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03/05/2008 01:38 PM

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bcc
Subject MMRP Historical Records Review

EPA and VDEQ approve the Final Historical Records Review for the Military Munitions Response Program at Radford Army Ammunition Plant, dated January 2008.

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1650 Arch Street
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Ammunition Systems Group
Energetic Systems Division
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January 16, 2008

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

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

Subject: With Certification, Historical Records Review, Radford Army Ammunition Plant, Virginia, Final January 2008
EPA ID# VA1 210020730

Dear Mr. Geiger and Mr Cutler:

Enclosed is the certification for the subject document that was sent to you on January 15, 2008. Also enclosed is a copy of the transmittal email message. During our conference call of December 18, 2007 our understanding was that both the Environmental Protection Agency and the Department of Environmental Quality would not comment on this document therefore we are submitting it as final. It would be helpful if confirmation to that effect could be provided in letter or by email.

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

Sincerely,

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

c: Durwood Willis
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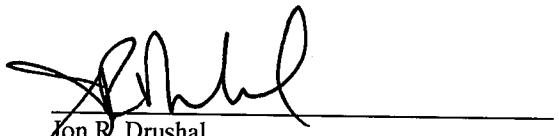
M Miano by J Yeakley
M. A. Miano

08-815-6
JMcKenna

Concerning the following:

Historical Record Review
Radford Army Ammunition Plant, Virginia
Military Munitions Response Program
Final January 2008

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

SIGNATURE: 
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Subject: Final Historical Record Review, Radford Army Ammunition Plant, Virginia, Military Munitions Response Program, January 2008 (UNCLASSIFIED)

Importance: High

Classification: UNCLASSIFIED
Caveats: NONE

All:

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

Certification letter will follow from Radford AAP under separate cover.

Immediately below are the POCs with tracking numbers:

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Willis)
Elizabeth A. Lohman, VDEQ, 792631295295, 1 CD Nancy Flaherty, USACE-Baltimore, 791832356068, 1 hard copy, 1 CD Mary Ellen Maly, USAEC, 1 hard copy, 799784624846, 1 hard copy, 1 CD William Geiger, US EPA Region III, 790916912098, 1 hard copy, 1 CD

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

Jim McKenna
Classification: UNCLASSIFIED
Caveats: NONE

Radford Army Ammunition Plant
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November 29, 2007

Mr. William Geiger
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Mr. James L. Cutler, Jr.
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Richmond, VA 24143-0100

Subject: With Certification, Historical Records Review, Radford Army Ammunition Plant, Virginia, November 2007
EPA ID# VA1 210020730

Dear Mr. Geiger and Mr Cutler:

Enclosed is the certification for the subject document that was sent to you on November 28, 2007. Also enclosed is a copy of the transmittal email message.

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

Sincerely,

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

c: Durwood Willis
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Rob Davie-ACO Staff
M.A. Miano
P.W. Holt
J. J. Redder
Env. File

Coordination: J. McKenna

M. A. Miano

07-815-224
JMcKenna

Concerning the following:

Historical Record Review
Radford Army Ammunition Plant, Virginia
Military Munitions Response Program
November 2007

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

SIGNATURE:
PRINTED NAME: Jon R. Drushal
TITLE: Lieutenant Colonel, US Army
Commanding

SIGNATURE:
PRINTED NAME: Kent Holiday
TITLE: Vice President and General Manager
ATK Energetics Systems

07-815-224
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Greene, Anne

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Cc: Sarah_Gettier@URSCorp.com; nancy.e.flaherty@nab02.usace.army.mil; Maly, Mary Ellen USAEC
Subject: Historical Record Review, Radford Army Ammunition Plant, Virginia, Military Munitions Response Program, November 2007 (UNCLASSIFIED)

Importance: High

Classification: UNCLASSIFIED
Caveats: NONE

All:

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Willis)
Elizabeth A. Lohman, VDEQ, 792461730038, 1 CD Nancy Flaherty, USACE-Baltimore, 798317688956, 1 CD Mary Ellen Maly, USAEC, 1 hard copy, 1 CD William Geiger, US EPA Region III, 799758348620, 1 hard copy, 1 CD

As we discussed in our first Technical Project Planning (TPP) session at RFAAP in July, this document presents the findings of our archive search regarding the former range located at RFAAP. This document provides all the available historical information we were able to discover regarding the site, and serves as the basis for developing the field sampling
approaches.

We plan to discuss the findings of this document and develop the sampling approach and associated data quality objectives for the field work with you at the second TPP session that we are trying to schedule as a conference call for either December 17th, 18th, or 19 th.

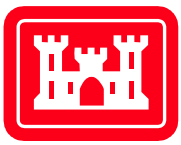
Thank you for support of the Radford AAP Installation Restoration Program.

Jim
Classification: UNCLASSIFIED
Caveats: NONE

FINAL

HISTORICAL RECORDS REVIEW RADFORD ARMY AMMUNITION PLANT, VIRGINIA

MILITARY MUNITIONS RESPONSE PROGRAM



Prepared for

U.S. Army Corps of Engineers, Baltimore District
10 South Howard Street
Baltimore, MD 21201

JANUARY 2008

URS Group, Inc.
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FINAL
HISTORICAL RECORDS REVIEW
RADFORD ARMY AMMUNITION PLANT, VIRGINIA
MILITARY MUNITIONS RESPONSE PROGRAM

January 2008

Prepared for:

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FINAL

HISTORICAL RECORDS REVIEW
RADFORD ARMY AMMUNITION PLANT, VIRGINIA

MILITARY MUNITIONS RESPONSE PROGRAM

DoD Contract Number: W912DR-06-C-0028

Reviewed and Approved by:

Scott McClelland
Program Manager
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Sarah Gettier
Project Manager
URS Group, Inc.

January 2008

TABLE OF CONTENTS

1. INTRODUCTION 1-1

1.1. Purpose/Scope 1-2
1.2. Project Drivers 1-2
1.3. Background 1-3
1.3.1. Inventory 1-3
1.3.2. Site Screening Process 1-3
1.4. Report Organization 1-4

2. SUMMARY OF PRELIMINARY ASSESSMENT 2-4

2.1. In Depth Chronological History of Installation 2-4
2.2. Phase 3 CTT Range Inventory 2-2
2.3. MMRP Site Descriptions 2-2

3. DATA COLLECTION AND DOCUMENT REVIEW PROCESS 3-1

3.1. Data Collection Methods 3-1
3.1.1. National and Regional Archives 3-1
3.1.2. Web Search 3-2
3.1.3. Site Visit 3-3
3.2. Archival/Historical and Other Records Collected 3-3
3.2.1. Documents/Reports 3-3
3.2.2. Archival Records 3-4
3.2.3. Maps/Drawings 3-4
3.2.4. Photographs/Aerial Photographs 3-6
3.2.5. Interviews 3-7
3.2.6. CTT Range Inventory Summary 3-7
3.3. Summary of Other Previous Investigations 3-8

4. HISTORICAL RECORDS REVIEW FINDINGS 4-1

4.1. Army Reserve Small Arms Range (RFAAP-001-R-01) 4-1
4.2. Potential MEC and MC 4-3

5. CONCEPTUAL SITE MODEL 5-1

5.1. General RFAAP Profile 5-1
5.1.1. Geography 5-1
5.1.2. Land Use and Demographics 5-1
5.1.3. Physical Profile 5-2
5.2. Army Reserve Small Arms Range 5-8
5.2.1. Area and Layout 5-8
5.2.2. 5.2.2 Structures 5-8
5.2.3. 5.2.3 Utilities 5-8
5.2.4. 5.2.4 Boundaries 5-8
5.2.5. 5.2.5 Security 5-8

5.2.6. Physical Profile 5-8
5.3. Land Use and Exposure Profile 5-9
5.3.1. Current Land Use/Activities 5-9
5.3.2. Current Human Receptors 5-9
5.3.3. Potential Future Land Use 5-9
5.3.4. Potential Future Human Receptors 5-9
5.3.5. Zoning/Land Use Restrictions 5-9
5.4. Munitions/Release Profile 5-9
5.4.1. Munitions Types and Release Mechanisms 5-9
5.4.2. Maximum Probable Penetration Depth 5-10
5.4.3. MEC Density 5-10
5.4.4. Munitions Debris/Fragments 5-10
5.4.5. Associated Munitions Constituents 5-10
5.4.6. Transport Mechanisms/Migration Routes 5-10
5.5. Pathway Analysis 5-11
5.5.1. MEC 5-11
5.5.2. MC 5-11

6. CONCLUSIONS 6-1

7. REFERENCES 7-1

LIST OF TABLES

Table 2-1. CTT Range Inventory Report and Site Summary 2-3
Table 3-1. Summary of Documents and Relevant Information 3-4
Table 3-2. Summary of Aerial Photographs 3-6
Table 4–2. Summary of Potential MEC and MC 4-3
Table 5–1. Average Monthly Temperature and Precipitation Data for RFAAP 5-2
Table 6-1. Summary of HRR Findings 6-1

LIST OF FIGURES

Figure 2-1. Installation Location Map 2-6
Figure 2-2. CTT Range Inventory Sites 2-7
Figure 2-3. CTT Ranges, UXO-DMM-MC Sites, New River Unit 2-8
Figure 4-1. Historical Aerial Photograph Compilation, Army Reserve Small Arms Range 4-5
Figure 4-2. Site Features based on Historical Aerial Photographs 4-6
Figure 4-3. Photographs of Current Site Conditions 4-7
Figure 4-4. CTT and HRR Boundaries, Army Reserve Small Arms Range 4-8
Figure 5-1. MC Exposure Pathway Analysis, Army Reserve Small Arms Range 5-13
Figure 6-1. MRS Boundary, Army Reserves Small Arms Range 6-3

LIST OF APPENDICES

Appendix A Archives Searched/Data Sources
(available only as a compact disk)

Appendix B Archive Documents and Research Materials
(available only as a compact disk)

Appendix C Interview Records

Appendix D Munitions Data Sheets

Appendix E TPP1 Meeting Minutes and Site Visit Photographs

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TABLE OF ACRONYMS

Acronym	Definition
AEC	Army Environmental Command
A/I	Active/inactive
AEDB-R	Army Environmental Database-Restoration
AMC	Army Materiel Command
amsl	above mean sea level
AOC	Area of Concern
Army	United States Army
ARS	Advance Range Survey
ASR	Archive Search Report
ATK	Alliant Techsystems, Inc.
bgs	below ground surface
B&W	Black and white
CEMED	Cease Maintenance, Excess and Dispose
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CSM	Conceptual Site Model
CTT	Closed, transferring, and transferred
DERP	Defense Environmental Restoration Program
DMM	Discarded military munitions
DoD	Department of Defense
EDR	Environmental Data Resources, Inc.
EPA	U.S. Environmental Protection Agency
EPIC	Environmental Photographic Interpretation Center
FUDS	Formerly Used Defense Site
FY	Fiscal year
GOCO	Government-Owned Contractor-Operated
HRR	Historical Records Review
ICRMP	Integrated Cultural Resources Management Plan
INRMP	Integrated Natural Resources Management Plan
IRP	Installation Restoration Program
ITRC	Interstate Technology & Regulatory Council
MC	Munitions constituents
MEC	Munitions and explosives of concern
MMRP	Military Munitions Response Program
MRS	Munitions Response Site

Acronym	Definition
MRSPP	Munitions Response Site Prioritization Protocol
NAIP	National Agriculture Imagery Program
NARA	National Archives and Records Administration
RAC	Risk Assessment Code
RAAP	Radford Army Ammunition Plant
RFAAP	Radford Army Ammunition Plant
RCRA	Resource Conservation and Recovery Act
RDX	Cyclotrimethylenetrinitramine
RFA	RCRA Facility Assessment
RG	Record group
RI	Remedial Investigation
SARA	Superfund Amendment and Reauthorization Act
SCS	U.S. Soil Conservation Service
SI	Site Inspection
SSP	Site Screening Process
SWMU	Solid Waste Management Unit
TNT	Trinitrotoluene
TPP1	Technical Project Planning
URS	URS Corporation
U.S.	United States
USACE	United States Army Corps of Engineers
U.S.C.	United States Code
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
UXO	Unexploded ordnance
VaDOT	Virginia Department of Transportation

GLOSSARY OF TERMS

Closed Range – A military range that has been taken out of service as a range and that either has been put to new uses that are incompatible with range activities or is not considered by the military to be a potential range area. A closed range is still under the control of a Department of Defense (DoD) component.

Defense Site – All locations that currently are or formerly were owned by, leased to, or otherwise possessed or used by the DoD. The term does not include any operational range, operating storage or manufacturing facility, or facility that is used or was permitted for the treatment or disposal of military munitions.

Discarded Military Munitions (DMM) – Military munitions that have been abandoned without proper disposal or removed from storage in a military magazine or other storage area for the purpose of disposal. The term does not include unexploded explosive ordnance, military munitions that are being held for future use or planned disposal, or military munitions that have been properly disposed of consistent with applicable environmental laws and regulations.

Explosive Ordnance Disposal – The detection, identification, on-site evaluation, rendering safe, recovery, and final disposal of unexploded ordnance by a military response unit. It may also include explosive ordnance that has become hazardous by damage or deterioration.

Explosives Safety – A condition where operational capability and readiness, personnel, property, and the environment are protected from unacceptable effects of an ammunition or explosives mishap.

Formerly Used Defense Site (FUDS) – A DoD program that focuses on compliance and cleanup efforts at sites that were formerly used by the DoD. A FUDS property is eligible for the Military Munitions Response Program if the release occurred prior to October 17, 1986; the property was transferred from DoD control prior to October 17, 1986; and the property or project meets other FUDS eligibility criteria.

Military Munitions – All ammunition products and components produced for or used by the armed forces for national defense and security, including ammunition products or components under the control of the DoD, the United States (U.S.) Coast Guard, the U.S. Department of Energy, and the National Guard. The term includes confined gaseous, liquid, and solid propellants, explosives, pyrotechnics, chemical and riot control agents, smokes and incendiaries, including bulk explosives and chemical warfare agents, chemical munitions, rockets, guided and ballistic missiles, bombs, warheads, mortar rounds, artillery ammunition, small arms ammunition, grenades, mines, torpedoes, depth charges, cluster munitions and

dispensers, demolition charges, and devices and components of the above. The term does not include wholly inert items, improvised explosive devices, and nuclear weapons, nuclear devices, and nuclear components, other than non-nuclear components of nuclear devices that are managed under the nuclear weapons program of the Department of Energy after all required sanitation operations under the Atomic Energy Act of 1954 have been completed.

Munitions and Explosives of Concern (MEC) – This term, which distinguishes specific categories of military munitions that may pose unique explosives safety risks, means unexploded ordnance, DMM, or munitions constituents (e.g., Trinitrotoluene [TNT] or Cyclotrimethylenetrinitramine [RDX]) present in high enough concentrations to pose an explosive hazard.

Munitions Constituents (MC) – Any materials originating from unexploded ordnance, DMM, or other military munitions, including explosive and non-explosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions.

Munitions Response Site (MRS) – A discrete location requiring a munitions response as recommended in Military Munitions Response Program (MMRP) policy guidance and protocols.

Operational Range – A range that is under the jurisdiction, custody, or control of the Secretary of Defense and that is used for range activities; or although not currently being used for range activities, that is still considered by the Secretary to be a range and has not been put to a new use that is incompatible with range activities. (10 United States Code [U.S.C.] 101(e)(3)(A) and (B)). Also includes "military range," "active range," and "inactive range" as those terms are defined in 40 Code of Federal Regulations (CFR) §266.201.

Other than Operational Range – Includes all property that is under jurisdiction, custody, or control of the Secretary of Defense that is not defined as an Operational Range.

Range – A designated land or water area set aside, managed, and used for range activities of the DoD. Ranges include firing lines and positions, maneuver areas, firing lanes, test pads, detonation pads, impact areas, electronic scoring sites, buffer zones with restricted access and exclusionary areas, and airspace areas designated for military use in accordance with regulations and procedures prescribed by the Administrator of the Federal Aviation Administration.

Transferred Range – A range that is no longer under military control and had been owned, leased, or otherwise possessed and used by the DoD, transferred, or returned from the DoD to another entity, including federal entities. This includes a military range that was used under the terms of an executive order, special-use permit or authorization, right-of-way, public land order, or other instrument issued by the federal land manager. Additionally, property that was

previously used by the military as a range, but did not have a formal use agreement, also qualifies as a transferred range.

Transferring Range – A range that is proposed to be leased, transferred, or returned from the DoD to another entity, including federal entities. This includes a military range that was used under the terms of a withdrawal, executive order, special-use permit or authorization, right-of-way, public land order, or other instrument issued by the federal land manager or property owner. An active range will not be considered a transferring range until the transfer is imminent (generally defined as the transfer date is within 12 months and a receiving entity has been notified).

Unexploded Ordnance (UXO) – Military munitions that have been primed, fuzed, armed, or otherwise prepared for action; have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel, or material; and remain unexploded either by malfunction, design, or any other cause.

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1. INTRODUCTION

The United States Congress established the Military Munitions Response Program (MMRP) in 2002 under the Defense Environmental Restoration Program (DERP) to address Department of Defense (DoD) sites with unexploded ordnance (UXO), discarded military munitions (DMM), and munitions constituents (MC) located on current and former military installations. Sites that are not eligible for the MMRP include: sites that had releases after September 30, 2002, properties classified as operational military ranges, permitted disposal facilities, and operating munitions storage facilities. The United States (U.S.) Army's (Army) inventory of closed, transferring, and transferred (CTT) military ranges and defense sites with UXO, DMM, or MC identified sites eligible for action under the MMRP. At Radford Army Ammunition Plant (RFAAP), Virginia, three sites were identified in the *Final CTT Range Inventory Report,* (Malcolm Pirnie, 2002; hereafter referred to as the *CTT Range Inventory Report*). Only one site is eligible under the MMRP, two of the sites are addressed under the Installation Restoration Program (IRP) and are not eligible for DERP funding. This report presents the findings of the Site Inspection (SI) Historical Records Review (HRR) which is being prepared to support the SI. During the course of performing the HRR, the findings of the *CTT Range Inventory Report* were refined, and changes to the Munitions Response Sites (MRS) sizes are detailed in this report.

The DoD is currently establishing policy and guidance for munitions response actions under the MMRP. Key program drivers developed to date, direct that munitions response actions will be conducted under the process outlined in the National Contingency Plan (40 Code of Federal Regulations [CFR] 300) as authorized by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 United States Code (U.S.C.) 9065, as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), Public Law 99-499 (hereinafter CERCLA). The DoD objective is to address the MMRP sites in accordance with CERCLA; however, the Army realizes that some installations will need to address these sites under the Resource Conservation and Recovery Act (RCRA) Corrective Action Program.

RFAAP is owned by the Army and is operated by contractor Alliant Ammunition and Powder Company, LLC, a division of Alliant Techsystems, Inc. (ATK). RFAAP investigates sites under the RCRA Corrective Action Permit issued by the Environmental Protection Agency, Region III (EPA) in October 2000. Therefore, the SI will follow RCRA terminology not CERCLA terminology. The *CTT Range Inventory Report* for RFAAP marked the completion of the RCRA Facility Assessment (RFA) phase of MMRP work under RCRA, and the next phase of the MMRP is the execution of a MMRP Site Screening Process (SSP) Report.

1.1. PURPOSE/SCOPE

The purpose of the HRR is to perform a records search to document historical and other known information for MMRP sites at RFAAP. This information will be used to supplement the *CTT Range Inventory Report* information, and to facilitate decisions on what information is needed to determine the next steps in the RCRA process. The SSP Work Plan will be the next step in this process.

1.2. PROJECT DRIVERS

Federal, State, and Local laws, as well as DoD and Army regulations and guidance, provide the regulatory structure for managing MMRP sites at RFAAP. The final structure of the MMRP is uncertain, as DoD and the EPA are still resolving key issues at the national level. However, key legislative and administrative precedents will influence the final regulatory framework for the MMRP, and these items include:

Defense Environmental Restoration Program (DERP) Management Guidance (September 2001)

The DERP Management Guidance establishes a MMRP component for UXO, DMM, and MC defense sites. DERP dates back to the SARA of 1986, and the scope of the DERP are defined in 10 U.S.C. §2701(b), which states that the:

> Goals of the program shall include the following: … (1) The identification, investigation, research and development, and cleanup of contamination from hazardous substances, pollutants, and contaminants. (2) Correction of other environmental damage (such as detection and disposal of unexploded ordnance) which creates an imminent and substantial endangerment to the public health or welfare or to the environment.

National Defense Authorization Act (Fiscal Year [FY] 02) (Sections 311-312)

Sections 311-312 of the National Defense Authorization Act of FY02 tasked DoD to develop and maintain an inventory of defense sites that are known or suspected to have UXO, DMM, or MC. Section 311 required DoD to develop a protocol for prioritizing defense sites for response activities in consultation with the states and Tribes. Section 312 requires the DoD to create a separate program element to ensure that the DoD can identify and track munitions response funding.

Munitions Response Site Prioritization Protocol (MRSPP) (32 CFR Part 179)

The MRSPP was promulgated in October 2005, in compliance with Section 311 of the National Defense Authorization Act of FY02. This protocol provides the method by which

DoD will assign a relative priority for munitions responses to each MRS in the inventory of defense sites known or suspected of containing munitions and explosives of concern (MEC) or MC.

The September 2001 Management Guidance for the DERP and the Defense Authorization Act FY02, described above, established the MMRP. The DERP and the MMRP provide guidance and methods for conducting a baseline inventory of defense sites containing, or potentially containing, UXO, DMM, or MC, and the MRSPP provides the method for DoD to assign a relative priority for subsequent munitions response. Data collected during the SSP will be used to prepare the MRSPP for each MRS.

1.3. BACKGROUND

The *CTT Range Inventory Report* for RFAAP serves as the RFA phase of work. The SSP Report is the subsequent phase in the RCRA process.

1.3.1. Inventory

The Army conducted its Range Inventory in three phases. The first phase (Phase 1) involved a data call issued through the Army Environmental Command (AEC) requesting general information about ranges on various installations under each U.S. Army Major Command. The Phase 1 Inventory was conducted using a questionnaire named the Advance Range Survey (ARS). The ARS allowed the Army to meet the short-term data goal of supporting the DoD preparation of Senate Report 106-50.

The ARS for the New River Ordnance Plant was completed in September 1993. The RFAAP ARS data was submitted to AEC and compiled into a master database of U.S. Army installations.

The ARS met the Army's initial needs; however, the long-term needs required a more detailed inventory that could not be obtained from information in the ARS. The follow-on inventory was divided into two phases. The Phase 2 Inventory addressed operational ranges (formerly referred to as active/inactive [A/I] ranges); whereas, the Phase 3 Inventory covered CTT ranges and sites with UXO, DMM, or MC.

The *CTT Range Inventory Report* was completed for RFAAP in August 2002. The Phase 3 Inventory identified three closed ranges totaling 5.4 acres. Additional information regarding the results of the *CTT Range Inventory Report* is discussed in Sections 2.2 and 2.3.

1.3.2. Site Screening Process

The primary goal of the MMRP SSP is to collect information necessary to make one or more of the following decisions: 1) determine whether a RCRA Facility Investigation/Corrective

Measures Study (RFI/CMS) is required at the site; 2) determine whether an immediate response is needed; or 3) determine whether the site qualifies for no further action. The MMRP SSP at RFAAP will address: 1) MEC, which includes UXO, DMM, and MC in high enough concentrations to pose an explosive hazard; and 2) MC issues for the MMRP sites. The secondary goals of the SSP include collecting data to prepare better Cost to Complete estimates and completing the MRSPP for each MMRP site.

1.4. REPORT ORGANIZATION

This HRR has the following sections:

- Section 1 – Introduction
- Section 2 – Summary of Preliminary Assessment
- Section 3 – Data Collection and Document Review Process
- Section 4 – Summary of Findings
- Section 5 – Conceptual Site Model (CSM)
- Section 6 – Conclusions

The following supporting information and analyses are included in the HRR appendices:

- Archives Searched/Data Sources (Appendix A)
- Archive Documents (Appendix B)
- Interview Records (Appendix C)
- Munitions Data Sheets (Appendix D)
- Technical Project Planning (TPP1) Meeting Minutes and Site Visit Photographs (Appendix E)

2. SUMMARY OF PRELIMINARY ASSESSMENT

2.1. IN DEPTH CHRONOLOGICAL HISTORY OF INSTALLATION

RFAAP (also referred to as the “Installation”) is a government-owned, contractor-operated industrial complex. The Installation is owned by the U.S. Department of the Army and was operated under contract with Hercules, Inc., from 1941 until 1995 when ATK became the operating contractor. RFAAP consists of two non-contiguous areas in Pulaski and Montgomery Counties. The Main Manufacturing Area is located in Pulaski and

Montgomery Counties 40 miles southwest of Roanoke, Virginia as illustrated in Figure 2-1. The New River Unit is located 6 miles west of the Main Manufacturing Area in Pulaski County. RFAAP was initially established in 1941 as two separate facilities, a smokeless powder plant (Radford Ordnance Works) that produced approximately 600 million pounds of powder during World War II and a bag manufacturing and loading plant for artillery, cannon, and mortar projectiles (New River Ordnance Works). The facilities operated separately until 1945. Radford Ordnance Works was renamed "Radford Arsenal" and the New River Ordnance Works was assumed as a subpost. Following World War II, the New River Ordnance Works was closed and classified as surplus, but the magazine area was withdrawn from surplus in April 1946 and placed on standby along with the Radford Arsenal. The facilities were reactivated during the Korean and Vietnam Wars. The facility underwent extensive renovation during the Korean War and experienced further expansion during the 1960's. Radford Arsenal was renamed "Radford Ordnance Plant" in 1961, and then "Radford Army Ammunition Plant" in 1963 (GlobalSecurity.org; Malcolm Pirnie, 2002).

Since inception, RFAAP has served U.S. combat operations as a propellant and explosives producer. RFAAP began manufacturing 2,4,6-Trinitotoluene (TNT) in 1968, in support of the Vietnam War, but was shut down in 1974 after an accident. TNT production began again in 1983, but became idle in 1986 due to an inventory surplus (Secretary of Defense). Today, RFAAP manufactures a variety of propellants, both solvent and solventless.

2.2. PHASE 3 CTT RANGE INVENTORY

The *CTT Range Inventory Report* was completed for RFAAP in November 2002 (Malcolm Pirnie, 2002). This report marked the completion of the RFA phase of work under RCRA. The purpose of the *CTT Range Inventory Report* for RFAAP was to identify CTT ranges at RFAAP. The specific requirements of this investigation included: mapping CTT ranges and sites with UXO, DMM, or MC; collecting and preparing the data for inclusion in Army databases; conducting an assessment of explosive safety risk using the Risk Assessment Code (RAC) on each CTT range or site; and determining which sites potentially qualify for the MMRP.

The *CTT Range Inventory Report* identified three closed ranges totaling 5.4 acres. The sites being evaluated in the SSP and the associated acreages, as determined in the *CTT Range Inventory Report,* are identified in the following section.

2.3. MMRP SITE DESCRIPTIONS

Three sites were identified as part of RFAAP in the August 2002 *CTT Range Inventory Report* (Figure 2-2 and Figure 2-3). These are:

- Army Reserve Small Arms Range (3 acres)
- Northern Burning Grounds (2 acres)
- Western Burning Grounds (0.4 acres)

The *CTT Range Inventory Report* includes an assessment of explosive safety risk for the identified sites. The RAC process required the completion of a worksheet that consisted of a series of questions regarding each CTT range or site. Based on the results of the worksheet, a relative score (RAC score) was assigned to each area. The RAC score is an estimate of the relative explosives safety risk, which was reported as a number from one (high explosives safety risk) to five (negligible explosives safety risk).

Table 2-1. CTT Range Inventory Report and Site Summary

Range/ Site Name	MMRP AEDB-R* Number	Classification	Total Area (Acres)	Munitions Type(s)	RAC Score
Army Reserve Small Arms Range	RFAAP-001-R-01	Closed	3	Small Arms	5
Northern Burning Grounds	N/A	Closed	2	Propellants (Solid, Liquid)	**
Western Burning Grounds	N/A	Closed	0.4	Propellants (Solid, Liquid)	**

*Army Environmental Database-Restoration (AEDB-R)
** The RAC score is only developed for range, UXO, and DMM sites.

The *CTT Range Inventory Report* includes a discussion of DERP eligibility for these sites. The CTT team determined that the Northern Burning Grounds site and the Western Burning Grounds Site are covered under the IRP and are not MMRP eligible. Therefore, the only MRS at RFAAP is the Army Reserve Small Arms Range. The burning grounds sites will not be discussed further herein.

The following description of the MMRP eligible site is taken verbatim from the C*TT Range Inventory Report.* The site history and data are refined in the HRR and the quoted text serves only as the point of departure for the subsequent analysis provided in Section 4 of this document:

> *ARMY RESERVE SMALL ARMS RANGE –The closed Army Reserve Small Arms Range occupied approximately 3 acres. It was used for small arms training from approximately 1941 to 1967. The closed range is located along the southeastern boundary of RAAP [Radford Army Ammunition Plant]. A berm (approximately 200 feet long by 10 feet high) is still present and indicates that the direction of fire was southeast. The berm is adjacent to a*

stream which forms the installation boundary. This range likely contained 10-15 stations. The "Radford Ordnance Works Historic Investigation" states that 155,375 rounds of ammunition were "expended in the pistol range by the RAAP police department from October 1941 to October 1945." The range may have also been used by the local rifle club (1946-1967).

Although public access to all of RAAP is currently restricted, the former small arms range is not within the secure manufacturing area and public access may have been possible in the past. The former range is currently a grass field surrounded by an unlocked fence. The field was once used as a baseball field accessible by the public. The field is still used for baseball although the frequency of use has decreased due to the increase in security at RAAP.

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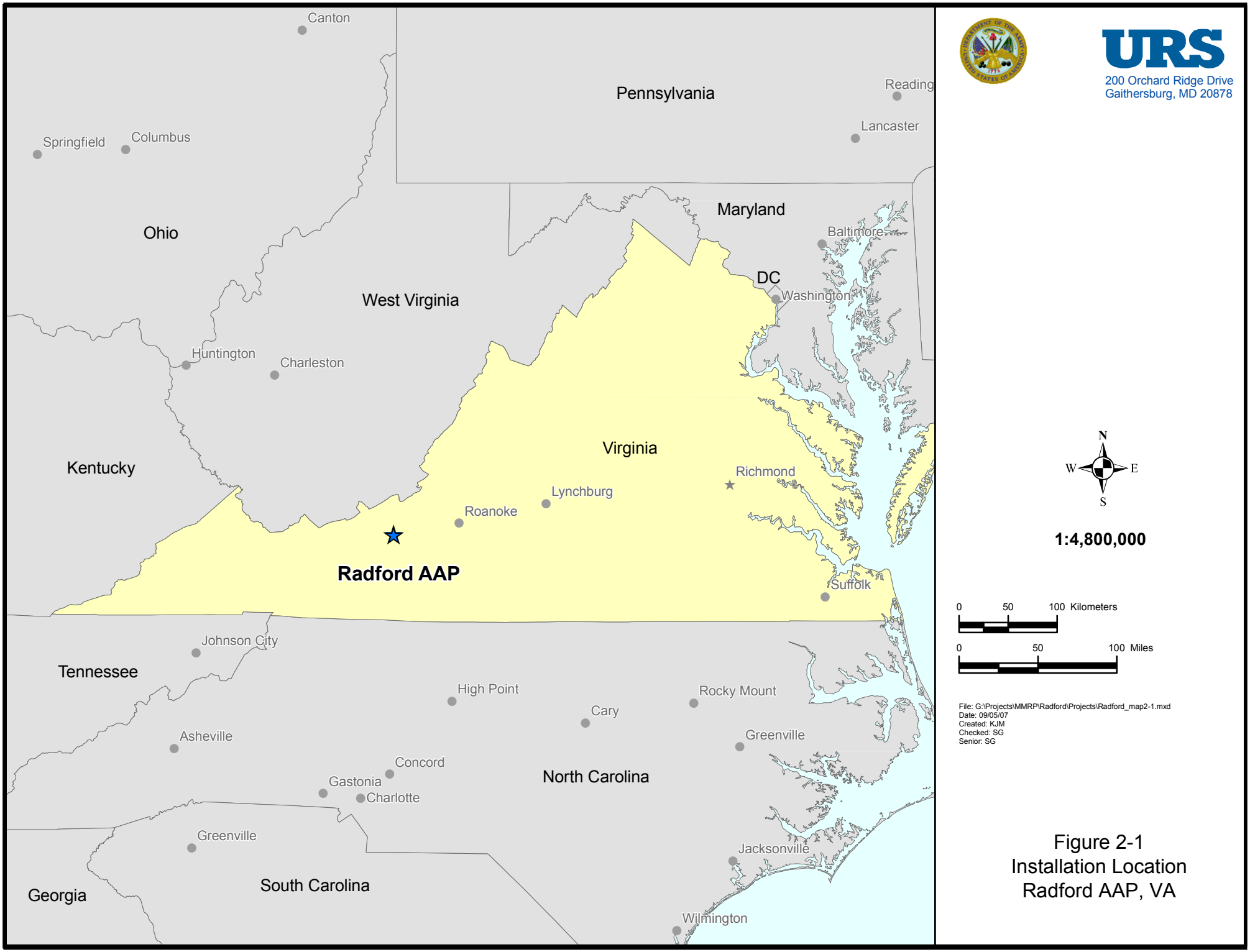

URS
200 Orchard Ridge Drive
Gaithersburg, MD 20878

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Date: 09/05/07
Created: KJM
Checked: SG
Senior: SG

Figure 2-1
Installation Location
Radford AAP, VA

CTT Ranges, UXO-DMM-MC Sites
Main Manufacturing Area, RFAAP, VA

URS
200 Orchard Ridge Drive
Gaithersburg, MD 20878

Installation Location

Legend

- Installation Boundary
- Roads
- Contours
- Counties
- Streams
- Waterbodies
- Operational Range Area
- Closed
- Transferring
- Transferred
- Non Range, Non UXO-DMM-MC Area

Projection	UTM, Zone 17
Horizontal Datum	NAD83
Units	Meters
Grid	500 Meters

N
W E
S

1:25,000

0 250 500 Meters

0 1,000 2,000 Feet

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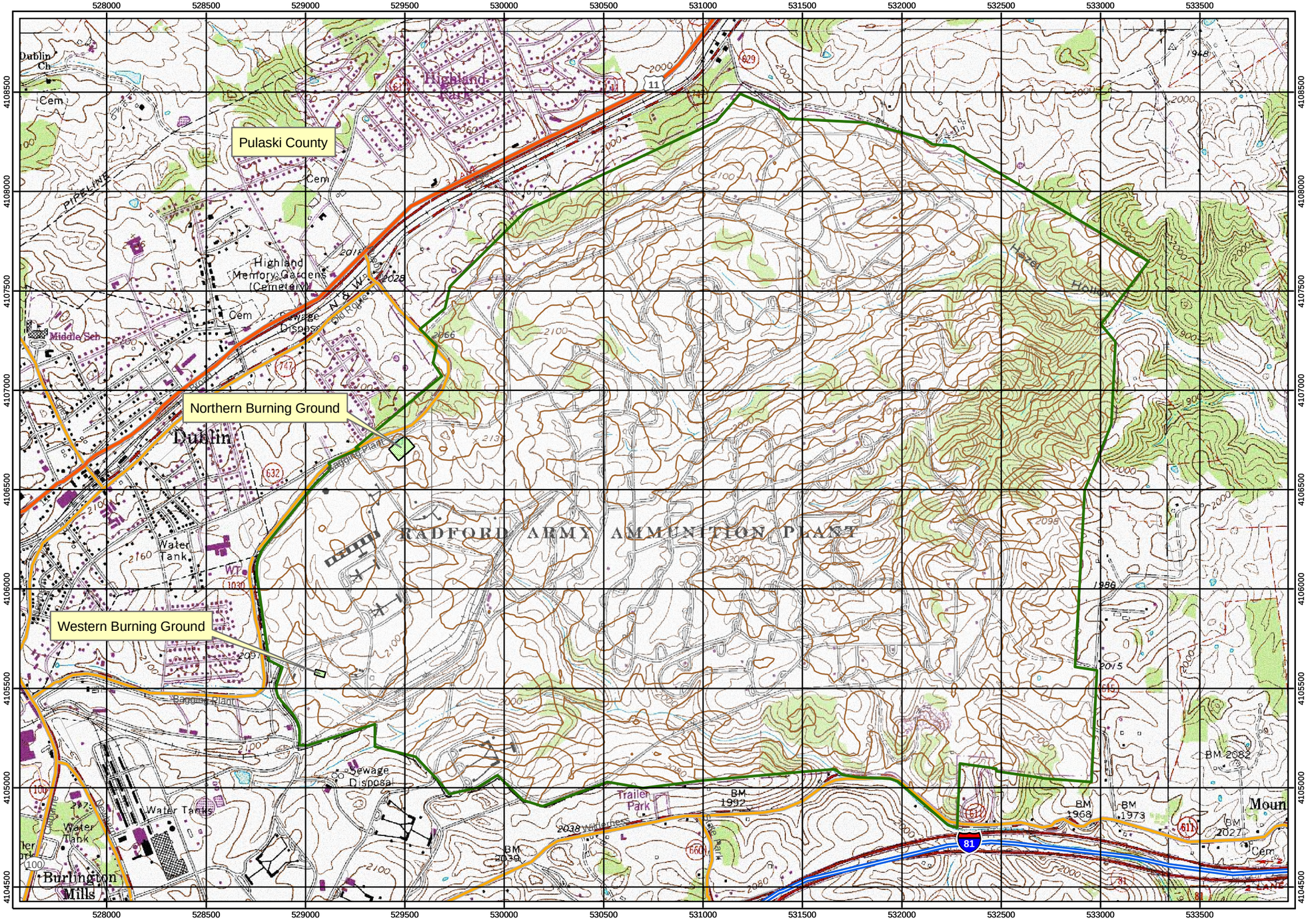
Date: 09/05/07
Created: KJM
Checked: SG
Senior: SG

Figure 2-2
CTT Range Inventory
Main Manufacturing Area
RFAAP, VA

CTT Ranges, UXO-DMM-MC Sites
New River Unit, RFAAP, VA

URS
200 Orchard Ridge Drive
Gaithersburg, MD 20878



Installation Location

Legend

- Installation Boundary
- Roads
- Contours
- Operational Range Area
- Closed
- Transferring
- Transferred
- Non Range, Non UXO-DMM-MC Area

Projection	UTM, Zone 17
Horizontal Datum	NAD83
Units	Meters
Grid	500 Meters

N
W E
S

1:20,000

0 250 500 Meters

0 1,000 2,000 Feet

File: G:\Projects\MMRP\Radford\Projects\Radford_E-2_drg.mxd
Date: 09/05/07
Created: KJM
Checked: SG
Senior: SG

Figure 2-3
CTT Range Inventory
New River Unit
RFAAP, VA

3. DATA COLLECTION AND DOCUMENT REVIEW PROCESS

Four primary sources of information were researched as part of the data collection effort for the HRR. The types of data included:

1. National and regional archives record group (RG) search;
2. Installation site visits;
3. Interviews; and
4. Review of the *CTT Range Inventory Report* and backup data.

Relevant archival record repositories and RGs were selected based on guidance set forth in:

- *Technical/Regulatory Guideline for Munitions Response Historical Records Review*, prepared by the Interstate Technology & Regulatory Council (ITRC) Unexploded Ordnance Team (ITRC, 2003), and
- *Guide to Environmental Research, Environmental Cleanup at Former and Current Military Sites: A Guide to Research*, U.S. Army Corps of Engineers (USACE) Engineering Pamphlet (EP) 870-1-64, November 2001.

3.1. DATA COLLECTION METHODS

3.1.1. National and Regional Archives

The search of national and local archival repositories produced useful information concerning the history of ranges at RFAAP. The findings and sources for archival research services provided by Heritage Research Center, Ltd. are presented in Appendix A. In addition, the retrieved resources are included on the enclosed CD as Appendix B. These resources will be referenced using the code provided in that report, e.g., RADF000##; the corresponding document is provided as an image file with the corresponding name.

The archival repositories and RGs that were searched for this HRR are listed below.

- National Archives and Records Administration – College Park, MD

  Textual Branch
  - RG 51: Records of the Office of Management and Budget
  - RG 77: Office of the U.S. Army Chief of Engineers
  - RG 107: Office of the Secretary of War
  - RG 156: Office of the Chief of Ordnance
  - RG 159: Office of the Inspector General
  - RG 165: War Department General and Special Staffs
  - RG 175: Records of the Chemical Warfare Service

- RG 234: Reconstruction Finance Corporation
- RG 319: Army Staff
- RG 330: Records of the Department of Defense
- RG 334: Records of the Inter-Service Agencies
- RG 335: Office of the Secretary of Army
- RG 337: Army Field Forces Headquarters, Ordnance Sec., Decimal File, 1945-1948
- RG 338: Records of U.S. Army Operational, Tactical, and Support Organizations (World War II and Thereafter)
- RG 407: Adjutant General's Office
- RG 429: Organizations in the Executive Office of the President
- RG 553: U.S. Army Training & Doctrine Command

Cartographic Branch

- RG 319: U.S. Army Staff

Still Picture Branch

- RG 111: Office of the Chief Signal Officer

- National Archives and Records Administration – Mid-Atlantic Region, Philadelphia, PA
  - RG 156: Office of the Chief of Ordnance
  - RG 269: General Services Administration
  - RG 270: War Assets Administration
- Military History Institute, Carlisle Barracks, PA
  - Radford Ordnance Works Completion Report (December 15, 1941)
  - The World War II Ordnance Department's Government-Owned Contractor-Operated Industrial Facilities: Radford Ordnance Works Historical Investigation (February 1996)
  - The World War II Ordnance Department's Government-Owned Contractor-Operated Industrial Facilities: Radford Ordnance Works Transcripts of Oral History Interviews (May 1996)
  - Radford Army Ammunition Plant: Supplemental Photographic Documentation of Archetypical Buildings, Structures and Equipment for U.S. Army Material Command, National Historic Content for World War II Ordnance Facilities (April 1995)
  - Installation Profile

3.1.2. Web Search

In addition to the data sources listed above, research was conducted on the internet to supplement archival data and data obtained from the Installation. The internet sources that were searched for this HRR are based on Appendix B of the *Technical/Regulatory Guidelines for Munitions Response Historical Records Review* (ITRC, 2003). A complete list of all web sources is located in Appendix A.

Internet sources provided primarily general information about RFAAP, and specific information rarely contained details regarding training or firing at the ranges or sites. Details from the internet search are provided in the MRS description in Section 4.

3.1.3. Site Visit

After the kick-off meeting on July 18, URS Group Inc. (URS) conducted a site visit of RFAAP to review available data resources. Sarah Gettier and James Spencer of URS, with representatives from USACE-Baltimore District, the Installation and AEC, visited the site. URS Engineer Sarah Gettier conducted the initial site visit to review relevant Installation materials for RFAAP. While onsite, URS reviewed documents, maps and historical photographs. URS staff met with:

- Mr. Jim McKenna, Installation IRP Project Manager
- Mr. Jerry Redder, ATK Environmental Engineer
- Mr. Douglas Day, RFAAP Safety and Risk Manager

The original text of the site visit is provided in the TPP1 meeting minutes in Appendix E. As part of the site visit, URS staff took photographs to document the current condition of RFAAP. These photographs are also provided in Appendix E.

3.2. ARCHIVAL/HISTORICAL AND OTHER RECORDS COLLECTED

The following subsections present the data collected from the sources outlined in Section 3.1. Although additional records may have been reviewed from the sources presented in the previous sections, the records listed in this section represent the data that were determined to be applicable to the HRR.

3.2.1. Documents/Reports

Table 3-1 lists documents that provided relevant information regarding former ranges and training areas within RFAAP. Additional information regarding these documents is provided in Section 3.3.

Table 3-1. Summary of Documents and Relevant Information

Document Name	General History	General Installation Information	Munitions Use	MC
Final Closed, Transferred, and Transferring (CTT) Range/Site Report, Fort A.P. Hill, Virginia. Malcolm Pirnie, Inc. November 2002.	X	X	X	X
Radford Army Ammunition Plant, Army Defense Environmental Restoration Program, Installation Action Plan. August 22, 2006.	X	X	X	X
Archives Search Report, New River Ordnance Plant, Radford, Virginia, USACE-St. Louis District, September 1993.	X	X		
The World War II Ordnance Department's Government-Owned Contractor-Operated (GOCO) Industrial Facilites: Radford Ordnance Works Historic Investigation, Gray & Pape, Inc., February 1996.	X	X		
Facility-Wide Background Study Report, Radford Army Ammunition Plant, IT Corporation, December, 2001.		X		
RCRA Facility Assessment of Radford Army Ammunition Plant, Radford, Virginia, EPA, 1987.	X	X		
Supplemental Photographic Documentation of Archetypal Buildings, Structures, and Equipment for U.S. Army Materiel Command National Historic Context for World War II Ordnance Facilities, Radford Army Ammunition Plant, Radford, Virginia, Geo-Marine, Inc., April 1995.	X	X		
Site Screening Process, Radford Army Ammunition Plant, Radford, Virginia, October 26, 2001.		X		
Final Master Work Plan, Radford Army Ammunition Plant, Radford, Virginia, URS, August 2003.		X		

3.2.2. Archival Records

Numerous aerial photographs and one Report of Observations regarding RFAAP were obtained in the Heritage Archives Search. These materials were scanned, and are included in Appendix B.

3.2.3. Maps/Drawings

A map of RFAAP was provided to URS by AEC contractor Niki Miller in GIS format.

The following maps and drawings were obtained during the HRR:

- Radford Ordnance Works Map. December 15, 1941. War Department, Office of the Quartermaster General, Semi-monthly Field Report, Part 1. This map is black and

white (B&W) and was part of the *Radford Ordnance Works Completion Report* (RADF0003).

- New River Ordnance Plant Hercules Powder Company, Plan of Site. Map not dated. (RADF0011).
- Real Property Utilization Survey-1972, RAAP. Radford Army Ammunition Plant, U.S. Army, Radford, Virginia, Hercules Incorporated (RADF012).
- Real Property Utilization Survey-1972, New River Ordnance Plant. New River Ordnance Plant, U.S. Army, Dublin, Virginia, Hercules Incorporated (RADF014).
- Modernization Site Plan, FY70 thru FY-81. Radford Army Ammunition Plant, U.S. Army, Radford, Virginia, Hercules Incorporated (RADF015). This map is a B&W copy of a color map; the colors indicate FY year in which funding is expected.
- Radford Ordnance Works, Radford, Virginia, Smokeless Powder Manufacturing Plant, War Department, Office of the Quartermaster General, Weekly Field Report, Part 1A of 4, Week Ending – May 10, 1941, Present Est. Com. Date: August 25, 1941 (RADF0023)
- Radford Ordnance Works, Radford, Virginia, Smokeless Powder Manufacturing Plant, War Department, Office of the Quartermaster General, Weekly Field Report, Part 1B of 4, Week Ending – May 10, 1941, Present Est. Com. Date: August 25, 1941 (RADF0024)
- Radford Ordnance Works, Radford, Virginia, Smokeless Powder Manufacturing Plant, War Department, Office of the Quartermaster General, Weekly Field Report, Part 1D of 4, Map of Powder Line "A", Week Ending – May 10, 1941, Present Est. Com. Date: August 25, 1941 (RADF0025)
- Radford Ordnance Works, Radford, Virginia, Smokeless Powder Manufacturing Plant, War Department, Office of the Quartermaster General, Weekly Field Report, Part 1 of 4, Week Ending – May 10, 1941, Present Est. Com. Date: August 25, 1941 (RADF0026)
- War Department, Radford Ordnance Works, Hercules Powder Company, Partial Burning Firing Emplacement. A stamp stating "Restricted Fig. 7, RD-3-Winnerling, October 1, 1945" is visible on the map (RADF0049).
- Radford Ordnance Works, Area Map, Radford, Virginia, January 1, 1943 (RADF0054).

– General Plot Plan, Radford Arsenal, 1951. This map is from the *Highlights of Radford Arsenal, Radford, Virginia* (RADF0057).

3.2.4. Photographs/Aerial Photographs

An archives search conducted by Heritage Research Center, Ltd. identified several B&W, vertical stereo-mode aerial photographs of RFAAP from U.S. Soil Conservation Service (SCS) flights in 1953; these are available through the National Archives and Records Administration (NARA) Cartographic Division, College Park, MD. In addition, URS contracted with a regulatory database company, *Environmental Data Resources Inc (EDR),* which provided aerial photographs from 1956, 1963, 1976, 1982, and 1998 (EDR, 2007). The URS-Richmond office had aerial photo enlargements from 1949, 1962, 1981, and 1986. All aerial photographs are provided in Appendix B.

During the site visit, Jerome Redder of ATK provided URS access to a hard copy of the Environmental Photographic Interpretation Center (EPIC) aerial photographs for this site from 1949, 1962, and 1971. Mr. Redder provided scanned photocopies of the aerial photographs and sent them to URS. These photocopies are included in Appendix B.

Table 3-2. Summary of Aerial Photographs

Aerial Date/Source	Comment	Reference
1949/EPIC	Black-and-white aerial photo enlargement showing two slightly disturbed areas and a surrounding perimeter road. Scale 1:23,600	URS-Richmond and ATK, 2007
1953/NARA	Black-and-white, low altitude aerial photograph showing two firing points (circular scared areas) and Stroubles Creek. No berm present. Scale 1:20,000	RADF0065
1956/USGS	Black-and-white, poor quality aerial photograph; roads are somewhat visible and two potential firing points are evident. The western firing point has a much larger scarred area than the eastern firing point. No berm present. Scale 1:60,000	EDR, 2007
1962/EPIC	Black-and-white aerial photo enlargement with two firing points clearly visible. Location of berm is in the shadow of the trees and not visible. Scale 1:20,000	URS-Richmond and ATK, 2007
1963/USGS	Black-and-white, poor quality aerial photograph; roads are somewhat visible and two potential firing points are evident. Scale 1:27,026	EDR, 2007
1971/EPIC	Black-and-white aerial photo enlargement; potential firing points appear to be overgrown with vegetation and a dirt road transverses the site from northeast to southwest. Berm is clearly visible. Scale 1:20,000	ATK, 2007
1976/USGS	Black-and-white, very poor quality aerial photograph; roads are somewhat visible. Scale 1:80,000	EDR, 2007
1981/VaDOT	Black-and-white, leaf-off, aerial photo enlargement; two baseball fields visible. Shadow in berm area from trees. Scale 1:24,000	URS-Richmond

Aerial Date/Source	Comment	Reference
1982/USGS	High altitude, black-and-white aerial photograph, very poor quality; roads are somewhat visible.	EDR, 2007
1986/possibly USFS	Natural color aerial photo enlargement; two baseball fields are very clearly visible.	URS-Richmond
1998/USGS	1:40,000-scale color infrared NAPP aerial photograph; Stroubles Creek is clearly visible.	EDR, 2007
2005/USGS-NAIP	Natural color, digital aerial image; only one baseball field appears to be in use, forested areas are plush with leaves, Stroubles Creek is not visible.	URS-Gaithersburg

Note: The reference column directs the reader to the Heritage Report file number in Appendix A or to the EDR report files in Appendix B. All files are electronic on CD.
EPIC – Environmental Photographic Interpretation Center
NAIP – National Agriculture Imagery Program
NAPP – National Aerial Photography Program
USFS – U.S. Forest Service
USGS – U.S. Geological Survey
VaDOT – Virginia Department of Transportation

3.2.5. Interviews

Interviews with site personnel were conducted during the site visit and by telephone. Records from these interviews are included in Appendix B.

3.2.6. CTT Range Inventory Summary

The *CTT Range Inventory Report* was completed for RFAAP in November 2002 (Malcolm Pirnie, 2002). The purpose of this Report for RFAAP was to identify CTT ranges at RFAAP. The specific requirements of this investigation are outlined in Section 2.2 of this HRR.

Three sites are identified at RFAAP in the November 2002 *CTT Range Inventory Report* and are listed below. These sites are shown on Figure 2-2 and descriptions are provided in Section 2.3.

- Army Reserve Small Arms Range (3 acres)
- Northern Burning Grounds (2 acres)
- Western Burning Grounds (0.4 acres)

The Northern Burning Grounds and Western Burning Grounds are managed under the IRP, and are not eligible for investigation under MMRP.

3.3. SUMMARY OF OTHER PREVIOUS INVESTIGATIONS

Based on the data repositories reviewed for the HRR, the following previous investigations were identified, which contain information pertaining to munitions use and/or relevant environmental data at RFAAP.

RCRA Facility Assessment of Radford Army Ammunition Plant, Radford, Virginia, EPA, 1987.

This report presents the results of a RFA conducted to evaluate releases of hazardous waste or hazardous constituents and the need to implement corrective actions under the 1984 Hazardous and Solid Waste Amendments to the RCRA. The report provides information on the environmental setting at RFAAP and identifies 81 Solid Waste Management Units (SWMUs) and 17 Areas of Concern (AOCs). The report further documents locations, provides photographs, describes operations, identifies wastes managed, and discusses potential releases from solid waste management activities. The discussion is primarily focused on the chemical hazards from waste storage, disposal, and treatment activities, not munitions.

Archives Search Report, New River Ordnance Plant, Radford, Virginia, U.S. Army Corps of Engineers, September 1993.

The Archives Search Report (ASR) addresses a portion of the New River Ordnance Plant designated as DERP-FUDS Site No. C03VA0047 and compiles information obtained through historical research at various archives and records holding facilities, interviews with persons associated with the site or its operations, and personal visits to the site. The purpose of the ASR is to establish the possible use or disposal of chemical warfare materials on the site, and to determine, when possible, the type of material, munitions or container, quantities, and area of disposal. The archive searches produced no evidence or indication of contamination and no additional actions are recommended in the report.

Supplemental Photographic Documentation of Archetypal Buildings, Structures, and Equipment for U.S. Army Materiel Command National Historic Context for World War II Ordnance Facilities, Radford Army Ammunition Plant, Radford, Virginia, Geo-Marine, Inc., April 1995.

This report provides photographic documentation in partial fulfillment of an Army Materiel Command (AMC) Legacy Resource Program demonstration project for assistance to small installations, as well as partial fulfillment of a 1993 Programmatic Agreement among the AMC, the Advisory Council on Historic Preservation, and multiple State Historic Preservation Officers concerning the program to discontinue maintenance of, or dispose of, particular government-owned properties. The work was conducted in compliance with the

National Environmental Policy Act of 1969; the National Historic Preservation Act of 1966, as amended; the Archaeological and Historic Preservation Act of 1974, as amended; and Executive Order No. 11593, "Protection and Enhancement of the Cultural Environment."

The objective of the project was to photographically record World War II vintage buildings and equipment, including numerous buildings that housed different stages of the ammunition manufacturing process. Buildings and equipment seem to have been selected based on architectural design. The report provides an historical overview of production operations, starting with construction in 1940 through 1993, when the production operations had been greatly curtailed, and includes photographs of Administrative Facilities, Housing for Employees, Manufacturing and Chemical Process Buildings, Support Facilities for Manufacturing, Shipping and Storage Facilities, Support Facilities for Employees, and Utilities and Infrastructures. The report does not include photographs of the Army Reserves Small Arms Range.

The World War II Ordnance Department's Government-Owned Contractor-Operated (GOCO) Industrial Facilities: Radford Ordnance Works Historic Investigation, Radford Army Ammunition Plant, Radford, Virginia, Geo-Marine, Inc., February 1996.

This report examines historical records related to the construction and operations of RFAAP. The effort was undertaken as part of an AMC Legacy Resource Program demonstration project to assist small installations and aid in the completion of mitigation efforts set up in a 1993 Programmatic Agreement among the AMC, the Advisory Council on Historic Preservation, and multiple State Historic Preservation Officers concerning the program to discontinue maintenance of, or dispose of, particular government-owned properties. The work was conducted in order to develop the national historic context of the facility, focusing on the impacts on State and local history. The report provides a discussion of the historical operations of the Radford Ordnance Works, New River Ordnance Plant, and the now-demolished Virginia Ordnance Works from the end of World War II to the present. The discussion addresses the military/political history, architecture/engineering design, construction, operations, and social history of the facilities. The report does not address training operations in the vicinity of the Army Reserves Small Arms Range.

U.S. EPA Permit for Corrective Action and Waste Minimization, Radford Army Ammunition Plant, Radford, Virginia, effective date October 31, 2000.

This permit was issued by the EPA under the authority of the Solid Waste Disposal Act as amended by RCRA and the 1984 Hazardous Solid Waste Amendments, as well as 40 CFR Parts 260-271 and Part 124. The permit provides terms and conditions for Alliant Ammunition and Powder Company LLC, as the operator of RFAAP, to develop, implement,

and monitor response actions to address releases of hazardous waste or hazardous constituents and prevent or mitigate migration of such releases from the facility. The permit also identifies specific SWMUs and AOCs requiring investigation and corrective measures, outlines requirements, and provides guidance for these activities.

Site Screening Process (SSP), Radford Army Ammunition Plant, Radford, Virginia, October 26, 2001.

The SSP was developed for the investigation of site screening areas specified in the Permit for Corrective Action and Waste Minimization (October 2000). The SSP was designed using specific human health and ecological screening processes to assess whether hazardous substances, pollutants, contaminants, hazardous wastes, or hazardous constituents were released to the environment and to determine whether an area warranted further investigation, should be subject to an interim removal action, or should be considered for no further action. The SSP details the tasks involved in site screening, including: 1) performance of a desktop audit and site visit to develop the scope of the SSP site-specific work plan, 2) preparation of a SSP site-specific work plan, 3) performance of the field work, 4) evaluation of the data and completion of pre-remedial risk screenings, and 5) assessment of the need for further investigation. The results of these tasks were to be presented in individual SSP reports for each area with recommendations for future action.

Facility-Wide Background Study Report, Radford Army Ammunition Plant, Radford, Virginia, IT Corporation, December 2001.

The Facility-Wide Background Study was conducted at the Main Manufacturing Area and New River Unit of RFAAP to characterize naturally occurring background soil inorganic concentrations and establish a baseline for inorganic compounds of concern. The work was intended to produce defensible and statistically significant data and address shortcomings in a previous attempt to identify site-specific background concentrations. The report presents a final set of point estimates approved by EPA for the background data set to be used as reference for point-by-point comparisons for site screening.

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

This work plan was prepared to facilitate and streamline the RCRA site investigations at RFAAP pursuant to the Permit for Corrective Action and Waste Minimization (October 2000). The work plan provides a comprehensive collection of standard procedures, protocol, and methodologies to be followed during RCRA field investigations. Multiple Work Plan Addenda were to be developed separately to address the site-specific information for each RCRA site, including past site operations, potential constituents of concern, sampling

strategies, etc. The work plan includes an Installation description, a discussion of the environmental setting, discussions of site investigation planning and program management, approaches to human health and ecological risk assessments, and general information on site safety and security.

Integrated Natural Resources Management Plan for Radford Army Ammunition Plant, Radford, Virginia, June 2005.

The Integrated Natural Resources Management Plan (INRMP) for RFAAP was prepared to ensure that natural resource conservation measures and Army activities on mission land are integrated and are consistent with federal stewardship requirements. The INRMP is intended to provide guidance on the proper development, management, and maintenance of all land under DoD jurisdiction in accordance with proven scientific methods, procedures, and techniques to facilitate and prevent delays in the military missions and operation. Initiatives planned in the INRMP for the following five years include: 1) steps to control invasive species, 2) continued support of scientific studies on the grassland and fauna community and maintenance of vegetation at the New River Unit, 3) reforestation of harvested areas, and 4) continued harvesting of pine plantations and replanting of areas with the goal of converting areas to native hardwoods to improve wildlife habitat. The INMRP documents RFAAP land uses and natural resources management and discusses resource monitoring, as well as enforcement and implementation.

2006 Radford Army Ammunition Plant Installation Action Plan

The Installation Action Plan identifies 45 Installation Restoration Program and 18 Environmental Restoration sites as Response Complete. One MMRP site, the Army Reserve Small Arms Range, is also documented (as identified in the *CTT Range Inventory Report*) as a Closed Range. The site inspection was scheduled to begin in October 2006 and be completed in 2007, with follow-up actions/phases as required.

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4. HISTORICAL RECORDS REVIEW FINDINGS

There is a single MRS at RFAAP, the Army Reserve Small Arms Range. The Northern Burning Ground and Western Burning Ground identified in the *CTT Range Inventory Report* are to be managed through the IRP and therefore are not MMRP-eligible. A detailed description of the site based on the HRR findings is provided in the following subsections. The approximate site location as determined in the *CTT Range Inventory Report* is provided in Figure 2-2.

4.1. ARMY RESERVE SMALL ARMS RANGE (RFAAP-001-R-01)

The Army Reserve Small Arms Range is a former small arms firing range. The *CTT Range Inventory Report* states that the site was used for small arms training from approximately 1941 to 1967. The closed range is located along the southeastern boundary of the Main Manufacturing Area of RFAAP and occupies approximately 3 acres. At the time the *CTT Range Inventory Report* was prepared, a berm was still present indicating that the direction of fire was southeast. The berm was adjacent to a stream which forms the Installation boundary. Although public access to all of RFAAP is currently restricted, the former range is not within the secure manufacturing area and public access may have been possible in the past. The former range is currently a grass baseball field surrounded by an unlocked fence.

The Army Reserve Small Arms Range was added to RFAAPs RCRA Corrective Action Permit July 15, 2005.

Web-based research found no specific records of firing or training at RFAAP. Many of the online materials focused on the manufacturing of propellants, which began in 1941 and continues today.

As discussed in Section 3.2.4, several historical aerial photographs were obtained and reviewed for this HRR. The highest resolution aerial photographs that depict this site were complied and are presented in Figure 4-1. In 1949, ground scarring is visible, indicating two possible firing points and a perimeter road. The 1953 and 1962 aerial photographs depict two firing points as more circular scarred areas. A firing berm is clearly visible in the 1971 EPIC aerial photograph. The berm is approximately 270 feet long. It is probable that the berm existed in 1962; however, there is a rather large shadow in that area in the photograph. The more recent aerial photographs (1981 and 1986) clearly depict the area as a baseball field with two baseball diamonds. The 1981 aerial photograph also has a similar shadow over the area where the berm is present. Figure 4-2 presents the site features (i.e, firing points and berm) based on the historical aerial photographs from 1949, 1953, 1962, and 1971. It appears that the firing direction has changed over time. In 1949 the direction is south, and in 1953 and 1962 the direction appears to have shifted slightly to the southeast.

The exact dates of range operation could not be confirmed during the HRR; however, the interview with Mr. Doug Day established that the berm was present in 1968 when he fired into it while serving in the National Guard, Company B 1st Battalion 116th Infantry. In summary, it is possible that the firing berm was constructed between 1953 and 1968 (when firing ceased).

Mr. Day also indicated the firing range was used for .30 caliber training with M1s and M14s. He stated that the targets were approximately 100 meters from the firing points (Figure 4-2). He confirmed that there were approximately 10 to 15 stations present at the site.

URS contacted the National Guard and the Army Reserve to obtain further historical records about the Army Reserve Small Arms Range but no relevant historical information regarding the site was identified.

Several photographs of the site were taken at the time of the site visit. These provide some indication of the site layout, and of the current site conditions (Figure 4-3). The berm is overgrown with a tangle of weeds and mature trees. The berm is approximately 10 feet high. Stroubles Creek flows behind the perimeter fence directly behind the berm. A steep hill is located south of Stroubles Creek. It is possible that this hill was used as a backstop before the berm was constructed. No bullets were observed in the berm at locations of disturbed soil (i.e. groundhog holes or uprooted trees) during the site visit. URS did observe building debris, including pieces of conductive flooring, behind the berm. Other observations included a thin deteriorated concrete symbol in the shape of an "H" in the middle of the grassy field (between the baseball diamonds). Mr. Redder and Mr. McKenna indicated that the Army uses this field for Helicopter landings.

The *CTT Range Inventory Report* states that 155,375 rounds of ammunition were "expended in the pistol range by the RAAP Police department from October 1941 to October 1945." This information was obtained from the *Radford Ordnance Works Historic Investigation* (Geo-Marine, Inc., 1996) in the section on Installation security. It does not, however, specify the location of the pistol range. The *CTT Range Inventory Report* also states "the range may have also been used by the local rifle club (1946-1967)." URS was unable to verify this information.

In summary, the HRR data suggest that the Army Reserve Small Arms Range operated as a firing range beginning sometime in the early 1940s. It served as a small arms training range used by both the National Guard and the Army Reserve for .30 caliber firing. Use of the range ceased in 1968.

No maps that depict the historic range were identified during the HRR. Therefore, the historic range boundary was developed based on the historical aerial photographs. The range differs in shape from the range site identified in the *CTT Range Inventory Report,* which was square and did not encompass the entirety of the range. The present layout (Figure 4-4) was determined

from a contemporary (2005) site aerial photograph, and is considered highly reliable. Because it is possible that the steep hill behind the berm was used for a backstop before the berm was constructed, the range boundary was increased to include a portion of this hill. The estimated maximum height of impact to the hillside behind the stream is 20 feet based on the height of the berm (10 feet). As compared to the 3 acres of the site identified in the *CTT Range Inventory Report*, the findings of the HRR indicate that the actual size of the MRS is approximately 7.6 acres. In addition, the length of the berm is approximately 270 feet based on the review of the 1971 aerial photograph; this is an increase in the length reported in the *CTT Range Inventory Report*.

4.2. POTENTIAL MEC AND MC

Based on the comprehensive review of historical records—including aerial photographs, land use data, interviews, web-based research, etc.—a single MRS exists at RFAAP: the Army Reserve Small Arms Range.

This site was a small arms training range, likely emphasizing pistols or other small side arms used by law-enforcement agents. Consequently, there is no expectation for MEC of any type at this location.

MC at small arms ranges is related to metals found in small arms munitions, primarily lead. Other metals can be associated with small arms, but lead is commonly the most abundant, and serves as a good indicator of whether arms use has affected site media, such as soil, and whether high levels of MC are present at the MRS.

Figure 4-4 presents the location of the site identified in this HRR. Table 4-2 presents the potential MEC and the associated MC that are expected to be found on the subject MMRP site. The information is based on the findings of the research conducted for this HRR.

Table 4–2. Summary of Potential MEC and MC

MRS	Potential Munitions	Primary Release Mechanism	Potential MEC	Potential MC
RFAAP-001-R-01 (Army Reserve Small Arms Range)	.30-caliber Small Arms	M1 M14	None	Metals, primarily lead

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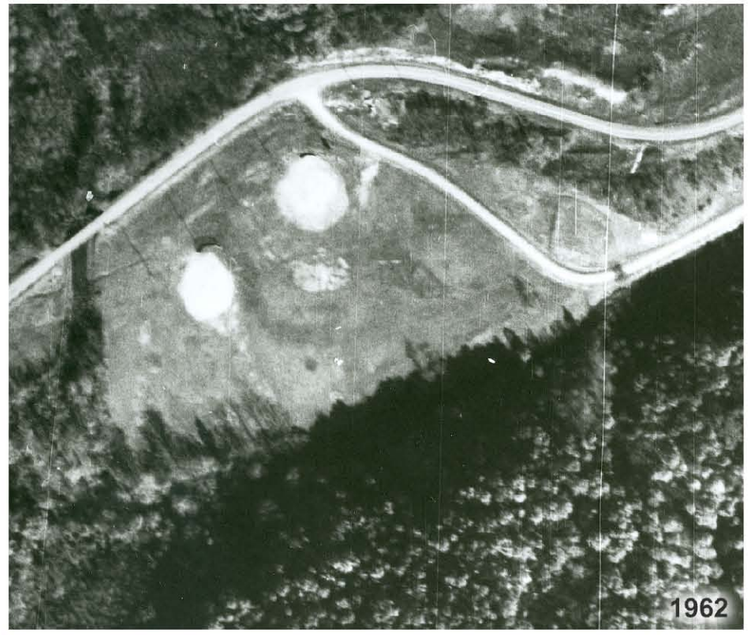
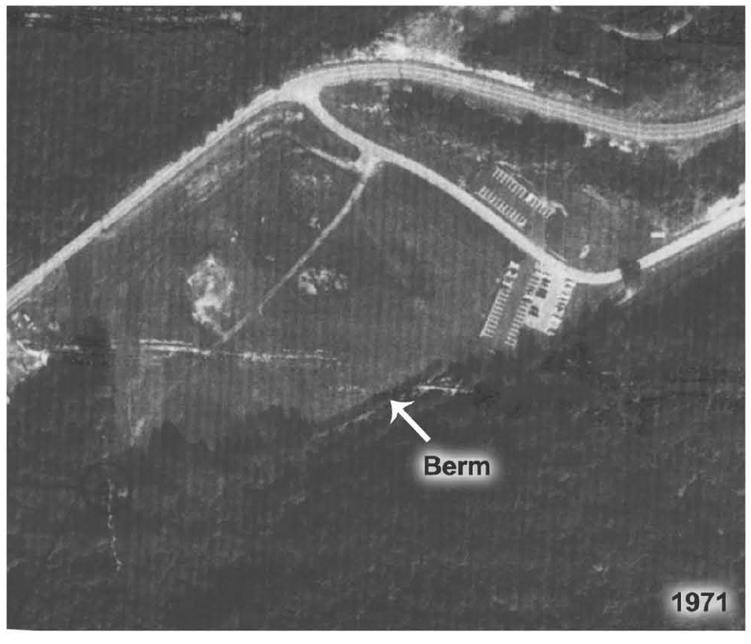
Main Manufacturing Area, RFAAP, VA

URS
200 Orchard Ridge Drive
Gaithersburg, MD 20878





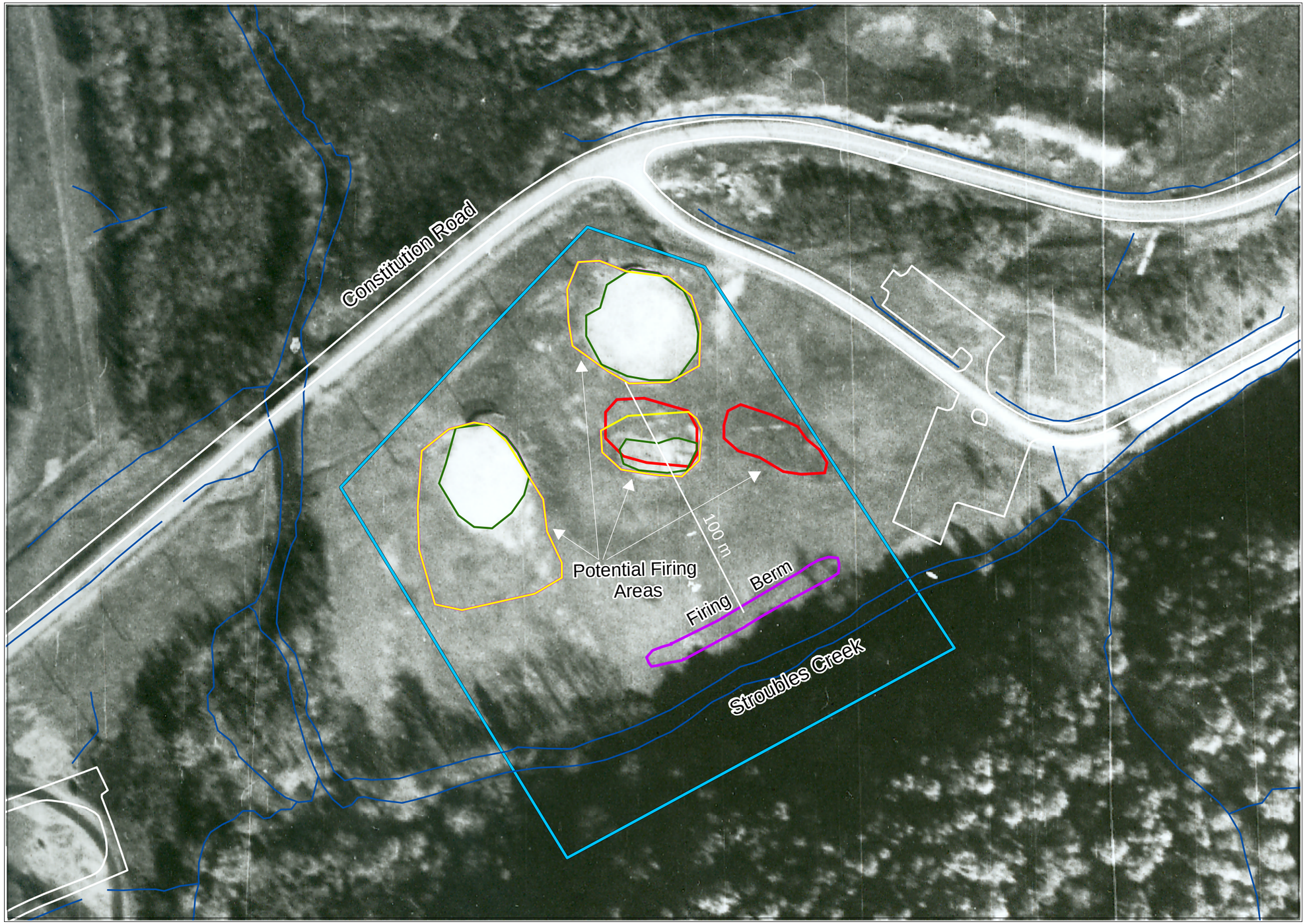
File: G:\Projects\MMRP\Radford\Projects\photo_compilation.mxd
Date: 09/05/07
Created: KJM
Checked: SIS
Senior: SG

Figure 4-1
Historical Aerial Photograph Compilation

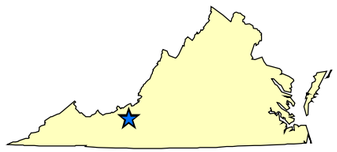
Army Reserve Small Arms Range
RFAAP, VA

Army Reserve Small Arms Range

URS
200 Orchard Ridge Drive
Gaithersburg, MD 20878



Installation Location



Radford AAP

Legend

- HRR Range Boundary
- Historic Feature
- Streams

Potential Firing Areas

- 1962
- 1953
- 1949

Source of Aerial: 1962 EPIC

N
W E
S

1:1,500

0 5 10 20 30 40 Meters

0 30 60 120 180 240 Feet

File: G:\Projects\MMRP\Radford\Projects\radford_Fig_4-2.mxd
Date: 10/20/07
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Checked: SG
Senior: SG

Figure 4-2
Site Features based on
Historical Aerial Photographs
RFAAP, VA

Berm with mature trees, facing southeast.

URS

Radford Army Ammunition Plant
MMRP HRR

FIGURE 4-3
Army Reserve Small Arms Range
Site Visit Photographs of Berm

Army Reserve Small Arms Range

URS
200 Orchard Ridge Drive
Gaithersburg, MD 20878

Installation Location

Radford AAP

Legend

- HRR Range Boundary
- CTT Range Boundary
- Historic Feature
- Streams

Source of Aerial:
USDA NAIP 2005 imagery

1:2,600

0 5 10 20 30 40 Meters

0 30 60 120 180 240 Feet

File: G:\Projects\MMRP\Radford\Projects\radford_Fig_4-3.mxd
Date: 09/012/07
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Figure 4-4
CTT and HRR Boundaries
Army Reserve Small Arms Range
RFAAP, VA

5. CONCEPTUAL SITE MODEL

This section is separated into two parts. The first part provides a discussion of the physical characteristics (climate, geology, etc.) and land use components that describe RFAAP as a whole. The second part presents the site-specific CSMs developed for the MRS, including MEC and MC occurrence and potential for exposure. The CSMs consider exposure and migration pathways via soil, surface water/sediment, and groundwater. Because MC associated with these sites (explosives and metals) are not volatile, the air migration pathway is not considered to be complete and is not included in any of the CSMs.

5.1. GENERAL RFAAP PROFILE

5.1.1. Geography

RFAAP is located in the mountains of southwest Virginia in Pulaski and Montgomery Counties. RFAAP lies in one of a series of narrow valleys typical of the Valley and Ridge Province of the Appalachian Mountains. Oriented in a northeast-southwest direction, the valley is approximately 25 miles long, with a width of 8 miles at the southwest end, narrowing to 2 miles at its northeast end. The plant lies along the New River in the relatively narrow northeast corner of the valley.

5.1.2. Land Use and Demographics

Because of the steep terrain, the area surrounding RFAAP has not been highly developed. Land use is mostly rural; the less rugged areas are primarily used for agriculture. The Jefferson National Forest is located approximately 2 miles north of the Facility. The majority of land in the New River Valley, which includes Montgomery, Pulaski, Giles, and Floyd Counties as well as the city of Radford, is forested. Thirty-eight percent (%) of the area of the New River Valley is classified as non-forest land, including agricultural land, developed land, and water acreage (Dames & Moore, 1992). The Blacksburg-Christiansburg-Virginia Polytechnic Institute Water Authority owns four parcels of land adjacent to RFAAP.

According to FedStats, the estimated population of Montgomery County in 2006 was 84,541 and the estimate population of Pulaski County was 35,055. These local populations have 47.4 percent and 50.3 percent females, respectively. The majority of the local population in both counties is white. The median age of the population in Montgomery County is 26 years and in Pulaski County is 40 years (Virginia Economic Development Partnership).

5.1.3. Physical Profile

The details in the physical profile data for RFAAP are primarily from the *RFAAP Master Work Plan* (URS, 2003). This report did not address MMRP sites or issues, but is a peer-reviewed resource for physical data.

5.1.3.1. Climate

The climate of the area encompassing RFAAP is classified as "moderate continental." Moderately mild winters and warm summers characterize this climate. The prevailing winds are from the southwest, with a northerly component during the cold season. The average yearly wind speed is eight miles per hour (Dames & Moore 1992).

Montgomery County, where the Army Reserve Small Arms Range is located, is characterized by a moderate climate with an average rainfall of 38 inches. The average annual temperature in the nearby town of Pulaski, Virginia is 64.6 degrees F. July has the highest average total precipitation and November the lowest. July is the warmest month with an average maximum temperature of 83.3 degrees F and January the coldest month with an average minimum temperature of 22.9 degrees F (Southeast Regional Climate Center).

Table 5–1. Average Monthly Temperature and Precipitation Data for RFAAP

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max Temperature (F)	43.0	46.5	55.6	65.5	73.4	79.8	83.3	82.4	76.4	66.7	56.4	46.0	64.6
Average Min. Temperature (F)	22.9	24.8	31.5	39.3	47.8	55.9	60.2	59.0	52.1	40.6	32.9	25.6	41.1
Average Total Precipitation (inches)	2.70	2.72	3.33	2.93	3.66	3.68	4.01	3.33	2.85	2.70	2.51	2.75	37.16

http://radar.meas.ncsu.edu/cgi-bin/sercc/cliRECtM.pl?va6955 Period of Record: 8/ 1/1948 to 12/31/2005

Snowfall in the RFAAP area averages 17 inches annually. Montgomery and Pulaski Counties lie in one of the areas of highest occurrence of dense fog in the United States. Dense fog can be expected to occur between 20 and 45 days per year.

5.1.3.2. Geology

RFAAP is located in the New River Valley, which crosses the Valley and Ridge province approximately perpendicular to the regional strike of bedrock, and chiefly cuts Cambrian and Ordovician limestone or dolostone. Deep clay-rich residuum is prevalent in areas underlain by carbonate rocks. The valley is covered by river floodplain and terrace deposits; karst topography is dominant.

Karst features at RFAAP include sinkholes, bedrock voids, pinnacled bedrock, and springs formed by the dissolution of calcium carbonate by naturally occurring carbonic acid in rainwater. The greatest areas of karst features are controlled by bedrock stratigraphy and structure, and by the presence of major drainages.

RFAAP occupies the central portion of the Pulaski fault thrust sheet (Schultz 1988). Four major rock units underlie RFAAP including the Elbrook Formation (Cambrian), the Rome Formation (Cambrian), the Conococheague Formation (Cambrian), and the McCrady/Price Formation (Mississippian). The Elbrook and McCrady/Price Formations outcrop at RFAAP. Unconsolidated sediments of Quaternary age overlie the rock units; this sediment includes alluvial, residual, and colluvial deposits.

5.1.3.3. Topography

RFAAP lies within the Valley and Ridge province of the Appalachian physiographic division. The Valley and Ridge province is characterized by a series of long, narrow, flat-topped mountain ridges separated by valleys of varying widths. RFAAP is located within a valley.

The topography within the Installation varies from a relatively flat floodplain to elevated uplands in the extreme southeast section. The New River forms the RFAAP boundary on the north, with the elevation approximately 1,675 feet above mean sea level (amsl). The eastern boundary represents a transition from floodplain elevation of 1,680 feet amsl to an upland elevation of 1,900 feet amsl. The southern boundary traverses terrain consisting of creek bottoms and sharply rising summits. The western boundary follows the bluff line overlooking the New River to a point where the Norfolk and Western Railroad crosses the lower arm of the horseshoe area. This Facility displays an overall relief of 342 feet. In the horseshoe area to the north and east, the New River has a narrow floodplain. The horseshoe area exhibits rolling karst terrain, with three prominent terraces and escarpments, which are remnants of ancient New River floodplains.

RFAAP contains prominent karstic features including sinkholes, caves, and caverns. Karst landforms occur in carbonate rock formations as the result of the dissolution of rock by naturally occurring carbonic acid in rainwater migrating along bedding planes and fractures. As the rock is dissolved, solution features such as cavities and channels form beneath the surface. Occasionally, large cavities collapse producing a depression or sinkhole on the surface. Numerous sinkholes are apparent along the western and southern boundaries of the Installation.

5.1.3.4. Soil

As part of the Montgomery County and Pulaski County soil surveys, the SCS has prepared detailed maps and descriptions of the soil types underlying the Main Manufacturing Area. There are 27 SCS soil types that underlie the Main Manufacturing Area. The physical and chemical

characteristics of the primary soil types (soil comprising 5 % of the soil at the Main Manufacturing Area or greater) are summarized below (SCS 1985a, 1985b).

Braddock Loam (2 to 30% slopes). Braddock soil comprises approximately 17% of the soils at the Main Manufacturing Area and consists of soils situated on gentle to steep slopes on high terraces.

Reaction of Braddock soils ranges from very strongly acid to strongly acid. The organic matter content of this soil is moderately low and permeability is moderate. Available water capacity of the Braddock soil is moderate and surface runoff is medium. The Braddock soil does not have a seasonally high water table within 60 inches of the surface.

A typical profile of the Braddock soil consists of a 7-inch thick surface layer of dark yellowish brown loam underlain by a minimum 60-inch thick subsoil of yellowish-red clay and red clay. Depth to bedrock is greater than 60 inches.

Caneyville-Opequon-Rock Outcrop Complex (25 to 60% slopes). This complex comprises approximately 21% of the soils at the Main Manufacturing Area in primarily undeveloped areas of the Facility. The Caneyville-Opequon-Rock Outcrop complex consists of approximately 30% Caneyville soils, 25% Opequon soils, 20% rock outcrop, and 25% other soils.

Reaction of the Caneyville soil ranges from strongly acid to neutral. Reaction of the Opequon soil ranges from medium acidic to mildly alkaline. The organic matter content is moderate for both soils with rapid surface runoff. Permeability is moderately slow in the Caneyville soil and moderately slow or moderate in the Opequon soil. Available water capacity is low in the Caneyville soil and very low in the Opequon soil.

A typical profile of the Caneyville soil consists of an 8-inch thick surface layer of brown silt loam underlain by a 24-inch thick subsoil of yellowish-red very plastic clay. Limestone bedrock is typically at a depth of 30 inches.

Generally, the typical Opequon soil profile consists of a 4-inch thick surface layer of brown silt, clay loam underlain by an 11-inch thick subsoil of yellowish-brown sticky and plastic clay. The substratum is olive brown, very shaly clay approximately 15 inches thick. This clay is sticky and plastic. Limestone bedrock is typically at a depth of 15 inches.

Unison-Urban Land Complex (2 to 25% slopes). This complex comprises approximately 32% of the soils at the Main Manufacturing Area and occurs on side slopes and ridgetops. The map unit consists of approximately 50% Unison soils, 25% Urban land, and 25% other soils.

Reaction of Unison soils ranges from strongly acid to medium acid. The organic matter content of this soil is low to moderate and permeability is moderate. Available water capacity of the Unison soil is moderate and surface runoff is medium. In disturbed areas, the above soil

characteristics are extremely variable. A typical profile of the Unison soil in undisturbed areas consists of a 15-inch thick surface layer of dark brown and brown loam underlain by a 43-inch thick subsoil of yellowish-red sticky and plastic clay. The substratum is red sandy clay loam below a depth of approximately 58 inches. Depth to bedrock is greater than 60 inches. Urban land consists of soil covered by streets, parking lots, buildings, and other structures.

Wheeling Sandy Loam. This soil map unit comprises approximately 9% of the soils of the Main Manufacturing Area and consists of soils situated on nearly level terraces.

Reaction of the Wheeling soils ranges from strongly acid to medium acid. The organic matter content of this soil is moderately low and permeability is moderate. Available water capacity of the Wheeling soil is moderate and surface runoff is slow. The Wheeling soil does not have a seasonally high water table within 60 inches of the surface. A typical profile of the Wheeling soil consists of a 10-inch thick surface layer of dark brown sandy loam underlain by a 42-inch thick subsoil of dark brown sandy clay loam and sandy loam. The substratum is dark brown, gravelly sandy loam to minimum depth of 60 inches.

5.1.3.5. Hydrogeology

Hydrogeologic conditions at RFAAP are not well characterized. Groundwater is found in two types of aquifers: alluvium water table aquifer and bedrock aquifer. The alluvium aquifer occurs primarily within the flood plain areas adjacent to the New River. In these areas, groundwater flow may occur within alluvium present above bedrock at a depth of 15 to 25 feet below ground surface (bgs). A water table within alluvium has been identified both in the Main Manufacturing Area and horseshoe area.

Hydrogeological conditions of the bedrock aquifer at RFAAP are complex because of (1) the intense structural deformation of the bedrock units and (2) the karst nature of the aquifer contained within limestone and dolostones underlying the Installation. Geologic mapping and photolineament studies at RFAAP have shown that there is a significant potential for movement of water through solution features such sinkholes and for preferential movement of water with karst conduits and along fractures or faults.

5.1.3.6. Hydrology

The New River is the most significant surface water feature within RFAAP. The Installation is built within and adjacent to a prominent meander loop of this river. Within RFAAP, the river width varies from 200 to 1,000 feet, but averages approximately 400 feet. The river flow varies due to water management at Claytor Dam, approximately 9 miles upgradient (south) from RFAAP. Downstream from the Claytor Dam, typical flows of the New River range between 3,200 and 8,000 million gallons per day. During typical flow conditions, the depth is

approximately 4 to 6 feet; however, pools may be 10 feet deep. There are 13 miles of river shoreline within the RFAAP boundaries.

The headwaters of the New River are in northwestern North Carolina, near the Tennessee state border. In the RFAAP area, the New River flows northwesterly cutting cliffs through the bedrock. The path of the New River, which is generally perpendicular to the ridgelines of the Valley and Ridge province, indicates that the river existed prior to the Paleozoic folding of these rocks. In some areas, this river has eroded 4,000 feet of rock. During the Paleozoic, the erosion rate of the river was higher than the uplift rate of the rocks. This produced the entrenched river channel present today.

Stroubles Creek is the largest local tributary of the New River and flows through the southeast sector of RFAAP. Several branches that originate on and off the Facility feed this creek. Flow within Stroubles Creek and its tributaries consist primarily of storm water runoff. Groundwater discharging from the karst bedrock may also supply significant stream flow. Manmade, surface drainage ways at RFAAP also influence local drainage. The direction of surface drainage flow within RFAAP is ultimately toward the New River. Prior to entering the Installation, branches of Stroubles Creek flow through rural areas and the town of Blacksburg.

5.1.3.7. Vegetation

The Virginia Department of Game and Inland Fisheries (1999) conducted an Installation-wide biological survey at RFAAP. Eight community types were identified at RFAAP: bottomland forest, calcareous forest, cliffs, grasslands, oak forest, pine plantation, successional forest, and water. Tree species at RFAAP include the short leaf pine, loblolly pine, eastern white pine, yellow poplar, and black walnut. Grassland communities at RFAAP comprise 4,379 acres, or about 63 % of the 6,901-acre total. Plant species include but are not limited to fescues, sedges, flaxes, and milkweed.

The RFAAP Main Manufacturing Area contains 13 acres of wetland habitat and 225 acres of deepwater habitat. The New River contains 3.5 acres of wetland habitat. This combined acreage amounts to 2 % of the total land area. A *Wetlands Inventory Report for Radford Army Ammunition Plant, Montgomery and Pulaski Counties, Virginia*, identifies dominant species in the wetland plant communities as Red Maple, Cattail, and Phragmites. Common Associates include Sycamore, Black Gum, Bluejoint, and Sedge. Other plants observed include Beak Rush, Bluegrass, Blue-joint, Canada Rush, Broom Sedge, Common Reed, Soft Rush, and Duckweed (U.S. Fish and Wildlife Service, 2002).

5.1.3.8. Beneficial Resources

RFAAP provides habitat for white-tailed deer, groundhogs, squirrels, raccoons, red fox, opossum, red-tailed hawk, opossum, shrew, voles, mice, and bats. A variety of reptiles and amphibians are common on the Installation.

The RFAAP property contains 2,240 buildings and structures, most of which are industrial structures built during the World War II era. In pursuance of the 1993 Programmatic Agreement arising from the Army's program to Cease Maintenance, Excess and Dispose (CEMED), a stipulated program of documentation of the RFAAP's World War II history and architectural-engineering complex was completed during 1995-1996. For the lifespan of the PA, 1993-1998, this documentation fulfilled the CEMED requirements with regard to the treatment of the RFAAP's World War II-period resources. The documentation also fulfilled the mitigation for ceasing maintenance of the structures identified for disposal at RFAAP (ICRMP, 2006).

A site-wide archeological survey has not been conducted at the facility. Systematic archaeological surveys have been undertaken of a few selected tracts within RFAAP, and a number of known sites have been recorded. Based on available information and the large size of the RFAAP property, it is expected that many additional archaeological resources are present within the property, representing both the prehistoric and historic period (ICRMP, 2006).

5.1.3.9. Ecological Profile

Endangered plants and animals were not observed at RFAAP during the biological survey. Five state-listed rare plants were observed at RFAAP during the survey: *Clematis* coattails, *Cystoptris tennesseensis* (Tennessee bladder fern), *Hasteola suaveolens* (false Indian plaintain), *Sagittaria rigida (*sessile-fruited arrowhead), and *Eleocharis intermedia* (matted spikerush). State-threatened animals located at RFAAP include the invertebrate *Speyeria idalia (*regal fritillary butterfly) and the birds *Ammodramus henslowii* (Henslow's sparrow) and *Lanius ludovicianus (*loggerhead shrike).

Migratory waterfowl are found throughout the spring and winter near the New River because the Installation is on the Atlantic Flyway. Federally protected black vultures are present at RFAAP during certain times of the year. Public fishing occurs in the New River where it flows through RFAAP.

5.1.3.10. Security

Access to RFAAP is restricted through the use of manned checkpoints that limit access with gate access and/or roadblocks on all roads leading into the Installation. The Installation is surrounded by a perimeter fence. Access to the Installation is restricted to Army personnel, authorized

civilian personnel, contractors, and visitors. Security personnel routinely patrol the Installation by vehicle.

5.2. ARMY RESERVE SMALL ARMS RANGE

5.2.1. Area and Layout

The Army Reserve Small Arms Range is located south of Constitution Road. The firing direction for this range was to the southeast. A firing berm is still present at the site.

5.2.2. 5.2.2 Structures

A 1985 *Historic American Engineering Record* identified 1,230 buildings at RFAAP with 1,050 at the Radford site and 180 at the New River site (Mack and Hess, 1985). The structures present at this range include a berm that served as a backstop during firing and is located along the southeast side of the site. Two deteriorating baseball backstops are present.

5.2.3. 5.2.3 Utilities

Telephone lines running parallel to Constitution Road are present at the site.

5.2.4. 5.2.4 Boundaries

The land uses outside the boundaries of the Army Reserve Small Arms Range are described as follows:

- Western boundary: RFAAP property
- Eastern boundary: RFAAP property
- Northern boundary: Constitution Road, RFAAP property
- Southern boundary: Stroubles Creek, RFAAP installation boundary heavily forested

5.2.5. 5.2.5 Security

The site is surrounded by an unlocked fenced, and is accessible to all authorized personnel and visitors that are allowed on the installation.

5.2.6. Physical Profile

The physical profile of the Army Reserve Small Arms Range is similar to that presented in Section 5.1.3 with the following site-specific details.

The topography of the site is relatively flat with Stroubles creek bordering the site on the west and south. The southern side of the MRS is a steep hillside directly south of Stroubles Creek. The crest of the hillside is estimated to be approximately 1,990 feet above mean sea level. However, only a portion of the hillside is included in the MRS, as the estimated maximum height of impact to the hillside behind the stream is 20 feet based on the 10-foot high berm. Groundwater is present at depths of approximately 15 to 25 feet bgs.

5.3. LAND USE AND EXPOSURE PROFILE

5.3.1. Current Land Use/Activities

The Army Reserve Small Arms Range is a grassy field and is periodically used for helicopter landings.

5.3.2. Current Human Receptors

Current human receptors include RFAAP military personnel, civilian contractors, and trespassers at RFAAP.

5.3.3. Potential Future Land Use

Potential future land use is expected to be consistent with current land use as an active military Installation.

5.3.4. Potential Future Human Receptors

Potential future human receptors are the same as current human receptors.

5.3.5. Zoning/Land Use Restrictions

RFAAP and is reserved for military uses. A grassed baseball field now occupies the site of the former training range.

5.4. MUNITIONS/RELEASE PROFILE

5.4.1. Munitions Types and Release Mechanisms

Munitions used at the Army Reserve Small Arms Range include small arms.

The typical release mechanisms for the Army Reserve Small Arms Range were intentional activities, such as firing into a target area, and unintentional activities, such as rounds fired falling outside the target area or rounds discarded for various reasons.

5.4.2. Maximum Probable Penetration Depth

The expected munitions at the Army Reserve Small Arms Range do not have an associated penetration depth. These and other MC components are expected to have been deposited on the soils surface.

5.4.3. MEC Density

MEC presence is not expected at the Army Reserve Small Arms Range due to its singular use as a small arms training site.

5.4.4. Munitions Debris/Fragments

No munitions debris or fragment-producing munitions were identified for the Army Reserve Small Arms Range.

5.4.5. Associated Munitions Constituents

As noted in Table 4–1, the MC associated with the Army Reserve Small Arms Range includes the following: black powder (potassium nitrate, sulfur, and charcoal), and metals (primarily lead).

5.4.6. Transport Mechanisms/Migration Routes

The primary transport mechanisms identified for the Army Reserve Small Arms Range include the following:

Erosion: The Army Reserve Small Arms Range is vegetated and erosional forces (e.g., heavy rains) may transport soil to a small degree. Wind is considered an insignificant cause of soil erosion.

Soil Disturbance: Surface and subsurface soil disturbance can cause the transport and migration of MC from one environmental medium to another (soil to surface or groundwater or both) through surface water runoff and erosion. Since there has been no development of the Army Reserve Small Arms Range, the potential for soil disturbance is very low.

Infiltration: Based on the soil types present in the Army Reserve Small Arms Range, the potential for MC to migrate from surface soil to subsurface soil and to groundwater via infiltration exists.

5.5. PATHWAY ANALYSIS

5.5.1. MEC

A MEC pathway analysis was not prepared for the Army Reserve Small Arms Range because MEC is not expected to be present.

5.5.2. MC

An MC pathway analysis was prepared for the Army Reserve Small Arms Range (Figure 5–1). Biota is the only receptor expected to ingest vegetation at this site. Crops are not grown, and domestic animals are not raised at the site. Biota has potentially complete pathways for contact with MC impacted vegetation. All other pathways for vegetation in the food chain are expected to be incomplete.

The pathways between game/fish/prey and Installation personnel, contractors, and visitors are incomplete because hunting is not allowed in this area, and the only water body at the site does not support fishing. Biota has potentially complete pathways through the potential ingestion of prey that may have fed on contaminated vegetation at the site.

Potentially complete pathways for ingestion and dermal contact exist between surface water/sediment and all receptors at this site because there is a potential for erosion to enable the migration of MC to Stroubles Creek located along the western and eastern boundary of the site.

The groundwater ingestion exposure route is incomplete because there are no groundwater supply wells at the site. Potentially complete pathways for all exposure routes for both surface and subsurface soil exist for all receptors. Given the current use of the site, the potential for soil disturbance to occur exists which may expose subsurface soils. Also, the subsurface pathway would be potentially complete for biota because they may nest or burrow at this site.

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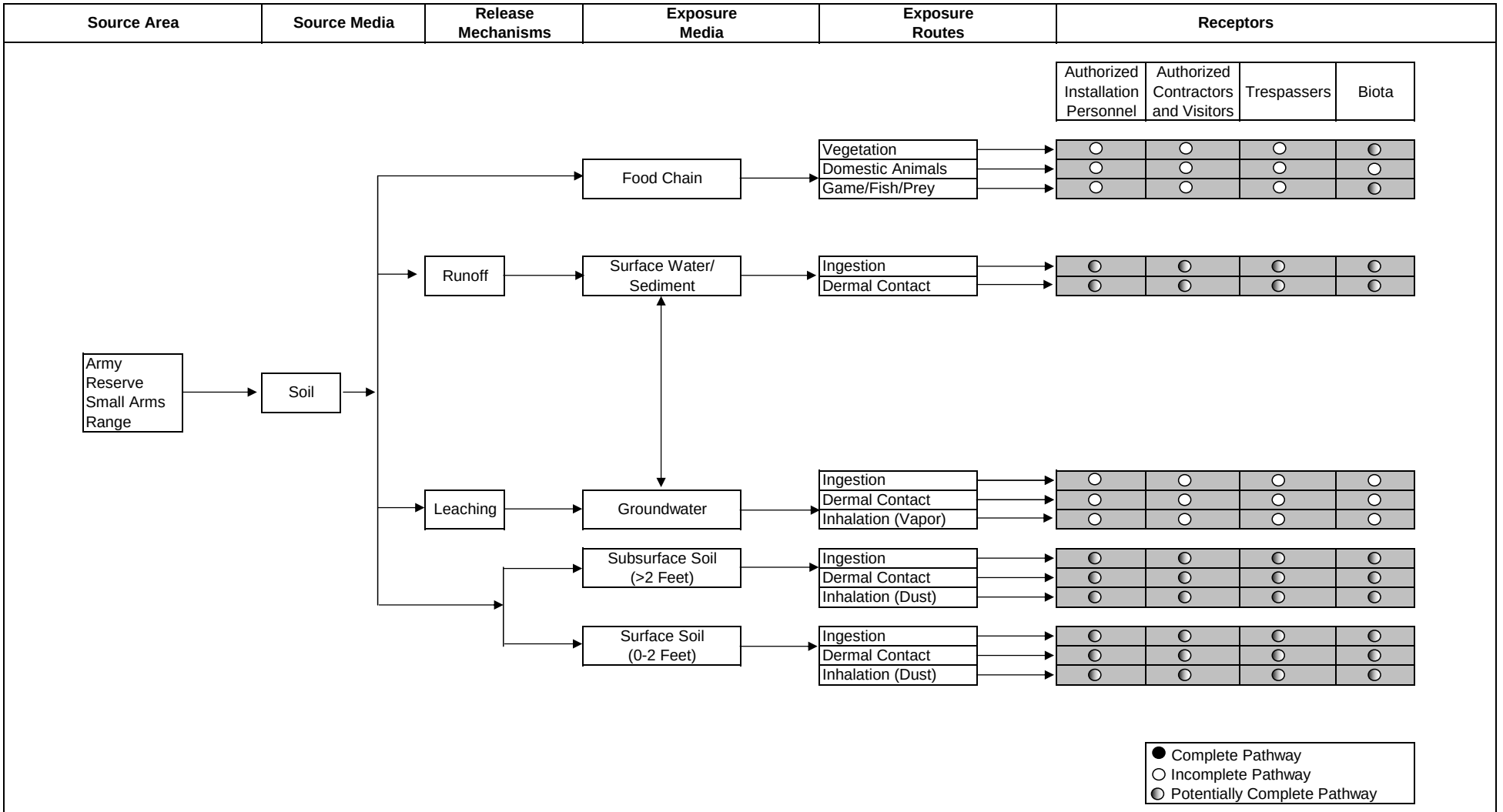

URS	Prepared for: USACE	Historical Records Review MC Exposure Pathway Analysis Army Reserve Small Arms Range	URS Corporation Figure 5-1 9/10/2007

6. CONCLUSIONS

The *CTT Range Inventory Report* identified three sites at RFAAP: the Army Reserve Small Arms Range, Northern Burning Grounds, and the Western Burning Grounds. However, only the Army Reserve Small Arms Range was determined to be MMRP eligible as the burning grounds sites are evaluated under RFAAP's IRP. The use of the Army Reserve Small Arms Range for training is substantiated by historical evidence and the site qualifies for the MMRP. No additional MRSs were identified based on the HRR research.

The HRR findings and recommendations for the MMRP site are provided in this section. Table 6-1 provides a listing of MRS by name, AEDB-R number, acreage (CTT and HRR), and any special comments.

The Army Reserve Small Arms Range (AEDB-R RFAAP-001-R-01) was identified as a potential MMRP site in the *CTT Range Inventory Report*. Based on a review of aerial photographs collected as part of the HRR, this site was found to have a slightly different configuration than that presented in the *CTT Range Inventory Report*. The actual acreage of the site is approximately 7.6 acres as compared to the 3 acres reported in the *CTT Range Inventory Report*. This site was estimated to be used from 1941 to 1968 as a range, and subsequently for recreation as baseball fields. The berm visible in aerial photographs during the operational period of the range is still present at the site.

MEC is not expected at this site; expended small arms are not MEC. There is no evidence or data regarding MC at the site. However, based on findings for similar small arms ranges operated by the Army, there is a potential for MC to be present. The most likely indicator for MC is in the form of lead in soil, or elemental lead from bullets at the berm behind the target locations.

Table 6-1. Summary of HRR Findings

Site Name	MMRP AEDB-R Number	CTT vs. HRR Acreage	Comments
Army Reserve Small Arms Range	RFAAP-001-R-01	3/7.6	Range size increased slightly due to re-drawing range size based on aerial photographs.

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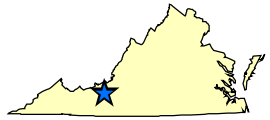
Army Reserve Small Arms Range

URS
200 Orchard Ridge Drive
Gaithersburg, MD 20878

Installation Location



Radford AAP

Legend

- HRR Range Boundary
- Historic Feature
- Streams

Source of Aerial:
USDA NAIP 2005 imagery

N
W E
S

1:2,000

0 5 10 20 30 40 Meters

0 25 50 100 150 200 Feet

File: G:\Projects\MMRP\Radford\Projects\radford_Fig_6-1.mxd
Date: 09/012/07
Created: VAL
Checked: SG
Senior: SG

Figure 6-1
MRS Boundary
Army Reserve Small Arms Range
RFAAP, VA

7. REFERENCES

Dames & Moore, 1992. *Draft RFI Report for the Radford Army Ammunition Plant, Virginia*. Prepared for the U.S. Army Toxic and Hazardous Materials Agency.

Diloia, Leonard, 2005. *Integrated Natural Resources Management Plan for Radford Army Ammunition Plant, Radford, Virginia.* June 1, 2005.

Draper Aden Associates, 2001. *Alternate Source Demonstration for Trichloroethene: Hazardous Waste Management Unit 5, Radford Army Ammunition Plant, Radford, Virginia*. February 2001.

Environmental Data Resources, Inc., 2007. *EDR Historical Topographic Map Report.* Radford Army Ammunition Plant, Bagging Plant Road/Old US-11, Radford, Virginia 24084. Inquiry Number: 1969899.13. July 3, 2007.

Engineering-Science, 1985. *Engineering Report for the RFAAP Closure of Acid Waste Lagoons and Hazardous Waste Landfill*. Prepared for Department of the Army Corps of Engineers. June 1985.

FedStats, 2007. *MapStats, Montgomery County, Virginia,* http://www.fedstats.gov/qf/states/51/51121.html, Last Updated May 4, 2007.

FedStats, 2007. *MapStats, Pulaski County, Virginia,* http://www.fedstats.gov/qf/states/51/51155.html, Last Updated May 4, 2007.

Freeze, R.A. and J.A. Cherry, 1979. Groundwater. Prentice-Hall, Engleside Cliffs, NJ., p. 604.

Geo-Marine, Inc., 1995. *Radford Army Ammunition Plant Supplemental Photographic Documentation of Arhetypal Buildings, Structures, and Equipment for U.S. Army Materiel Command National Historic Context for World War II Ordnance Facilities.* April 1995.

Geo-Marine, Inc., 1996. *The World War II Ordnance Department's Government-Owned Contractor-Operated (GOCO) Industrial Facilities: Radford Ordnance Works Historic Investigation.* February 1996.

GlobalSecurity.org, 2005. *Military, Radford Army Ammunition Plant,* http://www.globalsecurity.org/military/facility/aap-radford.htm, Last Updated August 21, 2005.

Heath, R.C., 1984. Groundwater Regions of the United States. U.S. Geological Survey Water Supply Paper 2242, p. 78.

IT Corporation, 2001. *Facility-Wide Background Study Report*, Radford Army Ammunition Plant, Radford, Virginia. December 2001.

IT Environmental Programs, Inc., 1991. *Removal of DNT from Wastewaters at Radford Army Ammunition Plant*. U.S. Army Corps of Engineers Toxic and Hazardous Materials Agency, Report No. CETHA-TS-CR-91031. March 1991.

ITRC, 2003. *Technical/Regulatory Guidelines, Munitions Response Historical Records Review,* Interstate Technology & Regulatory Council UXO Team, November 2003.

Jones, R.H. and W.D. Langmack, 1976. *Biological Pilot Plant Study at Radford Army Ammunition Plant.* October 1976.

Mack, Robert C. and Jeffrey A. Hess, 1985. *Historic American Engineering Record: Radford Army Ammunition Plant, VA-37.* 1985.

Malcolm Pirnie, 2002. *Closed Transferring and Transferred Range/Site Inventory Report, Fort A.P. Hill, Virginia, U.S. Army Materiel Command*. November 2002.

Montgomery County, Virginia. *About Montgomery County,* http://www.montva.com/departments/econdev/about.php.

Office of the Under Secretary of Defense, 2001. *Management Guidance for the Defense Environmental Restoration Program (DERP).* September 2001.

Radford Army Ammunition Plant, Virginia, Army Defense Environmental Restoration Program Installation Action Plant. May/FY06. August 22, 2006.

Schultz, A.P., 1988. *Horses in Fensters of the Pulaski Thrust Sheet, Southwestern Virginia: Structure, Kinematics and Implications for Hydrocarbon Potential of the Eastern Overthrust Belt*. U.S. Geological Survey Bulletin.

Secretary of Defense Environmental Awards U.S. Army Nomination, *Pollution Prevention, Team: Radford Army Ammunition Plant Pollution Prevention Team, Virginia*. Fiscal Year 2006.

Site Screening Process (SSP), Radford Army Ammunition Plant, Radford, Virginia. Author Unknown. October 26, 2001.

Soil Conservation Service and Forest Service. 1985a. *Soil Survey of Montgomery County, Virginia.*

Soil Conservation Service and Forest Service. 1985b. *Soil Survey of Pulaski County, Virginia.*

Southeast Regional Climate Center, *Pulaski, Virginia (446955), Period of Record Monthly Climate Summary*, Period of Record: 8/1/1948 to 12/31/2005, http://radar.meas.ncsu.edu/cgi-bin/sercc/cliRECtM.pl?va6955.

URS Corporation (URS), 2003. *Master Work Plan*. Radford Army Ammunition Plant, Radford, Virginia. August 2003.

U.S. Army Corps of Engineers, 1993. *Defense Environmental Restoration Program for Formerly Used Defense Sites, Ordnance and Explosive Waste Chemical Warfare Materials Archive Search Report: New River Ordnance Plant, Radford, Virginia.* September 1993.

U.S. Army Corps of Engineers, 2001. *Guides to Environmental Research, Environmental Cleanup at Former and Current military Sites: A Guide to Research.* USACE Engineering Pamphlet (EP) 870-1-64, November 2001.

U.S. Environmental Protection Agency, 1987. *RCRA Facility Assessment of Radford Army Ammunition Plant.* 1987.

U.S. Environmental Protection Agency, 2000. *CY 2000 Toxic Release Inventory Report*. FY 2001 Annual Report to Congress.

U.S. Environmental Protection Agency, 2000. *Innovative Remediation Technologies: Field-Scale Demonstration Projects in North American, 2nd Edition.* Year 2000 Report. EPA 542-B-00-004. June 2000.

U.S. Environmental Protection Agency, 2000. *Permit for Corrective Action and Waste Minimization: Radford Army Ammunition Plant, Radford, Virginia.* October 31, 2000.

U.S. Fish and Wildlife Service, 2002. *Wetlands Inventory Report for Radford Army Ammunition Plant, Montgomery and Pulaski Counties, Virginia*. January 2002.

Virginia Department of Game and Inland Fisheries, 1999. *Biological Survey of the Radford Army Ammunition Plant; including Threatened, Endangered, and Species of Concern.* Prepared for Radford Ammunition Plant, May.

Virginia Economic Development Partnership, *Montgomery and Pulaski Counties, Virginia, Community Profiles.*

Appendix A

Archives Searched/Data Resources
(Provided on Enclosed Compact Disk)

Radford Army Ammunition Plant, VA
Archival Research Report
Heritage Research Center, Ltd.
August 6, 2007

Heritage Research Center, Ltd. conducted archival research related to this installation. The following lists the repositories visited and sources reviewed in that effort. The list reflects the entries/collections and boxes we actually reviewed. It should be noted that Heritage reviewed finding aids and catalogs extensively for each repository, entry and collection to identify potentially relevant materials for review.

National Archives and Records Administration – College Park, MD

Textual Branch

RG 51, Records of the Office of Management and Budget

- Entry 127, Records of the Office of Management and Organization, Property and Supply Management Branch, 1953-1960
  - Box 1 - Nothing relevant; records concerned other installations.
- Entry 149B, War Projects Unit / Inspection Reports, 1940-1945
  - Boxes 205-206 – Contained records concerning to Radford Arsenal, but nothing relevant to range areas.

RG 77, Office of the Chief of Engineers

- Entry 391, Construction Completion Reports, 1917-1943
  - Boxes 47-49, 55-58, 67, 125, 268, 269, 308, 309 - Nothing relevant; records concerned other installations.
- Entry 391B, Construction Completion Reports, 1917-1943
  - Boxes 13-16, 19, 90 - Nothing relevant; records concerned other installations.
  - Box 79 – Contained reports related to Radford, but nothing relevant to range areas or ordnance.
- Entry 393, Historical Record of Buildings, 1905-1942
  - Boxes 23-25, 37, 38, 78, 82, 219, 256 – Nothing relevant; records concerned other installations.
- Entry 1013, General Correspondence with Districts, 1941-1945
  - Boxes 92-101, 136-145, 206-213, 233-243, 273-280, 312-322, 340-344 - Nothing relevant; records concerned other installations.
- Entry 1014, Correspondence with Divisions, 1941-1945
  - Boxes 15-18-20-27, 108-118, 122-127 - Nothing relevant; records concerned other installations.

RG 107, Secretary of War

- Entry 101, Cross-Reference Sheets to General Correspondence, 1943-1946
  - Boxes 1-15 - Contains nothing of relevance.
- Entry 102, Administration Assistant to the Secretary of War, 1943-46

    - Boxes 37 (decimal 333) - Contains nothing of relevance.
- Entry 108, Army and Navy Munitions Board, 1946-1947
    - Boxes 1-10 - Contains nothing of relevance.
- Entry 159, Under Secretary, Special Assistant for Construction, General Correspondence, 1940-45
    - Boxes 893-905 - Contains nothing of relevance.
- Entry 168, Purchase and Contract Branch Construction Section, Subject Files, 1940-1942
    - Boxes 1206-1210 - Contains nothing of relevance.
- Entry 216, Office of Assistant Secretary of War for Air
    - Boxes 178-187 - Contains nothing of relevance.

RG 156, Office of the Chief of Ordnance

- Entry 646, Histories of Ordnance Field Installations and Activities, 1940-45
    - Boxes 145-148 – COPIED material concerning Radford Ordnance Works.
- Entry 654I, Histories of Ordnance Field Installations and Activities, 1940-45
    - Boxes 69-92 - Contains nothing of relevance.
- Entry 700, Inspections and Investigative Reports, 1942-44
    - Boxes 23-38 - Contains nothing of relevance.
- Entry 775, Industrial Service, Executives Division, Installations Branch, Records Relating to Ordnance-Owned and Contractor Operated Facilities, 1941-45
    - Boxes 28-46 - Contains nothing of relevance.
- Entry 776, Industrial Service; Executives Division; Installations Branch; Records Relating to Ordnance-Owned and Contractor Operated Facilities, 1941-45
    - Boxes 47-48 - Contains nothing of relevance.
- Entry 815, Industrial Service; Ammunition Division, Production Engineering Branch, Research and Development Project and Progress Reports Prepared by the Radford Ordnance Works, 1942-45
    - Boxes 342-359 - COPIED post plans for Radford.
- Entry 1023A, Histories of Ordnance Field Installations and Activities, 1946-54
    - Boxes 17-23, 48-51, 73-74, 77-78, 87, 92-93, 101-102, 108-111 - Contains nothing of relevance.
- Entry 1023B, Executive Office, Historical Branch, Histories of Ordnance Field Installations and Activities, 1946-54
    - Boxes 1-47, 52-72, 75, 113-157 - COPIED material concerning Radford.
- Entry 1124A, Inspection General Office, General Investigative Files, 1950-55
    - Boxes 9, 11-12, 20-23, 26-40 - Contains nothing of relevance.
- Entry 1124B, Inspection General Office, General Investigative Files, 1950-55
    - Boxes 1-4 - Contains nothing of relevance.
- Entry 1125, Office of the Ordnance Inspector General, IG Inspector Files, 1950-1956
    - Boxes 1-24 - Contains nothing of relevance.
- Entry 1126, Investigation and Inquiry Files, 1955-62
    - Boxes 45-49 - Contains nothing of relevance.
- Entry 1138B, Reports of Ordnance Observers, 1946-54

    - Boxes 1-2 - Contains nothing of relevance.
- Entry 1284, Industrial Division, Weapons and Fire Control Branch, Facilities and Resources Section, Records Relating to the Expansion or Rehabilitation of Ordnance Facilities, 1953-54
    - Box 266 - Contains nothing of relevance.
- Entry 1337, Installation Status Directive Files, 1954-61
    - Box - Contains nothing of relevance.

RG 159, Office of the Inspector General

- Entry 26B, General Correspondence, 1917-1934
    - Boxes 6-8, 13-28, 33, 39 – Nothing relevant; records concerned administrative matters.
- Entry 26C, General Correspondence, 1935-1939
    - Boxes 40, 41, 49, 52, 55-58, 71, 77-78, 226, 250, 251, 257 - Nothing relevant; records concerned administrative matters.
- Entry 26D, General Correspondence, 1939-1947
    - Boxes 395, 403, 410, 412, 426, 510, 519, 520, 524, 528-535, 707-717, 721, 722, 760, 768, 915, 955-959 - Nothing relevant; records concerned other installations.
    - Boxes 1080, 1085 - Nothing relevant; records concerned administrative matters.
- Entry 26E, General Correspondence, 1939-1947
    - Boxes 131-137, 145, 177, 181, 185-187 - Nothing relevant; records concerned other installations.
    - Box 190 – Contained records related to Radford, but nothing relevant to range areas or ordnance.
    - Boxes 191, 194, 315 - Nothing relevant; records concerned other installations.
    - Box 327 – Contained records related to Radford, but nothing relevant to range areas or ordnance.
    - Boxes 614, 684 - Nothing relevant; records concerned other installations.

RG 165, War Department General and Special Staffs

- Entry 484, Legislative and Liaison Division, Legislative Branch, Correspondence, Reports, and Other Papers Relating to Proposed Legislation Affecting War Department, January 1943-August 1946, Correspondence and Other Papers Relating to Pending Passing Legislation Affecting the War Department, January 1943-August 1946
    - Boxes 202, 243, 311-313 – Nothing relevant; records concerned administrative matters.
- Entry 484C, Card File of Approved WPA National Defense Projects, 1941-1942
    - Boxes 1-5 - Nothing relevant; records concerned other installations.
- Entry 484D, War Department Special Staff Legislation and Liaison Division Federal Agencies Branch, Federal Works Agency Project Files, 1940-1946
    - Boxes 7-9, 39-41, 62-67, 69 – Nothing relevant; records concerned other installations.

- Box 70 – Contained records related to Radford, but nothing relevant to range areas.
- Boxes 71-72 - Nothing relevant; records concerned other installations.

RG 175, Chemical Warfare Service

- Entry 1A, Decimal File Correspondence, 1946-54
  - Boxes 7, 12, 13, 18, 19, 23, 29, 34-35, 46-47, 54, 67, 76, 90, 92, 99, 100, 116-118, 124-125, 143-144, 153-154, 172-173, 18-186, 194-197, 199-204, 206, 207, 209, 210, 215, 216, 220, 221, 223-226, 228, 232, 234, 236, 238, 239, 241, 243-245, 248, 250, 251 - Nothing of relevance.
- Entry 2A, General Correspondence, 1942-47
  - Boxes 1-14 - Nothing of relevance
- Entry 4A, Security Classified Correspondence, 1942-45
  - Boxes 133-154 - Nothing of relevance

RG 234, Reconstruction Finance Corporation

- Entry 337, Records Relating to Liquidation of Defense Plants by the RFC's Office of Defense Plants, 1942-1956
  - Boxes 1-12 – Nothing relevant; records concerned other installations.

RG 319, Army Staff

- Entry 47C, Army Intelligence; Project Decimal File, 1941-1945
  - Boxes 1157-1160, 1171, 1172, 1183-1186, 1212, 1221, 1245, 1266 – Nothing relevant; records concerned other installations.
  - Boxes 1274, 1316, 1325, 1660 - Nothing relevant; records concerned other installations.

RG 330, Department of Defense

- Entry 173, Subject File, 1951-1955
  - Boxes 253-260 – Nothing relevant; materials concerned other installations.
- Entry 179, Assistant Secretary of Defense for Property, Director of Real Property Management, Real Estate Division, General Subject File, 1951-53
  - Boxes 40-52 - Nothing of relevance.

RG 334, Records of Inter-Service Agencies

- Entry 15, Records of the Armed Services Explosives Safety Board, 1939-1948
  - Box 14 – COPIED documents concerning a fire at the "burning ground" at Radford in 1946.
  - Box 15 – Contained documents for Radford, but nothing concerning range areas.
  - Boxes 1-13, 16-19 – Documents concerning explosion reports, but nothing relevant to this installation.

RG 335, Secretary of the Army

- Entry 58B, General Correspondence, Security Classified, 1955-1962

    - Box 95 – Contained materials concerning Radford, but nothing relevant to range areas.
    - Boxes 96-105, 107, 156-157, 272-278, 280-281, 322, 325 – Contained information on inspections and training, but not at this installation.
- Entry 60, General Correspondence, 1964-1964
    - Boxes 59-60, 88-95 – Contained miscellaneous, administrative materials; nothing relevant to this installation.

RG338. U.S. Army Commands, 1942-present

- Entry 78L, US Army Commands, 1933-66
    - Boxes 1-2 - Nothing of relevance.
- Entry 109, Operating Program Records, 1968-78
    - Boxes 1-4 - Nothing of relevance.
- Entry 189, Historical Reports, 1950-58, 8th Army
    - Boxes 1-3 - Nothing of relevance.
- Entry 37042, Unit Histories, Ordnance Detachments
    - Box 574 - COPIED material concerning Radford Ordnance Works.

RG 407, Adjutant General's Office

- Entry 360B, Army AG Classified Decimal File, 1943-1945
    - Boxes 2125, 2203-2210, 3089, 3095, 3111 - Nothing relevant, records concerned other installations.
- Entry 363A, Army AG Classified Decimal File, 1940-1942
    - Boxes 414, 500, 957 - Nothing relevant; records concerned administrative matters.
    - Boxes 961, 995, 2651-2671, 3963, 3985 - Nothing relevant; records concerned other installations.
- Entry 363B, Army AG Decimal File, 1946-1948
    - Boxes 1132, 1223-1233, 1503, 1506, 1519 - Nothing relevant; records concerned other installations.
- Entry 363D, Army AG Decimal File, 1951-1952
    - Boxes 505, 569-91, 941, 944, 956 - Nothing relevant; records concerned other installations.
- Entry 363E, Army AG Decimal File
    - Boxes 194, 212-218, 356, 357, 359 - Nothing relevant; records concerned other installations.
- Entry 363F, Army Central Decimal File, 1940-1956
    - Boxes 97-106 - Nothing relevant; records concerned administrative matters.
- Entry 377, Station Lists
    - Boxes 1-7 - Nothing relevant; records concerned administrative matters.

RG 429, Organizations in the Executive Office of the President

- Entry 12, Records of the Federal Property Council: Central Real Property Surveys
    - Box 92 – COPIED maps which included the New River Ordnance Plant, a ballistics range as well as current and future red ash dumps.

RG 553, U.S. Army Training and Doctrine Command

- Entry 171, Field Artillery Board
  - Box 1 - Nothing relevant; records concerned administrative matters.
- Entry 173, USA Artillery Board
  - Box 1 - Nothing relevant; records concerned administrative matters.

National Archives and Records Administration, Still Pictures Branch – College Park, MD

RG 111, Office of the Chief Signal Officer

- Series SC, WWII section
  - Boxes 1 (new box list), 11-12 (new), 17 (new), 19 (new), 23 (new), 47 (new), 62 (new), 147 (new), 201 (new), 356 (new), 424 (new), 444 (new), 831 (new), 834 (new); box 250 (old box list), 268 (old), 282 (old) - Contains nothing of relevance.
  - Box 26 (new) – COPIED 1941 photo of unspecified range taken from the firing line.
- Series SC, Vietnam section
  - Boxes 335, 350, 368, 407, 418, 421 - Contains nothing of relevance.

National Archives and Records Administration, Cartographic and Aerial Photography Branch – College Park, MD

RG 319, Army Staff

- Series CE, Photographs of US and Foreign Nations, 1942-64
  - Box 48, folders 133-134 - Nothing of relevance.
- Series CF, Photos of Posts and Camps in US, 1946-66
  - Boxes 2, 10, 13 and 14 - Nothing of relevance.

National Archives and Records Administration – Mid-Atlantic Region, Philadelphia, PA

RG 156, Office of the Chief of Ordnance

- This RG contained materials for Radford, but nothing relevant to range areas.

Finding aids for the following RGs were reviewed, also, but no relevant materials were identified for review:

- RG 269, General Services Administration
- RG 270, War Assets Administration

Military History Institute, Carlisle Barracks, PA

- *Radford Ordnance Works Completion Report* (December 15, 1941) – N/A (ARCH COLL 2, Row 150)
  - COPIED a report on construction with a map.

- *The World War II Ordnance Department's Government-Owned Contractor-Operated Industrial Facilities: Radford Ordnance Works Historical Investigation* (February 1996) - M. Neville and Debra A. McClane (UF533.U8 no. 6A)
    - Contained a historical account of the Radford Works, but nothing relevant to ranges or ordnance.
- *The World War II Ordnance Department's Government-Owned Contractor-Operated Industrial Facilities: Radford Ordnance Works Transcripts of Oral History Interviews* (May 1996) - Ashley M. Neville and Debra A. McClane (UF533.U8 no. 6C)
    - Contained transcripts of interviews with former employees of the Radford Works, but nothing relevant to ranges or ordnance.
- *Radford Army Ammunition Plant: Supplemental Photographic Documentation of Archetypical Buildings, Structures and Equipment for U.S. Army Material Command, National Historic Content for World War II Ordnance Facilities* (April 1995) – K. Diane Kimberly and Kathleen E. Hiatt (UF533,U8 no. 6)
    - Contained photographs of buildings, but nothing relevant to ranges or ordnance.
- *Installation Profile* – Radford AAP (1989)- N/A (UL171.R32 U54)
    - COPIED a brief overview with a section on burn areas.

Radford Army Ammunition Plant Historical Correspondence

Repository: MHI - Carisle Barracks, PA

Title: Installation Profile - Radford AAP
Author:
Recipient/CC:
Call Number: UL 171.23 R32 U54 1988/89
Document Date: 1/1/1989 **Pages Copied:** 2 pages

Document Abstract:

RCRA required RAAP to close two hazardous waste surface impoundments and a hazardous waste landfill by November 1989, then extended to January 1989. Another was closed in May 1989. Decontamination of the site was currently underway. At its completion, a "clean" closure would be attempted and the site could be reused. Burns were also underway. On April 21, 1988 an explosion in a MK 90 2.75" rocket motor production facility closed production until March 1989. Production was at 15K/grain/mo.

Title: Radford Ordnance Works
Author: War Department , Office of the Quartermaster General
Recipient/CC:
Call Number: Arch Coll 02, Row 150, Box 2
Document Date: 12/15/1941 **Pages Copied:** 2 pages

Document Abstract:

Map of Radford Ordnance Works shows magazine areas, trench mortar range, gun range, and powder lines.

Repository: NA - College Park, MD

Title: Schematics of Partial Burning Firing Emplacement and descriptions of firing ranges
Author: US Army Ordnance Corps
Recipient/CC:
Call Number: RG 156, Entry 815, Box I352, RD-3, Historical Summary: Radford Arsenal, 9/2/1945-6/30/1951, pp. 1285, 1988, 1301.
Document Date: 10/1/1945 **Pages Copied:** 4 pages

Document Abstract:

Drawing shows the details of the Hercules Powder Company - Radford Ordnance works Development Department. In January 1945, the facilities were expanded to include flight testing of 3/8/ inch stick powder from a rocket launcher. The round was fired into the sand-filled tunnel that served as a fragment trap for static testing. The distance between the launcher and the tunnel was about 40 feet.

Title: Map of New River Ordnance Plant, May 3, ????
Author: War Department
Recipient/CC:
Call Number: RG 51, Entry 149B, Box 205, Bureau of the Budget, War Projects Unit/Inspection Reports 1940-45, War Department Virginia (Portsmouth - Radford)
Document Date: **Pages Copied:** 1 page

Document Abstract:
Map shows detailed site map of the New River Ordnance Facility Hercules Powder Company. It mentions ammunition igloos. It shows loading units and igniter units on the map.

Title: Maps of Radford Army Ammunition and New River Ordnance Plants, Real Property Utilization Surveys, 1972
Author: McCoy, C.
Recipient/CC:
Call Number: RG429, Entry 12, Box 92,Organizations in the Executive Office of the President, Records of the Federal Property Council: Central Real Property Surveys
Document Date: 3/29/1972 **Pages Copied:** 3 pages

Document Abstract:
Maps show the whole production area including storage and security areas. A ballistics range and the current red ash dump, as well as, the future site for the red ash dump are shown. The waste powder incinerator facility, nitroglycerin emulsion lines, nitrocellulose manufacturing facility, and rolled powder area are all shown. A schedule of proposed activities includes TNT handling, rolled powder area, paste preparation, nitroglycerin emulsion line, nitrocellulose thermal dehydration, benite production, ballistics testing, and cannon propellant production.

Title: Maps of New River Ordnance Plant
Author: War Department
Recipient/CC:
Call Number: RG 51, Entry 149B, Box 205, Bureau of the Budget, War Projects Unit/Inspection Reports 1940-45, War Department Virginia (Portsmouth - Radford)
Document Date: 1/15/1942 **Pages Copied:** 4 pages

Document Abstract:
Maps show the New River Ordnance Works' manufacturing plant including the black powder dry plant, the loading lines and igniter lines, magazine area, and the bag loading plant. A map of the overall facility is included.

Title: Maps of Radford Ordnance Woks of smokeless powder manufacturing plant
Author: War Department, Office of the Quartermaster General
Recipient/CC:
Call Number: RG 51, Entry 149B, Box 205, Bureau of the Budget, War Projects Unit/Inspection Reports 1940-45, War Department Virginia (Portsmouth - Radford)
Document Date: 5/10/1941 **Pages Copied:** 4 pages

Document Abstract:
Maps show manufacturing plant with an estimated completion date of August 25, 1941. Shows powder lines, pepper tunnel, finishing areas, rolled powder area, and double base powder area.

Title: Executive Order 11508 Installation Survey Report, Radford Army Ammunition Plant, Radford, Virginia, Date of Survey 3-4 April 1972
Author: Department of the Army
Recipient/CC:
Call Number: RG429, Entry 12, Box 92,Organizations in the Executive Office of the President, Records of the Federal Property Council: Central Real Property Surveys
Document Date: 6/1/1972 **Pages Copied:** 5 pages

Document Abstract:

Survey to determine utilization of land at the Radford Army Ammunition Plant in Radford, VA. Maps that accompany are at RADF0013-16. The discussion includes description of the 4,154 government-owned acres making up RAAP and divided by the New River into a production area and a storage area. It is maintained by Hercules Corporation for manufacture of solid propellant for small arms, cannon and rockets, motor increments and igniters, assorted explosives, and related items. The storage land is 2,941 acres. A new TNT production facility was added in 1968. It can product 300,000 lbs of TNT per 24 hours. The red ash dump is 93.75 acres with a proposed extension in the works. A second project proposed is the 204.02 acres future TNT Truck Holding Area.

Title: "3 Dead, 3 Injured in Fire at Radford Ordnance Plant"
Author: Associated Press
Recipient/CC:
Call Number: RG 334, Entry 15, Box 14
Document Date: 7/27/1946 **Pages Copied:** 1 page

Document Abstract:

Article states that an explosive flash of old powder occurred during destroying procedures.

Title: Summary of Report of Fire at a Burning Ground at Radford Arsenal.
Author: Board of Officers at Fire at Burning Ground, Radford, Arsenal.
Recipient/CC:
Call Number: RG 334, Entry 15, Box 14
Document Date: 7/26/1946 **Pages Copied:** 2 pages

Document Abstract:

Accident that occurred during destruction by burning of an experimental type of smokeless powder for 30 caliber carbine ammunition is described.

Title: Description of powder burning
Author: US Army Ordnance Corps
Recipient/CC:
Call Number: RG 156, Entry 1023B, Box C132, Historical Summary: Radford Arsenal, 9/2/1945-6/30/1951
Document Date: 1/1/1951 **Pages Copied:** 1 page

Document Abstract:

During the destruction of obsolete smokeless powder at the burning ground, an accident occurred where 3 men were killed.

Title: **Aerial Photograph - Radford Army Ammunition Plant, VA**
Author:
Recipient/CC:
Call Number: **RG 145 Frame: ON034798/10232735-DTP-5L-127**
Document Date: **10/8/1953** **Pages Copied:** **1 photo**

Document Abstract:
Aerial photo of Radford Army Ammunition Plant, VA. Should show small arms range.

Title: **Map of Radford Ordnance Works, Radford, Virginia, Area Map**
Author: **US Army Ordnance Corps**
Recipient/CC:
Call Number: **RG 156, Entry 646, Box A145, Radford Ordnance Works, Basic History thru 12/31/1942**
Document Date: **1/1/1943** **Pages Copied:** **2 pages**

Document Abstract:
Map shows magazine areas, trench mortar area, gun range area, tnt area, smokeless powder lines, pentolite area, pepper tunnel, rolled powder area, NG area, nitro cotton lines, acid area, powder areas, and double base powder area.

Title: **Highlights of Radford Arsenal, Radford, Virginia**
Author: **US Army Ordnance Corps and Hercules Powder Company, Operating Contractor**
Recipient/CC:
Call Number: **RG 338, Entry 37042, Box 574, Folder: "Radford Arsenal Unit History"**
Document Date: **1/1/1951** **Pages Copied:** **2 pages**

Document Abstract:
Map shows cast propellant area, n.g. area, pilot areas, pre-mix areas, magazine areas, ballistics range, powder burning ground, increment areas, finishing area, solvent recovery area, oleum plant, storage area, powder lines, solventless sheet area, N.C. Lines, acid area, and N.G. area.

Title: **Project description for contract to manufacture nitrocellulose smokeless powder**
Author:
Recipient/CC:
Call Number: **RG 51, Entry 149B, Box 205, Bureau of the Budget, War Projects Unit, Inspection Reports 1940-1945, War Department, Virginia (Records of the War Department General and Special Staffs Legislative and Liaison Division 1942-1948, card File of Approved WPA National Defense Projects 1941-1942**
Document Date: **Pages Copied:** **2 pages**

Document Abstract:
Excerpt from inspection of Radford Army Ammunition Plant. Manufacture of nitrocellulose smokeless powder is discussed. The method of disposal by Hercules solvent recovery tanks is discussed.

Title: Aerial Photograph - Radford Army Ammunition Plant, VA
Author:
Recipient/CC:
Call Number: RG 145 Frame: ON034798/10232735-DTP-5L-101
Document Date: 10/4/1953 **Pages Copied:** 1 photo

Document Abstract:
Aerial photo of Radford Army Ammunition Plant, VA. Should show Northern Burning Ground.

Title: Aerial Photograph - Radford Army Ammunition Plant, VA
Author:
Recipient/CC:
Call Number: RG 145 Frame: ON034798/10232735-DTP-5L-102
Document Date: 10/4/1953 **Pages Copied:** 1 photo

Document Abstract:
Aerial photo of Radford Army Ammunition Plant, VA. Should show Western Burning Ground.

Title: Aerial Photograph - Radford Army Ammunition Plant, VA
Author:
Recipient/CC:
Call Number: RG 145 Frame: ON034797/10232736-DTP-4L-87
Document Date: 10/2/1953 **Pages Copied:** 1 photo

Document Abstract:
Aerial photo of Radford Army Ammunition Plant, VA.

Title: Accident at Burning Ground
Author: Dietrick, Carroll H.
Recipient/CC:
Call Number: RG 334, Entry 15, Box 14
Document Date: 9/24/1946 **Pages Copied:** 3 pages

Document Abstract:
Details of an accident at the Burning Ground at Radford when double base smokeless powder ignited after unloading from a truck.

Repository: NA - College Park, MD, Still Picture Branch

Title: Photograph, Gun Range, Radford AAP
Author: US Army Signal Corps
Recipient/CC:
Call Number: 111SC-125428
Document Date: 9/30/1941 **Pages Copied:** 2 pages

Document Abstract:
Photograph of Gun Range where 155mm, M-1 and 105mm Howitzers are used in test firing and are fired into tunnels.

Appendix B

Archive Documents and Research Materials
(Provided on Enclosed Compact Disk)

Appendix C
Interview Records

URS

RECORD OF CONVERSATION

Project: **Radford Army Ammunition Plant HRR** **Date: 7/18/07**

Contact: **Mr. Jerome Redder, ATK, Radford Army Ammunition Plant**

Mr. Redder was interviewed in person by Sarah Gettier on July 18, 2007. Mr. Redder stated that he had some old EPIC aerial photographs in his office that should show the Army Reserve Small Arms Range. We viewed the aerial photographs from 1949, 1962, and 1971. The 1949 aerial showed road scars and ground scarring but no berm. The 1962 aerial photograph showed a shadow near Stroubles creek, but no berm. On the 1971 aerial photograph a berm is clearly visible.

Mr. Redder then took Ms. Gettier to the document room in Building 220. The Army Reserve Small Arms Range was noted on several maps as Area 214. When we looked in the binder cataloging the documents and maps, the sheet for Area 214 was missing. We randomly searched the files for maps and documents. We found very general installation maps but nothing specific to the Army Reserve Small Arms Range.

Mr. Redder then took Ms. Gettier to the accounting office in Building 200 to see if they had any records. The only record found for that area was a 1983 accounting record which indicated softball backstops were installed.

RECORD OF CONVERSATION

Project: **Radford Army Ammunition Plant HRR** **Date: 7/3/07**

Contact: **Mr. Jim McKenna, IRP Manager, Radford Army Ammunition Plant**

Mr. McKenna was interviewed on the phone by Sarah Gettier on July 3, 2007. Mr. Mckenna stated that there has been no sampling under the IRP at the Army Reserve Small Arms Range. The site is near SWMU 41 across an unnamed tributary. The berm still exists at the site. He indicated that Radford works under a Corrective Action Permit. He also said that he works closely with Mr. Jim Spencer (URS-Richmond) and I should get in touch with him to get a copy of the Master Work Plan, Site Screening Process, and SOPs. He indicated that other contractors have tried to attempt the SSP but didn't follow the process correctly and it was a waste of time. He also mentioned that the IRP has a website with an information repository.

7/20/07 – Mr. McKenna sent Ms. Gettier the following email:

Sarah,

I have a couple of notes/items from the subject meeting that I want to reiterate so they don't get lost.

1. The back stop (rear) contains building debris that includes pieces of conductive flooring. The HRR report needs to acknowledge this.

2. The Site Screening Process is just that, a process and not merely a different format or nomenclature. My understanding is that Jim Spencer can assist you in incorporating the SSP into this effort as you go forward.

Thanks.
Jim McKenna

Classification: UNCLASSIFIED
Caveats: NONE

URS

RECORD OF CONVERSATION

Project: **Radford Army Ammunition Plant HRR** **Date:** **7/18/07**

Contact: **Mr. Douglas Day, Radford Army Ammunition Plant**

Mr. Day was interviewed in person by Sarah Gettier on July 18, 2007. Mr. Day stated that he was in the National Guard and had fired at the Army Reserve Small Arms Range. He remembers targets were against the berm, approximately 100 meters away from the firing point. He joined the Company B 1st Battalion 116th Infantry in 1968. He recalled that at any given time there could be 150 people using the firing range and verified that there were approximately 10-15 stations located in front of the berm. He said both the National Guard and the Army Reserves used the firing range and rotated the time spent there every 2-3 months or so. The weapons that were fired were M1s and M14s (both 30 caliber), no M16s were used there.

He remembers that the Army decided that the firing range was too close to the TNT area in late 1968 and at that time they stopped using it. Firing was moved into an indoor range after shut down; he believed that was in the basement of Building 200.

URS

RECORD OF CONVERSATION

Project: **Radford Army Ammunition Plant HRR** **Date: 8/29/07**

Contact: **Mr. James Tobias, U.S. Army Center of Military History**

Mr. Tobias was contacted by email by Sarah Gettier on August 29, 2007.

-----Original Message-----
From: Sarah_Gettier@URSCorp.com [mailto:Sarah_Gettier@URSCorp.com]
Sent: Wednesday, August 29, 2007 9:13 AM
To: CMH Answers
Subject: Army Reserve Small Arms Range at Radford Army Ammunition Plant
Importance: High

I am trying to determine what types of firing occurred at this small arms range. I'd like to know more about how many targets there were and at what distance the firing point was from the berm. The berm is still present today at this site.

This site was used for small arms training from approximately 1941 to 1967. The existing berm is approximately 200 feet by 10 feet high. This berm likely contained 10-15 stations.

Any historical maps or information that the Army Reserve History office has would be greatly appreciated.

Thank you,
Sarah

p.s. I have already researched the National Archives and several other repositories.

Mr. Tobias replied on September 24, 2007.

Classification: UNCLASSIFIED
Caveats: NONE

Dear Sarah M. Gettier,

Thank you for your 29 August 2007 inquiry regarding an Army Reserve small arms range at Radford Army Ammunition Plant.

Unfortunately, the only historical information that we have on the Radford Army Ammunition Plant is an old fact sheet from November 1940 that provides information on the location of the installation, on postal services, on phone and telegraph services, and on rail access. The firing range is not mentioned in this document.

Because this was an Army Reserve firing range, we recommend that you contact the Office of Army Reserve History. They may be able to help you locate the information that you seek. Here is their contact information:

Office of Army Reserve History
ATTN: AFRC-MHM
1401 Deshler Street SW
Fort McPherson, GA 30330-2000

We apologize that we could not provide any information, and we hope that this helps you to locate the information that you seek. If you have any further questions, please feel free to contact us and good luck with your research.

Sincerely,
Mr. James Tobias
Public Inquiries Section
U.S. Army Center of Military History
103 Third Avenue
Ft. McNair, DC 20319-5058

Appendix D
Munitions Data Sheets

.30 Caliber (.30-06 Springfield) Ammunition

DESCRIPTION

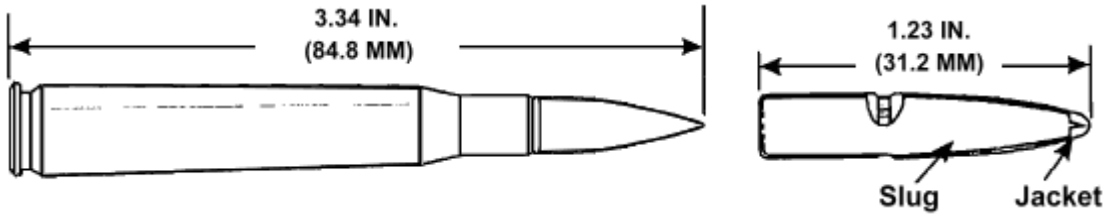
Rifle ammunition is issued in the form of a complete round. A complete round (cartridge) consists of all the components (cartridge case, bullet or shot, propellant powder, and primer) necessary to fire the weapon once.

Ballistic data for .30 ammunition.

Model	Cartridge Weight	Cartridge Length	Propellant	Projectile Weight	Chamber Pressure	Velocity 78 ft (23.8 m) from muzzle
M1 HPT	432 gr (27.99 g)	3.34 in (84.84 mm)	IMR 4198	?	67,500 psi (4,745 kg/cm²)	N/A
M1 Tracer	399 gr (25.85 g)	3.34 in (84.84 mm)	IMR 4895	?	52,000 psi (3,656 kg/cm²)	2,665 fps (812 mps)
M2 AP	424 gr (27.47 g)	3.34 in (84.84 mm)	WC 852	165.7 gr (10.74 g)	54,000 psi (3,796 kg/cm²)	2,715 fps (828 mps)
M2 Ball	416 gr (26.96 g)	3.34 in (84.84 mm)	IMR 4895	150 gr (9.72 g)	50,000 psi (3,515 kg/cm²)	2,740 fps (835 mps)
M3 Grenade	248 gr (16.07 g)	2.49 in (63.25 mm)	IMR 4895	N/A	N/A	180 fps (55 mps) 5.5 ft (1.7 m) from muzzle, projected grenade
M14 API	407 gr (26.37 g)	3.34 in (84.84 mm)	WC 852	?	54,000 psi (3,796 kg/cm²)	2,780 fps (847 mps)
M22 Frangible	320 gr (20.74 g)	3.29 in (83.57 mm)	SR 4759	?	?	1,320 fps (402 mps) 53 ft (16 m) from muzzle
M25 Tracer	401 gr (25.98 g)	3.34 in (84.84 mm)	WC 852	145.5 gr (9.43 g)	50,000 psi (3,515 kg/cm²)	2,665 fps (812 mps)
M40 Dummy	268 gr (17.37 g)	3.34 in (84.84 mm)	N/A	?	N/A	N/A

M72 Match	425 gr (27.54 g)	3.34 in (84.84 mm)	IMR 4895	?	50,000 psi (3,515 kg/cm²)	2,640 fps (805 mps)
M1909 Blank	218 gr (14.13 g)	2.49 in (63.25 mm)	SR 4990	N/A	N/A	N/A

Cartridge, Caliber .30, Ball, High Pressure Test, M1

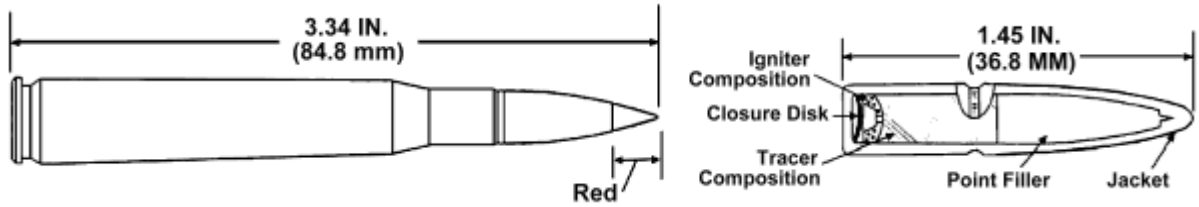


The cartridge is used to proof test caliber .30 rifles and machine guns during manufacture, test, or repair.

The cartridge is identified by stannic-stained (silvered) cartridge case.

Type Classification: STD - OTCM 37119

Cartridge, Caliber .30, Tracer, M1

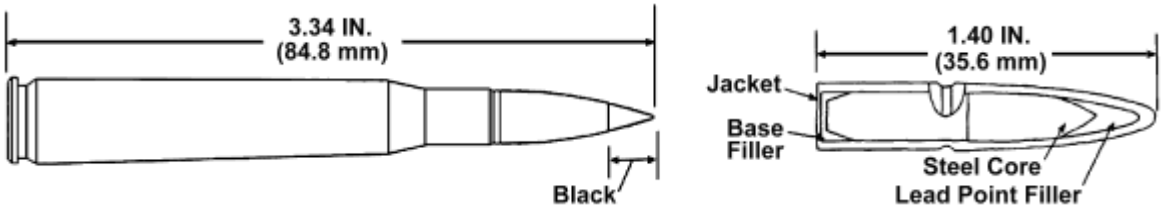


The tracer element is intended to permit visible observation of the bullet's in-flight path, or trajectory, to the target.

The cartridge is identified by a red bullet tip. Tracer composition: R256.

Type Classification: OBS - MSR 11756003

Cartridge, Caliber .30, Armor Piercing, M2

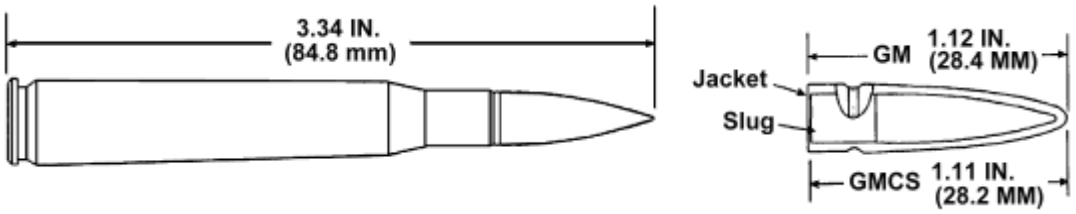


Penetration, fired at 7/8-inch (22.23 mm) thick homogeneous armor plate at 100 yards (91 m), will be not less than 0.42 inch (10.66 mm).

The cartridge is identified by a black bullet tip.

Type Classification: OBS - MSR 11756003

Cartridge, Caliber .30, Ball, M2

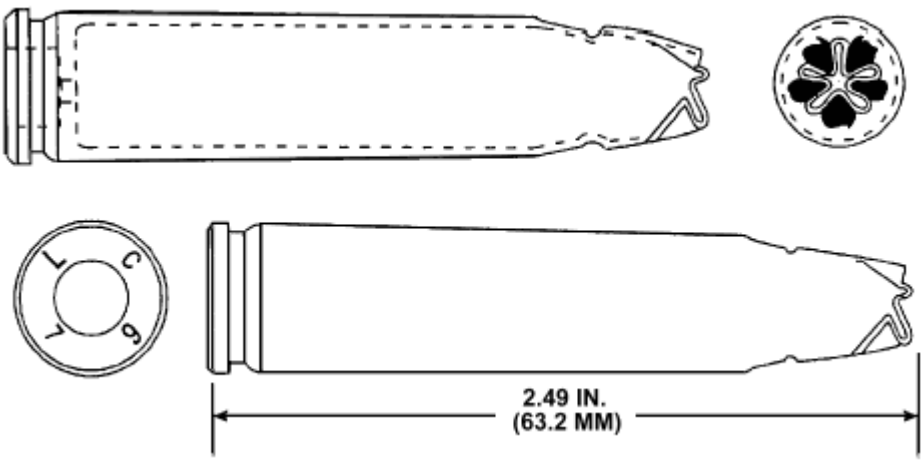


The cartridge is intended for use against personnel or unarmored targets.

The cartridge is identified by a plain bullet tip.

Type Classification: OBS - MSR 11756003

Cartridge, Caliber .30, Grenade, M3

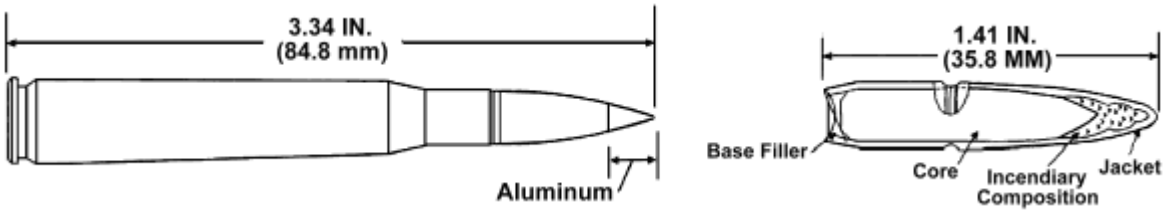


The cartridge provides the pressure, on functioning, to project rifle grenades when using a grenade projection adapter.

The cartridge is identified by a rose-petal (rosette-crimped) closure of' the cartridge case mouth.

Type Classification: OBS - MSR 11756003

Cartridge, Caliber .30, Armor Piercing Incendiary, M14

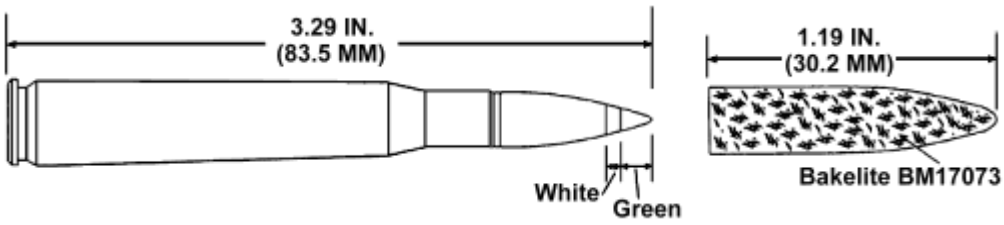


Penetration, fired at 7/8-inch (22.23 mm) thick homogeneous armor plate at 100 yards (91 m), will be not less than 0.42 inch (10.66 mm). Upon impact with a target, the incendiary composition bursts into flame and will ignite flammable material.

The cartridge is identified by an aluminum bullet tip. Incendiary composition: 2 grains (0.13 g) IM 11.

Type Classification: OBS - MSR 11756003

Cartridge, Caliber .30, Ball, Frangible, M22

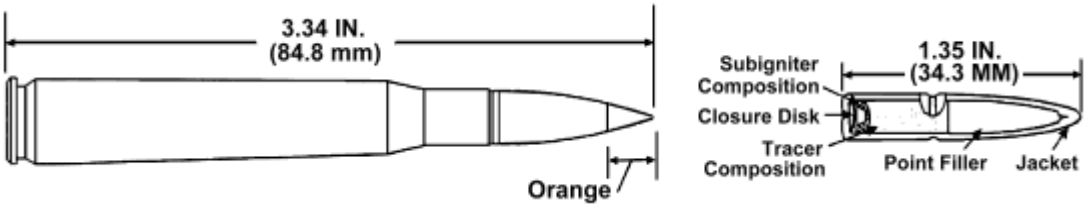


The bullet disintegrates upon striking a hard or armored target, leaving a pencil-like mark to indicate a hit during gunnery practice.

The cartridge is identified by a green bullet tip with a white ring to the rear of the green color.

Type Classification: OBS - MSR 11756003

Cartridge, Caliber .30, Tracer, M25



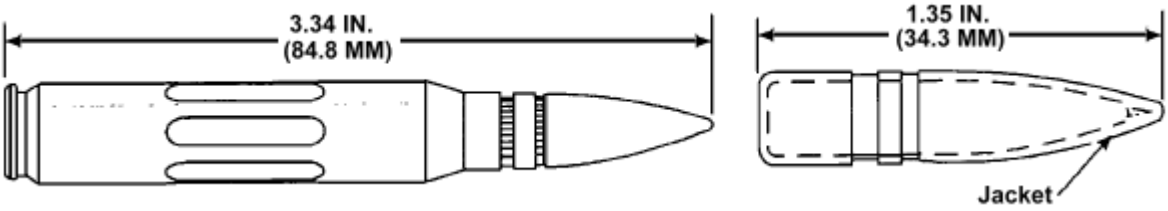
The cartridge is intended for use against personnel and unanmored targets.

In flight, the bullet exhibits a trace of full luminosity from a point not greater than 75 yards (69 m) from the muzzle of the weapon to a point not less than 900 yards (823 m) from the muzzle.

The cartridge is identified by an orange bullet tip.

Type Classification: OBS - MSR 11756003

Cartridge, Dummy, Caliber .30, M40

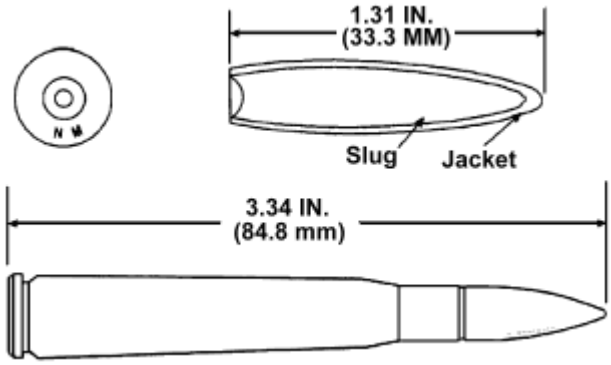


The cartridge is inert, and is used for practice in loading weapons, for simulated firing to detect flinching of personnel when firing, and for inspecting and testing the mechanisms of small arms weapons.

The cartridge is identified by six 1-inch longitudinal corrugations (flutings) in the cartridge case. In addition, there is no primer.

Type Classification: STD - OTCM 37119

Cartridge, Caliber .30, Ball, Match, M72

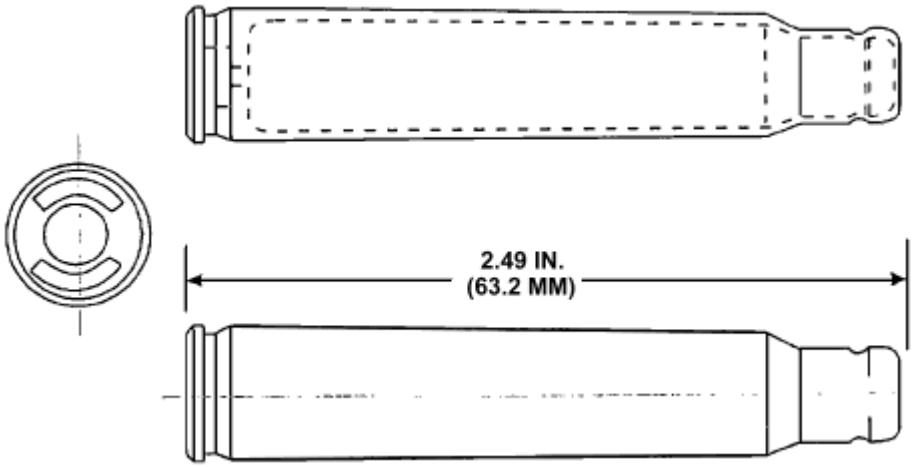


The cartridge is designed to be fired only in weapons designated as competition rifles.

The cartridge is identified by head stampings on the base of the cartridge case with either the initials NM (National Match) or the word MATCH. The primer is uncrimped, the bullet has no crimped cannelure, and the case is not crimped to the bullet.

Type Classification: STD - OTCM 37119

Cartridge, Caliber .30, Blank, M1909



The cartridge is used for simulated firing in training or for saluting purposes.

The cartridge is identified by the absence of a bullet and has a crimped cartridge case mouth.

Type Classification: OBS - MSR 11756003

Last updated: 25-MAY-2006

To the best of my knowledge all military data and images presented in these pages are UNCLASSIFIED, NON-SENSITIVE, and approved for public release.

Sources:
TM 43-0001-27 Army Ammunition Data Sheets For Small Caliber Ammunition.
TM 9-1005-211-12 M1911A1 Operator's Manual.
TM 9-1005-317-10 M9 Operator's Manual.
TM 9-1305-201-20&P Unit Maintenance Manual for Small Arms Ammunition.
2005 ARMY PROCUREMENT OF AMMUNITION Budget Estimate.

Appendix E

TPP1 Meeting Minutes and Site Visit Photographs

MEETING MINUTES

PURPOSE: Radford Army Ammunition Plant (RFAAP) MMRP Site Inspection Technical Project Planning (TPP1) Meeting

LOCATION: Radford, VA, Building 220

DATE: 18 July 2007

TIME: 1530 - 1630

Attendees	Organization	Phone	email
Jim Cutler	VDEQ	804.698.4498	jlcutler@deq.virginia.gov
Will Geiger	EPA, Region III	215.814.3413	Geiger.william@epa.gov
Mary Ellen Maly	USAEC	410.436.7083	Maryellen.h.maly@us.army.mil
Rich Mendoza	ÚSAEC	309.782.1871	richard.r.mendoza@us.army.mil
Nancy Flaherty	USACE, Bal District	410.779.2796	Nancy.E.Flaherty@usace.army.mil
Jim McKenna	RFAAP	540.639.8641	Jim.mckenna@us.army.mil
Jerry Redder	ATK	540.639.7536	Jerome.redder@atk.com
Sarah Gettier	URS	301.721.2299	Sarah_gettier@urscorp.com
James Spencer	URS	804.474.5420	James_O_Spencer@urscorp.com

VDEQ = Virginia Department of Environmental Quality
EPA = Environmental Protection Agency
USAEC = U.S. Army Environmental Command
USACE = U.S. Army Corps of Engineers, Baltimore District
ATK = Alliant Techsystems, Inc.

The meeting began with introductions at 1530.

I. Presentation

A hardcopy of the PowerPoint presentation was distributed to all attendees. The slides outlined the development of the MMRP, how it is implemented, and information pertaining to Radford Army Ammunition Plant provided in the Phase 3 Closed, Transferring, and Transferred Inventory Report. Mary Ellen Maly and Sarah Gettier led a discussion during the presentation, including the following items:

- Discussed legal basis of MMRP and definitions.
- Discussed the status of MMRP within the Defense Environmental Restoration Program, and the relationship of funding sources.
- Summarized the MMRP process (Preliminary Assessment, Historical Records Review [HRR], Site Inspection [SI], etc.), and status at RFAAP. The distinction between a site inspection and site investigation was discussed.
- Presented primary and secondary goals of the MMRP SI (including the Munitions Response Site Prioritization Protocol).
- Described the one RFAAP defense site included in the MMRP SI.
- Discussed MMRP SI deliverables and schedule.

II. Discussion

The following topics were discussed after the presentation.

1. S.Gettier can provide a copy of the Phase 3 (Closed, Transferring and Transferred Range/Site Inventory) Report if anyone needs it. J.McKenna noted that this document, along with other documents, is also available on the RFAAP IRP website. http://www.radfordaapirp.org/inforepo/online-index.htm
2. RFAPP is working under a Resource Conservation and Recovery Act (RCRA) Corrective Action Permit. The installation is operated by ATK, for the Army's Joint Munitions Command through a facilities use contract.
3. EPA Region III is the lead agency; however VDEQ has the authority at RFAAP. W.Geiger and J.Cutler said they would accept Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) terminology but would prefer to see RCRA. Therefore, it was agreed that during the MMRP process, documents would use RCRA terminology.
4. J. Redder and J. McKenna said that the Army Reserve Small Arms Range was added to the RCRA Corrective Action permit July 15, 2005.
5. The Northern Burning Grounds and the Western Burning Grounds are sites handled under the Installation Restoration Program (IRP) and are not eligible for MMRP. They are located on a non-contiguous unit (The New River Unit).
6. J. McKenna explained that the installation has a unique Site Screening Process (SSP) that he would like the MMRP to follow.
7. Discussed the importance of adopting the TPP and review of Data Quality Objectives (DQOs) prior to executing any field activities. M.Maly asked the VDEQ and EPA if they would agree that lead is the only analyte necessary to be analyzed at this site, as lead is a very good indicator for small arms use. It would not be necessary to sample the soil for other chemicals at this site. She indicated that at almost 70% of the installations where a firing berm was present, lead is the indicator compound. W.Geiger and J.Cutler said they would have to discuss that back at the office and would get back to the MMRP team before the next meeting (TPP2).
8. M. Maly mentioned that the intent is for the site at RFAAP to go through the SI, but from that point forward, the MRS Site Prioritization Protocol (MRSPP) will be used to rank sites and prioritize funding in a manner similar to IRP sites.
9. N.Flaherty said that Bryan Frey from USACE will be conducting MRSPP training for the Formerly Used Defense Sites (FUDS) program at the EPA Region III offices in Philadelphia soon. She will obtain the information and send to W.Geiger.
10. Document distribution was discussed. It was agreed that URS may submit documents to the regulators directly. However, before sending the documents

to the regulators and stakeholders, the installation will provide a cover letter after the document as been certified by the installation.

11. EPA and VDEQ agreed to a 30-day review structure. EPA requested two (2) hardcopies and electronic copies. W.Geiger said these documents will not be sent to multiple reviewers and he will most likely consult with in house personnel when providing his comments. VDEQ would like one (1) hardcopy of draft documents, and two (2) hardcopies and electronic copies of final documents.
12. J.Mckenna indicated that the distribution list for the Army can be found on the cover letters of existing documents on the IRP website, however, Russ Fish should be removed from the distribution.
13. S.Gettier briefed the team of the earlier review of the Environmental Photographic Interpretation Center (EPIC) Aerial Photographs that J.Redder had in his office.
    - ✓ 1949 Aerial Photograph - ground scarring is apparent in the area of the Army Reserve Small Arms Range.
    - ✓ 1962 Aerial Photograph –ground scarring visible however there is a noticeable shadow near the Stroubles Creek and a berm is not discernible.
    - ✓ 1971 Aerial Photograph – A berm is clearly observable.
14. S.Gettier briefed the team of the discussions held with Mr. Doug Day. He works at RFAAP in the Hazards Analysis Group. The following information was obtained from D.Day:
    - ✓ D. Day joined the National Guard (Christiansburg) in 1968, Unit Company B, 116 Infantry.
    - ✓ He indicated that after the TNT Area was built the firing range use was discontinued by the National Guard.
    - ✓ He recalled that up to 150 soldiers at time would use the Army Small Arms Firing Range and verified that there were approximately 10-15 stations located in front of the berm. He said that the firing distance was approximately 100 meters.
    - ✓ The weapons of use at this time were M1s and M14s (30 caliber). No M16s were used by the National Guard at this range to his knowledge.
15. J.Redder indicated that there is another pistol range located on RFAAP and said this range should be considered an “operational range”. This range is approximately 1-2 acres in size and is mainly used by security for training. A map of the range will be provided to AEC for the Operational Range Inventory Sustainment (ORIS) program.
16. RFAAP does have an active Restoration Advisory Board (RAB). J. McKenna suggested that URS present the MMRP at the next RAB. The next meeting is September 20. Due to the timing of the submitting the Stakeholder Draft HRR in November, the next RAB in December would probably work best. It is believed that due to the holidays the RAB will be held the second Thursday in December (Dec 13th). It was also suggested to coordinate the TPP2 meeting with this RAB meeting.

The meeting concluded at 1630 and J.McKenna, J.Redder, S.Gettier, J.Cutler, and W.Geiger went on a site visit.

III. Site Visit

1. Team walked the flat grassy field of the Army Reserve Small Arms Range. It was apparent that the site had previously been used for playing baseball with two designated fields and deteriorating backstops.
2. A helicopter mark (looks like the letter H made of concrete) is located in the center of the field and J.Redder indicated that this field is currently used for helicopter landings.
3. The berm is still present and overgrown. Mature trees are found on the berm.
4. An unlocked fence surrounds the site.
5. Stroubles Creek flows behind the berm on the other side of the fence. There is a steep hill behind Stroubles Creek. This hill could have acted as a secondary backstop or a primary one if the Army used the range before construction of the berm.
6. During this initial visit, no bullets were visible on the surface of the berm or near any areas where soil was disturbed by groundhogs.
7. Concrete building debris was found behind the berm, including pieces of conductive flooring.

Berm with mature trees, facing southeast.

Berm facing southeast

Berm facing southeast

Grassy field facing northeast towards Constitution Road

Behind berm

URS	USAEC	**Radford Army Ammunition Plant MMRP HRR**	**Army Reserve Small Arms Range Site Visit Photographs**

Behind berm facing southeast towards Stroubles Creek and steep hill

Behind berm towards steep hill Stroubles Creek

Backside of berm

Standing at the end of the berm facing east towards the parking lot

Corroded metal rods, potentially used for mounting targets