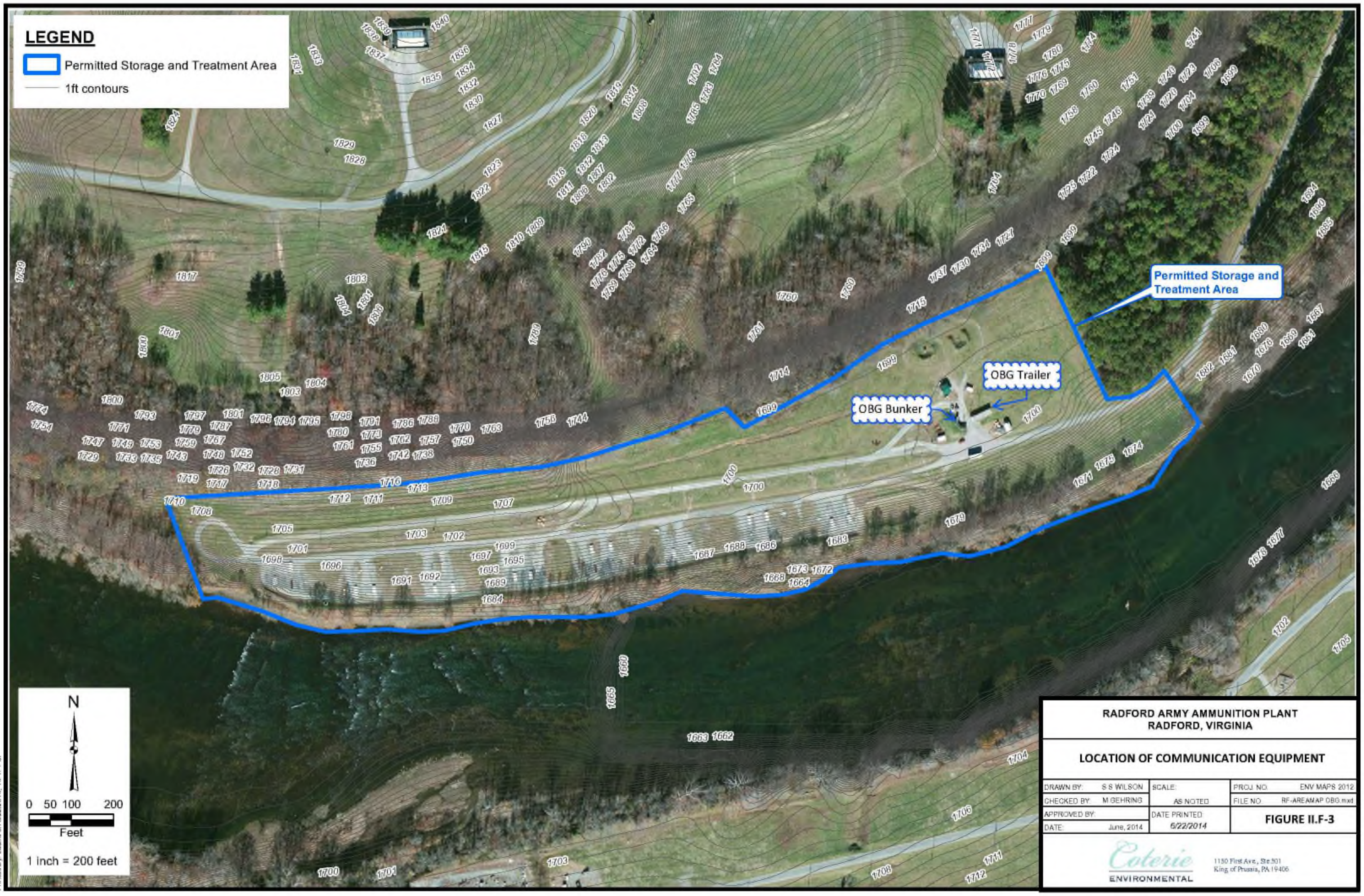


FIGURE II.F-4: EMERGENCY EQUIPMENT LOCATIONS

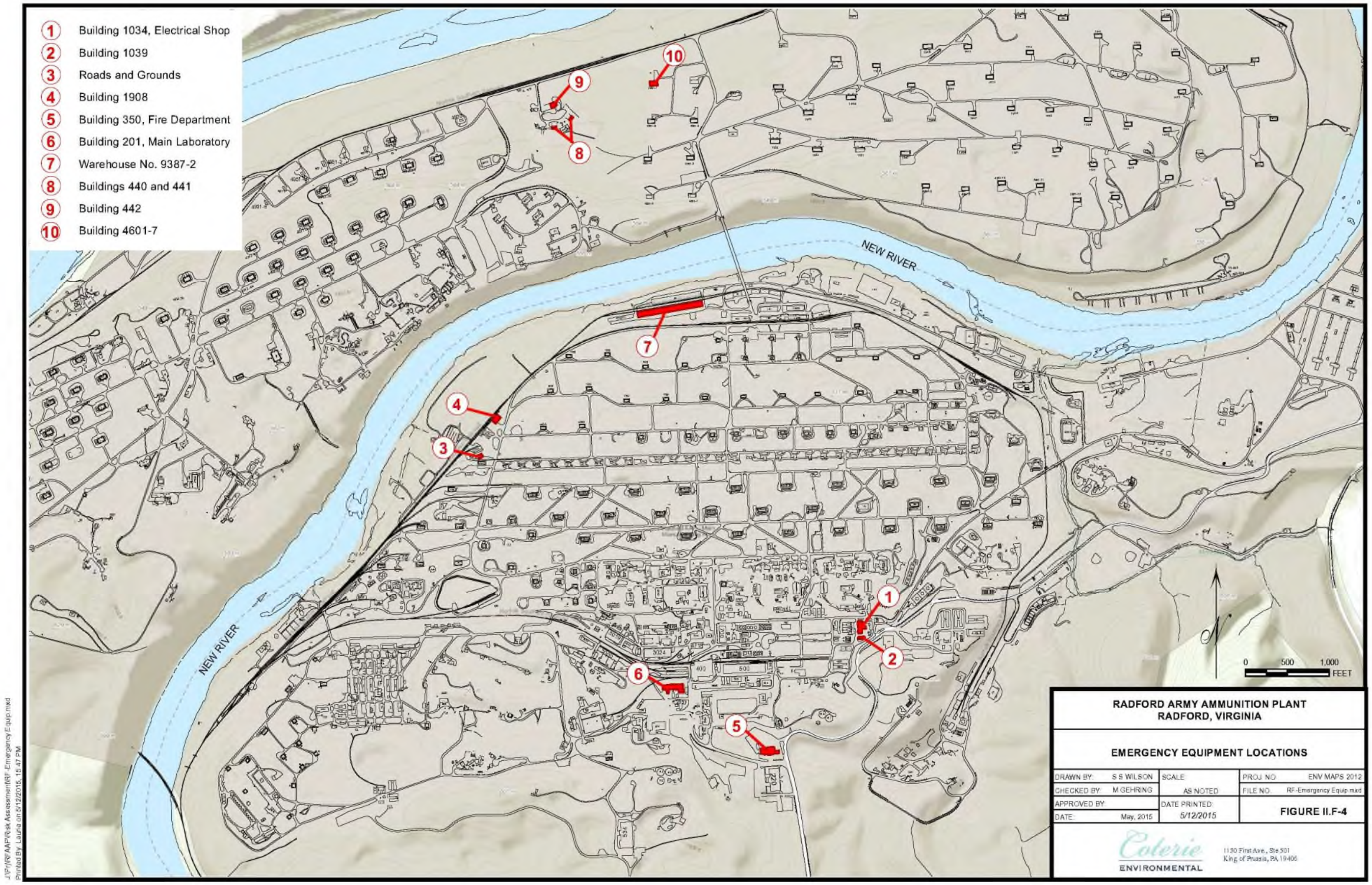
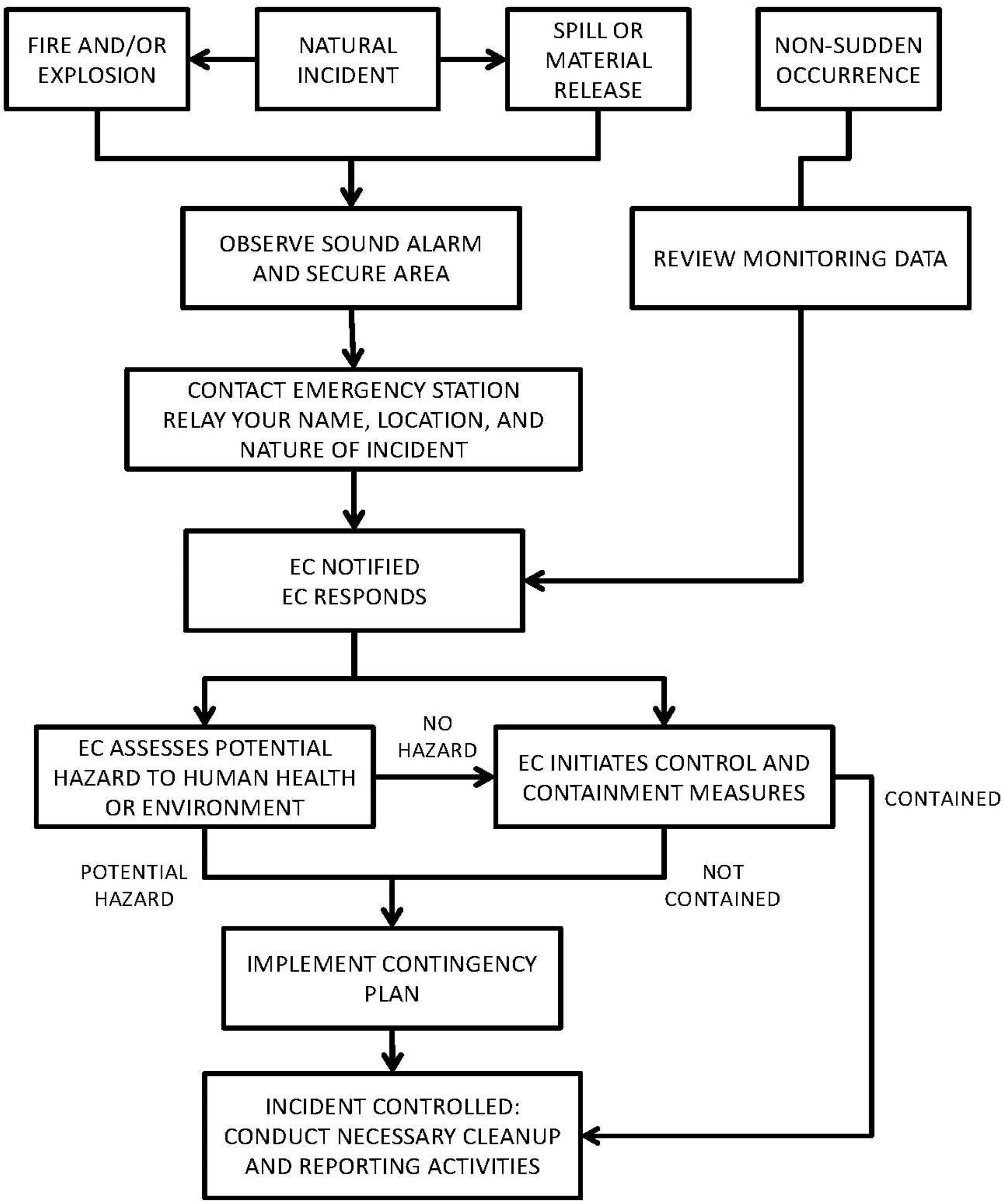


FIGURE II.F-5: CONTINGENCY PLAN IMPLEMENTATION LOGIC DIAGRAM

FIGURE II.F-5
CONTINGENCY PLAN IMPLEMENTATION LOGIC DIAGRAM



EC: Emergency Coordinator

FIGURE II.F-6: AREA EVACUATION ROUTES

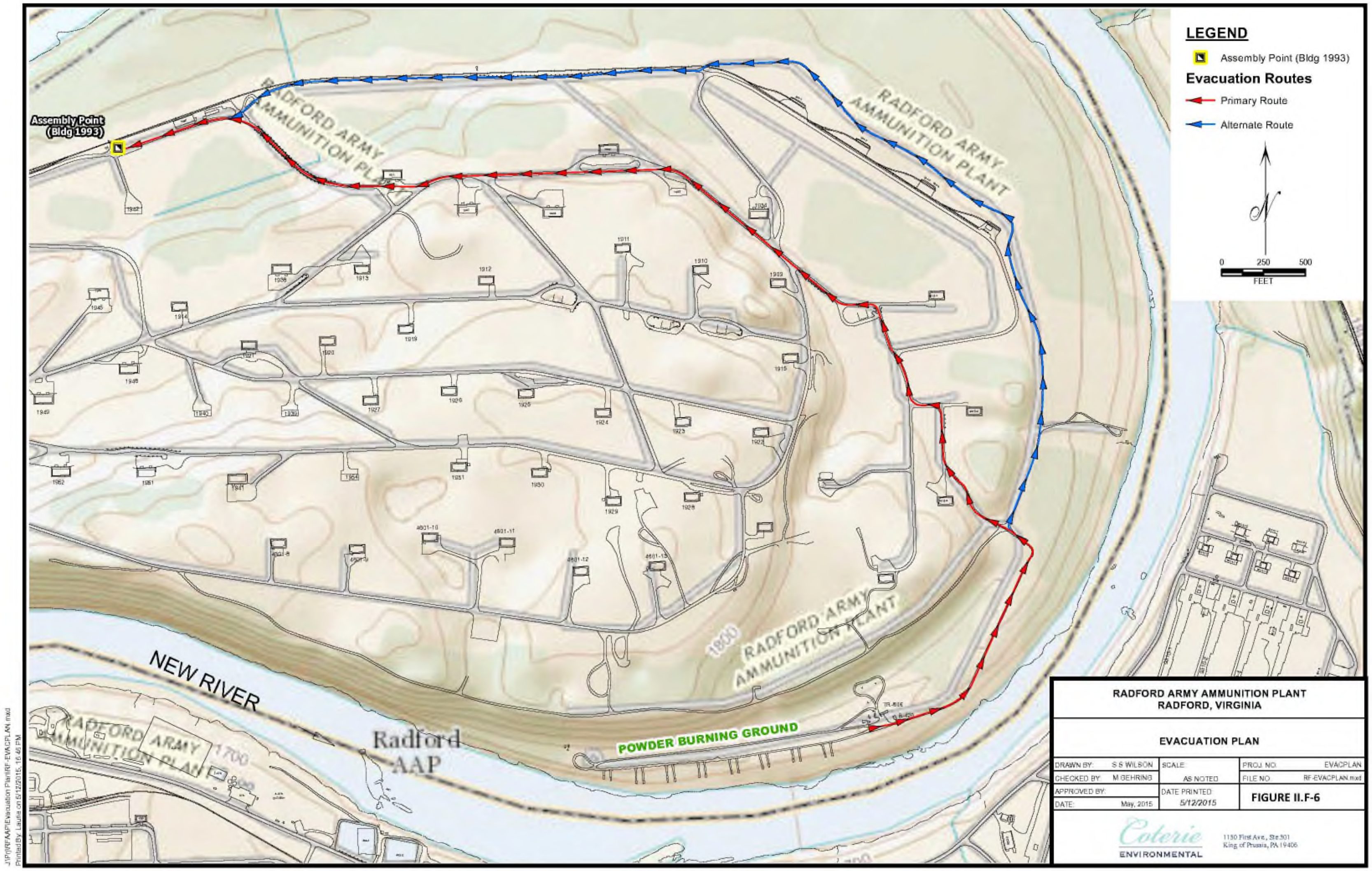


TABLE II.F-1: NOTIFICATION ACTION SUMMARY

ON-SITE Emergency Coordinators:

Contacts to be made include:

Emergency Coordinator	Office Phone	Home Phone	Home Address
Plant Dispatch	540-639-7323	NA	NA
Environmental Emergency On-Call Representative **(Primary EC)**	540-230-8970	NA	NA
Safety On-Call Representative (**Alternate EC)**	540-505-8585	NA	NA
Environmental Manager – (**Alternate EC)**	Security will Contact [1]	Available if necessary from security and human resources [1]	
Environmental Lead Specialist – Hazardous Waste (**Alternate EC)**	Security will Contact [1]	Available if necessary from security and human resources [1]	
Safety, Health & Environmental Manager **Alternate EC)**	Security will Contact [1]	Available if necessary from security and human resources [1]	

[1] In order to enhance the protection of defense services and defense articles and protect the unauthorized export of defense information under the International Traffic in Arms Regulations (ITAR), promulgated in Title 22 Code of Federal Regulations (CFR) Parts 120 through 130, the actual contact information of individual persons or contractors in the employ of RFAAP have been withheld from this Permit. This information is readily available for review and inspection at the facility upon request. The relevant data is also readily available to plant security and supervision to respond to an emergency.

ON-SITE Notifications

In addition to the notifications listed above, the EC or a designated representative should provide notification of all major emergencies to the environmental and operations management team.

OFF-SITE Notifications

To be made by the Environmental Manager or a designated representative as needed:

1. Virginia Department of Environmental Quality Blue Ridge Regional Office (540) 562-6700

2. National Response Center (for releases above an RQ) (800) 424-8802

3. Virginia Department of Emergency Management (800) 468-8892

4. Montgomery County Local Emergency Planning Committee (LEPC) (540) 382-2951

5. Pulaski County Local Emergency Planning Committee (LEPC) (540) 980-7705

6. Emergency Service Resources (Fire, Ambulance, Police) 911

TABLE II.F-2: EMERGENCY EQUIPMENT LOCATIONS AT RFAAP

Location No. on Figure 5	**Location Description**	**\vailable**
1	Bldg. 1034, Electric Shop	Raincoats, rubber gloves, respirators
2	Bldg. 1039	Self-contained breathing apparatus (2)
3	Roads and grounds	Respirators, goggles, air fed respirators, safety belts, shoe cleats, air compressors (250 and 700 CFM ratings), portable pumps (50, 100 and 700 GPM capacities), cranes, bulldozers, movers, graders, tow tractors, portable electric generators, backhoes, front-end loaders, portable tankers, absorbent pads, booms, cloths
5	Bldg. 1908	Absorbent material / booms
6	Bldg. 350, Fire Department	Ladder truck, engine, utility truck, brush truck, ATV's, command vehicle, and ambulance.
7	Bldg. 350	HAZMAT trailer with response gear, special operations trailer, and 2boats.
9	Bldg. 201, Main Laboratory	Nitroglycerine remover
10	Bldgs. 440 and 441 (incinerators)	Fire extinguishers
11	Bldg. 442	Telephone access
12	Bldg. 4601-7	Telephone access and spill cleanup equipment

TABLE II.F-3: EVALUATION CRITERIA FOR IMPLEMENTATION OF THE CONTINGENCY PLAN

In accordance with the Contingency Plan Implementation Logic Diagram (Figure II.F-5), the following are examples of when the contingency plan would need to be implemented:

<u>For a fire and/or explosion:</u>

- If the fire causes a release of toxic fumes that go off plant or impacts personnel.
- If the fire could spread (is not contained), thereby possibly igniting materials in other locations on-site or off-site, or could cause heat induced leaks or explosions.
- If the use of fire suppressant could result in contaminated runoff that cannot be contained.
- If an explosion has or could:
    - Result in damage from flying fragments or shock waves
    - Ignite other hazardous waste at the facility
    - Release toxic materials that could cause harm to human health or the environment or cannot be contained.
- Or if a fire or explosion endangers human health or the environment for any other reason.

<u>For spills or material releases</u>

- If a spill endangers human health or the environment.

TABLE II.F-4: SPILL RESPONSE MEASURES

The spill response program will be coordinated by the Emergency Coordinator or designated representative. Guidelines are provided concerning safety, containment, evaluation, notification, treatment and monitoring as related to each spill incident.

1. Safety

    a. Evaluate the hazard of the spilled chemical to personnel that may be involved in containment, clean up, treatment and monitoring operations.

    b. Assure proper clothing and protective equipment is available and used by personnel involved in the spill response.

2. Containment

    a. Establish the expected flow path of the spilled material.

    b. Locate the nearest proposed damming site.

    c. Erect a dam –- notify Roads and Grounds regarding construction of dam.

3. Evaluation of Spill Extent

    a. Obtain pH readings at site if chemical spilled was an acid or base.

    b. Confirm stoppage of leak at source.

4. Initial Notification

    a. Delegated to the Emergency Coordinator

    b. Notify appropriate agencies (see Notification Action Summary)

5. Treatment

    a. Straw or other absorbers will be supplied to entrap hazardous wastes that are spilled. Sites/locations within the plant containing straw and other entrapment materials are controlled by Roads and Grounds.

6. Monitor Program

   Upon receiving notification of an accidental loss to the industrial sewer or surface streams, personnel will obtain grab samples at specified locations and time intervals as determined by the Emergency Coordinator.

   a. In-Plant Sites

      i. Suggested sampling sites will be determined based on the location of the spill

      ii. Samples will be collected at internal locations as designated.

   b. New River Site

      i. Sampling at the New River site will be performed on a staggered basis since the river flow approximates one mile per hour. Sampling will be performed by the operator at Building 4330.

7. Final Treatment

   a. Determine disposition of impounded material depending on type and quantity of spill. Ensure EPA and DEQ concur with disposition.

   b. Provide monitoring for duration of disposition.

Explosion fragments and materials as well as contaminated soils will be decontaminated in either the decontamination oven or the decontamination incinerator on-site at RFAAP provided they are not TCLP toxic or reactive. The decontaminated materials will then be disposed of in a permitted landfill or as decontaminated scrap.

APPENDIX II.F-1 :MUTUAL ASSISTANCE AGREEMENTS

TABLE 1: MUTUAL ASSISTANCE AGREEMENTS WITH LOCAL MUNICIPALITIES

ENTITY	DATE OF AGREEMENT	SERVICES INCLUDED
City of Radford	July 11, 2011	Firefighting equipment and personnel
Montgomery County	October 19, 2020	Emergency and medical services personnel
Pulaski County	October 19, 2020	Emergency and medical services personnel
United States Army Research, Development, and Acquisition Information Services Activity	June 26, 1992	Force-Protection Support Responsibilities

Copies of each of the mutual aid agreements referenced above are maintained onsite and are readily available for inspection and review if requested.

ATTACHMENT II.G– CLOSURE PLAN

II.G.1. INTRODUCTION

This Closure Plan has been prepared for the Open Burning Ground (herein referred to as the OBG) at the Radford Army Ammunition Plant (RFAAP). The OBG is a permitted treatment unit used for the treatment of hazardous waste generated onsite at the RFAAP by the owner, operator, and tenant operations. This section presents the purpose of the Closure Plan, background information on the RFAAP and the OBG, and a summary of information contained within the Closure Plan.

II.G.1.a. Purpose

This Closure Plan has been prepared for the facility as part of a Hazardous Waste Management Permit Application for the RFAAP. The purpose of the Closure Plan is to develop a closure strategy that assures the RFAAP will close the hazardous waste facilities in a manner that:

(a) Minimizes the need for further maintenance; and

(b) Controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere; and

(c) Complies with the closure requirements of 9 VAC 20-60-264, 40 CFR § 264 Subpart G and 264.197 and 264.603.

II.G.1.b. Background

This section provides a brief overview of the operations at RFAAP and those operations performed at the OBG.

RFAAP OPERATIONS

The RFAAP encompasses approximately 4,104 acres and is located in southwest Virginia within Pulaski and Montgomery Counties as shown in Figure II.G-1. The New River separates Pulaski and Montgomery counties and also divides the RFAAP into two portions commonly known as the Horseshoe Area and Main Manufacturing Area. These two areas and the approximate boundary of the RFAAP are shown on the topographic map in Figure II.G-2.

The OBG is located in the southeast section of the Horseshoe Area on the northern bank of the New River as shown in Figure II.G-2 and is used for the open burning of waste propellant. Propellant wastes that cannot be safely treated in the onsite incinerators (e.g., those containing metal particles, rocks, and similar debris) are treated at the OBG. Figure II.G-3 shows the OBG boundary and the locations of the actual structures.

RFAAP is a government-owned, contractor-operated (GOCO) industrial installation responsible to the U.S. Army. The mission of the RFAAP is to manufacture propellants, explosives, and chemical materials as assigned. As a GOCO operation, RFAAP has both government and contractor organizations. For the purpose of this permit application, the facility consists of all contiguous portions of the RFAAP. The facility specifically includes both the Horseshoe Area and the Main Manufacturing area. Wastes from onsite activities (including those of both the operating contractor and government tenant operations) are managed at the OBG.

The facility was first constructed in 1940 and began operations producing smokeless powder (single base, double base and triple base propellants) in 1941. Since that time various processes/products have been added to the facility including production of cast propellants, trinitrotoluene (TNT), commercial propellants, and load, assemble and pack facilities. Specific operations vary based upon contracted capacity and products from the Department of Defense and U.S. allies.

OBG OPERATIONS

Equipment included as part of the OBG include the waste burn pans and covers and the remote ignition system. No permitted storage areas are present at the OBG area. Wastes are brought to the area immediately prior to being place in the pans of ignition.

Specific operations that are performed at the OBG include:

- Waste materials are transported from production areas in <20 gallon containers to the OBG. The waste is then loaded into the burning pans.

- The burning pans are prepared for ignition by spreading the waste out on each pan and adding diesel fuel and dunnage materials if necessary.

- The burning pans are remotely ignited.

- Ash from the burning pans is collected and accumulated onsite. The ash is staged onsite pending sample analysis and is then disposed offsite at a properly permitted disposal facility.

II.G.2. HAZARDOUS WASTE CHARACTERISTICS ANALYSIS

This section provides a general discussion of the types and sources of hazardous wastes managed at the OBG. This information includes the general types of wastes managed, specific waste streams, and maximum hazardous waste inventory.

II.G.2.a. General Waste Types

The hazardous wastes that are treated at the permitted facility include waste energetic materials and spill "cleanup" residues generated at the facility. These wastes are hazardous due to their ignitability (D001) and/or reactivity (D003). Additionally, some of the wastes may exhibit the toxicity characteristic for certain metals and/or 2,4-dinitrotoluene. A detailed description of the wastes is provided in the Waste Analysis Plan in Attachment II.B of this Permit.

II.G.2.b. Waste Composition

The composition of the waste propellant mixtures burned at the OBG varies over time due to changes in the production schedule at the RFAAP. Generally, these wastes include miscellaneous energetic wastes. For purposes of classification under RCRA, these wastes have been segregated into waste groups that differ based on their primary components and RCRA waste codes. There are no wastes managed in the permitted storage and treatment area that are incompatible with one another. Of those wastes discussed in the Waste Analysis Plan, those in Groups 2, 3, 5 and 6 are only treated in the incinerators; wastes from these groups may not treated at the OBG.

II.G.2.c. OBG Maximum Hazardous Waste Inventory

At any given point in time, the hazardous wastes present at the OBG may include those wastes scheduled for treatment that day and the residue from burning the waste material. Given that wastes are only transferred to the OBG on the day they are scheduled for treatment, no actual hazardous production wastes are factored into the maximum quantity of waste for the closure calculations; only the residues from treatment are included.

Based on historical ash generation and disposal records, the maximum amount of ash present a the burning ground at any point in time is estimated to be 30 drums at 400 pounds each, for a total ash quantity of 12,000 pounds. These residues, along with any wastes that remain at the RFAAP and have not yet been treated at the OBG and cannot otherwise be treated onsite, will be disposed of at a properly permitted offsite facility.

II.G.3. REVIEW OF POTENTIAL IMPACTS

This section contains a review of potential impacts to soil and groundwater in the permitted treatment and storage facilities as a result of hazardous waste management activities. These potential impacts will be evaluated and appropriately addressed as part of the closure activities.

II.G.3.a. Impacts to Soil

In accordance with the EPA Corrective Action Permit, a Plant-wide Background Study was completed in September 2000. The soil samples collected during the Plant-wide Background Study were analyzed for all of the hazardous constituents listed in Appendix VIII of 40 CFR Part 261. The report on these analyses was submitted to and approved by the DEQ in May 2002. Since that time, additional soil sampling has been conducted as part of the RCRA soil monitoring program at the OBG. The results from this sampling are submitted to DEQ on a periodic basis. Data from these sampling events or another comprehensive and more recent event will be used in the evaluation of soils during closure.

II.G.3.b. Impacts to Groundwater

Groundwater at the OBG has been evaluated on a semiannual basis for potential impacts in accordance with the OBG RCRA permit. This data and/or other groundwater information will be used in the evaluation of the groundwater during facility closure if it is deemed appropriate and current by the DEQ at the time of actual closure. If the data is not acceptable to the DEQ, alternative groundwater monitoring locations and/or analytical results will be submitted to the DEQ for approval.

II.G.4. GENERAL CLOSURE ANALYSIS

This section presents the general goals and criteria for developing a closure strategy and developing criteria for closure. Feasible options for closure of the facilities are reviewed and evaluated with regard to regulatory requirements and environmental protection, economic feasibility, and practicality.

II.G.4.a. General Closure Criteria

As stated in the introduction, the purpose of the Closure Plan is to develop a closure strategy that assures the RFAAP will close the hazardous waste facilities in a manner that:

(a) Minimizes the need for further maintenance;

(b) Controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere; and

(c) Complies with the closure requirements of 9 VAC 20-60-264 and 40 CFR 264 Subpart G and Subpart X.

These criteria will be satisfied by removing equipment and structures from the OBG and assessing samples of the area surrounding the OBG against either background standards or risk-based standards. The sections that follow provide a detailed discussion on how RFAAP intends to satisfy these closure criteria.

II.G.4.b. Closure Alternatives

Various alternatives are available for closure of the OBG. At this time, RFAAP expects to provide for clean closure of the OBG. This would include removal all hazardous waste and equipment from the OBG and all hazardous constituents from the area surrounding the OBG at the time of closure. Assessment of the “cleanliness” of the soils and groundwater would be made by comparing samples of the media to background standards. If any contamination is found, the contaminated media would be removed or cleaned to below background standards, as described below.

Alternatively, RFAAP may opt to perform closure of the OBG in a “risk-based” method. All hazardous waste and equipment would still be removed from the OBG. However, under this option, the collected media samples would be compared to risk-based standards instead of background standards. Removal or cleanup decisions would then be made based on the concentration of hazardous constituents relative to these standards. The risk-based standards used will be those that are current at the time of closure. The risk assessment protocol to be used in making this assessment will be submitted for DEQ approval at the time of closure.

Actual closure may occur as some hybrid of the clean and risk-based closure techniques. For example, it may be relatively simply to provide clean closure of the soils by simply excavating any contaminated soil. However, risk-based closure of the groundwater may be required with some level of post-closure care due to the impossibility of “removing” contaminated groundwater.

The various components of the facilities that will need to be addressed as part of the closure process include the physical structures included as part of the OBG as well as the soil and groundwater underlying these facilities. A specific discussion on the closure alternatives for each of these components is provided below.

CLOSURE ALTERNATIVES FOR STRUCTURES AND EQUIPMENT

Once hazardous waste treatment operations cease at the OBG it will be necessary to partially or completely close the OBG facility. The equipment included in this closure process will be the OBG pans, the pan covers, and the refractory clay lining in the pans. No other equipment is included in the waste management operations at the OBG. Two basic options are available for closure of this equipment.

First a hazardous waste contractor can dismantle the pans and covers. The dismantled equipment can then be containerized as a hazardous waste and shipped offsite for treatment/disposal. In this option, no hazardous waste determination would be made; the materials would just be assumed to be hazardous out of an abundance of caution.

The second closure option would require that the pans be disassembled (clay lining removed) and the pans and covers be decontaminated. Once decontaminated the equipment can then be further dismantled and disposed of as non-hazardous solid waste or recycled as scrap material. This option will require greater onsite management of the materials and documentation. However, overall costs should be significantly lower as the only hazardous waste generated that would require offsite treatment or disposal would likely be the pan clay lining materials as opposed to significant quantities of contaminated debris as generated in the first option. Decontamination of the actual pans could occur through either thermal treatment to removal all residual energetic materials, or a series of decontamination washes and rinses. The later of these options is less preferred, as it will result in additional waste generation. However, onsite facilities may not be available to thermally decontaminate the pans.

At a minimum, the potential for hazardous waste contamination in each of these pieces of equipment will be reviewed upon initiation in closure. In all likelihood, RFAAP will utilize the second of these options when disposing of the OBG equipment due to the smaller amount of hazardous waste generation/disposal and advantages of recycling the non-hazardous equipment (such as the decontaminated steel pans). The final decision on the disposition of the equipment will be provided to DEQ at the time of closure. If the second option is indeed selected as the primary means for management, appropriate sampling results will be provided to demonstrate the hazardous and/or non-hazardous characterization of each piece of equipment.

CLOSURE ALTERNATIVES FOR SOIL AND GROUNDWATER

Once the pans and covers have been removed from the site, it will be necessary to address any potential impacts to soil and groundwater. The first step in this process will be to implement a sampling protocol to determine the following:

- If soils in the area of the OBG have been contaminated; and
- If any impacts that did occur have migrated through the soil to the uppermost aquifer.

Once the extent of any impacts is determined, a closure approach for the soils and groundwater will be developed. Three basic closure options are available depending on the impacts encountered:

- Option 1: If no impact to groundwater is encountered, pursue clean closure or risk-based closure for any contaminated soil.

- Option 2: If limited impact to groundwater is encountered, remove source material or “hot spots” and perform limited follow-on monitoring as appropriate.

- Option 3: If significant groundwater impact is discovered, remove source material and/or provide some means of groundwater control.

At this time there are various options for excavating soil for offsite treatment/disposal as well as various onsite and in-situ treatment methods that may be applicable depending upon the exact nature of impacts to soil and the types of contamination (*e.g.*, metals, organics). For the purpose of this Closure Plan it is assumed that any potential soil impacts will be limited in nature and that soil excavation will be a feasible and cost effective closure option.

It should be noted that actual closure of the facilities is not anticipated for some time. As such, innovative treatment alternatives may become available that may be more favorable to excavation and offsite treatment/disposal. Based upon the actual extent of any impacts and technological advances, RFAAP may choose to modify this Closure Plan based upon findings when each facility is closed.

II.G.4.c. Partial and Final Closure

Final closure of the OBG is not anticipated in the near future, nor is partial closure of any portion of the OBG. At such time that closure is expected, this Closure Plan will be reviewed and updated as necessary to reflect any changes to the closure philosophy or expected procedures. Should any portion of the OBG be closed prior to final closure, those portions will be closed in accordance with all applicable closure procedures in this Closure Plan or an approved, updated version of it.

II.G.5. DETAILED CLOSURE PROCESS

This section presents a detailed description of the closure process that is anticipated for the OBG considering the closure alternative selected in Section II.G.4. This process will include the following steps:

1. Inventory Removal

2. Site Preparation

3. Evaluation of Surface and Subsurface Impacts

4. Management and Disposal of Miscellaneous Materials

5. Site Restoration

6. Certification of Closure

7. Post-Closure Care and Groundwater Monitoring

Figure II.F-4 provides a flow chart outlining the closure approach that is planned.

II.G.5.a. Inventory Removal

The initial step in the closure process will be treatment and removal of the remaining hazardous waste.

After receipt of the final quantity of hazardous waste at the facility (or specific portion thereof identified for partial closure), all hazardous waste inventory will be removed by treatment in the usual manner. Any remaining waste that cannot be treated will be transported for treatment/disposal at a permitted facility. Likewise, all ash will be collected and disposed of at a permitted disposal facility.

After the final wastes have been processed and the ash residues have been removed, the OBG burning pans and covers will be removed. As defined above, the pans will be either decontaminated and handled as a non-hazardous waste or will be manifested to a RCRA permitted offsite disposal facility that is capable of handling the waste in accordance with all state and federal laws.

II.G.5.b. Site Preparation

Once the remaining hazardous waste inventory is treated, a series of preparatory activities will be performed prior to the start of actual facility closure. These activities will include the following:

1. Delineation of exclusion zones around the various work areas as needed for the safety of workers involved with the closure operations and those of RFAAP staff in surrounding areas. Specific items will be addressed as part of RFAAP safety policies and health and safety plans developed by any subcontractors involved in the closure operations.

2. Establishment of decontamination areas for personnel and equipment involved in the closure operations.

3. Establishment of staging areas for uncontaminated demolition debris, contaminated scrap/debris, contained liquids, and other waste streams including containers for any contaminated material. No waste or contaminated material shall be placed on the ground with or without a liner.

4. Establishment of temporary facilities required for closure activities (e.g., storage trailers, field office, etc.)

5. Visual inspection of the burning pads for cracks or gaps. All such cracks or gaps will be sealed with an epoxy sealant to assure that wash solution will not migrate into or through the material.

6. Other permitting that may be required (e.g., modification of VPDES permit for treatment of wastes generated as part of the closure activities, VPDES storm water permit for construction activities, *etc.*).

DECONTAMINATION AND CLOSURE OF THE OBG EQUIPMENT

If RFAAP opts to decontaminate the OBG burning pans and covers instead of disposing them as hazardous waste, the equipment will be placed into either a permanent or temporary containment structure. The equipment will then be decontaminated using a combination of mechanical cleanings and high and low pressure washes. Mechanical cleaning will involve the removal of visual residue on the pans via a combination of scraping, sweeping, or other appropriate methods. This will be followed by a single high pressure, low volume wash. The high pressure washing may include steam or detergent for more effective cleaning. Three successive low pressure ambient temperature water rinses will then follow this high pressure washes. The third, final rinse will then be collected and analyzed to verify the equipment's status as either hazardous or non-hazardous waste. If the rinsate samples indicate no contamination is present above regulatory levels, the equipment will be recycled or disposed offsite as non-hazardous waste. If the rinsate samples indicate that contamination is still present, RFAAP will either repeat the decontamination procedures or dispose of the equipment offsite as hazardous waste.

The concrete pads at the OBG will be mechanically cleaned and rinsed with high and low pressure washes. The high pressure washing will utilize a low volume of wash water and may include steam or detergent for more effective cleaning. Three successive low pressure ambient temperature water rinses will then follow these high pressure washes. The third, final rinse will then be collected and analyzed to show that the pad's surface meets established closure criteria. If the rinsate samples indicate no surface contamination is present above regulatory levels, the concrete will be removed and shipped offsite as non-hazardous waste. If the rinsate samples indicate that contamination is still present, RFAAP will either repeat the decontamination procedures or remove the concrete and ship it offsite as hazardous waste.

As the historical operations at the OBG did not use pans core sampling will be performed to determine if contaminated soils are beneath the burn pads. These core samples will be analyzed for Constituents of Concern (COC) (totals) using specified methods from SW-846. If the results of the analyses indicate that the underlying soil contains hazardous COCs, it will be excavated and shipped offsite to a permitted hazardous waste disposal facility. If the results of the analyses indicate that the underlying soil is not contaminated with hazardous COCs above appropriate risk thresholds, it will be left in place.

II.G.5.c. Evaluation of Surface and Subsurface Impact

The burning pan loading area and ignition area will be surveyed for visible signs of a material release. Prior to the performance of field work, a sampling plan will be prepared for the VDEQ documenting the potential areas of concern, identifying appropriate sampling grids for these areas, and an appropriate field assay procedure to augment the laboratory samples. In general, all such sampling will be conducted in accordance with the soil monitoring program described in Attachment II.C of this Permit.

If necessary, based upon the results of the soil survey, contaminated structures and subsoil's, including any groundwater that is determined to be contaminated, will be removed and properly disposed. Removal will continue until clean closure is achieved either to background or the approved risk-based standards. If clean closure cannot be achieved then the facility will close the site as a landfill or in accordance with the applicable regulations.

II.G.5.d. Management and Disposal of Miscellaneous Materials

The cleanup operations will likely result in the generation of other miscellaneous materials that may be contaminated during the cleanup process. Such materials may include but may not be limited to the following:

- Brushes, brooms, mops, buckets and related cleaning supplies;
- Shovels, absorbents, and other tools; and
- Plastic sheeting.

All such waste materials will be characterized as required to facilitate onsite treatment or offsite disposal. Liquid wastes may be discharged to the RFAAP wastewater treatment facility in accordance with the facility VPDES permit if such wastes are compatible with the treatment processes.

II.G.5.e. Site Restoration

Once the waste materials and contaminated equipment have been removed from the site, the area surrounding the OBG will be restored. In the event that demolished foundation structures and/or other materials must be excavated for disposal offsite, site restoration will include backfill and compaction of any excavations, grading and revegetation of the affected area(s). All backfill material must be analyzed before use at the site to ensure that it is "clean fill." The backfill material will be analyzed for the constituents specified in Table II.G-1 by appropriate methods from SW-846, latest edition. Additional constituents may be added to the analyses at the time of closure, pending VDEQ approval. In the event that it becomes necessary to conduct excavations at the time of closure, a detailed plan of the proposed excavation and site restoration activities will be submitted to the DEQ for approval.

II.G.5.f. Certification of Closure

Within 60 days of completion of the closure process, the Permittees will submit, by registered mail, a certification that the OBG has been closed in accordance with the specifications of this Closure Plan. The certification will be signed by an independent, Virginia registered professional engineer. The certification will also be signed by the Installation Commander, and a principal corporate officer or duly authorized representative(s) of the contracted operator pursuant to 9 VAC 20-60-264 and 40 CFR Part 264.115.

II.G.5.g. Post-Closure Care and Groundwater Monitoring

As previously discussed it is the intent of RFAAP to close the OBG such that there is unrestricted future land use of the area. As such, no specific provisions for site monitoring, land restrictions, etc. have been included in this Closure Plan. Should site conditions change that would necessitate a change in the closure approach, such post closure care and monitoring may be warranted. If necessary, details of such activities will be developed in a future amendment to the Closure Plan.

II.G.6. CLOSURE COST AND SCHEDULE

Federal facilities are exempt from the closure financial requirements pursuant to 9 VAC 20-60-264 and 40 CFR § 264.140(c).

The Department will be notified at least 45 days before final closure of the OBG is expected to begin. The date upon which closure is expected to begin will be the date upon which the final volume of hazardous waste is received at the OBG. Table II.G-2 shows the proposed schedule from notification of the department through submittal of the closure certification. As shown in the table, all closure activities are to be completed within 180 days. Certification of closure must be made within 60 days after the completion of closure activities. This time frame allows for the required sample analyses, additional decontamination and/or soil removal (as needed), and re-sampling.

In the event that the proposed timeframe proves insufficient for the completion of closure activities, the permittees will submit a demonstration for the need for additional time.

In the event that the RFAAP is unable to complete closure of the OBG within the timeframe established above and outlined in 40 CFR § 264.113, RFAAP will request an extension to the closure period. In making this request, RFAAP will provide a demonstration that the required closure activities will take longer than 180 days to complete and RFAAP has and will continue to take all steps necessary to prevent threats to human health and the environment from the unclosed but not operating hazardous waste management unit, including compliance with all applicable permit requirements. Pursuant to 40 CFR § 264.113(c)(2), the request for an extension of the closure period will be made at least 30 days prior to expiration of the 180-day period allotted for closure.

If the facility's permit is terminated, or if the facility is otherwise ordered, by judicial decree or Order of the Board, to cease receiving hazardous waste, OBG will be closed in accordance with the deadlines established in 9 VAC 20-60-264 and 40 CFR § 264.113.

II.G.7. MODIFICATION TO CLOSURE PLAN

The permittees will submit a written request for a permit modification to authorize a change in the approved Closure Plan whenever:

- Changes in operating plans or facility design affect the Closure Plan;
- There is a change in the expected year of closure, if applicable; or
- In conducting partial or final closure activities, unexpected events require a modification of the approved Closure Plan.

The permittees will submit a written request for a permit modification including a copy of the amended Closure Plan for approval as follows:

- At least 60 days prior to the proposed change in facility design or operation; or
- No later than 60 days after an unexpected event has occurred that has affected the Closure Plan.

If an unexpected event occurs during the partial or final closure period, the permittees will request a permit modification no later than 30 days after the unexpected event. The Department will approve, disapprove or modify this amended plan in accordance with the procedures in 40 CFR Parts 124 and 270. In accordance with 40 CFR § 270.32, the approved Closure Plan will become a condition of this Permit.

FIGURE II.G-1: LOCATION MAP

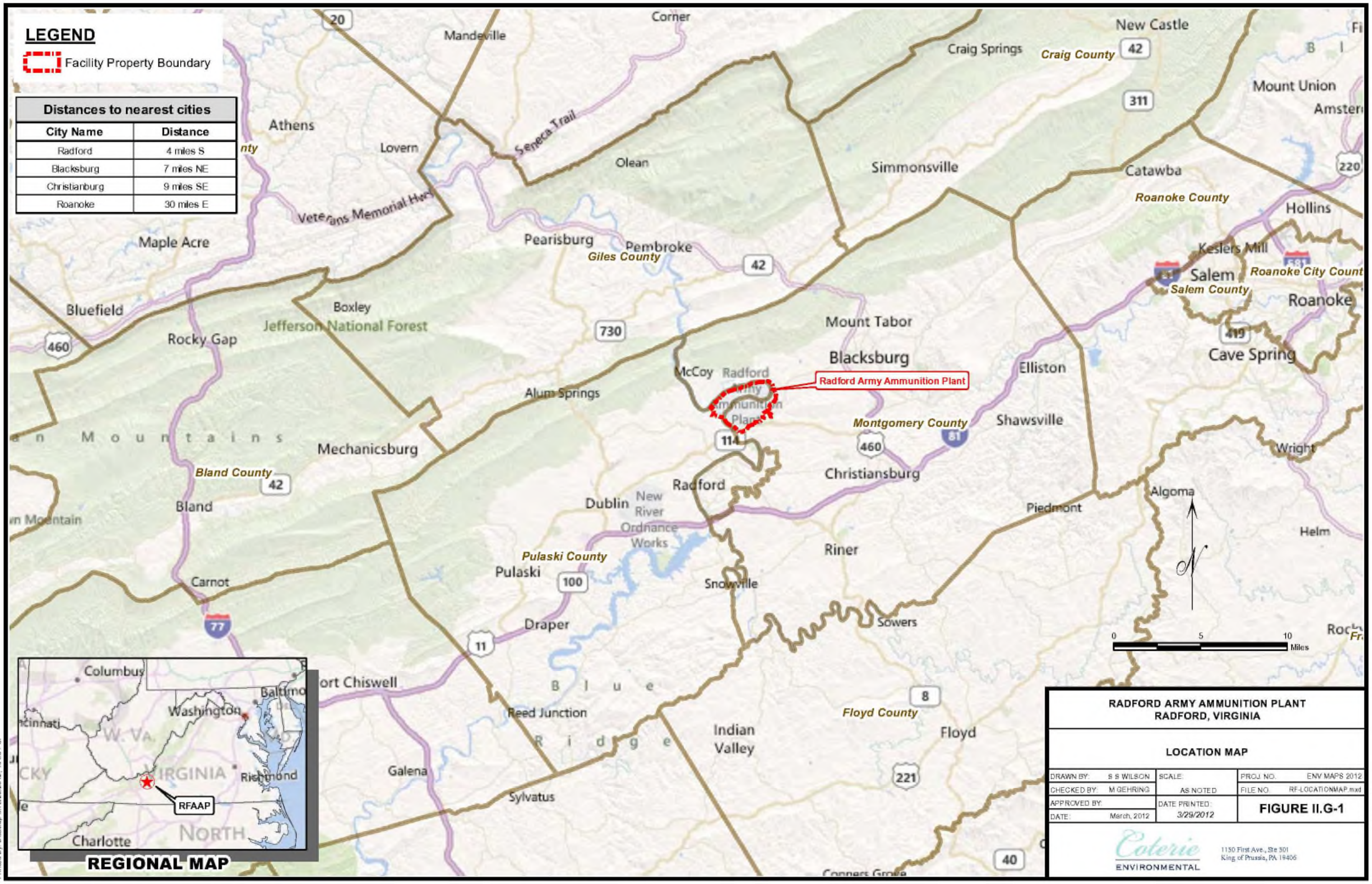


FIGURE II.G-2: TOPOGRAPHIC MAP

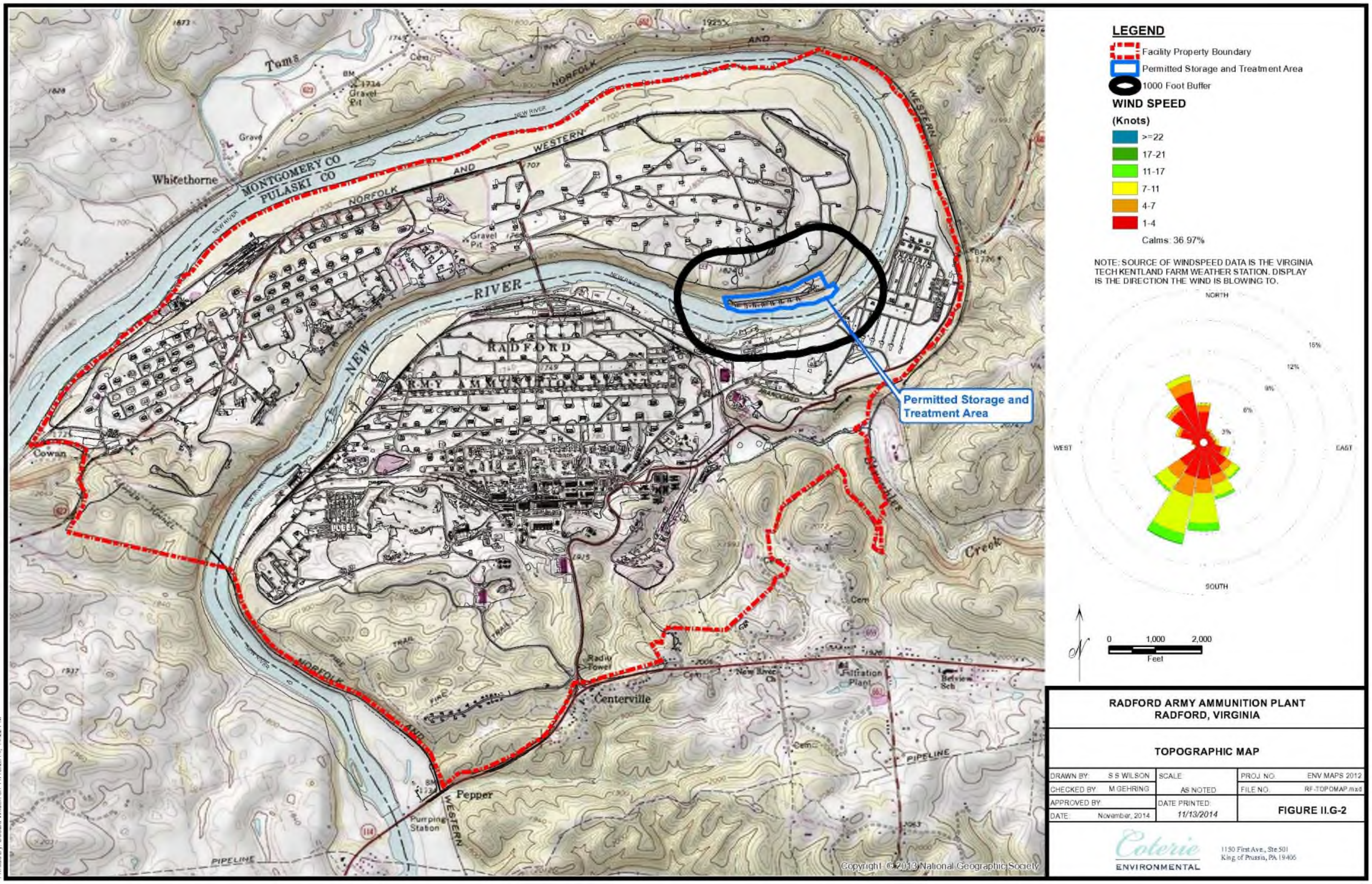


FIGURE II.G-3: LAYOUT OF BURNING GROUND STRUCTURES

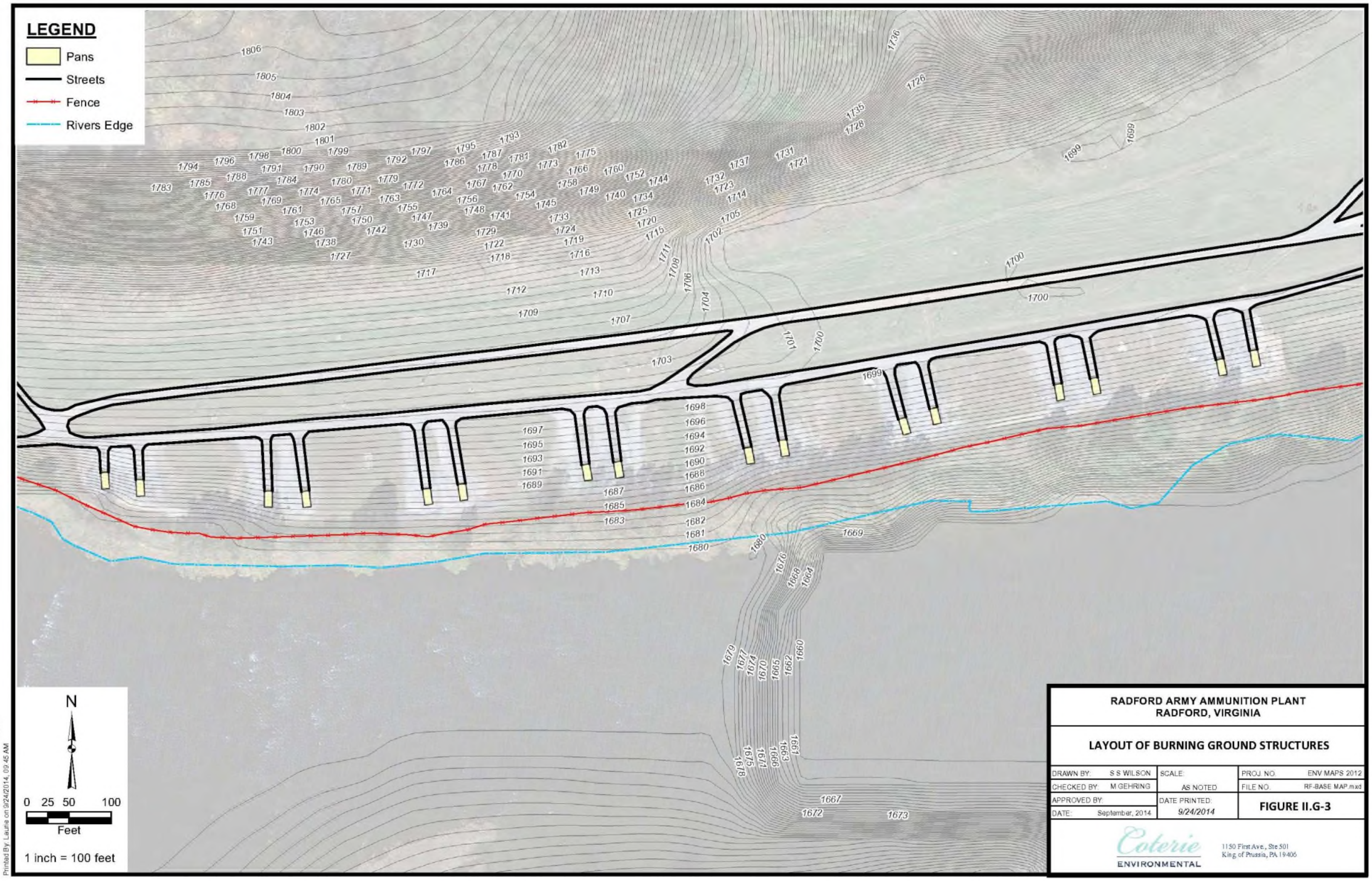


FIGURE II.G-4: LOGIC DIAGRAM

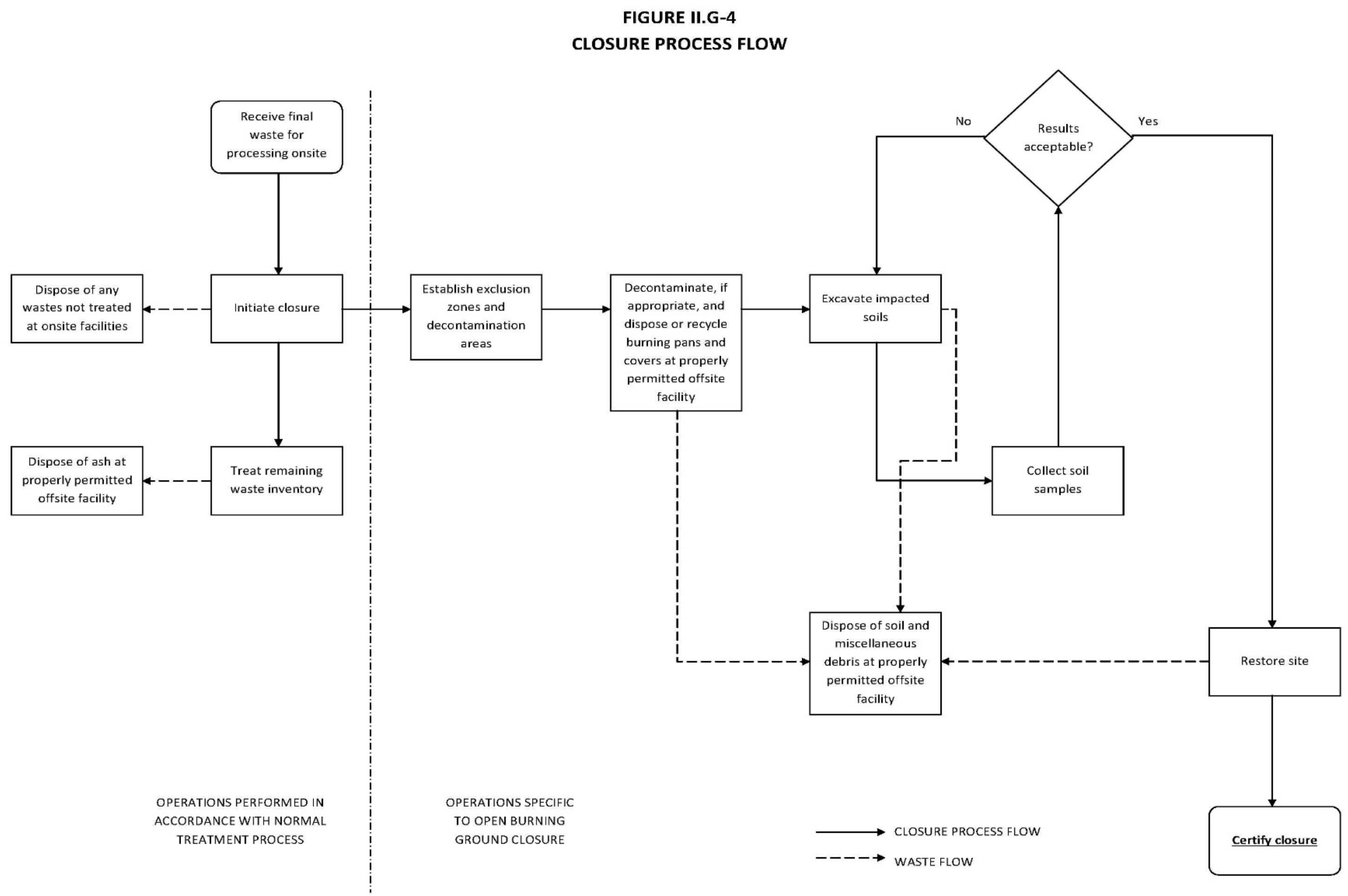


TABLE II.G-1: HAZARDOUS CONSTITUENTS FOR EVALUATION DURING CLOSURE OF THE OPEN BURNING GROUND

Parameter	**CAS #**	Analytical Method **(SW-846)**	**Estimated Quantitation Limits (µg/L)**
Arsenic	7440-38-2	6020	5
Barium N.O.S.	(Barium) 7440-39-3	6020	10
Benzene	71-43-2	8260	5
Carbon tetrachloride	56-23-5	8260B	
Chromium compounds N.O.S.	(Chromium) 7440-47-3	6020	5
Dibutyl phthalate (Di-n-butyl phthalate)	84-74-2	8270	10
Diethyl phthalate	117-81-7	8270	10
Dinitrobenzene, N.O.S.	25154-54-5	8270	10
2,4-Dinitrotoluene	121-14-2	8091	0.08
Diphenylamine	122-39-4	8270	10
Lead N.O.S.	(Lead) 7439-92-1	6020	1
Mercury	7439-97-6	7470A	
Nitroglygerin	55-63-0	8332	10 mg/L
Nitrosamines, N.O.S.	Multiple	8330	Varies
Total Phenols (found in phenolic resin)	108-95-2	9066	5
Silver	7440-22-4	6020	2

N.O.S: Not Otherwise Specified, signifies those members of the general class not specifically listed by name in Appendix VIII of 40 CFR Part 261.

TABLE II.G-2: ANTICIPATED CLOSURE SCHEDULE
Open Burning Ground
Radford Army Ammunition Plant

Days From Beginning of Closure	Event
- 45	Notification of Department
0	Receive last volume of waste
0-2	Treat final volume of waste
2-5	Remove residuals from burning pans
5-15	Select tentative locations for background sampling, seek approval from Department
15-20	Inspect for cracks in burning pads
20-30	Disassemble, clean, and decontaminate burning pans and covers
30-75	Sample wash water
55-100	Sample analysis
55-75	Soil sampling
100-125	Soil removal (if necessary)
90-125	Repeat sampling and analysis (if necessary)
110-140	Additional soil removal (if necessary)
90-150	Repeat sampling and analysis (if necessary)
180	Completion of closure activities
240	Submit signed closure certification to the Department

Times, in days, are from the date upon which closure begins.

ATTACHMENT II.H – SECURITY PROVISIONS AND MAINTENANCE

II.H.1. INTRODUCTION

Protection of plant personnel, property, resources and operations at the Radford Army Ammunition Plant (RFAAP), a Government-owned, contractor-operated (GOCO) manufacturing facility, is provided by the operating contractor or a subcontractor in accordance with Department of the Defense (DOD), Department of the Army (DA), United States Army Joint Munitions Command (USAJMC) and other regulatory guidance and standards. Generally, a subcontractor security guard force is used to perform and enforce prescribed physical security measures.

II.H.2. SECURITY PROCEDURES AND EQUIPMENT

The RFAAP is a protected military installation, under 24-hour surveillance by a trained security force. RFAAP is considered a “closed post” in that access is controlled at all times by perimeter barriers with limited, manned entry control points. The secured areas of the installation have been designated as Limited and Posted Areas. More than 70 percent of the RFAAP’s acreage is enclosed in three limited areas. All propellant manufacturing, storage, testing and support activities, except for administration, are included in limited areas. Those areas outside of the limited area but within the posted area are restricted to non-energetic activities.

In addition to the protection offered by the physical barriers, additional security is provided by Security Guard patrols, manned security posts, a badge identification system, lock and key accountability and rotation, vehicle registration and inspection, pre-employment background investigations, security lighting, warning signs, and other physical barriers.

II.H.3. 24-HOUR SECURITY SYSTEM

The security guard force provides 24-hour, 7-day a week security coverage of the RFAAP, performing various security duties across the installation as required to protect the installation and the operations performed therein.

II.H.4. BARRIER AND MEANS TO CONTROL ENTRY

Entry to the RFAAP is restricted 24 hours per day, 7 days a week to authorized personnel. Personnel must be in possession of a valid personnel identification badge or visitor badge. If the person has valid official business at the plant or is accompanying a person who does have such business, posted area visitor badges are issued and the time and date of entry is recorded.

The open burning ground (OBG) is located within the limited area of the plant. Access to this area is strictly controlled through manned security gates that perform an identification check of each person entering the area. Only those persons with valid contractor, government, or visitor identification badges are permitted. At the OBG area itself, each person entering the area must notify the area operator and obtain permission. Access to the pans themselves is restricted by a chained gate, which prevents vehicle entry to the area and deters manned entry. A sign on the gate indicates "Waste Explosive Burning Ground -- Unauthorized Personnel Keep Out -- Visitors shall not enter beyond this point without direct permission of Supervisor or Chief Operator."

Protection of sensitive and critical information about the RFAAP and its operations is important to the successful achievement of the RFAAP mission. If adversaries (terrorists, criminals, foreign intelligence organizations or governments, etc.) can gain information about RFAAP, correctly analyze it, and act upon it, the compromise of this information could prevent or seriously degrade mission success. The National Operations Security (OPSEC) Program, which is outlined in National Security Decision Directive 298 (NSDD 298), requires each executive department and agency with a national security mission to have an OPSEC program. Likewise, Department of Defense (DOD) Directive 5205.02E, DOD Operations Security Program, supports the national program and is the basis for the Department of the Army's implementing guidance and policy, Army Regulation 530-1, Operations Security. As a result of these OPSEC and DOD concerns and requirements, specific details on the security and means to control entry at the RFAAP are withheld from this Permit. Information necessary to demonstrate compliance with 40 CFR § 264.14(b)(2) (ii) is maintained onsite and is available for review and inspection by authorized individuals as necessary.

II.H.5. <u>WARNING SIGNS</u>

At all plant entrances and in areas designated as posted, the following “Condition to Entry” signs have been erected:

CONDITION OF ENTRY
TO
RADFORD ARMY AMMUNITION PLANT

All persons, their possessions and vehicles are liable to search upon entering, during their stay, or upon their leaving this installation. Entry of persons and/or vehicles constitutes consent to search by proper authorities at any time.
The following articles are prohibited on this installation:

- Alcohol
- Firearms, Ammunition and Weapons
- Explosives and Explosives Devices
- Cameras (Unless Authorized in Writing)
- Camera Cell Phones (Unless Registered)
- Intoxicants and Drugs
- Gambling Devices
- Chemical Emission Devices
- Stolen Property and Obscene Literature

By Order of the Commanding Officer

Signs reading “US Government Property - No Trespassing” are located approximately every 500 feet on the installation boundary, except where designated limited area fences are not located on or are reasonably adjacent to the property boundary.

Every 500 feet on limited area fences and at other highly visible locations, such as corners and gates, the following signs are located on the fence facing outward:

US ARMY
RESTRICTED AREA
WARNING

This Area has been declared a Restricted Area by authority of the Commanding Officer, in accordance with provisions of the Directive issued by the Secretary of Defense on 20 August 1954, pursuant to the provisions of Section 21, Internal Security Act of 1950. Unauthorized entry is prohibited. All persons and vehicles entering hereon are liable to search. Photographing, making notes, drawings, maps, or graphic representations of this area or test activities, are prohibited unless specifically authorized by the Commanding Officer. Any such material found in the possession of unauthorized persons will be confiscated.

In addition, information signs warning against smoking and the introduction of matches and other flame-producing devices are displayed at all normally used gates.

II.H.6. <u>ENTRY TO REGULATED UNITS</u>

No reactive waste storage occurs at the OBG. The waste is delivered in powder vans, placed directly in the burning pans and ignited that day. Therefore the primary protection against area entry is necessary only during unit operation and immediately before and after burning activities are performed.

Entry to the OBG is controlled via personnel monitoring and displayed signage. All personnel entering the area must check in with the control trailer prior to entering the burning area. Physical barriers are also provided to deter entry to the area while the unit is in operation. Once the pans are loaded and immediately prior to their firing, a cable gate is stretched across the road before the entrance to the area. This gate restricts all traffic into the area on the main access road.

Prior to igniting the pans, three loud speakers directed toward the river broadcast a warning message and siren signal. Flashing red lights at both ends of the site are also activated. Adjacent to these lights, posted signs warn “DANGER UNAUTHORIZED PERSONNEL KEEP OUT.” These signs can be read from a distance of at least 25 feet.

Once the pans have been ignited, the cable gate across the road is removed, allowing access from the road to the OBG trailer. However, as long as the pans are burning, cable gates that stretch across the pan avenue are locked, preventing vehicular and deterring foot traffic from entering the active area. Access to the office area is permissible during this period of time.

ATTACHMENT II.I – 100-YEAR FLOODPLAIN PROTECTION PLAN

II.I.1. Floodplain Standard

The open burning ground (OBG) is located within the 100-year floodplain. Figure II.I-1 provides a depiction of the 100-year floodplain elevations relative to the OBG. The source of data for this determination is the National Flood Insurance Program, Flood Insurance Rate Map, dated November 7, 2011.

Pursuant to 40 CFR § 264.18, any facility located within a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of waste by a 100-year flood unless the owner or operator can demonstrate to the Regional Administrator's satisfaction that:

(i) Procedures are in effect that will permit the waste to be removed safely to a location where the wastes will not be vulnerable to flood waters before flood waters can reach the facility;

(ii) No adverse effects on human health or the environment will result if washout does occur.

These requirements are satisfied through a combination of measures, including administrative practices that are contained in the facility-wide flood protection plan and OBG-specific flood response procedures, and engineering controls that are reflected in the OBG stormwater management design. In addition, soil monitoring is conducted in accordance with the procedures described in Section II.I.4 and the Soil Monitoring Program in Attachment II.C to ensure that no adverse impacts have occurred in the area surrounding the OBG due to flooding or other events.

II.I.2. Facility-Wide Flood Protection Measures

RFAAP has instituted a facility-wide flood protection plan to ensure protection of facility operations and managed materials in the event that flooding conditions are expected. The Flood Plan for RFAAP is located in Plant Protection Standard 1.70, titled "Flood Watch" (or current update). The procedure discusses safety precautions, flood watch procedures, reporting, flood levels and buildings affected by high waters.

Utilities personnel are responsible for monitoring the river elevations at the River Bridge. When flooding appears imminent, readings are taken at the River Bridge at a minimum of once per hour. At an elevation of 1,695 feet at the River Bridge (five feet below flood stage at the bridge), or if conditions warrant, a Utilities Division representative shall collect information from local sources to help evaluate the flooding potential. This information will be updated hourly provided the river level is rising and/or is in flood stage.

The time the flood waters will take to reach the facility varies depending on the amount of discharge at Claytor Dam. It is estimated that a flood crest starting at Claytor Dam will reach the facility in approximately 2 to 3 hours.

Utilities personnel shall request the Security Police Dispatcher to notify key personnel in the instance of the following events:

- The Claytor Lake dam gates are opened 20 feet or more;
- The water level reaches an elevation of 1,697 feet at the River Bridge; or
- Flooding conditions are predicted.

The Environmental Department shall coordinate the removal of waste materials from potentially impacted locations (such as the OBG), as well as any corrective action and cleanup activities that are necessary. Engineering is responsible for estimating damages to physical facilities and equipment.

II.I.3. Open Burning Ground Flood Protection Measures

In the event that the New River height at the River Bridge reaches 1,695 ft mean sea level (MSL) (five feet below flood stage at the bridge), RFAAP will institute the flood protection plan for the OBG. When this plan is activated, RFAAP will take action to prevent harm to human health and the environment due to the washout of the hazardous waste management area. The below provides a summary of the actions that will be taken. Each of the below tasks will be prioritized based on the rate of rise in the river levels and other factors. However, the utmost priority in a flooding situation will remain the safety of personnel working in the area.

Three potential scenarios exist with flood response at the open burning ground:

1. An immediate evacuation is not required and the pans have not been loaded for a burn.
2. An immediate evacuation is not required and the pans have been loaded for a burn.
3. An immediate evaluation is required to protect the safety of area personnel.

Dedicated and trained personnel are available to carry out the necessary activities to respond to each of these scenarios. The sections below provide a description of the procedures that will followed under each scenario. In general, ample time exists between flood notification and the arrival of flood waters at the facility to remove or process all hazardous wastes at the OBG (*i.e.*, immediate evacuation of the area should not be required upon initial notice of flooding potential). However, if at any time during the first two scenarios, should the situation change and conditions become dangerous for personnel, any or all of the procedures detailed herein may be abandoned, an emergency shutdown will be performed, and the area will be evacuated.

Immediate Evacuation Not Required, Pans Have Not Been Loaded

Provided that an immediate evacuation of the area is not warranted and the area has not set up for a burn, all ash residue will be removed from the pans and placed in drums per normal procedures. If less than 24 hours has elapsed since the last burn, supervision will inspect the pans and determine the proper method for safe handling of the materials. Two options are available for cooling the material in the pans:

1. For small hot spots, the operators will apply small amounts of water as necessary to extinguish the hot spots.

2. For larger hot spots or entire pans with hot residue, the Fire Department will thoroughly wet the contents of the pans to extinguish the materials.

   After removal, the containerized ash will be moved to an appropriate storage building outside the region threatened by the flood waters if time allows.

Immediate Evacuation Not Required, Pans Have Been Loaded

In the event that an immediate evacuation of the area is not warranted and the area has already set up for a burn, the burn will commence due to safety concerns. After an hour, the pans will be inspected for flames. If the burn is already completed, the fire department will be called to cool the pans with water and the ash/water will be removed into drums per normal procedures. If the burn is not complete after an hour, the pans will be inspected each hour until the area must be evacuated. If time does not allow for the pans to be emptied of ash, they will be covered and left in place. Any subsequent discharge of hazardous ash residue to the environment will be reported consistent with the procedures provided in the Contingency Plan (Attachment II.F).

Immediate Evacuation Required

In the event that an immediate evacuation is warranted, the open burning ground will be left in its current status, all electronics will be secured, and paper files will be removed (if possible). If pans have been loaded with material at the time that evacuation is ordered and time is not available for removal of materials, or if removal of materials from the pans is not possible due to personnel safety concerns (*e.g.*, Class 1.1 explosives are in the pans or diesel has already been applied to the energetic material), the material will be abandoned in place.

Even though there is no recent history of abandonment due to flooding, the most likely situations that would trigger such a response would be one in which the discharge of the Little River approximately one-half mile below the Claytor Lake dam resulted in flash flooding or in the case of a major and rapid snow melt. In such a situation, the Contingency Plan will be implemented and an immediate incident report will be filed with the appropriate environmental agencies as specified in the Contingency Plan (Attachment II.F).

Table III.I-1 provides a summary of locations, activities, and timing required to enact this plan after the New River reaches a height of 1,695 ft MSL at the River Bridge. As demonstrated in the table, ample time exists between flood notification and the arrival of flood waters at the facility to implement the flood plan activities.

II.I.4. <u>Protection of Human Health in the Event of Washout</u>

In addition to removing the waste from the OBG when flooding is expected, RFAAP has instituted a soil monitoring program (SMP) to ensure that the soils in the OBG, if washed downstream during a flood, will not have adverse effects on human health and the environment.

The SMP for the OBG is provided in Module II, Attachment II.C of this permit. This plan describes the methods by which monitoring locations are selected, the procedures by which samples are collected and analyzed, and the actions required in the event that any constituent is detected above the action levels described therein. Institution of this plan ensures recognition of contaminated areas and immediate treatment and/or removal of any contaminated soils.

II.I.5. <u>Stormwater Design Considerations</u>

40 CFR § 264.273 requires that facilities incorporate measures into their facility design to properly control run-on and run-off from the treatment unit in the event of a 24-hour, 25-year storm. While this design measure does not ensure protection of the facility during a 100-year flooding event, it does help to mitigate the effects from the storm and extend the period of time during which wastes can be moved prior to flood waters overcoming the site.

In accordance with these requirements, RFAAP has designed features into the OBG site that help satisfy the requirements for run-on and run-off control. Included in this design is a system for diverting run-on around the OBG site and directing run-off away from the OBG site. This system includes:

- Four drainage areas, designed to manage over 87.5 cubic feet per second (cfs) of stormwater discharge.

- A containment berm (Berm A) along the southern boundary, a trench drain and a culvert that are designed to mitigate water flow into the site and contain and direct run-off from the site. Water traveling in the trench drain between the toe of Berm A and the burning pans is directed through the culvert into a sediment basin outside of Berm A to the northeast of the site. Stormwater is then discharged from the basin through a principal spillway and out to the New River through RFAAP Outfall #17.

- A diversion berm (Berm B) that runs the length of the site along the northern boundary, a drainage swale, ditch, and two culverts that prevent flow from two of the drainage areas from encroaching onto the OBG site and discharge the stormwater out to the New River through RFAAP Outfall #12.

An overview of these features is provided in Figure II.1-2.

FIGURE II.I-1: FLOOD MAP

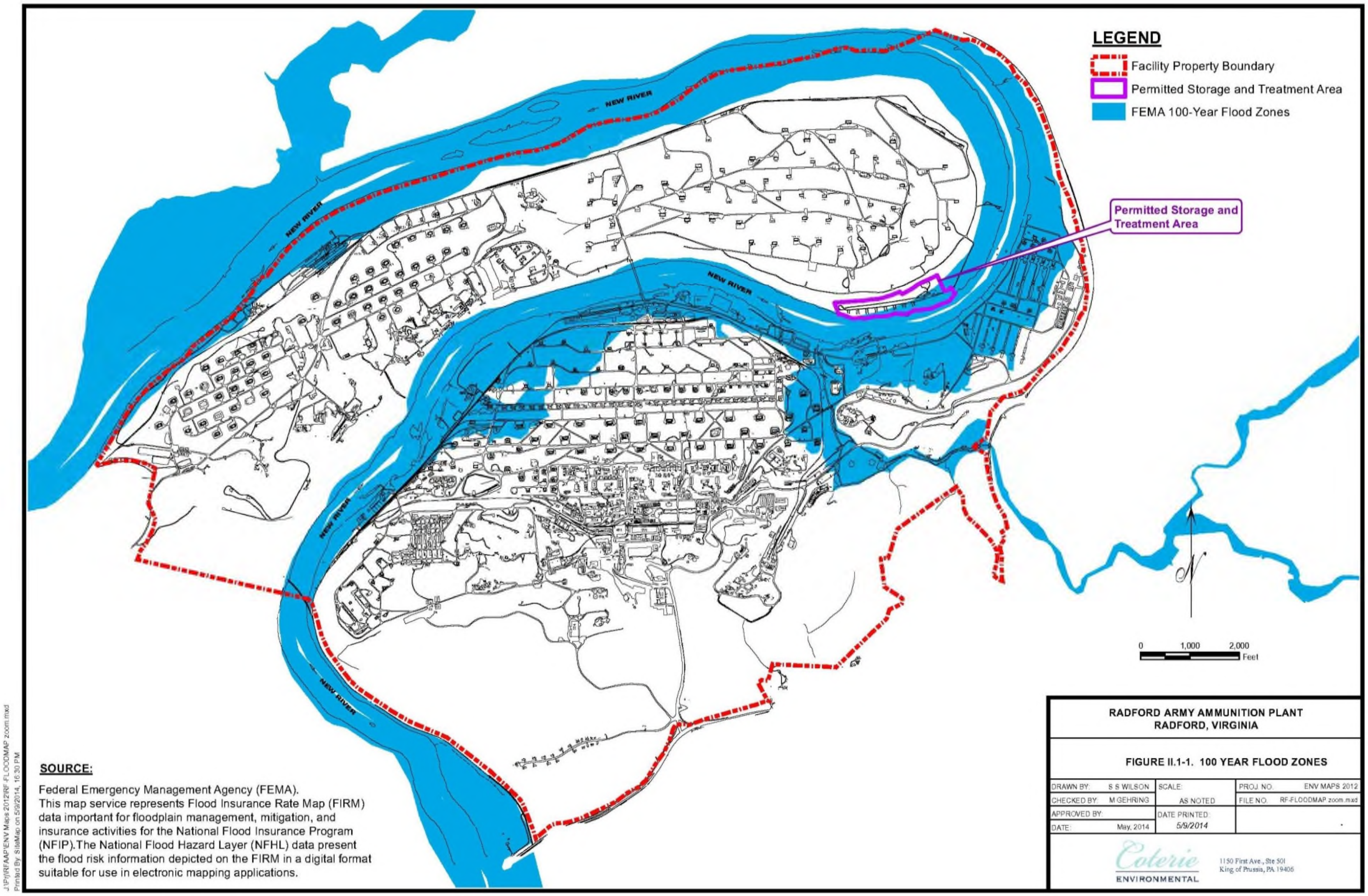
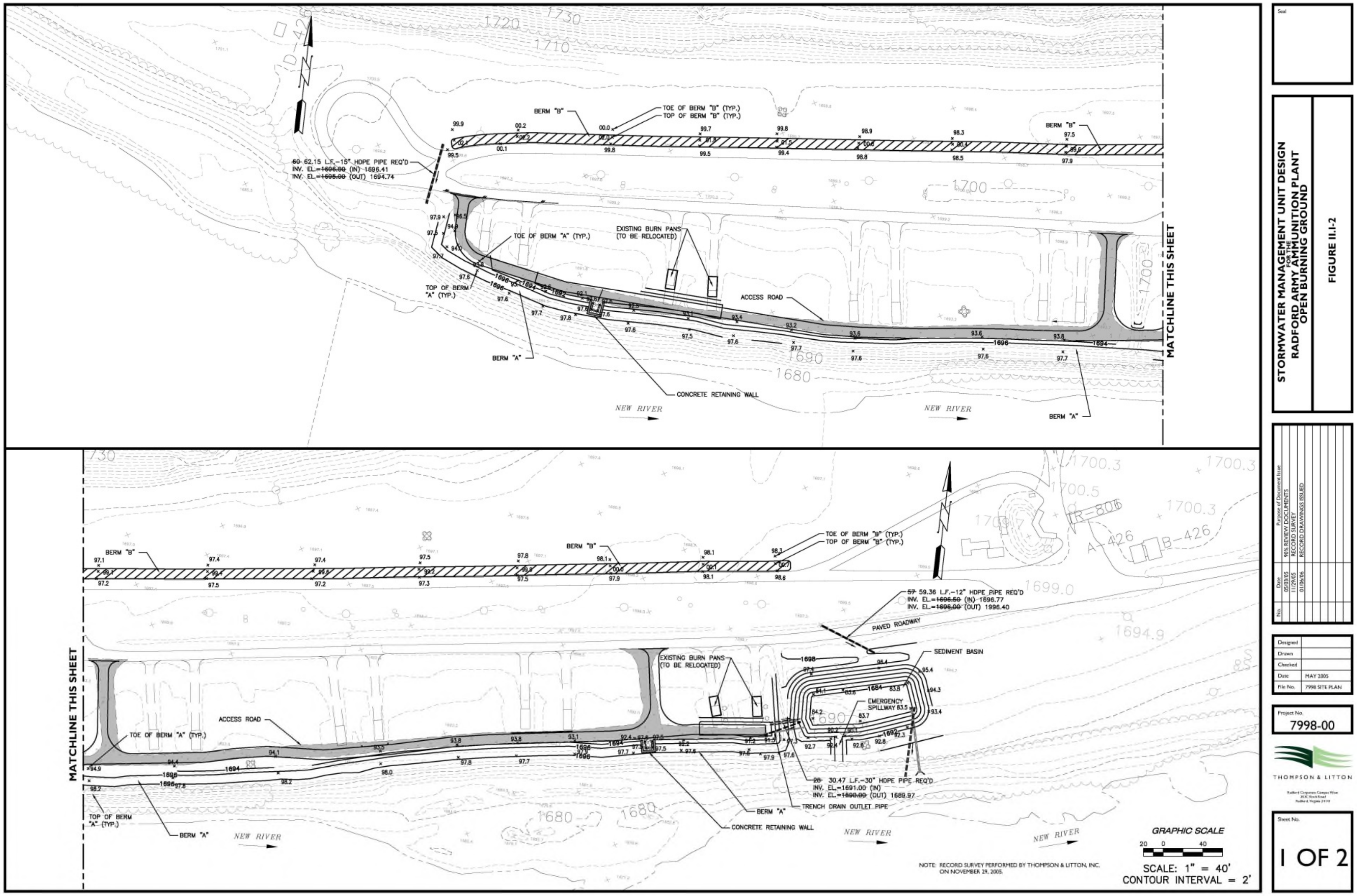


FIGURE II.I-2: STORMWATER MANAGEMENT DESIGN



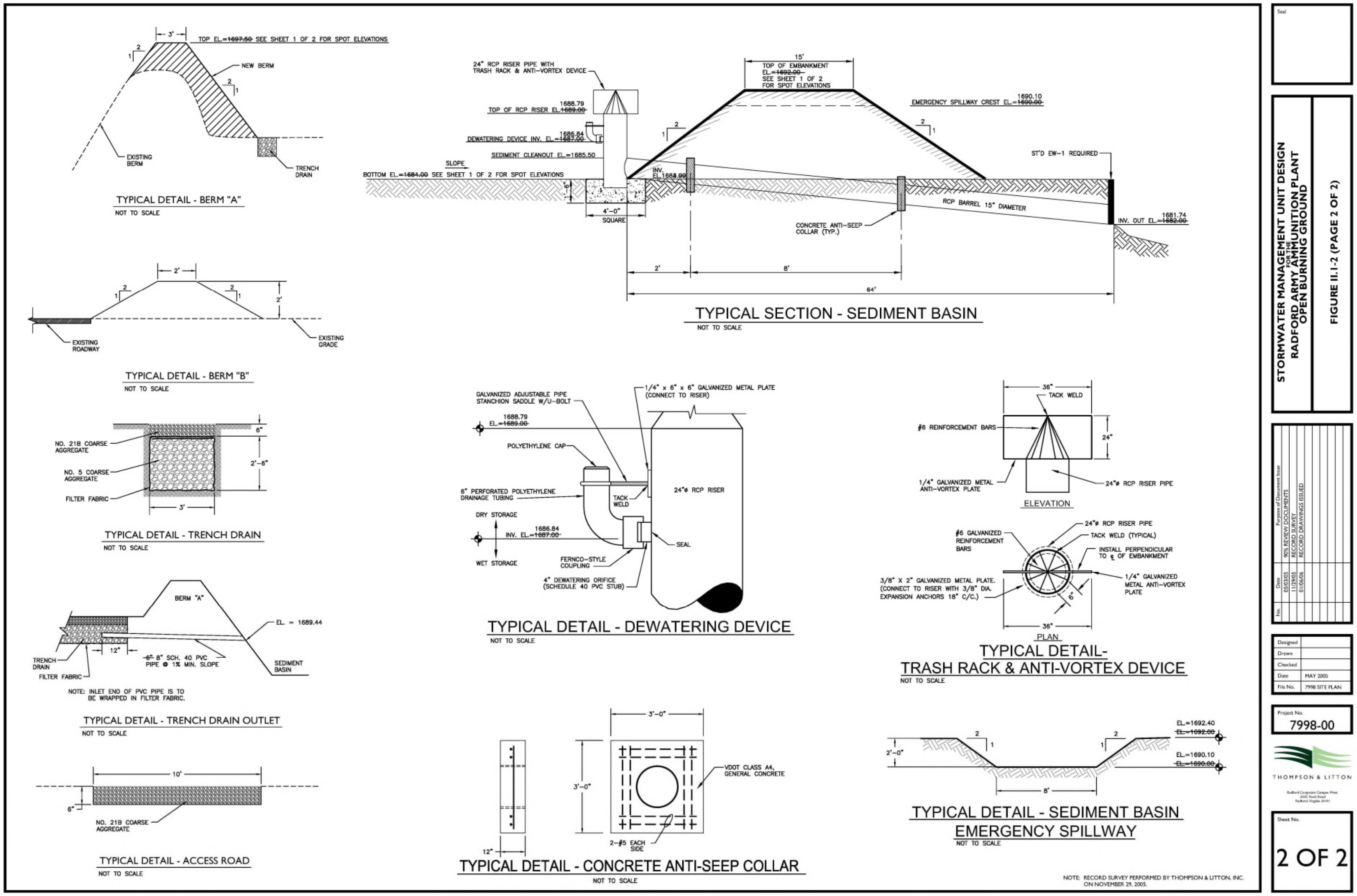

TYPICAL DETAIL - BERM "A"
NOT TO SCALE
TYPICAL DETAIL - BERM "B"
NOT TO SCALE
TYPICAL DETAIL - TRENCH DRAIN
NOT TO SCALE
TYPICAL DETAIL - TRENCH DRAIN OUTLET
NOT TO SCALE
TYPICAL DETAIL - ACCESS ROAD
NOT TO SCALE
TYPICAL SECTION - SEDIMENT BASIN
NOT TO SCALE
TYPICAL DETAIL - DEWATERING DEVICE
NOT TO SCALE
TYPICAL DETAIL - CONCRETE ANTI-SEEP COLLAR
NOT TO SCALE
TYPICAL DETAIL-
TRASH RACK & ANTI-VORTEX DEVICE
NOT TO SCALE
TYPICAL DETAIL - SEDIMENT BASIN
EMERGENCY SPILLWAY
NOT TO SCALE
NOTE: RECORD SURVEY PERFORMED BY THOMPSON & LITTON, INC. ON NOVEMBER 29, 2005.
STORMWATER MANAGEMENT UNIT DESIGN
FOR THE
RADFORD ARMY AMMUNITION PLANT
OPEN BURNING GROUND
FIGURE II.I-2 (PAGE 2 OF 2)
Project No.
7998-00
THOMPSON & LITTON
2 OF 2

TABLE II.I-1: REMOVING WASTE IN THE EVENT OF FLOODING

Type of Material	Location to which waste will be moved	Procedures and equipment to be used	Personnel Required	Time required for waste movement
Solid waste propellant in containers	Facility Hazardous Waste Accumulation Area	Move wastes to the Explosive Hold House per standard procedures using powder vans	Trained storage and treatment area personnel	Loading: 20 minutes (max, 47 cans) Transport: 10 minutes (5500 feet) Unloading: 20 minutes Total: 50 minutes
Solid waste propellant loaded into pans	Facility Hazardous Waste Accumulation Area	Initiate burn or remove wastes as directed by supervision. (See discussion for decision matrix). Move wastes and/or residues to the accumulation area using powder vans following standard procedures	Trained storage and treatment area personnel	Burning: 1 hour Removing residue: 30 minutes Transport: 10 minutes (5500 feet) Unloading: 20 minutes Total: 2 hours
Ash residue in pans	Facility Hazardous Waste Accumulation Area	Transport waste to accumulation area using powder vans following standard procedures	Trained storage and treatment area personnel	Approximately 40 minutes (based on transporting 30 drums in two trips between the OBG and the holding area)

MODULE III – OPERATING CONDITIONS

III.A. GENERAL

This Module is organized with separate Parts to identify the operational and performance requirements that are specific to the open burning ground (OBG).

The OBG is located along the banks of the New River in the southeastern portion of the Radford Army Ammunition Plant (RFAAP) known as the horseshoe area. The OB operations are conducted in an area approximately 100 feet by 1,500 feet (see Figure III-1). The actual burning of explosive waste is performed in 6-foot by 18-foot burning pans that are located on approximately 250-foot square raised pads. There are eight raised pads in the area, each holding two burning pans for a total of 16 pans.

III.B. PERMITTED AND PROHIBITED WASTE IDENTIFICATION

III.B.1. Those hazardous wastes that may be managed at the permitted open burning grounds are waste energetic materials and spill "clean-up" residues generated at the Radford Army Ammunition Plant (RFAAP) by either the contracted operator (the Permittees) or one of the RFAAP tenant organizations. No wastes generated outside of the RFAAP will be received or treated at the permitted treatment area.

Only those hazardous wastes that are consistent with the requirements of the facility's RCRA Permit and that are described in Module II, Attachment II.B Waste Analysis Plan (WAP) will be open burned. Of the 20 groups of wastes described in the WAP, wastes from all groups except Groups 2, 3, 5, and 6 may be treated by open burning. Under no circumstances will the following materials be managed at the open burning ground:

i. Radioactive wastes, or mixed radioactive and hazardous wastes;

ii. Wastes that are listed pursuant to 9 VA 20-60-261, incorporating 40 CFR §§261.31, 32, and 33, by reference, will be managed at the permitted treatment area.

iii. Any material contaminated with or suspected of being contaminated with military warfare agents accepted for thermal treatment at the OB unit. Examples of such chemical warfare agents are:

- Choking agents
- Nerve agents
- Blood agents

- Blister agents
- Incapacitating agents
- Vomiting compounds
- Tear producing compounds
- Herbicides

iv. Smoke and incendiary devices, as these materials are not suitable for treatment at the OBG for a variety of reasons.

III.B.2. Some of the materials treated at the OBG are the same wastes that would be treated at the incinerator except that they may contain rocks, tramp metal, and other foreign object debris (FOD) that will damage the incinerator grinder or present an explosion hazard in the grinder. In addition, those energetic wastes that will not feed into the grinder due to their physical shape or thickness, and those energetics that have through Hazard Analysis been designated as unsafe for the grinder or incinerator may be treated at the OBG.

III.B.3. The performance standards for the OBG have been established to ensure protection of human health and the environment. These standards have been based upon site-specific demonstrations made in the Human Health and Ecological Risk Assessments for skid burns and propellant burns, respectively.

In general, each open burn shall be limited as follows to protect human health and the environment:

- Propellant burns (“Dry” Burns) - 5,600 pounds/day for up to 183 days/year.
- Skid burns (“Wet” Burns) - 2,000 pounds/day for up to 365 days/year.

III.B.4. RFAAP may accept tenant wastes for accumulation in a RFAAP less than 90 day accumulation area. All wastes from RFAAP tenant organizations must be treated within 90 days from the point of generation by the RFAAP tenant organization.

III.C. OPEN BURNING GROUND OPERATIONS

III.C.1. The OBG is located along the banks of the New River in the southeastern portion of the RFAAP known as the horseshoe area. Each of the 16 burn pads utilized in the OBG operations has been configured to provide an elevated, impermeable surface on which to place the open burning pans and conduct the open burning operations. Figure III-2 provides a graphical representation of the typical pad configuration.

As shown in the figure, each pan is elevated sufficiently above the adjacent New River and is protected by a stormwater berm and stormwater trench. In addition, four drainage areas are provided to collect stormwater generated from precipitation events. Water collected in the drainage areas is then directed away from the OBG using a series of diversion berms, drainage culverts, and swales. These, and other unit design features, have been structured to ensure proper management of run-on and run-off in accordance with 40 CFR § 264.273. Figure III-3 provides an overview of the stormwater management features associated with the area.

III.C.1.a. The run-on control system has been designed pursuant to 40 CFR § 264.273(c) to prevent the flow of water onto the OBG during peak discharge resulting from a 24-hour, 25-year storm. This run-on control system includes a series of diversion berms and drainage culverts that direct the discharge from a design storm away from or around the OBG site and redirect it back to the River through RFAAP Outfall #12. These features are depicted on Figure III-3.

III.C.1.b. The run-off control system has been designed pursuant to 40 CFR § 264.273(d) to control the volume of water resulting from a 24-hour, 25-year storm within the confines of the OBG. This run-off control system includes four separate drainage areas and a series of containment berms, trench drains, and culverts that direct collected water to a sediment basin and prevent it from overtaking the OBG site. Stormwater releases from the sediment basin are controlled via a principal spillway that discharges through RFAAP Outfall #17. These features are depicted on Figure III-3.

III.C.2. The Open Burning Ground is composed of 16 burn pans. Two types of burns are performed on these pans: propellant burns and skid burns. Each burn utilizes a maximum weight of 1,000 pounds of energetic material per burn pan, with typical weights being much less. Each of these burn scenarios were evaluated in the site-specific human health and ecological risk assessment using the criteria described below.

Propellant burns, which are also referred to as “dry” burns, are conducted with materials that do not require an aid in burning. The material included in these burns is spread directly on the pan and ignited with a remote igniter. Pursuant to III.B.3, propellant burns are limited to no more than 5,600 pounds of energetic waste per day and can be performed up to 183 days per year, weather permitting.

For those wastes that require an aid to burning, a skid of wooden pallets is covered with cloth or cardboard, treated with diesel fuel, and ignited. Placing the wastes on the pallets and treating them with diesel fuel helps to encourage air movement, provide adequate fuel for the process, and support proper combustion of the waste. Pursuant to III.B.3, this type of assisted burn or “skid burn” is limited to a total weight of 2,000 pounds of energetic waste per day spread over multiple pans as necessary. These skid burns, which are also referred to as "wet" burns, may be performed 365 days per year, weather permitting.

These two burn scenarios correspond to 1,024,800 pounds/year of propellant wastes and 730,000 pounds/year of skid wastes.

III.C.3. Figures III-4 and III-8 provide construction and material details of the burn pans, supports, and pads. The figures also provide details of the pan covers, which are mounted on wheels and can be rolled manually over the pans to prevent rain from collecting in the pans and overflowing onto the ground. The burning pans are each lined with six inches of clay or ceramic mastic to insulate the metal from the intense heat of burning. There are no liners or leak containment systems below the burning pans, as only solid materials are treated in the pans. The pans are inspected daily prior to loading to ensure that they are not leaking.

III.C.4. Each morning that the OBG plans to operate the Chief Burning Ground Operator or the Area Manager checks the local weather forecast to evaluate predicted precipitation events, wind speeds, New River level, Pond level at Claytor Lake, and recent rainfall at the headwaters of the New River in North Carolina. Based on this forecast, the Chief Burning Ground Operator or the Area Manager then decides whether to begin loading the pans. If the forecast predicts greater than a 50% chance of precipitation within 3-hours of the start of a burn or if the winds are greater than 20 miles per hour, the Area Manager will not allow open burning to commence. If the winds above 3 miles per hour and are below 15 miles per hour and there is no precipitation at the time of ignition, the operations will commence. Once the pan is loaded with waste the waste cannot be removed safely from the pan. If precipitation occurs after the pans have been loaded but before they are ignited, then the pans will be covered and no open burning will occur. If precipitation occurs unexpectedly during firing of a pan, the materials will be inspected after the burn is complete. Any unburned materials will be reworked into a new pan and will be refired. The burning ground will not intentionally operate during precipitation nor will operators be working if there is a thunderstorm in the local vicinity of the burning ground.

III.C.5. Prior to each burn, the pans and the surrounding area from the previous day's operations are visually inspected for material that may not have been consumed in the previous burn. If the operator sees any unburned material, the residue is collected and is placed on another burning pan for treatment. Further information on facility inspections is provided in Attachment III.E.

After this initial inspection, the pans are loaded with waste selected from the plant's less than 90-day accumulation areas. The criteria for selection are the accumulation start date and the theoretical burn rate of the material (to ensure that fast burning material is not covered by slower burning material).

III.C.6. The arming circuit used for burn ignition is checked for continuity and the trigger device is placed in the pan and covered with dry propellant. The operators then proceed as follows:

- Assure that all personnel are away from the burning pan area.
- Hook cables across upper roadway.
- Record the following information on DUP-7714, or current update, just before firing:

  (1) Sky condition (Use Codes) – AWAS

  (2) Visibility – AWAS

  (3) Temperature (Deg. F)

  (4) Wind Speed (Shall not be below 3 mph or above 15 mph)

  (5) Wind Direction

  (6) Area Operational (Yes/No/NMTB*)

  (7) Cloud Ceiling Height

  (8) Type of material Destroyed

  (9) Remarks (Chance of Precipitation should not be >50%)

Turn DUP-782 (or current update), "Tracking Record and Disposition of Waste Propellant or Nitro-Cotton," into area office to file.

III.C.7. The burning ground pans have a waste capacity of 1000 pounds each, for material that will produce a mass fire, not an explosion or a detonation. To ensure the safety of the few boaters that use the river in front of the OBG, Radford posts a person across the river approximately 200 feet upstream from Pad Number 8. This observer has visibility of the entire stretch of the river adjacent to the OBG from this vantage point. The Waste will not be ignited if a person is observed on the river shoreline between these 2 observation posts. The observers and the burning ground operators turn on rotating red lights located along the river in front of the burning ground to advise boaters that the burning ground is about to begin operations. In addition, a siren is sounded for approximately 10 seconds, and the operator makes the following announcement twice over a loud speaker:

"Warning, the Burning Ground of the Radford Army Ammunition Plant is about to begin Burning Operations. Evacuate the River Area immediately."

The burning pans are not ignited until assurance is received from both observers that the area between them is clear. If anyone is observed within these locations, they shall be verbally warned to move from the area. Burning shall not be performed until the area is clear.

The wastes are ignited only after the operator is sure that no one is on the river and that all of the procedures for ignition have been followed.

III.D. ASH/RESIDUE MANAGEMENT

Operators wait at least one-half hour after a burn before approaching a pan to examine the residue. Generally, the morning following the burning operations, the operator inspects the pans that were used the previous day. Any inert residue is collected and placed in a container at the OBG less than 90 day accumulation area.

Prior to placing the residue into the accumulation container a grab sample of residue is obtained and placed in a separate small container. Each day that ash residue is collected in the pans, a small sample is taken and added to the composite ash sample container. After approximately day 60 of accumulation, the samples are thoroughly mixed and sent to the RFAAP Technical Analytical Laboratory to evaluate the reactivity and to test for oxidizing compounds. On an annual basis, the facility performs a full TCLP analysis of the ash composite for regulated metals and for underlying constituents of concern to make sure that the waste meets Land Disposal Restrictions (reference 40 CFR § 268.48).

Upon receiving the results from the RFAAP Technical Analytical Laboratory the waste is shipped to a permitted landfill for disposal in accordance with all Virginia and federal laws and regulations.

In addition to providing information required for proper disposal and shipping of the residue, the reactivity analyses described above are used to demonstrate compliance with 40 CFR § 264.13, which requires the facility to provide a demonstration of the effectiveness of the thermal treatment process.

III.E. INSPECTION SCHEDULE AND PROCEDURES

The Permittee shall inspect the OBG in accordance with the inspection schedule set out in Attachment II.D.

III.F. MONITORING REQUIREMENTS

The Permittee shall conduct monitoring of the wastes treated at the OBG in accordance with Attachment II.B.

The Permittee shall conduct ground-water monitoring at the OBG in accordance with Permit Modules IV, V, and/or VI as appropriate.

The Permittee shall conduct soil monitoring at the OBG in accordance with the Soil Monitoring Program provided in Attachment II.C.

III.G. FACILITY MODIFICATION AND EXPANSION

Permit Modification – Virginia DEQ reserves the right to modify this Permit in accordance with 40 CFR § 270.41.

Permit Modification at the Request of the Permittee Modifications or expansions of the facility shall be accomplished in accordance with 40 CFR § 270.42.

III.H. RECORDKEEPING AND REPORTING

The Permittee shall comply with all applicable procedures for recordkeeping and reporting requirements provided in 40 CFR §§ 264.73 (b) and 268.7, along with, the Inspection Schedule presented in Attachment II.D. Also refer to III.C.7 and Section II.I.

III.H.1. WASTE MINIMIZATION PLAN

The Waste Minimization Plan is included in Attachment III.A. The plan was designed to address RFAAP continued efforts to reduce the amount of hazardous waste sent to the OBG.

FIGURE III-1: AREA MAP

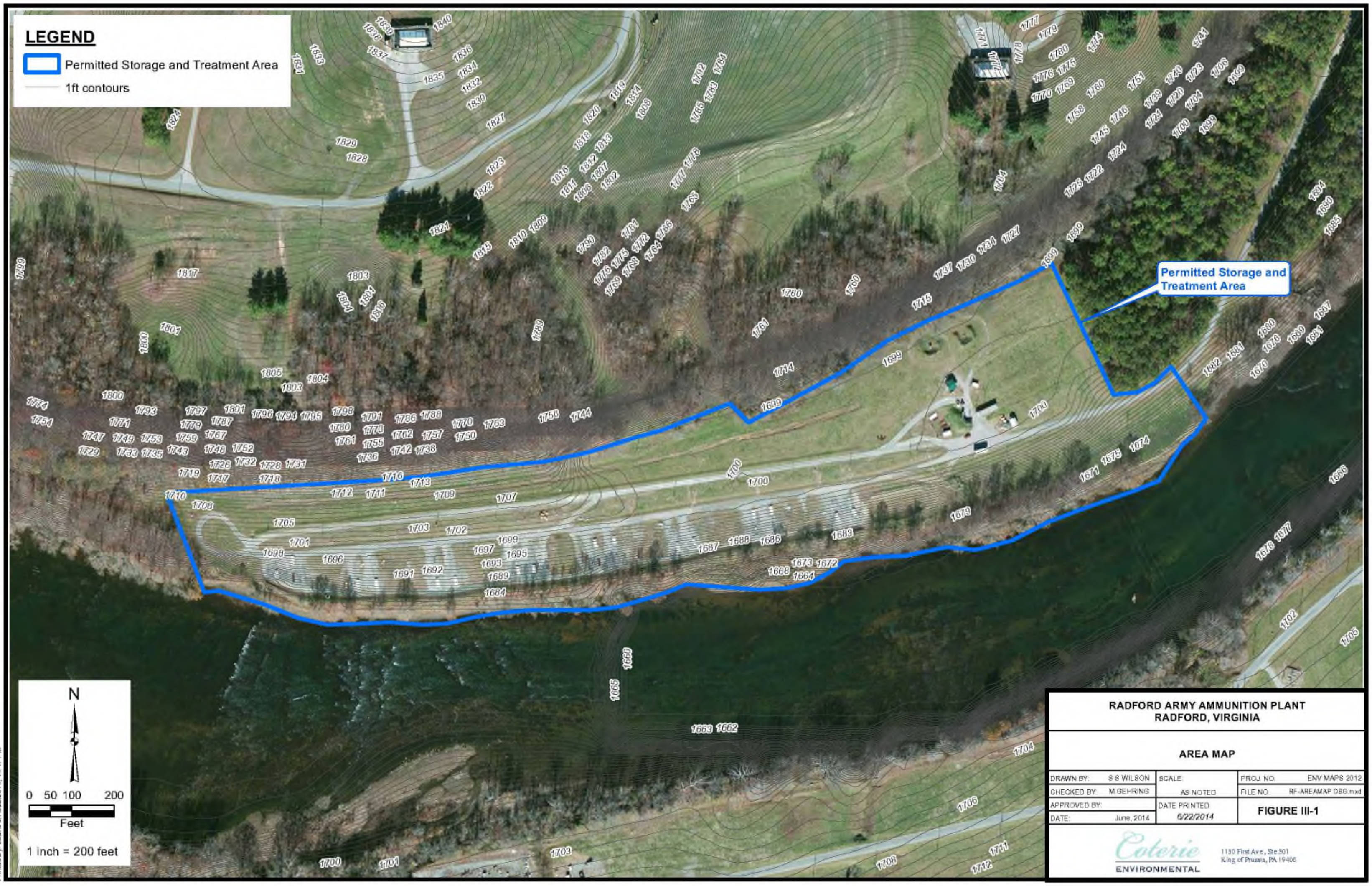


FIGURE III-2: PAN PROFILE

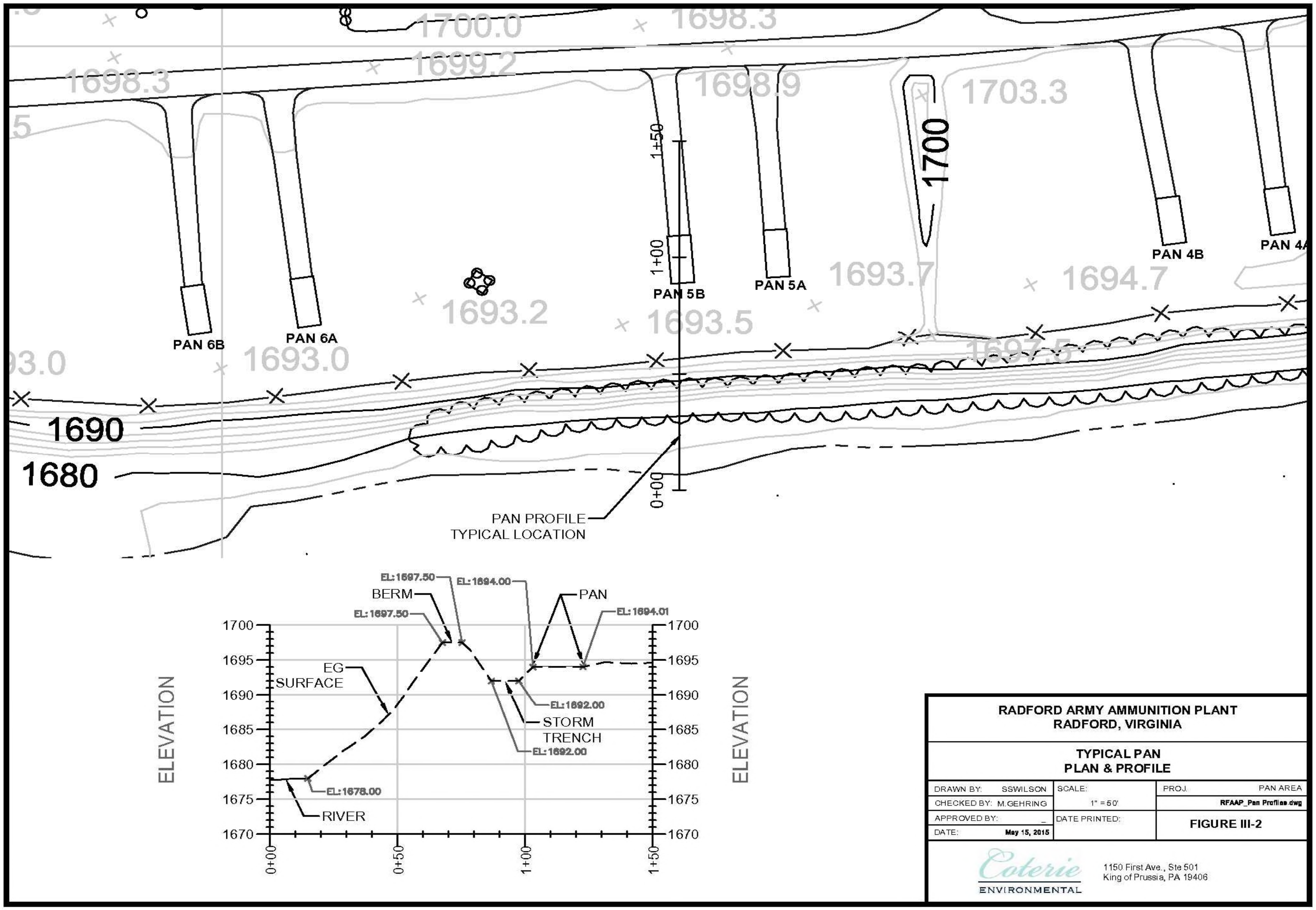
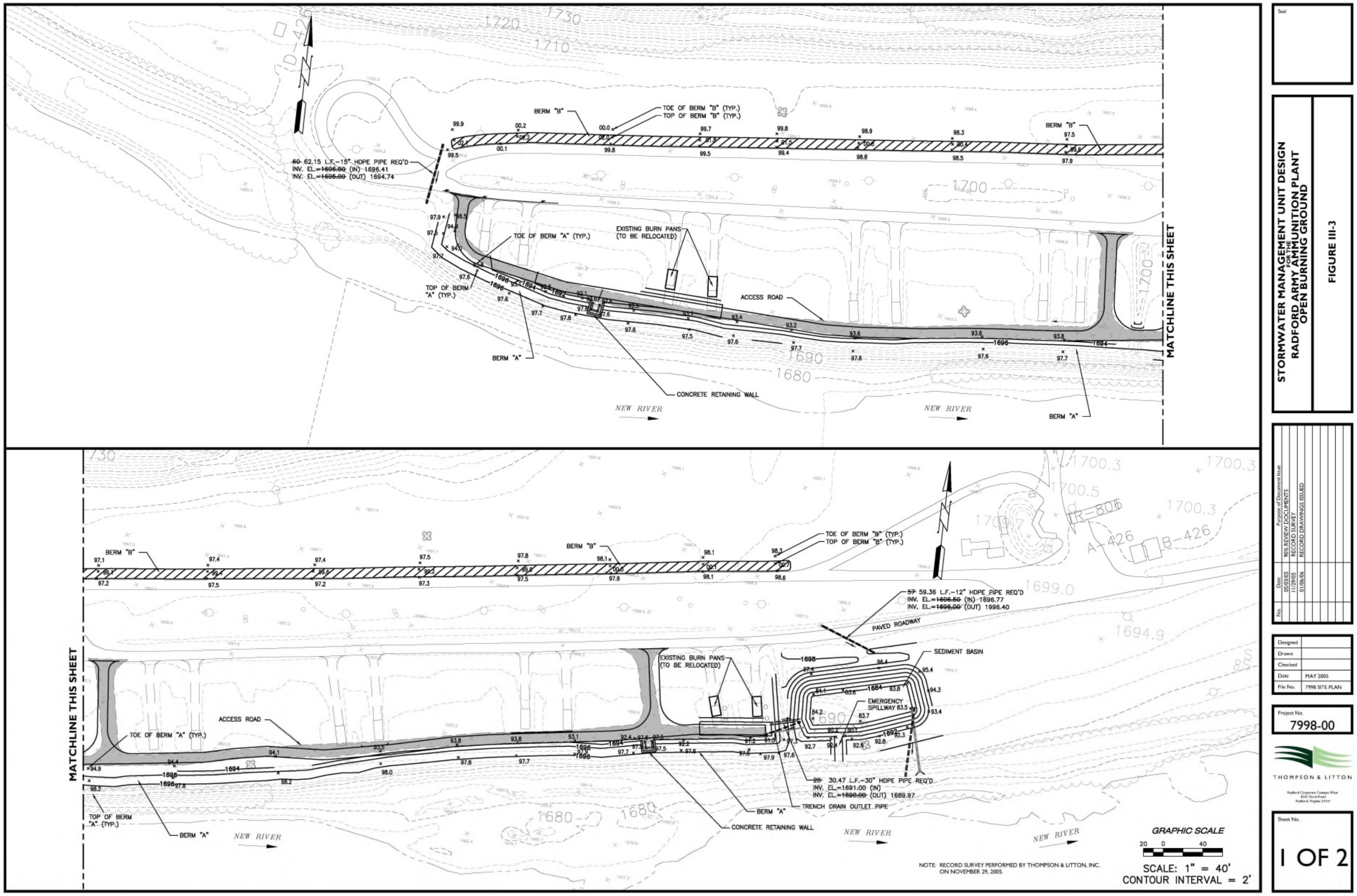


FIGURE III-3: STORMWATER MANAGEMENT DESIGN



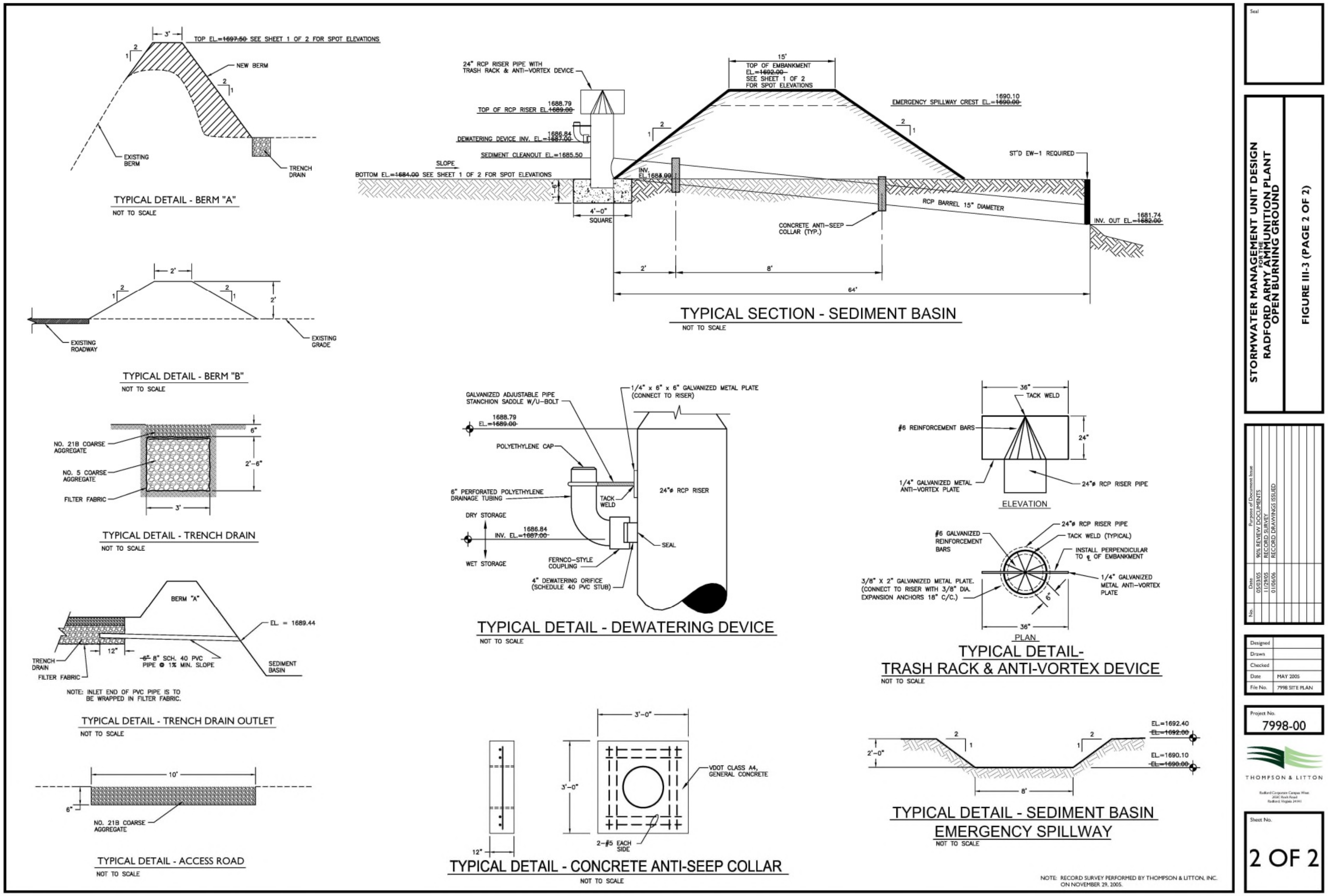

TOP EL.=1697.50 SEE SHEET 1 OF 2 FOR SPOT ELEVATIONS
NEW BERM
EXISTING BERM
TRENCH DRAIN
TYPICAL DETAIL - BERM "A"
NOT TO SCALE
24" RCP RISER PIPE WITH TRASH RACK & ANTI-VORTEX DEVICE
TOP OF RCP RISER EL.
DEWATERING DEVICE INV. EL.
SEDIMENT CLEANOUT EL.=1685.50
SLOPE
BOTTOM EL.=1684.00 SEE SHEET 1 OF 2 FOR SPOT ELEVATIONS
TOP OF EMBANKMENT EL.=1692.00 SEE SHEET 1 OF 2 FOR SPOT ELEVATIONS
EMERGENCY SPILLWAY CREST EL.
ST'D EW-1 REQUIRED
RCP BARREL 15" DIAMETER
CONCRETE ANTI-SEEP COLLAR (TYP.)
INV. OUT EL.
4'-0" SQUARE
64'
TYPICAL SECTION - SEDIMENT BASIN
NOT TO SCALE
EXISTING ROADWAY
EXISTING GRADE
TYPICAL DETAIL - BERM "B"
NOT TO SCALE
NO. 21B COARSE AGGREGATE
NO. 5 COARSE AGGREGATE
FILTER FABRIC
TYPICAL DETAIL - TRENCH DRAIN
NOT TO SCALE
GALVANIZED ADJUSTABLE PIPE STANCHION SADDLE W/U-BOLT
1/4" x 6" x 6" GALVANIZED METAL PLATE (CONNECT TO RISER)
POLYETHYLENE CAP
6" PERFORATED POLYETHYLENE DRAINAGE TUBING
TACK WELD
24"ø RCP RISER
DRY STORAGE
WET STORAGE
SEAL
FERNCO-STYLE COUPLING
4" DEWATERING ORIFICE (SCHEDULE 40 PVC STUB)
TYPICAL DETAIL - DEWATERING DEVICE
NOT TO SCALE
#6 REINFORCEMENT BARS
TACK WELD
1/4" GALVANIZED METAL ANTI-VORTEX PLATE
24"ø RCP RISER PIPE
ELEVATION
#6 GALVANIZED REINFORCEMENT BARS
INSTALL PERPENDICULAR TO ℄ OF EMBANKMENT
3/8" X 2" GALVANIZED METAL PLATE. (CONNECT TO RISER WITH 3/8" DIA. EXPANSION ANCHORS 18" C/C.)
PLAN
TYPICAL DETAIL- TRASH RACK & ANTI-VORTEX DEVICE
NOT TO SCALE
BERM "A"
EL. = 1689.44
TRENCH DRAIN
FILTER FABRIC
8" SCH. 40 PVC PIPE @ 1% MIN. SLOPE
SEDIMENT BASIN
NOTE: INLET END OF PVC PIPE IS TO BE WRAPPED IN FILTER FABRIC.
TYPICAL DETAIL - TRENCH DRAIN OUTLET
NOT TO SCALE
NO. 21B COARSE AGGREGATE
TYPICAL DETAIL - ACCESS ROAD
NOT TO SCALE
VDOT CLASS A4, GENERAL CONCRETE
2-#5 EACH SIDE
TYPICAL DETAIL - CONCRETE ANTI-SEEP COLLAR
NOT TO SCALE
TYPICAL DETAIL - SEDIMENT BASIN EMERGENCY SPILLWAY
NOT TO SCALE
NOTE: RECORD SURVEY PERFORMED BY THOMPSON & LITTON, INC. ON NOVEMBER 29, 2005.
STORMWATER MANAGEMENT UNIT DESIGN FOR THE RADFORD ARMY AMMUNITION PLANT OPEN BURNING GROUND
FIGURE III-3 (PAGE 2 OF 2)
MAY 2005
7998 SITE PLAN
7998-00
THOMPSON & LITTON
2 OF 2

FIGURE III-4: PAN AND COVER DETAILS

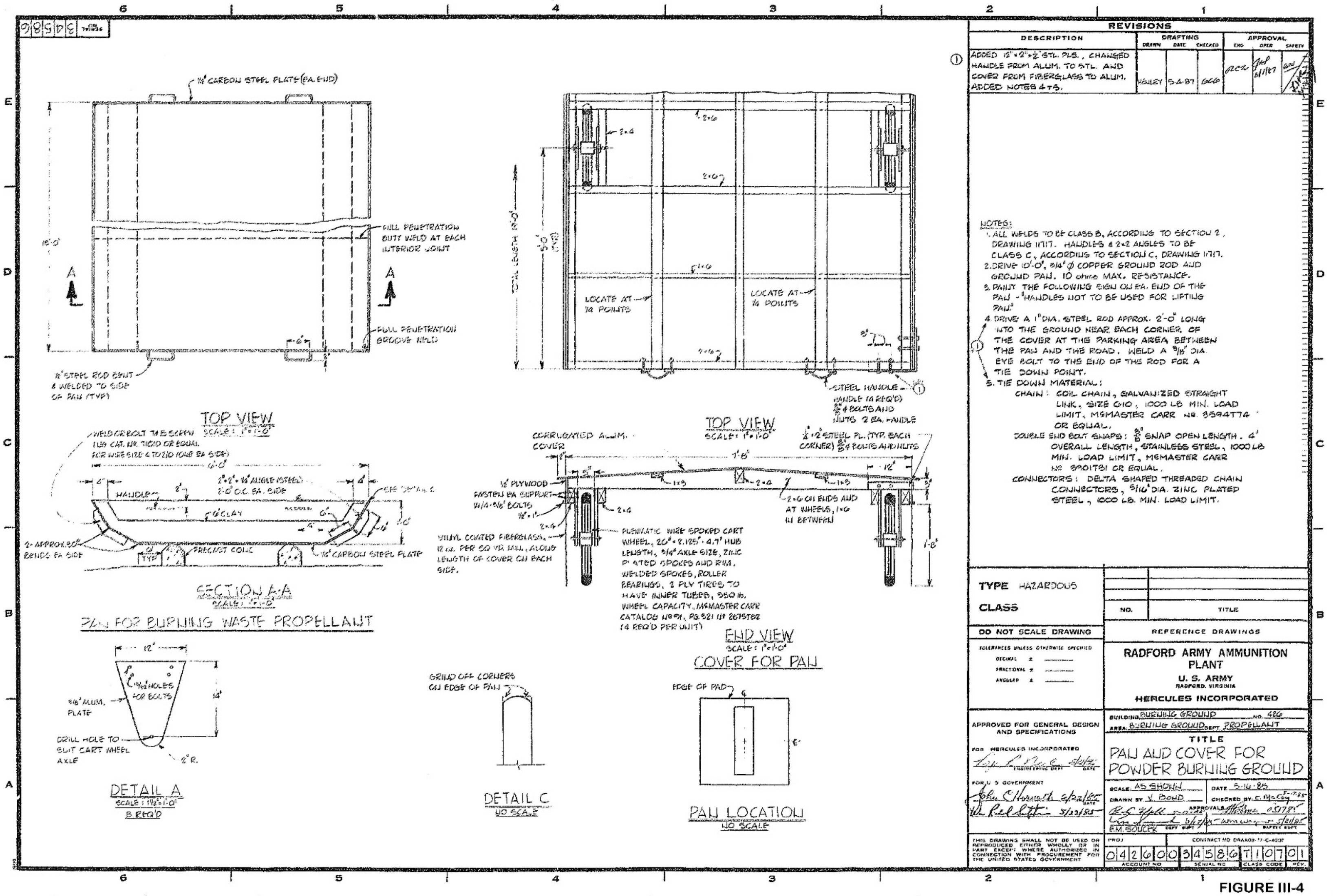


FIGURE III-5: PAN AND COVER DETAILS

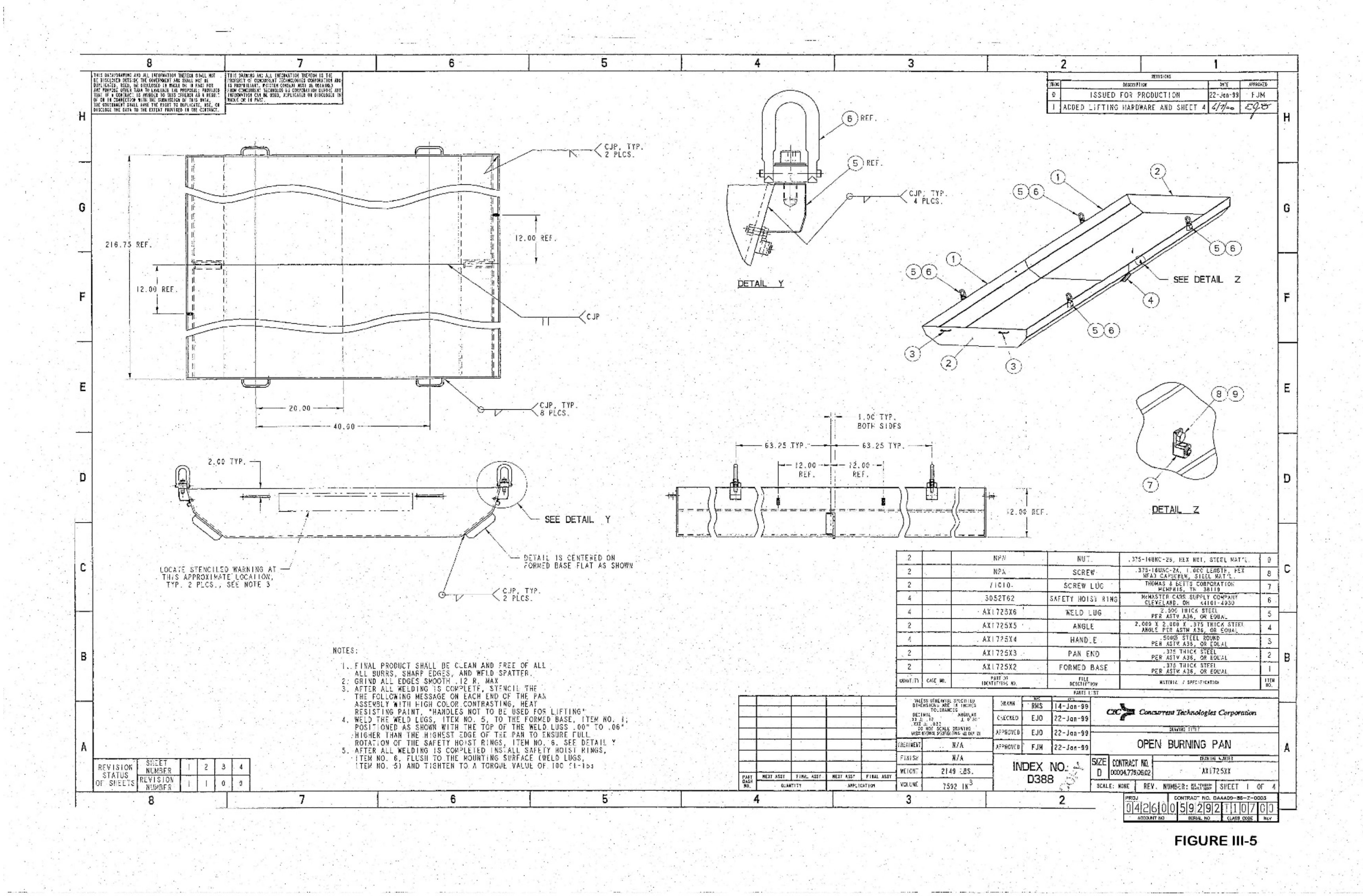


FIGURE III-6: PAN AND COVER DETAILS

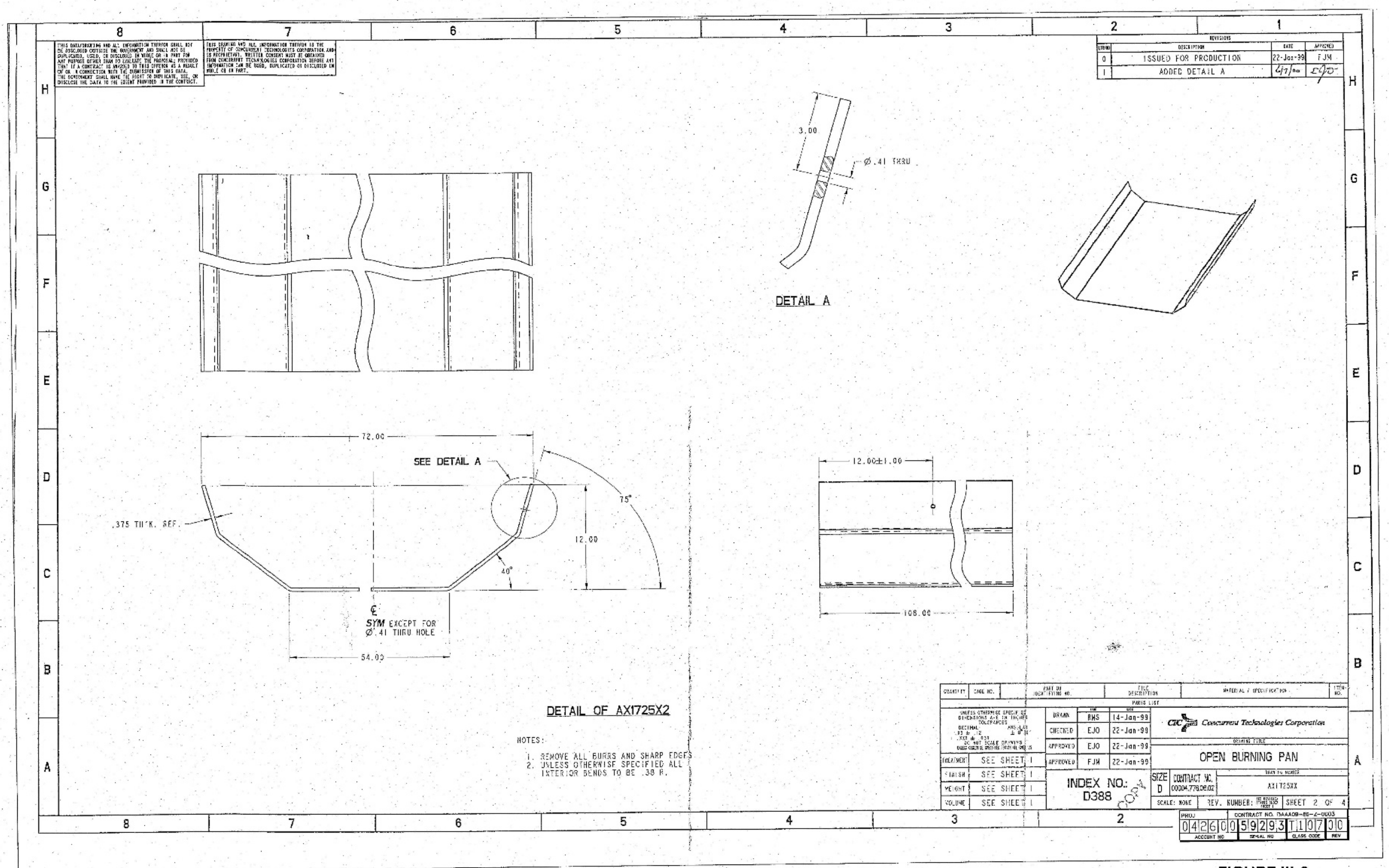


FIGURE III-6

FIGURE III-7: PAN AND COVER DETAILS

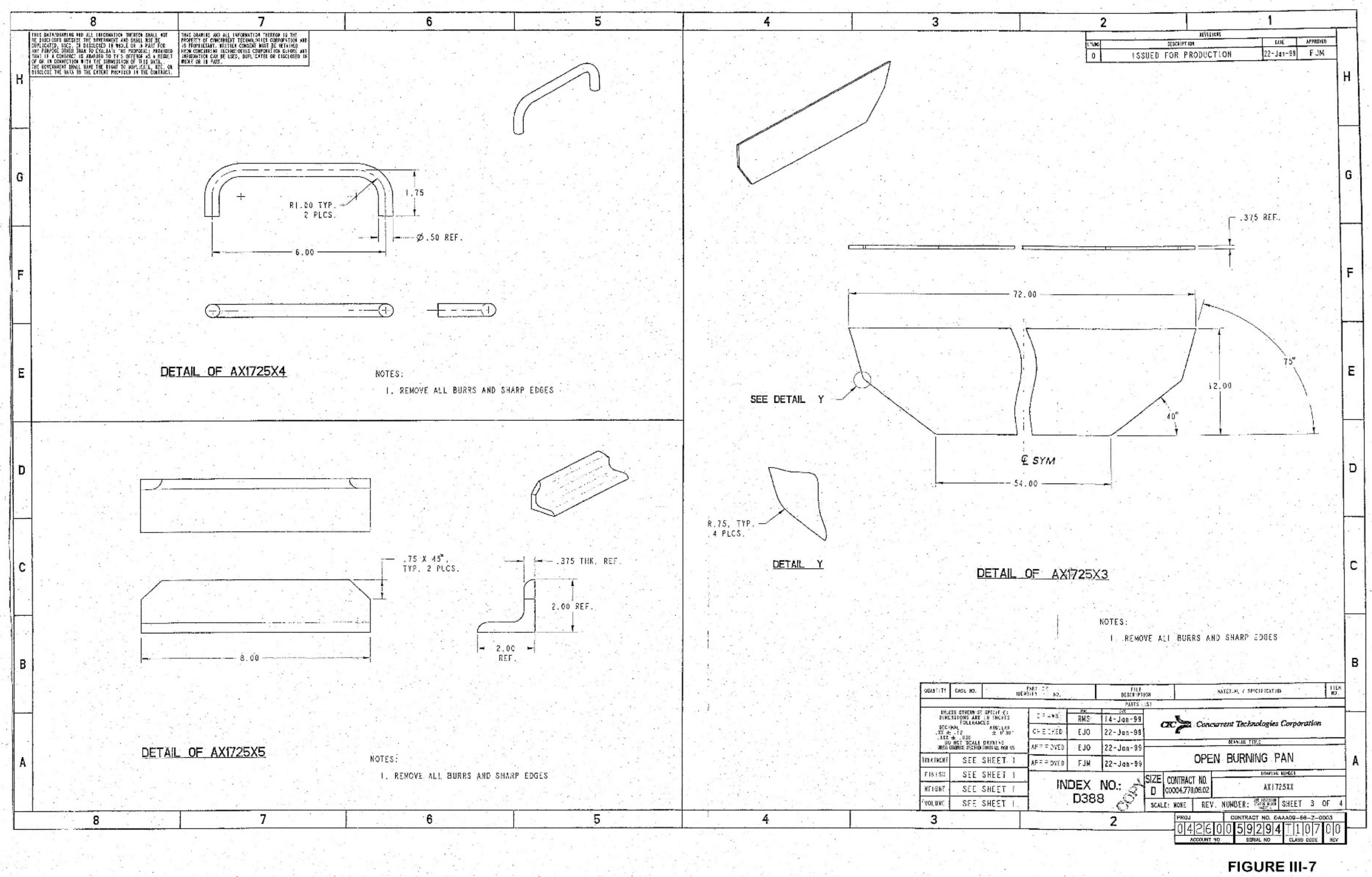


FIGURE III-8: PAN AND COVER DETAILS

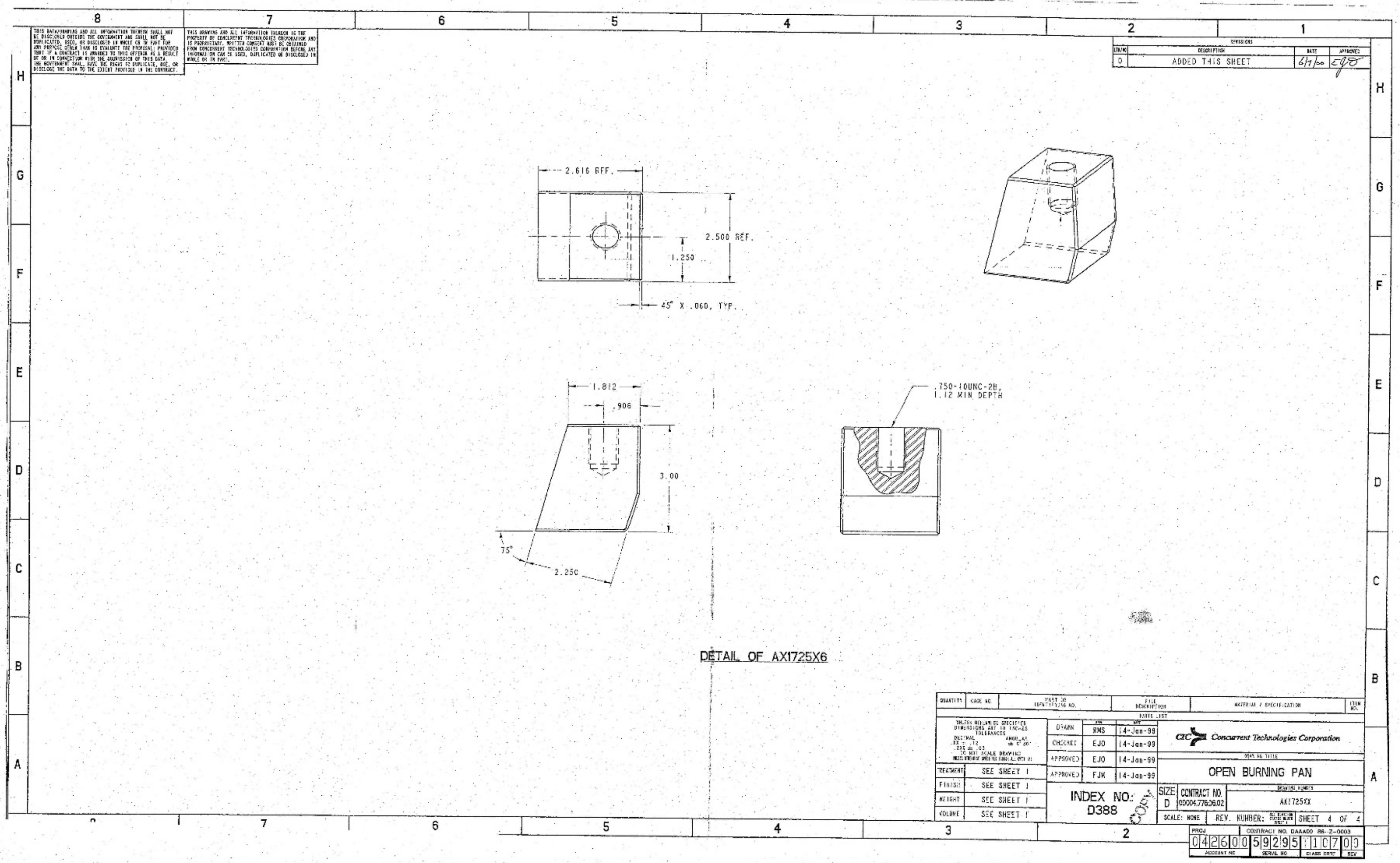


FIGURE III-8

MODULE III – LIST OF ATTACHMENTS

The following Attachments are incorporated, in their entirety, by reference into this Permit. These incorporated attachments are enforceable conditions of this Permit. Some of the documents contain excerpts from the Permittees' Hazardous Waste Permit Application. The Department has, as deemed necessary, modified specific language excerpted from the permit application. Additional modifications are prescribed in the Permit Conditions (Modules I through VII), and thereby supersede the language of the attachments. Facility operations shall be in accordance with the contents of the Attachments and this Permit.

Attachment III.A – Waste Minimization Plan

ATTACHMENT III.A - WASTE MINIMIZATION PLAN

Radford Army Ammunition Plant (RFAAP) has developed a waste minimization program aimed at reducing the amount of energetic waste processed at the open burning ground (OBG) as well as reducing the overall amount of waste generated on the facility.
The following summarizes the waste minimization goals for the facility:

1. RFAAP will continue to target redirection of waste materials from the OBG either back into the process or to other treatment solutions that provide control of air pollutant emissions. In doing this, RFAAP will target maintaining the proportion of OBG waste to total waste generated onsite at or below 40 percent.

2. RFAAP will reduce the amounts of energetic waste containing lead generated on the facility and in turn reduce the amount of energetic waste going to the OBG.

3. RFAAP will continue to evaluate methods to modernize their operations and waste treatment technologies and will continue to track the development of alternative technologies to supplement or eliminate the use of the OBG.

Each of these goals is implemented on a program, production, and individual operation basis through a variety of methods. For example, some of these goals are integrated into Environmental Management System (EMS) program objectives. Others, such as specific waste reduction or redirection efforts, are implemented on a facility wide and individual operation basis in cooperation with the operations and environmental management teams and the area managers and engineers. In addition, RFAAP's modernization group is charged with finding new and innovative ways to modernize and improve plant processes and operations. Many of these projects are associated with the government's pollution prevention (P2) efforts.

Metrics for waste generation are maintained by the Environmental Department and are continuously tracked and evaluated. In focusing on this priority, RFAAP has successfully reduced the overall amount of waste going to the OBG by nearly 50 percent from 2017 to 2020.

MODULE IV - DETECTION MONITORING

IV.A. HIGHLIGHTS

The Open Burn Ground (OBG) at the Radford Facility Army Ammunition Plant (RFAAP) is a waste propellant open burning ground. The OBG is located on the southeastern end of the Horseshoe Area on the flood plain of the New River and consists of eight above-ground burning assemblies.

Groundwater monitoring has been conducted at the OBG since 1992. The OBG was in Interim Status, and groundwater monitoring activities were conducted quarterly in accordance with the requirements of 40 CFR § 265. In October 1999, the "Groundwater Quality Assessment Report" for the OBG was submitted to the Virginia Department of Environmental Quality (DEQ/Department). A groundwater monitoring list was included in the report. The monitoring list consisted of a subset of the constituents listed in 40 CFR 264 Appendix IX that previously had been detected in the groundwater and/or that would be reasonably expected to be in or derived from the waste burned at OBG.

In September 2005, DEQ issued the original *Permit for the Treatment of Hazardous Waste by Open Burning* (Permit) for the OBG (effective on October 28, 2005). However, beginning in Fourth Quarter 2003, quarterly groundwater monitoring was conducted in accordance with the "Detection Groundwater Monitoring Program for the Open Burning Ground", dated September 2003, in anticipation of receipt of the Permit.

Exceedances of established background values for carbon tetrachloride and perchlorate during the Fourth Quarter 2005 Detection monitoring event prompted the need to develop a Compliance Monitoring program in accordance with the requirements of the Permit. As a result, during First Quarter 2006, all wells were sampled for the full Appendix IX constituent list and the hazardous constituents detected formed the basis for the Compliance Monitoring List for the OBG Unit.

The Permittee submitted a revised Compliance Monitoring Plan with proposed Groundwater Protection Standards (GPSs) to the Department and the first semiannual groundwater Compliance Monitoring event for 2007 was conducted in accordance with the revised Compliance Monitoring Plan during Second Quarter 2007.

During semiannual groundwater Compliance Monitoring, concentrations of at least two constituents, perchlorate and carbon tetrachloride, exceeded their respective GPSs at one or more downgradient well(s). As a result, according to 40 CFR § 264.91(a)(2), the Permittee implemented a Corrective Action Program (CAP) under 40 CFR § 264.100.

Permit Module VI – *Corrective Action and Groundwater Monitoring Program*, was approved by the DEQ in the Class 3 Hazardous Waste Permit Modification dated September 27, 2011. This module was revised on Feb 22, 2012, November 9, 2013, June 12, 2014 and with this permit module.

Currently, groundwater is conducted semiannually in accordance with the Corrective Action and Groundwater Monitoring Program.

This permit module, Module IV – Detection Monitoring, presents requirements of the Detection Monitoring Program and includes the Sampling and Analyis Plan (SAP) for the facility which is incorporated by reference in the Compliance Monitoring and Corrective Action Monitoring permit modules.

IV.B. DETECTION MONITORING REQUIREMENTS

IV.B.1. The Detection Monitoring Program requires semiannual monitoring of a background well and at downgradient wells detailed below. Static groundwater elevation will be measured at all wells specified in Permit Section IV.B.1.a.during each sampling event.

a. Groundwater beneath the OBG shall be monitored with one background groundwater monitoring well and three downgradient point of compliance wells located as specified on the map presented in Figure IV-1. Monitoring well 13MW2 is the background well for the OBG and monitoring wells 13MW3, 13MW4, and 13MW7 are the point of compliance wells.

b. In addition to the wells specified in Permit Condition IV.B.1.a., wells 13MW5, 13MW6 and 13MW8 will serve as plume monitoring wells downgradient of the unit to determine whether continued migration of constituents of concern has occurred.

c. Well 13MW1 will be used as a piezometer to measure static groundwater elevations during each sampling event.

IV.B.2. The compliance point wells and background well will be sampled in accordance with the Sampling and Analysis Plan (Attachment IV.A) and the following schedule:

a. The background well and downgradient point of compliance and plume monitoring wells specified in Permit Section IV.B.1. will be sampled at least semiannually for the constituents listed in Attachment IV.B. Samples for each constituent will be collected using the methods specified in Attachment IV.A and analyses shall be obtained using the EPA SW-846 Methods specified in Attachment IV.B. Additionally, the laboratory must be accredited for the analytical method, matrix and target analyte by the Virginia Environmental Laboratory Accreditation Program (VELAP).

b. Alternate methods may be approved by the Director, provided the request is in writing and submitted 30 days prior to the sampling event. Proposed alternate methods must achieve the same Limit of Quantitation (or lower) as the specified method and meet the requirement of Attachment IV.A Section III.C. In addition, the performing laboratory must have VELAP accreditation for the alternative method, matrix and analyte.

IV.C. WELL LOCATION, INSTALLATION AND CONSTRUCTION

The Permittee shall maintain the groundwater monitoring system as specified below:

IV.C.1. The Permittee shall maintain groundwater monitoring wells 13MW1, 13MW2, 13MW3, 13MW4, 13MW5, 13MW6, 13MW7, and 13M8 at the locations specified on the map presented in Figure IV-1. If additional monitoring wells are required they shall be installed and sampled in accordance with the requirements of 40 CFR § 264.97.

a. Boring logs for monitoring wells 13MW1, 13MW2, 13MW3, 13MW4, 13MW5, 13MW6, 13MW7, and 13MW8 are included as Attachment IV.A, Appendix 8.

b. Monitoring well design and construction details for monitoring wells 13MW1, 13MW2, 13MW3, 13MW4, 13MW5, 13MW6, 13MW7, and 13MW8 are included as Attachment IV.A, Appendix 8.

IV.C.2. All groundwater monitoring wells required by this permit shall be maintained in conformance with the following:

a. The groundwater monitoring system must yield samples in the background well that represent the quality of the background groundwater unaffected by leakage from any regulated unit, and from downgradient wells that yield samples representative of the quality of groundwater passing the compliance point.

b. The number and location of monitoring wells must be sufficient to identify and define all logical release pathways from the regulated unit to the uppermost aquifer based on site specific hydrogeologic characterization.

IV.C.3. The Permittee shall maintain the monitoring wells identified in Permit Section IV.C.1. of the Permit in accordance with the plans and specifications presented in Attachment IV.A, Appendix 8.

IV.C.4. The Director must approve the addition or removal of all monitoring wells prior to installation or decommissioning.

a. All wells deleted from the monitoring program shall be plugged and abandoned in accordance with Attachment IV.A, Appendix 7. Well plugging methods and abandonment certification shall be submitted to the Director within thirty (30) days from the date the wells are removed from the monitoring program.

b. All monitoring wells added to the existing groundwater monitoring system described in Permit Section IV.C.1. must be constructed in accordance with the requirements of EPA's *RCRA Groundwater Monitoring Technical Enforcement Guidance Document* (TEGD) and approved by the Department (Attachment IV.A, Appendix 5).

IV.D. INDICATOR PARAMETERS AND MONITORING CONSTITUENTS

IV.D.1. The Permittee shall monitor all wells as described in Permit Section IV.C.1 for all parameters and constituents specified in Attachment IV.B.

IV.D.2. Background groundwater concentrations for parameters and constituents established subsequent to Permit issuance are listed in Attachment IV.C..

IV.D.3. For those parameters and constituents in Attachment IV.B for which no accurate background values are established at the time the Permit is issued (or for constituents added to the monitoring program during the life of the Permit), the Permittee shall establish accurate background values in accordance with the procedures in Attachment IV.A, Appendix 6.

a. Background groundwater quality for a new monitoring parameter or constituent shall be based on data from quarterly sampling of 13MW2 obtained over the course of one year. Existing data may be used to establish background concentrations provided it is of sufficient quality with approval from DEQ.

IV.E. SAMPLING AND ANALYSIS PROCEDURES

The Permittee shall use the following techniques and procedures when obtaining and analyzing samples from the groundwater monitoring wells described in Permit Sections IV.C.:

IV.E.1. Groundwater monitoring samples shall be collected using the techniques described in Attachment IV.A.

IV.E.2. Samples shall be preserved, packed, and shipped off-site for analysis in accordance with the procedures specified in Attachment IV.A.

IV.E.3. Samples shall be analyzed in accordance with the procedures specified in Attachment IV.A using the methods prescribed in Attachment IV.B. Additionally, the laboratory must have current VELAP accreditation for the analytical method, matrix and target analyte.

IV.E.4. Samples shall be tracked and controlled using the COC procedures specified in Attachment IV.A.

IV.E.5. The Permittee must determine the concentration of hazardous constituents and parameters listed in Attachment IV.B in the groundwater at the compliance point at least semiannually.

IV.F. ELEVATION OF THE GROUNDWATER SURFACE

IV.F.1. The Permittee shall determine the groundwater surface elevation at each monitoring well (13MW1, 13MW2, 13MW3, 13MW4, 13MW5, 13MW6, 13MW7, and 13MW8) each time groundwater is sampled in accordance with Attachment IV.A.

IV.F.2. The Permittee shall report the surveyed elevation of any additional or replacement monitoring well(s) when installed with as-built drawings. The total depth of wells and the elevation of the following shall be recorded: top of the casing, ground surface and/or apron elevation, and the top of the protective casing.

IV.G. STATISTICAL PROCEDURES

IV.G.1. When evaluating the monitoring results in accordance with Permit Section IV.H., the Permittee shall use the procedures in Attachment IV.A, Appendix 6.

a. If the appropriate statistical test (specified in Attachment IV.A, Appendix 6 and/or approved by the Director) indicates that the difference between the established background (or upgradient well concentration) and the downgradient well concentration is significant, the Permittee may resample within thirty (30) days of receipt of original laboratory data, not to exceed sixty days (60) from the date of original sample collection.

b. If the second round of analyses specified in Permit Section IV.H.1.a. indicates that the difference is significant, the Permittee shall conclude that a statistically significant change has occurred.

IV.H. MONITORING PROGRAM AND DATA EVALUATION

The Permittee shall determine groundwater quality as follows:

IV.H.1. The Permittee shall collect, preserve, and analyze groundwater samples pursuant to Permit Section IV.E.

IV.H.2. For each hazardous constituent identified in Permit Section IV.D., the Permittee shall determine whether there is statistically significant evidence of an increase for any parameter or chemical constituent each time the concentration of hazardous constituents is monitored in groundwater at the compliance point. In determining whether such an increase has occurred, the Permittee shall compare the groundwater quality at each monitoring well specified in Permit Section IV.B. of the Permit, to the background concentration for that constituent, in accordance with the procedures specified in Attachment IV.A, Appendix 6, if appropriate. These determinations shall be made each time groundwater monitoring occurs.

IV.H.3. The Permittee shall determine the groundwater flow rate and direction in the uppermost aquifer at least annually.

IV.H.4. The Permittee shall perform the statistical evaluation required by Permit Section IV. G. within 30 days from the date the final analytical results are available from the laboratory performing the analyses.

IV.H.5. Pursuant to Permit Section IV.G., if the Permittee determines there is a statistically significant increase above the concentration limits specified in Attachment IV.C for the constituents specified in Permit Section IV.D. (indicating that the background concentration is being exceeded), at any monitoring well at the point of compliance, the Permittee shall:

a. Notify the Department in writing within seven (7) days of the determination. The notification must specify what parameters or constituents have shown evidence of a statistically significant increase

b. Immediately sample the groundwater in all monitoring wells for the constituents listed in Appendix IX of CFR 40 Part 264.

c. For any Appendix IX constituents detected, the Permittee may resample within thirty (30) days from the date of the final laboratory report and repeat the analysis for those constituents that are present above the laboratory detection limit. If the results of the second analysis confirm the initial results, the detected Appendix IX constituents will form the basis for Compliance Monitoring.

d. If the second analysis (Permit Section IV.H.5.c.) confirms the presence of constituents not included in the Detection Monitoring program or if the Permittee chooses not to resample, the Permittee shall establish the background values for each additional 40 CFR Part 264 Appendix IX constituent found in the groundwater pursuant to Permit Sections IV.D.2 and IV.D.3.

e. Within ninety (90) days, the permittee shall submit to the Director a Permit modification request to establish a Compliance Monitoring Program [40 CFR § 264.98(h)]. The application must include the following:

i. An identification of the concentration of each CFR 40 Part 264 Appendix IX constituent found in the groundwater at each monitoring well at the compliance point.

ii. Proposed changes to the groundwater monitoring system necessary to meet the requirements of compliance monitoring as described in 40 CFR § 264.99.

iii. Proposed changes to the monitoring frequency, sampling and analysis procedures, or methods or statistical procedures used at the facility necessary to meet the requirements of compliance monitoring as described in 40 CFR § 264.99.

iv. For each hazardous constituent detected at the compliance point, a proposed concentration limit, or a notice of intent to seek an alternate concentration limit for a hazardous constituent.

IV.H.6. If the Permittee determines, pursuant to Permit Condition IV.H.5., that there is a statistically significant increase above the background concentration for the constituents specified in Attachment IV.B, the Permittee may make a demonstration that the exceedance was due to sources other than a regulated unit or errors in sampling, analysis, evaluation, or natural variation in the groundwater.

a. The Permittee must notify the Director in writing, within seven (7) days, that a demonstration will be made.

b. The Permittee must submit a report to the Director within ninety (90) days that demonstrates that a source other than a regulated unit caused the exceedance or that the exceedance was a result of an error in sampling, analysis, or evaluation.

c. The Permittee must submit to the Director within 90 days an application for a permit modification to make any appropriate changes in the Detection Monitoring Program at the facility.

d. The Permittee must continue to monitor in accordance with the Detection Monitoring Program established under 40 CFR § 264.98.

IV.I. REPORTING AND RECORDKEEPING

IV.I.1. The Permittee shall enter all monitoring, testing, and analytical data obtained pursuant to Permit Section IV.H. in the operating record. The data must include all computations, calculated means, variances, and results of statistical tests and must be submitted to the Director, at least annually, no later than March 1 of each year.

IV.I.2. The Permittee shall submit the analytical results (Permit Section IV.H.), whenever there is a change in flow rate or direction, or evidence of a statistically significant increase in one or more of the hazardous constituents being monitored, or at least annually with the annual groundwater report.

IV.I.3. The Permittee shall submit by March 1 potentiometric contour maps depicting groundwater flow paths and the supporting groundwater elevation data to determine whether the requirements for locating the monitoring network continue to be satisfied. If the evaluation determines the existing monitoring wells no longer satisfy the requirements of 40 CFR § 264.97(a), the Permittee shall immediately submit a permit modification request to the Director to bring the monitoring system back into compliance.

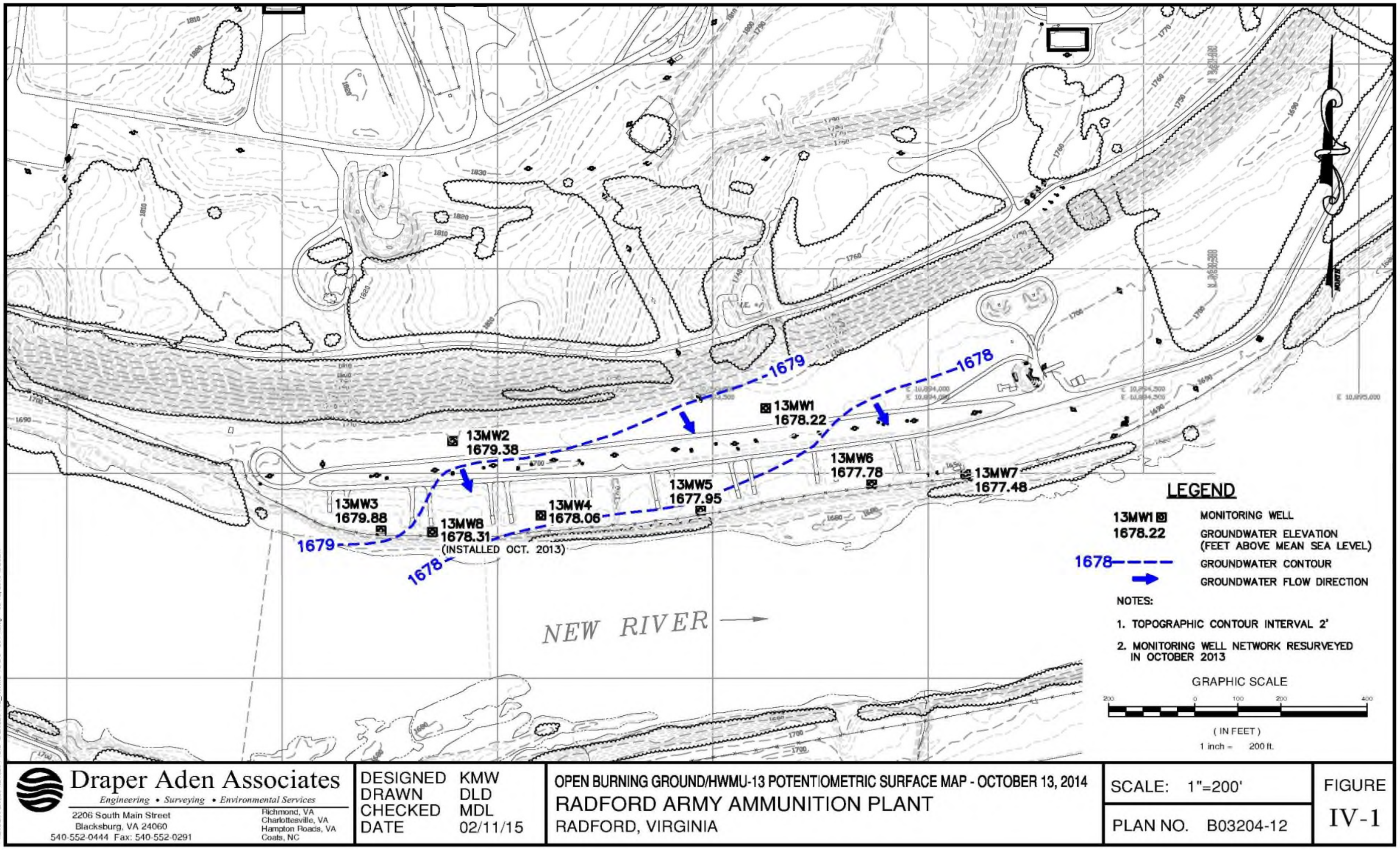
IV.J. ASSURANCE OF DETECTION

The Permittee shall demonstrate to the Director that groundwater monitoring measures necessary to achieve compliance with the monitoring requirements under 40 CFR § 264.92 are taken during the term of the Permit.

IV.K. REQUESTS FOR PERMIT MODIFICATION

IV.K.1. If the Permittee or the Director determines the Groundwater Detection Monitoring Program no longer satisfies the requirements of 40 CFR § 264.98, then the Permittee shall submit to the Director an application for a permit modification to make any appropriate changes to the program in accordance with 40 CFR § 264.98(h).

Figure IV-1: Potentiometric Surface Map



MODULE IV – LIST OF ATTACHMENTS

The following Attachments are incorporated, in their entirety, by reference into this Permit. These incorporated attachments are enforceable conditions of this Permit. Some of the documents contain excerpts from the Permittees' Hazardous Waste Permit Application. The Department has, as deemed necessary, modified specific language excerpted from the permit application. Additional modifications are prescribed in the Permit Conditions (Modules I through VII), and thereby supersede the language of the attachments. Facility operations shall be in accordance with the contents of the Attachments and this Permit.

Attachment IV.A – Groundwater Monitoring Program Sampling and Analysis Plan

Attachment IV.B – Groundwater Monitoring List

Attachment IV.C – Initial Monitoring List

ATTACHMENT IV.A- GROUNDWATER MONITORING PROGRAM SAMPLING AND ANALYSIS PLAN

TABLE OF CONTENTS

RADFORD FACILITY ARMY AMMUNITION PLANT OBG, SAMPLING AND ANALYSIS PLAN

I. SAMPLING

I.A. INTRODUCTION

40 CFR§§ 270.14(c)(5), 270.14(c)(6)(iv), and 270.14(c)(7)(vi) require a description of the sampling, analysis, and statistical comparison procedures proposed for evaluating groundwater monitoring data. In addition, 40CFR 264.97(d) and 264.97(e) outline minimum procedures and techniques for groundwater monitoring programs implemented pursuant to 40 CFR Part 264 Subpart F. These regulations require that groundwater monitoring programs include measurement, sampling, and analytical methods that accurately assess groundwater quality, and that provide early detection of hazardous constituents released to groundwater.

Groundwater beneath the OBG unit will be monitored with the one background monitoring well, and the six downgradient monitoring wells discussed below and located as specified on the map presented in Figure IV-1. Monitoring well 13MW2 is the background well. Monitoring wells 13MW3, 13MW4, and 13MW7 are the point of compliance wells for the unit. Monitoring wells 13MW5, 13MW6, and 13MW8 are the plume monitoring wells for the unit. In addition, well 13MW1 will be used as a piezometer to measure static groundwater elevations during each sampling event. 13MW1 may also be used as another source for background concentration data following approval from the Department.

The RFAAP Sampling and Analysis Plan (S&AP) is an essential part of the Detection Monitoring Program in that it stipulates the field sampling, laboratory analysis, and annual reporting methods to be utilized throughout the post-closure period. The S&AP addresses the Detection Monitoring Program requirements prescribed in the 9 VAC 20-60, 40 CFR § 264.98 and as described in this RCRA Permit.

I.B. SAMPLING FREQUENCY

Groundwater samples will be collected and analyzed semiannually at each point of compliance well and plume monitoring well for all the constituents listed in Attachment IV.B. Attachment IV.B lists the parameters, constituents, and test methods required for the Detection Monitoring Program. The Permittee may resample for any statistically significant detection within 30 days to confirm or refute the detection.

I.C. FIELD METHODS

The following activities should be performed prior to collecting ground-water samples for analysis:

- Measurement of static water level elevation;
- Detection and sampling of immiscible layers; and
- Well purging.

I.C.1. Measurement of Static Water Level Elevations:

Prior to purging each well, the static water level (and depth to the bottom of each well not equipped with dedicated pumps) will be measured to ±0.01 foot. Well measurements will be made using an electronic water level probe, referenced to a predetermined mark at the top of the well casing. The elevation of the top of the well casing (with locking cap removed) will be established to an elevation ±0.01 foot, in relation to the existing landfill datum, which will be established from a National Geodetic Vertical Datum.

The static water level measuring device used will be constructed of inert materials and will be thoroughly decontaminated prior to each use to prevent cross contamination from one well to another. The meter will be decontaminated by washing with non-phosphate detergent and rinsing three times with deionized water prior to air-drying. Decontamination fluid will be containerized and disposed of in an on-site wastewater treatment system if available or a publicly owned treatment facility with approval. Sampling members will wear clean gloves during sampling and shall change gloves between sampling each well at a minimum.

The static groundwater surface elevations obtained prior to each sampling event shall be used to create potentiometric maps to determine whether the requirements for locating the monitoring wells continues to be satisfied. If the potentiometric maps reveal that the depths, location, or number of wells is insufficient to monitor hazardous waste constituents migrating from the waste management area, new well locations and depths will be submitted to the Department for their approval and subsequent installation and monitoring. Any new wells will be installed prior to the next regularly scheduled groundwater sampling event.

Background wells and wells where constituents have not historically been detected will be measured first, followed by wells where constituents have been noted to help prevent cross-contamination. All measurements for each well will be recorded in the Groundwater Log. Measurements that do not correlate with the previous trends will be verified in the field with different measurement technology, if necessary.

I.C.2. Calculation of Static Water Volume:

The static water level and the total depth (obtained from well construction logs for wells equipped with dedicated pumps or measured in wells not equipped with dedicated pumps) will be used to calculate the volume of stagnant water in the well. For wells not equipped with dedicated pumps, measurement of the total depth will provide a check on the integrity of the well (e.g., identify siltation problems), as well as characterize changes in hydraulic conditions that may occur over time.

For wells equipped with dedicated pumps, the pump shall be pulled and the total well depth and sediment thickness shall be calculated if the data from turbidity measurements and field parameters collected during the course of purging and sampling indicate that silt has accumulated in the well. Corrective measures shall be taken prior to the next sampling event, if necessary.

I.C.3. Immiscible Layers:

Each well shall be tested for the presence of immiscible fluids prior to well evacuation and sample collection. The procedures for testing for immiscible fluid layers are as follows:

1. Air in the wellhead will be screened for organic vapors using a photo ionization detector or other appropriate device.

2. An electronic interface probe or other appropriate device capable of detecting light and dense immiscible fluids will be lowered into the well to determine the existence of any immiscible layers.

3. If immiscible layers are detected, immiscible phases will be collected prior to any purging activities.

I.C.4. Well Purging

The volume of stagnant water in each well will be determined prior to well evacuation based on the static water level, well depth, well diameter, filter pack length, and borehole diameter. Three volumes of the pore space of the screen filter pack and three volumes of the well casing will be purged prior to sampling if possible. The volume of stagnant water to be purged shall be calculated according to the formulae presented in Appendix 2 of this Attachment or the volume purged shall be sufficient when pH, temperature, and conductivity have stabilized. Purge volume calculations will be recorded in the Groundwater Log shown in Appendix 1 of this Attachment.

a. If the wells prove to be low yield, wells will be evacuated to dryness once and will be purged at a rate that will not cause recharge water to be excessively agitated. Dry and low recharge rates will be noted in the field observations.

b. All purge water will be containerized and disposed of in an on-site wastewater treatment system if available or a publicly owned treatment facility with approval.

When micropurging techniques are utilized, EPA guidance shall be followed (EPA/540/S-95/504). Dedicated bladder pumps shall be placed with their input at the midway point of the screened interval. Flow rates should be low enough to minimize drawdown of the system. Water quality indicator parameters are used to determine purging needs. In-line flow cells are used to continuously monitor pH, specific conductance, temperature, etc. Purging is considered complete when indicator parameters have stabilized. Water levels and pumping rates will be monitored and recorded in addition to any adjustments.

The stabilization parameters of pH, temperature, conductivity, dissolved oxygen, and oxidation/reduction potential will be measured at the start and end of sampling as a check on the stability of the water sampled over time. A minimum of four (4) replicate measurements of the stabilization parameters will be recorded in the Groundwater Log shown in Attachment 1 for each groundwater sample. In addition to the start and end measurements, additional measurements will be taken every three minutes. All purging equipment that has been or will be in contact with groundwater should be decontaminated prior to use (See Section I.C.6.). Decontamination water should be stored in appropriate containers and disposed of per I.C.4.b.

I.C.5. Groundwater Sampling Equipment:

The Department prefers that all sampling equipment be dedicated to a particular well. The following recommendations apply to the selection of sampling equipment:

- Sampling equipment should be chosen based on the analytes of interest and the characteristics and depth of the saturated zone from which the sample is withdrawn. For example, the choice of sampling equipment should reflect consideration of the potential for light non-aqueous phase liquid (LNAPL)and dense non-aqueous phase liquid (DNAPL) constituent.

- Sampling equipment should be constructed of inert material. Sample collection equipment should not alter analyte concentrations, cause loss of analytes via sorption, or cause gain of analytes via desorption, degradation, or corrosion.

- Sampling equipment should be designed such that Viton®, Tygon®, silicone, or neoprene components do not come into contact with the groundwater sample.

- Sampling equipment should cause minimal sample agitation and should be selected to reduce and/or eliminate sample contact with the atmosphere during sample transfer. Sampling equipment should not allow volatilization or aeration of samples to the extent that analyte concentrations are altered.

- Dedicated bladder pumps should be placed with the pump-intake located in the middle or slightly above the middle of the screened interval.

I.C.6. Decontamination:

When dedicated equipment is not used for sampling (or well purging) or when dedicated equipment is stored outside of the well, it will be thoroughly decontaminated between wells by disassembling and washing with (non-phosphate) detergent, thoroughly rinsed with de-ionized water, and air dried. All equipment coming in contact with media suspected of being contaminated will be decontaminated before it contacts a media that is likely to be less contaminated or uncontaminated.

All non-dedicated groundwater sampling equipment will be cleaned over a decontamination pad after each use in the following manner:

- Rinse with tap water.
- Wash with a non-phosphate laboratory detergent and tap water.
- Rinse with distilled water
- Wash with laboratory-grade methanol or isopropanol
- Triple rinse with de-ionized or distilled water
- Allow to air dry.

If the equipment is not to be used again immediately, it should be packaged and properly stored to protect it from dust and dirt. Equipment may be wrapped in aluminum foil (shiny side on the outside) and placed in a plastic bag. A label should be affixed to the outside wrapping summarizing the decontamination procedure and stating the date of decontamination. Decontaminated sampling equipment should not be placed on the ground or on other contaminated surfaces prior to insertion in the well.

The decontamination pad will be lined with polyethylene sheeting and sloped to promote drainage towards one corner into an in-ground container. This will facilitate removal of any potentially contaminated decontamination fluids. All decontamination water that is generated during sampling activities will be collected in containers and will be subsequently emptied into the Biological Wastewater Treatment Plant at RFAAP. Disposable items will be disposed of as solid waste in an approved, permitted landfill.

I.C.7. Groundwater Sample Collection

Monitoring well sampling should always progress from a well that is the least contaminated to the well that is the most contaminated, to minimize the potential for cross-contamination of samples that may result from inadequate decontamination of sampling equipment. Samples should be collected and containerized according to the volatility of the target analytes. The preferred collection order for some of the more common groundwater analytes is as follows:

- Volatile organics and total organic halogens
- Dissolved gases, total organic carbon and dissolved organic carbon
- Semi-Volatile Organics
- Pesticides/herbicides
- PCBs
- Metals and cyanide
- Perchlorate
- Total Phenols
- Major water quality cations and anions (sulfate, chloride, etc.)
- Nitrate

A sample collecting bottle kit should be prepared from the sample parameter list in accordance with approved sample analysis methods (see Appendix 4). The sample kit should be stored in clean coolers for transport to the site. To preserve sample integrity, all samples should be collected in precleaned containers, preserved when required, and stored at the appropriate temperature. The containers shall be shipped with caps that are securely fastened. Samples shall be transferred directly from the sampling device to the sample containers.

The following recommendations apply to the use and operation of groundwater sampling equipment:

- Check valves should be designed and inspected to ensure that fouling problems do not reduce delivery capabilities or result in aeration of samples.
- Sampling equipment should never be dropped into the well, as this will cause degassing of the water upon impact.
- Contents of the sampling device should be transferred to sample containers in a controlled manner that will minimize sample agitation and aeration.

- Decontaminated sampling equipment should not be allowed to come into contact with the ground or other contaminated surfaces prior to insertion into the well.

- Groundwater samples should be collected as soon as possible after the well is purged. Water that has remained in the well casing for more than about 2 hours has had the opportunity to exchange gases with the atmosphere and to interact with the well casing material.

- The rate at which a well is sampled should not exceed the rate at which the well was purged. Low sampling rates, approximately 0.1 L/min, are suggested. Pumps should be operated at rates less than 0.1 L/min when collecting samples for volatile organics analysis.

- Pump lines should be cleared at a rate of 0.1 L/min or less before collecting samples for volatiles analysis so that the samples collected will not be from the period of time when the pump was operating more rapidly.

- Pumps should be operated in a continuous, non-pulsating manner so that they do not produce samples that are aerated in the return tube or upon discharge.

- When sampling wells that contain LNAPLs, a stilling tube should be inserted in the well. Groundwater samples should be collected from the screened interval of the well below the base of the tube.

- Groundwater samples collected for analysis for organic constituents or parameters should not be filtered in the field.

- Sample collection must be accomplished prior to a flow-through cell, and subsequent to stabilization of indicator field parameters.

I.D. FIELD AND LABORATORY QA/QC PROGRAM

All laboratories performing groundwater analysis shall be VELAP accredited for the analytical method, matrix and target analyte.

Field Quality Assurance/Quality Control (QA/QC) requires the routine collection and analysis of QC samples to verify that the sample collection and handling process has not affected data quality of the project samples. Both field and laboratory QC samples should be prepared during the sampling event. QC samples may include:

Field QC Samples:

- Field duplicate (one blind field duplicate per event/all target constituents);

- Equipment rinsate Blank (required only when non-disposable and non-dedicated equipment is being used);

- Trip Blank (see comment below)

Laboratory QC Samples:

- Matrix spike (MS) sample; and

- Sample duplicate (either a sample duplicate or a matrix spike duplicate (MSD)) as appropriate to the analytical method; typically a MS/MSD/ sample duplicate is required with each sampling batch or 20 samples.

A trip blank should be prepared by the laboratory and analyzed when samples are being analyzed for volatile organic analytes. A trip blank should be submitted with samples each day that samples are collected. Project MS/MSD/Sample duplicate should be collected from locations that are known or suspected to be impacted, where practical. The collection of additional sample volume is required for project specific laboratory QC samples noted above.

I.D.1. The field duplicate sample and the equipment rinseate blank should be prepared exactly as regular investigation samples with regard to sample volume, containers, and preservation. The concentrations of any contaminants found in blank samples should not be used to correct the groundwater data. Target analyte concentrations in blanks should be documented, and if the concentrations are more than an order of magnitude greater than the field sample results, the Permittee should resample the groundwater. Other QA/QC practices such as sampling equipment calibration, equipment decontamination procedures, and COC procedures are discussed in other sections of this Attachment.

I.D.2. Laboratory QA/QC Program

The Permittee's laboratory should provide for the use of control samples. The Permittee should use appropriate statistical procedures to monitor and document performance and to implement an effective program to resolve testing problems (e.g., instrument maintenance, operator training). Data from control samples (e.g., spiked samples, duplicates, and blanks) should be used as a measure of performance or as an indicator of potential sources of cross-contamination. All QC data should be submitted to the Department with the groundwater monitoring sample results.

I.D.3. At a minimum, all field instruments should be calibrated at the beginning of each use and in accordance with the frequency suggested by the manufacturer. Field instruments should be calibrated using at least two calibration standards spanning the range of results anticipated during the sampling event. For example, if groundwater pH is expected to be near pH 7, the two standards used to calibrate the pH meter should be pH 4 and pH 10, respectively.

I.E. SAMPLE HANDLING AND CHAIN-OF-CUSTODY (COC)

Sample handling will be strictly controlled to prevent sample contamination. COC control for all samples will consist of the following:

1. Labels will be placed on individual sample containers while sampling indicating the sampler’s initials, date and time of sample collection, place of collection, and preservation method used for the sample.

2. A custody seal should be placed on the shipping container or on the individual sample bottles. Custody seals provide prevention or easy detection of sample tampering. The custody seal should bear the signature of the collector and the date signed. The custody seal can be placed on the front and back of a cooler, around the opening of a polyethylene overpack bag or on the lid of each sample container.

3. No sample should be brought back to the laboratory for preservation. It is recommended that two polyethylene overpack bags be used in shipping. The first will contain the sample bottles, the second the ice needed to keep the samples at $\leq$ 6 degrees Celsius (C). A temperature history of the samples should be maintained as a QC measure. Upon receipt of the shipment, the laboratory should record the temperature on the chain-of-custody record. The method holding time is defined by the analytical method and listed in Appendix 4. Holding time refers to the period from sample collection to sample extraction and/or analysis.

4. A COC record should be completed and should accompany every sample shipment. The COC record should contain enough copies so that each person possessing the shipment receives his/her own and should be designed to allow the Permittee to reconstruct how and under what circumstances a sample was collected, including any problems encountered. An example of a COC form that includes the necessary information is included as Appendix 3.

5. Samples will be packaged and labeled for shipment in compliance with current U.S. Department of Transportation regulations. All samples will be shipped priority/overnight via commercial carrier or hand delivered to the lab.

6. Samples will arrive at the laboratory via the overnight delivery service or hand delivery. Upon delivery to the laboratory, the ice chests will be checked for intact custody seals and the samples will be unpacked and the information on the accompanying COC records will be examined. If the samples shipped match those described on the COC form, the laboratory sample coordinator will sign the form and assume responsibility for the samples. If problems are found with the

sample shipment, the laboratory sample custodian will sign the form and record the problems in the "remarks" section.

7. Any missing samples, missing sample tags, broken sample bottles, or unpreserved samples will be noted on the COC record. If there are problems with individual samples, the sample custodian will inform the laboratory coordinator of such problems. The laboratory custodian will then contact the Permittee to determine a viable solution to the problem.

8. All information relevant to the sample will be secured at the end of each business day. All samples will be stored in a designated sample storage refrigerator, access to which will be limited to laboratory employees.

I.F. FIELD LOGBOOK

Field technician(s) will keep an up-to-date field logbook documenting information pertaining to field activities. Appendix 1 of this Attachment provides an example of a Groundwater Log that includes the necessary information that must be completed for each monitoring well sampled.

II. LABORATORY ANALYSIS

II.A. INTRODUCTION

The groundwater parameters and constituents to be analyzed include organic and inorganic constituents that have been used at the facility or have been routinely detected in the facility's waste, sludge, and/or groundwater (Attachment IV.B). Attachment IV.B also lists analytical methods that must be used in the analysis of groundwater samples. All analyses must be conducted by a laboratory that is VELAP accredited for the analytical method, matrix and target analyte.

Laboratory methods will be selected to yield reporting limits (Limit of quantitation, or LOQ) values that are equal to or below human health-based standards for the target analytes, where practical. The human health-based standards are established as: follows:

- Maximum Contaminant Levels (MCLs) under the Safe Drinking Water Act;

- Alternate Concentration Limits (ACLs) whenever MCLs are not available; or

- EPA Regional Screening Levels (RSLs) when MCLs or ACLs are not available.

ACLs are calculated by VURAM using a residential ground water ingestion-modeling scenario by VADEQ. If an ACL or EPA Tap Water RSL for a specific constituent is less than the lowest LOQ listed in SW-846 for that constituent, then an appropriate, DEQ approved, LOQ should be used.

II.B. <u>LABORATORY QA/QC</u>

The analytical laboratory must develop, implement and maintain a quality system program to generate data of known and documented quality based on national performance standards adopted under the National Environmental Laboratory Accreditation Program (NELAP). Analytical laboratories producing compliance data must be accredited under 1VAC30-46, also called the Virginia Environmental Laboratory Accreditation Program (VELAP). VELAP accreditation under 1VAC30-46 incorporates TNI (The NELAC Institute) standards and its quality system requirements. The QA/QC plan for each VELAP accredited laboratory can be provided for review, if requested.

III. <u>DATA EVALUATION</u>

III.A. <u>ANALYTICAL DATA REVIEW AND VALIDATION</u>

To assess data quality, the Permittee and/or its representative will review and validate the analytical data in accordance with the following United States EPA guidance documents:

- *Test Methods for Evaluating Solid Wastes - Physical and Chemical Methods*, USEPA SW-846, 3rd edition - Final Update I, II/IIA and III), as updated;

- *USEPA National Functional Guidelines for Superfund Organic Methods Data Review, January 2017,* where applicable and as updated.

- *USEPA National Functional Guidelines for Inorganic Superfund Data Review, January 2017,* where applicable and as updated.

III.B. <u>STATISTICAL EVALUATION</u>

Statistical evaluations will be performed in general accordance with Appendix 6 to Attachment IV.A.

III.C. <u>DATA QUALITY OBJECTIVE</u>

It is the Permittee's responsibility to report sufficient valid analytical results for each monitoring event. Reported data will be, at a minimum, of such quality to immediately detect a release from the regulated unit.

IV. <u>RECORD KEEPING AND REPORTING</u>

IV.A. <u>INTRODUCTION</u>

Copies of all groundwater analytical results, groundwater semiannual reports, groundwater annual reports, and groundwater level elevations, as well as the Groundwater S&AP, shall be maintained at the RFAAP throughout the active life of the facility and post-closure care period. The Permittee shall report the groundwater monitoring information to the Director described in Sections IV.B and IV.C below.

IV.B. GROUNDWATER MONITORING RESULTS

The Permittee shall report concentrations or values of the parameters and constituents listed in Attachment IV.B for each required groundwater monitoring well within 30 days after completing each analysis.

IV.C. ANNUAL REPORT

The Permittee shall submit an Annual Groundwater Monitoring Report to the DEQ by March 1st of the following year for the year beginning January 1st and ending December 31st. The annual report should contain:

1. Static groundwater level elevations;

2. Potentiometric surface maps reflecting each sampling event;

3. Groundwater flow rate and direction in the uppermost aquifer calculated after each sampling event;

4. Statistical evaluations of the concentrations or values of the parameters and constituents listed in Attachment IV.B;

5. The calculated or measured rate of migration of hazardous waste or hazardous waste constituents in the groundwater; and

6. Results of the evaluations of groundwater surface evaluations to determine whether the requirements for locating the monitoring wells continue to meet the criteria set forth in 40 CFR § 264.97.

Appendix 1

GROUNDWATER LOG EXAMPLE

SAMPLING EVENT ____

LOCATION ____
WELL NO. ___________________________ DATE: ___________________
WEATHER ___________________________ TEMPERATURE: __________________

MEASUREMENT TEAM ____
TIME WELL CASING UNLOCKED____

DEPTH TO WATER FROM TOP OF OUTER CASING ____________________ FT
DEPTH OF WELL FROM TOP OUTER CASING ____________________ FT
STATIC WASTER LEVEL ____________________ FT

MEASUREMENT TECHNIQUE: [ ] WATER LEVEL INDICATOR
[ ] OTHER/EXPLAIN ________________________

<u>FORMULAS FOR DETERMINING PURGE VOLUME</u> **TWD =**

Water Level above Sand Pack: [ ]
$3 \times [(\pi r_b^2 h_s - \pi r_c^2 h_s) \times 0.3 + (\pi r_c^2 h_w)]$

Water Level below Sand Pack: [ ]
$3 \times [\pi r_b^2 h_w - \pi r_c^2 h_w) \times 0.3 + (\pi r_c^2 h_w)]$

where:
r_b = radius of boring =
r_c = radius of casing =
h_s = height of sand =
h_w = height of water =

IMMISCIBLE LAYERS:	[ ] YES	[ ]NO
DETECTION METHOD:	[ ] VISUAL	[ ] OTHER_______________
COLLECTION METHOD:	[ ] BEAKER	[ ]OTHER________________

SAMPLE IDENTIFICATION ____

PURGE TEAM ____

PURGE PROCEDURE/EQUIPMENT: [ ]TEFLON BAILER
[ ]WELL PUMP

PURGE TIME ______________________________ PURGE VOLUME ______________________

PURGE APPEARANCE ____
COMMENTS ____
____
____

SAMPLING EVENT: ____

LOCATION: ____
WELL: _________________________ DATE _________________________

SAMPLING PROCEDURE/EQUIPMENT: [ ]TEFLON BAILER
[ ]WELL PUMP

SAMPLING TIME: ____

pH METER CALIBRATED WITH BUFFERS: [ ]4 [ ]7 [ ]10
pH METER CALIBRATED BY: ____
CONDUCTIVITY METER CALIBRATED WITH STANDARD SOLUTION OF ________________

CONDUCTIVITY METER CALIBRATED BY: ____

pH(S.U.) ________________, ________________, ________________,

TEMP (°C) ________________, ________________, ________________,

COND (µS) ________________, ________________, ________________,

SAMPLE COLLECTION TIME: CONTAINER*/PRESERVATIVE

(1)__________	VOC(G/NONE)	(2)__________	TOX(A/HNO_3)
(3)__________	TOC(A/H_2SO_4)	(4)__________	COD(A/H_2SO_4)
(5)__________	O&G/TPH(A/HCL)	(6)__________	PHEN(A/H_2SO_4)
(7)__________	N(/)	(8)__________	PHOS(A/H_2SO_2)
(9)__________	SO(/)	(10)__________	TMET(P/HNO_3)
(11)__________	DMET(P/NONE)	(12)__________	pH,COND(P/NONE)
(13)__________	CHLORIDE(P/NONE)	(14)__________	SMLL TST(P/NONE)

(15)________ CN^- (P/NONE) (16)________ (P/NONE)

FINAL pH (S.U.) ____________ FINAL TEMPERATURE (°C)_________________
FINAL CONDUCTIVITY (μS) _______________

LOCKED WELL AT __________________

COMMENTS ____
____
____
____
____

NOTES:

1. G = GLASS, A=AMBER GLASS BOTTLE, P=PLASTIC (POLYETHYLENE)
2. Samples requiring chilling to ≤6 °C should be placed in shipping containers with ice to reduce the temperature as soon as possible after sample collection. Ideally, samples should be shipped the day of collection for overnight delivery to the laboratory. If samples cannot be shipped the day of collection, the sample temperature should be maintained at ≤6 °C, until they are shipped to and received by the laboratory. COC forms will have Shipping/Receiving temperature boxes for recording data.
3. IDW: Collect all used decontamination solutions and rinses; store in a labeled 55 gallon drum for no more than 90 days in accordance with DEQ's Investigation Derived Waste (IDW) Policy.
4. SILTATION: If the level of siltation is higher than 1 foot above the base of the screen, the well will need to be redeveloped. Note whether the level of siltation is greater than 1 foot in the comments section.
5. DEDICATED TEFLON TUBING: replace if older than one year; note in comments the date the tubing was installed.

Appendix 2

CALCULATIONS OF PURGE VOLUME

Determine purge volume as follows:

Water Level above sand pack:

$3 \text{ x } [(\Pi\, r_b^2\, h_s - \Pi\, r_c^2\, h_s) \text{ x } 0.3 + (\Pi\, r_c^2\, h_w)]$

Water Level below sand pack

$3 \text{ x } [(\Pi\, r_b^2\, h_w - \Pi\, r_c^2\, h_w) \text{ x } 0.3 + (\Pi\, r_c^2\, h_w)]$

where:

r_b = radius of boring
r_c = radius of casing
h_s = height of sand
h_w = height of water

This calculation must be based upon 30% filter pack volume. Once the volume to be purged is known, purging can begin. The purge water will be collected, containerized and disposed of in accordance with local, state and federal regulations and laws.

Appendix 3: EXAMPLE CHAIN OF CUSTODY

CHAIN OF CUSTODY RECORD

Laboratory:

Client: **Attn:** **Address:** **Phone:** **Fax:** **Fax:**	**Consultant:** **Attn:** **Address:** **Phone:** **Fax:**	**Sample Site:** RFAAP, Radford, Virginia **Location:** HWMU-13 (Open Burning Ground) **Event:** Annual Soil Monitoring **DAA JN:** **Lab JN:**	**Project Specific (PS) or Batch (B) QC:** **Sample Collection for Project Complete?** ***YES*** **Carrier:** ____________ **Tracking Number:** ____________ ____________
Box 1: Matrix SW Surface Water GW Groundwater L Leachate S Soil T Trip Blank E Equipment Blank P Product O Other	**Box 2: Preservative** A HCL B HNO_3 C H_2SO_4 D $Na_2S_2O_3$ E NaOH F ZnAc G Other (<4 deg C) H None	**Box 3: Filtered/Unfiltered** F Filtered U Unfiltered **Box 5: Sample Container Type** P Plastic V VOA AG Amber Glass CG Clear Glass **Box 4: Sample Type** G Grab C Composite	**Invoice** **Copy to Consultant:** ***YES*** **Bill:** ***CLIENT*** ***OTHER*** ________ **Preserved and shipped on ice:** ***YES***

Box 4 - Sample Type																**GENERAL NOTES:**
Box 3 - Filtered/Unfiltered																
Required pH of Sample																
Box 2 - Preservative																
Box 5 - Sample Container Type																
Sample ID	**Date:**	**Time**	**Box 1: Matrix**	**Number of Bottles**												

Clients Special Instructions:

Received by lab in Good Condition _____ Yes _____ No Custody Seal Intact _____ Yes _____ No Temperature upon arrival _____ Received on Ice _____ Yes _____ No
Describe problems, if any:

Sampler Name (Print):	Date:	#1 Relinquished by (Signature):	Date:	#2 Relinquished by (Signature):	Date:	Sample Storage Time Requested:
Sampler Signature:	Time:	Company Name:	Time:	Company Name:	Time:	
Sampler Name (Print):	Date:	#1 Received by (Signature):	Date:	#2 Received by (Signature):	Date:	30 DYS ORG/6 MTHS INORG
Sampler Signature:	Time:	Company Name:	Time:	Company Name:	Time:	

Appendix 4

SAMPLE CONTAINERS AND PRESERVATIVES

Analyte	SW-846 Analysis Numbers	Container	Preservative	Holding Time (days)
Metals except mercury	6010, 6020	HDPE	HNO_3 to pH<2	6 months
Dissolved Metals except mercury	6010, 6020	HDPE	Field filter using 0.45 micron filter. HNO_3 to pH<2	6 months
Mercury	7470	HDPE	HNO_3 to pH<2	28
Dissolved mercury	7470	HDPE	Field filter using 0.45 micron filter. HNO_3 to pH<2	28
Energetics and PETN	8330	Amber glass	≤6° C	7/40
Nitroglycerin	8330	Amber glass	≤6° C	7/40
Cyanide	9012	HDPE	≤6° C , NaOH to pH>12	14
Alkalinity	310.2/2320	Amber Glass or HDPE	≤6° C	14 days
Nitrate as N	9056	Glass	≤6° C	48 hours
Sulfate/Chloride	IC300, 9056	Glass	≤6° C	28 days
Chlorate	IC300	Amber Glass	EDA, ≤6° C	28 days
Chlorite	IC300	Amber glass	EDA, ≤6° C	14 days
Perchlorate	314.0/6850	HDPE or Glass	≤6° C , field filtered using 0.2 micron filter	28
Total Organic Carbon (TOC)	9060	HDPE	≤6° C , HCl or H2S04, to pH <2	28
Dissolved Organic Carbon (DOC)	9060	HDPE	Field filter using 0.45 micron filter HCl or- H2S04, to	28

			pH <2, ≤6° C	
Appendix IX Volatile Organics	8260	40 ml Glass VOA	≤6 ° C, HCl to pH<2,	14
Appendix IX Semi-volatile Organics	8270	Amber glass	≤6 ° C	7/40
Appendix IX Organochlorines	8081	Amber glass	≤6° C	7/40
Appendix IX Herbicides	8151	Amber glass	≤6 ° C	7/40
Appendix IX Organophosphates	8141	Amber glass	≤6 ° C	7/40

NOTES:

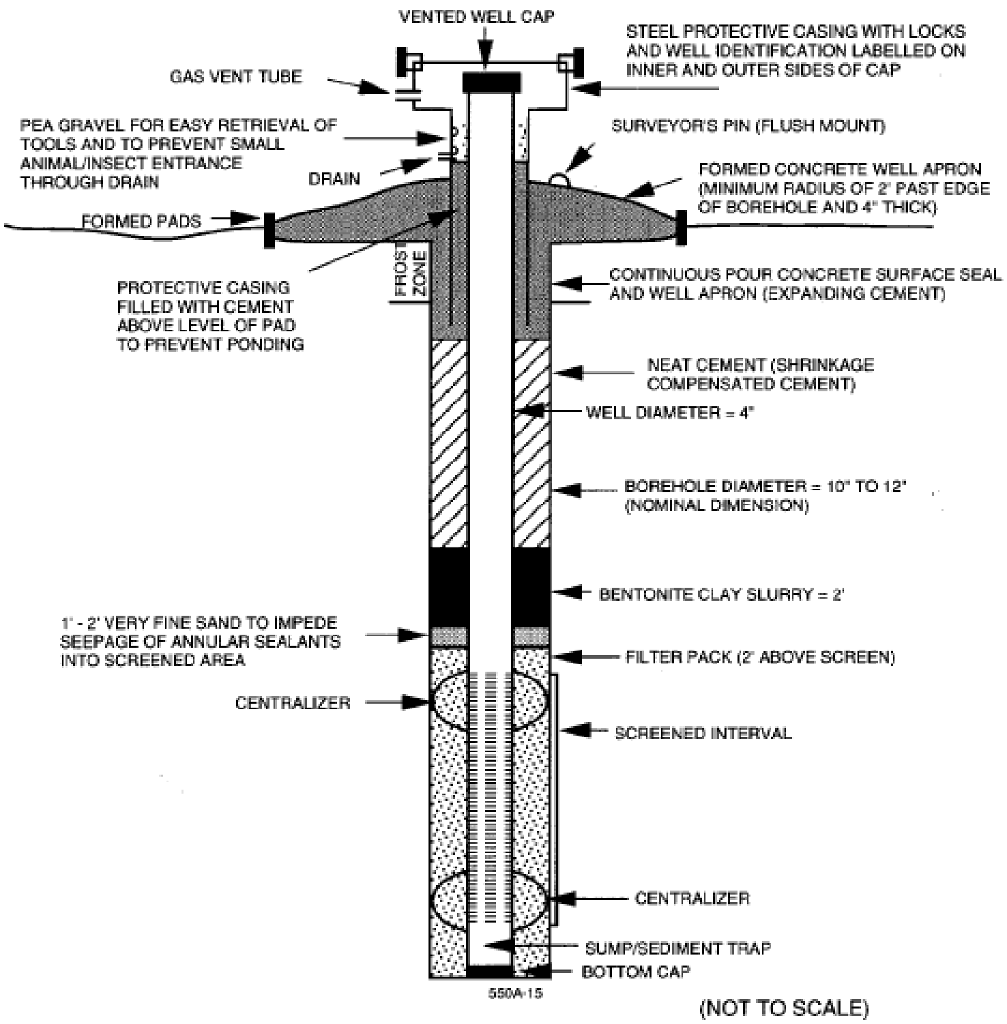
1. References:
   Test Methods for Evaluating Solid Waste - Physical/Chemical Methods, SW-846 (3rd Edition, as updated.

   Methods for Chemical analysis of Water and Wastes, EPA-600/4-79-020.
   Standard Methods for the Examination of Water and Wastewater, 19th edition or other method with prior VDEQ approval.

   *Current analytical method updates are represented with suffixes on each method (e.g., SW-846 Method 6020***A***). The laboratory performing the analysis must be VELAP accredited, for a current method update.*

2. Container Types:
   HDPE = Plastic (polyethylene)
   T = Fluorocarbon resins (PTFE, Teflon. FEP, PFA, etc.)

Appendix 5
MONITORING WELL CONSTRUCTION DIAGRAM
(from *EPA Technical Enforcement Guidance Document, 1986*)



CROSS-SECTION OF TYPICAL MONITORING WELL

Appendix 6

STATISTICAL PROCEDURES

A. HIGHLIGHTS

In accordance with 40 CFR § 264.97(g), the permittee will collect an appropriate number of samples from upgradient well(s) and an appropriate number of samples from each of the point of compliance wells specified in Permit Section IV.C.1. Appropriate background sample sizes for the preferred method of statistical analysis will be collected prior to the scheduled date of the statistical analysis.

Statistical analysis of the groundwater data will include the following:

1. Outliers
2. Testing of normality
3. Missing data
4. Evaluation of data below detection limits or quantitation limits
5. Selection of statistical method
6. Verification sampling strategy (optional)

B. OUTLIERS

An outlier refers to a data point which is an inconsistently large or small value. An outlier can be observed due to sampling, laboratory, transportation, or transcription errors. To remove the possibility of including data with this type of error, the historical data should be screened for each well and constituent for the existence of outliers (USEPA 1992 section 6.2) using the method described by Dixon (1953) or another method approved by the VADEQ. Background observations, which are considered to be outliers, should not be included in the statistical analysis. If an extreme value occurs in a point-of-compliance well or during a Detection sampling event, the facility should collect a re-sample during the Detection period of the initial sample. Any elimination of an outlier data must be approved by the Department.

C. TESTING NORMALITY OF DATA DISTRIBUTION

The Permittee shall verify that the distribution of monitoring data for the Hazardous Constituents is consistent with the assumptions of the selected statistical test method. A multiple group version of the Shapiro-Wilk test shall be applied to determine if the distribution of the data is normal or lognormal. To test for log normality, the natural logarithms of original data are taken and if the distribution of the transformed concentrations is normal then the data are considered to be log-normally distributed. The permittee may use any other appropriate method for testing the distributional assumptions (see Gibbons 1994a for a review, also see USEPA 1992). However, the permittee shall demonstrate that the alternative method can detect deviations from normality with similar power as the Shapiro-Wilk and Shapiro-Francia methods. No testing of normality is required when the percentage of non-detects or non-quantified values is greater than 50%. Once the distribution of the data is determined, the permittee should apply statistical tests as follows:

- When the detection frequency is less than 50% and/or transformation fails to bring about normality, a non-parametric method should be used.

- When the detection frequency is between 50%-75%, a parametric test can be performed with an adjustment for non-detects. Aitcheson's or Cohen's adjustments are recommended. Determination of the appropriate adjustment to be applied should be based on the properties of the data set (USEPA, 1992, Section 2.2).

- When the detection frequency is 75% or greater, an appropriate parametric test may be applied without adjusting for non-detects. Non-detects should be analyzed using one half the laboratory limit of detection or quantitation.

D. <u>MISSING DATA</u>

If a sampling event results in a missing data value, an attempt to resample for the missing value shall be made within two weeks.

E. <u>DATA BELOW DETECTION LIMITS</u>

For data where the non-detects or non-quantified values are less than 25 percent, the Permittee shall replace the non-detects or non-quantified values with one half the laboratory limit of detection or quantitation. However, when the percentage of non-detects or non-quantified values is greater than 25 percent and less than 50 percent the mean and standard deviation should be adjusted using Atchison's method (USEPA 1992 section 2.2.2 and Aitchison, 1955). An acceptable alternative to Aitchison's method is Cohen's maximum likelihood estimator (Cohen, 1961). Extensive tables and computational details are also provided in Gibbons, 1994a. The approach for selection between the two methods is described in USEPA (1992) section 2.2.1.

F. <u>SELECTION OF STATISTICAL METHOD</u>

The Permittee shall use an appropriate statistical method consistent with the Virginia Hazardous Waste Management Regulations. As specified in these regulations, the level of significance for individual well comparison shall be no less than 0.01 and no less than 0.05 for multiple comparisons. However, these performance standards do not apply for prediction intervals, tolerance intervals and control charts. The false positive rate for these interval methods or control charts can depend on the number of data points available from the background wells at the time of statistical comparison. A larger number of background data points can decrease the false positive rate for these tests. In the event the Permittee has decided to use an interval method or other statistical method, and if the selected method requires additional samples, the Permittee shall collect the requisite additional samples for conducting appropriate statistical analysis within DEQ acceptable timeframes and frequencies. The statistical comparison shall not be delayed due to collection of an inadequate number of samples. The false positive rate for a single constituent/well comparison shall not be lower than 0.01 unless the Permittee can demonstrate that an alternative false positive rate will provide at least 50% power to detect a 3 standard deviation increase above background levels and 80% power to detect a 4 standard deviation increase above background levels.

1. Interval Method

   If the Permittee uses an interval method and the percentage of detects is greater than 50%, the Permittee shall test the data from the background wells for normality. If the background well data are normally or log-normally distributed the permittee shall use a parametric interval method. Table 1 provides the suggested minimum number of samples for calculation of parametric interval methods that are acceptable to VADEQ. In the event the background data are not normally or log-normally distributed the permittee shall use a non-parametric interval method. Suggested test methods and recommended minimum sample size requirements are provided in Table 1. However, a statistical analysis can be conducted with a smaller dataset than the suggested size at any time. Please note that these methods can lead to higher false positive or false negative rates with smaller samples sizes. For each sampling event, the permittee shall calculate the appropriate interval for the background data set based on the method selected, and compare each data point from the compliance well to the upper limit. If the compliance well data exceeds the upper limit, the permittee shall report that there has been a statistical increase of contaminants in the groundwater.

2. Other Methods

   In the event the Permittee has selected any other method listed in the Virginia Hazardous Waste Management Regulations, the Permittee shall collect the appropriate number of samples and shall maintain the appropriate level of significance specified above.

G. <u>VERIFICATION SAMPLING (OPTIONAL)</u>

Verification resampling can be an integral part of the statistical methodology. .. All verification samples must be collected prior to the next scheduled sampling event at the earliest time practical or as approved by the DEQ or as specified in this permit.

H. COMPARISON OF POINT OF COMPLIANCE WELL DATA TO A STANDARD DURING COMPLIANCE OR CORRECTIVE ACTION MONITORING

The facility will initially perform a value-to-value comparison to GPS for all groundwater monitoring data. If a GPS exceedance is noted during the value-to-value comparison for a parameter(s), the facility may collect a verification sample and results from the verification sample will be compared to the GPS in a value-to-value comparison as long as the comparison is completed within 30 days of receipt of the initial sampling event data from the laboratory. Further, the facility may collect three additional independent groundwater samples during the compliance period for the suspect constituent(s) in order to perform a statistical comparison to GPSs that is based on ACL or MCL. The facility should calculate lower normal confidence limit to compare it to the standard compliance wells data. The facility should calculate upper normal confidence limit to compare it to the standard corrective action monitoring wells data. The level of confidence of the interval should be 80% for a sample size of 4-7 and 95% for a sample size of 8-10.

I. REFERENCES

1. Aitchison, J. On the distribution of a positive random variable having discrete probability mass at the origin, Journal of American Statistical Association, 50(272), 901-908 (1955).

2. Cohen, A.C. Tables for maximum likelihood estimates: Singly truncated and singly censored samples, Technometrics, 3, 535-541 (1961).

3. Gibbons, R.D. Statistical Methods for Groundwater Monitoring, John Wiley and Sons, Inc., 1994.

4. Gibbons, R.D. Some conceptual and statistical issues in analysis of groundwater monitoring data, Environmetrics, 7, 185-199 (1996).

5. USEPA, Statistical analysis of groundwater monitoring data at RCRA facilities. Addendum to Interim Final Guidance. Office of Solid Waste, July 1992.

6. USEPA, Statistical analysis of groundwater monitoring data at RCRA facilities - Interim Final guidance (April 1989).

7. USEPA. 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance*. USEPA Office of Resource Conservation and Recovery. March 2009. GPO. Washington, DC. EPA 530/R-09-007.

Table 1

Suggested Minimum Samples*			
	Parametric	Non-Parametric	Non-Parametric Interval %Confidence
CABF T-test	4	NA	NA
Wilcoxon Rank Sum	NA	5	NA
Confidence Interval	4	NA	NA
Tolerance Interval	8	19	95%
Prediction Interval	8	13	99%#
Shewhart CUSUM Chart+	8	NA	NA

* The above tests can be used with fewer samples; however it will increase the false positive rate.

Includes one verification re-sample, use 19 samples for a 95% Prediction Interval with no verification re-samples.

+ For Intra-well testing only.

NA Not Applicable.

Appendix 7

MONITORING WELL ABANDONMENT PROCEDURES

NOTE: Approval from the Director must be granted before any monitoring well may be abandoned.

A. Well abandonment activities must be completed in accordance with the Department's well abandonment policy, *VDEQ Recommended Well Abandonment Policy*, VDEQ, July 10, 2015 or most recent policy.

ATTACHMENT
METHODOLOGY FOR GROUNDWATER MONITORING WELL ABANDONMENT

The facility shall receive prior approval from the Department (VDEQ) to abandon any monitoring wells and/or piezometers. The following procedures shall be used

A. Monitoring wells and/or piezometers will be abandoned by pressure grouting methods. Surface installations (protective covers or manholes) will be removed and an attempt to pull the casing string with the rig will be made. Once this has either been accomplished or has failed, grouting operations will commence as described below. NOTE - All tremie rods and other downhole equipment will be steam cleaned prior to introduction into the hole or well.

    1. Monitoring well abandonment will be accomplished by lowering a tremie pipe to the bottom of the borehole.

    2. Portland cement/bentonite grout will then be pumped down the tremie pipe until an even flow of consistent grout returns at the surface.

    3. The tremie pipe will be removed from the borehole on completion of grouting operations and a minimum four inch thick and six foot diameter concrete cap will be constructed over the grouted borehole.

B. Removed casings will be steam cleaned, cut up into manageable sections, and disposed of as refuse.

C. All decontamination fluid will be containerized and handled pursuant to decontamination fluid handling procedures and all applicable local, state, and federal regulations.

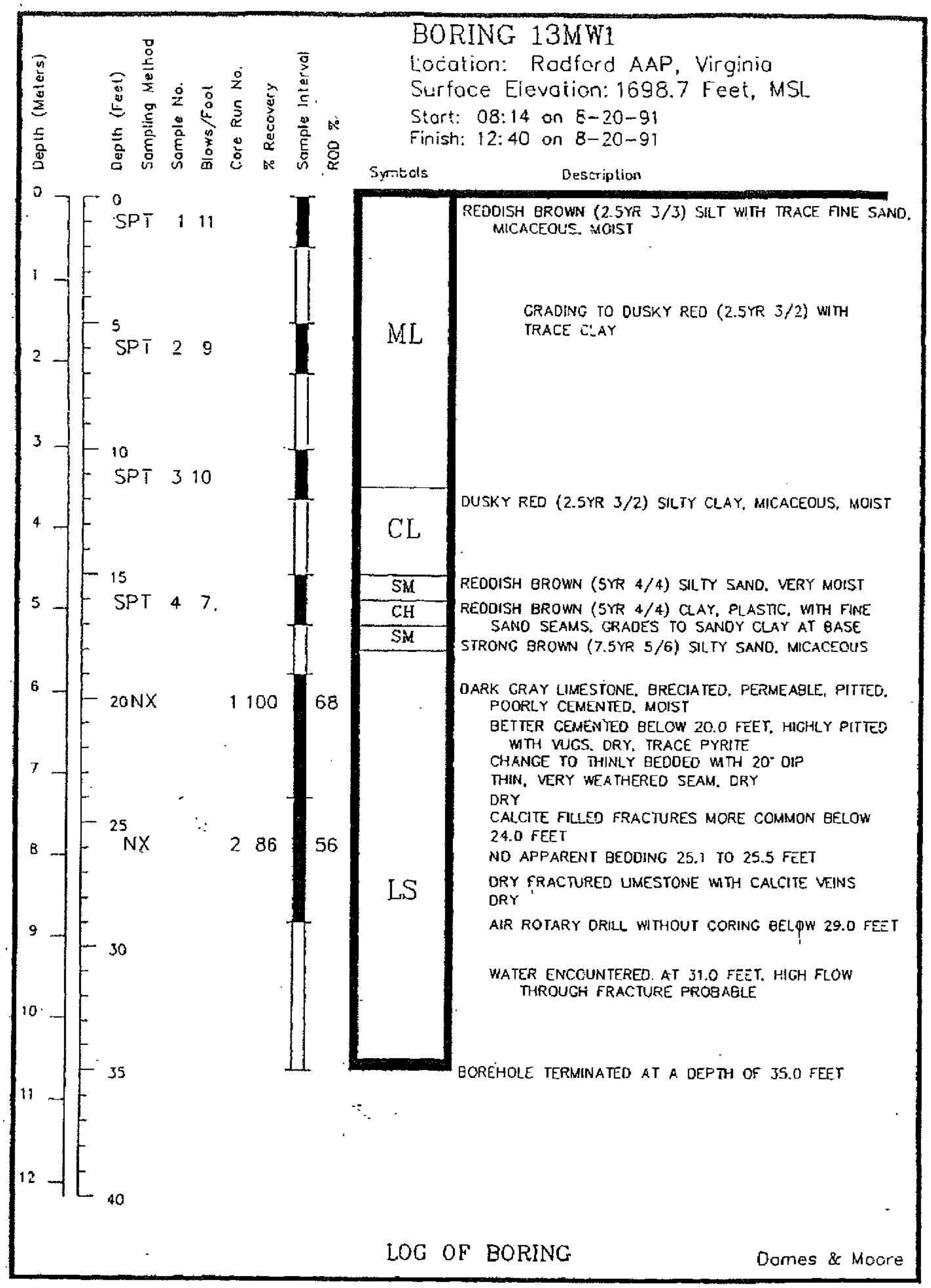
Appendix 8

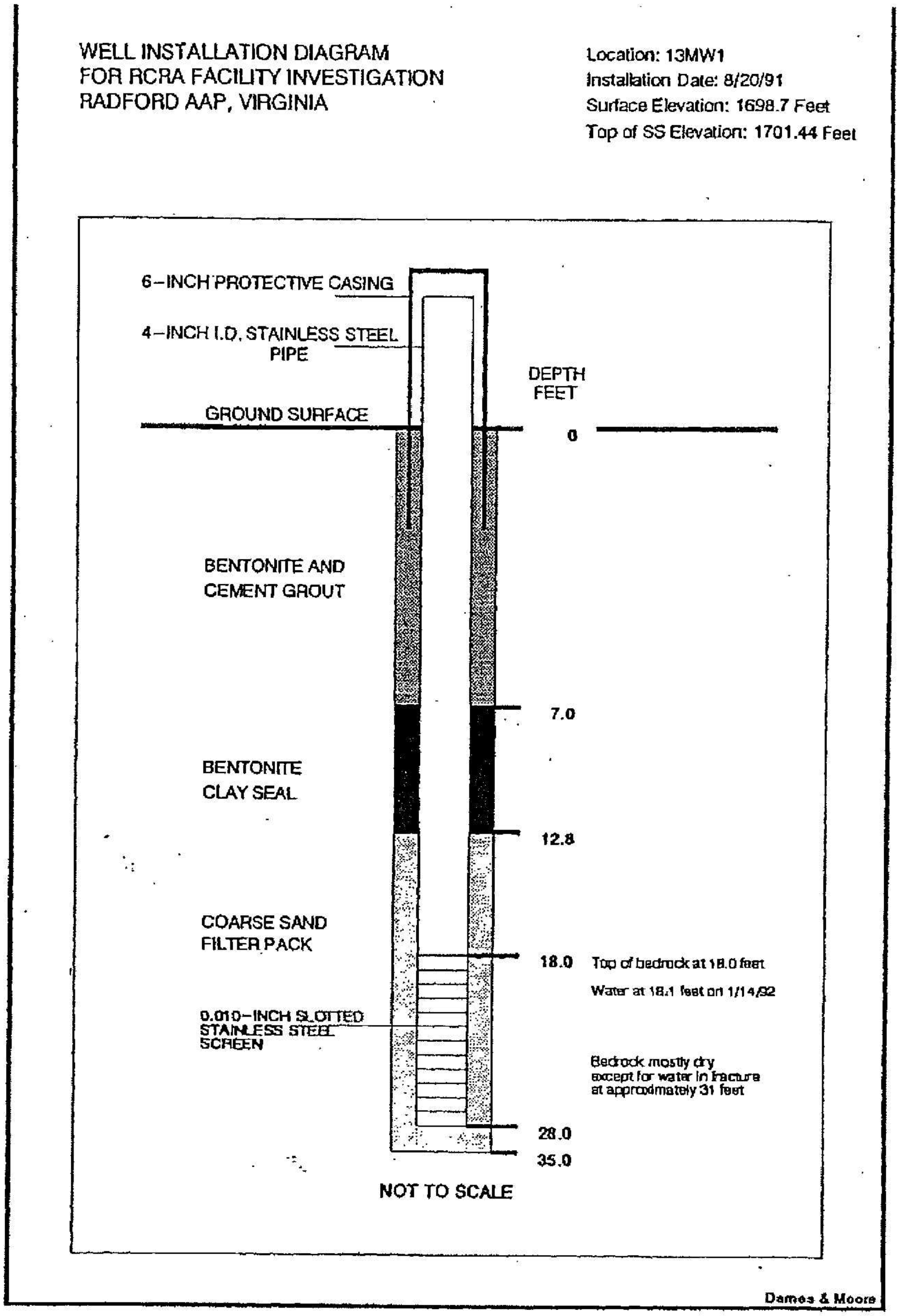
BORING LOGS AND WELL CONSTRUCTION DIAGRAMS

Boring logs and well construction diagrams for groundwater monitoring wells are included as appendices to this Attachment.

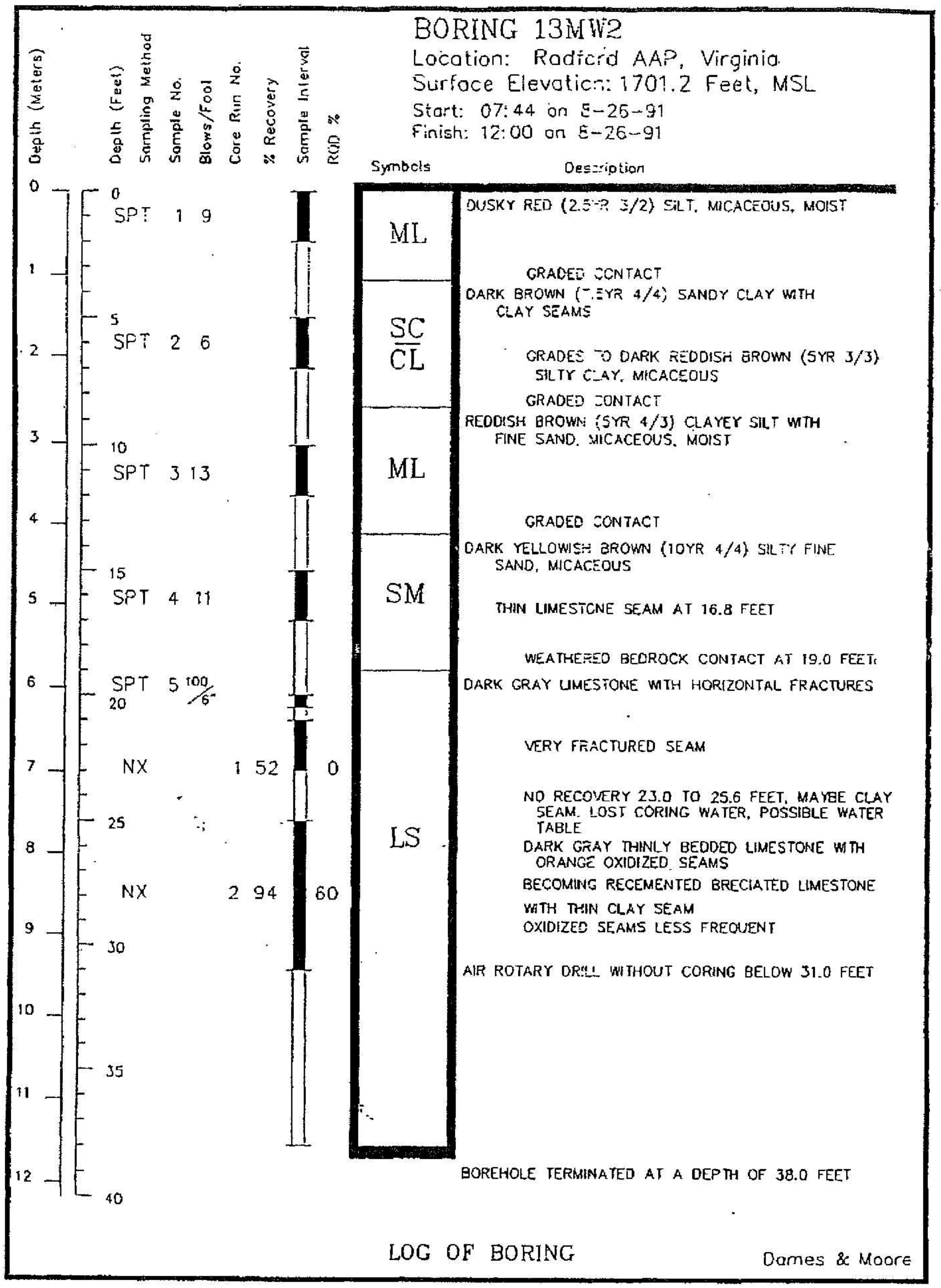
Well 13MW1
Well 13MW2
Well 13MW3
Well 13MW4
Well 13MW5
Well 13MW6
Well 13MW7
Well 13MW8

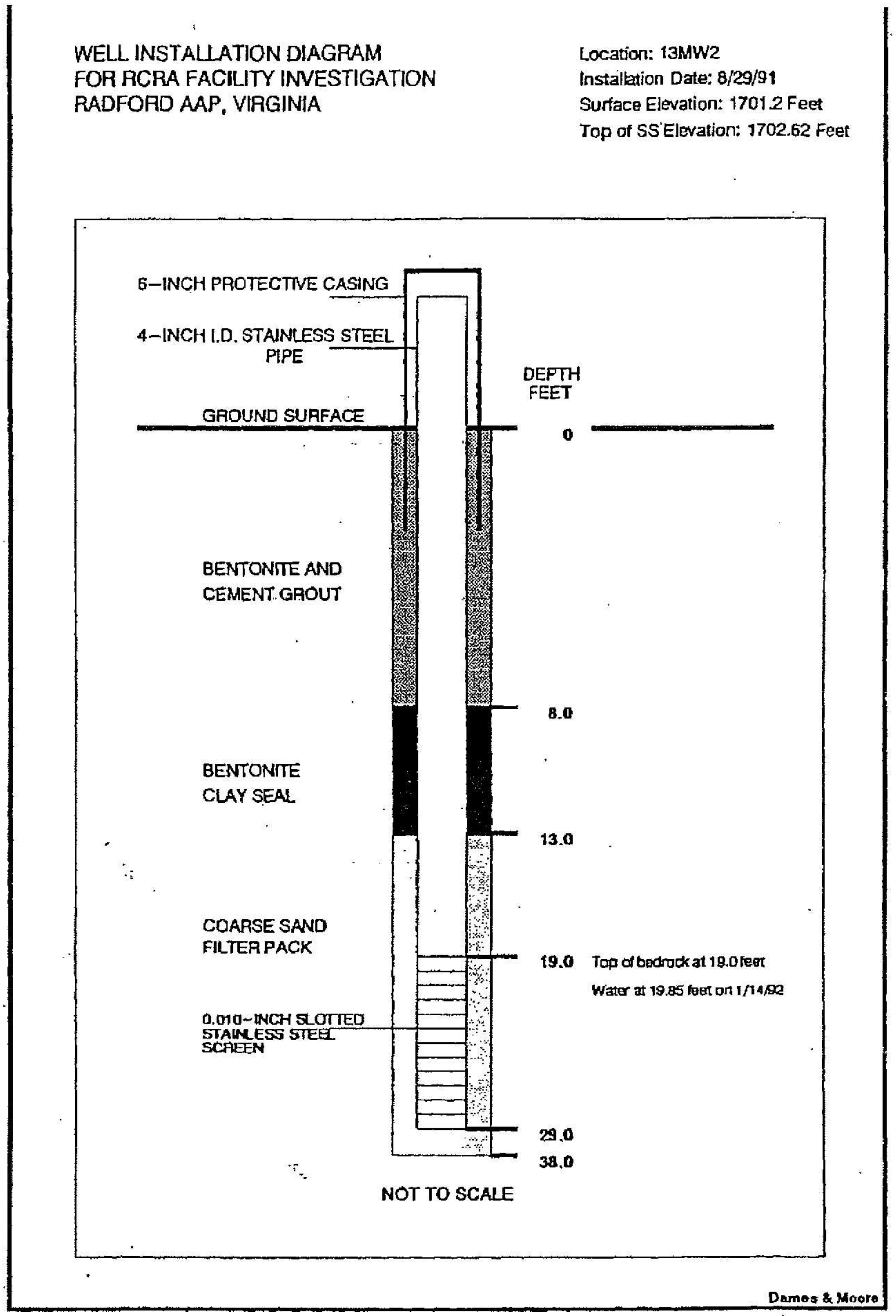
BORING LOG AND WELL CONSTRUCTION DIAGRAM FOR 13MW1



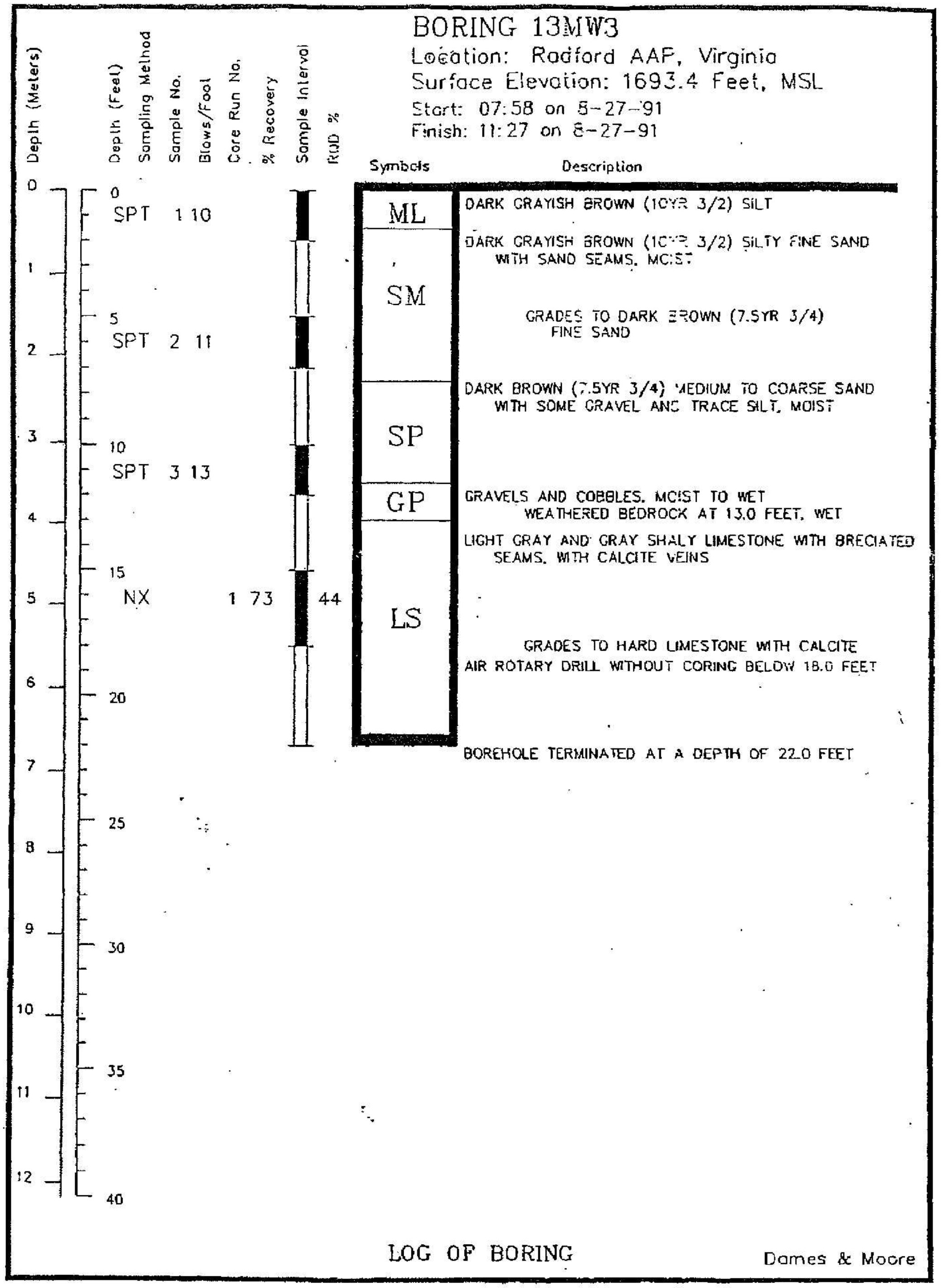

WELL INSTALLATION DIAGRAM
FOR RCRA FACILITY INVESTIGATION
RADFORD AAP, VIRGINIA
Location: 13MW1
Installation Date: 8/20/91
Surface Elevation: 1698.7 Feet
Top of SS Elevation: 1701.44 Feet
6-INCH PROTECTIVE CASING
4-INCH I.D. STAINLESS STEEL PIPE
DEPTH FEET
GROUND SURFACE
0
BENTONITE AND CEMENT GROUT
7.0
BENTONITE CLAY SEAL
12.8
COARSE SAND FILTER PACK
18.0
Top of bedrock at 18.0 feet
Water at 18.1 feet on 1/14/92
0.010-INCH SLOTTED STAINLESS STEEL SCREEN
Bedrock mostly dry except for water in fracture at approximately 31 feet
28.0
35.0
NOT TO SCALE
Dames & Moore

BORING LOG AND WELL CONSTRUCTION DIAGRAM FOR 13MW2



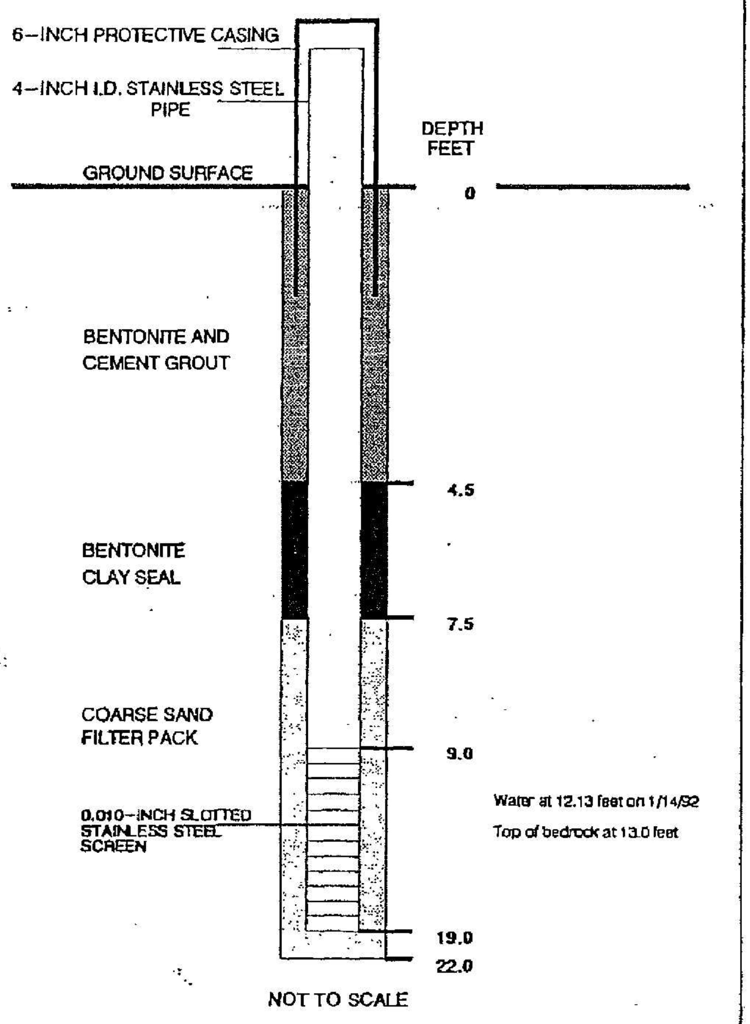

WELL INSTALLATION DIAGRAM
FOR RCRA FACILITY INVESTIGATION
RADFORD AAP, VIRGINIA
Location: 13MW2
Installation Date: 8/29/91
Surface Elevation: 1701.2 Feet
Top of SS Elevation: 1702.62 Feet
6–INCH PROTECTIVE CASING
4–INCH I.D. STAINLESS STEEL PIPE
DEPTH FEET
GROUND SURFACE
0
BENTONITE AND CEMENT GROUT
8.0
BENTONITE CLAY SEAL
13.0
COARSE SAND FILTER PACK
19.0
Top of bedrock at 19.0 feet
Water at 19.85 feet on 1/14/92
0.010–INCH SLOTTED STAINLESS STEEL SCREEN
29.0
38.0
NOT TO SCALE
Dames & Moore

BORING LOG AND WELL CONSTRUCTION DIAGRAM FOR 13MW3



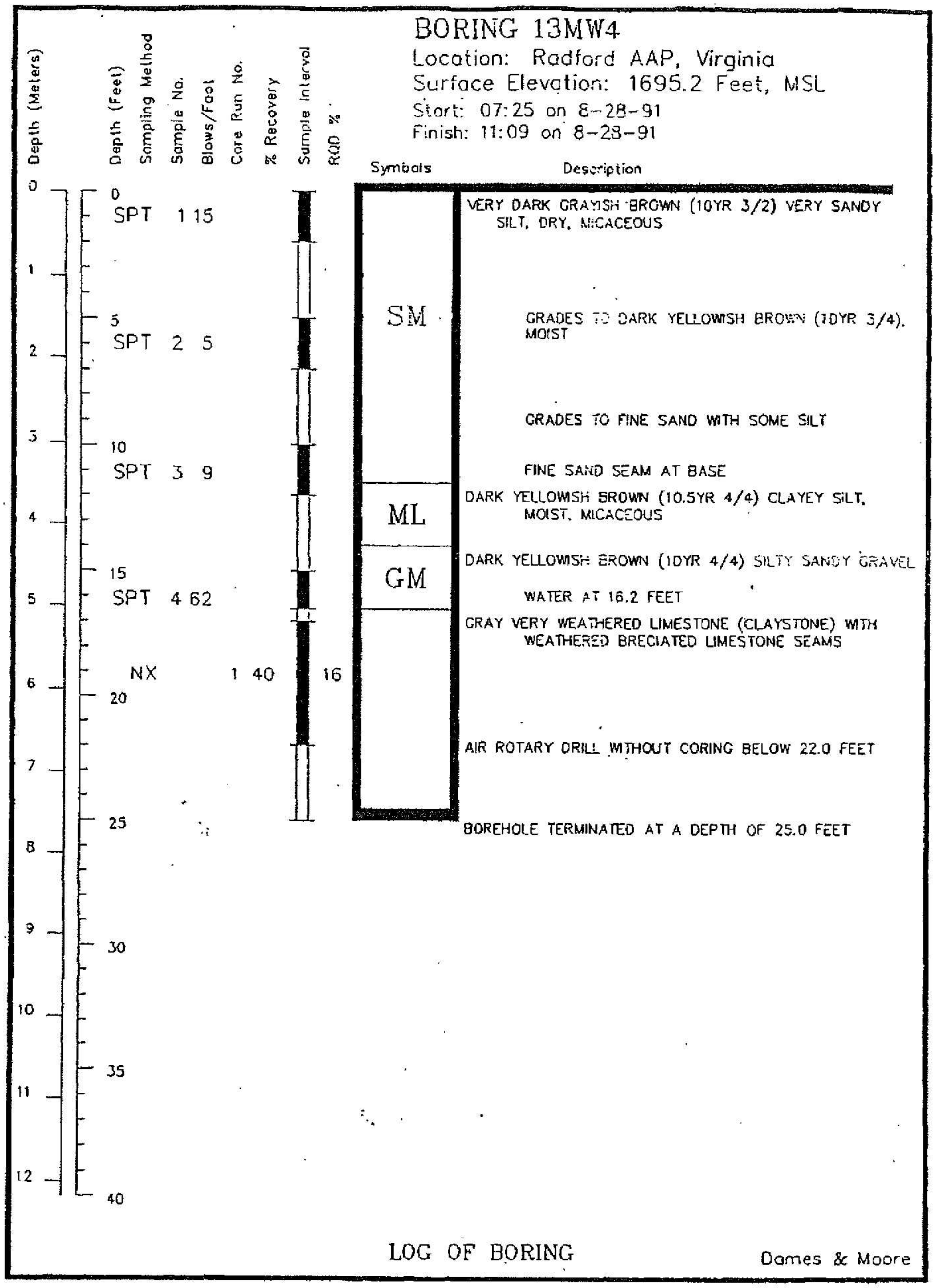
WELL INSTALLATION DIAGRAM
FOR RCRA FACILITY INVESTIGATION
RADFORD AAP, VIRGINIA

Location: 13MW3
Installation Date: 8/27/91
Surface Elevation: 1693.4 Feet
Top of SS Elevation: 1694.47 Feet



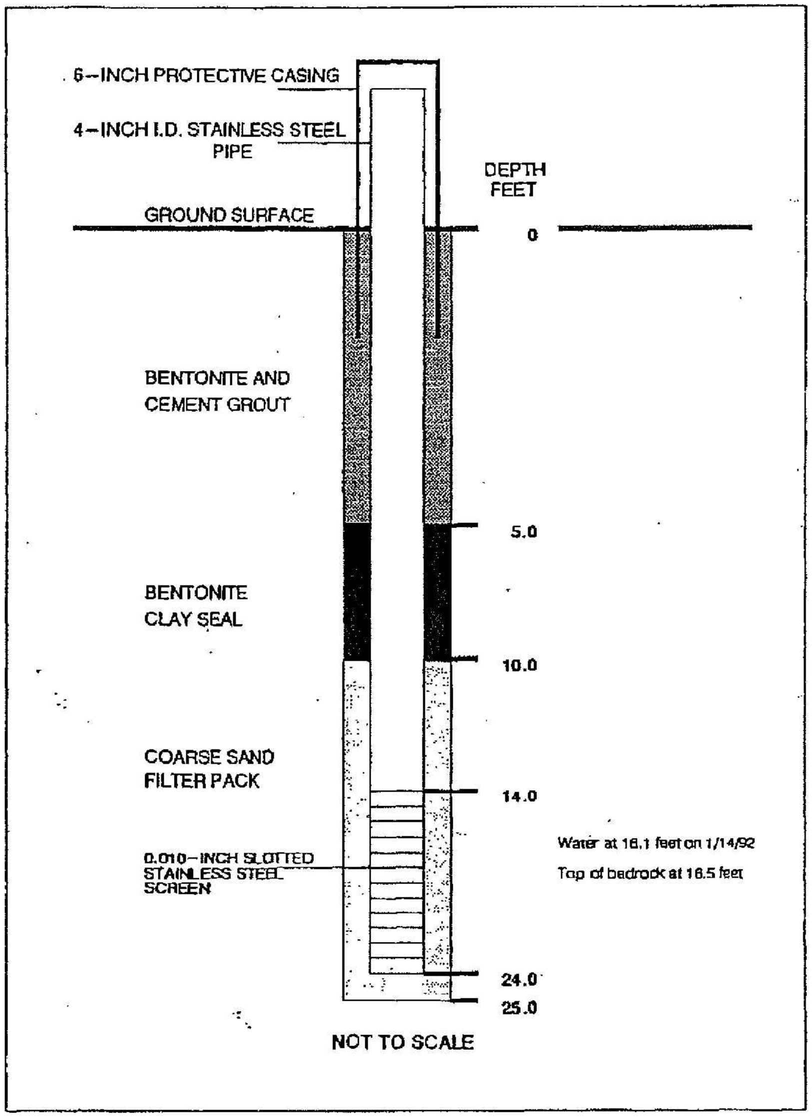
Dames & Moore

BORING LOG AND WELL CONSTRUCTION DIAGRAM FOR 13MW4



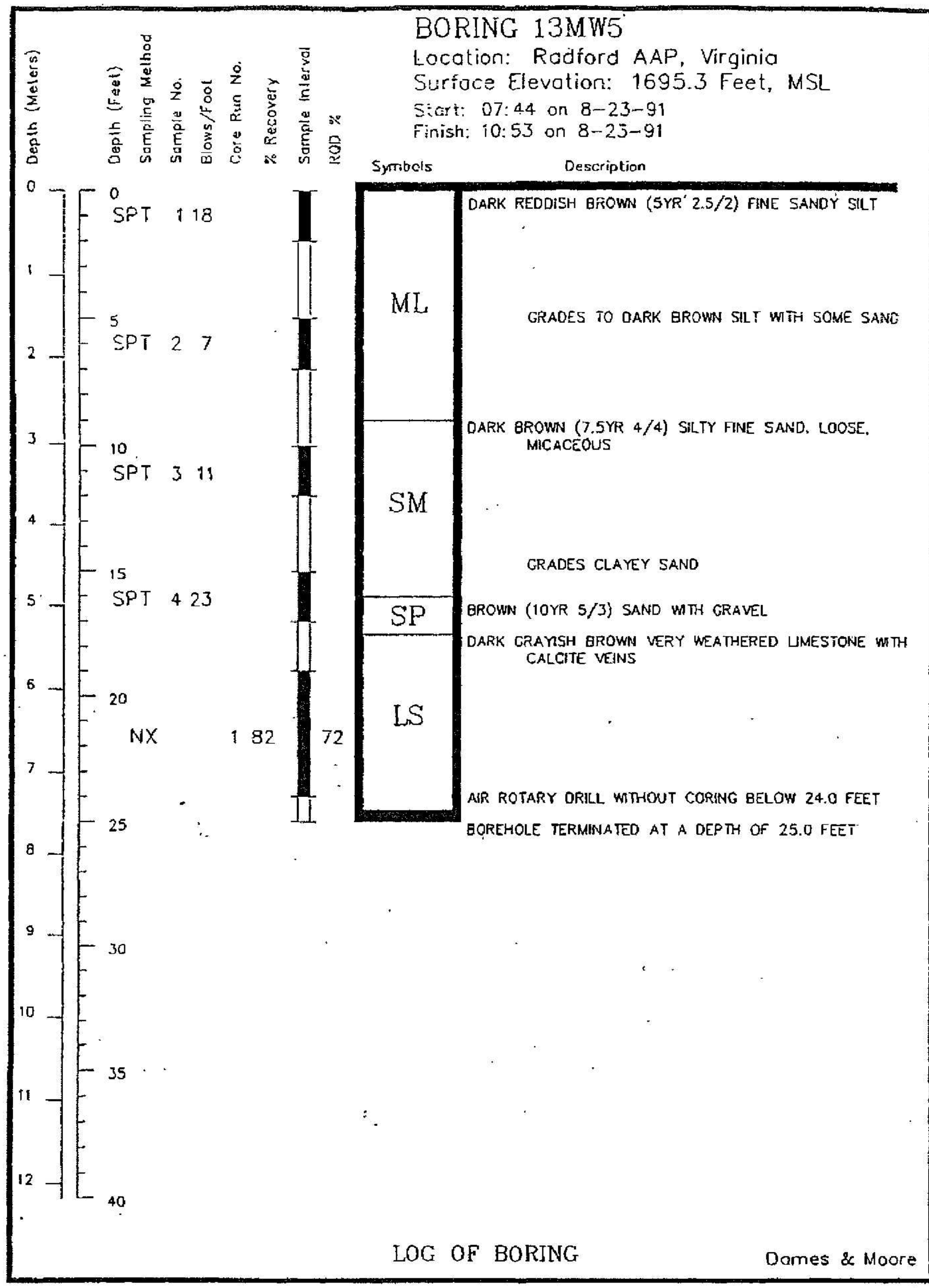
WELL INSTALLATION DIAGRAM
FOR RCRA FACILITY INVESTIGATION
RADFORD AAP, VIRGINIA

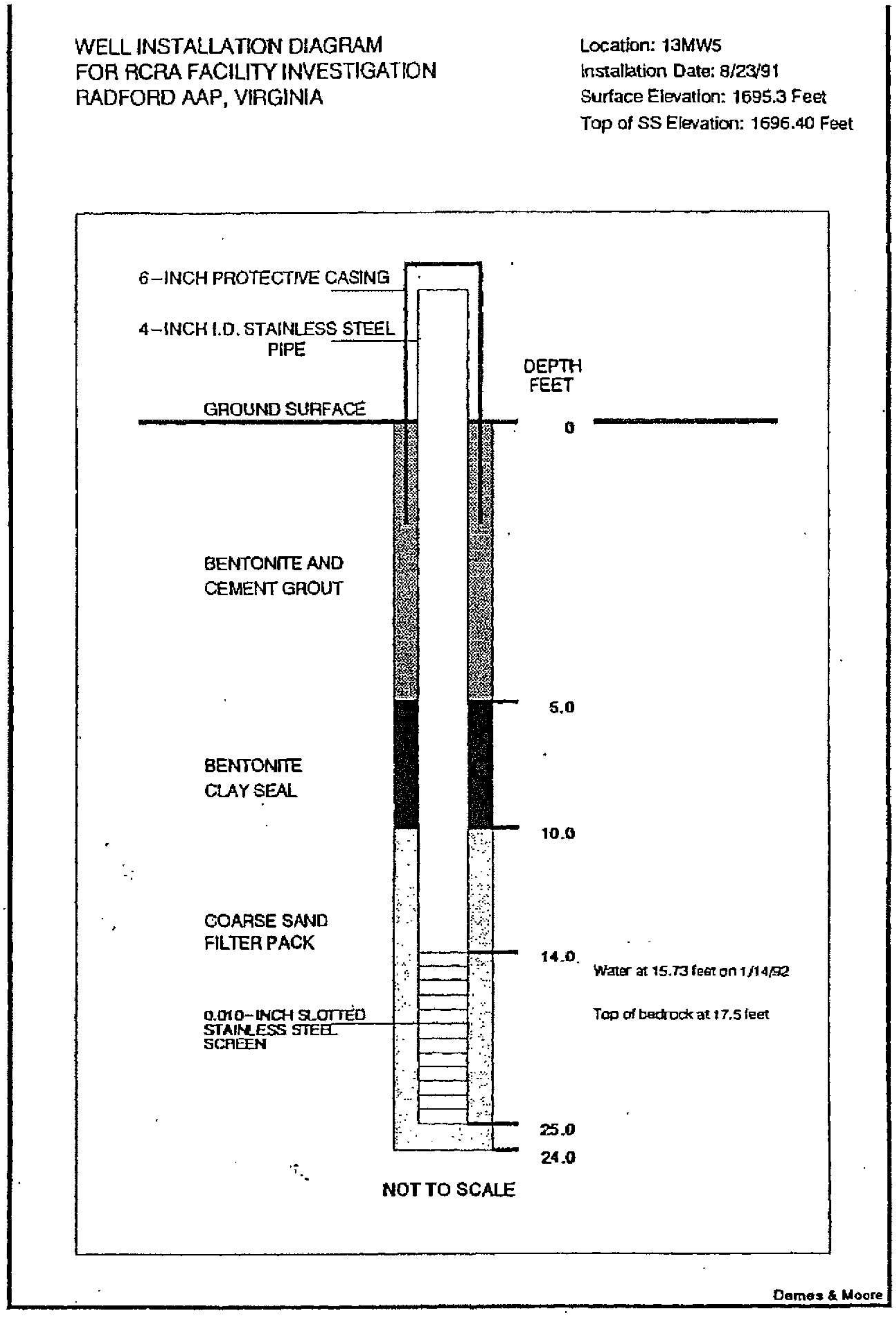
Location: 13MW4
Installation Date: 8/28/91
Surface Elevation: 1695.2 Feet
Top of SS Elevation: 1696.40 Feet



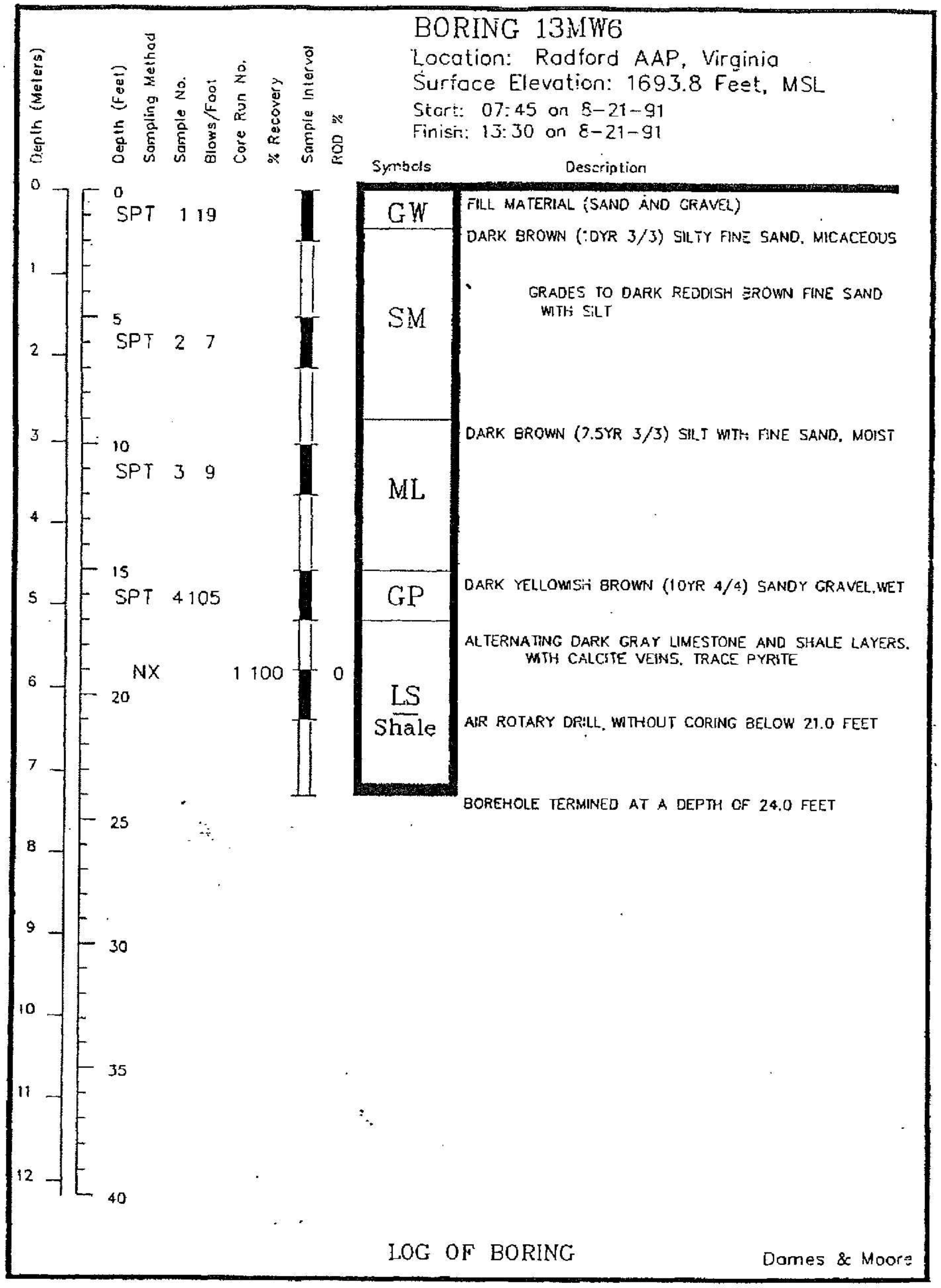
Dames & Moore

BORING LOG AND WELL CONSTRUCTION DIAGRAM FOR 13MW5



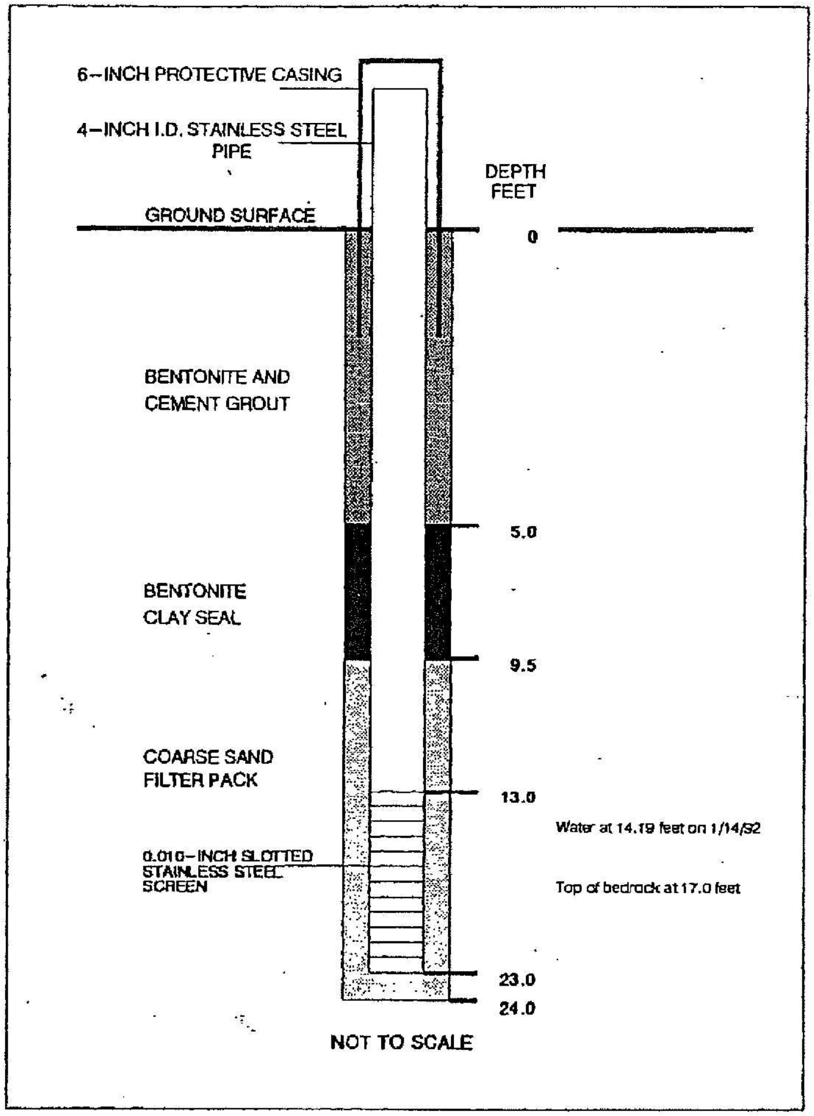

WELL INSTALLATION DIAGRAM
FOR RCRA FACILITY INVESTIGATION
RADFORD AAP, VIRGINIA
Location: 13MW5
Installation Date: 8/23/91
Surface Elevation: 1695.3 Feet
Top of SS Elevation: 1696.40 Feet
6-INCH PROTECTIVE CASING
4-INCH I.D. STAINLESS STEEL PIPE
DEPTH FEET
GROUND SURFACE
0
BENTONITE AND CEMENT GROUT
5.0
BENTONITE CLAY SEAL
10.0
COARSE SAND FILTER PACK
14.0
Water at 15.73 feet on 1/14/92
Top of bedrock at 17.5 feet
0.010-INCH SLOTTED STAINLESS STEEL SCREEN
25.0
24.0
NOT TO SCALE
Dames & Moore

BORING LOG AND WELL CONSTRUCTION DIAGRAM FOR 13MW6



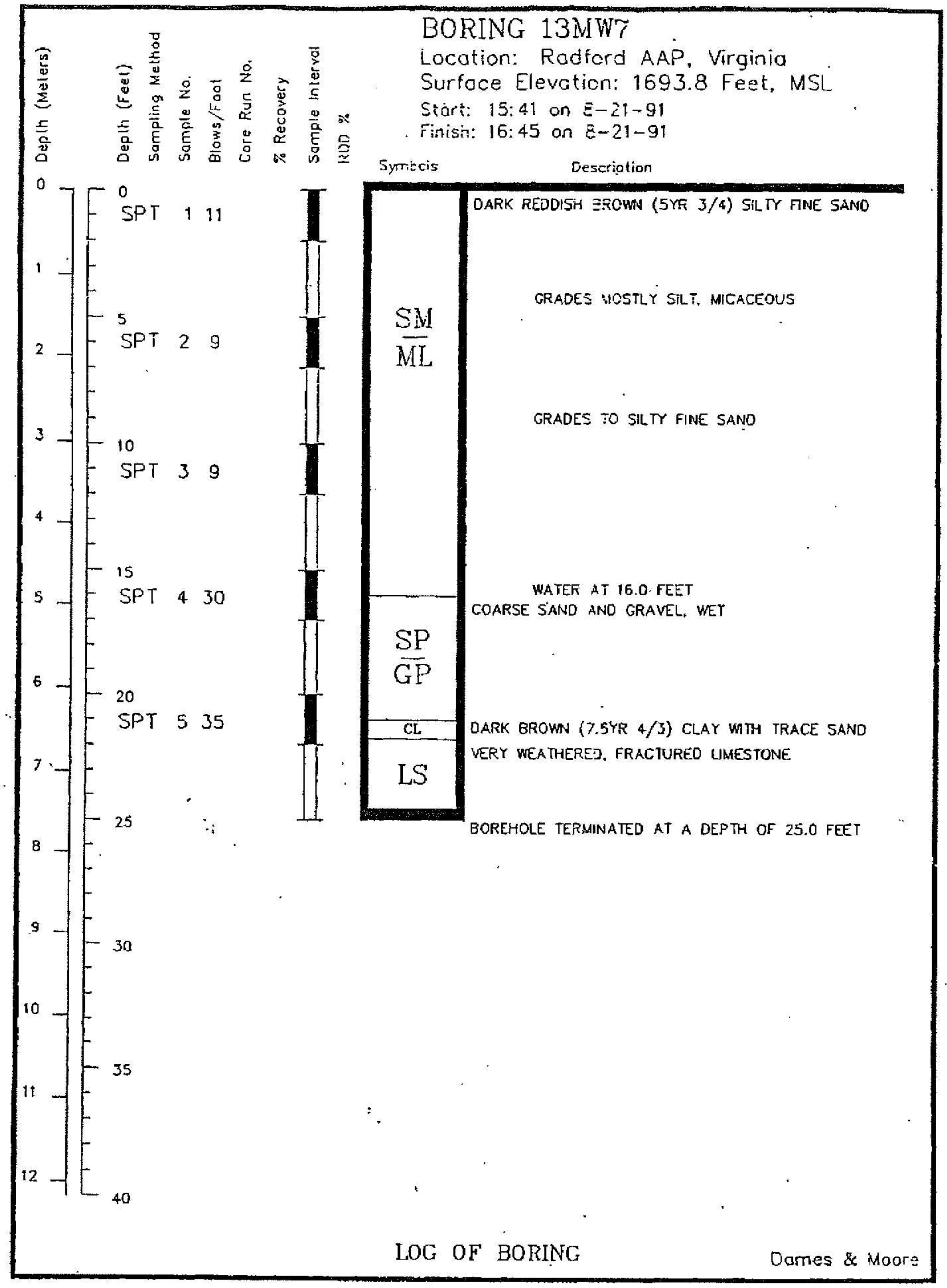
WELL INSTALLATION DIAGRAM
FOR RCRA FACILITY INVESTIGATION
RADFORD AAP, VIRGINIA

Location: 13MW6
Installation Date: 8/21/91
Surface Elevation: 1693.8 Feet
Top of SS Elevation: 1696.05 Feet



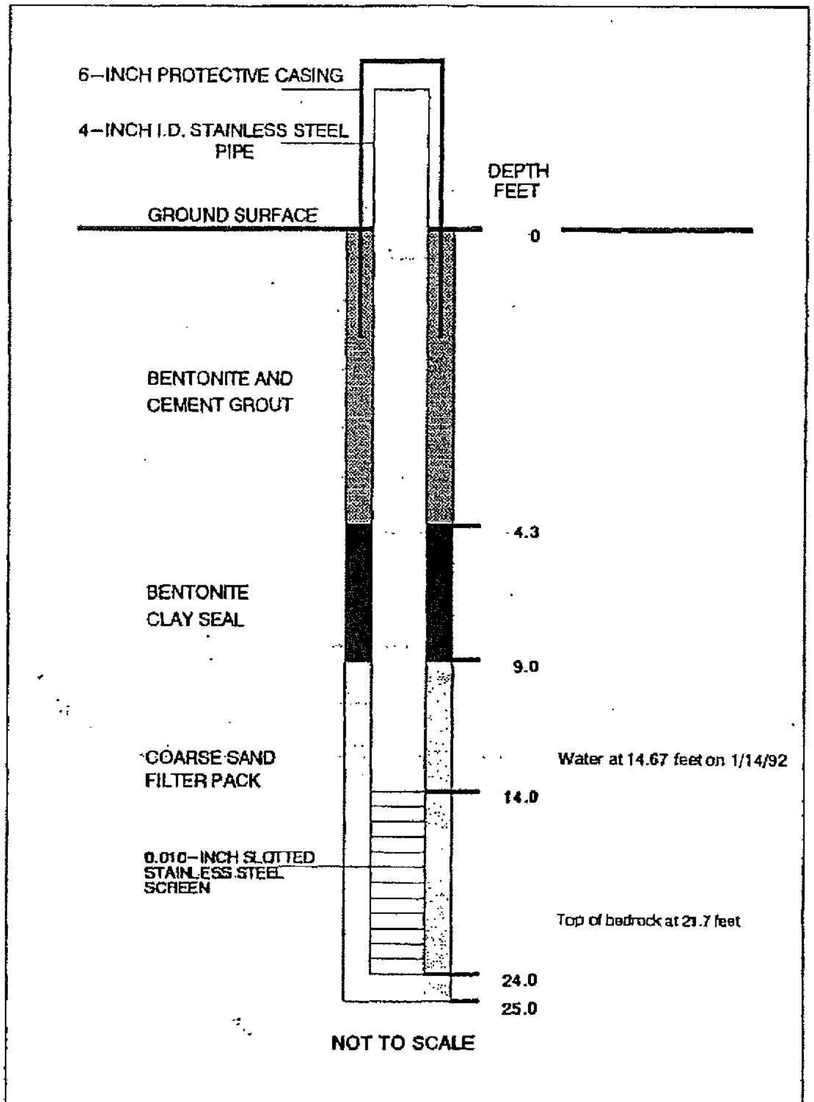
Dames & Moore

BORING LOG AND WELL CONSTRUCTION DIAGRAM FOR 13MW7



WELL INSTALLATION DIAGRAM
FOR RCRA FACILITY INVESTIGATION
RADFORD AAP, VIRGINIA

Location: 13MW7
Installation Date: 8/22/92
Surface Elevation: 1693.8 Feet
Top of SS Elevation: 1695.21 Feet



Dames & Moore

BORING LOG AND WELL CONSTRUCTION DIAGRAM FOR 13MW8

DRAPER ADEN ASSOCIATES
Engineers • Geologists • Hydrologists

LOG OF: **13MW8** (1 of 1)

Project Number: **B03204-137E**

Client:		Drilling Company:	**Davidson Drilling**
Project:	**RAAP - OBG**	Driller:	**Chase Davidson**
Location:	**OBG**	Boring Method:	**HSA/Air**
North: **3,599,857.7**	East: **10,892,849.3**	Logged by:	**KMW**
Total Depth **24.0'** Elev GS: **1693.6**	Reference: **Ground Surface**	Completion Date:	**October 24, 2013**

Samp ID	Blow Counts	N Value	Depth Scale	DESCRIPTION (USC)	Stratum Elev	PID (ppm)	WELL LOG	H2O	REMARKS
				7 7/8" Diameter HSA. Light orange-brown gravel and sand with silt.	1692.6				Riser extends ~2.41' above ground surface. Measuring point elevation = 1696.01. Surface completion includes 6" lockable steel stick-up in 5'x5' concrete apron. Two protective bollards installed north of the well.
				Dark gray-brown medium grained sand with silt.	1689.6				
			5	Dark gray-brown fine grained sand with silt.					Bentonite grout to surface by tremie method.
									4" ID stainless steel riser.
							1685.0		
			10						Bentonite seal above sand pack.
							1682.6		
					1681.6				Sand filter ~2.25' above top of screened interval.
				Dark gray-brown clayey sand with silt.	1679.6		1680.4		
				River gravel and cobbles with sand and silt. Auger refusal at 15' bgs; switch to air rotary drilling with 6" dia air hammer.	1678.6			∇ ▼	Depth to water observed during drilling. Depth to water observed on 10/30/13.
			15	Limestone bedrock. Installed temporary 6" ID steel casing to top of bedrock.					18" bladder pump set between 18.5-20.0 bgs to capture upper aquifer and allow for seasonal fluctuations in the water table.
			20						10' of 4" ID stainless steel screen with pre-cut 0.01" slots.
					1671.6				
				Boring terminated at 23'10" to allow for potential slough during well construction. Installed well screen, riser and sand pack. Remove temporary casing and backfill outer annulus as noted.	1669.8		1670.5 1670.4 1669.8		Stainless steel pipe cap welded to bottom of screen. Filter sand at bottom.

WELL_LOG RAAP - OBG SOURCE AREA.GPJ DRAPER.GDT 12/9/13

Appendix 9: INVESTIGATION DERIVED WASTE POLICY

20-80-004-1995
References Revised 09-2003

MEMORANDUM

TO: Waste Operations Staff
Regional Waste Compliance Managers

FROM: Hassan Vakili, Director
Waste Operations

DATE: July 5, 1995

COPY: Bob Burnley

SUBJECT: Department Policy on Investigation Derived Waste (IDW)

Attached is a copy of the "Policy for the Handling of Investigation Derived Waste (IDW)" that has recently been finalized. Please ensure that all appropriate staff receive copies of this policy which will hopefully serve to address the questions that have been raised regarding the proper management of these types of wastes.

If you should have any questions regarding this matter or require further clarification, please contact Ulysses Brown at (804) 527-5148.

Department of Environmental Quality
Waste Operations
Policy for the Handling of
Investigation Derived Waste (IDW)

The Department of Environmental Quality (DEQ), Waste Operations has received a request for guidance from the regulated community concerning the Commonwealth of Virginia's requirements regarding the management and disposal of investigation derived waste (IDW). Because Virginia administers an authorized state RCRA program, the Virginia Solid Waste Management Regulations (VSWMR) and the Virginia Hazardous Waste Management Regulations (VHWMR) will serve as the governing requirements in lieu of Federal RCRA regulations contained in the Code of Federal Regulations (40 CFR 260 - 270) except for the Land Disposal Restrictions of 40 CFR 268. For reference, please see the Virginia Waste Management Act, Code of Virginia §10.1-1400 et seq.; the Virginia Hazardous Waste Management Regulations (VHWMR) (9 VAC 20-60-10 et seq.); the Virginia Solid Waste Management Regulations (VSWMR) (9 VAC 20-80-10 et seq.); Federal: the Resource Conservation and Recovery Act (RCRA), 42 USC 6901; and the U. S. Department of Transportation Rules for the Transportation of Hazardous Materials, 49 CFR Part 107, 171.1 - 172.558.

With regard to IDW, it is the site manager's responsibility to determine whether the wastes generated during an investigation meet the definition of a solid or hazardous waste. The site manager will be either the on-scene coordinator (i.e., either the federal official predesignated by the Environmental Protection Agency (EPA) or the U.S. Coast Guard to coordinate and direct federal responses under subpart D or the official designated by the lead agency to coordinate and direct removal actions under subpart E of the National Contingency Plan (NCP)), or the remedial project manager (i.e., the official designated by the lead agency to coordinate, monitor, or direct remedial or other response actions under subpart E of the NCP).

If there is a possibility that either the ground water or the soil at the location where a monitoring well is installed is contaminated, the site manager must determine whether or not the well cuttings, purge water, and/or other IDW are contaminated (i.e., whether they are solid or hazardous wastes). In these cases, the site manager may use knowledge of the contaminated media to declare that the IDW is solid or hazardous waste. If analysis shows that no contamination is present in the soil or the ground water at the location where the monitoring well is installed, neither the well cuttings, nor the purge water would be regulated as a solid waste. An example of a situation where the site manager might use knowledge to determine proper disposition (i.e., testing would not be required) would involve materials generated at locations where wells are installed for the purpose of ascertaining naturally occurring levels of inorganic constituents and there is no basis to expect contamination, i.e., there is no past history of hazardous waste management activities or releases in these areas. If this is the case, the soils, cuttings, purge water, etc. would not be regulated as solid wastes. Test results or knowledge of the waste should be used to screen the well cuttings, purge water and other IDW to demonstrate that concentrations of contaminants are below or equal to background levels.

Purge water, well cuttings from monitoring wells, and other IDW, if tested, must be done so in accordance with EPA SW-846, Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, 3rd edition, 1986, as updated. If contaminant levels are found to be above background levels, the IDW would be considered a solid waste. Should test results further indicate that the IDW contains a listed hazardous waste, or if the IDW exhibits a characteristic of hazardous waste, the IDW is a hazardous waste and must be managed and disposed in accordance with the VHWMR. Alternatively, contaminated IDW that contains a listed hazardous waste must be managed as a hazardous waste until it no longer "contains" the hazardous waste, i.e., until the constituent levels are below site specific risk based levels. This is consistent with EPA's Contained In Policy. The DEQ should be contacted directly to determine the site specific risk based levels that would apply to IDW that contains listed hazardous waste.

If the IDW is not a hazardous waste, but contains levels of contaminants above background levels, the IDW must be managed in accordance with the VSWMR. Solid waste generated from cleanup or investigation activities is considered a special waste under Part VIII of the VSWMR. Prior to acceptance of a special waste for disposal at a solid waste management facility, the operator must obtain prior authorization from the Department. Purge water, on the other hand, must be disposed at a publicly owned treatment works (POTW) or other wastewater treatment system operating in accordance with its Virginia Pollutant Discharge Elimination System (VPDES) permit, provided that all other pertinent criteria are satisfied.

The on-site treatment, storage, or disposal of IDW must be authorized by a permit from the DEQ. A generator of hazardous IDW may accumulate such wastes in tanks or containers in accordance with 40 CFR 262.34. Treatment of hazardous waste in tanks or containers within the 90 day accumulation period may only occur upon prior written approval from the appropriate DEQ Regional Office.

This policy may be revised or rescinded at any time as Federal and/or State regulations change.

Signed:

[signed]

____
Hassan Vakili, Director
Waste Operations

6-28-95
References Revised 09-2003
____
Date

ATTACHMENT IV.B - GROUND WATER MONITORING LIST

Constituents	CASRN	Analytical Method
Energetics		
1,3,5-trinitrobenzene	99354	8330
1,3-dinitrobenzene	99650	8330
2,4-dinitrotoluene	121142	8330
2,6-dinitrotoluene	606202	8330
Nitroglycerin	55630	8330
Semivolatiles		
3,3'-dimethylbenzidine	119937	8270
Benzo(a)anthracene	56553	8270
Benzo(a)pyrene	50328	8270
Benzo(b)fluoranthene	205992	8270
Benzo(k)fluoranthene	207089	8270
Bis(2-ethylhexyl)phthalate	117817	8270
Butyl benzyl phthalate	85687	8270
Dibenzo(a,h)anthracene	53703	8270
Diethyl phthalate	84662	8270
Dimethyl phthalate	131113	8270
Di-n-butyl phthalate	84742	8270
Fluoranthene	206440	8270
Hexachloroethane	67721	8260
Indeno(1,2,3-cd)pyrene	193395	8270
Naphthalene	91203	8260
Volatiles		
1,1-dichloroethane	75343	8260
1,1-dichloroethene	75354	8260
Benzene	71432	8260
Benzyl chloride	100447	8260
Carbon tetrachloride	56235	8260
Chloroform	67663	8260
Methyl bromide	74839	8260
Methyl chloride	74873	8260
Methylene chloride	75092	8260

Constituents	CASRN	Analytical Method
Toluene	108883	8260
1,1,1-trichloroethane	71556	8260
Trichloroethene	79016	8260
Trichlorofluoromethane	75694	8260
Total Metals		
Antimony	7440360	6010/6020
Arsenic	7440382	6010/6020
Barium	7440393	6010/6020
Chromium	7440473	6010/6020
Lead	7439921	6010/6020
Mercury	7439976	7470
Nickel	7440020	6010/6020
Selenium	7782492	6010/6020
Zinc	7440666	6010/6020
Miscellaneous		
Perchlorate	14797730	314.0/6850

Note:

1. Alternate SW-846 Methods may be approved by the Department if the request is in writing and submitted at least 30 days prior to the sample collection event. Proposed alternative methods must achieve the appropriate Data Quality Objective (i.e. at least a Department approved health-based concentration limit).

2. Current method updates are represented without suffixes on each method (e.g., SW-846- Method 6020A). The laboratory performing the analysis must be VELAP accredited for a current method update.

3. The laboratory performing the analysis must be VELAP accredited for the matrix, method and analyte.

ATTACHMENT IV.C - INITIAL BACKGROUND CONCENTRATIONS

Constituents	CASRN	Initial Background Concentration
Energetics		
1,3,5-trinitrobenzene	99354	2.5
1,3-dinitrobenzene	99650	2.5
2,4-dinitrotoluene	121142	10
2,6-dinitrotoluene	606202	5
Nitroglycerin	55630	16
Semivolatiles		
2,4-dichlorophenol	120832	10
3,3'-dimethylbenzidine	119937	10
2-chlorophenol	95578	10
3-methylphenol	108394	20
4-methylphenol	106445	20
4-nitrophenol	100027	20
Acetophenone	98862	10
Benzo(a)anthracene	56553	10
Benzo(a)pyrene	50328	10
Benzo(b)fluoranthene	205992	10
Benzo(k)fluoranthene	207089	10
Bis(2-ethylhexyl)phthalate	117817	10
Butyl benzyl phthalate	85687	10
Dibenzo(a,h)anthracene	53703	10
Dibenzofuran	132649	10
Diethyl phthalate	84662	10
Dimethyl phthalate	131113	10
Di-n-butyl phthalate	84742	10
Di-n-octyl phthalate	117840	10
Diphenylamine	122394	10
Fluoranthene	206440	10
Hexachloroethane	67721	10
Indeno(1,2,3-cd)pyrene	193395	10
Naphthalene	91203	1
Nitrobenzene	98953	10

Constituents	CASRN	Initial Background Concentration
Phenol	108952	10
Pyrene	129000	10
Volatiles		
1,1-dichloroethane	75343	1
1,2-dichloroethane	107062	1
1,1-dichloroethene	75354	1
Benzene	71432	5
Benzyl chloride	100447	5
Carbon tetrachloride	56235	5
Chlorobenzene	108907	5
Chloroform	67663	1
Methyl bromide	74839	1
Methyl chloride	74873	5
Methylene chloride	75092	5
Tetrachloroethene	127184	1
Toluene	108883	5
1,1,1-trichloroethane	71556	1
Trichloroethene	79016	1
Trichlorofluoromethane	75694	1
Vinyl chloride	75014	1
Total Metals		
Antimony	7440360	6
Arsenic	7440382	5
Barium	7440393	206
Cadmium	7440439	1
Chromium	7440473	112
Lead	7439921	14
Mercury	7439976	2.52
Nickel	7440020	5
Selenium	7782492	5
Silver	7440224	2.4
Zinc	7440666	5
Miscellaneous		
Perchlorate	14797730	4

MODULE V - GROUNDWATER COMPLIANCE MONITORING PROGRAM

V.A. HIGHLIGHTS

The Open Burn Ground (OBG) (a.k.a., Hazardous Waste Management Unit - 13 (HWMU-13) at the Radford Army Ammunition Plant (RFAAP) is a waste propellant open burning ground. The OBG is located on the southeastern end of the Horseshoe Area on the flood plain of the New River and consists of eight above-ground burning assemblies. The waste spill "clean-up" residues are hazardous due to their reactivity (D003) as specified in 9VAC 20-60-261, incorporating 40 CFR § 261.23, toxicity (D005, D008 and D030) as specified in 9VAC 20-60-261, incorporating 40 CFR § 261.24, and/or ignitability (D001) as specified in 9VAC 20-60-261, incorporating 40 CFR § 261.21.

Groundwater monitoring has been conducted at the OBG since 1992. The OBG was in Interim Status, and groundwater monitoring activities were conducted quarterly in accordance with the requirements of 40 CFR § 265. In October 1999, the "Groundwater Quality Assessment Report" for the OBG was submitted to the Virginia Department of Environmental Quality (DEQ/Department). A groundwater monitoring list was included in the report. The monitoring list consisted of a subset of the constituents listed in 40 CFR 264 Appendix IX that previously had been detected in the groundwater and/or that would be reasonably expected to be in or derived from the waste burned at OBG.

In September 2005, DEQ issued the original *Permit for the Treatment of Hazardous Waste by Open Burning* (Permit) for the OBG (effective on October 28, 2005). However, beginning in Fourth Quarter 2003, quarterly groundwater monitoring was conducted in accordance with the "Detection Groundwater Monitoring Program for the Open Burning Ground", dated September 2003, in anticipation of receipt of the Permit.

Exceedances of established background values for carbon tetrachloride and perchlorate during the Fourth Quarter 2005 Detection monitoring event prompted the need to develop a Compliance Monitoring program in accordance with the requirements of the Permit. As a result, during First Quarter 2006, all wells were sampled for the full Appendix IX constituent list and the hazardous constituents detected formed the basis for the Compliance Monitoring List for the OBG Unit.

The Permittee submitted a revised Compliance Monitoring Plan with proposed Groundwater Protection Standards (GPSs) to the Department and the first semiannual groundwater Compliance Monitoring event for 2007 was conducted in accordance with the revised Compliance Monitoring Plan during Second Quarter 2007.

During semiannual groundwater Compliance Monitoring, concentrations of at least two constituents, perchlorate and carbon tetrachloride, exceeded their respective GPSs at one or more downgradient well(s). As a result, according to 40 CFR § 264.91(a)(2), the Permittee implemented a Corrective Action Program (CAP) under 40 CFR § 264.100.

Permit Module VI – *Corrective Action and Groundwater Monitoring Program*, was approved by the DEQ in the Class 3 Hazardous Waste Permit Modification dated September 27, 2011. This module was revised on Feb 22, 2012, November 9, 2013, June 12, 2014 and with this permit module.

Currently, groundwater is conducted semiannually in accordance with the Corrective Action and Groundwater Monitoring Program.

This permit module, Module IV – Detection Monitoring, presents requirements of the Detection Monitoring Program and includes the Sampling and Analysis Plan (SAP) for the facility which is incorporated by reference in the Compliance Monitoring and Corrective Action Monitoring permit modules.

Currently, RFAAP continues to monitoring groundwater semiannually at the OBG in accordance with the Corrective Action and Groundwater Monitoring Program.

This permit module, Module V – Compliance Monitoring, presents requirements of the Compliance Monitoring Program in the event the OBG returns to semiannual groundwater Compliance monitoring.

V.A.1. Soils and Geology

For general soil occurrence and properties for RFAAP see Section 2.1 of Permit Attachment II.C. The general hydrogeologic setting and characteristics for RFAAP are described in Sections 2.0 and 2.2 of Permit Attachment II.C.

For HWMU-13 the geological cross section location map and geological cross sections are included in Figures V.A.1 and V.A.2 at Attachment V.A.

The OBG is underlain by an approximately 13-20 feet thick alluvial deposit consisting of clay and silt overlying sand and gravel. The alluvium is underlain by Middle Cambrian Age carbonate bedrock of the Elbrook Formation comprised of dolomite and limestone with lesser shale and siltstone. The distinctive feature of the formation is the thin bedding and generally shaley character. Much brecciation is evident through the formation. Lowlands characterized by karst features form over these rock types. Bedrock was encountered beneath OBG at depths ranging from 13 to 20 feet BGS. The bedrock surface is irregular.

Geologically distinctive or consistent karst lineament trends were not observed within the Horseshoe Area. Karst features are likely obscured or are not obvious due to the thickness of the mantled terrace deposits, and/or due to historical site development. In the Horseshoe Area, unconsolidated materials are most likely eroded and conveyed to the New River via internal networks of natural “conduits” in the bedrock. These conduits consist of solutionally-enlarged joints, bedding, planes, and fault surfaces. During field reconnaissance, solution channels were most often observed in association with outcrops of tectonic breccia; several outcrops of tectonic breccia were observed within the steep slope along the northern edge of the OBG. Significant dissolution of bedrock was not typically observed along joints and bedding. A perennial spring (with several adjacent seeps) is located approximately 1,700 feet north/northeast of the OBG. No other springs or perennial surface water flow was observed in the Horseshoe Area. Except during extreme precipitation events, almost all precipitation infiltrates into the subsurface via sinkholes or other karst features. Very little or no precipitation is conveyed to the New River via surface channels.

V.A.2. Hydrology and Groundwater

Specific groundwater elevation contour and flow direction maps (2^{nd} and 4^{th} Quarters 2014) for the OBG are included in Figures V.A.3 and V.A.4 of Permit Attachment V.A.

The monitoring wells at the OBG are screened within the carbonate bedrock or across the alluvium/bedrock interface. Static water levels during the last year ranged from approximately 1678.31 to 1679.97 for 13MW7 and from approximately 16778.22 to 1679.61 for 13MW1 feet above Mean Sea Level (MSL). The groundwater fluctuations at the OBG typically range from approximately 0.9 to 1.9 feet annually. As shown on the groundwater contour maps (Figure V.A.3 and V.A.4 of Permit Attachment V.A), the apparent horizontal groundwater flow direction beneath the OBG is generally to the south toward the New River.

Karst hydrogeologic systems are usually anisotropic, and characterized by turbulent flow and vertical hydraulic gradients. For the groundwater flow velocity calculation Darcian flow conditions were assumed for the weathered carbonate bedrock beneath OBG.

The estimated groundwater velocity across the OBG was calculated to be approximately 4.25×10^{-2} ft/day or 15.5 ft/year, based on the following:

- An average hydraulic conductivity of 6.56 * 10Exp(-5) ft/second;
- An average hydraulic gradient of 0.003 ft/ft; and
- An assumed effective porosity of 0.40, based on a representative range of porosities for karst carbonate rock and clayey, silty sand and gravel alluvium.
- The actual groundwater flow velocities in the carbonate bedrock may vary as much as one to two orders of magnitude from the velocity presented above, depending on water level conditions and the distribution of karst conduits.

V.B. COMPLIANCE MONITORING SYSTEM REQUIREMENTS

The groundwater beneath OBG shall be monitored in accordance with 40 CFR §§ 264.97 and 246.99.

V.B.1. Groundwater Monitoring System

Groundwater beneath OBG shall be monitored with one (1) upgradient background groundwater monitoring well, three (3) downgradient point of compliance wells, and three (3) downgradient plume monitoring well located as specified on the maps presented in Figures V.A.3 and V.A.4 of Permit Attachment V.A. Monitoring well 13MW2 is located upgradient of the unit and will serve as the background well for the OBG. Monitoring wells 13MW3, 13MW4, and 13MW7 are located downgradient of the unit and will serve as the point of compliance wells. Monitoring wells 13MW5, 13MW6, and 13MW8 are the downgradient plume monitoring wells for the unit. In addition, well 13MW1 will be used as a piezometer to measure static groundwater elevations during each sampling event. Further, the facility may collect background data from 13MW1 following approval from the Department.

V.B.2. Sampling Schedule

The background wells and point of compliance wells shall be sampled in accordance with the Sampling and Analysis Plan (Permit Attachment IV.A) and the following schedule.

a. The downgradient point of compliance wells, plume monitoring wells and, when needed, the background well specified in Permit Condition V.B.1. shall be sampled at least semiannually for the constituents listed in Permit Attachment V.B. Samples shall be collected using the methods specified in Permit

Attachment IV.A and analyses shall be obtained using the methods specified in Permit Attachment V.B. Additionally, the laboratory must be accredited for the analytical method, matrix and target analyte by the Virginia Environmental Laboratory Accreditation Program (VELAP).

b. Downgradient point of compliance wells specified in Permit Condition V.B.1 shall be sampled annually for all constituents listed in 40 CFR Part 264 Appendix IX, as listed in Permit Attachment V.D. Samples shall be analyzed using the methods specified in Permit Attachment V.D. The performing laboratory must have VELAP accreditation for the alternative method, matrix and analyte.

c. Alternate methods may be approved by the Director, provided that the request is in writing and submitted thirty (30) days prior to the sampling event. Proposed alternate methods must achieve the same Limit of Quantitation, or lower, as the specified analytical method and must meet the requirements of Permit Attachment IV.A, Section III.C. In addition, the performing laboratory must have VELAP accreditation for the alternative method, matrix and analyte.

V.C. WELL LOCATIONS, CONSTRUCTION AND MAINTENANCE

V.C.1. Well Locations

a. The locations of the monitoring wells comprising the groundwater monitoring system as described in Permit Condition V.B.1 are presented on Figures V.A.3 and V.A. 4 of Permit Attachment V.A.

b. Boring logs, design and construction details for monitoring wells listed in Permit Condition V.B.1 are presented in Permit Attachment IV.A, Appendix 8.

V.C.2. Well Maintenance

Monitoring wells shall be maintained at their locations depicted on Figures V.A.3 and V.A.4 presented in Permit Attachment V.A. The Permittee shall inspect all monitoring wells listed in Permit Condition V.B.2 at each sampling event to ensure that they are not damaged. Any required repairs shall be made by the Permittee as soon as possible. If any of these wells are damaged beyond reasonable efforts for repair, the Permittee may petition the Director for approval to abandon the affected monitoring well in accordance with Permit Condition V.C.4. Permit modification applications shall be submitted in accordance with 40 CFR § 270.42.

V.C.3. Maintenance Standard

All monitoring wells required by this Permit shall be maintained in conformance with the following, pursuant to 40 CFR § 264.97(a):

a. The groundwater monitoring system must yield samples in the background wells that represent the quality of the background water unaffected by leakage from any regulated unit and, in downgradient wells yield samples that represent groundwater quality passing the point of compliance.

b. The number and location of groundwater monitoring wells must be sufficient to identify and define all logical release pathways from the regulated unit to the uppermost aquifer based on site specific hydrogeologic characterization.

V.C.4. Installation and Abandonment

The Director must approve the addition or removal of all monitoring wells prior to installation or abandonment, in accordance with 40 CFR § 270.42.

a. All monitoring wells which are to be abandoned shall be plugged and abandoned in accordance with Permit Attachment IV.A., Appendix 7. Well abandonment methods and certification shall be submitted to the Director within thirty (30) days from the date the wells are removed from the monitoring program.

b. All monitoring wells added to the groundwater monitoring system detailed in Permit Condition V.B.1 must be constructed in accordance with USEPA's RCRA Groundwater Monitoring Technical Enforcement Guidance Document (TEGD) or subsequent USEPA guidance documents, and must meet the requirements of 40 CFR § 264.99(b).

V.D. GROUNDWATER PROTECTION STANDARD

The Permittee shall monitor the groundwater to determine if the regulated unit complies with the groundwater protection standard (GPS) established in accordance with 40 CFR Part 264.92 and 9VAC-20-60-264.B(7).

V.D.1. Hazardous Constituents and Groundwater Protection Standard (GPS)

a. Hazardous constituents are any constituents listed in Appendix VIII to 40 CFR § 261 or in 40 CFR 264 Appendix IX, as defined in 9VAC-20-60-264.B(6).

b. GPS are established based upon background concentrations from background groundwater monitoring at OBG, USEPA Safe Drinking Water Act Maximum

Contaminant Levels (MCL), Alternate Concentration Limits (ACL) established by the Department, or USEPA Region III Regional Screening Levels (RSLs)

c. Background concentrations established at the time of permit issuance are listed in Permit Attachment V.C. For any newly detected hazardous constituents, background values shall be established in accordance with 40 CFR § 264.97(g) and as specified in Permit Attachment IV.A, Appendix 6. Background groundwater quality for a new monitoring parameter or constituent shall be based on data from quarterly sampling of 13MW2 obtained over the course of one year. Existing data may be used to establish background concentrations provided it is of sufficient quality, following approval from DEQ.

d. The hazardous constituents of concern and their GPS for OBG are listed in Permit Attachment V.E.

e. If USEPA implements any changes to MCLs, the GPS defined by that MCL shall be updated to reflect the most current value established by USEPA. The Department will notify the Permittee of any such change and will provide an amended Permit Attachment V.E. to the Permittee. Within ninety (90) days of receiving the amended Permit Attachment V.E., the Permittee shall provide notice of the modification(s) to all persons on the facility mailing list.

f. Any concentration limit based on a background value or ACL may be updated if new data become available. The Department will review the ACL changes annually and decide if the changes were significant enough to warrant the Department pursuing a permit amendment. The Department will notify the Permittee of any such change and will provide an amended Permit Attachment V.E. to the Permittee. Within ninety (90) days of receiving the amended Permit Attachment V.E., the Permittee shall provide notice of the modification(s) to all persons on the facility mailing list.

g. Newly detected hazardous constituents and their GPS will be added to Permit Attachment V.E. by the Department in accordance with Permit Condition V.H.7.

h. Removal of any constituent from Permit Attachment V.E. shall be requested in accordance with 40 CFR § 270.42.

V.D.2. Point of Compliance

The point of compliance extends vertically into the uppermost aquifer and is defined by the downgradient monitoring wells 13MW3, 13MW4, and 13MW7. The point of compliance represents the downgradient limit of OBG.

V.D.3. Compliance Period

a. The compliance period, during which the GPS must occur is equal to the period of time from the beginning of the waste management area's active life, including any waste management activity prior to permitting, until the end of the closure period and begins when the Permittee initiates a Compliance Monitoring Program meeting the requirements of 40 CFR § 264.99. OBG is currently active.

b. If the Permittee is required to conduct corrective action at the end of the specified compliance period, then the compliance period shall be extended until the Permittee demonstrates that the GPS has not been exceeded for three consecutive years.

V.E. SAMPLING AND ANALYSIS PROCEDURES

Pursuant to 40 CFR § 264.97(e), the groundwater monitoring program must include sampling and analytical methods that are appropriate for groundwater sampling and that accurately measure hazardous constituents in groundwater samples. To make changes to the groundwater sampling and analysis procedures specified in this section, the Permittee shall submit for Director approval an application for a Class 1 permit modification in accordance with 40 CFR 270.42, Appendix I.

V.E.1. Sample Collection and Sample Frequency

a. Groundwater samples shall be collected using the techniques described in Permit Attachment IV.A.

b. The Permittee must determine the concentration of constituents and parameters listed in Permit Attachment V.B in the groundwater at all background well(s) and all downgradient point of compliance and plume monitoring wells at least semiannually.

c. Additionally, downgradient point of compliance wells shall be sampled for the constituents from 40 CFR Part 264 Appendix IX as presented in Permit Attachment V.D (Annual Monitoring List) at least annually.

V.E.2. Sample Preservation, Transport and Documentation

a. Groundwater samples shall be preserved, packed and shipped to the receiving laboratory for analysis in accordance with the procedures specified in Permit Attachment IV.A.

b. Groundwater samples shall be tracked and controlled using the chain-of-custody procedures specified in Permit Attachment IV.A.

V.E.3. Sample Analysis

Groundwater samples shall be analyzed in accordance with the procedures described in Permit Attachments IV.B and D by a laboratory accredited for the analyte, matrix and method under VELAP.

V.F. GROUNDWATER SURFACE ELEVATION

V.F.1. Determination of Groundwater Surface Elevation
The Permittee shall determine the groundwater surface elevation in accordance with Permit Attachment IV.A at each groundwater monitoring well described in Permit Condition V.B.1 at least semiannually and each time groundwater is sampled.

V.F.2. Additional/Replacement Wells

The Permittee shall report the surveyed elevation of any additional or replacement monitoring well(s) when installed with as built drawings. The total well depth and the elevation of the following shall be recorded: top of the casing, ground surface and/or apron elevation, and top of the protective casing.

V.G. STATISTICAL PROCEDURES

For each hazardous constituent listed in Permit Attachment V.E, the Permittee shall determine whether there is a statistically significant increase over the concentration limit for that parameter or hazardous constituent during each compliance monitoring event in accordance with 40 CFR § 264.99(d) and the following procedures.

V.G.1. Statistical Evaluation

a. When evaluating the monitoring results pursuant to Permit Condition V.H., the Permittee shall use the statistical procedures in Permit Attachment IV.A, Appendix 6.

b. The Permittee may elect to perform a single empirical comparison of point of compliance well data to the GPS. If the point comparison indicates that the given data point is above the GPS, statistical procedures specified in Permit Attachment IV.A, Appendix 6 may be followed.

c. If the statistical comparison indicates that a statistically significant exceedance has occurred, the Permittee may elect to perform verification sampling as soon as practical but prior to the next regularly scheduled sampling event, pursuant to Permit Attachment IV.A, Appendix 6.

V.G.2. Schedule for Statistical Evaluation

The Permittee shall perform the required statistical evaluation within thirty (30) days of receipt of the analytical results from the laboratory.

V.H. MONITORING PROGRAM AND DATA EVALUATION

The Permittee shall determine groundwater quality in accordance with Permit Sections V.E., V.F. and V.G. as discussed below.

V.H.1. Groundwater Flow Direction and Velocity

The Permittee shall determine the groundwater flow direction and velocity in the uppermost aquifer at least semi-annually in accordance with Permit Condition V.B.2. Contaminant migration rate shall be calculated, if necessary to assure the effectiveness of compliance monitoring. Potentiometric maps showing groundwater elevation contour and flow direction during each sampling event shall be prepared at least annually.

V.H.2. Analytical Data Presentation

a. The Permittee shall present the groundwater quality at each monitoring well in a form appropriate for the determination of statistically significant increases, in accordance with 40 CFR § 264.97(h); and

b. The Permittee's report shall include at least the following information: the constituents analyzed, the GPS, the SW-846 test methods, method detection limits, level of quantitation, the laboratory and method required quality assurance/quality control (QA/QC) results, dilution factors, any laboratory specific limit of detection and/or limit of quantitation, the results of any screening analyses, and any other information needed to evaluate accuracy, precision, representativeness, comparability, and completeness of the groundwater quality data.

V.H.3. Determination of Increased Concentration

a. Pursuant to 40 CFR § 264.99(a), the Permittee shall determine the concentration of hazardous constituents and parameters listed in Permit Attachment V.B. in accordance with Permit Condition V.B.2.

b. During each compliance monitoring event, the Permittee shall determine for each hazardous constituent or parameter listed in Permit Attachment V.E. and in accordance with Permit Section V.G., whether there is a statistically significant increase over the GPS for that parameter or hazardous constituent.

V.H.4. <u>Determination of Additional Constituents Present</u>

a. Pursuant to procedures in 40 CFR § 264.98(f) and Permit Condition V.B.2., the Permittee shall determine if any additional hazardous constituents are present in the uppermost aquifer, and if so, at what concentrations. Constituent concentrations at levels between the Limit of Detection (LOD) and the Limit of Quantitation (LOQ) are subject to the requirements of Permit Condition V.H.4.

b. If a hazardous constituent is detected that is not already listed in Permit Attachment V.B., the Permittee may re-sample within one month of receipt of the analytical data and repeat the analysis. If the second analysis confirms the presence of the additional constituents, the Permittee shall report the concentration to the Director in writing within seven (7) days after the completion of the second analysis.

c. If the Permittee does not resample, or the second analysis confirms the presence of the additional constituent(s), the Permittee shall determine whether there is a statistically significant increase over the background values for each newly detected hazardous constituent. In determining whether such an increase has occurred, the Permittee must compare the groundwater quality at each point of compliance monitoring well specified in Permit Condition V.B.1 to background concentrations, in accordance with the statistical procedures specified in Permit Section V.G. and the following (Section V.H.5) procedures.

V.H.5. <u>Background Values for Newly Detected Constituents</u>

a. The Permittee shall establish background concentrations for each additional constituent detected pursuant to Permit Condition V.H.4. Background values shall be established in accordance with 40 CFR § 264.97(g) and the following procedures:

b. Background groundwater quality for a new monitoring parameter or constituent shall be based on data from quarterly sampling of 13MW2 obtained over the course of one year as specified in Permit Attachment IV.A, Appendix 6 (Statistical Analysis). The facility may collect quarterly background data from 13MW1 to obtain a more robust background dataset following approval from the Department. In this case, the background dataset would be one year's worth of data from the combination of wells 13MW1 and 13MW2. Existing data may be used to establish background concentrations provided it is of sufficient quality with approval from DEQ. Background monitoring well(s) are specified in Permit Condition V.B.1.

c. Newly detected constituent will be added to the Compliance Monitoring List (Permit Attachment V.B) and the established background value will be added to the Background Values Table (Permit Attachment V.C). Adding a newly detected constituent and its background concentration to Permit Attachment V.B and V.C is a Class 1 permit modification.

V.H.6. Alternate Source Demonstration for Newly Detected Constituents

Pursuant to 40 CFR § 264.98(g)(6) and the following conditions, the Permittee may attempt to demonstrate that the newly detected additional hazardous constituent came from a source other than the regulated unit, was due to an error in sampling, analysis or statistical evaluation, or was due to natural variability. The Director shall be notified of the intent to make the demonstration within seven (7) days of determining evidence of a statistically significant increase at the compliance point.

a. The demonstration shall begin within a reasonable time subsequent to the notification and a report documenting the results shall be submitted for review no later than ninety (90) days from the original notification.

b. The Permittee must continue to monitor in accordance with the Compliance Monitoring Program established in Permit Module V pursuant to 40 CFR § 264.99 (i)(4).

c. The Permittee must submit within ninety (90) days from the original notification a permit modification request to make any necessary changes to the compliance monitoring program at the facility in case the alternate source demonstration is unsuccessful.

V.H.7. Groundwater Protection Standard for Newly Detected Constituents

a. For any additional 40 CFR Part 264 Appendix IX hazardous constituent(s) determined to have a statistically significant exceedance above background, the Permittee shall put into effect a Class 1 permit modification to add the constituent to the compliance monitoring list, Permit Attachment V.B. In notifying the Director concerning the modification, the Permittee shall include the concentration of each hazardous constituent and a proposed concentration limit. The Permittee shall also specify if any changes to the groundwater monitoring system or the monitoring and analysis procedures are necessary to ensure continued compliance with 40 CFR § 264.99.

b. The Director will specify the GPS for each hazardous constituent and provide the Permittee with the amended Permit Attachment V.E. In establishing concentration limits, the Director will utilize background values determined through Permit Condition V.H.5 if no applicable MCL or ACL exists. The Permittee may request and the Director may establish an ACL in accordance with 40 CFR § 264.94 (b).

c. Within ninety (90) days of receiving the amended Permit Attachment V.E., the Permittee shall provide notice of the modifications to all persons on the facility mailing list.

V.I. SPECIAL REQUIREMENTS FOR GROUNDWATER PROTECTION STANDARD EXCEEDENCE

V.I.1. Notification

Pursuant to 40 CFR § 264.99(h), if the Permittee determines that concentration limits for any constituent are being exceeded for any point of compliance well, the Permittee shall notify the Director in writing within seven (7) days from the date of that determination. The notification must indicate the constituent(s), concentration(s), and sample location(s).

V.I.2. Corrective Action Requirements

The Permittee shall submit to the Director an application for a permit modification to establish a corrective action program meeting the requirements of 40 CFR Part 264.100 within one hundred eighty (180) days, or within ninety (90) days if an engineering feasibility study has been previously submitted to the Regional Administrator under 40 CFR Part 264.98(h)(5). The application must at a minimum include the following information:

a. A detailed description of corrective action that will achieve compliance with the GPS specified in the permit under paragraph (a) of this section; and

b. A plan for a groundwater monitoring program that will demonstrate the effectiveness of the corrective action. Such a groundwater monitoring program may be based on a compliance monitoring program developed to meet the requirements of 40 CFR § 264.99.

V.I.3. Alternate Source Demonstration

Pursuant to 40 CFR § 264.99(i), the Permittee may make a demonstration that the concentration limit was exceeded due to a source other than the regulated unit, or due to error in sampling, analysis, or statistical evaluation or due to natural variation. In making such a demonstration the Permittee shall:

a. Notify the Director within seven (7) days of determination that the demonstration will be attempted; and

b. Within ninety (90) days of the notification, submit a report to the Director demonstrating that a source other than the regulated unit caused the exceedance; and

c. Submit within ninety (90) days of the notification, an application for a permit modification to make any appropriate changes to the compliance monitoring program in case the alternate source demonstration is unsuccessful; and

d. Continue to monitor in accordance with the Compliance Monitoring Program established in Permit Module V pursuant to 40 CFR § 264.99 (i)(4).

V.J. REPORTING

The Permittee shall submit the analytical results required by Permit Section V.H whenever there is a change in flow rate or direction such that the groundwater monitoring system defined in Permit Condition V.B.1 is no longer adequate for the Compliance Monitoring Program, or whenever evidence of a statistically significant increase is identified, or at least annually with the annual groundwater monitoring report. Additional reporting requirements are specified in the following:

V.J.1. Groundwater Elevation/Potentiometric Contour Maps

a. Annually, the Permittee shall submit groundwater elevations and potentiometric contour maps depicting groundwater flow paths and supporting groundwater elevation data to determine if the requirements for locating the monitoring well network continue to be satisfied.

b. If the evaluation determines that the existing monitoring well network no longer satisfies the requirements of 40 CFR § 264.97(a), the Permittee shall immediately submit an application for a permit modification to make any appropriate changes to bring the monitoring system into compliance.

V.J.2. Contents of Annual Report

The report, submitted by March 1 of each year, shall meet all the requirements of an Annual Groundwater Report. The following items shall be included, at a minimum:

- Groundwater sampling results collected during the previous calendar year;
- Long-term time concentration plots of constituents of concern exceeding background for each well;
- When appropriate, graphic representation of groundwater contamination plumes for constituents exceeding background;
- Laboratory certificates from the previous calendar year;
- Potentiometric surface maps and static groundwater level elevation data collected during each sampling event during the previous calendar year;
- Evaluation of groundwater flow directions and gradients;
- Calculated or measured rate of migration of hazardous constituents in the groundwater;
- When appropriate, statistically calculated background values;
- Statistical evaluations of the groundwater data collected during the previous calendar year, including all computations, calculated means, variances, t-statistic values, and t-test results or the calculations and results of statistical tests that the Director has determined to be equivalent as appropriate; and
- Copies of all notifications and reports submitted as required by this Permit.

V.K. RECORDKEEPING

Groundwater monitoring data collected in accordance with Permit Section V.E, including all monitoring, testing and analytical data, must be maintained in the facility operating record in accordance with Permit Section I.E.

V.L. ASSURANCE OF COMPLIANCE

The Permittee shall demonstrate to the Director that groundwater compliance monitoring measures necessary to maintain compliance with the monitoring requirements under 40 CFR § 264.99 are being conducted during the term of the permit.

V.M. PERMIT MODIFICATION REQUEST

If the Permittee or the Director determines that the compliance monitoring program no longer satisfies the requirements of 40 CFR § 264.99, then the Permittee shall submit, within ninety (90) days, an application for a permit modification to make any appropriate changes to the program.

ATTACHMENT V.A- HYDROGEOLOGICAL MAPS/FIGURES FOR OBG (HWMU-13)

FIGURE V.A.1: OBG/HWMU-13 GEOLOGICAL CROSS SECTION LOCATION MAP

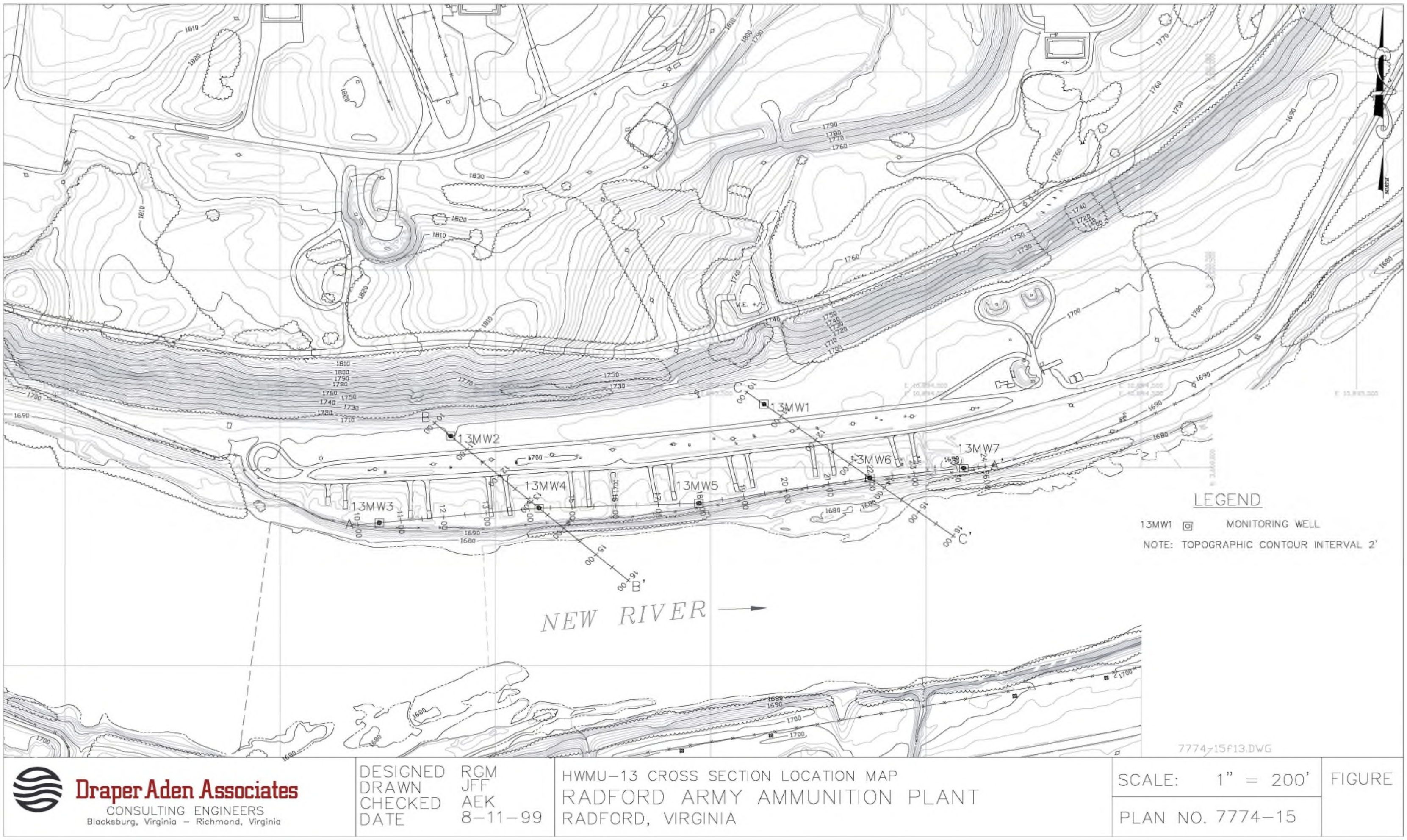


FIGURE V.A.2: OBG/HWMU-13 GEOLOGICAL CROSS SECTION FIGURES

FIGURE V.A.3: OBG/HWMU-13 GROUNDWATER ELEVATION CONTOUR MAP (2ND QUARTER 2014)

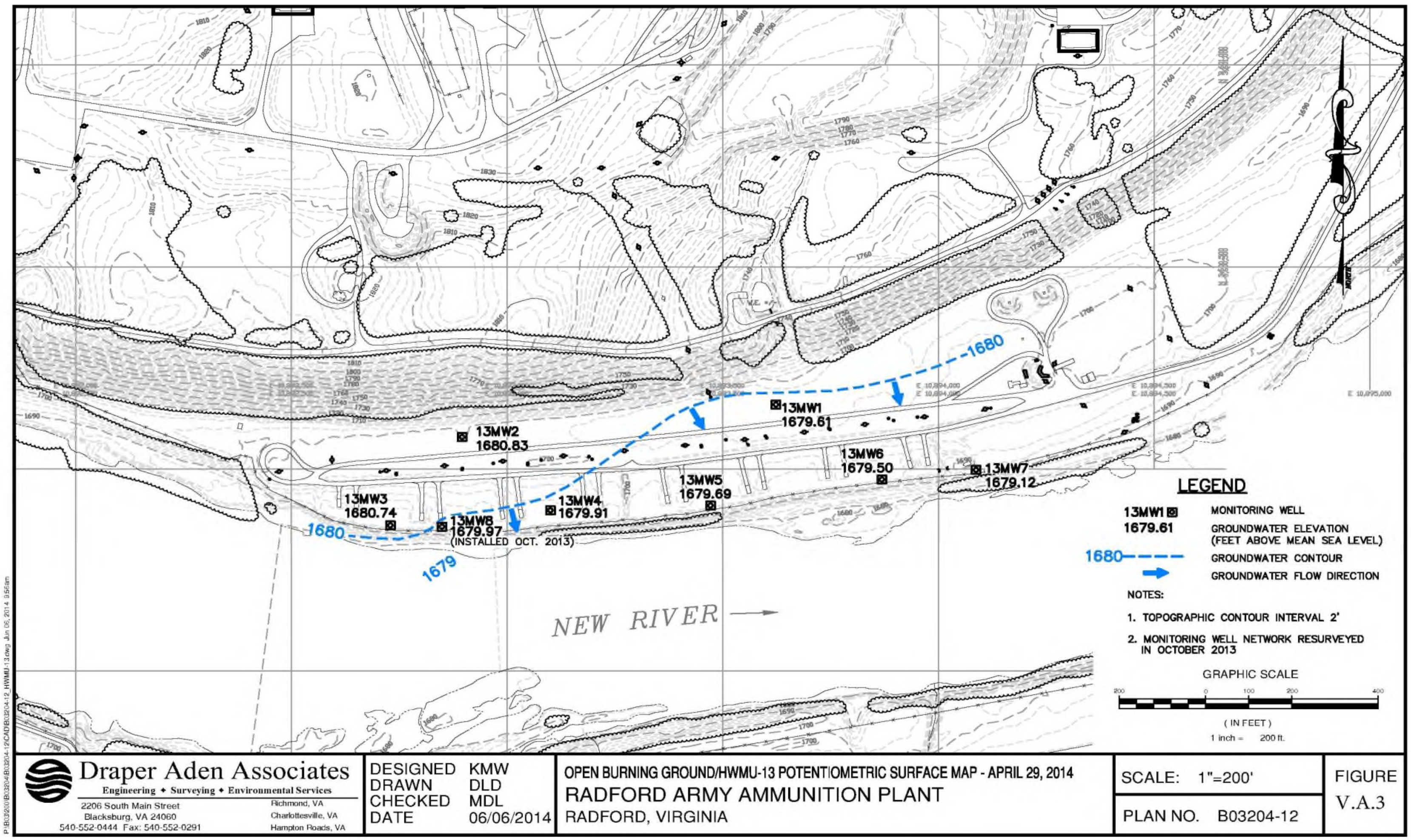
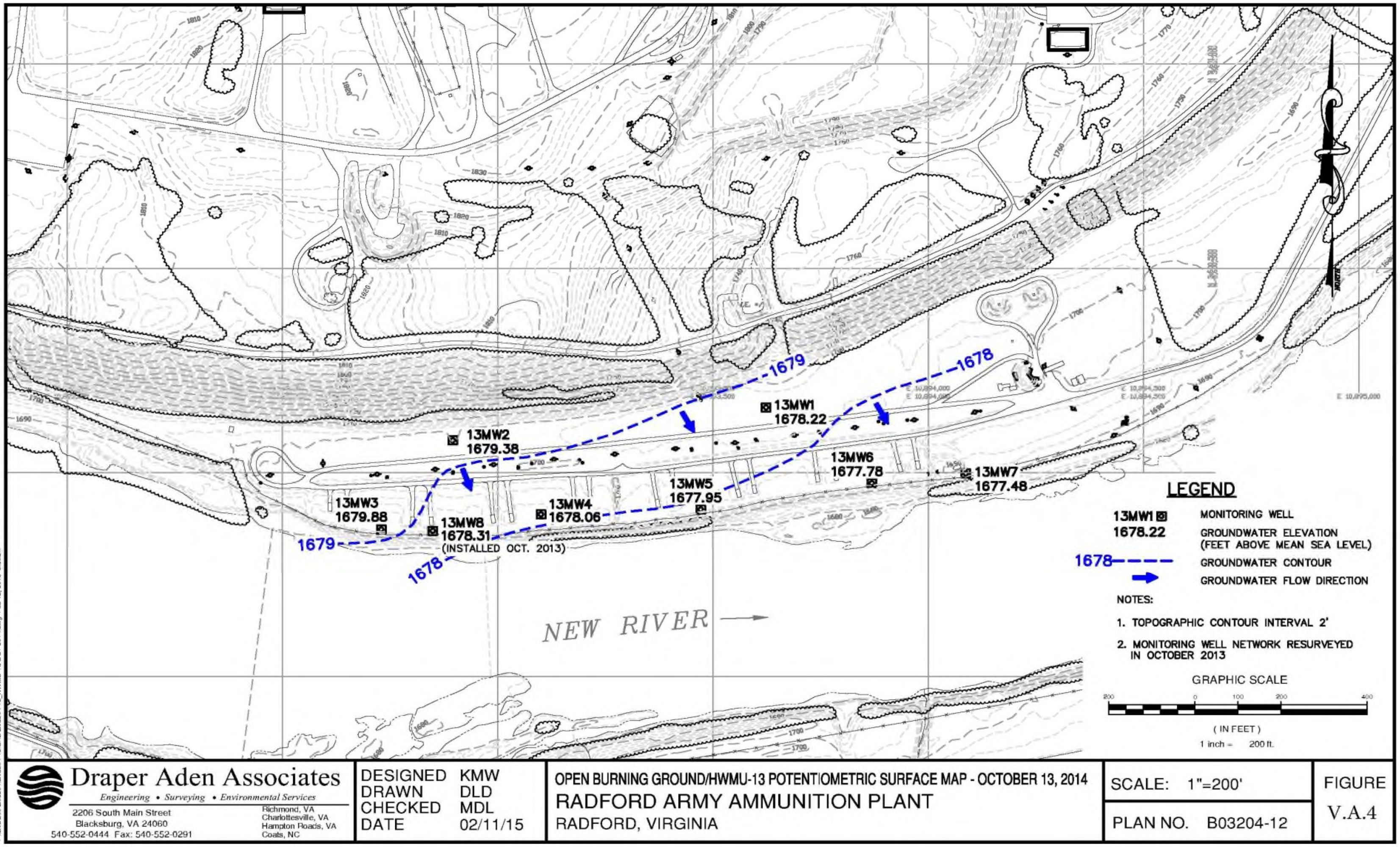


FIGURE V.A.4: OBG/HWMU-13 GROUNDWATER ELEVATION CONTOUR MAP (4TH QUARTER 2014)



ATTACHMENT V.B - COMPLIANCE GROUNDWATER MONITORING LIST

Constituent	CAS RN	Analytical Method
Energetics		
1,3,5-trinitrobenzene	99-35-4	8330
1,3-dinitrobenzene	99-65-0	8330
2,4-dinitrotoluene	121-14-2	8330
2,6-dinitrotoluene	606-20-2	8330
Nitroglycerin	55-63-0	8330
Semivolatiles		
3,3'-dimethylbenzidine	119-93-7	8270
Benzo(a)anthracene	56-55-3	8270
Benzo(a)pyrene	50-32-8	8270
Benzo(b)fluoranthene	205-99-2	8270
Benzo(k)fluoranthene	207-08-9	8270
Bis(2-ethylhexyl)phthalate	117-81-7	8270
Butyl benzyl phthalate	85-68-7	8270
Dibenzo(a,h)anthracene	53-70-3	8270
Diethyl phthalate	84-66-2	8270
Dimethyl phthalate	131-11-3	8270
Di-n-butyl phthalate	84-74-2	8270
Fluoranthene	206-44-0	8270
Indeno(1,2,3-cd)pyrene	193-39-5	8270
Naphthalene	91-20-3	8260
Volatiles		
1,1-dichloroethane	75-34-3	8260
1,1-dichloroethene	75-35-4	8260
Benzene	71-43-2	8260
Benzyl chloride	100-44-7	8260
Carbon tetrachloride	56-23-5	8260
Chloroform	67-66-3	8260
Methyl bromide	74-83-9	8260
Methyl chloride	74-87-3	8260
Methylene chloride	75-09-2	8260
Toluene	108-88-3	8260

Constituent	CAS RN	Analytical Method
1,1,1-trichloroethane	71-55-6	8260
Trichloroethene	79-01-6	8260
Trichlorofluoromethane	75-69-4	8260
Total Metals		
Antimony	7440-36-0	6010/6020
Arsenic	7440-38-2	6010/6020
Barium	7440-39-3	6010/6020
Chromium	7440-47-3	6010/6020
Lead	7439-92-1	6010/6020
Mercury	7439-97-6	7470
Nickel	7440-02-0	6010/6020
Selenium	7782-49-2	6010/6020
Zinc	7440-66-6	6010/6020
Miscellaneous		
Perchlorate	14797-73-0	314.0/6850

Note:

1. Alternate SW-846 Methods may be approved by the Department if the request is in writing and submitted at least 30 days prior to the sample collection event. Proposed alternative methods must achieve the appropriate Data Quality Objective (i.e. at least a Department approved health-based concentration limit).

2. Current method updates are represented without suffixes on each method (e.g., SW-846- Method 6020A). The laboratory performing the analysis must be VELAP accredited for a current method update.

3. The laboratory performing the analysis must be VELAP accredited for the matrix, method and analyte.

ATTACHMENT V.C - OPEN BURNING GROUND CALCULATED BACKGROUND VALUES

Constituent	CAS RN	Background Value (µg/l unless otherwise noted)
Energetics		
1,3,5-trinitrobenzene	99-35-4	2.5
1,3-dinitrobenzene	99-65-0	2.5
2,4-dinitrotoluene	121-14-2	10
2,6-dinitrotoluene	606-20-2	5
Nitroglycerin	55-63-0	16
Semivolatiles		
2,4-dichlorophenol	120-83-2	10
3,3'-dimethylbenzidine	119-93-7	10
2-chlorophenol	95-57-8	10
3-methylphenol	108-39-4	20
4-methylphenol	106-44-5	20
4-nitrophenol	100-02-7	20
Acetophenone	98-86-2	10
Benzo(a)anthracene	56-55-3	10
Benzo(a)pyrene	50-32-8	10
Benzo(b)fluoranthene	205-99-2	10
Benzo(k)fluoranthene	207-08-9	10
Bis(2-ethylhexyl)phthalate	117-81-7	10
Butyl benzyl phthalate	85-68-7	10
Dibenzo(a,h)anthracene	53-70-3	10
Diethyl phthalate	84-66-2	10
Dimethyl phthalate	131-11-3	10
Di-n-butyl phthalate	84-74-2	10
Diphenylamine	122-39-4	10
Fluoranthene	206-44-0	10
Hexachloroethane	67-72-1	10
Indeno(1,2,3-cd)pyrene	193-39-5	10

Constituent	CAS RN	Background Value (µg/l unless otherwise noted)
Naphthalene	91-20-3	1
Nitrobenzene	98-95-3	10
Phenol	108-95-2	10
Volatiles		
1,1-dichloroethane	75-34-3	1
1,2-dichloroethane	107-06-2	1
1,1-dichloroethene	75-35-4	1
Benzene	71-43-2	5
Benzyl chloride	100-44-7	5
Carbon tetrachloride	56-23-5	5
Chlorobenzene	108-90-7	5
Chloroform	67-66-3	1
Methyl bromide	74-83-9	1
Methyl chloride	74-87-3	5
Methylene chloride	75-09-2	5
Tetrachloroethene	127-18-4	1
Toluene	108-88-3	5
1,1,1-trichloroethane	71-55-6	1
Trichloroethene	79-01-6	1
Trichlorofluoromethane	75-69-4	1
Vinyl chloride	75-01-4	1
Total Metals		
Antimony	7440-36-0	6
Arsenic	7440-38-2	5
Barium	7440-39-3	205.9
Cadmium	7440-43-9	1
Chromium	7440-47-3	112
Lead	7439-92-1	14
Mercury	7439-97-6	2.52
Nickel	7440-02-0	5
Selenium	7782-49-2	5
Silver	7440-22-4	2.4
Zinc	7440-66-6	5

Constituent	CAS RN	Background Value (μg/l unless otherwise noted)
Miscellaneous		
Perchlorate	14797-73-0	4

ATTACHMENT V.D - APPENDIX IX OF 40 CFR PART 264 GROUNDWATER MONITORING LIST

Constituent	CAS RN	Method	QL µg/l
Antimony	7440-36-0	6010/6020	5
Arsenic	7440-38-2	6010/6020	5
Barium	7440-39-3	6010/6020	10
Beryllium	7440-41-7	6010/6020	1
Cadmium	7440-43-9	6010/6020	1
Chromium	7440-47-3	6010/6020	5
Cobalt	7440-48-4	6010/6020	5
Copper	7440-50-8	6010/6020	5
Lead	7439-92-1	6010/6020	5
Mercury	7439-97-6	7470A	0.2
Nickel	7440-02-0	6010/6020	5
Selenium	7782-49-2	6010/6020	5
Silver	7440-22-4	6010/6020	2
Thallium	7440-28-0	7841	2
Tin	7440-31-5	6010/6020	10
Vanadium	7440-62-2	6010/6020	5
Zinc	7440-66-6	6010/6020	30
Sulfide	18496-25-8	9034	5000
Cyanide	57-12-5	9012	10
Acenaphthene	83-32-9	8270	10
Acenaphthylene	208-96-8	8270	10
Acetone	67-64-1	8260	10
Acetonitrile	75-05-8	8260	20

Constituent	CAS RN	Method	QL μg/l
Acetophenone	98-86-2	8270	10
2-Acetylaminofluorene	53-96-3	8270	100
Acrolein	107-02-8	8260	20
Acrylonitrile	107-13-1	8260	20
Aldrin	309-00-2	.8081	0.05
Allyl chloride	107-05-1	8260	2
4-Aminobiphenyl	92-67-1	8270	50
Aniline	62-53-3	8270	10
Anthracene	120-12-7	8270	10
Aramite	140-57-8	8270	10
Benzene	71-43-2	8260	1
Benzyl alcohol	100-51-6	8270	10
Carbon tetrachloride	56-23-5	8260	1
Benzo[a]anthracene	56-55-3	8270	10
Benzo[b]fluoranthene	205-99-2	8270	10
Benzo[k]fluoranthene	207-08-9	8270	10
Benzo[a]pyrene	50-32-8	8270	10
Chlorobenzene	108-90-7	8260	1
Chloromethane	74-87-3	8260	1
Benzo[ghi]perylene	191-24-2	8270	10
Di-n-butyl phthalate	84-74-2	8270	10
Diethyl phthalate	84-66-2	8270	10
2,4-Dinitrotoluene	121-14-2	8330B	10
p-Phenylenediamine	106-50-3	8270	100
Diphenylamine	122-39-4	8270	10
alpha-BHC	319-84-6	8081	0.05
beta-BHC	319-85-7	8081	0.05
delta-BHC	319-86-8	8081	0.05
gamma-BHC	58-89-9	8081	0.05
Hexachloroethane	67-72-1	8270	10
Methylene chloride	75-09-2	8260	1
bis(2-Chloro-1-methylethyl)ether	108-60-1	8270	10
bis(2-Chloroethoxy)methane	111-91-1	8270	10
bis(2-Chloroethyl) ether	111-44-4	8270	10
bis(2-Ethylhexyl)phthalate	117-81-7	8270	10
Bromodichloromethane	75-27-4	8260	1
Bromoform	75-25-2	8260	1
4-Bromophenyl phenyl ether	101-55-3	8270	10

Constituent	CAS RN	Method	QL µg/l
2-Butanone	78-93-3	8260	10
Butyl benzyl phthalate	85-68-7	8270	10
Carbon disulfide	75-15-0	8260	1
Chlordane	57-74-9	8081	0.5
p-Chloroaniline	106-47-8	8270	10
Chlorobenzilate	510-15-6	8270	10
p-Chloro-m-cresol	59-50-7	8270	10
Chloroethane	75-00-3	8260	1
Chloroform	67-66-3	8260	1
2-Chloronaphthalene	91-58-7	8270	10
2-Chlorophenol	95-57-8	8270	10
4-Chlorophenyl phenyl ether	7005-72-3	8270	10
Chloroprene	126-99-8	8260	2
Chrysene	218-01-9	8270	10
2,4-Dichlorophenoxyacetic acid	94-75-7	8151A	4
4,4'-DDD	72-54-8	8081	0.05
4,4'-DDE	72-55-9	8081	0.05
4,4'-DDT	50-29-3	8081	0.05
Diallate	2303-16-4	8270	20
Dibenz(a,h)anthracene	53-70-3	8270	10
Dibenzofuran	132-64-9	8270	10
Dibromochloromethane	124-48-1	8260	1
1,2-Dibromo-3-chloropropane	96-12-8	8260	2
1,2-Dibromoethane	106-93-4	8260	1
1,2-Dichlorobenzene	95-50-1	8270	10
1,3-Dichlorobenzene	541-73-1	8270	10
1,4-Dichlorobenzene	106-46-7	8270	10
3,3'-Dichlorobenzidine	91-94-1	8270	50
trans-1,4-Dichloro-2-butene	110-57-6	8260	1
Dichlorodifluoromethane	75-71-8	8260	1
1,1-Dichloroethane	75-34-3	8260	1
1,2-Dichloroethane	107-06-2	8260	1
1,1-Dichloroethene	75-35-4	8260	1
trans-1,2-Dichloroethene	156-60-5	8260	1
2,4-Dichlorophenol	120-83-2	8270	10
2,6-Dichlorophenol	87-65-0	8270	10
cis-1,3-Dichloropropene	10061-01-5	8260	1

Constituent	CAS RN	Method	QL µg/l
trans-1,3-Dichloropropene	10061-02-6	8260	1
Dieldrin	60-57-1	8081	0.05
1,2-Dichloropropane	78-87-5	8260	1
O,O-Diethyl O-2-pyrazinyl	297-97-2	8270	50
Dimethoate	60-51-5	8270	20
p-(Dimethylamino)azobenzene	60-11-7	8270	20
3,3'-Dimethylbenzidine	119-93-7	8270	50
a,a-Dimethylphenethylamine	122-09-8	8270	50
2,4-Dimethylphenol	105-67-9	8270	10
Dimethyl phthalate	131-11-3	8270	10
m-Dinitrobenzene	99-65-0	8270	10
4,6-Dinitro-o-cresol	534-52-1	8270	50
2,4-Dinitrophenol	51-28-5	8270	50
2,6-Dinitrotoluene	606-20-2	8330B	10
4,6-Dinitro-2-sec-butylphenol	88-85-7	8270	20
Di-n-octyl Phthalate	117-84-0	8270	10
1,4-Dioxane	123-91-1	8260	200
Disulfoton	298-04-4	8270	50
Endosulfan I	959-98-8	8081	0.05
Endosulfan II	33213-65-9	8081	0.05
Endosulfan sulfate	1031-07-8	8081	0.05
Endrin	72-20-8	8081	0.05
Endrin aldehyde	7421-93-4	8081	0.05
Ethylbenzene	100-41-4	8260	1
Ethyl methacrylate	97-63-2	8260	1
Ethyl methanesulfonate	62-50-0	8270	10
Famphur	52-85-7	8270	10
Fluoranthene	206-44-0	8270	10
Fluorene	86-73-7	8270	10
Heptachlor	76-44-8	8081	0.05
Heptachlor epoxide	1024-57-3	8081	0.05
Hexachlorobenzene	118-74-1	8270	10
Hexachlorobutadiene	87-68-3	8270	10
Hexachlorocyclopentadiene	77-47-4	8270	50
Hexachlorophene	70-30-4	8270	100
Hexachloropropene	1888-71-7	8270	100

Constituent	CAS RN	Method	QL µg/l
2-Hexanone	591-78-6	8260	10
Indeno[1,2,3-cd]pyrene	193-39-5	8270	10
Isobutyl alcohol	78-83-1	8260	50
Isodrin	465-73-6	8081	0.1
Isophorone	78-59-1	8270	10
Isosafrole	120-58-1	8270	20
Kepone	143-50-0	8081	1
Methacrylonitrile	126-98-7	8260	2
Methapyrilene	91-80-5	8270	50
Methoxychlor	72-43-5	8081	0.1
Bromomethane	74-83-9	8260	1
3-Methylcholanthrene	56-49-5	8270	20
Iodomethane	74-88-4	8260	1
Methyl methacrylate	80-62-6	8260	2
Methyl methane sulfonate	66-27-3	8270	10
2-Methylnaphthalene	91-57-6	8270	10
Methyl parathion	298-00-0	8270	10
4-Methyl-2-pentanone	108-10-1	8260	10
2-Methylphenol	95-48-7	8270	10
3 & 4-Methylphenol	m 108-39-4/p 106-44-5	8270	10
Dibromomethane	74-95-3	8260	1
Naphthalene	91-20-3	8260	10
1,4-Naphthoquinone	130-15-4	8270	50
1-Naphthylamine	134-32-7	8270	10
2-Naphthylamine	91-59-8	8270	10
o-Nitroaniline	88-74-4	8270	50
m-Nitroaniline	99-09-2	8270	50
p-Nitroaniline	100-01-6	8270	50
Nitrobenzene	98-95-3	8270	10
o-Nitrophenol	88-75-5	8270	10
p-Nitrophenol	100-02-7	8270	50
4-Nitroquinoline-1-oxide	56-57-5	8270	100
N-Nitrosodi-n-butylamine	924-16-3	8270	10
N-Nitrosodiethylamine	55-18-5	8270	10
N-Nitrosodimethylamine	62-75-9	8270	10
N-Nitrosodiphenylamine	86-30-6	8270	10
N-Nitrosodipropylamine	621-64-7	8270	10
N-Nitrosomethylethylamine	10595-95-6	8270	10

Constituent	CAS RN	Method	QL µg/l
N-Nitrosomorpholine	59-89-2	8270	10
N-Nitrosopiperidine	100-75-4	8270	10
N-Nitrosopyrrolidine	930-55-2	8270	10
5-Nitroso-o-toluidine	99-55-8	8270	20
Parathion	56-38-2	8270	10
Pentachlorobenzene	608-93-5	8270	10
Pentachloroethane	76-01-7	8270	50
Pentachloronitrobenzene	82-68-8	8270	50
Pentachlorophenol	87-86-5	8270	10
Phenacetin	62-44-2	8270	20
Phenanthrene	85-01-8	8270	10
Phenol	108-95-2	8270	10
Phorate	298-02-2	8270	50
2-Picoline	109-06-8	8270	20
PCBs	1336-36-3	8082	0.5
Pronamide	23950-58-5	8270	20
Propionitrile	107-12-0	8260	4
Pyridine	110-86-1	8270	20
Safrole	94-59-7	8270	20
Silvex	93-72-1	8151	1
Styrene	100-42-5	8260	1
Sulfotep	3689-24-5	8270	50
Total TCDF	55722-27-5	8280	*
Total PeCDF	30402-15-4	8280	*
Total HxCDF	55684-94-1	8280	*
Total TCDD	41903-57-5	8280	*
2,3,7,8-TCDD	1746-01-6	8280	*
Total PeCDD	36088-22-9	8280	*
Total HxCDD	34465-46-8	8280	*
2,4,5-Trichlorophenoxyacetic acid	93-76-5	8151	1
1,2,4,5-Tetrachlorobenzene	95-94-3	8270	10
1,1,1,2-Tetrachloroethane	630-20-6	8260	1
1,1,2,2-Tetrachloroethane	79-34-5	8260	1
Tetrachloroethene	127-18-4	8260	1
2,3,4,6-Tetrachlorophenol	58-90-2	8270	50
Toluene	108-88-3	8260	1
o-Toluidine	95-53-4	8270	20
Toxaphene	8001-35-2	8081	2

Constituent	CAS RN	Method	QL µg/l
1,2,4-Trichlorobenzene	120-82-1	8270	10
1,1,1-Trichloroethane	71-55-6	8260	1
1,1,2-Trichloroethane	79-00-5	8260	1
Trichloroethene	79-01-6	8260	1
Trichlorofluoromethane	75-69-4	8260	1
2,4,5-Trichlorophenol	95-95-4	8270	10
2,4,6-Trichlorophenol	88-06-2	8270	10
1,2,3-Trichloropropane	96-18-4	8260	1
O,O,O-Triethyl phosphorothioate	126-68-1	8270	50
sym-Trinitrobenzene	99-35-4	8270	50
Vinyl acetate	108-05-4	8260	10
Vinyl chloride	75-01-4	8260	2
Xylenes (Total)	1330-20-7	8260	10

Notes:

1. CAS RN. Denotes Chemical Abstracts Registry Number.
2. Method. **Denotes *Test Methods for Evaluating Solid Waste – Physical and Chemical Methods, SW-846 (as updated)***
3. QL. Denotes estimated quantitation limit for method. Actual quantitation will depend on instrument used for analysis, sample matrix and laboratory .
4. Current method updates are represented without suffixes on each method (e.g., SW-846-Method 6020A). The laboratory performing the analysis must be VELAP accreditedfor a current method update.
5. The laboratory performing the analysis must be VELAP accredited for the matrix, method and analyte.

ATTACHMENT V.E- GROUNDWATER PROTECTION STANDARDS

Constituent	CLASS	CAS # -1	USEPA METHOD -2	QL (ug/L)- 3	BACK-GROUND (ug/l) - 4	MCL (ug/L) -5	ACL (ug/L)- 6	RSL (ug/L) - 7	GPS (ug/L) - 8	GPS Based on
Antimony, Total	metal	7440-36-0	6010/6020	5	6	6	7.8		6	MCL
Arsenic, Total	metal	7440-38-2	6010/6020	5	5	10	0.052		10	MCL
Barium, Total	metal	7440-39-3	6010/6020	10	206	2000	3800		2000	MCL
Chromium, Total	metal	7440-47-3	6010/6020	5	112	100	-		112	Bckgrnd
Lead, Total	metal	7439-92-1	6010/6020	10	14	15	-		15	MCL
Mercury, Total	metal	7439-97-6	7470	0.5	2.52	2	0.63		2.52	Bckgrnd
Nickel, Total	metal	7440-02-0	6010/6020	5	5	-	390		390	ACL
Selenium, Total	metal	7782-49-2	6010/6020	5	5	50	100		50	MCL
Silver, Total	metal	7440-22-4	6010/6020	2	2.4		94		94	ACL
Zinc, Total	metal	7440-66-6	6010/6020	30	5	-	6000		6000	ACL

Constituent	CLASS	CAS # -1	USEPA METHOD -2	QL (ug/L)-3	BACK-GROUND (ug/l) -4	MCL (ug/L) -5	ACL (ug/L)-6	RSL (ug/L) -7	GPS (ug/L) -8	GPS Based on
Perchlorate	Misc.	14797-73-0	314.0/6850	4	4	-	-	15	15	RSL
Benzo[a]anthracene	PNA	56-55-3	8270	10	10	-	0.03		0.034	ACL
Benzo[a]pyrene	PNA	50-32-8	8270	10	10	0.2	0.02		0.2	MCL
Benzo[b]fluoranthene	PNA	205-99-2	8270	10	10	-	0.25		0.25	ACL
Benzo[k]fluoranthene	PNA	207-08-9	8270	10	10	-	2.5		2.5	ACL
Dibenz[a,h]anthracene	PNA	53-70-3	8270	10	10	-	0.025		0.025	ACL
Fluoranthene	PNA	206-44-0	8270	10	10	-	800		800	ACL
Indeno [1,2,3-cd] pyrene	PNA	193-39-5	8270	10	10	-	0.25		0.25	ACL
1,3,5-Trinitrobenzene; *sim-*	energetic	99-35-4	8330	10	2.5	-	590		590	ACL

Constituent	CLASS	CAS # -1	USEPA METHOD -2	QL (ug/L)-3	BACK-GROUND (ug/l) -4	MCL (ug/L) -5	ACL (ug/L)-6	RSL (ug/L) -7	GPS (ug/L) -8	GPS Based on
1,3-Dinitrobenzene; *m-*	energetic	99-65-0	8330	4	2.5	-	2		2	ACL
2,4-Dinitrotoluene	energetic	121-14-2	8330	10	10	-	0.24		0.24	ACL
2,6-Dinitrotoluene	energetic	606-20-2	8330	10	5	-	0.048		0.048	ACL
Nitroglycerin	energetic	55-63-0	8330	16	16	-	-	2	2	RSL
Bis (2-ethylhexyl) phthalate	semivolatile	117-81-7	8270	10	10	6	5.6		6	MCL
Butyl benzyl phthalate	semivolatile	85-68-7	8270	10	10	-	16		16	ACL
Diethyl phthalate	semivolatile	84-66-2	8270	10	10	-	15000		15000	ACL
3,3'-Dimethylbenzidine	semivolatile	119-93-7	8270	10	10	-	0.0065		0.0065	ACL
Dimethyl phthalate	semivolatile	131-11-3	8270	10	10	-	-		10	QL/Bckgnd

Constituent	CLASS	CAS # -1	USEPA METHOD -2	QL (ug/L)-3	BACK-GROUND (ug/l) -4	MCL (ug/L) -5	ACL (ug/L)-6	RSL (ug/L) -7	GPS (ug/L) -8	GPS Based on
Di-n-butyl phthalate	semivolatile	84-74-2	8270	10	10	-	900		900	ACL
Benzene	volatile	71-43-2	8260	1	5	5	0.46		5	MCL
Benzyl Chloride	volatile	100-44-7	8260	5	5	-	-	0.089	0.089	RSL
Carbon tetrachloride	volatile	56-23-5	8260	1	5	5	0.46		5	MCL
Chloroform	volatile	67-66-3	8260	1	1	80	0.22		80(9)	MCL
1,1-Dichloroethane	volatile	75-34-3	8260	1	1	-	2.7		2.7	ACL
Methyl bromide; Bromomethane	volatile	74-83-9	8260	1	1	-	7.5		7.5	ACL
Methyl chloride; Chloromethane	volatile	74-87-3	8260	1	5	-	190		190	ACL

Constituent	CLASS	CAS # -1	USEPA METHOD -2	QL (ug/L)-3	BACK-GROUND (ug/l) - 4	MCL (ug/L) -5	ACL (ug/L)-6	RSL (ug/L) - 7	GPS (ug/L) - 8	GPS Based on
Methylene chloride; Dichloromethane	volatile	75-09-2	8260	1	5	5	11		5	MCL
Naphthalene	volatile	91-20-3	8260	1	1	-	0.17		0.17	ACL
Toluene	volatile	108-88-3	8260	1	5	1000	1100		1000	MCL
1,1,1-Trichloroethane	volatile	71-55-6	8260	1	1	200	8000		200	MCL
Trichloroethene (TCE)	volatile	79-01-6	8260	1	1	5	0.49		5	MCL
Trichlorofluoromethane	volatile	75-69-4	8260	1	1	-	1113		1113	ACL

This Annual GW Monitoring Constituent List for the CA Program is based on the Groundwater Compliance Monitoring List Attachment V.B, plus any constituent detected in Appendix IX in the past, the constituents reasonably expected or suspected to be in or derived from the waste managed in the unit, and the daughter products for carbon tetrachloride.

(1) CAS #: Chemical Abstracts Service registry number.

(2) *Test Methods for Evaluating Solid Waste- Physical/Chemical Methods, SW-846 (as updated). Current method updates are represented without suffixes on each method (e.g., SW-846 Method 6020A). The laboratory performing the analysis must be VELAP accredited, where applicable, for current method update.*

(3) QL: Quantitation Limit. Actual laboratory-specific QL may vary under the approval of DEQ.

(4) Calculated background. See *Constituent Background Values for the Detection Groundwater Monitoring Program* prepared by Draper Aden
Associates, May 10, 2005 for listed Background values.

(5) MCL: Maximum Contaminant Level of USEPA National Primary Drinking Water Regulations (Safe Drinking Water Act).

(6) ACL: VA DEQ Alternate Concentration Limit. November 2019; effective January 18, 2020.

(7) RSL: USEPA Regional Screening Level (RSL) – November 2020 (https://www.epa.gov/risk/forms/contact-us-about-regional-screening-levels-rsls (accessed November 23, 2020)). For perchlorate, 15 ug/l is recommended preliminary remediation goal (PRG). See current RSL table, “G” = user’s guide Section 5.

(8) GPS: Groundwater Protection Standard. The criteria by which GPSs are developed are following:

a. Use calculated Background values if greater than promulgated regulatory values (EPA MCL or VDEQ ACL). If Background = QL and is greater than promulgated regulatory value (EPA MCL or VDEQ ACL), then use MCL or ACL as GPS.
b. If EPA MCL is promulgated and Background is less than the MCL, use the MCL as GPS.
c. If EPA MCL is not promulgated, use the VDEQ ACL as GPS if greater than Background.

d. If no MCL or ACL, use EPA Regional Screening Level (RSL).

(9) The MCL for total Trihalomethanes, including Bromodichloromethane, Bromoform, Dibromochloromethane, and Chloroform, is 80 ug/l.

For any monitoring event, if a GPS for a constituent in the table above is less than the QL, the Permittee will perform verification of any detection (i.e. value greater than the Detection Limit) of such a constituent using low-level analytical methods, if such methods are standard methods that are routinely available from commercial laboratories. Furthermore, the low-level analytical method will be used only if the QL achievable by that method is less than, or equal to, the MCL or ACL for the subject constituent. If the verification event confirms a quantifiable detection (i.e. value greater than the QL) above the applicable MCL or ACL, a revised background concentration will be established using low-level analytical methods, if appropriate, and the GPS will be updated based on the new background concentration if warranted.

MODULE VI - CORRECTIVE ACTION AND GROUNDWATER MONITORING PROGRAM

VI.A. HIGHLIGHTS

The Open Burn Ground (OBG) (a.k.a., Hazardous Waste Management Unit - 13 (HWMU-13) at the Radford Facility Army Ammunition Plant (RFAAP) is a waste propellant open burning ground. The OBG is located on the southeastern end of the Horseshoe Area on the flood plain of the New River and consists of eight above-ground burning assemblies. The waste spill “clean-up” residues are hazardous due to their reactivity (D003) as specified in 9VAC 20-60-261, incorporating 40 CFR § 261.23, toxicity (D005, D008 and D030) as specified in 9VAC 20-60-261, incorporating 40 CFR § 261.24, and/or ignitability (D001) as specified in 9VAC 20-60-261, incorporating 40 CFR § 261.21.

Groundwater monitoring has been conducted at the OBG since 1992. The OBG was in Interim Status, and groundwater monitoring activities were conducted quarterly in accordance with the requirements of 40 CFR § 265. In October 1999, the “Groundwater Quality Assessment Report” for the OBG was submitted to the Virginia Department of Environmental Quality (DEQ/Department). A groundwater monitoring list was included in the report. The monitoring list consisted of a subset of the constituents listed in 40 CFR 264 Appendix IX that previously had been detected in the groundwater and/or that would be reasonably expected to be in or derived from the waste burned at OBG.

In September 2005, DEQ issued the original *Permit for the Treatment of Hazardous Waste by Open Burning* (Permit) for the OBG (effective on October 28, 2005). However, beginning in Fourth Quarter 2003, quarterly groundwater monitoring was conducted in accordance with the “Detection Groundwater Monitoring Program for the Open Burning Ground”, dated September 2003 and included in the Part B Permit Application for the OBG, in anticipation of issuance of the Permit.

Exceedances of established background values for carbon tetrachloride and perchlorate during the Fourth Quarter 2005 Detection monitoring event prompted the need to develop a Compliance Monitoring program in accordance with the requirements of the Permit. As a result, during First Quarter 2006, all wells were sampled for the full Appendix IX constituent list and the hazardous constituents detected formed the basis for the Compliance Monitoring List for the OBG Unit.

The Permittee submitted a revised Compliance Monitoring Plan with proposed Groundwater Protection Standards (GPSs) to the Department and the first semiannual groundwater Compliance Monitoring event for 2007 was conducted in accordance with the revised Compliance Monitoring Plan during Second Quarter 2007.

During semiannual groundwater Compliance Monitoring, concentrations of two constituents, perchlorate and carbon tetrachloride, were detected greater than their respective GPSs at one or more downgradient well(s). As a result, according to 40 CFR § 264.91(a)(2), the Permittee implemented a Corrective Action Program (CAP) under 40 CFR § 264.100.

Permit Module VI – *Corrective Action and Groundwater Monitoring Program*, was approved by the DEQ in the Class 3 Hazardous Waste Permit Modification dated September 27, 2011. This module was revised on February 22, 2012, November 9, 2013, June 12, 2014 and with this reissuance of the Permit. Currently, groundwater is conducted semiannually in accordance with the Corrective Action and Groundwater Monitoring Program.

VI.B. CORRECTIVE ACTION PROGRAM

VI.B.1. The Corrective Action Program shall meet the requirements specified in 40 CFR § 264.100.

VI.B.2. The Corrective Action Program shall prevent hazardous constituents listed in the Annual Groundwater Monitoring List for Corrective Action Program from exceeding their respective GPSs (or concentration limits) listed in Permit Attachment VI.C at the point of compliance by removing the hazardous waste constituents or by treating them in place, pursuant to 40 CFR § 264.100(b).

VI.B.3. The Permittee shall conduct a corrective action program to remove or treat in place any hazardous constituents that exceed their respective concentration limits, as determined pursuant to Permit Condition VI.H (GPS), in the groundwater between the point of compliance and the downgradient facility property boundary, in accordance with 40 CFR § 264.100(e).

VI.B.4. The Corrective Action Program, undertaken pursuant to 40 CFR § 264.100 and this permit, as modified, may be terminated with the prior approval of the Director if the concentrations of all hazardous constituents listed in the Permit Attachment VI.C are reduced to levels below their respective GPSs specified in Permit Attachment VI.C. If the compliance period has not ended at the time of the Director’s approval to terminate the corrective action program, groundwater monitoring shall then be conducted in accordance with Permit Module V – Compliance Monitoring Program. The Permittee shall continue corrective action measures during the compliance period to the extent necessary to ensure that the GPS is not exceeded, pursuant to 40 CFR 264.100(f).

VI.B.5. If corrective action is required beyond the compliance period, it shall continue until the GPS for any constituent in any well has not been exceeded for three consecutive years, pursuant to 40 CFR § 264.100(f).

VI.B.6. The Permittee shall report in writing to the Director on the effectiveness of the Corrective Action Program, and shall propose all appropriate modifications and/or additional corrective action measures. The Permittee shall submit these reports at least annually, on March 1 of each year, and may combine these reports with the annual groundwater monitoring reports required by Permit Condition VI.L.

VI.B.7. The Permittee shall implement the Corrective Action Program as specified in this Permit Module, pursuant to 40 CFR § 264.100. The goal of this corrective action program is to reduce perchlorate and carbon tetrachloride to levels below their GPSs within a reasonable period of time at the point of compliance and throughout the plume (40 CFR § 264.100), using monitored natural attenuation (MNA).

VI.C. SOURCE AREA EVALUATION

VI.C.1. In accordance with the 2011 Class 3 Permit Modification, the Permittee completed a Source Area Evaluation (SAE) at the OBG to evaluate (to the extent possible) the source area(s) of the hazardous constituents of concern (HCOCs) detected at concentrations exceeding the GPSs at that time in the groundwater at the Unit. The SAE was conducted in accordance with the DEQ-approved SAE Sampling and Analysis Plan (SAP) included as Permit Attachment VI.A. The results of the SAE were used to further refine the remediation activities to be conducted under the CAP to protect human health and the environment.

VI.C.2. Additional submittals in support of Permit Conditions VI.D and VI.E shall not be considered changes to the Corrective Action Program as required by 40 CFR Part 264.100(h) [i.e., they are not considered to be a determination that the Corrective Action Program no longer satisfies the requirements of the regulations]; therefore, submission of such addenda shall not require a permit modification.

VI.D. SOURCE REMOVAL (RESERVED)

VI.D.1. Source material was not discovered during the SAE and source removal as anticipated in the 2011 Permit modification was not implemented.

VI.E. GROUNDWATER REMEDIATION

VI.E.1. Remediation Objectives

Concurrent with source area evaluation activities, the Permittee implemented a Monitored Natural Attenuation (MNA) as the groundwater remedy. The principal remediation objective is to reduce perchlorate and carbon tetrachloride concentrations below their respective GPSs within a reasonable period of time at the point of compliance. To accomplish this principal objective, the Corrective Action Program was designed to:

- Collect data listed in Permit Attachment VI.B

- Delineate the extent of the perchlorate and carbon tetrachloride plumes in groundwater; and

- Identify the presence and concentrations of HCOCs and biodegradation indicators in groundwater which verify the efficacy of natural attenuation. Perchlorate degradation to chloride proceeds in the general sequence of perchlorate to chlorate to chlorite to hypochlorite to chloride. Carbon tetrachloride is degraded to chloroform, methylene chloride, chloromethane and ultimately methane.

RFAAP continues to monitor groundwater at the OBG semiannually in accordance with the Corrective Action and Groundwater Monitoring Program. Historical concentrations and trend graphs for perchlorate and carbon tetrachloride from 2003 through 2015 are included in Permit Attachment VI.D. Fourth Quarter 2015 concentrations for perchlorate and carbon tetrachloride are presented in Figures VI.D.1-2 in Permit Attachment VI.D.

VI.E.2. Installation of Additional Monitoring Wells

Based on the results of the SAE, an additional well, 13MW8 was installed in order to monitor impacted groundwater. 13MW8 was installed in accordance with the requirements of Permit Condition VI.G.4, and shall serve as a plume well for the monitoring of the HCOCs and daughter products identified in Permit Attachment VI.B and Attachment VI.C, if any. Additional monitoring wells, if required, shall be installed in accordance with the requirements of Permit Condition VI.G.4, and shall serve as plume wells for the monitoring of the HCOCs and daughter products identified in Permit Attachment VI.B and Attachment VI.C, if any.

VI.E.3. Performance Monitoring

The MNA component of corrective action at the site will rely on performance monitoring to document progress in restoring groundwater quality. Performance monitoring will be conducted in accordance with the Corrective Action Monitoring Program as specified in Permit Sections VI.F through VI.O.

VI.E.4. Program Evaluation

The performance monitoring data will be compiled, validated and reported to the Department on at least an annual basis to evaluate the performance and effectiveness of MNA to reduce constituent concentrations below the GPSs. The performance monitoring data will be included in the Annual Groundwater Monitoring Report specified in Permit Condition VI.L. The evaluation shall contain adequate information to demonstrate that the remedial measures are addressing the groundwater contamination at the OBG and progress is being made toward the remediation objectives. The following contents shall be contained in the evaluation, if available:

a. Estimated amounts of contaminants remediated during the previous six months and total remediated;

b. Sampling and analysis results;

c. Proposed modifications to the corrective action program to enhance performance and/or to correct deficiencies and malfunctions; and

d. Other recommendations regarding the CAP, as appropriate.

VI.E.5. Alternative Groundwater Remediation Methods

If the Department or the Permittee determine that MNA is ineffective as a corrective action program, the Permittee shall evaluate and pursue other means of groundwater remediation. The Permittee shall submit to the Department an application for a Class II permit modification to modify the Corrective Action Program within 180 days of the determination that MNA is no longer effective and that a modification to the corrective action process is required. Alternative groundwater remediation methods may include ex-situ pump-and-treat (P&T) systems utilizing for example ion exchange or granular activated carbon, ex-situ biological processes, enhanced in situ anaerobic bioremediation, or a combination of these.

VI.F. CORRECTIVE ACTION MONITORING PROGRAM

A groundwater monitoring program must be implemented to demonstrate the effectiveness of the corrective action program (§264.100(d)). The corrective action monitoring program may be based on the compliance monitoring program (Permit Module V), but must be as effective in determining compliance with the GPS under 40 CFR § 264.92 and in determining the success of the corrective action program.

This Corrective Action Monitoring Program is based upon the Compliance Monitoring Program (Permit Module V) modified as necessary to meet the performance standards for a Corrective Action Monitoring Program (9VAC20-60-264.100).

VI.F.1. Groundwater Monitoring System

a. The groundwater beneath the unit shall be monitored with one upgradient groundwater monitoring well, three downgradient point of compliance wells, and three downgradient plume monitoring well located as specified on the map presented in Figure V.A.3 in Permit Attachment V.A.

b. Monitoring well 13MW2 is located upgradient of the unit and will serve as the background well for the OBG. Monitoring wells 13MW3, 13MW4, and 13MW7 are located downgradient of the unit and will serve as the point of compliance wells. Monitoring wells 13MW5, 13MW6, and 13MW-8 are the downgradient plume monitoring wells for the unit. In addition, well 13MW1 will be used as a piezometer to measure static groundwater elevations during each sampling event. Further, the facility may collect quarterly background data from 13MW1 following approval from the Department in order to obtain a more robust background dataset. Additional monitoring wells, if required will serve as plume wells for the monitoring of the HCOCs and daughter products and for the MNA parameters listed in Permit Attachment VI.B.

c. Static groundwater elevations (and total depths for wells that do not contain dedicated pumps) will be measured at all wells specified in Permit Conditions VI.F.1.a and b. during each sampling event.

VI.F.2. Sampling Schedule

a. The background well, point of compliance wells, and plume monitoring well(s) will be sampled in accordance with the Sampling and Analysis Plan (Permit Attachment IV.A) and the following schedule.

b. The downgradient point of compliance and plume monitoring wells and, when needed, the background well specified in Permit Condition VI.F.1 will be sampled at least semiannually for the constituents listed in Permit Attachment VI.B. The downgradient point of compliance and plume monitoring wells will also be sampled at least semiannually for the MNA parameters listed in Permit Attachment VI.B. Samples will be collected using the methods specified in Permit Attachment IV.A and analyses will be conducted using the methods specified in Permit Attachments V.B and VI.B.

c. Additional plume monitoring wells, if required as discussed in Permit Condition VI.E.2 will be sampled at least semiannually for the HCOCs and daughter products and for the MNA parameters listed in Permit Attachment VI.B.

d. Downgradient point of compliance wells specified in Permit Condition VI.F.1 will be sampled annually for all constituents listed in Permit Attachment VI.C. Samples will be analyzed using the methods specified in Permit Attachment VI.C.

e. Alternate SW-846 methods, or other applicable methods, may be approved by the Director, provided that the request is in writing and submitted thirty (30) days prior to the sampling event. Proposed alternate methods must achieve the same QL, or lower, as the specified analytical method and must meet the requirements of Permit Attachment IV.A (Groundwater Monitoring Sampling and Analysis Plan).

f. Additionally, the laboratory must be accredited for the analytical method, matrix and target analyte by the Virginia Environmental Laboratory Accreditation Program (VELAP).

VI.G. WELL LOCATIONS, CONSTRUCTION, AND MAINTENANCE

VI.G.1. Well Locations

a. The locations of the monitoring wells comprising the groundwater monitoring system as described in Permit Condition VI.F.1 are presented on Figure V.A.3 of Permit Attachment V.A.

b. Boring logs, design and construction details for monitoring wells listed in Permit Condition VI.F.1 are presented in Permit Attachment IV.A, Appendix 8.

c. Boring logs, design and construction details for additional monitoring wells, if required, installed as discussed in Permit Condition VI.E.2 will be submitted as an addendum to the Corrective Action Plan.

VI.G.2. Well Maintenance

Monitoring wells shall be maintained at their locations depicted on Figure V.A.3 presented in Permit Attachment V.A.

a. All monitoring wells in the Monitoring Program, as listed in Permit Condition VI.F.1, shall be maintained and inspected at least semiannually to ensure proper operation. Any required repairs shall be made by the Permittee as soon as possible.

b. The Permittee shall inspect all monitoring wells listed in Permit Condition VI.F.1 at least annually to ensure that they are not damaged. If any of these wells are damaged beyond reasonable efforts for repair, the Permittee may petition the Director for approval to abandon the affected monitoring well in accordance with Permit Condition VI.G.4. Appropriate permit modification applications shall be submitted in accordance with 40 CFR § 270.42.

VI.G.3. Maintenance Standard

All monitoring wells required by this Permit will be maintained in conformance with the following, pursuant to 40 CFR § 264.97(a):

a. The groundwater monitoring system must yield samples in the background well(s) that represent the quality of the groundwater unaffected by a release from any regulated unit and, in downgradient wells yield samples that represent groundwater quality passing the point of compliance.

b. The number and location of groundwater monitoring wells must be sufficient to identify and define all logical release pathways from the regulated unit to the uppermost aquifer based on site specific hydrogeologic characterization.

VI.G.4. Installation and Abandonment

The Director must approve the addition or removal of all monitoring wells prior to installation or abandonment, in accordance with 40 CFR § 270.42.

a. All monitoring wells which are to be abandoned shall be plugged and abandoned in accordance with Permit Attachment IV.A, Appendix 7. Well abandonment methods and certification shall be submitted to the Director within thirty (30) days from the date the wells are removed from the monitoring program.

b. All monitoring wells added to the groundwater monitoring system must be constructed in accordance with USEPA’s RCRA Groundwater Monitoring Technical Enforcement Guidance Document (TEGD) or subsequent USEPA guidance documents, and must meet the requirements of 40 CFR § 264.99(b).

VI.H. GROUNDWATER PROTECTION STANDARD

The Permittee will monitor the groundwater to document that the regulated unit complies with the GPS established in accordance with 40 CFR § Part 264.92 and 9VAC-20-60-264.B(7), or that the groundwater is being remediated to attain that standard.

VI.H.1. Hazardous Constituents and Groundwater Protection Standard (GPS)

a. Hazardous constituents are any constituents listed in 40 CFR 261 Appendix VIII or in 40 CFR 264 Appendix IX, as defined in 9VAC-20-60-264.B(6).

b. GPSs are established based upon background values from background groundwater monitoring at the OBG, USEPA Safe Drinking Water Act Maximum Contaminant Levels (MCL), Alternate Concentration Limits (ACL) established by the Department, or USEPA Region III Regional Screening Levels (RSLs).

c. Background concentrations established at the time of permit issuance are listed in Permit Attachment V.C. For any newly detected hazardous constituents, background values shall be established in accordance with 40 CFR § 264.97(g) and as specified in Permit Attachment IV.A, Appendix 6. Background groundwater quality for a constituent or monitoring parameter shall be based on at least four (4) data points collected at background monitoring well(s) during a period not exceeding one (1) year.

d. The hazardous constituents annually analyzed and their GPSs for the CA program for the OBG are listed in Permit Attachment VI.C. Constituents in Permit Attachment VI.C were based on the groundwater Compliance Monitoring Constituents (Permit Attachment V.B), plus previously detected in the groundwater beneath the units, or were determined to be part of the hazardous waste or hazardous waste constituents treated at the unit.

VI.H.2. Changes to Groundwater Protection Standards

a. The Permittee will use the GPS presented in Permit Attachment VI.C. If USEPA implements any changes to MCLs or RSLs, the GPS defined by that MCL or RSL shall be updated to reflect the most current value established by USEPA. The Department will notify the Permittee of any such change and will provide an amended Permit Attachment VI.C to the Permittee. Within ninety (90) days of receiving the amended Permit Attachment VI.C, the Permittee shall provide notice of the modification(s) to all persons on the facility mailing list.

b. Any concentration limit based on a background value or ACL may be updated if new data become available. The Department will review the ACL changes annually and decide if the changes were significant enough to warrant the Department pursuing a permit amendment. The Department will notify the Permittee of any such change and will provide an amended Permit Attachment V.E. to the Permittee. Within ninety (90) days of receiving the amended Permit Attachment V.E., the Permittee shall provide notice of the modification(s) to all persons on the facility mailing list.

VI.I. SAMPLING AND ANALYSIS PROCEDURES

Pursuant to 40 CFR § 264.97(e), the groundwater monitoring program must include sampling and analytical methods that are appropriate for groundwater sampling and that accurately measure hazardous constituents in groundwater samples. The groundwater monitoring program must include consistent sampling and analysis procedures that are designed to ensure monitoring results that provide a reliable indication of groundwater quality below the waste management area. To make changes to the groundwater sampling and analysis procedures specified in this section, the Permittee will submit for Director approval an application for a Class 1 permit modification in accordance with 40 CFR § 270.42, Appendix I. The Permittee shall use the following techniques and procedures when obtaining and analyzing samples from the groundwater monitoring wells described in Permit Condition VI.F.1. Additionally, the laboratory performing the analysis must be VELAP accredited for the method, matrix and analyte.

VI.I.1. Sample Collection and Sample Frequency

Groundwater samples will be collected using the techniques described in Permit Attachment IV.A at the frequency specified in Permit Condition VI.F.2.

VI.I.2. Sample Preservation, Transport and Documentation

a. Groundwater samples will be preserved, packed and shipped to the receiving laboratory for analysis in accordance with the procedures specified in Permit Attachment IV.A.

b. Groundwater samples will be tracked and controlled using the chain-of-custody procedures specified in Permit Attachment IV.A.

VI.I.3. Sample Analysis

Groundwater samples will be analyzed in accordance with the procedures described in Permit Attachments VI.B and VI.C. In addition, the performing laboratory must have VELAP accreditation for the alternative method, matrix and analyte.

VI.J. GROUNDWATER SURFACE ELEVATION

VI.J.1. Determination of Groundwater Surface Elevation

The Permittee will determine the groundwater surface elevation in accordance with Permit Attachment IV.A at each groundwater monitoring well described in Permit Condition VI.F.1 at least semiannually and each time groundwater is sampled.

VI.J.2. Elevation of Additional/Replacement Wells

The Permittee will report the surveyed elevation of any additional or replacement monitoring well(s) when installed with as built drawings. The total well depth and the elevation of the following will be recorded: top of the casing, ground surface and/or apron elevation, and top of the protective casing.

VI.K. MONITORING PROGRAM AND DATA EVALUATION

The Permittee will determine groundwater quality in accordance with Permit Sections VI.I and VI.J as discussed below.

VI.K.1. Groundwater Flow Direction and Velocity

The Permittee will determine the groundwater flow direction and velocity in the uppermost aquifer at least semiannually in accordance with Permit Condition VI.F.2. Constituent migration rate will be calculated, if necessary to demonstrate the effectiveness of corrective action monitoring. Potentiometric maps showing groundwater elevation contour and flow direction during each sampling event shall be prepared at least annually.

VI.K.2. Analytical Data Presentation

a. The Permittee shall determine the concentrations/values of hazardous constituents and MNA parameters semiannually listed in Permit Attachment VI.B and annually listed in Permit Attachment VI.C in accordance with Permit Conditions VI.F.2. and VI.I. The Permittee shall independently complete the validation of the data within the two (2) weeks of the data being available from the laboratory performing the analyses.

Estimated values between the method detection limit (MDL) and quantitation limit (QL) will be validated and qualified with the “J” flag to indicate the constituent is present and detected at or above the MDL, but below the QL and the associated value is estimated. The “U” flag will be used to indicate that the constituent is not detected at or above the MDL.

b. The Permittee will present the groundwater quality at each monitoring well in a form appropriate for the determination of statistically significant increases, in accordance with 40 CFR § 264.97(h).

c. The Permittee's report will include at least the following information: the constituents analyzed and concentration with qualifier, the background value, the GPS, the SW-846 test methods, MDL, QL, laboratory quality assurance/quality control (QA/QC) results, duplicate analyses, dilution factors, any laboratory specific MDL and/or QL, the results of any screening analyses, and any other information needed to evaluate accuracy, precision, representativeness, comparability, and completeness of the groundwater quality data.

VI.K.3. Determination of Additional GPS-Exceedance Constituents Present

The Permittee shall analyze samples from the Point of Compliance Wells specified in Permit Condition VI.F.1. for all constituents contained in Permit Attachment VI.C (Annual Monitoring List for CAP) annually to determine whether additional hazardous constituents, which are not the targets for the current corrective action (e.g. perchlorate and carbon tetrachloride), are present in the uppermost aquifer at levels exceeding the established GPSs specified in Permit Attachment VI.C.

a. In determining whether such an exceedance has occurred, the Permittee shall compare the groundwater quality at each downgradient point of compliance well specified in Permit Condition VI.F.1. to the GPS for that constituent specified in Permit Attachment VI.C:

- If a single independent sample was collected at the point of compliance well, the Permittee shall conduct a simple empirical comparison of the GPS and the measured value;

- If multiple independent samples were collected from each point of compliance well, a statistical comparison to the GPS which is approved by the Director shall be conducted. The statistical comparison shall be in accordance with Appendix 6 to Permit Attachment IV.A.

b. The Permittee shall notify the Director within seven (7) days from receipt of the laboratory data of any exceedances of the GPS. The notification shall include the concentration of constituent exceeding the GPS and shall identify the monitoring well(s) where the GPS was exceeded.

c. The Permittee may resample within (60) days from receipt of the laboratory data and repeat the analysis for the detected Permit Attachment VI.C constituent.

d. If the second analysis confirms the presence of constituents at levels exceeding an established GPS or if the Permittee does not resample, the Permittee shall then report the constituents to the Director in writing within seven (7) days and the Permittee must take corrective action for that constituent as required by Permit Condition VI.O.

VI.K.4. Alternate Source Demonstration

The Permittee may attempt to demonstrate that a groundwater concentration limit was exceeded due to sources other than the regulated unit, was due to an error in sampling, analysis or statistical evaluation, or was due to natural variability in the groundwater. The demonstration shall be conducted as follows:

a. The Permittee shall include a statement in the notification to the Director pursuant to Permit Condition VI.K.3. that the demonstration will be attempted.

b. Resampling, if a part of the demonstration, must be conducted within sixty (60 days of receipt of original laboratory data.

c. The Permittee must submit a report to the Director within 90 days of the notification that demonstrates a source other than the regulated unit caused the groundwater protection standard to be exceeded or that the apparent non-compliance was a result of an error in sampling, analysis, or evaluation. The Permittee must also submit to the Director within 90 days of the notification in Permit Condition VI.K.3. an application for a permit modification to make any appropriate changes in the Corrective Action Program.

d. The Permittee must continue to monitor in accordance with the Corrective Action Program established under 40 CFR § 264.100.

VI.L. REPORTING

The Permittee will submit the analytical results required by Permit Condition VI.K whenever there is a change in flow rate or direction such that the groundwater monitoring system defined in Permit Condition VI.F.1 is no longer adequate for the Corrective Action Monitoring Program, or whenever evidence of a statistically significant increase above the GPS , or at least annually with the Annual Groundwater Monitoring Report. Additional reporting requirements are specified in the following:

VI.L.1. Groundwater Elevation/Potentiometric Contour Maps

a. Annually, the Permittee will submit groundwater elevations and potentiometric contour maps depicting groundwater flow paths and supporting groundwater elevation data to determine if the requirements for locating the monitoring well network continue to be satisfied.

b. If the evaluation determines that the existing monitoring well network no longer satisfies the requirements of 40 CFR § 264.97(a), the Permittee will submit an application for a permit modification to make appropriate changes to bring the monitoring system into compliance.

VI.L.2. Contents of Annual Report

The report, submitted by March 1 of each year, shall meet all the requirements of an Annual Groundwater Monitoring Report and shall include an evaluation of the corrective action program as required by Permit Condition VI.E.4. The following items will be included, at a minimum:

- The operator/owner certification signed and dated by an authorized representative of the Facility;
- Potentiometric surface maps and static groundwater level elevation data collected during each sampling event during the previous calendar year;
- Evaluation of groundwater flow directions and gradients;
- Calculated or measured rate of migration of hazardous constituents in the groundwater;
- Analytical Result/Data Summary containing the following columns: well name, sampling/analytical dates, constituents analyzed, analytical methods, MDL, QL,

resulting data (concentrations) with qualifiers, USEPA RSL and MCL (if promulgated), and background values (if applied and calculated);

- Detections of constituents above the GPS, whether it is the first exceedance of that constituent or a repeated exceedance;

- Long-term time concentration plots of constituents of concern exceeding GPS for each well;

- When appropriate, graphic representation of groundwater impact plumes for constituents exceeding GPS;

- When appropriate, statistically calculated background values;

- Statistical evaluations of the groundwater data collected during the previous calendar year, including all computations, calculated means, variances, t-statistic values, and t-test results or the calculations and results of statistical tests that the Director has determined to be equivalent as appropriate;

- Copies of notifications and reports submitted as required by this Permit Module; and

- Data package with the certification from the contract analytical laboratory.

VI.M. RECORDKEEPING

Groundwater monitoring data collected in accordance with Permit Section VI.I, including all monitoring, testing and analytical data, must be maintained in the facility operating record in accordance with Permit Section I.E.

VI.N. ASSURANCE OF COMPLIANCE

The Permittee will demonstrate to the Director that groundwater monitoring and corrective action measures necessary to achieve compliance with the groundwater protection standard of 40 CFR § 264.92 are being conducted during the term of the permit.

VI.O. PERMIT MODIFICATION REQUESTS

VI.O.1. Modifications to Corrective Action Plan

If the Permittee or the Department determines that the corrective action ongoing at the OBG is not adequate to protect human health and the environment, the Permittee will submit to the Department an application for a permit modification to modify the corrective action plan within 180 days of receipt of the Department's determination that additional or modified corrective action is required. Specifically, permit modification during implementation of corrective measures at the point of compliance for the regulated unit OBG shall be required if the Permittee or the Department has made any of the following determination:

a. A GPS has been exceeded for a constituent for which the current corrective measure contained in the Permit will not achieve the remediation goals (see Permit Condition VI.K.3 above) and an alternate remedial measure (see Permit Condition VI.E.5 above) is required to meet the requirements of 40 CFR § 264.100;

b. The corrective measures contained in this permit are no longer effective in remediating groundwater at the point of compliance and the GPSs are still being exceeded. A modification incorporating a different remedial measure is required; or

c. Significant changes must be made to the remedial measures contained in this Permit to protect human health and the environment.

VI.O.2. Modifications to Corrective Action Monitoring Program

If the Permittee or the Department determines that the corrective action monitoring program no longer satisfies the requirements of 40 CFR § 264.99 and 264.100, then within ninety (90) days, the Permittee shall submit an application for a permit modification to make any appropriate changes.

ATTACHMENT VI.A - SOURCE AREA EVALUATION SAMPLING AND ANALYSIS PLAN

Source Area EVALUATION
Sampling and Analysis Plan
IN SUPPORT OF THE
CORRECTIVE ACTION PLAN
FOR THE
OPEN BURNING GROUND

RADFORD ARMY AMMUNITION PLANT
RADFORD, VIRGINIA
EPA ID No. VA1210020730

Submitted to:
Mr. Matthew Stepien
Virginia Department of Environmental Quality
Office of Waste Permitting
629 East Main Street
Richmond, Virginia 23219
(804) 698-4500

Prepared by:
Draper Aden Associates, Inc.
Consulting Engineers
2206 South Main Street
Blacksburg, Virginia 24060
Phone: (540) 552-0444

July 2007
Revised June 2008
DAA JN: B03204-103

DRAPER ADEN ASSOCIATES (DAA) PREPARED THIS DOCUMENT (WHICH MAY INCLUDE DRAWINGS, SPECIFICATIONS, REPORTS, STUDIES AND ATTACHMENTS) IN ACCORDANCE WITH THE AGREEMENT BETWEEN DAA AND ALLIANT TECHSYSTEMS INC.

THE STANDARD OF CARE FOR ALL PROFESSIONAL ENGINEERING, ENVIRONMENTAL AND SURVEYING AND RELATED SERVICES PERFORMED OR FURNISHED BY DAA UNDER THIS AGREEMENT ARE THE CARE AND SKILL ORDINARILY USED BY MEMBERS OF THESE PROFESSIONS PRACTICING UNDER SIMILAR CIRCUMSTANCES AT THE SAME TIME AND IN THE SAME LOCALITY. DAA MAKES NO WARRANTIES, EXPRESS OR IMPLIED, UNDER THIS AGREEMENT IN CONNECTION WITH DAA’S SERVICES.

CONCLUSIONS PRESENTED ARE BASED UPON A REVIEW OF AVAILABLE INFORMATION, THE RESULTS OF OUR FIELD STUDIES, AND/OR PROFESSIONAL JUDGMENT. TO THE BEST OF OUR KNOWLEDGE, INFORMATION PROVIDED BY OTHERS IS TRUE AND ACCURATE, UNLESS OTHERWISE NOTED.

DAA'S LIABILITY, HEREUNDER, SHALL BE LIMITED TO AMOUNTS DUE DAA FOR SERVICES ACTUALLY RENDERED, OR REIMBURSABLE EXPENSES ACTUALLY INCURRED.

ANY REUSE OR MODIFICATION OF ANY OF THE AFOREMENTIONED DOCUMENTS (WHETHER HARD COPIES OR ELECTRONIC TRANSMITTALS) PREPARED BY DAA WITHOUT WRITTEN VERIFICATION OR ADAPTATION BY DAA WILL BE AT THE SOLE RISK OF THE INDIVIDUAL OR ENTITY UTILIZING SAID DOCUMENTS AND SUCH USE IS WITHOUT THE AUTHORIZATION OF DAA. DAA SHALL HAVE NO LEGAL LIABILITY RESULTING FROM ANY AND ALL CLAIMS, DAMAGES, LOSSES, AND EXPENSES, INCLUDING ATTORNEY’S FEES ARISING OUT OF THE UNAUTHORIZED REUSE OR MODIFICATION OF THESE DOCUMENTS. CLIENT SHALL INDEMNIFY DAA FROM ANY CLAIMS ARISING OUT OF UNAUTHORIZED USE OR MODIFICATION OF THE DOCUMENTS WHETHER HARD COPY OR ELECTRONIC.

CONCLUSIONS PRESENTED BY DAA DO NOT REFLECT VARIATIONS IN SUBSURFACE GROUNDWATER QUALITY THAT MIGHT EXIST BETWEEN OR BEYOND SAMPLING POINTS OR BETWEEN SPECIFIC SAMPLE COLLECTIONS EVENTS. DAA SHALL INCUR NO LIABILITY RESULTING FROM INFORMATION SUPPLIED BY OTHERS.

TABLE OF CONTENTS

1. INTRODUCTION

This document presents the Sampling and Analysis Plan (SAP) for the source area evaluation for the Open Burning Ground (OBG) located at the Radford Army Ammunition Plant (Radford AAP) in Radford, Virginia (Figure 1). The source area evaluation is being conducted in support of the Corrective Action Plan for the OBG. During Second Quarter 2007, hazardous constituents were detected in the groundwater beneath the OBG at concentrations exceeding the proposed Groundwater Protection Standards (GPS) for the Unit. As a result, Radford AAP is developing a CAP for the OBG in accordance with the requirements of 40 CFR § 264.100.

1.1. PROJECT OVERVIEW

The OBG is the waste propellant burning ground (Figure 2). Material that cannot be burned in the Explosive Waste Incinerators is open burned at this Unit. The Virginia Department of Environmental Quality (VDEQ) issued the final *Permit for the Treatment of Hazardous Waste by Open Burning* (Permit) for the OBG on September 28, 2005; the Permit became effective on October 28, 2005. Prior to the issuance of the final Permit, the OBG was in Interim Status, and groundwater monitoring activities were conducted quarterly in accordance with the requirements of 40 CFR Part 265 (Interim Status Standards). However, beginning in Fourth Quarter 2003, the groundwater at the OBG was monitored quarterly in accordance with the *Detection Groundwater Monitoring Program for the Open Burning Ground* dated September 2003 in anticipation of receipt of the Permit for the Unit. Radford AAP began semiannual Detection monitoring at the OBG in accordance with the Permit after it went into effect in October 2005.

Exceedances of established background concentrations for carbon tetrachloride and perchlorate during the Fourth Quarter 2005 monitoring event prompted the need to develop a Compliance monitoring program for the OBG in accordance with the requirements of the Permit. As a result, during First Quarter 2006, all wells were sampled for the full Appendix IX analyte list to determine the Compliance Monitoring List. The hazardous constituents detected during the initial Appendix IX analysis formed the basis for the Compliance Monitoring List for the Unit.

Radford AAP submitted a Compliance Monitoring Plan to the VDEQ in June 2006. Background values for each additional Appendix IX compound found in the groundwater were established in accordance with the procedures specified in the Permit. At least four data points from the background wells were used to establish a background concentration for each constituent. For constituents that were added to the list following the First Quarter 2006 Appendix IX monitoring event and that did not have adequate data, site-specific background concentrations were calculated using data from quarterly sampling events conducted throughout 2006 as directed by the VDEQ. Therefore, an additional sampling event for collection of background data was performed during Third Quarter 2006. During this event, only background wells 13MW1 and 13MW2 were sampled.

Following the collection of the background data, Radford AAP submitted a revised Compliance Monitoring Plan with proposed GPS to the VDEQ. The first semiannual groundwater monitoring event for 2007 was conducted in accordance with the revised Compliance Monitoring Plan during Second Quarter 2007. During the Second Quarter 2007 event, perchlorate was detected in one of the downgradient monitoring wells at a concentration exceeding the proposed GPS of 26µg/l. Radford AAP notified the VDEQ of the exceedance of the proposed GPS and the need to develop a CAP for the OBG in correspondence dated May 21, 2007.

1.2. PURPOSE AND OBJECTIVE

The purpose of the SAP is to define the activities that will be performed to evaluate the apparent source areas of the hazardous constituents of concern at the OBG. Accordingly, the objective of the SAP is to perform those activities necessary to delineate the source areas, to the extent possible, in order to develop an appropriate CAP that is sufficient to protect human health and the environment. The CAP will provide documentation and results of the data gathering activities conducted in accordance with this SAP.

2. SOURCE AREA EVALUATION

2.1. HAZARDOUS CONSTITUENTS OF CONCERN

2.1.1. Perchlorate

During Second Quarter 2007, perchlorate was detected in downgradient monitoring well 13MW4 at a concentration of 66.4 µg/l, which exceeded the proposed GPS of 26 µg/l. As shown in Table 1, the Second Quarter 2007 perchlorate concentration detected in well 13MW4 was consistent with previous perchlorate concentrations detected in the well. Additionally, perchlorate has been detected historically in downgradient monitoring well 13MW5 at concentrations below the proposed GPS of 26 µg/l (Table 1). Trend graphs for the perchlorate concentrations detected in wells 13MW4 and 13MW5 are included in Attachment VI.D.

All soil and groundwater samples collected from all borings in support of the source area evaluation will be analyzed for perchlorate.

2.1.2. Carbon Tetrachloride

From Fourth Quarter 2003 through Second Quarter 2006, carbon tetrachloride was detected consistently in downgradient monitoring well 13MW3 at concentrations exceeding the USEPA Maximum Contaminant Level (MCL) and proposed GPS of 5 µg/l (Table 2). Please note that carbon tetrachloride has not been detected at concentrations exceeding the proposed GPS in well 13MW3 since Second Quarter 2006; furthermore, carbon tetrachloride has never been detected in any other wells at the OBG. However, Radford AAP plans to delineate the carbon tetrachloride source area as part of this CAP in the event that future groundwater concentrations exceed the GPS. A trend graph for the carbon tetrachloride concentrations detected in well 13MW3 is included in Attachment VI.D.

All soil and groundwater samples collected from all borings in support of the source area evaluation will be analyzed for carbon tetrachloride and its associated daughter products: chloroform, methylene chloride, and chloromethane. Please note that chloroform, methylene chloride, and chloromethane have not been detected previously in the groundwater at the OBG.

2.1.3. Hazardous Constituent of Concern Detection Determination

All results will be reported by the laboratory to the Method Detection Limit (MDL). The laboratory will report the MDL and the Quantitation Limit (QL). However, it is important to note that the definition of an HCOC detection for this program will be an exceedance of the QL, not the MDL. Therefore, only results at or above the QL will be used in subsequent actions associated with the Corrective Action process.

- *Laboratory reporting data qualifier:* The laboratory will report any constituent detected between the MDL and the QL with the "J" qualifier to indicate an estimated value.

- *Data validation reporting data qualifier:* Estimated values between the MDL and QL will be validated and qualified with the "U" flag to indicate the result was not detected at or above the QL.

2.2. PROPOSED BORING LOCATIONS

The proposed boring locations from which soil and groundwater samples will be collected during the source area evaluation are illustrated in Figure 3. The proposed borings are located within or near former burn pits used at the OBG prior to the construction of the current burn pads. The locations of the former burn pits illustrated in Figure 3 are derived from the USEPA Environmental Photographic Interpretation Center (EPIC) *Installation Assessment, Radford Army Ammunition Plant, Radford Virginia, Volume 2*, dated June 1992 (TS-PIC-92372).

2.2.1. Vicinity of Well 13MW3

As shown in Figure 3, seven (7) borings are proposed within the boundaries of former burn pits to the west, north, and east of existing groundwater monitoring well 13MW3. The borings will be advanced to the top of bedrock, which is anticipated to be at a depth approximately 13 feet below grade. One groundwater sample and a minimum of two soil samples will be collected from each boring for analysis for perchlorate, carbon tetrachloride, chloroform, methylene chloride, and chloromethane (seven groundwater samples and minimum 14 soil samples total).

2.2.2. Vicinity of Well 13MW4

As shown in Figure 3, seven (7) borings are proposed within or near the boundaries of former burn pits to the west, north, and east of existing groundwater monitoring well 13MW4. The borings will be advanced to the top of bedrock (anticipated depth approximately 16 to 17 feet below grade). One groundwater sample and a minimum of two soil samples will be collected from each boring for analysis for perchlorate, carbon tetrachloride, chloroform, methylene chloride, and chloromethane (seven groundwater samples and minimum 14 soil samples total).

As also shown in Figure 3, three (3) additional borings are proposed along the berm located at the southern boundary of the OBG in the vicinity of groundwater monitoring well 13MW4 (one boring to the west of 13MW4 and two borings to the east of 13MW4). These three borings will be located as close to the northern toe of the berm as allowable by the stormwater drainage structure (subsurface textile wrapped stone) located at the toe of the berm. One groundwater sample and a minimum of two soil samples will be collected from each of these three borings for analysis for perchlorate, carbon tetrachloride, chloroform, methylene chloride, and chloromethane (three groundwater samples and minimum six soil samples total).

2.2.3. Vicinity of Well 13MW5

As shown in Figure 3, two (2) borings are proposed within the boundaries of former burn pits to the west and east of existing groundwater monitoring well 13MW5. The borings will be advanced to the top of bedrock (anticipated depth approximately 17 to 18 feet below grade). One groundwater sample and a minimum of two soil samples will be collected from each boring for analysis for perchlorate, carbon tetrachloride, chloroform, methylene chloride, and chloromethane (two groundwater samples and minimum 4 soil samples total).

2.2.4. Vicinity of Well 13MW6

As shown in Figure 3, two (2) borings are proposed within the boundaries of former burn pits to the west and east of existing groundwater monitoring well 13MW6. The borings will be advanced to the top of bedrock (anticipated depth approximately 21 to 22 feet below grade). One groundwater sample and a minimum of two soil samples will be collected from each boring for analysis for perchlorate, carbon tetrachloride, chloroform, methylene chloride, and chloromethane (two groundwater samples and minimum 4 soil samples total).

2.3. SOIL SAMPLE SELECTION CRITERIA

Surficial soil samples were collected on January 7-8, 2008 at each set of burning pans as part of the Permit-required semiannual soil monitoring program; the analytical data from that event will be incorporated into the Source Area Evaluation.

Selection of soil samples for analysis during the Source Area Evaluation will be based on a number of factors. At a minimum, soil samples will be collected from each boring at the visual interface of fill material and native soil, and from the six inches just above the water table. All soil samples collected will be grab samples. If there is no visual interface between fill material and native soil, the sample will be collected at the first confining layer of soil or clay. If impacted soil is evident (based on PID readings, visual and/or olfactory observations, etc.) a sample will be collected at the area of obvious impact and at least every six (6) feet thereafter. If no obvious impact is evident, only the minimum of two soil samples per boring is required.

3. SAMPLING AND ANALYSIS PLAN

This SAP for soil and groundwater samples has been developed to provide high quality sampling results through validation of the analytical results, and an assessment of analytical error. This SAP is consistent with USEPA SW-846 (Test Methods for Evaluating Solid Waste, 3rd Edition, November 1986, as updated). The procedures detailed in this SAP will be followed when soil and groundwater sampling occurs.

3.1. SAMPLE COLLECTION PROCEDURES

The proposed boring locations from which soil and groundwater samples will be collected are illustrated in Figure 3. The proposed borings are located within or near former burn pits used at the OBG prior to the construction of the current burn pads.

The soil borings will be advanced using a Geoprobe® rig. The Geoprobe® system utilizes direct-push technology to facilitate sample collection. At each boring location, soil core samples will be collected continuously using a four-foot long, 1.5-inch diameter piston-type sampler. Each soil core sample will be collected and retained in a non-reactive acetate liner within the four-foot sampler. Following sample collection, the acetate liner will be split longitudinally to expose the soil core, which will be visually evaluated, screened with a PID, and classified in the field by a geologist. As the sample collection device may pass through impacted soil material, there is potential for cross-contamination from impacted soil to clean subsoils. Therefore, soil samples will be collected from the undisturbed center of the cores to minimize potential cross-contamination.

Within each boring, a temporary monitoring well will be constructed using one-inch inside diameter Schedule 40 PVC risers and screens. At each temporary well, groundwater samples will be collected using either a new, disposable weighted polyethylene mini-bailer or a peristaltic pump equipped with precleaned, disposable tubing. The groundwater samples will be collected immediately following installation of the temporary wells as water from the surrounding aquifer enters the wells.

It is anticipated that a total of 21 groundwater samples and a minimum total of 42 soil samples will be collected from all of the borings for laboratory analysis for perchlorate, carbon tetrachloride, chloroform, methylene chloride, and chloromethane. Data validation will be completed on the laboratory analytical results.

3.1.1. Sample Containers and Preservation

Soil sample containers for perchlorate analysis will consist of pre-cleaned, 8-ounce, amber glass jars equipped with Teflon-lined lids. Soil sample containers for VOCs will consist of pre-cleaned, pre-preserved, 40-ml glass vials with Teflon-lined septa. Each soil sample for VOC analysis will be collected using a Terra Core sampler or equivalent. One 5-gram soil plug will be transferred into each of the containers, which consist of two 40-ml glass vials containing sodium bisulfate (low concentration analysis) and one 40-ml glass vial containing methanol (high concentration analysis). Additionally, one 2-ounce container of soil will be submitted for dry weight determination.

Groundwater sample containers for perchlorate will consist of pre-cleaned, 250-ml, polyethylene bottles equipped with Teflon-lined lids. Groundwater sample containers for VOCs will consist of pre-cleaned, pre-preserved, 40-ml glass vials with Teflon-lined septa.

The containers will be prepared prior to sampling by the contract laboratory in accordance with the procedures for the appropriate analytical methods as specified in SW-846. After collection, the soil samples will be placed in a cooler, chilled to approximately 4^{o}C and sealed with a custody seal for shipment to the analytical laboratory under chain-of-custody.

Soil and groundwater sample containers will be packed in a cooler chilled to approximately 4^{o}C with ice as soon as they are collected. Upon the completion of activities at the Unit, the coolers will be packed with additional ice and sealed with a custody seal for transport to the contract laboratory. The samples will be shipped to the laboratory by common carrier.

3.1.2. Sample Label and Seal

Each sample will be assigned a unique identification number. The sample identification number will include symbols/numbers to indicate the following information:

- Name of the Facility,
- Name of the Unit from which the sample is collected,
- (For soils) depth from which the sample is collected, and
- Laboratory analyses associated with the sample.

The sample labels will display the sample identification number, the sampling date and time, the initials of the sampler, the preservative(s) used (if any), and the type of analytical test. Project names and project number are optional. The sample containers will be labeled in advance of or at the time of sampling using indelible ink. The sample information will be printed on the label in a legible manner. The identification on the label, as described above, should be sufficient to enable cross-reference with the analytical laboratory logbook.

Labels should be affixed to sample containers prior to or at the time of sampling, and should be filled out at the time of collection using indelible ink. Clear packaging tape will be placed over the labels after being affixed to the containers and after the sample information has been recorded in order to provide water resistance.

Before packing a sample into the sample shipping container, or before the sample leaves the custody of sampling personnel, a sample custody seal will be affixed over the lid/cap of the sample container in a manner that it is necessary to break the seal to open the sample container. The seal must include the following information:

- Sample identification number (this number must be identical with the number on the sample label).
- Name of sampler.
- Date and time of sampling.

3.1.3. <u>Sample Packaging and Shipping</u>

Sample packaging and shipping will comply with the U.S. Postal Service regulations, Department of Transportation regulations, Virginia regulations governing transportation of hazardous materials, if applicable, and USEPA SW-846 (Chapter 9).

When the sample containers are shipped to the laboratory, a minimum of two custody seals will be placed on the shipping container in such a way that the shipping containers cannot be opened in transport without breaking the seal. In addition, the shipping sample containers will be sealed with strapping tape in a manner that the shipping container cannot be opened without cutting through the tape.

In the event that final receipt by the laboratory of any shipping container or sample bottle indicates evidence of compromised sample integrity, the laboratory QA/QC officer or his/her representative will notify the operator within 24 hours of receipt (contact information will be provided to the laboratory in the event that samples are shipped on a Friday for Saturday delivery). Subsequent to notification, sample integrity will be evaluated and appropriate actions will be taken to assure representative samples. Sample integrity evaluation and need for additional action will be conducted according to QA/QC guidance from USEPA SW-846. Resampling will be conducted if determined necessary.

3.2. FIELD DOCUMENTATION

Events that occur during the sample collection activities will be recorded in a field notebook. Pertinent sampling and field survey information will be recorded in the logbook. Logs will be kept in a waterproof, bound notebook with numbered pages. Entries will be printed in waterproof ink. No pages will be removed. Corrections will be made by drawing a single line through the incorrect data and initializing and dating the correction that was made to the side of the error. Entries in the logbook should contain at a minimum the following information:

- Location of sampling point.
- Name and address of field contact.
- Type of sample (i.e., soil or groundwater).
- Number and volume of samples taken.
- Purpose of sampling (i.e., source area delineation).
- Description of sampling point and sampling methodology.
- Date and time of collection.
- Parameters for analysis.
- Sample identification number.
- Sample distribution and transport method (i.e., name of laboratory, name of courier).
- Field observations.

- Any field measurements taken (i.e., pH, conductivity).
- Appearance of the samples.
- Relevant field conditions.
- Signatures of personnel responsible for observations.

Sampling personnel will document the location of each soil boring by measuring the distance from two existing groundwater monitoring wells in order to triangulate the location and to facilitate the recreation in the field of the data point at a future time.

3.3. CHAIN-OF-CUSTODY DOCUMENTATION

The sampling program will incorporate a chain-of-custody program to track the route and handlers of the soil and groundwater samples. The monitoring of sample possession from field sampling to laboratory analysis is important in the event that unexpected lab results occur and the security of transportation is evaluated. This documentation will contain several records and logs that assist in the quality control of the program.

The chain-of-custody record will be completed for the Unit and will accompany the samples to the contract laboratory. The completed form will be returned to Radford AAP with the analytical results. An example chain-of-custody form is included in Appendix B. The sample possession will be established from time of collection to the time of analysis. This record will contain the following information:

- Sample identification and location.
- Signature of sampler.
- Date and time of sampling.
- Sample type.
- Boring identification.
- Number of containers.
- Required analysis.
- Signatures of person(s) involved in possession.
- Times and dates of possession.

- Method of transportation.
- Statement for packing on ice.
- Temperature during shipment (minimum and maximum).
- Internal temperature upon arrival at laboratory.

The chain-of-custody form will be forwarded to the laboratory with the samples. As a precaution against this record being lost or altered, the sampling personnel will retain a copy of the chain-of-custody form documenting relevant information up until the first change of sample custody.

A sample analysis request sheet can further clarify the samples for each requested constituent. This additional check sheet will be utilized when necessary. This sheet sent along with the samples will contain the following information:

- Name of person receiving samples.
- Laboratory sample number.
- Date of sample receipt.
- Analysis to be performed.
- Internal temperature during shipping.

3.4. DECONTAMINATION

Downhole probing tools will be decontaminated prior to initiating field activities, between each boring, and prior to demobilization from the Site using a non-phosphate detergent/distilled water solution wash followed by a distilled water rinse. The Geoprobe® sample collection system uses dedicated, disposable acetate liners for each soil sample collected in order to minimize the risk of cross-contamination. Between soil samples, the direct-push samplers will be washed using a non-phosphate detergent/distilled water solution followed by a distilled water rinse.

3.5. BORING ABANDONMENT

Upon completion of the borings and collection of the necessary samples, each borehole will be sealed with a bentonite slurry to the ground surface.

3.6. DISPOSITION OF INVESTIGATION-DERIVED WASTE

Disposition of investigation-derived waste will be in general accordance with the VDEQ Policy for the Handling of Investigation Derived Waste (IDW) dated June 28, 1995, and the corresponding Addendum dated July 24, 1996.

Rinsate water generated during decontamination activities will be containerized within a steel drum and labeled as "Open Burning Ground Investigation Derived Waste – Decontamination Water – Awaiting Analysis: [DATE] ." A composite sample will be collected and analyzed for TCLP metals, TCLP VOCs, and TCLP dinitrotoluene (DNT) for disposal purposes. The drum will be stored in the OBG drum storage area pending receipt of the waste characterization analytical results and proper disposal.

The soil cuttings and waste Geoprobe® sample collection sleeves will be containerized within a steel drum and labeled as "Open Burning Ground Investigation Derived Waste – Soil Cuttings and Debris – Awaiting Analysis: [DATE] ." A composite sample will be collected and analyzed for TCLP metals, TCLP VOCs, and TCLP dinitrotoluene (DNT) for disposal purposes. The drum will be stored in the OBG drum storage area pending receipt of the waste characterization analytical results and proper disposal.

3.7. ANALYTICAL PROCEDURES

The soil and groundwater samples will be submitted either to TestAmerica Laboratories, Inc. (formerly Severn Trent Laboratories) of North Canton, Ohio or to DataChem Laboratories, Inc. of Salt Lake City, Utah for analysis as noted in Section 2.2 for perchlorate using USEPA SW-846 Method 6850, and for VOCs (carbon tetrachloride, chloroform, methylene chloride, and chloromethane) using the USEPA SW-846 Method 8260B (preparation method 5035 for soil samples). Analyses for perchlorate will not include additional Department of Defense requirements for site characterization. All laboratory analytical results for soil samples will be reported on a dry weight basis. Please reference section 2.1.3 for reporting of analytical results.

Data validation will be conducted using summary tables and raw data provided by the analyzing laboratory. Data validation will be conducted in general accordance with SW-846 Method requirements (Test Methods for Evaluating Solid Wastes – Physical and Chemical Methods, USEPA SW-846, 3rd Edition – Final Update I, II/IIA, and III) and CLP data validation guidelines (USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, October 1999 and USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, July 2002). Please reference section 2.1.3 for additional discussion regarding reporting of validated results.

3.8. QUALITY ASSURANCE/QUALITY CONTROL

During sample collection and analysis, Radford AAP and the laboratories performing the analytical testing will follow field and laboratory quality assurance and quality control (QA/QC) procedures consistent with chapter one of SW-846, 3rd Edition, November 1986, as updated. The appropriate QA/QC samples for this project as detailed below are summarized in Table 3.

3.8.1. Field QA/QC Program

The field QA/QC program is designed so that the field data gathered as part of the source area evaluation sampling program is reliable and valid. The field QA/QC program consists of routine collection and analysis of trip and equipment blanks and field duplicates.

For each day of sampling, one trip blank will be filled with laboratory-grade reagent water in the laboratory that has been selected to conduct the VOCs analyses. Each trip blank will be analyzed only for the same VOCs for which the soil and groundwater samples will be analyzed. The trip blank will accompany the sampling kit, in the transport cooler, at all times. A minimum of one trip blank per day of sampling will accompany the samples collected for VOCs analyses.

For each 9 hours on-site (equivalent to 1 day of sampling), one equipment blank will be collected to monitor the decontamination of any non-dedicated equipment (i.e., the stainless steel direct-push sampler tube shoe) used in the sampling process. The equipment blank will be prepared by pouring distilled or deionized water across the stainless steel shoe and collecting the water in sample containers. Each equipment blank will be analyzed for the same constituents as the soil and groundwater samples collected during those 9 hours on-site. SW-846 states that at least one equipment blank should be collected during each day of sampling; however, the proposed equipment blank collection strategy would mitigate the need to collect a large number of equipment blanks if the time allowed on-site each day is reduced to 4-5 hours or less due to burning operations.

One field duplicate soil sample and one field duplicate groundwater sample will be collected during each 9 hours on-site (equivalent to 1 day of sampling). With the exception of soil samples for VOCs analysis, each field duplicate will be collected by dividing a single sample into separate containers. Co-located field duplicate soil samples for VOCs analysis will be collected in accordance with the procedures specified in Section 3.1.1. The containers for field duplicates should be labeled as such. The field duplicate samples will be analyzed for the same constituents as the soil and groundwater samples collected during those 9 hours on-site. SW-846 states that at least one field duplicate should be collected for each matrix sampled during each day of sampling; however, the proposed field duplicate collection strategy would mitigate the need to collect a large number of field duplicates if the time allowed on-site each day is reduced to 4-5 hours or less due to burning operations.

The occurrence of constituents in blank samples may serve to qualify the results presented by the laboratory. Additional blanks or duplicate samples may be prepared and analyzed to address specific, unanticipated conditions. Resampling and reanalysis may be required in certain cases depending on project objectives.

Field QA/QC samples will not be collected in association with the IDW characterization samples (see Section 3.6).

3.8.2. Laboratory QA/QC Program

The contract laboratories performing the analytical testing will follow QA/QC procedures consistent with chapter one of SW-846, 3rd Edition, November 1986, as updated. Copies of the Quality Assurance Plans for Severn Trent Laboratories and for DataChem Laboratories are included (on CD-ROM) in Appendix C.

The contract laboratories will keep a logbook to document the processing steps that are applied to each soil and groundwater sample. The sample preparation techniques and instrument methods must be identified in this logbook. The results of the analysis of all quality control samples should be identified specific to each batch of samples analyzed. The logbook should also include the time, date, and name of person who performed each processing step. A copy of the logbook will be included in the validation package.

Dilution during analyses has a major impact on the overall quality and usability of the soil sample data. Large dilution factors may mask hazardous constituents that are present at low concentrations, which may result in constituent concentrations not being accurately identified. Therefore, when multiple analyses using sequential dilutions are required, the results from these multiple analyses will be reported.

In addition to the trip and equipment blanks and blind duplicates collected for the field QA/QC program, the laboratory will prepare and analyze at least one matrix spike (MS) for each analytical method employed per batch of 20 samples per sample matrix. The laboratory will also prepare and analyze either one matrix duplicate or matrix spike duplicate (MSD)for each analytical method employed per batch of 20 samples per matrix. Sufficient sample volume will be collected in the field so that the laboratory can prepare the matrix spike and matrix spike duplicate samples. One soil sample MS/MSD and one groundwater sample MS/MSD will be prepared and analyzed for each batch of 20 samples per matrix during this sampling event.

Batch QA/QC may be used to meet laboratory quality control for the IDW characterization samples.

4. HEALTH AND SAFETY PLAN

During the soil and groundwater sample collection activities, health and safety requirements as per 29 CFR Parts 1910.120 must be followed by all personnel present at the Site. All contractors will adopt, as a minimum, the Radford AAP Facility Health and Safety Plan (HASP). The Radford AAP HASP outlines the minimum health and safety requirements for the facility. The contractors will assure that all personnel entering the Site have had appropriate health and safety training required by the Occupational Safety and Health Administration (OSHA) and USEPA, and that the requirements of the HASP are implemented. A copy of the Radford AAP HASP is included in Appendix D.

ATTACHMENT VI.B - SEMI-ANNUALLY MONITORED NATURAL ATTENUATION PARAMETERSAND ANALYTICAL METHODS

Parameter	Analytical Method	Data Use
Hazardous Constituents of Concern (HCOCs) and Daughter Products		
Perchlorate[1]	SW-846 Method 6850 or Method 6860	HCOC. Evaluate concentration trends and attenuation with respect to GPS.
Chlorate	300 series	Degradation products of perchlorate. Evaluate concentration trends and attenuation.
Chlorite	300 series	
Hypochlorite	Not Commercially Available	
Chloride	300 series	
Carbon Tetrachloride	SW-846 Method 8260 (25 ml purge)	HCOC. Evaluate concentration trends and attenuation with respect to GPS.
Chloroform	SW-846 Method 8260 (25 ml purge)	Daughter products of carbon tetrachloride. Evaluate concentration trends and attenuation with respect to GPS.
Methylene Chloride	SW-846 Method 8260 (25 ml purge)	
Chloromethane	SW-846 Method 8260 (25 ml purge)	
Methane	RSK175M / 8015M	
Monitored Natural Attenuation (MNA) Parameters		
Total Organic Carbon	SW-846 Method 9060	By-product of organic compound oxidation and indicates the difference in microbial oxidation processes within versus outside the plume area.
Dissolved Organic Carbon	SW-846 Method 9060	
Dissolved Iron (surrogate for Fe^{+2}) [2]	6010/ 6020	May indicate anaerobic degradation due to depletion of oxygen, nitrate, and manganese.
Dissolved Manganese (Mn^{+2}) [2]	6010 / 6020	May indicate anaerobic degradation due to depletion of oxygen and nitrate.
Alkalinity	SM2320B/310.2	Buffers the groundwater system against acids generated during anaerobic biodegradation.
Nitrate (NO_3)	300	Substrate for microbial respiration if oxygen is depleted.

Sulfate (SO_4^{2-})	300	Substrate for anaerobic microbial respiration.
pH	Field	Aerobic and anaerobic processes are pH sensitive. Stabilization parameter for groundwater purging and sampling.
Dissolved Oxygen (DO)	Field	Concentrations indicate whether an aerobic or anaerobic pathway exists. Concentrations of <0.5 mg/L generally indicate anaerobic pathway. Dissolved oxygen contributes to the potential of biodegradation and other attenuation mechanisms.
Oxidation Reduction Potential (ORP)	Field	Reflects the relative oxidizing or reducing nature of the aquifer. ORP is influenced by the biologically mediated degradation of constituents and ranges from 800 mV (oxygenated) to -400 mV (strongly reducing). Stabilization parameter for groundwater purging and sampling.
Specific Conductance	Field	General parameters for water quality and stabilization parameters for groundwater purging and sampling.
Temperature and Turbidity	Field	

[1] Samples for Perchlorate to be filtered in field at time of collection using 0.20 micron filters.
[2] Samples for Dissolved Iron and Dissolved Manganese to be filtered in field at time of collection using 0.45 micron filters.
[3] *Test Methods for Evaluating Solid Waste- Physical/Chemical Methods, SW-846 (as updated).*
[4] Laboratories performing the analysis must be VELAP accredited for the method, matrix and analyte. Current analytical method updates are represented with a suffix on the method (e.g., 6020A). The laboratory performing the analysis must be VELAP accredited, where applicable, for current method update.

ATTACHMENT VI.C - CORRECTIVE ACTION PROGRAM – ANNUAL GROUNDWATER MONITORING LIST FOR RADFORD OBG/HWMU-13

Constituent	CLASS	CAS # (1)	USEPA SW_846 METHOD (2)	QL (ug/L) (3)	BACK-GROUND (ug/l) (4)	MCL (ug/L) (5)	ACL (ug/L) (6)	RSL (ug/L) (7)	GPS (ug/L) (8)	GPS Based on
Antimony, Total	metal	7440-36-0	6010/6020	5	6	6	7.8		6	MCL
Arsenic, Total	metal	7440-38-2	6010/6020	5	5	10	0.052		10	MCL
Barium, Total	metal	7440-39-3	6010/6020	10	206	2000	3800		2000	MCL
Chromium, Total	metal	7440-47-3	6010/6020	5	112	100	-		112	Bckgrnd
Lead, Total	metal	7439-92-1	6010/6020	10	14	15	-		15	MCL
Mercury, Total	metal	7439-97-6	7470	0.5	2.52	2	0.63		2.52	Bckgrnd
Nickel, Total	metal	7440-02-0	6010/6020	5	5	-	390		390	ACL
Selenium, Total	metal	7782-49-2	6010/6020	5	5	50	100		50	MCL
Zinc, Total	metal	7440-66-6	6010/6020	30	5	-	6000		6000	ACL
Perchlorate	Misc.	14797-73-0	314/6850	4	4	-	-	15	15	RSL
Benzo[a]anthracene	PNA	56-55-3	8270	10	10	-	0.03		0.03	ACL
Benzo[a]pyrene	PNA	50-32-8	8270	10	10	0.2	0.025		0.2	MCL

Constituent	CLASS	CAS # (1)	USEPA SW_846 METHOD (2)	QL (ug/L) (3)	BACK-GROUND (ug/l) (4)	MCL (ug/L) (5)	ACL (ug/L) (6)	RSL (ug/L) (7)	GPS (ug/L) (8)	GPS Based on
Benzo[b]fluoranthene	PNA	205-99-2	8270	10	10	-	0.25		0.25	ACL
Benzo[k]fluoranthene	PNA	207-08-9	8270	10	10	-	2.5		2.5	ACL
Dibenz[a,h]anthracene	PNA	53-70-3	8270	10	10	-	0.025		0.025	ACL
Fluoranthene	PNA	206-44-0	8270	10	10	-	800		800	ACL
Indeno [1,2,3-cd] pyrene	PNA	193-39-5	8270	10	10	-	0.25		0.25	ACL
1,3,5-Trinitrobenzene; *sim-*	energetic	99-35-4	8330	10	2.5	-	590		590	ACL
1,3-Dinitrobenzene; *m-*	energetic	99-65-0	8330	4	2.5	-	2		2	ACL
2,4-Dinitrotoluene	energetic	121-14-2	8330	10	10	-	0.24		0.24	ACL
2,6-Dinitrotoluene	energetic	606-20-2	8330	10	5	-	0.049		0.049	ACL
Nitroglycerin	energetic	55-63-0	8330	16	16	-	-	2	2	RSL
Bis (2-ethylhexyl) phthalate	semivolatile	117-81-7	8270	10	10	6	5.6		6	MCL
Butyl benzyl phthalate	semivolatile	85-68-7	8270	10	10	-	16		16	ACL

Constituent	CLASS	CAS # (1)	USEPA SW_846 METHOD (2)	QL (ug/L) (3)	BACK-GROUND (ug/l) (4)	MCL (ug/L) (5)	ACL (ug/L) (6)	RSL (ug/L) (7)	GPS (ug/L) (8)	GPS Based on
Diethyl phthalate	semivolatile	84-66-2	8270	10	10	-	15000		15000	ACL
3,3'-Dimethylbenzidine	semivolatile	119-93-7	8270	10	10	-	0.0065		0.0065	ACL
Dimethyl phthalate	semivolatile	131-11-3	8270	10	10	-	-		10	QL/ Bckgrnd
Di-n-butyl phthalate	semivolatile	84-74-2	8270	10	10	-	900		900	ACL
Benzene	volatile	71-43-2	8260	1	5	5	0.46		5	MCL
Benzyl Chloride	volatile	100-44-7	8260	5	5	-	-	0.089	0.089	RSL
Carbon tetrachloride	volatile	56-23-5	8260	1	5	5	0.46		5	MCL
Chloroform	volatile	67-66-3	8260	1	1	80	0.22		80(9)	MCL
1,1-Dichloroethane	volatile	75-34-3	8260	1	1	-	2.8		2.8	ACL
Methyl bromide; Bromomethane	volatile	74-83-9	8260	1	1	-	7.5		7.5	ACL
Methyl chloride; Chloromethane	volatile	74-87-3	8260	1	5	-	118		190	ACL
Methylene chloride; Dichloromethane	volatile	75-09-2	8260	1	5	5	8.9288		5	MCL

Constituent	CLASS	CAS # (1)	USEPA SW_846 METHOD (2)	QL (ug/L) (3)	BACK-GROUND (ug/l) (4)	MCL (ug/L) (5)	ACL (ug/L) (6)	RSL (ug/L) (7)	GPS (ug/L) (8)	GPS Based on
Naphthalene	volatile	91-20-3	8260	1	1	-	0.17		0.17	ACL
Toluene	volatile	108-88-3	8260	1	5	1000	1100		1000	MCL
1,1,1-Trichloroethane	volatile	71-55-6	8260	1	1	200	8000		200	MCL
Trichloroethene (TCE)	volatile	79-01-6	8260	1	1	5	0.49		5	MCL
Trichlorofluoromethane	volatile	75-69-4	8260	1	1	-	5200		5200	ACL

This Annual GW Monitoring Constituent List for the CA Program is based on the Groundwater Compliance Monitoring List Attachment V.B, plus any constituent detected in Appendix IX in the past, the constituents reasonably expected or suspected to be in or derived from the waste managed in the unit, and the daughter products for carbon tetrachloride. The criteria by which GPSs are developed are following:

(1) CAS #: Chemical Abstracts Service registry number.

(2) *Test Methods for Evaluating Solid Waste- Physical/Chemical Methods, SW-846 (as updated.* Current method updates are represented without suffixes on each method (e.g., SW-846- Method 6020A). The laboratory performing the analysis must be VELAP accredited for a current method update. The laboratory performing the analysis must be VELAP accredited for the matrix, method and analyte.

(3) QL: Quantitation Limit. Actual laboratory-specific QL may vary under the approval of DEQ.

(4) Calculated background. See *Constituent Background Values for the Detection Groundwater Monitoring Program* prepared by Draper Aden Associates, May 10, 2005 for listed Background values, as updated

(5) MCL: Maximum Contaminant Level of USEPA National Primary Drinking Water Regulations (Safe Drinking Water Act).

(6) ACL: VA DEQ Alternate Concentration Limit. November 2019 (effective January 18, 2020)

(7) RSL: USEPA Regional Screening Level (RSL) – November 2020 (https://www.epa.gov/risk/forms/contact-us-about-regional-screening-levels-rsls (accessed November 23, 2020)). For perchlorate, 15 ug/l is recommended preliminary remediation goal (PRG). See current RSL table, "G" = user's guide Section 5.

(8) GPS: Groundwater Protection Standard. The criteria by which GPSs are developed are following:

a. Use calculated Background values if greater than promulgated regulatory values (EPA MCL or VDEQ ACL). If Background = QL and is greater than promulgated regulatory value (EPA MCL or VDEQ ACL), then use MCL or ACL as GPS.

b. If EPA MCL is promulgated and Background is less than the MCL, use the MCL as GPS.

c. If EPA MCL is not promulgated, use the VDEQ ACL as GPS if greater than Background.

d. If no MCL or ACL, use EPA Regional Screening Level (RSL).

(9) The MCL for total Trihalomethanes, including Bromodichloromethane, Bromoform, Dibromochloromethane, and Chloroform, is 80 ug/l.

For any monitoring event, if a GPS for a constituent in the table above is less than the QL, the Permittee will perform verification of any detection (i.e. value greater than the Detection Limit) of such a constituent using low-level analytical methods, if such methods are standard methods that are routinely available from commercial laboratories. Furthermore, the low-level analytical method will be used only if the QL achievable by that method is less than, or equal to, the MCL or ACL for the subject constituent. If the verification event confirms a quantifiable detection (i.e. value greater than the QL) above the applicable MCL or ACL, a revised background concentration will be established using low-level analytical methods, if appropriate, and the GPS will be updated based on the new background concentration if warranted.

ATTACHMENT VI.D - HISTORICAL MONITORING DATA FOR PERCHLORATE AND CARBON TETRACHLORIDE

Radford Army Ammunition Plant
Attachment VI.D

Permit No. VA1210020730
Revision Date: June 2016

TABLE 1

OPEN BURNING GROUND
SUMMARY OF PERCHLORATE CONCENTRATIONS IN GROUNDWATER 2003-2015
RADFORD ARMY AMMUNITION PLANT, RADFORD, VIRGINIA

Monitoring Event	Perchlorate Concentrations in ug/l								GPS ug/l
	13MW1	13MW2	13MW3	13MW4	13MW5	13MW6	13MW7	13MW8	
4th Qtr 2003	~	~	4.3	140	6.9	~	~	na	na
1st Qtr 2004	~	~	~	76.6	9.9	~	~	na	na
2nd Qtr 2004	~	~	~	123	~	~	~	na	na
3rd Qtr 2004	~	~	~	132	9.9	~	~	na	na
4th Qtr 2004	~	~	~	90.1	10	~	~	na	na
1st Qtr 2005	~	~	~	90.1	8.2	~	~	na	na
2nd Qtr 2005	~	~	~	109	9.4	11.6	~	na	na
3rd Qtr 2005	~	~	~	89	8.7	~	~	na	na
4th Qtr 2005	~	~	~	46.3	8.1	~	~	na	na
2nd Qtr 2006	~	~	~	43.1	7.1 J	~	~	na	na
4th Qtr 2006	~	~	~	67.8	~	~	~	na	na
2nd Qtr 2007	~	~	~	**66.4**	~	~	~	na	24.5
4th Qtr 2007	~	~	~	**58**	13.1	~	~	na	26
2nd Qtr 2008	~	~	~	**81.9**	~	~	~	na	26
4th Qtr 2008	~	~	~	**82.7**	~	~	~	na	26
2nd Qtr 2009	~	~	~	**127**	~	~	~	na	26
4th Qtr 2009	~	~	~	**132**	~	5.2	~	na	26
2nd Qtr 2010	~	~	~	**143**	~	~	~	na	26
4th Qtr 2010	~	~	~	**34.1 J**	6.4 J	~	~	na	26
2nd Qtr 2011	~	~	~	**36**	~	~	~	na	26
4th Qtr 2011	~	~	~	15	~	~	~	na	26
2nd Qtr 2012	0.61	1.64	1.55	**30.8**	2.44	1.33	1.05	na	26
4th Qtr 2012	0.21	0.52	1.88	12.8	3.28	0.17 J	1.15	na	26
2nd Qtr 2013	2.77	2.29	2.53	**28.3**	3.35	1.51	1.21	na	15
4th Qtr 2013	na	1.14	1.79	12.1	2.77	0.956	2.71	2.45	15
2nd Qtr 2014	na	2.14	1.1	12.1	2.48	1.15	1.18	1.89	15
4th Qtr 2014	na	0.59	1.86	13.6	1.17	0.67	1.21	4.48	15
2nd Qtr 2015	na	0.74	1.33	11.3	1.59	1.87	1.4	11	15
4th Qtr 2015	na	1.86	1.42	5.07	2.28	1.56	0.96	8.75	15

NOTES:

Groundwater at the OBG was not sampled for perchlorate prior to 4th Quarter 2003.
Wells 13MW1 and 13MW2 were the upgradient monitoring wells for the OBG prior to VDEQ approval of Class 2 Permit Modification (June 18, 2013) which reclassified 13MW1 as an observation well for measurement of static water levels only.
Plume monitoring well 13MW8 added to the monitoring well network beginning in 4th Quarter 2013.
Proposed GPS of 24.5 ug/l used beginning in 2nd Quarter 2007. In correspondence dated October 24, 2007, VDEQ indicated that EPA Region III RBC of 26 ug/l should be used as GPS; therefore, 26 ug/l was used as GPS beginning in 4th Quarter 2007. GPS revised to 15 ug/l following VDEQ approval of Class 2 Permit Modification (June 18, 2013).
~: Not detected at or above the Quantitation Limit (QL).
J: Perchlorate was detected at or above the QL and the associated result is estimated due to quality control issues.
na: Not applicable.
Concentrations in bold denote greater than the GPS.
Perchlorate analyses conducted using EPA Method 314.0 from 4th Quarter 2003 through 4th Quarter 2011.
Perchlorate analyses conducted using EPA Method 6850 beginning 2nd Quarter 2012.

OBG - Perchlorate Concentrations in Groundwater 2003-2015

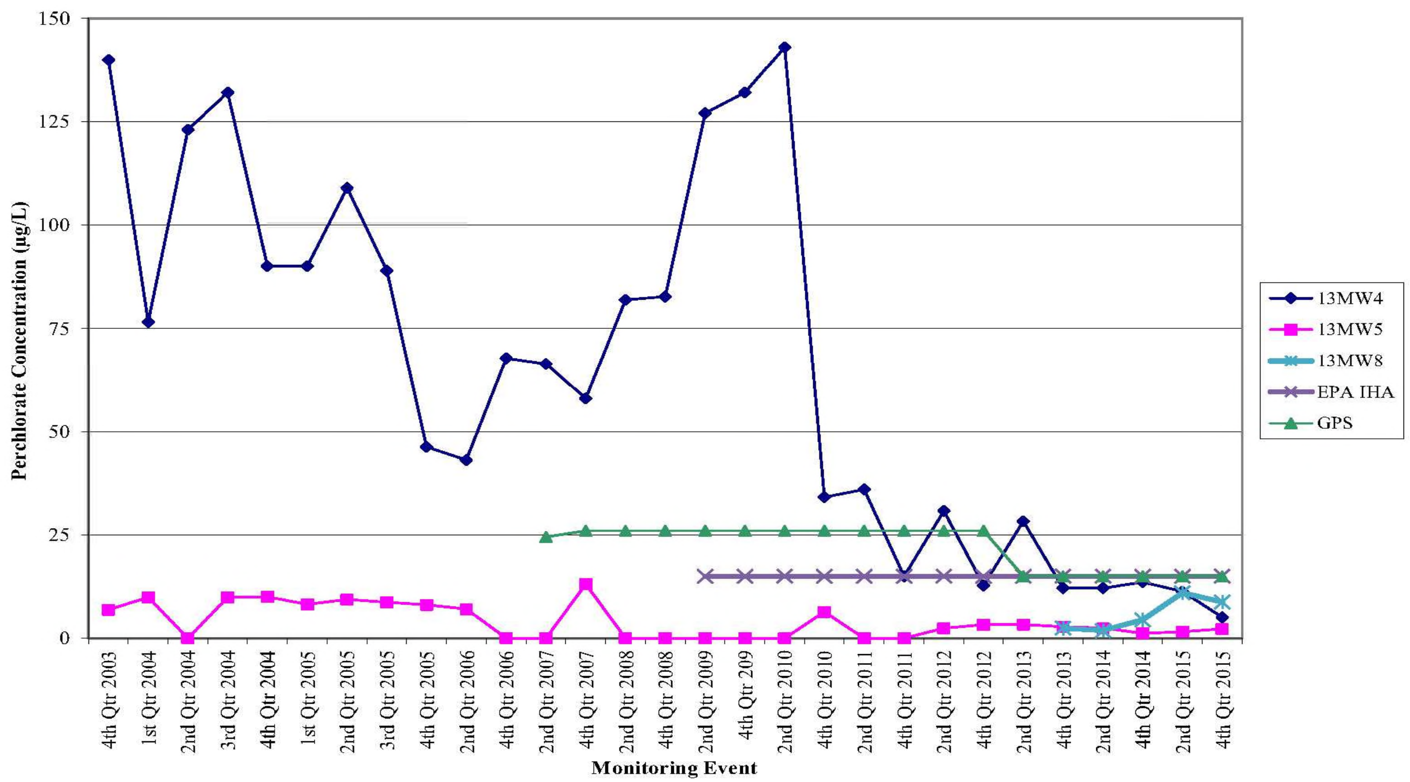


TABLE 2

OPEN BURNING GROUND
SUMMARY OF CARBON TETRACHLORIDE CONCENTRATIONS IN GROUNDWATER 2003-2015
RADFORD ARMY AMMUNITION PLANT, RADFORD, VIRGINIA

Monitoring Event	Carbon Tetrachloride Concentrations in ug/l								GPS ug/l
	13MW1	13MW2	13MW3	13MW4	13MW5	13MW6	13MW7	13MW8	
4th Qtr 2003	~	~	9.4	~	~	~	~	na	na
1st Qtr 2004	~	~	~	~	~	~	~	na	na
2nd Qtr 2004	~	~	7.4	~	~	~	~	na	na
3rd Qtr 2004	~	~	5.6 J	~	~	~	~	na	na
4th Qtr 2004	~	~	5.4	~	~	~	~	na	na
1st Qtr 2005	~	~	6.5	~	~	~	~	na	na
2nd Qtr 2005	~	~	10	~	~	~	~	na	na
3rd Qtr 2005	~	~	7.9	~	~	~	~	na	na
4th Qtr 2005	~	~	5.5	~	~	~	~	na	na
1st Qtr 2006	~	~	5.3	~	~	~	~	na	na
2nd Qtr 2006	~	~	6	~	~	~	~	na	na
3rd Qtr 2006	~	~	NA	NA	NA	NA	NA	na	na
4th Qtr 2006	~	~	~	~	~	~	~	na	na
2nd Qtr 2007	~	~	4.8	~	~	~	~	na	5
4th Qtr 2007	~	~	~	~	~	~	~	na	5
2nd Qtr 2008	~	~	4.3	~	~	~	~	na	5
4th Qtr 2008	~	~	**5.4**	~	~	~	~	na	5
2nd Qtr 2009	~	~	**6.6**	~	~	~	~	na	5
4th Qtr 209	~	~	**5.7**	~	~	~	~	na	5
2nd Qtr 2010	~	~	**7.9**	~	~	~	~	na	5
4th Qtr 2010	~	~	4.2	~	~	~	~	na	5
2nd Qtr 2011	~	~	4	~	~	~	~	na	5
4th Qtr 2011	~	~	4.4	~	~	~	~	na	5
2nd Qtr 2012	~	0.1 J	**7.3**	0.1 J	~	~	~	na	5
4th Qtr 2012	~	~	4	~	0.1 J	~	~	na	5
2nd Qtr 2013	~	0.3 J	**5.7**	0.2 J	~	~	~	na	5
4th Qtr 2013	na	0.1 J	**5.9**	0.1 J	0.1 J	~	~	0.2 J	5
2nd Qtr 2014	na	0.1 J	**8.2**	0.3 J	~	~	~	0.5 J	5
4th Qtr 2014	na	~	**5.7**	~	0.1 J	~	~	0.3 J	5
2nd Qtr 2015	na	~	**6.4**	~	0.1 J	~	~	0.8 J	5
4th Qtr 2015	na	0.1 J	2.8	~	~	~	~	0.3 J	5

NOTES:

Groundwater at the OBG was not sampled for carbon tetrachloride prior to 4th Quarter 2003.

Wells 13MW1 and 13MW2 were the upgradient monitoring wells for the OBG prior to VDEQ approval of Class 2 Permit Modification (June 18, 2013) which reclassified 13MW1 as an observation well for measurement of static water levels only.

Plume monitoring well 13MW8 added to the monitoring well network beginning in 4th Quarter 2013.

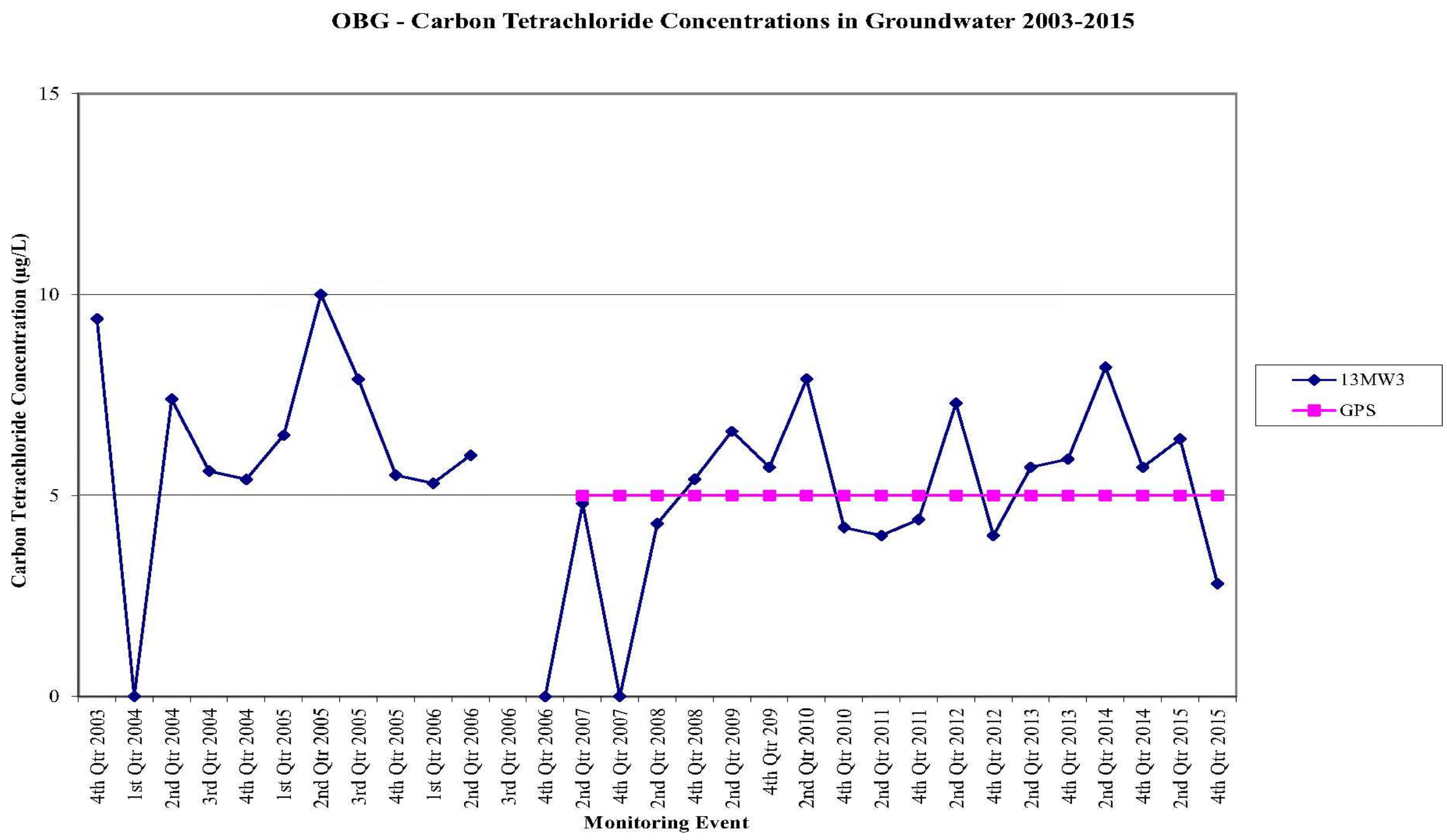
~: Not detected at or above the Quantitation Limit (QL).

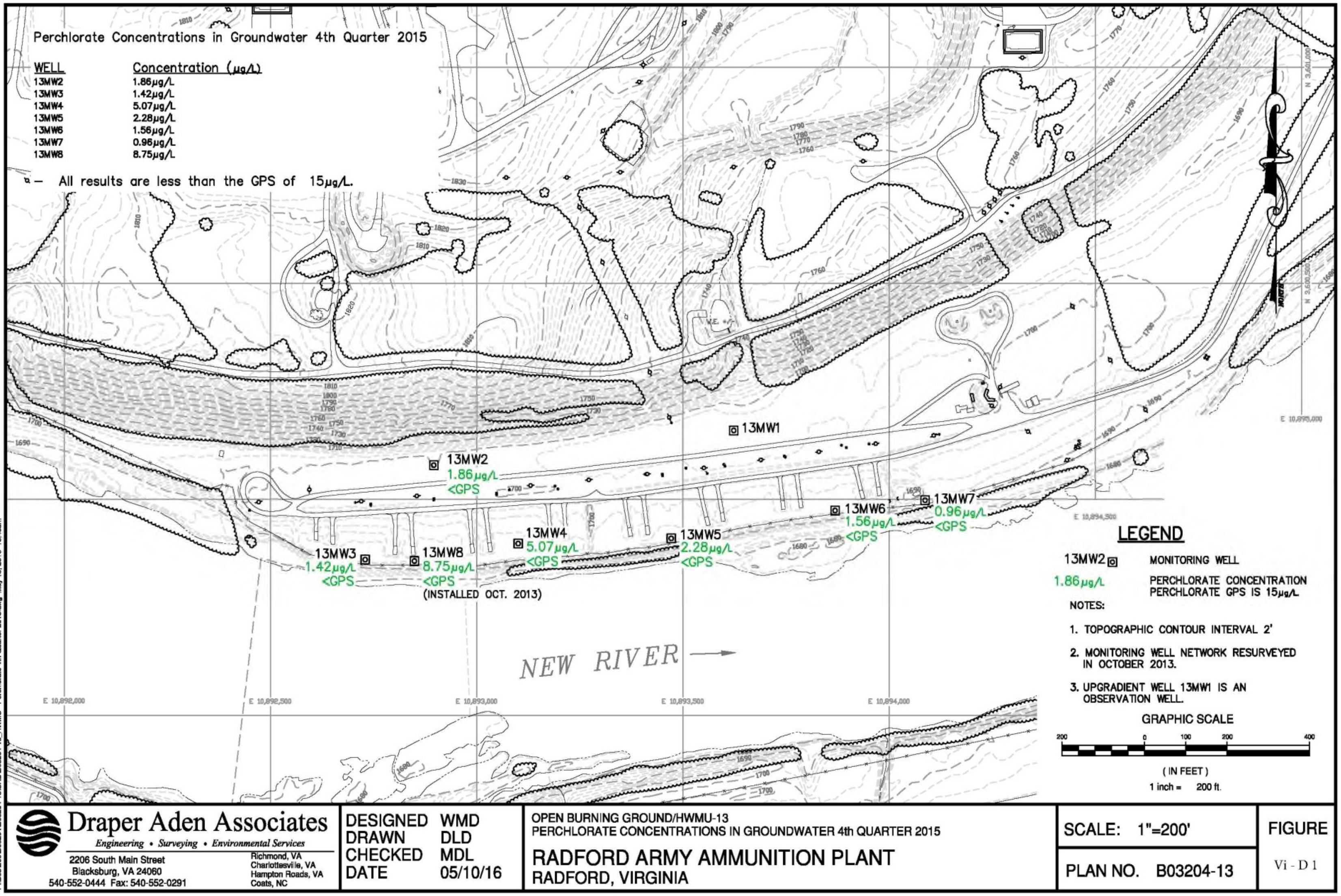
J: Carbon tetrachloride was detected at or above the QL and the associated result is estimated due to quality control issues.

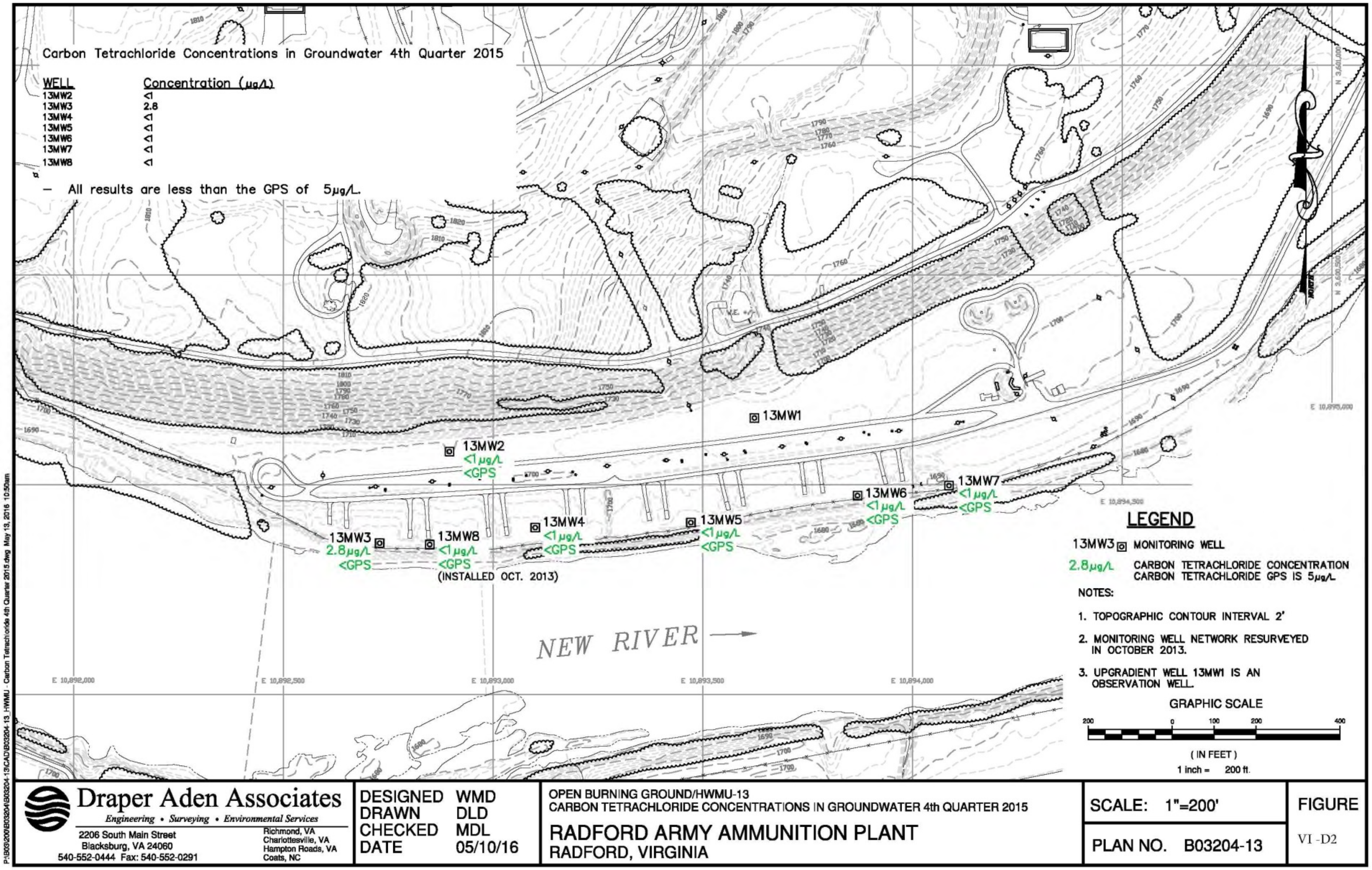
NA: Not analyzed. The downgradient monitoring wells at the OBG were not analyzed for carbon tetrachloride during 3rd Quarter 2006.

na: Not applicable.

Concentrations in bold denote greater than the GPS.


OBG - Carbon Tetrachloride Concentrations in Groundwater 2003-2015
Carbon Tetrachloride Concentration (µg/L)
15
10
5
0
13MW3
GPS
4th Qtr 2003
1st Qtr 2004
2nd Qtr 2004
3rd Qtr 2004
4th Qtr 2004
1st Qtr 2005
2nd Qtr 2005
3rd Qtr 2005
4th Qtr 2005
1st Qtr 2006
2nd Qtr 2006
3rd Qtr 2006
4th Qtr 2006
2nd Qtr 2007
4th Qtr 2007
2nd Qtr 2008
4th Qtr 2008
2nd Qtr 2009
4th Qtr 209
2nd Qtr 2010
4th Qtr 2010
2nd Qtr 2011
4th Qtr 2011
2nd Qtr 2012
4th Qtr 2012
2nd Qtr 2013
4th Qtr 2013
2nd Qtr 2014
4th Qtr 2014
2nd Qtr 2015
4th Qtr 2015
Monitoring Event


Perchlorate Concentrations in Groundwater 4th Quarter 2015
WELL Concentration (µg/L)
13MW2 1.86µg/L
13MW3 1.42µg/L
13MW4 5.07µg/L
13MW5 2.28µg/L
13MW6 1.56µg/L
13MW7 0.96µg/L
13MW8 8.75µg/L
All results are less than the GPS of 15µg/L.
13MW1
13MW2 1.86µg/L <GPS
13MW3 1.42µg/L <GPS
13MW8 8.75µg/L <GPS
(INSTALLED OCT. 2013)
13MW4 5.07µg/L <GPS
13MW5 2.28µg/L <GPS
13MW6 1.56µg/L <GPS
13MW7 0.96µg/L <GPS
NEW RIVER
LEGEND
13MW2 MONITORING WELL
1.86µg/L PERCHLORATE CONCENTRATION PERCHLORATE GPS IS 15µg/L
NOTES:
1. TOPOGRAPHIC CONTOUR INTERVAL 2'
2. MONITORING WELL NETWORK RESURVEYED IN OCTOBER 2013.
3. UPGRADIENT WELL 13MW1 IS AN OBSERVATION WELL.
GRAPHIC SCALE
(IN FEET)
1 inch = 200 ft.
Draper Aden Associates
Engineering • Surveying • Environmental Services
2206 South Main Street
Blacksburg, VA 24060
540-552-0444 Fax: 540-552-0291
Richmond, VA
Charlottesville, VA
Hampton Roads, VA
Coats, NC
DESIGNED WMD
DRAWN DLD
CHECKED MDL
DATE 05/10/16
OPEN BURNING GROUND/HWMU-13
PERCHLORATE CONCENTRATIONS IN GROUNDWATER 4th QUARTER 2015
RADFORD ARMY AMMUNITION PLANT
RADFORD, VIRGINIA
SCALE: 1"=200'
PLAN NO. B03204-13
FIGURE
Vi - D 1


Carbon Tetrachloride Concentrations in Groundwater 4th Quarter 2015
WELL
Concentration (µg/L)
13MW2 <1
13MW3 2.8
13MW4 <1
13MW5 <1
13MW6 <1
13MW7 <1
13MW8 <1
– All results are less than the GPS of 5µg/L.
13MW1
13MW2 <1 µg/L <GPS
13MW3 2.8µg/L <GPS
13MW8 <1 µg/L <GPS
(INSTALLED OCT. 2013)
13MW4 <1 µg/L <GPS
13MW5 <1 µg/L <GPS
13MW6 <1 µg/L <GPS
13MW7 <1 µg/L <GPS
NEW RIVER
LEGEND
13MW3 MONITORING WELL
2.8µg/L CARBON TETRACHLORIDE CONCENTRATION
CARBON TETRACHLORIDE GPS IS 5µg/L
NOTES:
1. TOPOGRAPHIC CONTOUR INTERVAL 2'
2. MONITORING WELL NETWORK RESURVEYED IN OCTOBER 2013.
3. UPGRADIENT WELL 13MW1 IS AN OBSERVATION WELL.
GRAPHIC SCALE
200 0 100 200 400
(IN FEET)
1 inch = 200 ft.
E 10,892,000
E 10,892,500
E 10,893,000
E 10,893,500
E 10,894,000
Draper Aden Associates
Engineering • Surveying • Environmental Services
2206 South Main Street
Blacksburg, VA 24060
540-552-0444 Fax: 540-552-0291
Richmond, VA
Charlottesville, VA
Hampton Roads, VA
Coats, NC
DESIGNED WMD
DRAWN DLD
CHECKED MDL
DATE 05/10/16
OPEN BURNING GROUND/HWMU-13
CARBON TETRACHLORIDE CONCENTRATIONS IN GROUNDWATER 4th QUARTER 2015
RADFORD ARMY AMMUNITION PLANT
RADFORD, VIRGINIA
SCALE: 1"=200'
PLAN NO. B03204-13
FIGURE
VI -D2

MODULE VII - SITE-WIDE CORRECTIVE ACTION

VII.A. CORRECTIVE ACTION FOR CONTINUING RELEASES; PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The requirements of 40 CFR § 264.101 are addressed by the Corrective Action Permit issued to the Permittees by DEQ which became effective on May 1, 2016 and shall remain in effect until May 1, 2026. The terms and conditions of the Corrective Action Permit issued by DEQ fulfill the Department's requirements for facility-wide corrective action as specified in 40 CFR § 264.101 as made applicable by 9 VAC 20-60-264.