# Final
# Feasibility Study for
# RVAAP-016-R-01 Fuze and Booster Quarry MRS
# Version 1.0

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract No. W912DR-15-D-0016
Delivery Order No. 0001

Prepared for:

US Army Corps
of Engineers®

North Atlantic Division, Baltimore District
10 S. Howard Street, Room 7000
Baltimore, MD 21201

Prepared by:

HydroGeoLogic, Inc.
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January 6, 2018

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# REPORT DOCUMENTATION PAGE

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**14. ABSTRACT**
This Final Feasibility Study for RVAAP-016-R-01 Fuze and Booster Quarry Munitions Response Site (MRS) Version 1.0 is submitted in support of the Multiple Award Military Munitions Services (MAMMS) Contract No. W912DR-15-D-0016, Task Order 0001. The objective of this FS is to develop, evaluate, and compare remedial action alternatives that will meet the remedial action objectives for the MRS so that the Department of Defense can select and propose an appropriate remedy. This FS used the information obtained during the Remedial Investigation to determine appropriate remedial actions based on the current and anticipated future land uses of the MRS.

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Ohio Environmental Protection Agency

John R. Kasich, Governor
Mary Taylor, Lt. Governor
Craig W. Butler, Director

2/16/2018

February 12, 2018

Mr. Mark Leeper, P.G., MBA
Team Lead
Cleanup and Restoration Branch
ARNG Directorate
111 South George Mason Drive
Arlington, VA 22204

**Re: US Army Ravenna Ammunition Plt RVAAP**
**Remediation Response**
**Project records**
**Remedial Response**
**Portage County**
**267000859199**

**Subject: Receipt and Review of the "Final Feasibility Study for RVAAP-016-R-01 Fuze and Booster Quarry MRS, Version 1.0," Dated January 6, 2018 (Work Activity No. 267000859199)**

Dear Mr. Leeper:

The Ohio Environmental Protection Agency (Ohio EPA), Northeast District Office (NEDO), Division of Environmental Response and Revitalization (DERR) has received and reviewed the document entitled, "*Final Feasibility Study for RVAAP-016-R-01 Fuze and Booster Quarry MRS, Version 1.0,*" dated January 6, 2018. This document, received by Ohio EPA NEDO on January 8, 2018, was prepared for the U.S. Army Corps of Engineers (USACE) Baltimore District, by HydroGeoLogic, Inc. in response to Ohio EPA's request for the final document sent December 12, 2017.

This document was reviewed by personnel from Ohio EPA's DERR, pursuant to the Director's Findings and Orders paragraph 39 (b), and we concur with the feasibility study in its final format. Please note, the document did not contain the Disclaimer Statement at the beginning of the document. This does not affect the technical aspects of the document.

If you have any questions or concerns, please do not hesitate to contact me at (330) 963-1235.

Sincerely,

Nicholas Roope
Site Coordinator
Division of Environmental Response and Revitalization

NCR/nvp

cc: Craig Coombs, USACE, Louisville District
Katie Tait/Kevin Sedlak, Camp Ravenna Environmental Office
Shreffler/Harris, Camp Ravenna Environmental Office, Vista Sciences

ec: Rod Beals, Ohio EPA, NEDO, DERR
Bob Princic, Ohio EPA, NEDO, DERR
Tom Schneider, Ohio EPA, SWDO, DERR

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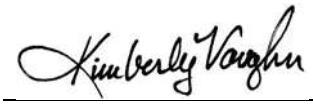
## CONTRACTOR'S STATEMENT OF INDEPENDENT TECHNICAL REVIEW

HydroGeoLogic, Inc. (HGL) has completed the *Final Feasibility Study for RVAAP-016-R-01 Fuze and Booster Quarry MRS, Version 1.0,* for the former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in the project. During the independent technical review, compliance with established policy principles and procedures, utilizing justified and valid assumptions, was verified. This included review of data quality objectives; technical assumptions; methods, procedures, and materials to be used; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets customer's needs consistent with law and existing USACE policy.

Reviewed/Approved by: Janardan J Patel Digitally signed by Janardan J Patel DN: cn=Janardan J Patel, o=HGL, ou=ECD, email=jpatel@hgl.com, c=US Date: 2018.01.03 18:55:52 -05'00' Date: January 6, 2018

Janardan Patel, PMP
Program Manager

Prepared/Approved by:  Date: January 6, 2018

Kimberly Vaughn
Project Manager

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# Feasibility Study for
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January **6**, 2018

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## RVAAP-016-R-01 Fuze and Booster Quarry MRS, Version 1.0

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ARNG – Army National Guard
COR – Contracting Officer's Representative
IED – Installation and Environmental Division
OHARNG – Ohio Army National Guard
RVAAP – Former Ravenna Army Ammunition Plant
USACE – United States Army Corps of Engineers

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# Acronyms and Abbreviations

| | |
|---|---|
| AEDB-R | Army Environmental Database - Restoration Module |
| ARAR | applicable or relevant and appropriate requirements |
| ARNG | Army National Guard |
| bgs | below ground surface |
| Camp Ravenna | Camp Ravenna Joint Military Training Center |
| CB&I | CB&I Federal Services, LLC |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CFR | Code of Federal Regulations |
| COR | Contracting Officer's Representative |
| CSM | conceptual site model |
| DERP | Defense Environmental Response Program |
| DoD | U.S. Department of Defense |
| FS | Feasibility Study |
| HGL | HydroGeoLogic, Inc. |
| INRMP | Integrated Natural Resources Management Plan |
| IRP | Installation Restoration Program |
| MC | munitions constituents |
| MEC | munitions and explosives of concern |
| MMRP | Military Munitions Response Program |
| MRS | munitions response site |
| NCP | National Oil and Hazardous Substances Contingency Plan |
| NPDES | National Pollutant Discharge Elimination System |
| OHARNG | Ohio Army National Guard |
| Ohio EPA | Ohio Environmental Protection Agency |
| RAO | remedial action objective |
| RI | Remedial Investigation |
| ROD | Record of Decision |
| RVAAP | Former Ravenna Army Ammunition Plant |
| USACE | U.S. Army Corps of Engineers |
| USC | United States Code |
| USEPA | U.S. Environmental Protection Agency |
| USP&FO | U.S. Property and Fiscal Officer |

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# EXECUTIVE SUMMARY

## Introduction

HydroGeoLogic, Inc. (HGL) has been contracted by the U.S. Army Corps of Engineers (USACE), North Atlantic Division, Baltimore District, to complete a Feasibility Study (FS) for the Fuze and Booster Quarry Munitions Response Site (MRS) (RVAAP-016-R-01) at the Former Ravenna Army Ammunition Plant (RVAAP) in Portage and Trumbull Counties, Ohio. This FS is being prepared under Delivery Order No. 0001 of *Multiple Award Military Munitions Services Performance-Based Acquisition* Contract No. W912DR-15-D-0016. The delivery order was issued by the USACE, Baltimore District, on August 26, 2016.

No explosive hazard or unacceptable risks are present on the MRS. Therefore, this FS evaluates No Action for the Fuze and Booster Quarry MRS to support No Action at the MRS.

## Fuze and Booster Quarry MRS History and Background

The Fuze and Booster Quarry MRS comprises 4.92 acres within RVAAP. The MRS is located south of Newton Falls Road and north of Fuze and Booster Road. The Fuze and Booster Quarry was a stone and ballast quarry excavated to provide building material for RVAAP. The quarry was used from 1945 until 1949 as an open burn area where sawdust waste generated at Load Lines 6 and 11 was thermally treated. Thereafter, the quarry was used as a landfill that reportedly accepted fuze and booster assemblies, projectiles, residual ash, and sanitary waste. In 1976, the landfill materials, inclusive of the munitions-related items historically disposed of at the MRS, were removed and transferred to either Ramsdell Quarry or one of the other burning grounds at RVAAP. Around this time three elongated ponds were constructed at the MRS for use as settling ponds. From 1987 through 1993, spent brine regenerate and sand filtration backwash water were discharged to the ponds from the facility's potable water treatment system. This discharge was regulated under a National Pollutant Discharge Elimination System (NPDES) permit. The ponds have been inactive since 1993 (e2M, 2007).

The current configuration of the MRS consists of the three elongated ponds situated end to end and separated by earthen berms. The surface water in the ponds is approximately 15 to 20 feet below the surrounding grade, and the depths of the water in the ponds fluctuate depending on the seasons and amount of precipitation. The southern two quarry ponds are filled with water year-round. Water is typically present in the northern pond; however, water levels can vary widely, and sometimes no water is present during very dry periods. The ponds are surrounded by a mature hardwood forest, and a gravel road leads up to the western side of the MRS.

Facility personnel have stated that any type of munitions produced when the facility was in operation may have been destroyed at the MRS. These munitions may have included rockets, bombs, fuzes, detonators, flares, missiles, grenades, landmines, medium- and large-caliber projectiles, explosives, mortars, propellants, practice ordnance, pyrotechnics, and small arms.

Current activities at the Fuze and Booster Quarry MRS include maintenance and natural resource management activities. While maintenance and natural resource management activities will continue at the site, the future land use for the MRS is for military training and hunting/fishing. These activities are preferably

assessed using the Commercial/Industrial Land Use Exposure Scenario and the Industrial Receptor as the Representative Receptor.

USACE completed a Remedial Investigation (RI) at the Fuze and Booster Quarry MRS in June 2015 as documented in *Final Remedial Investigation Report for RVAAP-016-R-01 Fuze and Booster Quarry MRS* (CB&I, 2015). No DoD military munitions confirmed to be munitions and explosives of concern (MEC) were found at the MRS during the RI; however, munitions debris (MD) was encountered. The MD items were solid and/or inert and did not pose an explosive safety hazard. Because no MEC was found during the intrusive investigation and based on the statistical approach used to select the number of anomalies to investigate, the RI concluded that no explosive hazards were present. Only cultural debris items (e.g., trash cans, metal pipes, and sheet metal) were observed within the ponds; no MEC or MD was observed in the ponds.

No explosive hazards were found during the RI; therefore, no MEC hazard assessment was required for the MRS. During the RI the MRS was assigned a Munitions Response Site Prioritization Protocol (MRSPP) priority of 5. The MRSPP tables were updated as part of the FS in accordance with the Munitions Response Site Prioritization Protocol Primer (DoD, 2007) and the revised MRSPP priority is “No Longer Required”.

The ecological risk assessment conducted as part of the RI determined that ecological receptors in the aquatic environment could be affected by site-related chemicals in wet sediment. The chemicals of concern identified during previous investigations at the MRS under the Installation Restoration Program (IRP) will continue to be addressed under the IRP. No risks due to munitions constituents (MC)-related contamination was identified in the human health risk assessment. Therefore, the results of the RI fieldwork concluded no unacceptable risks due to MC exists at the MRS.

## *Problem Identification*

During the RI, no MEC was found and no unacceptable risks due to MC-related contamination were identified at the MRS. Under CERCLA, as applied to Military Munitions Response Program (MMRP), if no explosive hazard or unacceptable risk due to MC-related contamination is found, there is no basis for a remedial action. As there is no exposure to potential hazards present at the MRS, no remedial action is necessary to ensure protection of human health and the environment.

# 1.0 INTRODUCTION

HydroGeoLogic, Inc. (HGL) has been contracted by the U. S. Army Corps of Engineers (USACE), North Atlantic Division, Baltimore District, to complete a Feasibility Study (FS) for the Fuze and Booster Quarry Munitions Response Site (MRS) at the Former Ravenna Army Ammunition Plant (RVAAP) in Portage and Trumbull Counties, Ohio. This FS is being prepared under Delivery Order No. 0001 of *Multiple Award Military Munitions Services Performance-Based Acquisition* Contract No. W912DR-15-D-0016. The delivery order was issued by the USACE, Baltimore District, on August 26, 2016.

## 1.1 Regulatory Framework and Authorization

Pursuant to the Department of Defense (DoD) Manual 4715.20, *Defense Environmental Response Program* (*DERP) Management* (DoD, 2012), USACE is conducting Military Munitions Response Program (MMRP) activities in accordance with the DERP statute (10 United States Code [USC] 2701 et seq.), the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) (42 USC § 9620), Executive Orders 12580 and 13016, and the *National Oil and Hazardous Substances Pollution Contingency Plan* (NCP) (40 Code of Federal Regulations [CFR] Part 300).

## 1.2 Purpose

The purpose of an FS is to develop, evaluate, and perform a detailed analysis of potential remedial alternatives for the MRS that will meet RAOs and allow the DoD to select and propose an appropriate remedy. This FS used the information obtained during the Remedial Investigation (RI) to perform a systematic analysis of appropriate remedial actions based on the current and anticipated future land uses of the MRS. This FS was developed in accordance with the U.S. Army's *Munitions Response Remedial Investigation/Feasibility Study Guidance* (U.S. Army, 2009) and with U.S. Environmental Protection Agency's (USEPA) *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA, 1988).

## 1.3 MRS Description

The 4.92-acre Fuze and Booster Quarry MRS is located south of Newton Falls Road and north of Fuze and Booster Road at RVAAP. The MRS was a stone and ballast quarry excavated to provide building material for RVAAP. The quarry was used from 1945 until 1949 as an open burn area where sawdust waste generated at Load Lines 6 and 11 was thermally treated. Thereafter, the quarry was used as a landfill that reportedly accepted fuze and booster assemblies, projectiles, residual ash, and sanitary waste. In 1976, the landfill materials, inclusive of the munitions disposed of at the MRS, were removed and transferred to either Ramsdell Quarry or one of the other burning grounds at the facility. Around this time the three elongated ponds were constructed at the MRS for use as settling ponds. From 1987 through 1993, spent brine regenerate and sand filtration backwash water were discharged to the ponds from the facility's potable water treatment system. This discharge was regulated under a National Pollutant Discharge Elimination System (NPDES) permit. The ponds have been inactive since 1993 (e2M, 2007).

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the northern pond; however, water levels can vary widely, and sometimes no water is present during very dry periods. The ponds are surrounded by mature hardwood forest, and a gravel road leads up to the western side of the MRS.

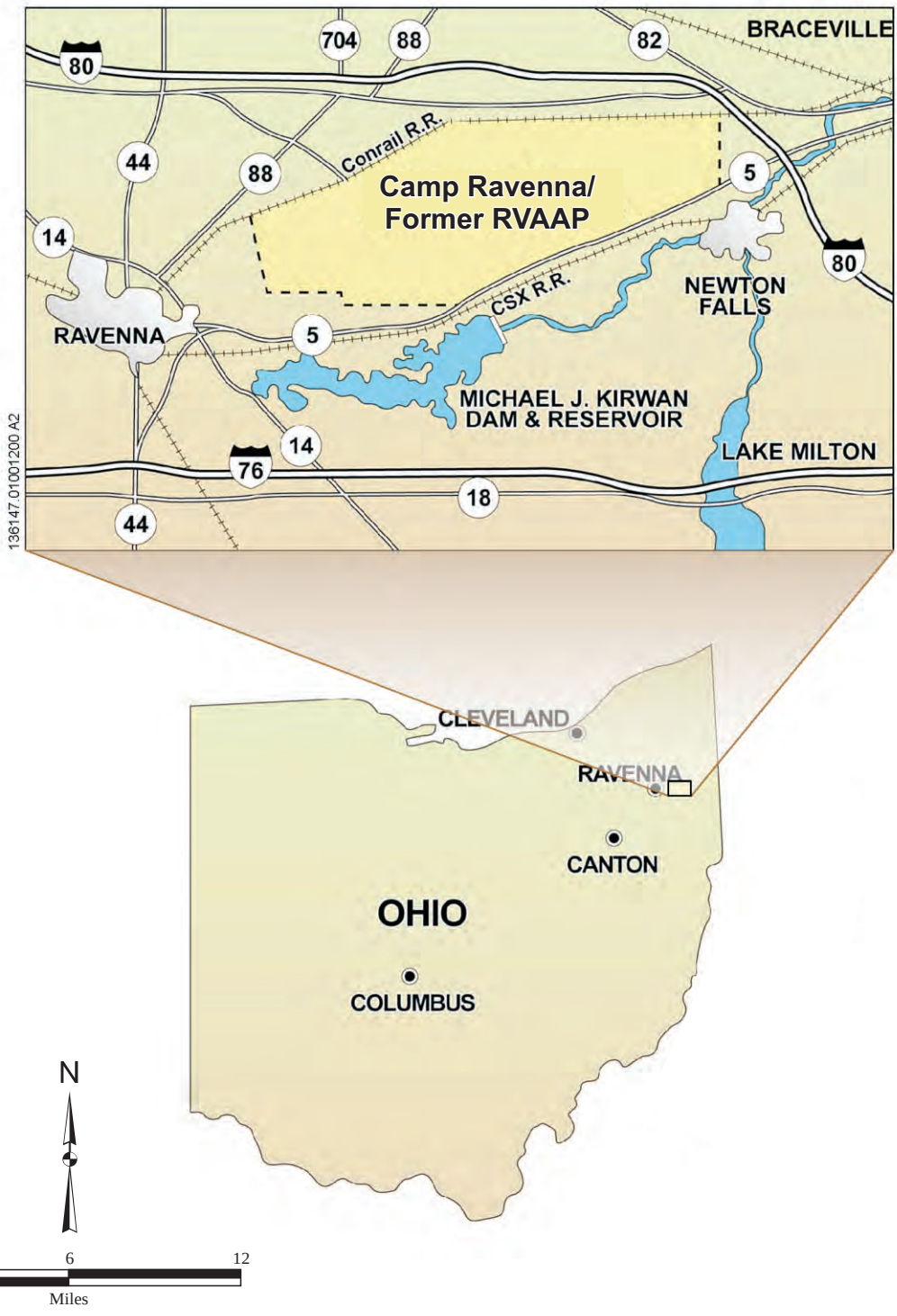
Facility personnel have stated that any type of munitions produced when the facility was in operation may have been destroyed at the MRS. These munitions may have included rockets, bombs, fuzes, detonators, flares, missiles, grenades, landmines, medium- and large-caliber projectiles, explosives, mortars, propellants, practice ordnance, pyrotechnics, and small arms.

### *1.3.1 Physical Setting and Administrative Control*

RVAAP (Federal Facility ID No. OH213820736), now known as the Camp Ravenna Joint Military Training Center (Camp Ravenna), is in northeastern Ohio within Portage and Trumbull Counties and is approximately 3 miles east-northeast of the city of Ravenna. The facility is approximately 11 miles long and 3.5 miles wide. The facility is bounded by the Norfolk Southern Railroad to the north; State Route 5, the Michael J. Kirwan Reservoir, and the CSX System Railroad to the south; State Route 534 to the east; and Garret, McCormick, and Berry Roads to the west. In addition, the facility is surrounded by the communities of Windham, Garrettsville, Newton Falls, Charlestown, and Wayland (Figure 1-1).

Administrative control of the 21,683-acre facility was transferred to the U.S. Property and Fiscal Officer (USP&FO) for Ohio and was subsequently licensed to the Ohio Army National Guard (OHARNG) for use as a training site, Camp Ravenna. The restoration program involves the cleanup of areas associated with operations at RVAAP located across the facility.

The Fuze and Booster MRS is a 4.92-acre parcel located south of Newton Falls Road and north of Fuze and Booster Road (Figure 1-2 and Figure 1-3). The MRS is located on federal property, with administrative accountability assigned to the USP&FO for Ohio. The MRS is jointly managed by the Army National Guard (ARNG) and OHARNG. Table 1-1 provides an administrative summary of the MRS.

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Source: CB&I

Legend

Camp Ravenna/Former RVAAP

**Figure 1-1**
**Location Map**
**Camp Ravenna/**
**Former RVAAP**
**Portage and Trumbull Counties, Ohio**

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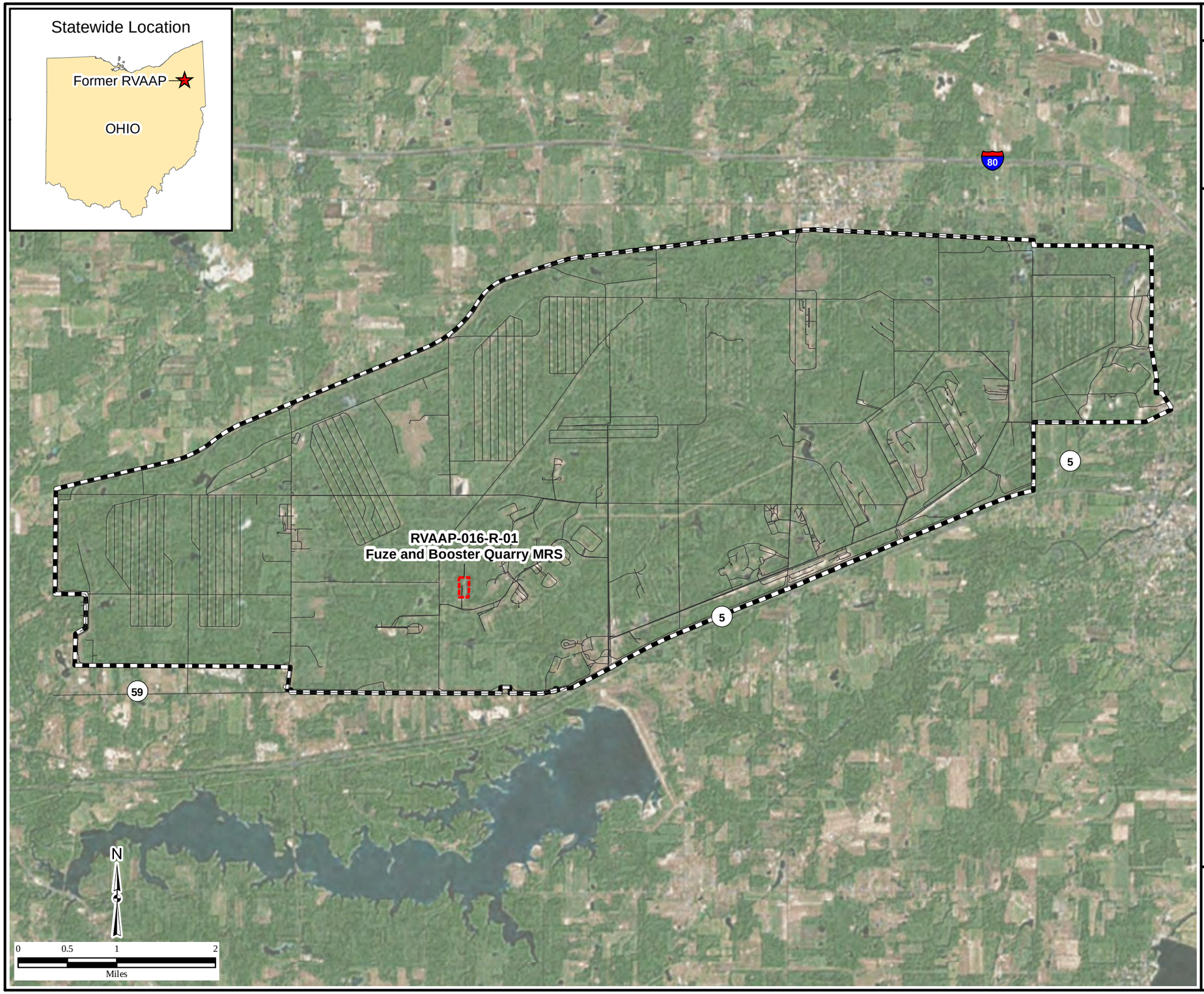


*HGL—Feasibility Study*
*Former RVAAP, Ohio*

# Figure 1-2
# MRS Location
# Fuze and Booster Quarry
# Former RVAAP
# Portage and Trumbull Counties, Ohio

Legend

- Road
- MRS
- Installation Boundary

Notes:
MRS=munitions response site
RVAAP=Ravenna Army Ammuntion Plant

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*ArcGIS Online Imagery*

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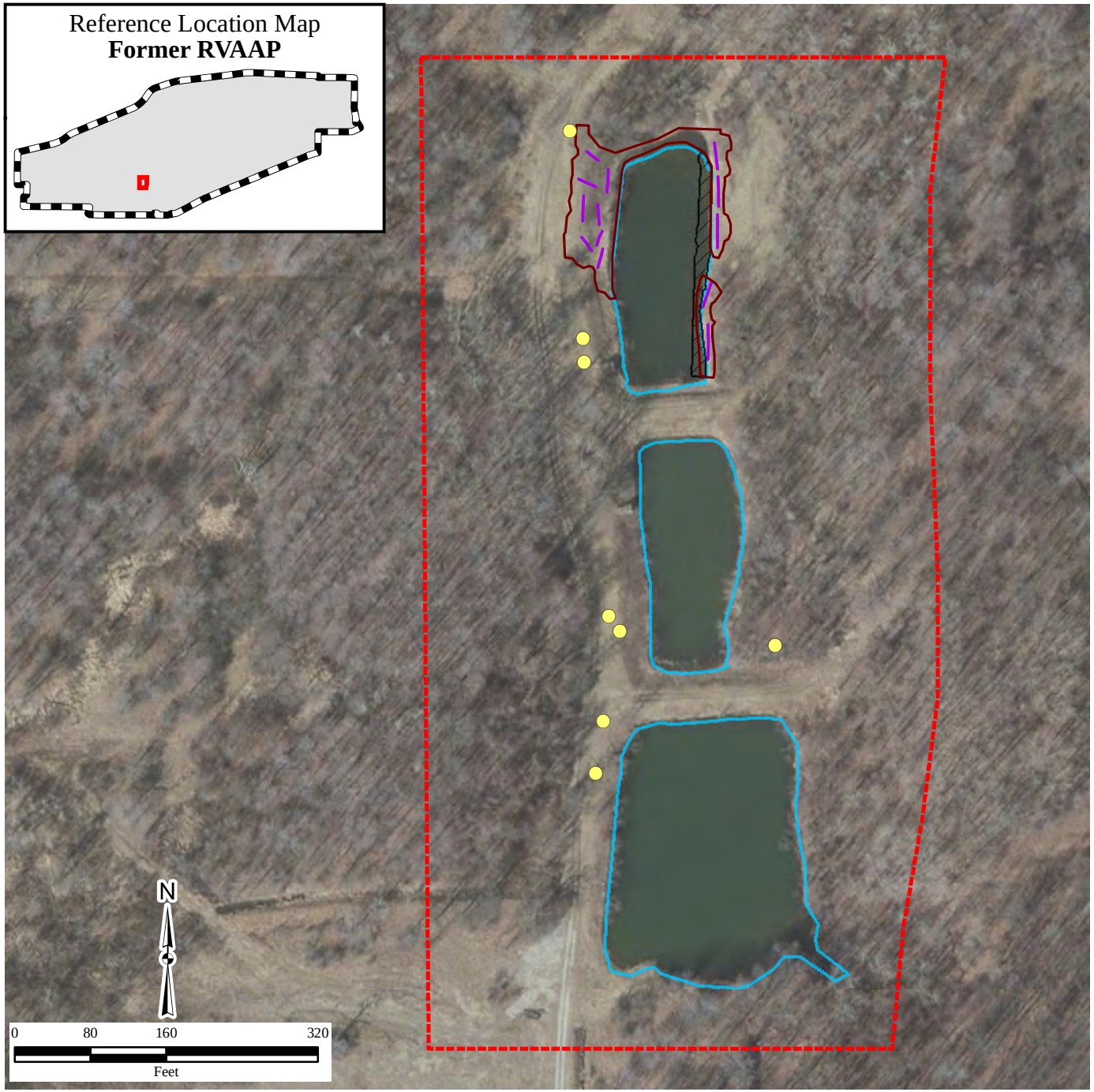


# Figure 1-3
# RI Intrusive Results
# Fuze and Booster
# Quarry MRS
# Former RVAAP
# Portage and Trumbull
# Counties, Ohio

Legend

Single Anomaly Results

- MDAS
- Exploratory Trench
- Area of Pond Not Accessible for Diving Operations
- Surface Water
- High Anomaly Density Area
- MRS
- Installation Boundary

Notes:
MDAS=material documented as safe
MRS=munitions response site
RI=Remedial Investigation
RVAAP=Ravenna Army Ammuntion Plant

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*Source: HGL,CB&I, USACE, e²M*
*ArcGIS Online Imagery*

HGL HydroGeoLogic, Inc

*HGL—Feasibility Study—Former RVAAP, Ohio*

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Table 1-1. Administrative Summary of the Fuze and Booster Quarry MRS

| Investigation Area | AEDB-R MRS Number | Area (Acres) | Property Owner | MRS Management Responsibility |
|---|---|---|---|---|
| Fuze and Booster Quarry MRS | RVAAP-016-R-01 | 4.92 | USP&FO | ARNG/OHARNG |

ARNG = Army National Guard.
AEDB-R = Army Environmental Database Restoration Module.
MRS = Munitions Response Site.
OHARNG = Ohio Army National Guard.
USP&FO = U.S. Property and Fiscal Officer.

## *1.4 Current and Projected Land Use*

The human health risk assessment conducted as part of the RI was completed prior to the issue of the "Final Technical Memorandum: Land Uses and Revised Risk Assessment Process for the Ravenna Army Ammunition Plant (RVAAP) Installation Restoration Program, Portage/Trumbull Counties, Ohio" (Risk Assessment Technical Memo) (Army National Guard Directorate, 2014). The Risk Assessment Technical Memo defined three Categorical Land Uses and Representative Receptors to be considered during the RI phase of the CERCLA process. These three land uses and Representative Receptors are summarized below.

1.) Unrestricted (Residential) Land Use – Resident Receptor (Adult and Child) (formerly called Resident Farmer);

2.) Military Training Land Use – National Guard Trainee; and

3.) Commercial/Industrial Land Use – Industrial Receptor (USEPA Composite Worker).

The Risk Assessment Technical Memo allowed for exceptions to evaluating these three land uses, depending upon their stage of completion. Because the RI was substantially complete by the time the Risk Assessment Technical Memo was finalized, the three land uses were not fully evaluated in the RI.

The RI report identified the Military Training Land Use as the most reasonably anticipated land use, and the National Guard Trainee was used as the Representative Receptor. The future land use is still expected to be military training, but will also include maintenance, natural resource management, hunting and fishing, and restoration activities (e.g., groundwater monitoring). Neither the hunting and fishing activities nor the National Guard Trainee's exposure scenario equate to full-time work, so neither scenario accounts for the potential of full-time personnel being present at the MRS. Therefore, when there is a possibility that a full-time occupational exposure may occur on a site, the Commercial/Industrial Land Use using the Industrial Receptor is evaluated. Additionally, the Military Training Land Use requires additional monitoring to ensure that no full-time occupational exposure occurs. For this FS, the Commercial/Industrial Land Use was evaluated using the Industrial Receptor to allow for full-time occupational personnel to work freely on the site.

The exposure scenario for the Industrial Receptor (USEPA's Composite Worker) does not include subsurface exposure. Since the National Guard Trainee's exposure scenario does include subsurface exposure to 4 feet below ground surface (bgs), this value was used to represent the subsurface depth for the Industrial Receptor in this FS. The RVAAP's Facility-Wide Human Health Risk Assessor Manual (USACE, 2005) has detailed descriptions of the exposure scenario and exposure parameters for the National Guard Trainee. The

exposure scenario and parameters for the Industrial Receptor can be found at the USEPA's Regional Screening Levels webpage.

## *1.5 Report Organization*

The organization of this FS, including the specific sequence of steps used to develop, screen, and analyze remedial alternatives, is as follows:

- Section 1.0 – Introduction: This section discusses the regulatory framework for and purpose of this FS, describes the MRS property and provides background information regarding it, and summarizes previous investigations.
- Section 2.0 – Project Objectives: This section presents the conceptual site model (CSM), applicable or relevant and appropriate requirements (ARARs), and remedial action objectives (RAOs) for the MRS.
- Section 3.0 – Detailed Analysis of the Alternative: This section presents a detailed evaluation of the No Action alternative. The evaluation is based on the nine criteria in the NCP: protection to human health and the environment; compliance with ARARs; long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; cost; state acceptance; and community acceptance.
- Section 4.0 – References: This section lists pertinent documents cited in this FS report.

# 2.0 PROJECT OBJECTIVES

This section presents a summary of the CSM for the Fuze and Booster Quarry MRS. Based on the results of the RI, no explosive hazards or unacceptable risks due to MC-related contamination are present at the MRS. Section 2.1 describes the current CSM and discusses any changes made to the CSM following the RI. Section 2.2 summarizes that there is no basis for a remedial action at the MRS.

## 2.1 Conceptual Site Model

The information collected during the RI and the conclusions reached were used to update the CSM and identify actual, potentially complete, or incomplete source-receptor interactions for the MRS for both current and reasonably anticipated future land uses. The CSMs (Figure 2-1a and 2-1b and Table 2-1) has three sections: Potential Sources, Receptors, and Interactions for MEC, with complete or incomplete exposure pathways identified for each receptor. Each section is discussed below:

- Sources: Sources are those areas where MEC has entered (or may enter) the physical system. A source is the location where MEC is situated or expected to be found.
- Receptors: A receptor is an organism (human or ecological) that contacts a chemical or physical agent. The pathway evaluation must consider both current and reasonably anticipated future land use, as receptors are determined on that basis.
- Interactions: Hazards from MEC arise from direct contact as a result of some human activity. Interactions describe ways that receptors come into contact with a source.

The applicable receptors presented in the RI report CSMs have been revised in the FS CSMs as discussed in Section 1.4. The RI CSMs presented the National Guard Trainee and Biota as the applicable receptors. The FS CSMs (Figure 2-1a and Figure 2-1b) includes the Industrial Receptor.

Table 2-1. Fuze and Booster Quarry CSM

| Description | CSM Finding |
|---|---|
| *Location Profile* | |
| Boundaries | Site comprises 4.92 acres within RVAAP as shown on Figure 1-2. |
| Structures | No structures and no paved roads are located within the MRS. |
| Utilities | No utilities are located within the MRS. |
| Security | Access to Camp Ravenna is controlled; however, access to the MRS is unrestricted. |
| *Land Use and Receptors* | |
| Current Land Use | Maintenance and natural resource management activities |
| Potential Future Land Use | Potential military training and hunting or fishing |
| Human Receptors | Industrial Receptor |
| Wetlands | Seasonal wetlands have been identified in the shallow areas of the quarry ponds through planning-level surveys; however, a jurisdictional delineation has not been conducted at the MRS. |
| Ecological Receptors | Biota such as terrestrial invertebrates (earthworms), voles, shrews, robins, foxes, owls, hawks, muskrat, mink, mallards, great blue heron, benthic invertebrates, and aquatic biota. |
| Cultural Resources | A cultural resources survey has not been conducted at this MRS. |

### *2.1.1 MEC Exposure Pathway Analysis*

An exposure pathway is the course a chemical or physical agent takes from a source to a receptor. Each potential MEC pathway includes a source, an interaction (access and activity), and a receptor. A pathway is considered complete when a source is known to exist and when receptors have access to the MRS while engaging in an activity that results in contact with the source. A pathway is considered potentially complete when a source has not been confirmed, but is suspected to exist, and when receptors have access to the MRS while engaging in an activity that results in contact with the source. Lastly, an incomplete pathway is any case where one of the four components (source, activity, access, or receptor) is missing from the MRS. As summarized on Figure 2-1, there are incomplete pathways for MEC for the Fuze and Booster Quarry MRS in the surface and subsurface.

#### *2.1.1.1 Sources*

An RI was completed at the Fuze and Booster Quarry MRS in 2015 to determine the nature and extent of DoD military munitions and munitions constituents (MC)-related contamination and to identify the associated hazards and risks posed to likely human and ecological receptors. No MEC was discovered during the RI. Approximately 74.5 pounds of MD items were encountered between 2 inches bgs and 14 inches bgs within eight targets following the digital geophysical mapping survey (Figure 1-3). MD was identified at isolated locations along slopes on the western sides of the ponds. MD included parts from the following munitions:

- 20mm M75 series armor-piercing tracers,
- 75mm MK1 series high-explosive projectiles,
- 155mm MK1 high-explosive projectiles, and

- Fuze and fragments associated with unknown munitions types.

In addition, 13 trenches were dug within areas with high anomaly densities along the banks of the northern pond. Most of the trenches were 20 feet in length. No MEC or MD was recovered from the trenches.
Divers performed an underwater investigation of the three ponds as part of the RI. Diving operations were not performed over a small 0.08-acre area near the eastern shore of the northern pond, where the water is approximately 1 to 2 feet deep and heavily vegetated. No DoD military munitions or MD were found during this underwater investigation.

#### *2.1.1.2 Receptors*

A receptor for the CSM is any human who comes into physical contact with a potential explosive hazard. The future land use for the Fuze and Booster Quarry MRS is Commercial/Industrial Land Use, and the human receptor with the greatest opportunity for exposure to an explosive hazard is the Industrial Receptor. As established in Section 1.4, the Industrial Receptor represents a full-time occupational receptor at the MRS, and the Commercial/Industrial Land Use includes activities consistent with full-time employees or career military personnel who are expected to work daily at Camp Ravenna. The maximum exposure depth for the Industrial Receptor is 4 feet bgs, which is below the maximum depth that MD was found during the RI fieldwork (14 inches bgs). Section 1.4 provides details on current and projected land use for this MRS.

#### *2.1.1.3 Interactions*

Interactions are the ways that receptors contact a source, and include both access and activity considerations. Activity describes ways that receptors come into contact with a source. Access describes the degree to which MEC is available to potential receptors. A receptor may contact MEC that is on the surface by walking through the MRS and treading on MEC unintentionally. A receptor may contact MEC in the subsurface when performing intrusive activities.

Current activities at the Fuze and Booster Quarry MRS include maintenance, natural resource management activities such as walking, and restoration activities (e.g., monitoring of existing groundwater wells). Current activities conducted at the MRS are not intrusive; however, based on potential military training the National Guard Trainee's exposure scenario does include subsurface exposure to 4 feet bgs. This value was used to represent the subsurface depth for the Industrial Receptor in this FS. Future land use for this MRS is expected to include the current activities and potentially military training activities. No construction projects requiring intrusive activities are currently scheduled for the MRS. As stated in Section 1.4, the Industrial Receptor is the Representative Receptor for this MRS, with a subsurface exposure depth defined as 4 feet bgs. Once on the MRS, receptors would have access to any potential MEC on the ground surface.

#### *2.1.1.4 MEC Exposure Conclusions*

Based on the findings of the RI, no explosive hazards are present at the MRS. No DoD military munitions confirmed to be MEC were found during RI intrusive investigations and only MD were found. Therefore, the surface and the subsurface pathways for MEC are considered incomplete for the Industrial Receptor.

### *2.1.2 MC Exposure Pathway Analysis*

The RI determined that no known or suspected unacceptable risk due to MC-related contamination exists at the MRS; therefore, there is not a complete MC exposure pathway for any terrestrial or aquatic biota receptor. The MC CSM is presented in Figure 2-1b and Table 2-1.

## *2.2 Problem Identification*

No explosive hazard is present at the MRS based on the findings of the RI. No DoD military munitions confirmed to be MEC were found at the MRS and only MD was found. No unacceptable risks are present on the MRS due to MC-related contamination as determined by the risk assessment presented in the RI. Therefore, under CERCLA, there is no basis for a remedial action at the MRS. This FS evaluates No Action for the Fuze and Booster Quarry MRS to support No Action at the MRS.

FIGURE 2-1a MEC CONCEPTUAL SITE MODEL
RVAAP-016-R-01 FUZE AND BOOSTER QUARRY MRS

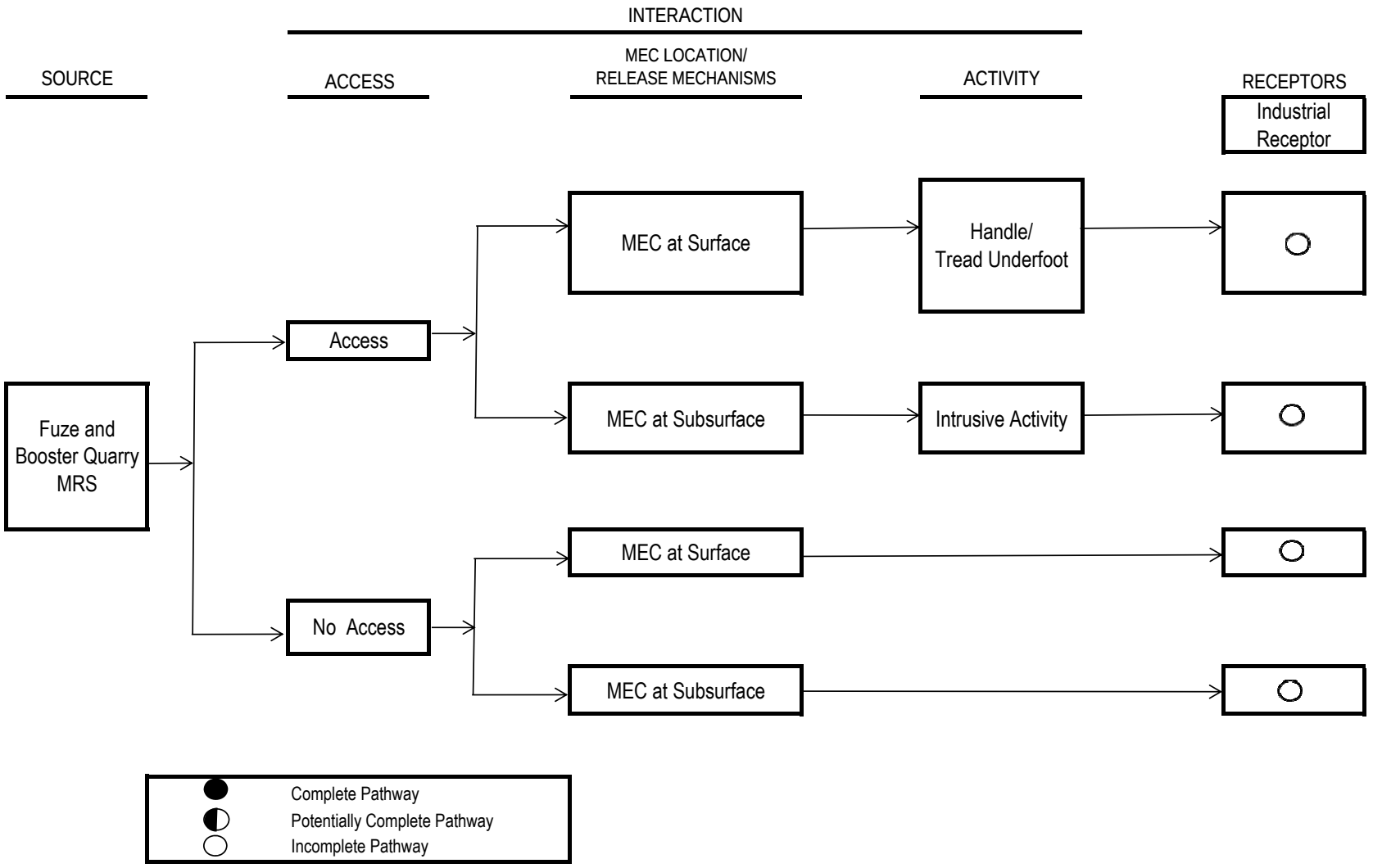

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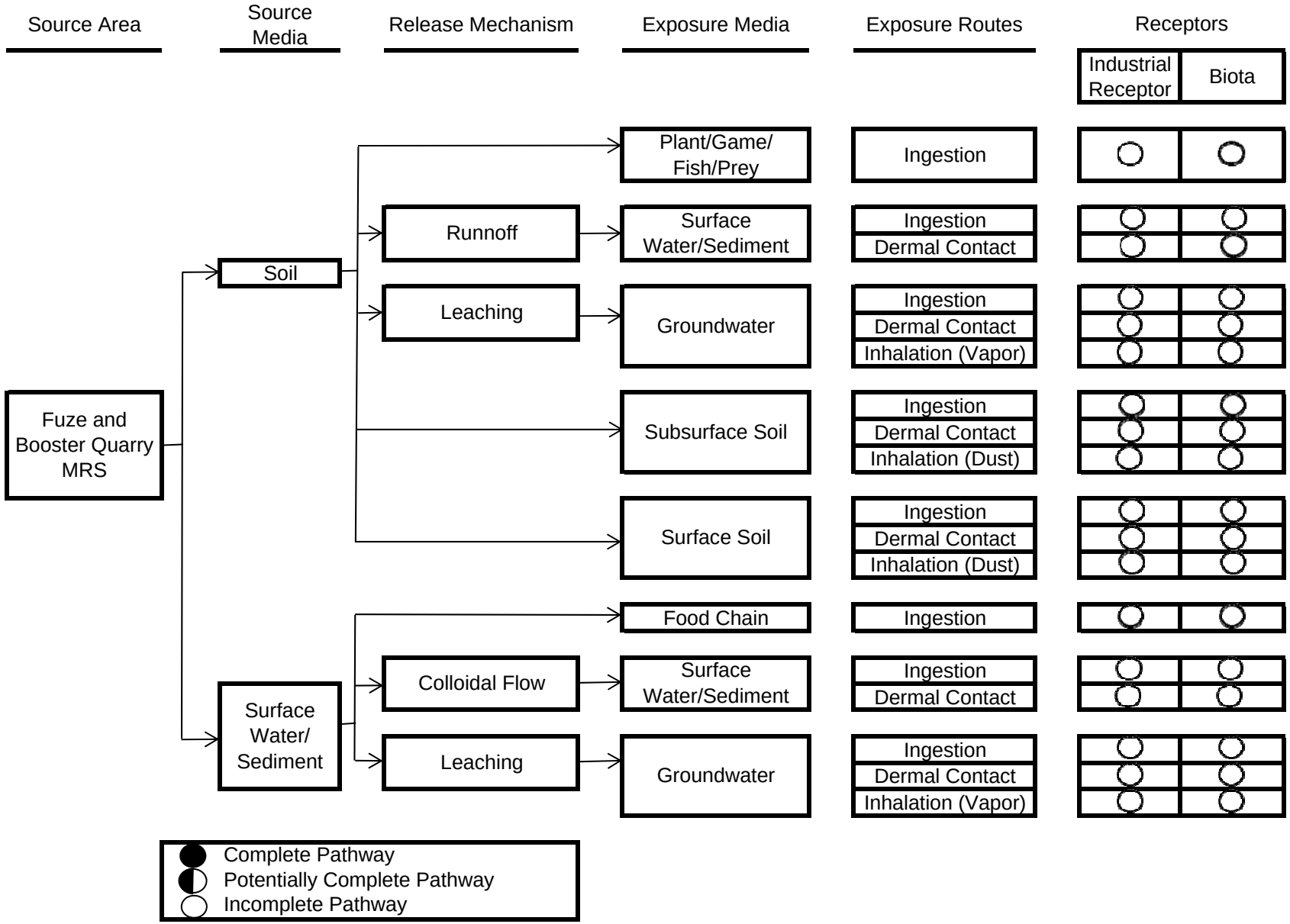
**FIGURE 2-1b MC CONCEPTUAL SITE MODEL**
**RVAAP-016-R-01 FUZE AND BOOSTER QUARRY MRS**



## *2.3 Preliminary Identification of Applicable or Relevant and Appropriate Requirements and "To Be Considered" Information*

Remedial actions must meet a level and standard of control that attain standards, requirements, limitation, or criteria that are "applicable or relevant and appropriate" (ARAR) under the Section 121 (d)(2)(A) of CERCLA. Because no unacceptable risk due to MC-related contamination are presented on the MRS, no chemical-specific ARARs are identified. Because no actions will be implemented under the No Action alternative, no location- or action-specific ARARs are identified.

## *2.4 Remedial Action Objectives*

As established in the RI, no explosive hazard or unacceptable risk due to MC-related contamination is present at the MRS. Therefore, development of RAOs for the MRS is unnecessary.

# 3.0 DETAILED ANALYSIS OF THE NO ACTION ALTERNATIVE

This section presents a detailed analysis of the No Action alternative. The analysis consists of evaluating No Action using the nine criteria listed in the NCP. The purpose of this detailed analysis is to support No Action at the MRS.

## 3.1 Overview of Evaluation

Section 300.430(e) of the NCP lists nine CERCLA criteria against which a remedial alternative must be assessed. The NCP (Section 300.430(f)) states that the first two criteria, protection of human health and the environment and compliance with ARARs, are "threshold criteria" that must be met by the selected remedial action unless a waiver is granted under Section 121(d)(4) of CERCLA. The next five criteria are "primary balancing criteria," and the trade-offs within this group must be balanced. The final two criteria, state and community acceptance, are "modifying criteria" that are evaluated following the comment periods on the FS report and the Proposed Plan.

## 3.2 Individual Analysis of the No Action Alternative

The following sections provide a detailed analysis of the No Action alternative according to the nine NCP criteria.

### 3.2.1 Threshold Criteria

Overall Protection of Human Health and the Environment – The selected remedy presented in the Record of Decision (ROD) must meet this threshold criterion. The threshold criterion will be met if the risks associated with human exposures are eliminated, reduced, or controlled, and if the remedial action is protective of the environment. No explosive hazard or unacceptable risk due to MC-related contamination is present at the MRS. Therefore, the No Action alternative is protective of human health and the environment and meets this criterion.

Compliance with ARARs – Compliance with ARARs is a threshold criterion that must be met by the remedial action. There are no chemical-specific, location-specific, or action-specific ARARs identified for this alternative. Therefore, the No Action alternative meets this criterion.

### 3.2.2 Balancing Criteria

Long-Term Effectiveness and Permanence – The level of risk associated with DoD military munitions and MC-related contamination after implementation of the remedial alternative is evaluated by this criterion. No explosive hazard or unacceptable risk due to MC-related contamination is present at this MRS. Therefore, the No Action alternative will be effective in the long term and no residual hazards or risks will remain at the MRS.

Reduction of Toxicity, Mobility, or Volume Through Treatment – The statutory preference for remedial technologies that significantly and permanently reduce the toxicity, mobility, or volume of the waste is addressed by this criterion. The No Action alternative includes no treatment because there is no explosive hazard or unacceptable risk associated with MC-related contamination is present at the MRS.

Short-Term Effectiveness – The effect of the remedial alternative from the beginning of construction and implementation to the completion of the remedial alternative is addressed under this criterion. Because no active remediation activities are conducted, no additional hazards are posed to current receptors or the future industrial receptor as a result of implementing the No Action alternative. The No Action alternative will not result in any adverse short-term effects on the environment.

Implementability – The technical and administrative feasibility of implementing the remedial action is addressed by this criterion. Technical feasibility refers to the ability to construct, reliably operate, and meet technology-specific regulations for process options until a remedial action is complete. Administrative feasibility refers to the ability to obtain approvals from other offices and agencies; the availability of treatment, storage, and disposal services; and the requirements for, and availability of, specific equipment and technical specialists. The No Action alternative does not involve active remediation; therefore, technical feasibility is not a consideration. No services or equipment are necessary to implement No Action. This alternative will not interfere with any planned remedial action in the future. The No Action alternative is administratively feasible to OHARNG/Camp Ravenna because no explosive hazard or unacceptable risk due to MC-related contamination is present on the MRS and the No Action alternative is expected to receive Ohio EPA concurrence because no explosive hazard or unacceptable risk due to MC-related contamination is present at the MRS.

Cost – Capital and long-term management costs are estimated under this criterion. The No Action alternative does not have any capital or long-term management costs associated with it.

### *3.2.3 Modifying Criteria*

State Acceptance – This criterion will be evaluated during incorporation of regulatory review comments into this FS, and during the future submittals of the Proposed Plan and ROD.

Community Acceptance – This criterion will be evaluated when the Proposed Plan is presented to the public for review and comment.

### *3.2.4 Overall Evaluation*

The No Action alternative is technically and administratively implementable and there are no costs. The No Action alternative is protective of human health and the environment because no explosive hazard or unacceptable risk due to MC-related contamination is present at the MRS.

## *3.3 Munitions Response Site Prioritization Protocol*

In response to a 2002 National Defense Authorization Act requirement, DoD developed the MRSPP as the methodology for prioritizing MRSs for response actions. In 2005, the Final Rule for the MRSPP was issued and codified at 32 Code of Federal Regulations Part 179. The MRSPP provided in the RI was revised for this Feasibility Study in accordance with 32 CFR Part 179 and the guidance provided in the *Munitions Response Site Prioritization Protocol Primer* (DoD, 2007). The MRSPP consists of the following three modules to evaluate the unique characteristics of each hazard type at an MRS: Explosive Hazard Evaluation (EHE), Chemical Warfare Materiel Hazard Evaluation (CHE), and Health Hazard Evaluation (HHE). The composite rating of the three modules is used to assign an MRS priority ranking for the MRS ranging from 1 to 8, with alternative ratings of Evaluation Pending, No Known or Suspected Hazard, or No Longer Required. The revised MRSPP for the Fuze and Booster Quarry MRS is included in Appendix A. The revised composite MRSPP priority is “No Longer Required”.

# 4.0 REFERENCES

Army National Guard Directorate (ARNG), 2014. "Final Technical Memorandum: Land Uses and Revised Risk Assessment Process for the Ravenna Army Ammunition Plant (RVAAP) Installation Restoration Program, Portage/Trumbull Counties, Ohio." February.

CB&I Federal Services LLC (CB&I), 2015. *Final Remedial Investigation Report for RVAAP-016-R-01 Fuze and Booster Quarry MRS*. June.

Department of Defense (DoD), 2007. *Munitions Response Site Prioritization Protocol Primer,* April.

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engineering-environmental Management, Inc. (e2M), 2007. *Final Military Munitions Response Program Historical Records Review*, *Ravenna Army Ammunition Plant, Ohio*. January.

U.S. Army, 2009. *Final United States Army Military Munitions Response Program Munitions Response Remedial Investigation/Feasibility Study Guidance.* November.

USACE, 2005. RVAAP*'s Facility-Wide Human Health Risk Assessor Manual, Amendment 1,* December.

U.S. Environmental Protection Agency (USEPA), 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final*. October.

USEPA, 2000. *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*. July.

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# *Appendix A*

# *Munitions Response Site Prioritization Protocol Worksheets*

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## Table A

## MRS Background Information

DIRECTIONS: Record the background information below for the MRS to be evaluated. Much of this information is available from DoD databases, such as RMIS. If the MRS is located on a FUDS property, the suitable FUDS property information should be substituted. In the MRS summary, briefly describe the UXO, DMM, or MC that are known or suspected to be present, the exposure setting (the MRS's physical environment), any other incidental non-munitions related contaminants found at the MRS (e.g., benzene, trichloroethylene), and any potentially exposed human and ecological receptors. Include a map of the MRS, if one is available.

| | |
|---|---|
| **Munitions Response Site (MRS) Name:** | **Fuze and Booster Quarry (RVAAP-016-R-01)** |
| **Component:** | US Army |
| **Installation/Property Name:** | **Ravenna Army Ammunition Plant** |
| **Location (City, County, State):** | Ravenna, Portage and Trumbull Counties, Ohio |
| **UTM Coordinates (NAD83):** | X = 495533.228229 Y = 4559646.312867 |
| **Site Name (RMIS ID):** | OH213820736 |
| **Project Name (Project No.):** | Ravenna Army Ammunition Plant/Contract No. W912DR-09D-0005/0002 |
| **Date Information Entered/Updated:** | 10-Oct-2017 |
| **Point of Contact (Name/Phone):** | Craig Coombs, USACE Louisville District/(502)315-6324 |

| **Project Phase ("X" only one):** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **PA** | | **SI** | | **RI** | X | **FS** | | **RD** |
| | **RA-C** | | **RIP** | | **RA-O** | | **RC** | | **LTM** |

| **Media Evaluated ("X" all that apply):** | | | | |
|---|---|---|---|---|
| | **Groundwater (human receptor)** | X | **Sediment (human receptor)** |
| | **Surface soil (human receptor)** | | **Surface water (ecological receptor)** |
| X | **Sediment (ecological receptor)** | | **Surface water (human receptor)** |

### MRS Summary

**MRS Description: Describe the munitions-related activities that occurred at the installation, the dates of operation, and the UXO, DMM (by type of munition, if known) or munitions constituents (by type, if known) known or suspected to be present):**

The Fuze and Booster Quarry MRS is a 4.92-acre site located south of Newton Falls Road and north of Fuze and Booster Road at the facility. The MRS was originally a stone and ballast quarry that was excavated to provide building material for the former RVAAP and began operations in 1945. The quarry was used from 1945 until 1949 as an open burn area where sawdust waste that may have been generated at Load Lines 6 and 11 were thermally treated. Thereafter, the quarry was used as a landfill that reportedly accepted fuze and booster assemblies, projectiles, residual ash, and sanitary waste. In 1976, the landfill materials were removed for the construction of the three existing elongated ponds for use as settling ponds. The ponds are currently inactive. According to facility personnel, any type of munitions produced at the plant may have been destroyed at the MRS; however, there is no documentation regarding the reported destruction of munitions at the MRS. No munitions or explosives of concern (MEC) were found during the RI field work; however, munitions debris (MD) was discovered. The MD was solid and/or inert, and posed no explosives safety hazard (RI Report, Section 9.1.1). Wet sediment samples were collected for munitions constituents (MC) characterization of the quarry ponds. The detected site-related chemicals (SRCs) do not pose potential risks to the National Guard Trainee that is the Representative Receptor; however, ecological receptors in the aquatic environments have the potential to be impacted (RI Report, Section 4.3). Since no MEC or material presenting a potential explosive hazard (MPPEH) has been found at the MRS to date and that there is no evidence that suggests there is a MC source at the MRS, there is no known or suspected MC hazard in wet sediment at the MRS (RI Report, Section 9.2).

**Description of Pathways for Human and Ecological Receptors:**

Based on the results of the RI field investigations, the use or introduction of munitions at the MRS is confirmed. Based on the findings of the RI, no explosive hazards are present at the MRS. The MRS was completely investigated during the R; no MEC was found and only MD were found. Therefore, the surface and the subsurface pathways for MEC are considered incomplete.Because no direct evidence of an explosive hazard exists, the pathways for MEC are incomplete for all receptors (RI Report, Sections 9.1.1). For the development of the MC conceptual site model (CSM); the findings of no MEC or even low concentrations of explosives or propellants in the wet sediment that would be indicative of a MC source is taken into consideration and there is no evidence that the detected SRCs originated from MEC, MPPEH or other specified munitions-related items or activities. Therefore, there is no known or suspected MC hazards at the MRS and the CSM was updated to reflect incomplete pathways for all human and ecological receptors in the terrestrial and aquatic environments (RI Report, Section 9.2).

**Description of Receptors (Human and Ecological):**

A receptor is an organism (human or ecological) that comes into physical contact with MEC. Human receptors identified for the Fuze and Booster Quarry MRS include both current and future land users. Potential users include facility personnel, contractors, potential trespassers, and the occasional hunter/trapper (e2M, 2008). Ecological receptors (biota) are based on animal species that are likely to occur in the terrestrial habitats at the MRS. The National Guard Trainee is considered the Representative Receptor. Ecological receptors (biota) are based on animal species that are likely to occur in the habitats at the MRS. The primary MRS-specific biota identified for the MRS include terrestrial invertebrates (earthworms), voles, shrews, robins, foxes, barn owls, hawks, muskrat, mink, mallards, great blue heron, benthic invertebrates, and aquatic biota (RI Report, Section 9.1.4).
Current activities at the Fuze and Booster Quarry MRS include maintenance and natural resource management activities. The future land use for the MRS will be military training (RI Report, Section 1.3.2).

# Table 1
# EHE Module: Munitions Type Data Element Table

Directions: Below are eleven classifications of munitions and their descriptions. Annotate the score(s) that correspond with **all** munitions types known or suspected to be present at the MRS.

Note: The terms *practice munitions* , *small arms* , *physical evidence* , and *historical evidence* are defined in Appendix C of the MRSPP Primer (Draft, Dec 2005).

| Classification | Description | Possible Score | Score |
|---|---|---|---|
| **Sensitive** | All UXO that are considered likely to function upon any interaction with exposed persons [e.g., submunitions, 40mm high-explosive (HE) grenades, white phosphorous (WP) munitions, high-explosive antitank (HEAT) munitions, and practice munitions with sensitive fuzes, but excluding all other practice munitions]. | 30 | |
| | All hand grenades containing energetic filler. | | |
| | Bulk primary explosives, or mixtures of these with environmental media, such that the mixture poses an explosive hazard. | | |
| **High explosive (used or damaged)** | All UXO containing a high-explosive filler (e.g., RDX, Composition B), that are not considered "sensitive." | 25 | |
| | All DMM containing a high-explosive filler that have been damaged by burning or detonation, or deteriorated to the point of instability. | | |
| **Pyrotechnic (used or damaged)** | All UXO containing pyrotechnic fillers other than white phosphorous (e.g., flares, signals, simulators, smoke grenades). | 20 | |
| | All DMM containing pyrotechnic fillers other than white phosphorous (e.g., flares, signals, simulators, smoke grenades) that have been damaged by burning or detonation, or deteriorated to the point of instability. | | |
| **High explosive (unused)** | All DMM containing a high-explosive filler that have not been damaged by burning or detonation, or are not deteriorated to the point of instability. | 15 | |
| **Propellant** | All UXO containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor). | 15 | |
| | All DMM containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor) that are damaged by burning or detonation, or deteriorated to the point of instability. | | |
| **Bulk secondary high explosives, pyrotechnics, or propellant** | All DMM containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor), that are deteriorated. | 10 | |
| | Bulk secondary high explosives, pyrotechnic compositions, or propellant (not contained in a munition), or mixtures of these with environmental media such that the mixture poses an explosive hazard. | | |
| **Pyrotechnic (not used or damaged)** | All DMM containing a pyrotechnic filler (i.e. red phosphorous), other than white phosphorous filler, that have not been damaged by burning or detonation, or are not deteriorated to the point of instability. | 10 | |
| **Practice** | All UXO that are practice munitions that are not associated with a sensitive fuze. | 5 | |
| | All DMM that are practice munitions that are not associated with a sensitive fuze and that have not been damaged by burning or detonation, or are not deteriorated to the point of instability. | | |
| **Riot control** | All UXO or DMM containing a riot control agent filler (e.g., tear gas). | 3 | |
| **Small arms** | All used munitions or DMM that are categorized as small arms ammunition [Physical evidence or historical evidence that no other types of munitions (e.g., grenades, subcaliber training rockets, demolition charges) were used or are present on the MRS is required for selection of this category.]. | 2 | |
| **Evidence of no munitions** | Following investigation of the MRS, there is physical evidence that there are no UXO or DMM present, or there is historical evidence indicating that no UXO or DMM are present. | 0 | 0 |
| **MUNITIONS TYPE** | **DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 30). | | **0** |

**DIRECTIONS**: Document any MRS-specific data used in selecting the ***Munitions Type*** classifications in the space below.

Based on the findings of the RI, no explosive hazards are present at the MRS. No MEC was found during RI intrusive investigations, which consisted of investigation of the entire MRS, and only MD were found. A total of 8 MD items were found at the MRS included pieces and fragments associated with unknown munitions types, a fuze from an unknown muintions type, MK1 series 75 and 155mm high explosives projectiles, and a M75 series 20mm armor piercing- tracer projectile. (RI Report, Section 4.2.2). The recovered MD items were solid and/or inert and posed no explosives safety hazard. Tables 2 – 9 are intentionally omitted according to Army Guidance.

**Tables 2 – 9 are intentionally omitted according to Army Guidance.**

## Table 10

## Determining the EHE Module Rating

**DIRECTIONS:**

1. From Tables 01 - 09, record the data element scores in the **Score** boxes to the right.

2. Add the **Score** boxes for each of the three factors and record this number in the **Value** boxes to the right.

3. Add the three **Value** boxes and record this number in the **EHE Module Total** box below.

4. Identify the appropriate range for the **EHE Module Total** at right.

5. Identify the **EHE Module Rating** that corresponds to the range selected and record this rating in the **EHE Module Rating** box at the lower right corner of this table.

NOTE: An alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when more information is needed to score one or more data elements, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS.

| | Source | Score | Value |
|---|---|---|---|
| **Explosive Hazard Factor Data Elements** | | | |
| Munitions Type | Table 01 | 0 | 0 |
| Source of Hazard | Table 02 | 0 | |
| **Accessibility Factor Data Elements** | | | |
| Location of Munitions | Table 03 | 0 | 0 |
| Ease of Access | Table 04 | 0 | |
| Status of Property | Table 05 | 0 | |
| **Receptor Factor Data Elements** | | | |
| Population Density | Table 06 | 0 | 0 |
| Population Near Hazard | Table 07 | 0 | |
| Types of Activities/Structures | Table 08 | 0 | |
| Ecological and/or Cultural Resources | Table 09 | 0 | |
| **EHE MODULE TOTAL** | | | **0** |

| EHE Module Total | EHE Module Rating |
|---|---|
| 92 to 100 | A |
| 82 to 91 | B |
| 71 to 81 | C |
| 60 to 70 | D |
| 48 to 59 | E |
| 38 to 47 | F |
| less than 38 | G |
| Alternative Module Ratings | Evaluation Pending |
| | No Longer Required |
| | No Known or Suspected Explosive Hazard |
| **EHE MODULE RATING** | **No Known or Suspected Explosive Hazard** |

# Table 11

## CHE Module: CWM Configuration Data Element Table

Directions: Below are seven classifications of CWM configuration and their descriptions. Annotate the score(s) that correspond to **all** CWM configurations known or suspected to be present at the MRS.

Note: The terms *CWM/UXO*, *CWM/DMM*, *physical evidence*, and *historical evidence* are defined in Appendix C of the MRSPP Primer (Draft, Dec 2005).

| Classification | Description | Possible Score | Score |
|---|---|---|---|
| **CWM, explosive configuration either UXO or damaged DMM** | The CWM known or suspected of being present at the MRS is (a) explosively configured CWM that are UXO (i.e. CWM/UXO), or (b) explosively configured CWM that are DMM (i.e. CWM/DMM) that have been damaged. | 30 | |
| **CWM mixed with UXO** | The CWM known or suspected of being present at the MRS are explosively configured CWM/DMM that have not been damaged, or nonexplosively configured CWM/DMM, or CWM not configured as a munition, that are commingled with conventional munitions that are UXO. | 25 | |
| **CWM, explosive configuration that are undamaged DMM** | The CWM known or suspected of being present at the MRS are explosively configured CWM/DMM that have not been damaged. | 20 | |
| **CWM, not explosively configured or CWM, bulk container** | The CWM known or suspected of being present at the MRS is (a) nonexplosively configured CWM/DMM, or (b) bulk CWM/DMM (e.g., ton container). | 15 | |
| **CAIS K941 and CAIS K942** | The CWM/DMM known or suspected of being present at the MRS is CAIS K941(toxic gas set M-1) or CAIS K942 (toxic gas set M-2/E11). | 12 | |
| **CAIS (chemical agent identification sets)** | Only CAIS, other than CAIS K941 and K942, are known or suspected of being present at the MRS. | 10 | |
| **Evidence of no CWM** | Following investigation, the physical evidence indicates that CWM are not present at the MRS, or the historical evidence indicates that CWM are not present at the MRS. | 0 | 0 |
| **CWM CONFIGURATION** | **DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 30). | | **0** |

**DIRECTIONS**: Document any MRS-specific data used in selecting the ***CWM Configuration*** classifications in the space below.

The RVAAP is listed on the Non-Stockpile CWM List as a site with known or possible buried CWM; however, there is no known historical or physical evidence of CWM being produced, stored, or used at the MRS. As such, Tables 12-19 are not applicable and have been intentionally omitted according to active Army Guidance.

**Tables 12 – 19 are intentionally omitted according to Army Guidance.**

## Table 20

## Determining the CHE Module Rating

| | | Source | Score | Value |
|---|---|---|---|---|
| **DIRECTIONS:** | **CWM Hazard Factor Data Elements** | | | |
| 1. From Tables 11 - 19, record the data element scores in the **Score** boxes to the right. | CWM Configuration | Table 11 | 0 | 0 |
| | Sources of CWM | Table 12 | 0 | |
| | **Accessibility Factor Data Elements** | | | |
| 2. Add the **Score** boxes for each of the three factors and record this number in the **Value** boxes to the right. | Location of CWM | Table 13 | 0 | 0 |
| | Ease of Access | Table 14 | 0 | |
| | Status of Property | Table 15 | 0 | |
| | **Receptor Factor Data Elements** | | | |
| 3. Add the three **Value** boxes and record this number in the **CHE Module Total** box below. | Population Density | Table 16 | 0 | 0 |
| | Population Near Hazard | Table 17 | 0 | |
| | Types of Activities/Structures | Table 18 | 0 | |
| | Ecological and/or Cultural Resources | Table 19 | 0 | |
| | **CHE MODULE TOTAL** | | | **0** |

| | CHE Module Total | CHE Module Rating |
|---|---|---|
| 4. Identify the appropriate range for the **CHE Module Total** at right. | 92 to 100 | A |
| | 82 to 91 | B |
| | 71 to 81 | C |
| | 60 to 70 | D |
| 5. Identify the **CHE Module Rating** that corresponds to the range selected and record this rating in the **CHE Module Rating** box at the lower right corner of this table. | 48 to 59 | E |
| | 38 to 47 | F |
| | less than 38 | G |
| NOTE: An alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when more information is needed to score one or more data elements, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS. | Alternative Module Ratings | Evaluation Pending |
| | | No Longer Required |
| | | No Known or Suspected CWM Hazard |
| | **CHE MODULE RATING** | **No Known or Suspected CWM Hazard** |

# Table 21

# HHE Module: Groundwater Data Element Table

## Contaminant Hazard Factor (CHF)

Directions: Record the **maximum concentrations** of all contaminants in the MRS's groundwater and their **comparison values** (from Appendix B, Relative Risk Site Evaluation (RRSE) Primer, Summer 1997 - Revised) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the **ratios** for each medium together, including additional contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard present in the groundwater, select the box at the bottom of the table.

Note: Use dissolved, rather than total, metals analyses when both are available.

| Contaminant [CAS No.] | Maximum Concentration (µg/L) | Comparison Value (µg/L) | Ratios |
|---|---|---|---|
| No samples have been collected at the MRS under the MMRP (RI Report) | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | Total from Table 27 | |
| | | **Sum the Ratios** | |

| CHF Scale | CHF Value |
|---|---|
| CHF > 100 | H (High) |
| 100 > CHF >2 | M (Medium) |
| 2 > CHF | L (Low) |

**CHF = $\sum$ ([Max Conc of Contaminant] / [Comparison Value for Contaminant])**

| | | |
|---|---|---|
| **CONTAMINANT HAZARD FACTOR** | Directions: Record **the CHF Value** from above in the box to the right (maximum value = H). | |

## Migratory Pathway Factor

Directions: Annotate the value that corresponds most closely to the groundwater migratory pathway at the MRS.

| Classification | Description | Value |
|---|---|---|
| **Evident** | Analytical data or observable evidence indicates that contamination in the groundwater is present at, moving toward, or has moved to a point of exposure. | H |
| **Potential** | Contamination in groundwater has moved only slightly beyond the source (i.e. tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined. | M |
| **Confined** | Information indicates a low potential for contaminant migration from the source via the groundwater to a potential point of exposure (possibly due to geological structures or physical controls). | L |

| | | |
|---|---|---|
| **MIGRATORY PATHWAY FACTOR** | Directions: Record **the single highest value** from above in the box to the right (maximum value = H). | |

## Receptor Factor

Directions: Annotate the value that corresponds most closely to the groundwater receptors at the MRS.

| Classification | Description | Value |
|---|---|---|
| **Identified** | There is a threatened water supply well downgradient of the source and the groundwater is a current source of drinking water or source of water for other beneficial uses such as irrigation/agriculture (equivalent to Class I or IIA aquifer). | H |
| **Potential** | There is no threatened water supply well downgradient of the source and the groundwater is currently or potentially usable for drinking water, irrigation, or agriculture (equivalent to Class I, IIA, or IIB aquifer). | M |
| **Limited** | There is no potentially threatened water supply well downgradient of the source and the groundwater is not considered a potential source of drinking water and is of limited beneficial use (equivalent to Class IIIA or IIIB aquifer, or where perched aquifer exists only). | L |

| | | |
|---|---|---|
| **RECEPTOR FACTOR** | Directions: Record **the single highest value** from above in the box to the right (maximum value = H). | |

| | |
|---|---|
| **Place an "X" in the box to the right if there is no known or suspected Groundwater MC Hazard** | |

# Table 22

## HHE Module: Surface Water - Human Endpoint Data Element Table

### Contaminant Hazard Factor (CHF)

Directions: Record the **maximum concentrations** of all contaminants in the MRS's surface water and their **comparison values** (from Appendix B, Relative Risk Site Evaluation (RRSE) Primer, Summer 1997 - Revised) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the **ratios** for each medium together, including additional contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard present in the surface water, select the box at the bottom of the table.

Note: Use dissolved, rather than total, metals analyses when both are available.

| Contaminant [CAS No.] | Maximum Concentration (µg/L) | Comparison Value (µg/L) | Ratios |
|---|---|---|---|
| No samples have been collected at the MRS under the MMRP (RI Report) | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | Total from Table 27 | |
| | | **Sum the Ratios** | |

| **CHF Scale** | **CHF Value** | **CHF = ∑ ([Max Conc of Contaminant] / [Comparison Value for Contaminant])** |
|---|---|---|
| **CHF > 100** | **H (High)** | |
| **100 > CHF >2** | **M (Medium)** | |
| **2 > CHF** | **L (Low)** | |

| | | |
|---|---|---|
| **CONTAMINANT HAZARD FACTOR** | Directions: Record **the CHF Value** from above in the box to the right (maximum value = H). | |

### Migratory Pathway Factor

Directions: Annotate the value that corresponds most closely to the surface water migratory pathway at the MRS.

| Classification | Description | Value |
|---|---|---|
| **Evident** | Analytical data or observable evidence indicates that contamination in the surface water is present at, moving toward, or has moved to a point of exposure. | H |
| **Potential** | Contamination in surface water has moved only slightly beyond the source (i.e. tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined. | M |
| **Confined** | Information indicates a low potential for contaminant migration from the source via the surface water to a potential point of exposure (possibly due to presence of geological structures or physical controls). | L |

| | | |
|---|---|---|
| **MIGRATORY PATHWAY FACTOR** | Directions: Record **the single highest value** from above in the box to the right (maximum value = H). | |

### Receptor Factor

Directions: Annotate the value that corresponds most closely to the surface water receptors at the MRS.

| Classification | Description | Value |
|---|---|---|
| **Identified** | Identified receptors have access to surface water to which contamination has moved or can move. | H |
| **Potential** | Potential for receptors to have access to surface water to which contamination has moved or can move. | M |
| **Limited** | Little or no potential for receptors to have access to surface water to which contamination has moved or can move. | L |

| | | |
|---|---|---|
| **RECEPTOR FACTOR** | Directions: Record **the single highest value** from above in the box to the right (maximum value = H). | |

| | |
|---|---|
| **Place an "X" in the box to the right if there is no known or suspected Surface Water (Human Endpoint) MC Hazard** | |

# Table 23

## HHE Module: Sediment - Human Endpoint Data Element Table

### Contaminant Hazard Factor (CHF)

Directions: Record the **maximum concentrations** of all contaminants in the site's sediment and their **comparison values** (from Appendix B, Relative Risk Site Evaluation (RRSE) Primer, Summer 1997 - Revised) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the **ratios** for each medium together, including additional contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard for human endpoints present in the sediment, select the box at the bottom of the table.

Note: N/A

| Contaminant [CAS No.] | Maximum Concentration (mg/kg) | Comparison Value (mg/kg) | Ratios |
|---|---|---|---|
| No MEC or MPPEH has been found at the MRS to date and there is no | | | |
| evidence that suggests there is an MC source in sediment. Therefore, there | | | |
| is no known or suspected MC risk in sediment at the MRS (RI Report, | | | |
| Section 9.2). | | | |
| | | | |
| | | Total from Table 27 | |
| | | **Sum the Ratios** | |

| CHF Scale | CHF Value |
|---|---|
| CHF > 100 | H (High) |
| 100 > CHF >2 | M (Medium) |
| 2 > CHF | L (Low) |

**CHF = $\sum$ ([Max Conc of Contaminant] / [Comparison Value for Contaminant])**

| | | |
|---|---|---|
| **CONTAMINANT HAZARD FACTOR** | Directions: Record **the CHF Value** from above in the box to the right (maximum value = H). | |

### Migratory Pathway Factor

Directions: Annotate the value that corresponds most closely to the surface water migratory pathway at the MRS.

| Classification | Description | Value |
|---|---|---|
| **Evident** | Analytical data or observable evidence indicates that contamination in the sediment is present at, moving toward, or has moved to a point of exposure. | H |
| **Potential** | Contamination in sediment has moved only slightly beyond the source (i.e. tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined. | M |
| **Confined** | Information indicates a low potential for contaminant migration from the source via the sediment to a potential point of exposure (possibly due to presence of geological structures or physical controls). | L |

| | | |
|---|---|---|
| **MIGRATORY PATHWAY FACTOR** | Directions: Record **the single highest value** from above in the box to the right (maximum value = H). | |

### Receptor Factor

Directions: Annotate the value that corresponds most closely to the surface water receptors at the MRS.

| Classification | Description | Value |
|---|---|---|
| **Identified** | Identified receptors have access to sediment to which contamination has moved or can move. | H |
| **Potential** | Potential for receptors to have access to sediment to which contamination has moved or can move. | M |
| **Limited** | Little or no potential for receptors to have access to sediment to which contamination has moved or can move. | L |

| | | |
|---|---|---|
| **RECEPTOR FACTOR** | Directions: Record **the single highest value** from above in the box to the right (maximum value = H). | |
| **Place an "X" in the box to the right if there is no known or suspected Sediment (Human Endpoint) MC Hazard** | | **X** |

# Table 24

## HHE Module: Surface Water - Ecological Endpoint Data Element Table

### Contaminant Hazard Factor (CHF)

Directions: Record the **maximum concentrations** of all contaminants in the MRS's surface water and their **comparison values** (from Appendix B, Relative Risk Site Evaluation (RRSE) Primer, Summer 1997 - Revised) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the **ratios** for each medium together, including additional contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard for ecological endpoints present in the surface water, select the box at the bottom of the table.

Note: Use either dissolved or total metals analyses.

| Contaminant [CAS No.] | Maximum Concentration (µg/L) | Comparison Value (µg/L) | Ratios |
|---|---|---|---|
| No samples have been collected at the MRS under the MMRP (RI Report) | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | Total from Table 27 | |
| | | **Sum the Ratios** | |

| CHF Scale | CHF Value |
|---|---|
| CHF > 100 | H (High) |
| 100 > CHF >2 | M (Medium) |
| 2 > CHF | L (Low) |

**CHF = $\sum$ ([Max Conc of Contaminant] / [Comparison Value for Contaminant])**

| | | |
|---|---|---|
| **CONTAMINANT HAZARD FACTOR** | Directions: Record **the CHF Value** from above in the box to the right (maximum value = H). | |

### Migratory Pathway Factor

Directions: Annotate the value that corresponds most closely to the surface water migratory pathway at the MRS.

| Classification | Description | Value |
|---|---|---|
| **Evident** | Analytical data or observable evidence indicates that contamination in the surface water is present at, moving toward, or has moved to a point of exposure. | H |
| **Potential** | Contamination in surface water has moved only slightly beyond the source (i.e. tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined. | M |
| **Confined** | Information indicates a low potential for contaminant migration from the source via the surface water to a potential point of exposure (possibly due to presence of geological structures or physical controls). | L |
| **MIGRATORY PATHWAY FACTOR** | Directions: Record **the single highest value** from above in the box to the right (maximum value = H). | |

### Receptor Factor

Directions: Annotate the value that corresponds most closely to the surface water receptors at the MRS.

| Classification | Description | Value |
|---|---|---|
| **Identified** | Identified receptors have access to surface water to which contamination has moved or can move. | H |
| **Potential** | Potential for receptors to have access to surface water to which contamination has moved or can move. | M |
| **Limited** | Little or no potential for receptors to have access to surface water to which contamination has moved or can move. | L |
| **RECEPTOR FACTOR** | Directions: Record **the single highest value** from above in the box to the right (maximum value = H). | |

**Place an "X" in the box to the right if there is no known or suspected Surface Water (Ecological Endpoint) MC Hazard**

# Table 25

## HHE Module: Sediment - Ecological Endpoint Data Element Table

### Contaminant Hazard Factor (CHF)

Directions: Record the **maximum concentrations** of all contaminants in the MRS's sediment and their **comparison values** (from Appendix B, Relative Risk Site Evaluation (RRSE) Primer, Summer 1997 - Revised) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the **ratios** for each medium together, including additional contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard for ecological endpoints present in the sediment, select the box at the bottom of the table.

Note: N/A

| Contaminant [CAS No.] | Maximum Concentration (mg/kg) | Comparison Value (mg/kg) | Ratios |
|---|---|---|---|
| No MEC or MPPEH has been found at the MRS to date and there is no | | | |
| evidence that suggests there is an MC source in sediment. Therefore, there | | | |
| is no known or suspected MC risk in sediment at the MRS (RI Report, | | | |
| Section 9.2). | | | |
| | | | |
| | | Total from Table 27 | |
| | | **Sum the Ratios** | |

| CHF Scale | CHF Value | |
|---|---|---|
| CHF > 100 | H (High) | CHF = ∑ ([Max Conc of Contaminant] / [Comparison Value for Contaminant]) |
| 100 > CHF >2 | M (Medium) | |
| 2 > CHF | L (Low) | |

| | | |
|---|---|---|
| **CONTAMINANT HAZARD FACTOR** | Directions: Record **the CHF Value** from above in the box to the right (maximum value = H). | |

### Migratory Pathway Factor

Directions: Annotate the value that corresponds most closely to the surface water migratory pathway at the MRS.

| Classification | Description | Value |
|---|---|---|
| **Evident** | Analytical data or observable evidence indicates that contamination in the sediment is present at, moving toward, or has moved to a point of exposure. | H |
| **Potential** | Contamination in sediment has moved only slightly beyond the source (i.e. tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined. | M |
| **Confined** | Information indicates a low potential for contaminant migration from the source via the sediment to a potential point of exposure (possibly due to presence of geological structures or physical controls). | L |

| | | |
|---|---|---|
| **MIGRATORY PATHWAY FACTOR** | Directions: Record **the single highest value** from above in the box to the right (maximum value = H). | |

### Receptor Factor

Directions: Annotate the value that corresponds most closely to the surface water receptors at the MRS.

| Classification | Description | Value |
|---|---|---|
| **Identified** | Identified receptors have access to sediment to which contamination has moved or can move. | H |
| **Potential** | Potential for receptors to have access to sediment to which contamination has moved or can move. | M |
| **Limited** | Little or no potential for receptors to have access to sediment to which contamination has moved or can move. | L |

| | | |
|---|---|---|
| **RECEPTOR FACTOR** | Directions: Record **the single highest value** from above in the box to the right (maximum value = H). | |

| | |
|---|---|
| **Place an "X" in the box to the right if there is no known or suspected Sediment (Ecological Endpoint) MC Hazard** | **X** |

# Table 26

# HHE Module: Surface Soil - Data Element Table

## Contaminant Hazard Factor (CHF)

Directions: Record the **maximum concentrations** of all contaminants in the MRS's surface soil and their **comparison values** (from Appendix B, Relative Risk Site Evaluation (RRSE) Primer, Summer 1997 - Revised) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the **ratios** for each medium together, including additional contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard present in the surface soil, select the box at the bottom of the table.

Note: N/A

| Contaminant [CAS No.] | Maximum Concentration (mg/kg) | Comparison Value (mg/kg) | Ratios |
|---|---|---|---|
| No samples have been collected at the MRS under the MMRP (RI Report) | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | Total from Table 27 | |
| | | **Sum the Ratios** | |

| CHF Scale | CHF Value |
|---|---|
| **CHF > 100** | **H (High)** |
| **100 > CHF >2** | **M (Medium)** |
| **2 > CHF** | **L (Low)** |

**CHF = $\sum$ ([Max Conc of Contaminant] / [Comparison Value for Contaminant])**

| | | |
|---|---|---|
| **CONTAMINANT HAZARD FACTOR** | Directions: Record **the CHF Value** from above in the box to the right (maximum value = H). | |

## Migratory Pathway Factor

Directions: Annotate the value that corresponds most closely to the surface soil migratory pathway at the MRS.

| Classification | Description | Value |
|---|---|---|
| **Evident** | Analytical data or observable evidence indicates that contamination in the surface soil is present at, moving toward, or has moved to a point of exposure. | H |
| **Potential** | Contamination in surface soil has moved only slightly beyond the source (i.e. tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined. | M |
| **Confined** | Information indicates a low potential for contaminant migration from the source via the surface soil to a potential point of exposure (possibly due to presence of geological structures or physical controls). | L |
| **MIGRATORY PATHWAY FACTOR** | Directions: Record **the single highest value** from above in the box to the right (maximum value = H). | |

## Receptor Factor

Directions: Annotate the value that corresponds most closely to the surface soil receptors at the MRS.

| Classification | Description | Value |
|---|---|---|
| **Identified** | Identified receptors have access to surface soil to which contamination has moved or can move. | H |
| **Potential** | Potential for receptors to have access to surface soil to which contamination has moved or can move. | M |
| **Limited** | Little or no potential for receptors to have access to surface soil to which contamination has moved or can move. | L |
| **RECEPTOR FACTOR** | Directions: Record **the single highest value** from above in the box to the right (maximum value = H). | |

| | |
|---|---|
| **Place an "X" in the box to the right if there is no known or suspected Surface Soil MC Hazard** | |

## Table 27

## HHE Module: Supplemental Contaminant Hazard Factor Table

### Contaminant Hazard Factor (CHF)

Directions: **Only use this table if there are more than five contaminants present at the MRS.** This is a supplemental table designed to hold information about contaminants that do not fit in the previous tables. Indicate the **media** in which these contaminants are present. Then record all **contaminants**, their **maximum concentrations** and their **comparison values** (from Appendix B, Relative Risk Site Evaluation (RRSE) Primer, Summer 1997 - Revised) in the table below. Calculate and record the **ratio** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** for each medium on the appropriate media-specific tables.

Note: For human exposures to groundwater and surface water, use dissolved, rather than total, metals analyses when both are available. Remember not to add ratios from different media.

| Media | Contaminant [CAS No.] | Maximum Concentration | Units | Comparison Value | Units | Ratios |
|---|---|---|---|---|---|---|
| Surface soil | | | mg/kg | | mg/kg | |
| Surface soil | | | mg/kg | | mg/kg | |
| Surface soil | | | mg/kg | | mg/kg | |
| Surface soil | | | mg/kg | | mg/kg | |
| Surface soil | | | mg/kg | | mg/kg | |
| Surface soil | | | mg/kg | | mg/kg | |
| Surface soil | | | mg/kg | | mg/kg | |
| Surface soil | | | mg/kg | | mg/kg | |
| Surface soil | | | mg/kg | | mg/kg | |
| Surface soil | | | mg/kg | | mg/kg | |
| Surface soil | | | mg/kg | | mg/kg | |
| Surface soil | | | mg/kg | | mg/kg | |
| Surface soil | | | mg/kg | | mg/kg | |
| | | | | SUBTOTAL FOR SURFACE SOIL | | 0 |
| Sediment | | | mg/kg | | mg/kg | |
| Sediment | | | mg/kg | | mg/kg | |
| Sediment | | | mg/kg | | mg/kg | |
| Sediment | | | mg/kg | | mg/kg | |
| Sediment | | | mg/kg | | mg/kg | |
| Sediment | | | mg/kg | | mg/kg | |
| Sediment | | | mg/kg | | mg/kg | |
| Sediment | | | mg/kg | | mg/kg | |
| Sediment | | | mg/kg | | mg/kg | |
| Sediment | | | mg/kg | | mg/kg | |
| Sediment | | | mg/kg | | mg/kg | |
| Sediment | | | mg/kg | | mg/kg | |
| Sediment | | | mg/kg | | mg/kg | |
| | | | | SUBTOTAL FOR SEDIMENT | | 0 |
| Surface water | | | µg/L | | µg/L | |
| Surface water | | | µg/L | | µg/L | |
| Surface water | | | µg/L | | µg/L | |
| Surface water | | | µg/L | | µg/L | |
| Surface water | | | µg/L | | µg/L | |
| Surface water | | | µg/L | | µg/L | |
| Surface water | | | µg/L | | µg/L | |
| Surface water | | | µg/L | | µg/L | |
| Surface water | | | µg/L | | µg/L | |
| Surface water | | | µg/L | | µg/L | |
| Surface water | | | µg/L | | µg/L | |
| Surface water | | | µg/L | | µg/L | |
| Surface water | | | µg/L | | µg/L | |
| | | | | SUBTOTAL FOR SURFACE WATER | | 0 |
| Groundwater | | | µg/L | | µg/L | |
| Groundwater | | | µg/L | | µg/L | |
| Groundwater | | | µg/L | | µg/L | |
| Groundwater | | | µg/L | | µg/L | |
| Groundwater | | | µg/L | | µg/L | |
| Groundwater | | | µg/L | | µg/L | |
| Groundwater | | | µg/L | | µg/L | |
| Groundwater | | | µg/L | | µg/L | |
| Groundwater | | | µg/L | | µg/L | |
| Groundwater | | | µg/L | | µg/L | |
| Groundwater | | | µg/L | | µg/L | |
| Groundwater | | | µg/L | | µg/L | |
| Groundwater | | | µg/L | | µg/L | |
| | | | | SUBTOTAL FOR GROUNDWATER | | 0 |

## Table 28

## Determining the HHE Module Rating

DIRECTIONS:

1. Record the letter values (H, M, L) for the **Contaminant Hazard**, **Migration Pathway**, and **Receptor Factors** for the media (from Tables 21 - 26) in the corresponding boxes below.
2. Record the media's three-letter combinations in the **Three-Letter-Combination** boxes below (three-letter combinations are arranged from Hs to Ms to Ls).
3. Using the reference provided below, determine each medium's rating ( A - G) and record the letter in the corresponding **Media Rating** box below.

| Medium (Source) | Contaminant Hazard Factor Value | Migratory Pathway Factor Value | Receptor Factor Value | Three-Letter Combination (Hs-Ms-Ls) | Media Rating (A - G) |
|---|---|---|---|---|---|
| **Table 21 - Groundwater** | | | | | |
| **Table 22 - Surface Water (Human Endpoint)** | | | | MML | |
| **Table 23 - Sediment (Human Endpoint)** | | | | MLL | |
| **Table 24 - Surface Water (Ecological Endpoint)** | | | | MML | |
| **Table 25 - Sediment (Ecological Endpoint)** | | | | MMM | |
| **Table 26 - Surface Soil** | | | | | |
| | | | **HHE MODULE RATING** | | **No Known or Suspected MC Hazard** |

DIRECTIONS (Continued):

4. Select the single highest **Media Rating** (A is the highest; G is the lowest) and enter the letter in the **HHE Module Rating** box below.

| HHE Ratings (for reference only) | |
|---|---|
| HHH | A |
| HHM | B |
| HHL | C |
| HMM | |
| HML | D |
| MMM | |
| HLL | E |
| MML | |
| MLL | F |
| LLL | G |

NOTE: An alternative module rating may be assigned when a module letter rating is used when more information is needed to score one or more media, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS.

| Alternative Module Ratings | |
|---|---|
| | Evaluation Pending |
| | No Longer Required |
| | No Known or Suspected MC Hazard |

## Table 29

## MRS Priority

DIRECTIONS: In the chart below, enter the letter **rating** for each module recorded in Table 10 (EHE), Table 20 (CHE), and Table 28 (HHE). Enter the corresponding numerical **priority** for each module. If information to determine the module rating is not available, choose the appropriate alternative module rating. The MRS priority is the single highest priority; record this number in the **MRS or Alternative Priority** box at the bottom of the table.

NOTE: An MRS assigned Priority 1 has the highest relative priority; an MRS assigned Priority 8 has the lowest relative priority. Only an MRS with CWM known or suspected to be present can be assigned Priority 1; an MRS that has CWM known or suspected to be present cannot be assigned Priority 8.

| EHE Rating | Priority | CHE Rating | Priority | HHE Rating | Priority |
|---|---|---|---|---|---|
| | | A | 1 | | |
| A | 2 | B | 2 | A | 2 |
| B | 3 | C | 3 | B | 3 |
| C | 4 | D | 4 | C | 4 |
| D | 5 | E | 5 | D | 5 |
| E | 6 | F | 6 | E | 6 |
| F | 7 | G | 7 | F | 7 |
| G | 8 | | | G | 8 |
| Evaluation Pending | | Evaluation Pending | | Evaluation Pending | |
| No Longer Required | | No Longer Required | | No Longer Required | |
| No Known or Suspected Explosive Hazard | | No Known or Suspected CWM Hazard | | No Known or Suspected MC Hazard | |

| Reference Table 10: | | Reference Table 20: | | Reference Table 28: | |
|---|---|---|---|---|---|
| EHE Module Rating | Priority | CHE Module Rating | Priority | HHE Module Rating | Priority |
| No Known or Suspected Explosive Hazard | No Known or Suspected Explosive Hazard | No Known or Suspected CWM Hazard | No Known or Suspected CWM Hazard | No Known or Suspected MC Hazard | No Known or Suspected MC Hazard |

| MRS or Alternative Priority | No Longer Required |
|---|---|