Final Work Plan

Time Critical Removal Action

RVAAP-004-R-01 Open Demolition Area #2

Former Ravenna Army Ammunition Plant

Ravenna, Ohio

Project No. PN453698

Prepared by: **U.S. Army Corps of Engineers**
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Baltimore, MD 21201

Prepared for: **Army National Guard Directorate**
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Arlington, VA 22204

March 18, 2016

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14. ABSTRACT

This Work Plan (WP) describes the technical approach including details for implementation, quality control, and quality assurance for the Time Critical Removal Action (TCRA) at RVAAP-004-R-01 Open Demolition Area #2 (ODA2) Munitions Response Site (MRS). The purpose of the TCRA is to mitigate significant explosive safety hazards posed to National Guard Soldiers trainees due to exposure to Munition of Explosive Concern/Material Potentially Posing an Explosive Hazard (MEC/MPPEH) at the ODA2 MRS. Removal of known MEC/MPPEH from this area will significantly reduce the explosive hazard in a timely and cost-effective manner. In addition, bi-annual surface sweeps will be conducted to monitor and/or reduce the potential for off site migration of MEC/MPPEH during high energy storm events.

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STATEMENT OF TECHNICAL REVIEW

PN: 453698

NAME OF PROJECT: Time Critical Removal Action at ODA2 MRS

LOCATION: Former Ravenna Army Ammunition Plant, OH (Camp Ravenna)

PROJECT MANAGER: Travis McCoun

DOCUMENT/DELIVERABLE: Time Critical Removal Action Work Plan, Preliminary Draft

An independent technical review (ITR) that is appropriate to the level of risk and complexity inherent in the project has been conducted as defined in the Project Management Plan. During the ITR, compliance with established policy, principles, and procedures, utilizing justified and valid assumptions, was verified. This included review of: assumptions; methods, procedures, and material used in analyses; alternatives evaluated; the appropriateness of data used and level obtained; and reasonableness of the result, including whether the product meets the stakeholders' needs consistent with law and existing USACE policy. The signatures of each of the disciplines below affirm that the ITR was accomplished and all comments resulting from ITR have been resolved.

TECHNICAL DISCIPLINE	REVIEWER	SIGNATURE
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CERTIFICATION OF INDEPENDENT TECHNICAL REVIEW

As noted above, all concerns resulting from independent technical review of the project have been fully resolved.

TECHNICAL TEAM LEAD
Travis R. McCoun, P.G.
Program Manager, NAB MMDC

DATE

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CHIEF, EMDC
Michael J. Rogers, P.E., PMP
Chief, Environmental & Munitions
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Ohio Environmental Protection Agency

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

April 8, 2016

Mr. Mark Leeper, P.G., MBA
Army National Guard Directorate
Environmental Programs Division
ARNGD-ILE-CR
111 South George Mason Drive
Arlington, VA 22204

Re: US Army Ravenna Ammunition Plt RVAAP
Remediation Response
Project Plans
Remedial Response
Portage County
267000859089

Subject: Comments on the "Responses to Ohio EPA Comments and Submittal of Final Work Plan, Time Critical Removal Action, Open Demolition Area #2, RVAAP-004-R-01 at the Former Ravenna Army Ammunition Plant, Ravenna, Ohio," Dated March 18, 2016, Ohio EPA ID # 267-000859-089

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, *"Responses to Ohio EPA Comments and Submittal of Final Work Plan, Time Critical Removal Action, Open Demolition Area #2, RVAAP-004-R-01 at the Former Ravenna Army Ammunition Plant, Ravenna, Ohio,"* dated March 18, 2016. This document, received by Ohio EPA's NEDO on March 18, 2016, was prepared by the U.S. Army Corps of Engineers (USACE) Baltimore District.

Ohio EPA has reviewed this document and has additional comments concerning the response to Ohio EPA Comment O-6. Ohio has concerns about averaging replicate ISM samples and the use of the replicate samples results. Ohio EPA suggests that a meeting be scheduled to discuss this issue and potentially draft an addendum to the Facility Wide Sampling and Analysis Plan (FWSAP), with the intent that the agreed upon procedure will be used for all future RVAAP projects.

Because this issue does not affect the initial phase of this project and sampling strategy, field work may proceed as noted in an email sent on March 23, 2016. However, in order for this Final Work Plan to be approved, Ohio recommends that the Final Work Plan be revised to state that this issue will be resolved in subsequent meetings and a potential addendum to the FWSAP. Once replacement pages are submitted, Ohio EPA will approve the Final Work Plan.

If you have any questions or concerns, please do not hesitate to contact me at (330) 963-1249.

Sincerely,

Andrew C. Kocher
Site Coordinator
Division of Environmental Response and Revitalization

ACK/nvr

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Final Work Plan

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March 18, 2016

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RVAAP-004-R-01 Open Demolition Area #2
Former Ravenna Army Ammunition Plant
Ravenna, Ohio

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AR = Administrative Record
ARNG – Camp Ravenna = Army National Guard – Camp Ravenna Joint Military Training Center
ARNG-ILE-CR = Army National Guard – Installations Logistics Environmental – Cleanup Restoration
Camp Ravenna = Camp Ravenna Joint Military Training Center
OHARNG = Ohio Army National Guard
Ohio EPA – NEDO = Ohio Environmental Protection Agency – Northeast District Office
Ohio EPA – CO = Ohio Environmental Protection Agency – Central Office

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Appendix G – Camp Ravenna Waste Management Guidelines and Inspection Forms

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Appendix I – First Responder Checklist

List of Abbreviations and Acronyms

ARNG	Army National Guard
ATF	Bureau of Alcohol, Tobacco, and Firearms and Explosives
BEM	Buried Explosion Module
BIP	Blow-in-Place
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulation
DA	Department of the Army
DDESB	Department of Defense Explosive Safety Board
Demil	Demilitarization
DFW	Definable Feature of Work
DID	Data Item Description
DoDI	Department of Defense Instruction
DoDM	Department of Defense Manual
DoD	Department of Defense
DQCRs	Daily Quality Control Reports
DQOs	Data Quality Objectives
ESQD	explosive safety quantity distance
ESS	Explosive Safety Submission
EESS	Environmental and Explosive Safety Section
FAA	Federal Aviation Administration
FSA	Field Staging Areas
FSP	Field Sampling Plan
FWSAP	Facility-Wide Sampling and Analysis Plan
FWFSP	Field Sampling Plan
FWQAPP	Facility-wide Quality Assurance Project Plan

List of Abbreviations and Acronyms (continued)

IS	Geographic Information System
GPS	Global Positioning System
HFD	Hazard Fragmentation Distance
ID	identification
IDW	Investigation-Derived Waste
LRL	Lakes and Rivers Louisville (District)
MC	Munitions Constituents
MDAS	Material Documented as Safe
MDEH	Material Documented as an Explosive Hazard
MEC	Munition of Explosive Concern
MGFD	munition with the greatest fragmentation distance
ISM	Incremental Sample Methodology
MPPEH	Material Potentially Posing an Explosive Hazard
MRS	Munitions Response Site
MSD	Minimum Separation Distance
MS/MSD	matrix spike / matrix spike duplicate
NAB	North Atlantic Baltimore (District)
NAD	North Atlantic Datum
NGB	National Guard Bureau
OB/OD	Open Burn / Open Detonation
ODA2	Open Demolition Area #2
OESS	Ordnance and Explosive Safety Specialist
OHARNG	Ohio Army National Guard
PPE	Personal Protective Equipment
QAPP	Quality Assurance Project Plan
QAR	Quality Assurance Reports

List of Abbreviations and Acronyms (continued)

QC	Quality Control
QCP	Quality Control Plan
RI	Remedial Investigation
REIMS	Ravenna Environmental Information Management System
RTK	Real Time Kinematic
SAP	Sampling and Analysis Plan
SDSFIE	Spatial Data Standards for Facilities, Infrastructure, and Environment
SOP	Standard Operation Procedure
SUXOS	Senior UXO Supervisor
SVOC	Semi-volatile Organic Compound
TCRA	Time Critical Removal Action
TNT	trinitrotoluene
TOC	Total Organic Content
USATCES	U.S. Army Technical Center for Explosives Safety
USP&FO	United States Property and Fiscal Officer
UTM	Universal Transverse Mercator
VOC	Volatile Organic Compound
DQCR	Daily Quality Control Report
USACE	U.S. Army Corps of Engineers
UXO	Unexploded Ordnance
UXOQCS	Unexploded Ordnance Quality Control Officer
UXOSO	Unexploded Ordnance Safety Officer

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1.0 INTRODUCTION

1.1 GENERAL

This Work Plan was prepared by the U.S. Army Corps of Engineers (USACE), Baltimore District, and describes the technical approach including details for implementation, quality control, and quality assurance for the Time Critical Removal Action (TCRA) at the Open Demolition Area #2 (ODA2) (RVAAP-004-R-01) Munitions Response Site (MRS), located at the Former Ravenna Army Ammunition Plant (RVAAP), now known as the Camp Ravenna Joint Military Training Center (Camp Ravenna), in Ravenna, Ohio (**Figure 1**).

This TCRA is being conducted pursuant to the Final Action Memorandum for the ODA2 MRS (RVAAP-004-R-01), and is consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

Site-specific information presented in this document is intended to supplement the Facility-wide Field Sampling Plan (FWFSP) and the Facility-wide Quality Assurance Project Plan (FWQAPP) for Camp Ravenna (USACE, 2011).

1.1.1 Project Description

Former demilitarization activities at the former RVAAP resulted in the release of Munition of Explosive Concern (MEC) and Material Potentially Posing an Explosive Hazard (MPPEH) at the ODA2 MRS (RVAAP-004-R-01), referred to hereafter as the ODA2 MRS. A Remedial Investigation (RI) was conducted at the ODA2 MRS and the findings were reported in the Final RI Report (USACE, 2015a). The report concluded that a release of MEC/MPPEH had occurred at the site, and the MRS boundary was modified to 317.4 acres (**Figure 2**).

In May 2015, North Atlantic Baltimore (NAB) District conducted a Probability Assessment (**Appendix A**) to identify areas inaccessible to potential receptors due to terrain and/or vegetation barriers, and delineate areas of low probability within the accessible areas of the MRS. The results of the May 2015 site assessment confirmed that specific areas of low probability could be delineated within the MRS, some areas of the MRS are inaccessible to potential receptors due to heavy/thick vegetation, and a removal action in moderate to high probability areas would significantly reduce the explosive safety hazard to potential receptors at the MRS (**Figure 3**).

This TCRA is being conducted to mitigate significant explosive safety hazards posed to National Guard soldiers/trainees due to exposure to MEC/MPPEH in surface and subsurface soil. In addition, data collected during the TCRA will be used to support the evaluation of remedial alternatives in the Feasibility Study.

1.1.2 Purpose

The purpose of the TCRA is to mitigate significant explosive safety hazards posed to National Guard Soldiers trainees due to exposure to MEC/MPPEH at the ODA2 MRS. Removal of known MEC/MPPEH from this area will significantly reduce the explosive hazard in a timely and cost-effective manner. In addition, bi-annual surface sweeps will be conducted to monitor and/or reduce the potential for offsite migration of MEC/MPPEH during high energy storm events.

1.1.3 Scope

The scope of the TCRA involves the following activities:

Moderate to High Probability Areas for encountering MEC (170.4 acres) – Location and recovery of 100% of MEC/MPPEH to depth of detection of 4 feet below ground surface (bgs) in all accessible areas. Known disposal areas will be cleared for MEC/MPPEH to 2 feet bgs and the boundaries will be clearly marked.

Low Probability for Encountering MEC (147 acres) – Location and recovery of 100% of surface MEC/MPPEH in all accessible areas. Inaccessible areas will be delineated during field operations.

Bi-annual Surface Sweeps – Conduct magnetometer-assisted surface sweeps of Sand Creek two (2) times per year to assess potential MEC/MPPEH migration within the ODA2 MRS after high-energy storm events, and to assess the potential for MEC/MPPEH migration at creek exit points on the installation boundary. Surface sweeps will be conducted at ODA2 through the period of performance for the TCRA: 31 AUG 2018.

The scope of this TCRA includes the following tasks:

- Boundary marking and vegetation removal for the areas identified as moderate to high probability for encountering MEC to facilitate access for all operations at the ODA2 MRS.
- Boundary marking for the areas identified as low probability for encountering MEC.
- Establish 100'x100' grid network for the moderate to high area and for the accessible areas within the low probability areas.
- Establish a buried explosion module (BEM) platform for the conduct of demolition operations for recovered MEC and MPPEH which is deemed acceptable to move.
- Conduct a MEC removal action to the depth two feet bgs on those areas identified to be former and/or newly discovered burial/disposal areas.
- With the exception of the burial areas, conduct a 100% MEC removal to depth of detection (four feet bgs) on 170.4 acres identified as moderate to high probability for encountering MEC.
- Conduct 100% instrument assisted surface removal of MEC in the accessible areas within the 147 acres identified as low probability for encountering MEC.
- Excavate a minimum of 10% of subsurface anomalies identified during the surface removal of MEC in the low probability area.
- Dispose of all MEC/MPPEH deemed acceptable to move in the BEM.
- Dispose of any MEC deemed unacceptable to move by blow in place method.
- Prepare a final Removal Action Report.
- Conduct magnetometer-assisted surface clearance of Sand Creek (2 events per year) and prepare Removal Action Report.

Prior to the start of field activities, a TCRA Explosives Safety Submission (ESS) will be prepared and submitted to the USACE Center of Expertise to be forwarded through the U.S. Army Technical Center for Explosives Safety (USATCES) to Department of Defense Explosive

Safety Board (DDESB) for approval. No work will commence until approval of the ESS has been granted by DDESB or interim approval granted by USATCES. The Army National Guard (ARNG) and Ohio Army National Guard (OHARNG) will also review the ESS.

The scope of this TCRA **does not include** remediation of munitions constituents (MC) in soil at the ODA2 MRS. If evidence of MC in soil is observed during the TCRA, the site will be sampled for MC, and the results will be provided to the installation for evaluation in the Feasibility Study. In addition, the scope of this TCRA **does not include** the remediation of known disposal pits. If a disposal pit is observed during the TCRA, the boundaries of the disposal area will be delineated. An MC sample will be collected from the disposal pit if evidence of an MC release is observed, and the results will be provided to the installation for evaluation in the Feasibility Study.

During the TCRA, MEC/MPPEH disposal activities will be monitored for release of MC to the environment. Any soil impacted by MEC/MPPEH disposal activities (to include impacted soils located beneath breached items during excavation) will be characterized, excavated, and containerized for disposal.

All removal activities will be conducted in accordance with the DDESB-approved ESS.

1.2 SITE DESCRIPTION

The former RVAAP, now known as the Camp Ravenna Joint Military Training Center (Camp Ravenna), located in northeastern Ohio within Portage and Trumbull counties, is approximately three (3) miles east/northeast of the City of Ravenna and one (1) mile north/northwest of the City of Newton Falls. The facility is approximately 11 miles long and 3.5 miles wide. The facility is bounded by State Route 5, the Michael J. Kirwan Reservoir, and the CSX System Railroad to the south; Garret, McCormick, and Berry Roads to the west; the Norfolk Southern Railroad to the north; and State Route 534 to the east. In addition, the facility is surrounded by the communities of Windham, Garrettsville, Charlestown, and Wayland. The property location is depicted in **Figure 1**.

Administrative accountability for the entire 21,683-acre facility has been transferred to the United States Property and Fiscal Officer (USP&FO) for Ohio and subsequently licensed to the OHARNG for use as a military training site, Camp Ravenna. The RVAAP restoration program involves cleanup of former production/operational areas throughout the facility related to former activities conducted under the RVAAP.

Past Department of Defense (DoD) activities at the former RVAAP date back to 1940 and include the manufacturing, loading, handling, and storing of military explosives and ammunition. The ODA2 MRS is a former Open Burn/Open Detonation (OB/OD) area, dumping ground, and burial site that was used from 1948 until 1991. During this period, the ODA2 MRS was used to detonate large caliber munitions and off-specification bulk explosives that could not be deactivated or demilitarized by any other means due to their condition. The site was also was used to destroy white phosphorus and bombs.

The ODA2 MRS is located in the central portion of the facility and is 317.4 acres in size. A 2.5-acre OB/OD Area is located at the north-central portion of the MRS and is an operational range.

The operational range is not part of the ODA2 MRS. The MRS location is illustrated on **Figure 2**.

1.2.1 Sources of MEC/MPPEH

The principle sources of MEC/MPPEH at the ODA2 MRS are the result of intentional detonations and potential burial of MEC and bulk explosives. These activities resulted in the potential for MEC/MPPEH to be present in the both the surface and subsurface soil at the MRS.

Specific MEC which may be present in the ODA2 MRS could include any type of munition in the conventional ammunition inventory that was stored and/or utilized at RVAAP. This includes 20mm – 155mm, grenades, rockets, bombs and their assorted components e.g. fuzes, burster tubes etc.

1.3 PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIVITIES

The Rocket Ridge Area was remediated under two TCRAs that occurred in 2009 and 2011. Burial Site 2 is located near the Rocket Ridge Area and was used for sorting and inspection activities in support of the 2011 TCRA. Following the 2011 TCRA, these areas of the ODA2 MRS were removed as potential source areas requiring further investigation.

An RI was conducted at the ODA2 MRS and the findings were reported in the Final RI Report (USACE, 2015a). The RI Report concluded that a release of MEC/MPPEH had occurred at the site, and the MRS boundary was modified based on the results of the investigation. The revised MRS acreage is 317.4 acres.

In May 2015, the USACE conducted a Probability Assessment to assess the probability for MEC/MPPEH at the ODA2 MRS (**Appendix A**). The purpose of the assessment was to visually assess the difficulties posed by site access/egress and to verify specific areas within ODA2 MRS with the highest concentrations of MEC/MPPEH. Specific objectives of the assessment included identifying areas that are inaccessible to potential receptors due to terrain and/or vegetation barriers, and delineation of areas of moderate to high and low probability for encountering MEC. The results of the probability assessment confirmed that specific areas of low probability could be delineated within the MRS. In addition, some areas of the MRS were observed to be inaccessible to potential receptors due to heavy/thick vegetation. Further, field observations confirmed that conducting a removal action in the moderate to high probability areas would be able to effectively reduce the probability to low probability for encountering MEC.

The results of the probability assessment were as follows (**Figure 3**):

- 170.4 acres were categorized as Moderate to High Probability;
- 147 acres were categorized as Low Probability; and
- 40 acres were identified as inaccessible.

1.4 CURRENT AND ANTICIPATED LAND USE TECHNICAL MANAGEMENT PLAN

The ODA2 MRS is currently managed as restricted access due to residual MEC. A small portion of the site is used for demolition of MEC in support of the restoration program. In the future, a

portion of the site will continue to be managed as restricted access and the rest of the site will be operational range (as part of a range complex).

1.5 WORK PLAN ORGANIZATION

This Work Plan was prepared following the format, content, and preparation instructions specified in Data Item Description (DID) MR-005-01 for a Type II Work Plan (USACE, 2009). Each section remains in the table of contents for reference and formatting purposes. Sections are organized as follows:

Section 1 – Introduction
Section 2 – Technical Management Plan
Section 3 – Field Operations Plan
Section 4 – Quality Assurance/Quality Control Plan
Section 5 – Waste Management Plan
Section 6 – Explosives Management Plan
Section 7 – Environmental Protection Plan
Section 8 – References

Appendices:
Appendix A - Probability Assessment

Appendix B - Project Organizational Chart

Appendix C - SAP Addendum

Appendix D - Buried Explosion Module Specifications and General Standard Operating Procedure for Demolition Operations

Appendix E - ODA2 MEC Notification Procedures and Reporting Form, Weekly Inspection Form, and Quantity Tracking Form

Appendix F - Data Quality Control Report Forms

Appendix G - Camp Ravenna Waste Management Guidelines and Inspection Forms

Appendix H - OHARNG Procedures for Inadvertent Discovery of Cultural Materials at Camp Ravenna

Appendix I – First Responder Checklist

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2.0 TECHNICAL MANAGEMENT PLAN

The Technical Management Plan details the approach, methods, and operational procedures that will be used for munitions response activities and technical operations at ODA2 MRS.

2.1 PROJECT OBJECTIVES

The objective of this TCRA is the removal of surface and subsurface MEC/MPPEH in the moderate to high probability areas, and the surface removal of MEC/MPPEH in the accessible areas in the low probability areas. The technical approach of this project involves the following:

- **Mobilization** – Includes mobilization of field staff, equipment and consumable materials to the site; setup, maintenance, and testing of equipment and facilities; familiarizing project personnel with the site; and safety requirements.
- **Grid Survey Activities and Removal Action Area Delineation** – Both moderate to high and low probability area boundaries will be established and identified with survey stakes. A 100'x100' grid system will be established in both areas before MEC/MPPEH activities are conducted.
- **Brush Clearing** – Vegetation removal will be necessary in limited areas within the moderate to high probability areas. Vegetation removal is not anticipated in the low probability areas.
- **Surface Removal of MEC/MPPEH** – An instrument assisted 100% removal of surface MEC/MPPEH will be accomplished in the accessible areas within the low probability area.
- **Subsurface Removal of MEC/MPPEH** – With the exception of pits/burial sites, 100% of MEC/MPPEH will be removed to depth of detection (4 feet bgs in the moderate to high probability areas. MEC will be removed to 2 feet bgs in pits/burial sites, if encountered.
- **Demolition and Disposal** – Demolition/disposal of recovered MEC/MPPEH items will be accomplished as outlined in the approved ESS.
- **MC Verification Sampling** – MC samples will be collected to verify that demolition/disposal activities have not caused a release of MC to the environment. MC sampling will be conducted under MEC/MPPEH items that display evidence of a release of MC to soil. If encountered, MC samples will be collected from disposal pits that display evidence of a release of MC to soil.
- **Site Restoration –** As this TCRA is not meant to address MC in soils, soils removed from excavated areas and detonation holes (from BIPs) will be reused to fill and grade the sites. If additional soil is required for backfill activities clean soil will be utilized.

2.2 PROJECT ORGANIZATION

2.2.1 Team Organization

The project team consists of USACE Staff from NAB and Lakes and Rivers Louisville (LRL) District, OHARNG, and ARNG. LRL is the Project Management District for Camp Ravenna. NAB is the Designated Technical Lead for this TCRA, and is responsible for overall management and execution of onsite activities for this action. An organizational chart for implementation of this Work Plan is presented in **Appendix B**. A summary of key personnel responsibilities is summarized in the following sections.

2.3 PROJECT PERSONNEL

The project will be executed using in-house labor resources. Team members include: Project Manager, Designated Technical Lead, Site Manager/ Senior UXO Supervisor (SUXOS), UXO Safety (UXOSO), Unexploded Ordnance Quality Control Officer (UXOQCS), Project Chemist, Contract Specialist, Ordnance and Explosive Safety Specialists (OESS), and support laborers. In addition, waste hauling and laboratory support contract services will be procured. No contractors will be physically laboring onsite as part of this TCRA.

The responsibilities for key positions for the field effort are described below:

- Project Manager – LRL is the Project Manager for Camp Ravenna. The LRL Project Manager is responsible for ensuring all resources needed to complete the work are available, the work is or sufficient quality and being completed in accordance with the established schedule, and effective coordination is occurring between the project and installation staff. The Project Manager will participate in the bi-weekly contractor call and the bi-weekly Army-only call to update the project team of progress and/or problems.

- Designated Technical Lead – The NAB Designated Technical Lead is responsible for managing Military Munitions Design Center project resources, and ensuring that adequate and qualified technical resources are available to execute the field operations, and coordinating project status/issues with the installation and LRL Project Manager. The Designated Technical Lead assists the Project Manager in developing and executing the technical approach for all actions taking place within the ODA2 MRS, and provides guidance to site personnel regarding compliance with local, state, federal and DoD regulations and guidelines. The Designated Technical Lead is the central point of contact for technical personnel, ensuring proper data flow, consistency of project execution and review of data and reports for accuracy, quality and completeness. The Designated Technical Lead will participate in the bi-weekly contractor call and the bi-weekly Army-only call to update the project team of progress and/or problems.

- Environmental and Explosive Safety Section (EESS) Chief – The EESS Chief will ensure qualified personnel are available to support the operation, manage and oversee site team members, monitor scheduling and funding expenditures and work closely with the Project Manager and Designated Technical Lead to assist as necessary with overall project management and technical issues.

- Site Manager / SUXOS – The Site Manager is responsible for day-to-day operations and completing the field effort. This includes, but is not limited to, safety, field coordination, field planning tasks, tracking progress of work, communicating with Project Manager and Designated Technical Lead, maintaining and submitting documentation, and schedule. The Site Manager coordinates and manages resources in coordination with the Project Manager. As the SUXOS, the site manager is also the senior subject matter expert in the field during the execution of the work. In addition to ordnance and explosive safety concerns, the SUXOS will also be responsible for the overall site safety.

- UXOSO / UXOQCS – The UXOSO/UXOQCS reports independently to the EESS Chief on safety and quality-related matters. The UXOSO/UXOQCS is responsible for monitoring all site activities to ensure strict compliance with established safety regulations and guidelines to include RVAAP specific guidance and to monitor all site activities to ensure that these activities are being carried out in accordance with established quality requirements and protocols as outlined in this TCRA Work Plan. The UXOSO/UXOQCS is responsible for conducting safety and Quality Control (QC) inspections of intrusive and explosives operations for compliance with the established procedures. The UXOSO/UXOQCS will perform daily surveillance of the work activities and issue corrective actions as necessary. The UXOSO/UXOQCS will maintain a daily log book and prepare daily Safety and Quality Assurance Reports (QAR) which addresses all aspects of site activities.

- Project Chemist – The project chemist ensures that the work performed is in accordance with the Facility-Wide Sampling and Analysis Plan (FWSAP), the Sampling and Analysis Plan (SAP) Addendum, Work Plan, Standard Operating Procedures (SOPs) and other pertinent analytical procedures. The chemist is responsible for tracking samples, managing data, coordinating with the laboratory, interpreting data, and producing analytical electronic reports.

- Ordnance and Explosive Specialist (OESS) – The OESS will be responsible for implementing day-to-day operations, and executing the work in accordance with the work plan and explosive safety plans. OESS Staff will be assigned responsibilities/positions of Site Manager/SUXOS, UXOSO and UXOQCS. All OESS staff members will be fully qualified per DDESB Technical Paper 18 for the position assigned.

- Contract Specialist – The contract specialist will be responsible for assisting with contracting needs. Several blanket purchase agreements exist and will be utilized to support simplified acquisitions for the project. The support person will engage with the contractors and team leader to provide the request for proposals and resources.

- Field Support Team – The field support team members will be utilized to perform tasks which primarily require physical abilities and effort. They report to their assigned team supervisor.

All project personnel are responsible for understanding and complying with all requirements established in plans, procedures, and regulations for executing their work in accordance with standard and accepted procedures. In addition, all personnel will be required to comply with the medical, training, experience and requirements for their respective field, and compliance with the Site Safety and Health Plan (USACE, 2015b).

2.3.1 Site Operations

Site operations will be accomplished by members of the NAB Environmental and Explosive Safety Staff. NAB will use a 5-7 person team to accomplish site activities. At a minimum the team will

include an OESS, a UXOSO/UXOQCS and Team Lead. Team size may increase or decrease dependent on the type of activity taking place.

2.4 PROJECT COMMUNICATION AND REPORTING

The project team will communicate clearly and effectively and will work collectively to make the TCRA a success. The Designated Technical Lead will be the primary point of contact with the customer at the Camp Ravenna Environmental Office for this project. The Designated Technical Lead will ensure that equipment and staff are phased in based on the schedule requirements to ensure that maximum efficiency is achieved. All personnel will review the project plans and relevant site documents in advance of site activities to familiarize them with the technical scope, schedule, and requirements. During field operations the Designated Technical Lead with the support of others (e.g., Site Manager, EESS Chief) will schedule and direct work, monitor schedule adherence, ensure quality and safety standards are maintained, and develop and execute corrective action plans as necessary.

2.5 PROJECT DELIVERABLES

Following the completion of field activities, a Removal Action Report will be prepared and submitted to the stakeholders. The content of the report will include at a minimum:

- Introduction and rationale for the removal action
- Site description and background
- Technical approach
- Discussion of all field activities
- Sample results
- Summary and conclusions

If applicable, any problems encountered in implementing the removal action, as well as corrective actions implemented, will be described in the Removal Action Report. The volume of materials removed and final disposition of those materials will be documented in a table, and trip tickets or manifests will be maintained and included in the report to support the tabular summary. The results of all testing performed to monitor site activities will be summarized in tables as well, and original laboratory reports will be maintained and included in the report to support the summaries.

2.6 PROJECT SCHEDULE

The overall schedule of the project is presented in **Figure 4**.

2.7 CONTRACTOR MANAGEMENT

It is anticipated that contractors will be used for laboratory services and waste disposal services during the TCRA at the ODA2 MRS. Contractors will only be onsite to drop off or pick up materials. All contractors will be escorted by USACE while onsite.

2.7.1 Laboratory Services

All analytical samples will be analyzed at a qualified lab (yet to be determined). The USACE currently has a laboratory blanket purchase agreement (BPA) with several laboratories qualified

to do this work. The selected laboratory will be responsible for analyzing all soil samples and reporting all analytical data for this project.

2.7.2 Waste Disposal Services

Several waste streams will be generated throughout the work performance, including vegetation, material documented as safe (MDAS), environmental media, decontamination fluids, and solid waste. All waste materials will be handled by a qualified waste hauler (yet to be determined). Waste characterization and handling procedures are discussed in **Section 5.0**. The USACE currently has a transportation and disposal BPA with several vendors qualified to do this work. The selected vendor will be responsible for transportation and disposal of all waste materials at approved disposal facilities. All items suitable for recycle (e.g. Material Documented as Safe [MDAS]), will be provided to a qualified vendor for recycling.

2.7.3 Management of Field Operations

Field work will be coordinated within the USACE – Baltimore office. Field teams may be composed of USACE personnel and any necessary contract support. All resources will be managed by the Designated Technical Lead and Site Manager. The Site Manager will be responsible for identifying appropriate field staff and will confirm that the proposed project personnel have the necessary experience and required training for the project.

2.8 PROJECT COMMUNICATION AND REPORTING

The Site Manager will maintain a daily log provide site reports outlining daily site activities to the Designated Technical Lead who in turn will distribute to the project team. The UXOQCS will maintain a daily log and provide weekly QARs. The Site Manager will maintain a daily log and provide completed grid sheets to the UXOQCS.

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3.0 FIELD OPERATIONS PLAN

3.1 OVERALL APPROACH TO MUNITIONS RESPONSE ACTIVITIES

The primary objective of the TCRA is to remove MEC/MPPEH from surface and subsurface soil at the ODA2 MRS. A combination of visual surveys, surface and subsurface removal actions, and MC verification sampling will be performed during the TCRA. Location and recovery of MEC/MPPEH will be conducted to a depth of 4 feet bgs in accessible moderate to high probability areas (170.4 acres). Disposal areas/burial pits will be cleared to a depth of 2 feet bgs and boundaries clearly marked. Location and recovery of 100% of surface MEC/MPPEH will be conducted in accessible low probability areas. Areas deemed inaccessible due to dense vegetation or terrain will be delineated. Magnetometer-assisted surface clearances will be conducted in Sand Creek two (2) times per year to assess potential MEC/MPPEH migration within the ODA2 MRS after high-energy storm events, and to assess the potential for MEC/MPPEH migration at creek exit points on the installation boundary. Surface sweeps will be conducted at ODA2 through the period of performance for the TCRA: 31 AUG 2018. MC verification sampling will be conducted to ensure munitions response actions are not releasing MC to the environment.

Soil sampling and analysis will be performed for MC as described in the SAP Addendum (**Appendix C**). The SAP Addendum is inclusive of an FSP and a QAPP and will apply to all site and laboratory activities. Project-specific Data Quality Objectives (DQOs), standard operating procedures, sampling and analytical methods are described in detail in SAP Addendum (**Appendix C**).

3.2 APPLICABLE GUIDANCE AND REGULATIONS

Munitions response activities will be performed in accordance with DoD, DA, USACE and local, state, and federal regulations. Persons engaged in the handling and transport of explosives will comply with Title 18 United States Code (U.S.C.) 842 and 29 Code of Federal Regulations (CFR) 1910.120. Intrusive activities and demolition will be conducted in accordance with the project Site Safety and Health Plan (USACE, 2015b) and the approved ESS.

3.3 ANTICIPATED MEC

Based on previous investigations and removal actions, MEC anticipated includes virtually anything in the conventional ammunition inventory which was stored and/or utilized at the former RVAAP.

3.4 GEOGRAPHIC INFORMATION SYSTEM MANAGEMENT

NAB will establish and manage a project Geographic Information System (GIS) to meet applicable federal, DOD, and Army geospatial standards. In addition, the GIS database will comply with requirements for the Ravenna Environmental Information Management System
REIMS. TCRA results, including grid progress dig information, and MEC recovery information will be tracked using the project GIS. GIS data will be created and managed in compliance with the following requirements:

- Data will adhere to all applicable federal, DoD, and Army geospatial standards, and be provided in Universal Transverse Mercator (UTM), Zone 18N, and WGS84 coordinate system.
- Spatial data and metadata will conform to the Federal Geographic Data Committee National Standards for Spatial Data Accuracy.
- Centroid coordinates and elevations of sampling locations will be supplied to REIMS as both an Excel file and a shapefile. The coordinate system, which will be clearly documented, will be in North Atlantic Datum (NAD) 83 Ohio State Plane North feet or NAD83 UTM Zone 17 North meters.
- Polygons for Incremental Sampling Methodology samples, remediated areas, and disposal pit discoveries will be supplied to REIMS as shapefiles or an ESRI compatible geodatabase.
- All data will comply with the standard for the National Guard: Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE) 2.6.

3.5 MOBILIZATION

This task will include mobilization of field staff; equipment (e.g., computers, detectors, vehicles) and consumable materials (e.g., flagging, stakes, spray paint, personal protective equipment [PPE]); setup, maintenance, and testing of equipment and facilities, computers, all-terrain vehicles, radios); and familiarizing project personnel with the site and with work and safety requirements.

There will be no site office established. Site personnel will accomplish all administrative tasks from their hotel room or if necessary utilize office space in the Camp Ravenna Environmental Office.

3.5.1 Grid Survey Activities and Removal Action Area Delineation

A grid system will be established across both the low and moderate to high TCRA areas prior to intrusive activities. The exact boundaries of these areas are unknown so grid location and configuration will be determined in the field. The grid system will cover each surface/subsurface removal area. The grid system will ensure full coverage is achieved in each TCRA area and provide the OESS team navigation and results tracking during the course of the project. The grid layout includes the following two primary steps; (1) establish boundary control points, (2) grid corner location survey. Each step is discussed in detail in the following sections:

3.5.1.1 Establish Boundary Control Points

- Boundary control points will be placed to accurately identify the bounds of each TCRA area. The boundary control points will also confirm that the surveyed boundary entirely overlaps each TCRA area. The overlap will ensure full coverage of the TCRA areas.
- Boundary control points will be at selected removal action area boundary locations.
- Boundary control points will be established by licensed professional surveyor or will be surveyed by a Trimble Real Time Kinematic (RTK) Global Positioning System (GPS) or equivalent laser total station

- Each boundary control point located by the will be marked by a wooden stake with fluorescent flagging. The wooden stake will have the unique boundary control point identification (ID).

3.5.1.2 Grid Corner Location Survey

- Each TCRA area will be subdivided into a 100'x100' grid system. The grid system will be used to track progress and results and to ensure complete coverage is achieved during the surface and subsurface removal actions.
- The grid layout/identification is a continuous 100'x100' alphanumeric grid system. A map and list of grid corner coordinates will be provided in the site report.
- Grid corner positions will be marked with a wooden stake denoted by a unique ID.
- Once established, the grid corner location will be uploaded to the project GIS.

3.5.2 Brush Clearing

All vegetation removal will be closely coordinated with the Camp Ravenna Environmental Office. Brush clearing will be conducted within the moderate to high probability areas to perform surface/subsurface MEC/MPPEH removal activities, as necessary. Minimal vegetation will be removed from the grids. There are no plans to remove any trees; however, if small tree removal is necessary, no trees larger than 3 inches will be removed. The goal is to accomplish the TCRA removal activities without significant impact to the surrounding environment. Brush will not be removed from the work site, rather fallen brush/trees will be managed and staged within the respective work grids. Vegetation staging will coordinated with the Camp Ravenna Environmental Office. Natural debris (i.e., fallen trees) that will interfere with activities will be cut and moved from the areas to be cleared as necessary. Brush clearing will be conducted immediately following the grid survey activities.

Areas with high grass may only be mowed prior to April or after August due to the potential for disturbing grassland nesting species. Felling of trees is not anticipated, but in the event tree removal is necessary, all removal will occur between the dates of 1 October to 31 March. No cutting of trees is permitted between April and October due to the Northern Long Eared Bat.

3.5.3 Geophysical Instrumentation

Hand held analog instruments (magnetometers) will be used at the ODA2 MRS for both surface and subsurface removal action field activities. One hundred percent coverage surface/subsurface removal over 170.4 acres of moderate to high probability areas and 100% coverage of accessible 147 acres (approximately 107 acres) of low probability area of the ODA2 MRS will be performed using either the Schonstedt GA-52Cx magnetic locator or similar device.

The Schonstedt GA-52Cx magnetic locator is a hand-held unit that detects changes in the Earth's ambient magnetic field caused by ferrous metal. Two fluxgate sensors are mounted a fixed distance apart and aligned in gradiometer configuration to eliminate a response to the Earth's ambient field. The magnetic locators generate an audio output and a meter deflection when either of the two sensors is exposed to a disturbance of the Earth's ambient field associated with a ferrous

target and/or the presence of a permanent field associated with a ferrous target. Schonstedt detectors are a "go/no go" instrument and will be checked once every morning prior to removal activities. Instruments will additionally be checked periodically throughout the day during operations.

3.5.4 Surface and Subsurface Removal Operations

3.5.4.1 OESS Qualifications

All OESS personnel are fully qualified as SUXOS per the criteria established in DDESB TP 18, Minimum Qualifications for Unexploded Ordnance (UXO) Technicians.

3.5.4.2 Removal Action Area Description

Low Probability Area

Surface removal of MEC/MPPEH will be conducted only in the accessible low probability area within the MRS. The surface removal area is estimated to be approximately 107 acres (**Figure 3**).

Moderate to High Probability Area

With the exception of identified pits/burials, subsurface removal of MEC/MPPEH to depth of detection (4' bgs) will be conducted in the moderate to high areas within the MRS. The subsurface removal area is estimated to be approximately 170.4 acres (**Figure 3**).

Disposal Pits

MEC/MPPEH will be removed in known disposal areas in the moderate to high probability area to a depth of 2 feet bgs, and the boundaries will be delineated based on observations made during removal activities.

3.5.5 Removal Action Procedures

3.5.5.1 Surface Removal Action Procedures

Low Probability Area

An instrument assisted surface removal of MEC/MPPEH will take place in the low probability areas within the MRS. Surface removal of MEC/MPPEH includes removal of items detected at ground surface either fully exposed or partially exposed using analog detection instruments such as the Schonstedt and/or Subsurface magnetometer that uses flux-gate technology. Tall grass, leaf litter and detritus will be removed down to the ground surface to investigate anomalies detected. If a detected anomaly is partially exposed it will be fully investigated. A minimum of 10% of subsurface anomalies detected will be investigated in each grid. This will be completed to verify that magnetic anomalies in low probability area are not MEC/MPPEH. If a surface and/or subsurface MEC/MPPEH is encountered then a 50'x50' grid will be established around the item and 100% of subsurface anomalies investigated.

The surface removal grid layout is a continuous 100'x100' numeric grid system with wooden stakes installed at grid corners. The grid boundaries will be established prior to performing surface

removal activities. Surface removal action will be conducted using a Schonstedt GA-52cX and/or subsurface magnetometer following daily QC testing. The following grid survey approach will be performed by the OESS team:

- Each grid will be subdivided into 5 foot sweep lanes. OESS will travel along individual search lanes and overlapping the sweep area.
- Each lane will be surveyed to achieve complete coverage and overlap within the established grid boundaries.
- Visual observations will also be made by the team as each transect is traversed and significant observations (e.g. stressed vegetation/stained soil) recorded on the grid sheet and in the daily log book.
- Grass, leaf litter and detritus will be removed to the ground surface to investigate items. If a metallic item is observed and/or detected, the UXO technician will investigate the item and remove it if exposed/partially exposed. Non-MEC/MPPEH related debris which is too large to move will be noted on the grid sheet and in the daily log book. Non-MEC/MPPEH related debris will be collected, handled, and disposed in accordance with procedures outlined in **Section 5.0**.
- Investigation results will be noted on each grid sheet. Significant finds will be noted in the daily log book and GPS coordinates taken.

3.5.5.2 Subsurface Removal Action Procedures

Moderate to High Probability Area

With the exception of identified pits/burials, surface/subsurface MEC/MPPEH removal to depth of detection (4' bgs) will be performed on 100% of the 170.4 acre moderate to high probability areas. MEC will be removed from the pits/burials to a depth of 2' bgs. Hand held magnetometers as previously discussed will be used for this removal action. It is anticipated that brush clearing will be required to facilitate subsurface removal activities. Brush clearing will be minimized to the clearance necessary to conduct removal activities on each grid. Brush clearing activities will be closely coordinated with the Camp Ravenna Environmental Office to ensure that protected plant species are not removed and vegetation is cut within allowable timeframes.

As with the surface removal, the surface/subsurface removal grid layout is a continuous 100'x100' numeric grid system with wooden stakes installed at grid corners. The grid boundaries will be established prior to performing surface/subsurface removal activities. The following grid survey approach will be performed by the OESS team:

- Each grid will be subdivided into 5 foot sweep lanes. OESS will travel along individual search lanes and overlapping the sweep area.
- Each lane will be surveyed to achieve complete coverage and overlap within the established grid boundaries.
- Subsurface removals will be accomplished via the industry standard "mag and dig" protocols in that each identified anomaly will be excavated upon detection.
- Visual observations will also be made by the team as each transect is traversed and significant observations (e.g. stressed vegetation/stained soil) recorded on the grid sheet and in the daily log book.

- In the event larger metallic items are encountered which cannot be removed the GPS coordinates of the item will be recorded on the grid sheet and in the daily log book.
- Investigation results will be noted on each grid sheet. Significant finds will be noted in the daily log book and GPS coordinates taken.
- Multiple pin flags will be used to mark the boundary of burial pits, if encountered. GPS coordinates will be taken of each corner of the pit and noted on the grid sheet and in the daily log book.

3.5.6 Munition with the Greatest Fragmentation Distance

As identified in the ESS, the 155mm HE projectile is the munition with the greatest fragmentation distance (MGFD). If a munition with a greater fragmentation distance is encountered during operations then that explosive safety quantity distance (ESQD) arc will be implemented immediately, work will continue and an amendment to the ESS submitted.

3.5.7 Minimum Separation Distances

The minimum separation distance (MSD) for the MRS is 450 feet, as identified in the ESS. Anomalies will be investigated by OESS teams only when an exclusion zone has been established around each anomaly location. The exclusion zone is based on the hazardous fragment distance (HFD) for the MGFD. No intrusive work will be performed until non-essential personnel are separated from the anomaly location by the HFD. The exclusion zone will be maintained by the OESS team until the excavation is complete. If an area cannot be blocked, spotters will alert the OESS team when non-essential personnel need to enter the exclusion zone. In this case, intrusive operations will be discontinued until the nonessential personnel leave the area.

3.5.8 MEC/MPPEH Removal

The following investigation procedures will be used when investigating anomalies:

- The item will be considered MEC/MPPEH until it is positively identified. The exclusion zone for the anomaly will be maintained during excavation.
- For surface anomalies, leaf litter and detritus will be removed down to the ground surface to investigate items. If a detected anomaly is not exposed or partially exposed after moving leaf litter and detritus down to ground surface, investigation of the detected anomaly will cease and UXO personnel will continue with surface removal activities.
- For subsurface anomalies, excavation will commence adjacent to the anomaly and will continue until the depth of the anomaly has been reached.
- Excavations will be continually checked using a magnetometer to avoid direct contact with the item.
- The sidewall of excavations will then be expanded to expose the item for inspection and identification.
- Earth moving equipment (mini-excavator) may be used when the depth of the item cannot be managed by manual excavation. Excavations will be performed in shallow lifts while the OESS performs anomaly avoidance procedures. Mechanical excavations will be used only until the excavation is within 12 inches from the item. Manual excavations will be used to remove the remaining soil cover.

- Recovered MEC/MPPEH that are acceptable to move will be held at a designated collection point within the grid until disposal operations can occur. Recovered MEC/MPPEH will be transferred from the subject grid to the BEM the day of a scheduled demolition event. All MPPEH and MEC which is acceptable to move will be disposed of using the BEM as an engineering control. If any item is deemed unacceptable to move, then that item will be blown in place.
- If the subsurface contact proves to be non-munitions related, the item will be removed and the hole re-checked with a Schonstedt GA-52cX. Non-MEC/MPPEH related debris will be collected, handled, and disposed in accordance with procedures outlined in **Section 5.0**.
- When the anomaly has been resolved or the hole is deemed "clear" of additional metallic material, the excavation will be refilled and tamped.

If an item is discovered to be at depths below 4 ft., the OESS team will conspicuously mark the location with flagging and continue to the next anomaly. The Site Manager will determine if the anomaly warrants further investigation or should be left in the ground.

3.5.9 MEC Demolition and Disposal

NAB will conduct demolition activities on an as-needed basis and in accordance with the ESS and the requirements of Technical Manual (TM) 60A-1-1-; EM 385-1-97, Explosives Safety and Health Requirements; and applicable Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF), federal, state, and local regulations. MEC/MPPEH will be disposed of in one of three ways: (1) blown-in-place (BIP) (2) transported to the BEM within the MRS to be destroyed, or (3) Explosive Ordnance Disposal (EOD) will respond. Demil by explosive demolition of any item will not occur until it has been positively identified. Use of EOD will be limited to the following scenarios:

- MEC cannot be identified as a conventional explosive.
- The fuze cannot be identified by type or function.
- Chemical warfare materiel is suspected.

MEC/MPPEH that is not acceptable to move will be BIP. MEC/MPPEH that is deemed acceptable to move will be relocated to the BEM for disposal. In the event of a BIP, MC sampling will occur post detonation as outlined in **Section 3.6** of the SAP Addendum (**Appendix C**).

At the beginning of the project, general notifications concerning project demolition operations will be made to the following offices/organizations:

- Camp Ravenna Range Control
- Camp Ravenna Range Operations
- Camp Ravenna Environmental Office
- Camp Ravenna Garrison Commander
- ARNG
- Ohio EPA
- Portage County Sherriff's Office
- Windham Fire Department
- Portage County Local Emergency Planning Committee

For specific demolition events, notifications and action specific information will be coordinated with Range Control, Camp Ravenna Environmental Office, and Ohio EPA using the notification form in **Appendix E**, as outlined in **Section 3.5.11**.

Demolition operations will be scheduled by the Site Manager on the basis of the weather and logistical considerations. Prevailing weather condition information will be obtained from a reliable resource such as Youngstown Airport, www.wunderground.com, or www.weather.com. Weather data will be logged before each on-site detonation. The demolition charges will not be primed or connected for electrical firing during the approach or presence of a thunderstorm. Other weather conditions (high winds, dust storms, temperature inversions, low altitude clouds, or cloud coverage of more than 50%) may adversely impact planned demolition operations. The Site Manager will consider these conditions when determining whether or not to conduct demolition operations.

The control of the demolition site must be maintained at all times during demolition operations. Nonessential personnel within the MSD, must evacuate to a safe area. The access road entering the MRS will be physically secured and monitored to prevent vehicular traffic during demolition operations. In addition, the exclusion zone will be monitored to prevent unauthorized personnel/foot-traffic from entering the MRS. Although not anticipated, if required, road closures will be coordinated with Range Control and the Camp Ravenna Environmental Office. The UXOSO and Demolition Team Leader will ensure that the area is clear of unauthorized personnel and equipment prior to permitting the attachment of the initiation devices to the priming charge. The control of the initiation devices will remain with the Demolition Team Leader until attachment to the firing circuit. An observer will be stationed where there is a good view of the approaches to the demolition site. It will be the responsibility of the observer to notify the Team Leader to suspend firing if a vehicle or person is seen approaching the general demolition site. The demolition materials will be accounted for by the demolition team at all times. Only the Amount of explosives needed to complete the day's demolition operations will be transported to the demolition site.

BIP sites will be photographed with a digital camera prior to and after firing of the shot, and the photograph(s) will be saved electronically for Removal Action Report. At a minimum after each detonation, the detonation points and general demolition site will be inspected to ensure that all items have been consumed. The area where demolition operations are being conducted will remain secured until the UXOSO and Demolition Team Leader have given "all clear."

In the event of a fire or unplanned explosion, site personnel will be responsible for extinguishing the fire. If they are unable to do so, they will notify the Range Control and evacuate the area. **NOTE: Do not attempt to fight explosive fires.**

3.5.10 Buried Explosion Module

The BEM calculation is used as an engineering control precision safety tool. Its primary function is to provide burial depth information to prevent fragmentation from being propelled great distances when conducting demolition in an area that cannot sustain an unlimited exclusion area. Through the use of the BEM the HFD exclusion area can be minimized to zero feet. As a safety

precaution the DDESB would still require a minimum HFD of 200 to 220 feet exclusion area, for qualified UXO personnel, based on the MEC/MPPEH item.

Specifically, the BEM is a spreadsheet calculator that requires user input related to the specific MEC item being disposed of during demolition operations. This information comes from the DDESB Fragmentation Data Review Sheets that are periodically updated with new data. The user input requirements are the fragment weight in pounds, fragment velocity in feet per second, the single item trinitro-toluene (TNT) equivalent weight in pounds, total number of items, and total weight of all donor charges in pounds. The last piece of information to input is the depth of burial in feet. The depth of burial input can adjust the HFD exclusion area requirement from maximum exclusion area to zero feet. For example, if a M107 155mm high explosive projectile is used for calculation you can adjust the depth of burial from the maximum exclusion area of 2,894 feet to zero feet by adding more or less burial material (sand) to the demolition shot. This method is also known as tamping which is the process of tightly packing mud, wet sand, clay or other dense material on and around an explosive charge that has been placed on the surface of an obstacle, ordnance or the like. It helps with reducing the initial report of the detonation and in some cases limiting the fragmentation exclusion area.

Use of the BEM on sites similar to the ODA2 MRS has resulted in limiting of potential contamination by detonation to less than 3 feet. Buried explosion module specifications are included in **Appendix D**.

3.5.11 BEM Notification and Reporting Requirements

The BEM will be physically located within the ODA2 MRS (**Figure 3**) and will be used to destroy all MEC/MPPEH that are deemed acceptable to move during the TCRA. For specific demolition events, pre-demolition notifications will be made to Range Control, the Camp Ravenna Environmental Office, and the Ohio EPA. Pre-demolition and post-demolition information will be provided to the Ohio EPA in accordance with the ODA2 MEC notification procedures outlined in (**Appendix E**). A copy of the notification and reporting form is included in **Appendix E**.

3.5.11.1 Standard Operating Procedures and Inspection Reporting

SOPs for BEM and demolition operations are included in **Appendix D**. SOPs used for demolition events will be included in pre-demolition and post-demolition information provided to Ohio EPA in accordance with the procedures outlined in (**Appendix E**). In addition, an inventory of all MEC/MPPEH demolition operations and wastes generated will be maintained on a Quantity Tracking Form (**Appendix E**). The following information will be provided to the installation:

- Inspection report for BEM structure.
- Inventory of all munitions that are disposed at the BEM.
- Net explosive weight of munitions destroyed (excluding donor charges).
- Written SOP that describes specifics of the demolition operation.
- Log of each demolition shot and inventory of all waste generated as part of the project (nonhazardous/scrap etc.) (**Appendix E**).

All demolition activities in ODA2 on acceptable to move items will be conducted using the BEM. The BEM fully contains the demolition explosion and prevents a release of MC to the environment.

Subsequently, no pre- or post-detonation media sampling will be conducted as part of this TCRA. Environmental sampling will be conducted at the BEM pre- and post-construction, as described in **Section 3.6.4**.

When in use, OESS personnel will conduct weekly inspections of the BEM structure using the inspection form included in **Appendix E**. This inspection report will be provided to the Camp Ravenna Environmental Office.

3.5.12 BIP Notification and Reporting Requirements

For specific demolition events, pre-demolition notifications will be made to Range Control, the Camp Ravenna Environmental Office, and the Ohio EPA. Pre-demolition and post-demolition information will be provided to the Ohio EPA in accordance with the ODA2 MEC notification procedures outlined in (**Appendix E**). A copy of the notification and reporting form is included in **Appendix E**.

3.5.13 Notifications for Work Occurring After Normal Business Hours

Removal activities will be fully coordinated with installation staff to ensure compatibility with operational requirements. As such, any work that will occur after 1630 hours during the week, or on a weekend, will be fully coordinated with the Camp Ravenna Environmental Office and Range Control prior to it taking place.

3.5.14 Material Potentially Presenting an Explosive Hazard

The NAB OESS Team will classify recovered items as MEC/MPPEH. MEC will be disposed of as described in **Section 3.5.9**. MPPEH will be inspected to determine whether it is material documented as an explosive hazard (MDEH) or MDAS. MDEH will be disposed of by detonation as described in **Section 3.5.9**.

The OESS Team will ensure that all MPPEH items are inspected per the criteria established in DoD Instruction (DoDI) 4140.62 and DoD Manual (D0DM) 6055.09M as follows:

- 100% inspection and 100% re-inspection by the OESS team.
- Verification of the inspection process by the UXOSO and Site Manager.
- Ensure that all MDEH is disposed of as in **Section 3.5.9**.
- Ensure that all certified MDAS is held in a secure container prior to final disposition.
- Ensure that appropriate documentation (DD Form 1348-1) is completed and accompanies the MDAS when released.

The DD Form 1348-1 will list the following:

- Basic material content.
- Estimated weight.
- Unique identification of each of the container and seal number.
- Location where the MDAS was obtained.

3.5.15 Bi-annual Magnetometer-Assisted Visual Surface Sweeps at Sand Creek

Magnetometer-assisted surface sweeps of Sand Creek will be conducted two (2) times per year to assess potential MEC/MPPEH migration within the ODA2 MRS after high-energy storm events, and to assess the potential for MEC/MPPEH migration at creek exit points on the installation boundary. Surface sweeps will be conducted at ODA2 through the period of performance for the TCRA: 31 AUG 2018. Visual survey activities will be conducted using a minimum of two OESS personnel. OESS personnel will conduct a magnetometer-assisted visual survey of sand creek from the culvert to the eastern boundary of the ODA2 MRS, and from the eastern boundary of the MRS to the installation boundary. OESS personnel will utilize hand held analog magnetometers to assist in areas with limited visibility such as tall grass, deep/murky water, etc. If encountered, MEC/MPPEH items, will be documented by type, described, and photographed. The location of the item will be recording using hand-held GPS. Once documented, acceptable to move MEC/MPPEH items will be transported to the BEM for disposal. Unacceptable to move items will be destroyed using BIP procedures. All MEC/MPPEH demolitions and disposal will be conducted as described in **Section 3.5.9**. MPPEH items will be inspected and handled in accordance with the procedures outlined in **Section 3.5.14**.

3.6 MUNITIONS CONSTITUENT VERIFICATION SAMPLING

During the TCRA, MEC/MPPEH disposal activities will be monitored for release of MC to the environment. Any soil impacted by MEC/MPPEH disposal activities (to include impacted soils located beneath excavated items) will be characterized, excavated, and containerized for disposal. MC sampling will be conducted to verify that a release of MC to the environment has not occurred as a result of removal action/disposal activities.

The scope of this TCRA does not include remediation of pre-existing MC in soil at the ODA2 MRS. If evidence of pre-existing MC in soil is observed during the TCRA, the site will be sampled and the results will be provided to the installation for further evaluation in the Feasibility Study. If evidence of a disposal pit is observed during the TCRA, the boundaries of the disposal area will be delineated during the MEC/MPPEH removal. If evidence of an MC release is observed in a disposal pit, an MC sample will be collected from the excavation prior to backfilling (the scope of the MEC/MPPEH removal action is 2 feet bgs in disposal pits). The analytical results will be provided to the installation for further evaluation in the Feasibility Study.

The following sections describe the sampling methods and procedures that will be used to conduct MC verification sampling. Sampling and analysis protocols will be performed as detailed in the SAP Addendum (**Appendix C**). There are four (4) situations where MC verification samples will be collected as part of this TCRA: 1) evidence of exposed filler, soil staining, or stressed vegetation; 2) evidence of MC release in disposal pits; 3) pre- and post- BIP operations; and 4) pre- and post- BEM construction/operation.

3.6.1 Exposed Filler, Soil Staining, and or Stressed Vegetation

If a MEC/MPPEH item is found that is broken open with exposed explosive filler, or evidence of soil staining or stressed vegetation observed in the field near or under an item, then a discrete soil sample will be collected and analyzed for MC. If a large cache of MEC/MPPEH is identified with

evidence of MC release to soil, an incremental sample methodology (ISM) sample will be collected as described in **Section 3.6.3.2**.

3.6.1.1 Discrete Soil Sampling and Analyses for MC

Discrete soil samples will be collected using the trowel/spoon method. All non-disposable equipment will be decontaminated prior to use. The depth interval for discrete samples under or around an item will be limited to the interval located from the land surface after the MEC/MPPEH item has been excavated or removed to a depth of 6 inches bgs. If located on the surface, the vegetative cover will be removed, and the soil sample will be collected below this interval. The soil sample will be collected using a disposable or stainless steel trowel or spoon. This instrument will be used to manually dig into the soil material to the required depth. Soil will be placed in a stainless steel bowl or disposable container and homogenized. The required sample volume will be placed into labeled containers and sealed. Excess material will be containerized and managed in accordance with **Section 5.0**. Soil volume being collected for volatile compounds will not be homogenized, rather this material will placed directly into the sample container.

The SAP Addendum (**Appendix C)** provides information regarding sample volume/mass, preservation methods, sample handling, and analytical methods for discrete samples. Discrete samples collected proximate to MEC/MPPEH with exposed filler, or exhibiting signs of soil staining or stressed vegetation will be analyzed for the following parameters: explosives, metals, propellants, semi-volatile organic compounds (SVOCs), total organic content (TOC), and pH. The exact number and location of discrete soil samples will be based on observations made in the field during MEC/MPPEH removal activities.

3.6.1.2 Analytical Results and Comparison to Screening Criteria

Analytical results will be compared to the Facility-wide Cleanup Goals, Camp Ravenna Background Values, and EPA Region 9 Screening Levels to determine if MC is present at concentrations that require excavation and removal. Location and analytical data will be forwarded to the installation for inclusion in the Feasibility Study.

3.6.2 Disposal Pits

If a MEC/MPPEH item is found comingled with other materials in a disposal pit, and there is evidence of MC release such as exposed filler material or soil staining in the excavation and/or debris during MEC/MPPEH removal, then either a discrete or a composite soil sample will be collected (depending on the size of the excavation) from the disposal pit and analyzed for MC.

3.6.2.1 Discrete/Composite Soil Sampling and Analyses for MC

Discrete soil samples will be collected using the trowel/spoon method. All non-disposable equipment will be decontaminated prior to use. The depth interval for discrete samples under or around an item will be limited to the interval located from the land surface after the MEC/MPPEH item has been excavated or removed to a depth of 6 inches bgs. If vegetative material is present, this material will be removed. The soil sample will be collected using a disposable or stainless steel trowel or spoon. This instrument will be used to manually dig into the soil material to the required depth. Soil will be placed in a stainless steel bowl or disposable container or container

and homogenized. The required sample volume will be placed into labeled containers and sealed. If a composite sample is being collected, equal volume soil samples will be collected with the sampling trowel/spoon, placed in a stainless steel bowl or disposable container or container and homogenized. Excess material will be containerized and managed in accordance with **Section 5.0**. Soil volume being collected for volatile compounds will not be homogenized, rather this material will placed directly into the sample container.

The SAP Addendum (**Appendix C)** provides information regarding sample volume/mass, preservation methods, sample handling, analytical methods for discrete/composite samples, and duplicate frequency criteria. Discrete/composite samples collected from disposal pits exhibiting signs of a release of MC will be analyzed for the following parameters: explosives, metals, propellants (nitrocellulose), SVOCs, TOC, and pH. The exact number and location of discrete/composite soil samples will be based on observations made in the field during MEC/MPPEH removal activities.

3.6.2.2 Analytical Results and Comparison to Screening Criteria

All excavations in disposal pits will be backfilled with excavated material after MC sampling and removal of MEC/MPPEH to 2 feet bgs. The boundaries of the disposal pit will be delineated during removal activities. Analytical results will be compared to the Facility-wide Cleanup Goals, Camp Ravenna Background Values, and EPA Region 9 Screening Levels to determine if MC is present in the disposal pit. Location and analytical data will be forwarded to the installation for inclusion in the Feasibility Study. All excavated material will be returned to its original location.

3.6.3 Blow-In-Place Operations

3.6.3.1 Pre-BIP Soil Sampling and Decision Unit

If a MEC/MPPEH item is determined to be unacceptable to move, BIP operations will be conducted. An ISM surface soil sample will be collected before and after demolition operations. A 25x25 foot decision unit will be established, centrally locating the MEC/MPPEH item within the decision unit. An ISM sample will be collected from the decision unit and consist of 30 randomly-located increments.

3.6.3.2 ISM Sample Collection and Analyses for MC

The purpose of the pre-BIP ISM sample is to determine concentrations of potential MC in surface soil prior to BIP operations. A decision unit will be established for pre-BIP ISM sampling. The decision unit will not exceed ¼ acre in size. Surface soil will be collected at a depth between 0 to 6" inches bgs within the decision unit. Soil increments will be collected below the vegetative cover, if present. The sample will consist of material collected from the entire depth interval. Each ISM surface soil sample will consist of 30 random samples collected from locations selected in a systematic random pattern throughout each decision unit. In the event that field conditions (i.e., uneven terrain and heavy vegetation) do not permit increments to be collected in a systematic random pattern, a stratified random pattern sampling will be used. Increments will be collected using a 7/8-inch diameter stainless steel step probe or similar approved sample collection device. All increments will be of equal size and volume to ensure an accurate sampling has been taken. The increments will be placed into a plastic lined bucket or plastic zip lock bag and combined to

make a single sample. If feasible, disposable tools may be utilized, otherwise decontamination of tools will be performed between decision units, but not during collection of the increments within a decision unit. Approximately 1 to 2 kilograms of soil will be collected for each ISM sample and submitted to the laboratory for processing and analysis. All sample processing (sieving, grinding, etc.) will be conducted under controlled conditions in the laboratory.

Soil volume being collected for volatile compounds will not be homogenized, rather, this material will placed directly into the sample container. The one discrete sample will be collected from within the decision unit using the trowel/spoon method. The specific location of the discrete sample will be biased toward the area most likely to contain volatile organic compounds, or if no such area is observed, the location will be randomly selected.

Field replicate samples will be collected from the decision units at the frequency listed in SAP Addendum (**Appendix C**). The collection of the field replicate samples requires two similar portions of soil. Therefore, at a decision unit where a field replicate is to be collected, three ISM samples will be collected from consisting of at least 30 increments each.

The SAP Addendum (**Appendix C)** provides information regarding sample volume/mass, preservation methods, sample handling, and analytical methods for ISM samples. Pre- and post-BIP ISM samples will be analyzed for the following parameters: explosives, metals, propellants (nitrocellulose), SVOCs, TOC, and pH. The exact number and location of BIP soil samples will be based on observations made in the field during MEC/MPPEH removal activities.

3.6.3.3 Post-BIP Soil Sampling and Comparison to Screening Criteria

Following MEC/MPPEH disposal operations, a post-BIP ISM sample will be collected from the decision unit using the same procedures used to collect the pre-BIP sample. The purpose of the post-BIP sample is to verify that demolition operations did not result in a release of MC to the environment. The analytical results for the pre- and post-BIP samples will be compared to determine whether or not a release of MC occurred in the decision unit as a result of BIP operations.

3.6.3.4 Soil Remediation and Confirmation Sampling

If the analytical results are elevated, the impacted soil will be excavated and containerized in an appropriate container and managed in accordance with the procedures outlined in **Section 5**. A confirmation sample will be collected to verify all MC contaminated soil has been removed from the decision unit to pre-BIP levels. The confirmation sample will be collected using the same sampling methodology as the characterization sample. The excavation will be backfilled with native material from the surrounding grids, or clean backfill will be used if existing material is not sufficient to return the excavation to original grade. If the analytical results from the confirmation sample still exceed the target concentrations, this process will be repeated until all MC contamination has been removed from the decision unit to acceptable levels.

3.6.4 Buried Explosion Module

3.6.4.1 BEM Soil Sampling and Decision Unit

Prior to construction of the BEM, a pre-construction ISM surface soil sample will be collected. A 50x50 foot decision unit will be established at the construction site. The BEM will be used to destroy acceptable to move MEC/MPPEH items during the TCRA. At the end of the project, or when the BEM is no longer needed, a follow-on ISM sample will be collected from the decision unit to verify that a release of MC has not occurred at the site.

3.6.4.2 Pre-construction Soil Sampling and Analyses for MC

The purpose of the pre-construction ISM sample is to determine a baseline concentration for potential MC contaminant concentrations in surface soil prior to BEM operations. Surface soil will be collected at a depth between 0 to 12 inches bgs within the 50 x 50 foot decision unit. The sample will consist of material collected from the entire depth interval. The ISM surface soil sample will consist of 30 random samples collected from locations selected in a systematic random pattern throughout each decision unit. Soil increments will be collected below the vegetative cover, if present. Increments will be collected using a 7/8-inch diameter stainless steel step probe or similar approved sample collection device. All increments will be of equal size and volume to ensure an accurate sampling has been taken. The increments will be placed into a plastic lined bucket or plastic zip lock bag and combined to make a single sample. If feasible, disposable tools may be utilized, otherwise decontamination of tools will be performed between decision units, but not during collection of the increments within a decision unit. Approximately 1 to 2 kilograms of soil will be collected for each ISM sample and submitted to the laboratory for processing and analysis. All sample processing (sieving, grinding, etc.) will be conducted under controlled conditions in the laboratory.

Soil volume being collected for volatile compounds will not be homogenized, rather, this material will placed directly into the sample container. The one discrete sample will be collected from within the decision unit using the trowel/spoon method. The discrete sample will be collected from the center of the BEM decision unit.

A field replicate and matrix spike / matrix spike duplicate (MS/MSD) sample will be collected during pre-construction sampling (**Appendix C**). The collection of the field replicate and MS/MSD samples requires three similar portions of soil. There will be an adequate quantity of soil for the lab to process an MS/MSD sample at the lab. It will be noted on the chain-of custody that an MS/MSD sample is also to be processed and analyzed. Therefore, three ISM samples will be collected from the BEM site consisting of at least 30 increments each.

The SAP Addendum (**Appendix C)** provides information regarding sample volume/mass, preservation methods, sample handling, and analytical methods for ISM samples. Pre-construction BEM ISM samples will be analyzed for: metals, explosives, propellants (nitrocellulose), SVOCs, PCBs, TOC, pH, volatile-organic compounds (VOCs), perchlorates, and phosphorus. Only one round of sampling will be conducted prior to construction and operation of the BEM. Sampling of the BEM decision unit will not be required during the operation of the BEM.

3.6.4.3 Post-Operation Soil Sampling

Following the de-construction of the BEM (removal of the sand material), an ISM sample will be collected from the 50x50 foot decision unit to confirm that a release of MC has not occurred at the site. This sample will be collected using the same methods and analyzed for the same analytical parameters as described in **Section 3.6.4.2**. A field replicate and MS/MSD sample will be collected as part of this confirmation sampling (**Appendix C**).

The purpose of the post-operation soil sample is to verify that BEM operations did not result in a release of MC to the decision unit. The analytical results will be compared to the pre-construction sample analytical results. If concentrations of MC in the post-operation sample suggest a release of MC occurred at the decision unit, the analytical results will be compared to the Facility-wide Cleanup Goals, Camp Ravenna Background Values, and EPA Region 9 Screening Levels to determine if MC is present at concentrations that require excavation and removal from the BEM decision unit.

3.6.4.4 Soil Remediation and Confirmation Sampling

If the analytical results exceed the screening criteria, the impacted soil will be excavated and containerized in an appropriate container and managed in accordance with the procedures outlined in **Section 5**. A confirmation sample will be collected to verify all MC contaminated soil has been removed to levels below the target concentrations. The confirmation sample will be collected using the same sampling methodology as the confirmation sample. The excavation will be backfilled with native material from the surrounding grids, or clean backfill will be used if existing material is not sufficient to return the excavation to original grade. If the analytical results from the confirmation sample still exceed the screening criteria, this process will be repeated until all MC contamination has been removed from the decision unit to acceptable levels.

3.6.4.5 BEM Containment Media and Sampling for MC

Sand will be imported from offsite to be used as containment media in the BEM. This material will be used to engineer containment of demolition operations. Sand will be reutilized for consecutive demolition operations. Sand will be certified clean by USACE prior to delivery to Camp Ravenna. All imported material will be analyzed for the same parameters as required for the BEM baseline testing, as described in **Section 3.6.4.2**. All analytical testing will be conducted at the quarry and verified free of contamination prior to delivery to Camp Ravenna.

The purpose of the BEM containment media sampling is to confirm that no outside contamination is being introduced to the site. An ISM sample will be collected from the source material at the location of origin. The ISM surface soil sample will consist of 30 random samples collected from locations selected in a systematic random pattern throughout the stockpile.

Increments will be collected using a hand trowel/spoon due to the unconsolidated nature of the sand material. All increments will be of equal size and volume to ensure an accurate sampling has been taken. The increments will be placed into a plastic lined bucket or plastic zip lock bag and combined to make a single sample. If feasible, disposable tools may be utilized, otherwise decontamination of tools will be performed between stockpiles, but not during collection of the increments within a single stockpile. Approximately 1 to 2 kilograms of soil will be collected for

each ISM sample and submitted to the laboratory for processing and analysis. All sample processing (sieving, grinding, etc.) will be conducted under controlled conditions in the laboratory.

Soil volume being collected for volatile or compounds will not be homogenized, rather, this material will placed directly into the sample container. The one discrete sample will be collected from the stockpile using the trowel/spoon method. The discrete sample will be collected from a single location in the stockpile.

A field replicate and MS/MSD sample will be collected during containment media sampling (**Appendix C**). The collection of the field replicate and MS/MSD samples requires three similar portions of soil. Therefore, three ISM samples will be collected from the stockpile consisting of at least 30 increments each.

The SAP Addendum (**Appendix C)** provides information regarding sample volume/mass, preservation methods, sample handling, and analytical methods for ISM samples. BEM containment media ISM samples will be analyzed for: metals, explosives, propellants (nitrocellulose), SVOCs, PCBs, TOC, pH, VOCs, perchlorates, and phosphorus. Sampling will be conducted at a frequency of one sample per 4,000 CY of material. It is currently unknown how much containment media will be needed for the BEM. A minimum of 1 sample will be required if the total volume of containment media is less than 4,000 CY.

During operation of the BEM, no additional sampling of the containment media will be required. If being transported off site, the containment media will be sampled using the same methodology and parameters used in the baseline sampling, and any characterization parameters required by the proposed landfill facility, to determine proper disposal.

3.6.5 Field Replicate and Duplicate QC Samples

Field Replicate Samples are ISM samples (two or more) that are completely separate samples collected by the same sapling procedure from the same Decision Unit (DU) but from a different set of locations. ISM replicate data will be used to average the results of ISM replicates to provide the most representative result for the DU. The Relative Standard Deviation (RSD) will be calculated to evaluate the precision of the data. A high RSD (>35%) from field replicates strongly suggests a substantial degree of heterogeneity in the DU contaminant concentrations.

Duplicate samples are discrete samples collected from the same location from one sample which is split into two samples in the field, or from a collocated sample from the same sample area. An ISM sample that has been properly processed (sieving, milling, homogenization) can be split for QA purposes. That split sample would be considered a duplicate which evaluates the effectiveness of the sample processing steps by the laboratory.

Field duplicate sample data for discrete samples is used to determine sampling error and subsampling errors of the Primary sample. The relative percent difference (RPD) between each analyte in the Primary and the Duplicate sample is calculated. This is used to determine the sample variability of the same sample. When the RPD for field duplicate data is greater than 30% for any analyte, the Army would use the greater of the two values. The Army notes that Ohio EPA has concerns about using the methodology described above and plans to coordinate a

meeting to discuss a resolution. Once resolved, an addendum to this WP/FWSAP may be required.

3.7 SITE RESTORATION

The excavation will be backfilled with native material from the surrounding grids, or clean backfill will be used if existing material is not sufficient to return the excavation to original grade, as necessary.

3.8 WORK SCHEDULE

The OESS teams may be working up to a 50-hour work week to ensure that field activities are completed on schedule. Extended work schedules and weekend work outside the core work hours of 0800 – 1630 will be requested through the Camp Ravenna Environmental Office and pre-approved by the Camp Ravenna Range Control.

4.0 QUALITY ASSURANCE/QUALITY CONTROL PLAN

This Quality Control Plan (QCP) identifies quality requirements to be implemented to ensure that overall project activities are accomplished using internal controls and review procedures. The intent of such controls is to eliminate conflicts, errors, and omissions and to ensure the technical accuracy of deliverables. This QCP is applicable to the ODA2 MRS project activities that will be performed by the NAB OESS Team, as described in the Work Plan.

This QCP identifies the approach and operational procedures to be employed to perform QC during activities associated with the project. The objectives of this QCP are to address the specific operating needs of the project and to establish the necessary levels of management and control to ensure all work performed meets the technical requirements of the applicable project plans and conforms in all respects to the requirements of the scope of work and applicable regulations. This QCP is applicable to the ODA2 MRS project activities that will be performed by the NAB OESS Team, as described in the Work Plan. Specifically, this work plan addresses the following:

- Daily Quality Control Reports (DQCRs)
- QC Inspection Process
- QC Audits
- Corrective/Preventive Action Procedures
- Lessons Learned
- Submittal Review and Document Change Procedures
- Qualifications and Training

4.1 Daily QC Reports

For all field work days, the UXOQCS is responsible for preparing and submitting the DQCR to the EESS Chief and the project file. The DQCR is to provide an overview of QC activities performed each day, including those performed for subcontractor and supplier activities. The QC reports are to present an accurate and complete picture of QC activities. They are to report both conforming and deficient conditions, and should be precise, factual, legible, and objective. Copies of supporting documentation, such as checklists and surveillance reports are to be attached. Each DQCR is to be assigned and tracked by a unique number followed by the date expressed as DDMMYY. Copies of DQCRs with attachments are to be maintained in the project file. Example DQCR forms for the three-phase inspection process (preparatory, initial and follow-up) are provided in **Appendix F**.

4.2 QC Inspections

The UXOQCS will be responsible for maintaining compliance with this QCP through the implementation of a three-phase inspection process. This section specifies the minimum requirements that must be met and to what extent QC monitoring must be conducted by the UXOQCS. The inspection system is based on the three-phase system of control to cover the activities. The three-phase inspection system consists of preparatory, initial, and follow-up inspections for applicable definable features of work (DFWs). The three-phase inspection system will be performed on all proposed work sequences.

A DFW is defined as a major work element that must be performed to execute and complete the project. It consists of an activity or task that is separate and distinct from other activities and requires separate control. The DFWs that have been identified for this project are as follows:

- Site setup/mobilization of personnel, equipment, and supplies.
- Grid survey activities.
- Brush clearing.
- Geophysical equipment testing and verification.
- Surface and subsurface removal operations.
- MC Verification Sampling.
- BEM Construction.
- MEC/MPPEH Demolition/disposal.
- MPPEH and MDAS inspection/accountability.
- Demobilization.

The UXOQCS will conduct initial, periodic and final inspections on each of the listed DFWs. Results of each inspection will be documented in the log book and on the weekly QAR.

4.2.1 Preparatory Phase Inspection

A preparatory phase inspection will be performed prior to beginning each DFW. The purposes are to review applicable work plans, processes, and specifications and verify that the necessary resources, conditions, and controls are in place and compliant before the start of work activities. The UXOQCS shall verify that lessons learned during similar previous work have been incorporated as appropriate into the project procedures to prevent recurrence of past problems. The UXOQCS shall generate and use a Preparatory Phase Inspection Checklist. The generic checklist provided in **Appendix F** may be customized to address the specific DFW, work scope, and MRS conditions. Work plans and operating procedures are to be reviewed by the UXOQCS to ensure that prequalifying requirements or conditions, equipment and materials, appropriate work sequences, methodology, hold/witness points, and QC provisions are adequately described. The UXOQCS shall verify, as applicable, the following:

- The required plans and procedures have been prepared and approved and are available to the field staff.
- Field equipment and materials meet required specifications.
- Field equipment is appropriate for intended use, available, functional, and calibrated.
- Work responsibilities have been assigned and communicated.
- Field staff possesses the necessary qualifications, knowledge, expertise, and information to perform their jobs.
- Arrangements for support services (such as on-site testing and off-site test laboratories) have been made.
- Prerequisite site work has been completed.

Discrepancies between existing conditions and approved plans/procedures are to be resolved. Corrective actions for unsatisfactory and nonconforming conditions identified during a preparatory inspection are to be verified by the QC staff prior to granting approval to begin work. Results are

to be documented in the Preparatory Phase Inspection Checklist and summarized in the DQCR (**Appendix F**).

4.2.2 Initial Phase Inspection

An initial phase inspection will be performed, as applicable, the first time each DFW is performed. The purposes will be to check preliminary work for compliance with procedures and specifications, to establish the acceptable level of workmanship, and to check for omissions and resolve differences of interpretation. The UXOQCS shall generate and use an initial inspection checklist. The Initial Phase Inspection Checklist form, provided in **Appendix F**, may be customized to address the specific work scope and MRS conditions. The UXOQCS will be responsible to ensure that discrepancies between site practices and approved specifications are identified and resolved. The UXOQCS will oversee, observe, and inspect all applicable DFWs at the MRS and ensure that off-site activities, such as analytical testing, are properly controlled. Discrepancies between MRS practices and approved plans/procedures are to be resolved and corrective actions for unsatisfactory and nonconforming conditions or practices are to be verified by the UXOQCS before granting approval to proceed. Results of initial inspections are to be documented in the initial phase inspection checklist and summarized in the DQCR.

4.2.3 Follow-Up Phase Inspection

Follow-up phase inspections will be performed periodically while the DFW is performed in order to ensure continuous compliance and level of workmanship. The UXOQCS will be responsible to monitor on-site practices and operations taking place, verify continued compliance of the specifications and requirements within the contract, MRS work scope, and applicable approved project plans and procedures. However, the Site Manager and Team Leader(s) are also responsible for monitoring performance. Discrepancies between site practices and approved plans/procedures will be resolved, and corrective actions for unsatisfactory and nonconforming conditions or practices must be verified by the UXOQCS prior to granting approval to continue work. Follow-up inspection results will be summarized in the DQCR. Periodic checks of procedures and/or documentation will be made for completeness, accuracy, and consistency. Follow-up inspections of field activity will typically include a review of field data and any calibration logs for all instruments in use.

Scheduled and unscheduled inspections will be performed as part of the surveillance phase. The following will be performed for each DFW:

- Inspections and surveillance to ensure compliance with project plans.
- Inspections and surveillance to ensure a high level of workmanship is maintained.
- Inspections and surveillance to ensure that appropriate information is being logged.
- Inspections and surveillance to ensure that 100% of MEC/MPPEH is being removed on the surface and subsurface in the moderate to high areas and on the surface in the accessible low probability areas.

Checks for the process and procedures used during execution of this Work Plan will be conducted by the Designated Technical Lead, EESS Chief, Site Manager, UXOSO/UXOQCS, and Team Leader(s).

4.2.4 Additional Inspections

Additional inspections may be performed on the same DFW at the discretion of UXOQCS. Completion and acceptance inspections will also be performed to verify that project requirements relevant to the DFW are satisfied.

4.2.5 Final Phase Inspection

At the completion of all work associated with a DFW, the UXOQCS will conduct an inspection of the work. The UXOQCS shall generate and use a Final Phase Inspection Checklist. The Final Phase Inspection Checklist form, provided in **Appendix F**, may be customized to address the specific work scope and MRS conditions. The work should be inspected for conformance to plans, specifications, quality, workmanship, and completeness. In the event discrepancies are noted during the final phase inspection the UQOQCS will immediately notify the Team Leader and Site Manager. The Team Leader will provide a plan to correct the deficiency prior to moving on to the next DFW. Once the deficiency has been rectified, a second inspection will be conducted by the UXOQCS to ensure that all deficiencies have been corrected. The inspections and resolutions will be completed within the schedule stated for completion of the entire work, or any particular increment thereof if the project is divided into increments by separate completion dates.

4.3 DOCUMENTING DEFICIENCIES AND CORRECTIVE ACTIONS

The UXOQCS is responsible for verifying compliance with this TCRA Work Plan through audits, inspections and surveillance of the DFWs. The EESS Chief, Designated Technical Lead, UXOQCS, and Project Manager will also coordinate with the Site Manager as deemed necessary to insure that work is progressing in accordance with the Work Plan. Discrepancies are to be communicated to the responsible individual the Team Leader and Site Manager and documented in the daily log.

4.3.1 Corrective Action Process

The EESS Chief, Designated Technical Lead, and Project Manager and UXOQCS are responsible for ensuring that the procedures for reporting, evaluating, and correcting nonconformance are addressed through the inspection process.

4.3.2 Continuous Improvement

Site personnel are encouraged to continuously review their processes and to suggest changes that improve the process; provide benefits; or improve project efficiency, safety, and quality. These suggestions can be submitted either formally through a written memorandum to the Site Manager or to the UXOQCS or informally through verbal discussions at project meetings.

4.4 Qualifications and Training

Project staff will be qualified to perform the specific tasks they are assigned on the project, as discussed in **Section 2** of the Work Plan. Site personnel may assist in the brush clearing and the establishment of boundaries and grids but may not conduct any operation which could result in contact with MEC. Only qualified OESS personnel will be authorized to conduct MEC/MPPEH removal actions. UXO personnel will meet the minimum qualification standards commensurate

with their duties, in accordance with DDESB TP 18. The UXOQCS will conduct and document all site-specific training and maintain records documenting the required qualifications and training for each site worker. The UXOQCS will monitor expiration dates in order to advise employees of the need for refresher training or other requirements and will maintain training records for personnel and visitors, as required by this work plan. All required records will be maintained on-site for audit purposes. Field Activity Daily Logs will be maintained by the UXOQCS to document details of field activities during QC monitoring activities.

4.5 Chemical Data Quality Management Plan

Chemical data quality management is discussed in the SAP Addendum (**Appendix C**) and FWSAP (USACE 2011).

4.6 PROJECT COMMUNICATION

Daily briefings will be held with the field personnel to review the project activities and to discuss technical and safety issues. The Site Manager and UXOQCS will conduct the meetings and ensure that the Daily Summary Report is completed and signed by the field personnel. The Site Manager and UXOQCS may schedule additional meetings to discuss technical and quality issues at any time. The Site Manager will maintain communications with the project management team and report any significant problems or decisions to the EESS Chief and Project Manager for assistance.

4.6.1 Weekly Project Meeting

If necessary a project team meeting will be held once per week during field activities with the field operations and project management personnel. The meeting will be used to discuss project progress and quality related issues.

4.6.2 Project Documentation

The Designated Technical Lead will control the project documentation to ensure that the documents are prepared and approved as required by this plan. The Designated Technical Lead will monitor and track the submission of the project documentation and delegate reviews Digital records of status reports will be maintained by the Designated Technical Lead for access by project personnel.

Comments received during the documentation review will be tracked in the project file and disseminated to the project team to ensure that corrective actions are incorporated for the life of the project. If necessary, a response to comments document will be prepared and submitted to the reviewer for approval. After approval, the comments and responses will be incorporated into the document and it will be resubmitted.

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5.0 WASTE MANAGEMENT PLAN

This section describes waste characterization, transportation, and disposal activities that will be performed in support of removal action. All investigation-derived waste (IDW) will be properly handled, labeled, characterized, and managed in accordance with the SAP Addendum (**Appendix C**) and **Section 6.0** of the FWSAP (USACE, 2011), federal and state of Ohio large-quantity generator requirements, and Camp Ravenna's Integrated Contingency Plan (OHARNG, 2015). All IDW will be appropriately accounted for as soon as possible and prior to conclusion of the project. Any shipment of IDW solid waste off-site will comply with all appropriate federal and state laws.

The scope of this TCRA does not include remediation of pre-existing MC in soil at the ODA2 MRS. Use of the BEM and engineering controls for MEC/MPPEH disposal will contain all detonations and prevent the release of MC to the environment during disposal operations. Subsequently, very little hazardous waste (if any) is anticipated to be generated as part of this TCRA. Hazardous waste (if any) is not anticipated to be generated as part of this TCRA. If generated, hazardous waste will be managed in accordance with the Camp Ravenna Hazardous Waste Management Plan.

Any MEC encountered will be demilitarized, classified as MDAS and disposed of accordingly. In this work plan, IDW includes all materials generated during performance of an investigation that could potentially pose a risk to human health and the environment. The following types of IDW are anticipated to be generated at ODA2 during TCRA activities:

- **Vegetation**: vegetation less than 3" in caliber will be removed from excavation areas.

- **MDAS**: MDAS (scrap metal) will be generated as a result of the MEC/MPPEH inspection and certification process.

- **Environmental Media**: Environmental media consisting of MC-contaminated soil derived from MEC disposal operations, including soil that has been contaminated from an incompetent round, or soil that has been contaminated with MC as a result of BIP/BEM disposal operations.

- **Decontamination Fluids:** Decontamination fluids generated from the decontamination of non-disposable sampling equipment, or decontamination of excavation equipment.

- **Solid Waste**: (expendable waste debris) including scrap metal, personal protective equipment (PPE), disposable sampling equipment and miscellaneous trash.

5.1 Vegetation

Vegetation waste will be generated as a result of the removal of surface vegetation from each grid. Any vegetation clearing/trimming activities will be minimized to the extent possible to allow for the execution of work. USACE will coordinate with the Camp Ravenna Environmental Office prior to performing work and any vegetation disturbance at Camp Ravenna. Trees and shrubs less

than 3" in caliber will be cut to within 3 inches of the ground surface. Roots and root balls may be removed during anomaly excavation. Vegetative material will not be removed from the site, rather, the material will be left "where it falls." Roots and root balls will be returned to excavations when backfilled. Efforts will be made to leave root and root balls intact; however, they may require breaking apart to facilitate removal. Vegetation may be cut to sizes that can be handled. Once cut, vegetation will be managed in such a way that it does not interfere with anomaly investigation activities. Care will be taken to minimize dust control during clearing and cutting of the vegetation.

Areas with high grass may only be mowed prior to April or after August due to the potential for disturbing grassland nesting species. Felling of trees is not anticipated, but in the event tree removal is necessary, all removal will occur between the dates of 1 October to 31 March. No cutting of trees is permitted between April and October due to the Northern Long Eared Bat.

5.2 MDAS

The management and disposition of MEC/MPPEH will be performed in accordance with DODI 4140.62 and DODM 6055.09M. Because recovered MDAS will ultimately be disposed offsite, it is imperative that procedures be established to preclude MPPEH from being commingled with MDAS. Per the DoD guidance, all MPPEH will be 100 percent independently inspected by OESS and then 100 percent re-inspected by a second OESS. The MPPEH inspection and certification process will include the following:

- The OESS will perform a 100 percent inspection of all MPPEH and determine the status of the item. A Second OESS will perform a 100 percent independent inspection (re909 inspection) of all MPPEH to verify the status.

- Items certified to be MDAS will be securely stored in lockable containers until it can be shipped to a local scrap dealer for recycling. All MDAS will be collected in a centralized, secured area and will be segregated from other metallic debris.

- MPPEH which cannot be certified as MDAS may require thermal treatment for smaller items and cavity access for any larger items which cannot be thermally treated.

- The site OESS will ensure that all site operations are being performed in accordance with applicable safety regulations and guidance.

- All material certified as MDAS will be released to a local scrap dealer for recycle.

- The MDAS will be placed into a sealed container with completed DD Form 1348-1, Issue Release/Receipt Document or equivalent, attached. The following statement will be included on the form: "This certifies and verifies that the material listed has been 100% inspected/100% re-inspected by separate qualified UXO technicians and to the best of our knowledge and belief, are inert and/or free from an explosive hazard."
- Both OESS personnel inspecting the material will sign the 1348-1.

- This DD Form 1348-1 will be maintained as a chain of custody until the MDAS reaches final disposition. The DD Form 1348-1 will be signed by the recycling vendor upon receiving the MDAS.

- 100% inspection and 100% re-inspection by the OESS team.

All MDAS will be released for off-site disposal following DoDI 4140.62 guidance. MDAS will be recycled using a local vendor that is approved by the Camp Ravenna Environmental Office. All recycled material will be tracked using the DD Form 1348-1 and reported to the Camp Ravenna Environmental Office.

5.3 Environmental Media and Solid Waste

Environmental media and solid waste will be contained separately. Environmental media will be limited to MC-contaminated soil derived from MEC disposal operations, including soil that has been contaminated from an incompetent round, or soil that has been contaminated with MC as a result of BIP/BEM disposal operations within the ODA2 MRS. No other environmental media will be generated. For solid waste, decontamination fluids will be containerized separately from expendable solid waste debris. Non-ordnance related scrap will be generated during intrusive investigations. This material will be stored separately from the MDAS and the metal will be recycled. Characterization and classification of the different types of IDW will be based on the specific protocols described below.

Soil: MC-contaminated soil may be containerized in an appropriate container and sealed with gasketed ring-topped lids. Disposition of the containerized soil will be based on analytical results from the environmental samples or from direct results of composite IDW samples.

Decontamination Fluids: Decontamination fluids will be placed in steel or polyethylene drums. Disposition of decontamination liquid will be based on the analytical results of composite grab samples from the containers.

Expendable Waste Debris: Expendable waste debris, including non-ordnance related scrap metal, will be segregated as non-contaminated and potentially contaminated material based on visual inspection, use of the waste material and field screening using field screening instruments. Scrap metal will be placed in roll-off containers for off-site recycling or disposal. Expendable waste debris considered to be non-contaminated (PPE, disposable sampling equipment and miscellaneous trash) will be placed in trash bags and stored in 55-gallon drums, sanitary waste bins, or other appropriate container whereas potentially contaminated expendable waste will be containerized in 55-gallon steel drums and sealed with gasketed ring-topped lids. Disposition of expendable waste debris will be based on correlative results of the environmental samples submitted for laboratory analyses.

All containerized environmental media and solid waste will be labeled in accordance with the SAP Addendum (**Appendix C**) and FWSAP (USACE, 2011) and managed in accordance with the Camp Ravenna Waste Management Guidelines (**Appendix G**). Label information on each container will be written in indelible ink and will include at a minimum: container number,

contents, source of the waste, source location, project name and MRS identification, physical characteristics of the waste, and generation dates. Each label will be placed on the side of each container at a location that will be protected from damage or degradation.

5.4 IDW Field Staging

USACE will coordinate central field staging areas (FSAs) within the ODA2 MRS with the Camp Ravenna Environmental Office. Waste will be generated during excavation activities and managed within each grid during intrusive activities. Following inspection/certification, waste materials will be consolidated at designated FSAs within the ODA2 MRS. All waste shall remain on the FSAs until analytical data is available from the laboratory and the waste can be appropriately classified. The FSAs will be visibly identified with signage and the drums/containers will be covered with poly sheeting or tarps if the FSAs are in an open location. Containerized IDW will be staged on wooden pallets. Decontamination fluids will be staged within secondary containment structures. To avoid potential container rupture due to freezing conditions, drums containing liquid IDW will be filled only to 75 percent capacity.

5.5 IDW Disposal

All disposal of IDW will be conducted in accordance with **Section 8.0** of the FWSAP (USACE, 2011). All waste determined to be 'non-hazardous, contaminated' or 'hazardous, contaminated' will be disposed off-site at a permitted waste facility. All IDW will be managed within the ODA2 MRS in accordance with the procedures outlined in **Section 5.4**. IDW determined to be non-hazardous will consolidated and transported to Building 1036. All waste will be managed in accordance with the procedure outlined in the Camp Ravenna's Integrated Contingency Plan (OHARNG, 2015). Non-contaminated expendable waste debris will be disposed as sanitary trash. MDAS and scrap metal will be sent off-site for recycling. Potentially contaminated expendable waste debris will be disposed similar to the associated waste under which it was generated.

5.6 Hazardous Waste

Hazardous waste generation is not anticipated as part of this TCRA. In the unlikely event that hazardous IDW is generated, this material will be consolidated and transported to Building 1047. If generated, hazardous waste will be managed in accordance with the Camp Ravenna Integrated Contingency Plan (OHARNG, 2015).

5.7 Compliance with Camp Ravenna Waste Management Guidelines

All staged waste will be managed in accordance with the FWSAP (USACE, 2011) and the Camp Ravenna Waste Management Guidelines (**Appendix G**). As part of these requirements, NAB will conduct weekly inspections of FSAs using the inspection checklist included in Appendix G. These reports will be provided to the Camp Ravenna Environmental Office.

6.0 EXPLOSIVES MANAGEMENT PLAN

6.1 GENERAL

The Explosives Management Plan outlines the procedures to be used by NAB personnel to acquire, receive, store, transport, issue, and report the loss of explosives used during this project. All personnel involved with explosives will comply with federal, state, and local laws as required.

6.2 LICENSES/PERMITS

No license/permits are required for USACE personnel working on a government installation.

6.3 ACQUISITIONS

NAB will purchase donor explosives and have them delivered to the explosives storage area as sited by the approved TCRA ESS. If additional explosives are required, the Site Manager will notify the EESS Chief.

6.4 INITIAL RECEIPT

Upon arrival at the site, the Site Manager will escort the vendor to the explosive storage area for unloading. Receipt of the explosives will occur as follows:

- The UXOSO/UXOQCS and Site Manager will conduct a thorough inventory of items received prior to accepting custody for the items.
- If it is determined that there is a discrepancy between the quantity delivered and the quantity shipped the shipment will not be accepted and the shipper will be contacted immediately to resolve the discrepancy. The EESS Chief and Project Manager will be apprised of the situation.*
- Once the quantity has been confirmed, the explosive delivery receipt will be signed and the explosives transferred to and stored in the approved type II ATF Magazines located in the explosive storage area. Explosives will be recorded on a magazine data card, such as DA Form 3020 (stack card).
- All material introduced or removed from the magazines will be entered on stack cards and explosive records will be updated.

**Note*: If the discrepancy cannot be resolved within 24 hours, the local law enforcement agency, and ATF will be notified. All original receipts, shipping documents, or invoices will be retained on-site as part of records management. Copies of the documentation will be provided in the final report as an appendix.

6.5 STORAGE

There are two Type II ATF Magazines on site for storage of donor materials. These magazines are sited in the ESS for storage of 1.4 material. Only 1.4 material is authorized to be stored on site. If 1.1 material is needed then an amendment to the ESS will be submitted and approved prior to bringing any 1.1 material on site. The location of these Type II magazines will be illustrated in the approved ESS.

6.6 TRANSPORTATION

The explosive storage area is located on the ODA2 MRS. No commercial transportation of explosives will be required. Donor materials may be transported to the BEM and/or BIP site by all-terrain vehicle (Kubota) or hand carried.

6.7 RETURN OF UNUSED EXPLOSIVES

All explosives not consumed on the same day will be returned to the magazine and the stack card updated to reflect the return.

6.8 DISPOSAL OF REMAINING EXPLOSIVES

Use of explosives will be monitored to minimize the requirement for disposal of unused explosives.

6.9 LOSS, THEFT, AND UNAUTHORIZED USE OF EXPLOSIVES

Loss or theft of explosives will be reported as stated in 27 CFR on Commerce in Explosives.

7.0 ENVIRONMENTAL PROTECTION PLAN

7.1 GENERAL

The environmental resources within the project boundaries and those affected outside the limits of permanent work under this contract will be protected during the entire period of this contract. NAB will confine its activities to areas defined by this Work Plan. Environmental protection will be as stated in the following subsections.

NAB is directly responsible for the implementation of this plan. Inspections will be made to assure field personnel's compliance with this plan. Following are several specific areas of concern that fall under environmental protection.

7.2 IDENTIFICATION OF AREAS REQUIRING PROTECTION

7.2.1 Endangered/Threatened Species

NAB will perform all site activities in such a manner as to avoid or minimize adverse effects to any endangered or protected plant/wildlife species and resources discovered on the site. If endangered or threatened species are encountered during site activities, NAB will locate and flag-off the areas and immediately notify and obtain guidance from Installation Environmental Office before continuing operations within the flagged area. All site personnel will adhere to the specific guidance received from the Installation Environmental Office.

7.2.2 Wetlands

Minor soil disturbance throughout the MRS will occur due to excavation of disposal pit areas and removal of munitions items. Surface clearance will occur in accessible low probability areas (nonintrusive). Hand excavation to the depth of detection will occur within 100 ft by 100 ft grids in low probability areas with concentrated anomalies. In known disposal pits, a mini excavator will be used to excavate to a depth of 2 foot bgs in moderate to high probability areas. In areas with unknown disposal pits, a mini excavator will be used to excavate to the depth of detection with a maximum depth of 4 foot bgs.

In accordance with Nationwide Permit #38, activities undertaken entirely on a CERCLA site by authority of CERCLA as approved or required by EPA, are not required to obtain permits under Section 404 of the Clean Water Act or Section 10 of the Rivers and Harbors Act. This permit also indicates that Ohio State Certification Special Limitation may apply.

A wetlands delineation including ORAM scores has not been completed within the MRS. However, wetlands have been identified within the MRS based on planning level survey data (desktop review of NWI maps and INRMP data). A wetlands map of the MRS is provided in **Figure 5**.. In order to avoid impacts to wetlands, USACE will hand dig all anomalies or disposal pits identified within wetlands areas on the MRS. Therefore, based on careful hand digging operations, the removal activities within wetland areas will not constitute temporary impacts to a wetland and Ohio State requirements will not apply.

7.2.3 Cultural and Archaeological Resources

The immediate project area has not been surveyed for cultural resources due to the fact that these are cleanup sites are part of the RVAAP restoration program. Walk overs and digging in these areas is a potential hazard, therefore surveys have not been completed. However, several surveys have been completed around the project area over the last several years. Six archaeological surveys were completed between 2004 and 2015 in the areas surrounding the project area. There are twenty-three archaeological sites identified during these 6 surveys in the areas surrounding the project area. Four of these sites meet the eligibility criteria for listing in the National Register of Historic Places (NRHP) and require further investigation. The remaining nineteen sites do not meet the criteria and no further investigations are necessary. The Ohio Historic Preservation Office concurred with the OHARNG determinations regarding the eligibility of these sites. The four eligible sites are between 1,500 to 3,000 feet from the project area. There is no potential for the proposed project to disturb any of these sites. In the event that cultural materials are inadvertently discovered, NAB will stop work and comply with the OHARNG Procedures for Inadvertent Discovery of Cultural Materials at Camp Ravenna. This policy is provided in **Appendix H**.

7.2.4 Water Resources

NAB will keep activities under surveillance, management and control to avoid pollution of surface and ground waters. Special management techniques as set out below will be implemented to control water pollution by site operations.

7.3 MITIGATION PROCEDURES

7.3.1 Waste Disposal

Disposal of any materials, waste, effluents, trash, garbage, unsatisfactorily decontaminated materials, oil, grease, chemicals etc., in areas adjacent to streams, rivers or lakes not authorized for waste disposal will not be permitted. Appropriate and authorized waste disposal containers will be located on site for use by site personnel. Disposal of waste, trash and other materials of the project will be disposed of offsite in accordance with requirements outlined in **Section 5.0** of this Work Plan and all applicable Federal, State and DoD/Army environmental regulations.

7.3.2 Solid Waste Disposal

Solid wastes will be placed in appropriate containers, which will be emptied regularly. All handling and disposal will be conducted to prevent further contamination and/or contaminant migration. All solid waste will be disposed of in accordance with requirements outlined in **Section 5.0** of this Work Plan and all applicable Federal, State and DoD/Army environmental regulations.

7.3.3 Hazardous Waste Disposal

Hazardous waste (if generated) will be disposed of in accordance with requirements outlined in **Section 5.0** of this Work Plan and all applicable Federal, State and DoD/Army environmental regulations.

7.3.4 Spill Control and Prevention

Special measure will be taken to prevent chemicals, fuels, oils, greases, bituminous materials, sawdust, waste washings, herbicides, insecticides, rubbish or sewage and other pollutants from entering public waters.

With the exception of the heavy equipment (when required) on-site, there is very little potential for spillage of large quantities of chemicals. NAB will take all necessary precautions to prevent spills and will implement contingency measures for cleanup should any occur. To minimize the potential for and impact of spillage, NAB will:

- Use and store minimal quantities of fuels and oils on-site;
- Apply work practice controls to prevent spills during refueling and maintenance of power tools, site vehicles and equipment; and
- Maintain on-site spill response supplies and equipment necessary to contain spilled materials and to remove and contain materials that become contaminated.

In the unlikely event a spill occurs, NAB will conduct First Responder Spill Release Response Actions (**Appendix I**) and conduct the following emergency procedures:

- Immediately (within 1 hour), notify Range Control. Range Control will notify the Camp Ravenna- Environmental Office. The Camp Ravenna Environmental Office will provide notification to Ohio EPA (if required);
  Provide incident-specific information to the Camp Ravenna Range Control using the First Responder Reporting Form (**Appendix I**)
- Halt site operations in the area and take immediate measures, using PPE and personnel to control and contain the spill;
- Isolate the hazardous area through flagging, removing or extinguishing ignition sources and evacuation of all unnecessary personnel from the area;
- If mandated by the nature of the spill, evacuate personnel upwind to the pre- designated assembly area, and post personnel at access routes to prevent unauthorized personnel from entering the area;
- Implement control measures, if needed, to reduce vapors, gases and/or dust emissions; and
- Conduct all spill response operations in accordance with the Camp Ravenna Integrated Contingency Plan (OHARNG, 2015).

7.3.5 Protection of Trees and Shrubs

Trees, shrubs, vines, grasses, landforms and other landscape features to be preserved will be clearly identified by coordination with the Camp Ravenna-Environmental/Natural Resources Office. With the exception of the moderate to high probability areas trees or shrubs will not be removed, cut, defaced, injured, or destroyed without the permission of Camp Ravenna-Environmental/Natural Resources Office. Brush removal in the moderate to high probability area will be limited to that which is necessary for access and work in each grid. Limited brush removal may be required in the low probability areas for access/egress.

Any vegetation clearing/trimming activities will be minimized to the extent possible to allow for the execution of work. Only trees and shrubs having less than 3" in caliber will be removed. Areas with high grass may only be mowed prior to April or after August due to the potential for disturbing grassland nesting species. Felling of trees is not anticipated, but in the event tree removal is necessary, all removal will occur between the dates of 1 October to 31 March. No cutting of trees is permitted between April and October due to the Northern Long Eared Bat.

7.3.6 Post Removal Cleanup

NAB will remove all signs of disturbed areas such as work areas, fencing or any other signs of construction within the work, storage, and access areas. The area will be restored to near natural conditions. Any damage to roads, bridges, gates, etc., as determined by Camp Ravenna Environmental Office will be restored to pre-operational conditions.

8.0 REFERENCES

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USACE, 2014. EM 385-1-1, Safety and Health Requirements Manual. 30 November.

USACE, 2015a. Final Remedial Investigation Report for the RVAAP-004-R-01 Open Demolition Area #2 Munitions Response Site, Version 1.0. Ravenna, Ohio, February 2015

USACE, 2015b. Site Safety and Health Plan. Time Critical Removal Action, Open Demolition Area #2 Munitions Response Site, September 2015

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FIGURES

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Figure 1: Installation Location Map

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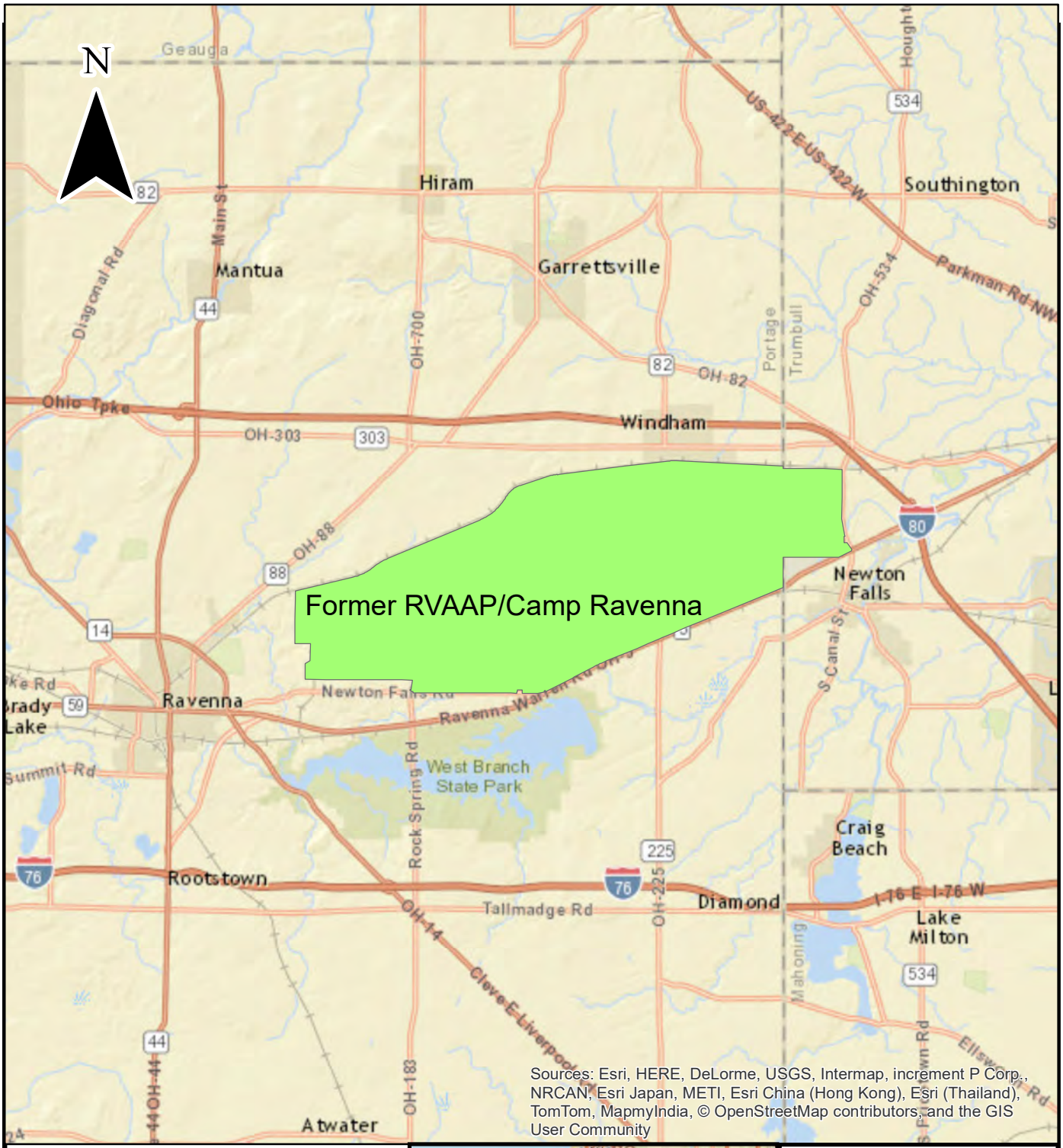
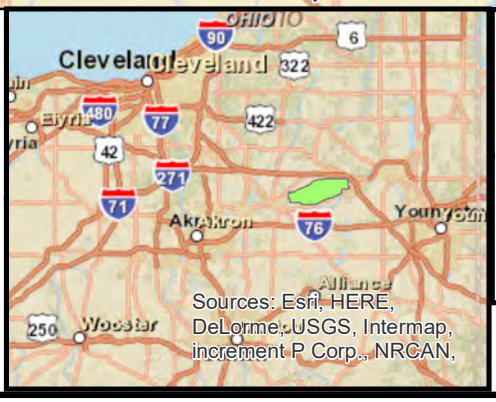


Camp Ravenna

0 1.25 2.5 5 Miles



US Army Corps of Engineers
Baltimore District

Figure 1
Installation Location Map

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Figure 2: Revised MRS Boundary – ODA2

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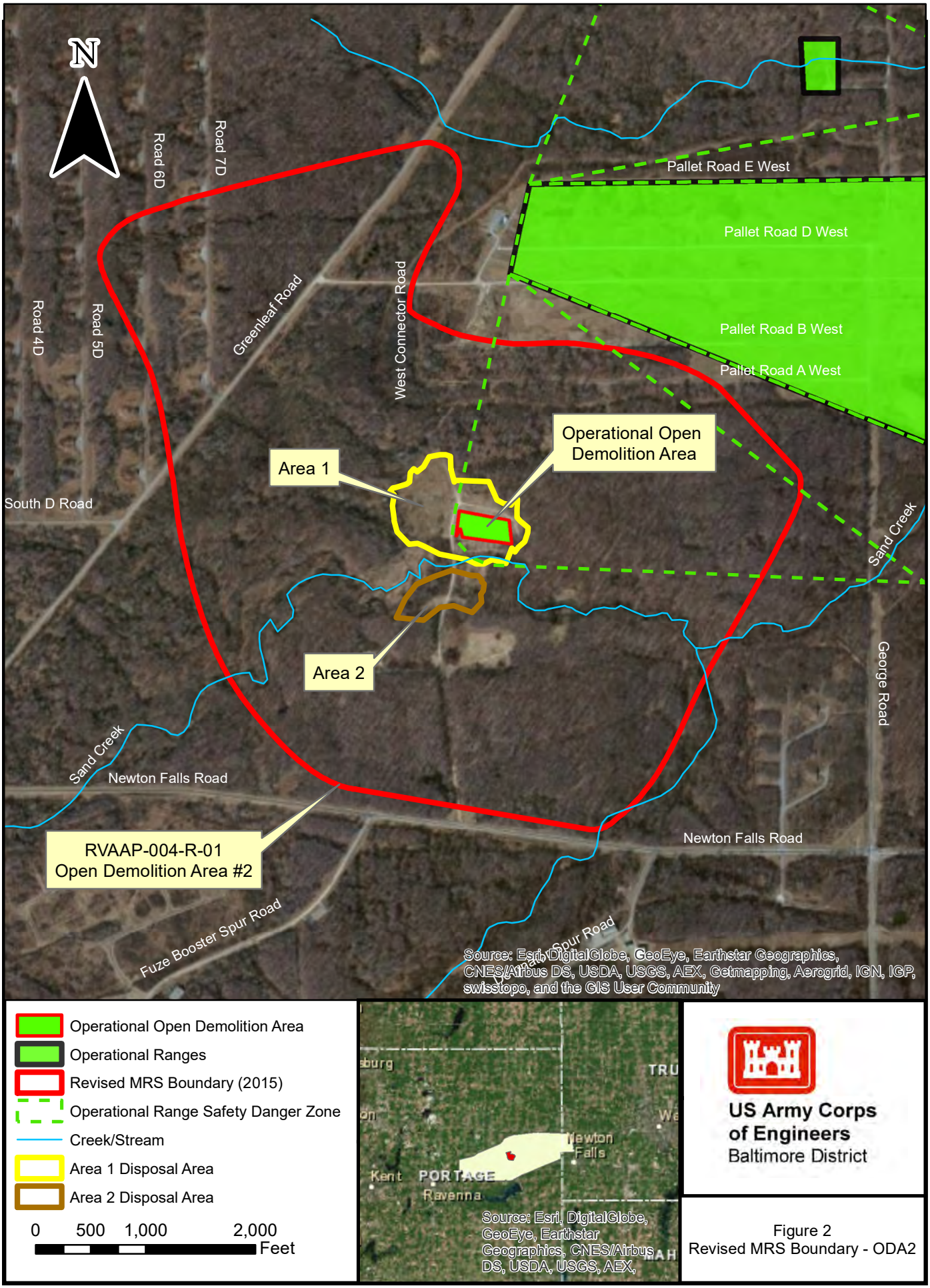

US Army Corps of Engineers
Baltimore District

Figure 2
Revised MRS Boundary - ODA2

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Figure 3: ODA2 MRS Probability Assessment

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Figure 3
ODA2 MRS Probability Assessment

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Figure 4: Schedule

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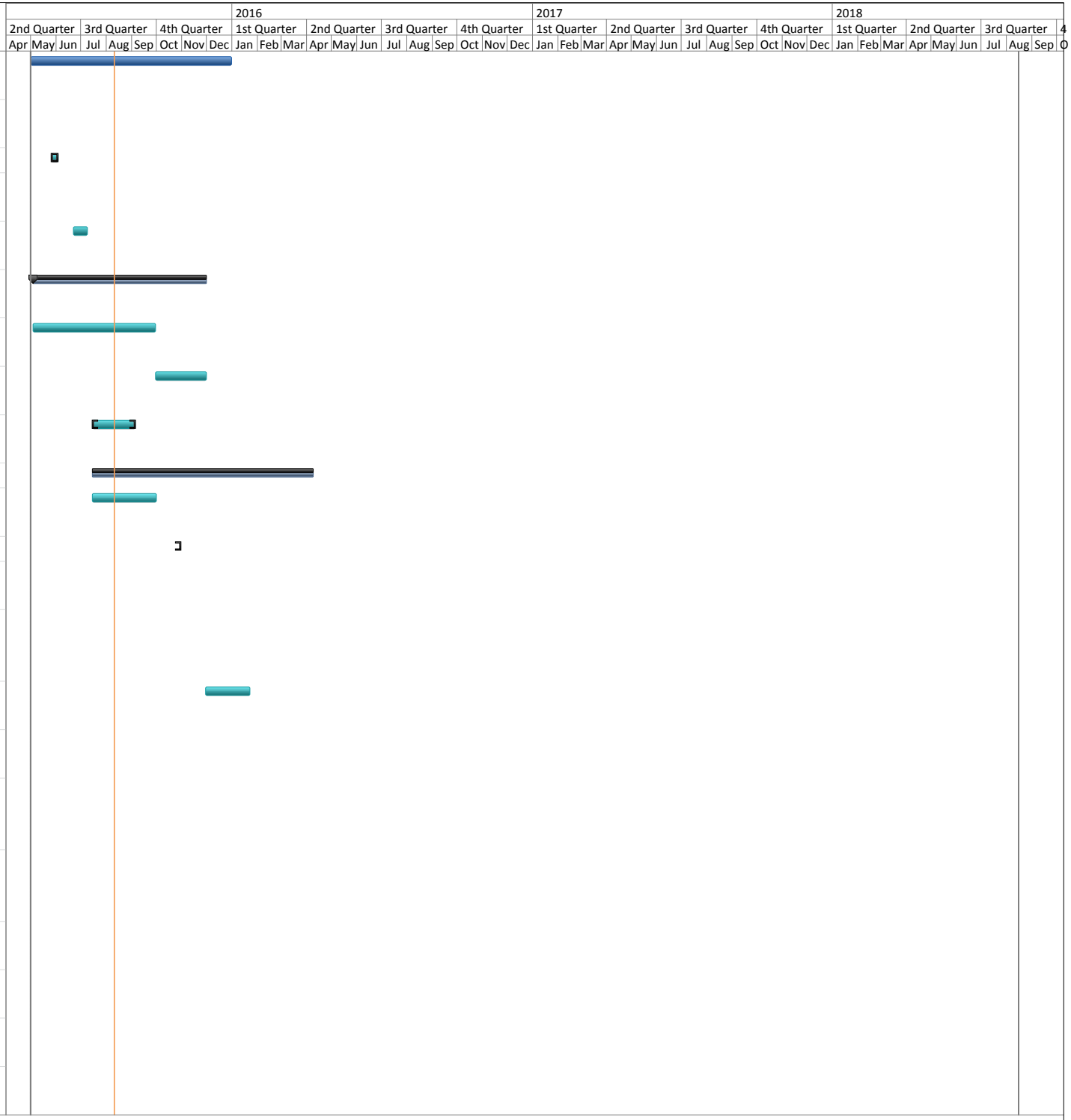
ID	Task Name	Duration	Start	Finish
1	**TASK 1: Project Management**	**260 days**	**Fri 5/1/15**	**Thu 12/31/15**
2	**TASK 2: Probability Assessment**	**46 days**	**Tue 5/26/15**	**Wed 7/8/15**
3	Fieldwork	9 days	Tue 5/26/15	Wed 6/3/15
4	Probability Assessment	19 days	Thu 6/4/15	Sun 6/21/15
5	Coorrdinate Results with Installation	18 days	Mon 6/22/15	Wed 7/8/15
6	**TASK 3: Explosives Safety Submittal**	**224 days**	**Mon 5/4/15**	**Mon 11/30/15**
7	Explosive Safety Submittal	158 days	Mon 5/4/15	Tue 9/29/15
8	Coordinate Approvals with USATCES/DDESB	66 days	Wed 9/30/15	Mon 11/30/15
9	**TASK 4: Site Safety and Health Plan**	**56 days**	**Wed 7/15/15**	**Sat 9/5/15**
10	**TASK 5: TCRA Work Plan**	**285 days**	**Wed 7/15/15**	**Fri 4/8/16**
11	Prepare and Submit PD to Army	82 days	Wed 7/15/15	Wed 9/30/15
12	PD Review	31 days	Thu 10/1/15	Fri 10/30/15
13	PD Comment Resoultion	14 days	Sat 10/31/15	Fri 11/13/15
14	Prepare and Submit Draft to Army and Ohio EPA	17 days	Sat 11/14/15	Sun 11/29/15
15	Army and Ohio EPA Draft Review	57 days	Mon 11/30/15	Fri 1/22/16
16	Draft Comment Clarification	14 days	Sat 1/23/16	Fri 2/5/16
17	Prepare and Submit Final to Armyand Ohio EPA	14 days	Sat 2/6/16	Fri 2/19/16
18	Army and Ohio EPA Final Review and Approval	52 days	Sat 2/20/16	Fri 4/8/16
19	**TASK 6: TCRA Scoping / Estimate**	**25 days**	**Fri 5/1/15**	**Sun 5/24/15**
20	**TASK 7: Contracting Supplies/Equipment**	**84 days**	**Mon 1/11/16**	**Tue 3/29/16**
21	BPA Call for Explosives	57 days	Mon 1/11/16	Fri 3/4/16
22	BPA Call for Heavy Equipment	57 days	Mon 1/11/16	Fri 3/4/16



ID	Task Name	Duration	Start	Finish
23	BPA for Analytical Services	57 days	Mon 1/11/16	Fri 3/4/16
24	**TASK 8: Action Memo**	**221 days**	**Mon 6/22/15**	**Fri 1/15/16**
25	Prepare and Submit PD to Army	12 days	Mon 6/22/15	Fri 7/3/15
26	PD Review	26 days	Sat 7/4/15	Tue 7/28/15
27	PD Comment Resoultion	17 days	Wed 7/29/15	Thu 8/13/15
28	Prepare and Submit Draft to Army and Ohio EPA	4 days	Fri 8/14/15	Mon 8/17/15
29	Army and Ohio EPA Draft Review	63 days	Tue 8/18/15	Fri 10/16/15
30	Draft Comment Clarification	14 days	Sat 10/17/15	Fri 10/30/15
31	Prepare and Submit Final to Army and Ohio EPA	17 days	Sat 10/31/15	Sun 11/15/15
32	Army and Ohio EPA Final Review and Approval	64 days	Mon 11/16/15	Fri 1/15/16
33	**Task 9: Removal Action Fieldwork**	**588 days**	**Mon 4/11/16**	**Mon 10/16/17**
34	**Task 10: After Action Report**	**322 days**	**Tue 10/17/17**	**Wed 8/15/18**
35	Prepare and Submit PD to Army	77 days	Tue 10/17/17	Thu 12/28/17
36	PD Review	38 days	Fri 12/29/17	Fri 2/2/18
37	PD Comment Resoultion	23 days	Sat 2/3/18	Sat 2/24/18
38	Prepare and Submit Draft to Army and Ohio EPA	21 days	Sun 2/25/18	Fri 3/16/18
39	Army and Ohio EPA Draft Review	64 days	Sat 3/17/18	Wed 5/16/18
40	Draft Comment Clarification	16 days	Thu 5/17/18	Thu 5/31/18
41	Prepare and Submit Final to Army and Ohio EPA	16 days	Fri 6/1/18	Fri 6/15/18
42	Army and Ohio EPA Final Review and Approval	64 days	Sat 6/16/18	Wed 8/15/18

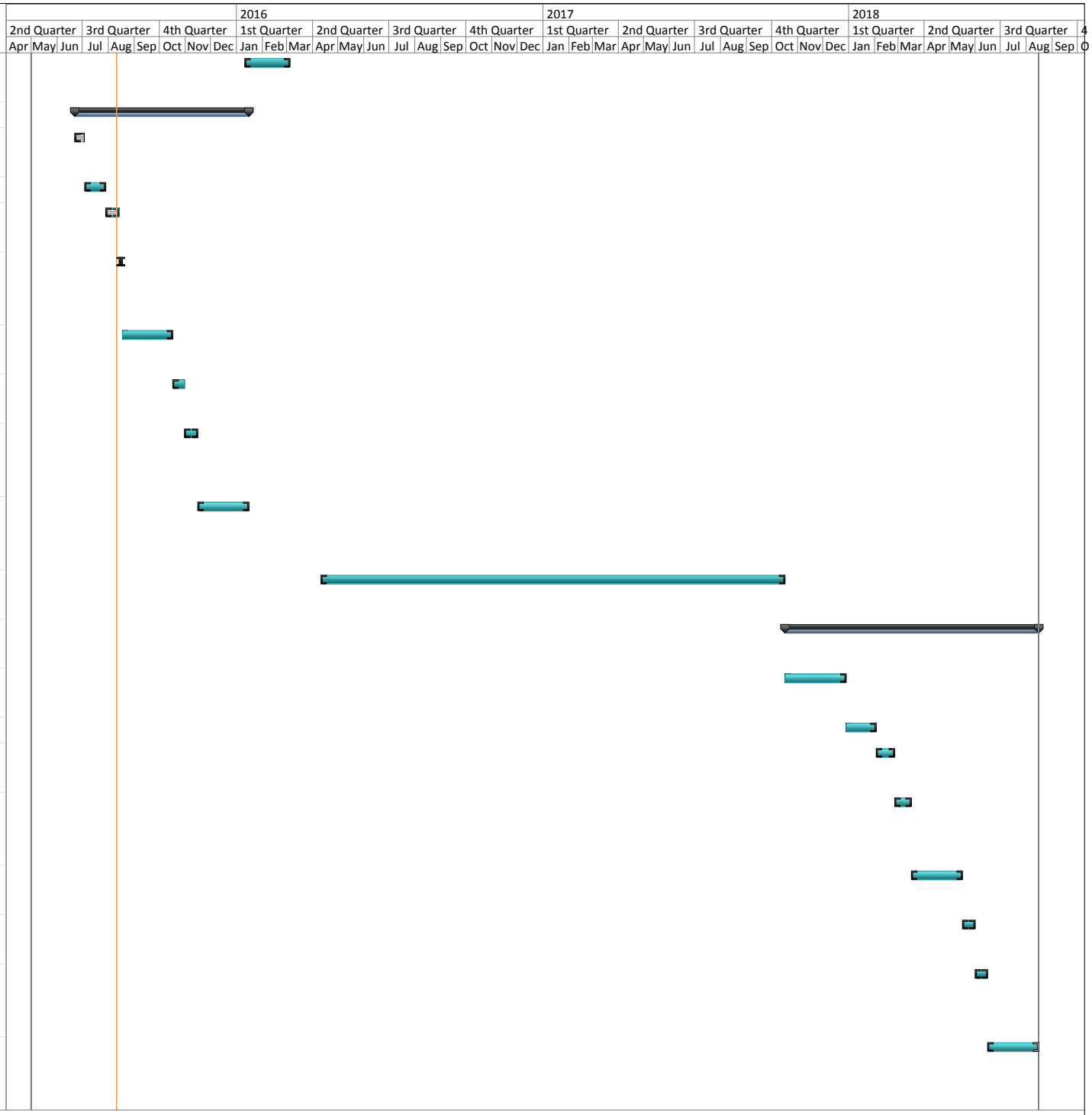


Figure 5: Wetlands ODA2 MRS Probability Assessment

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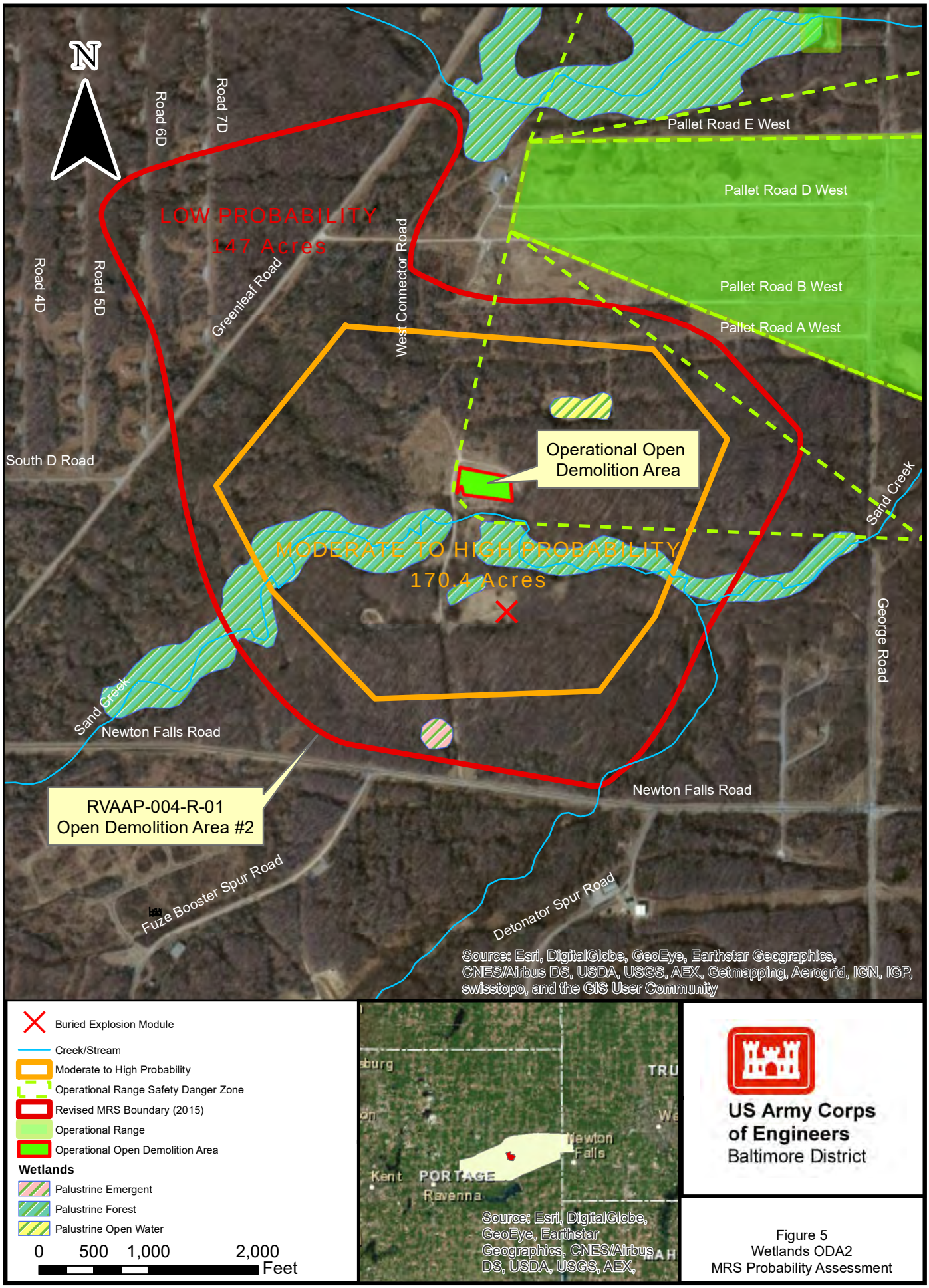

Figure 5
Wetlands ODA2
MRS Probability Assessment

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APPENDICES

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Appendix A: Probability Assessment

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FINAL MEMORANDUM FOR RECORD

Probability Assessment

RVAAP-004-R-01 Open Demolition Area #2 MRS

Former Ravenna Army Ammunition Plant

Portage and Trumbull Counties, Ohio

July 20, 2015

Prepared by:

UNITED STATES ARMY COPRS OF ENGINEERS
BALTIMORE DISTRICT

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CENAB-HM-EI 20 July 2015

MEMORANDUM FOR RECORD

SUBJECT: Probability Assessment for RVAAP-004-R-01 Open Demolition Area #2 MRS (ODA2), Former Ravenna Army Ammunition Plant (RVAAP)

1. REFERENCES:

a. Department of Defense Explosives Safety Manual 6055.09-M, August 2010

b. Department of the Army Pamphlet (DA Pam) 385-64

c. US Army Corps of Engineers (USACE) Explosive Safety Manual, EM 385-1-97

d. Remedial Investigation Report for RVAAP-004-R-01, Former Ravenna Army Ammunition Plant, Ohio, Open Demolition Area #2 MRS, February 2015

e. US Army Corps of Engineers Baltimore District (CENAB) Memorandum for the Record; Recommended Path Forward for ODA2, March 2015

2. PURPOSE:

The purpose of this Probability Assessment is to assess the probability for munitions and explosives of concern/material potentially presenting an explosive hazard (MEC/MPPEH) at the RVAAP-004-R-01 Open Demolition Area # 2 Munitions Response Site (ODA2 MRS), located at the former Ravenna Army Ammunition Plant (RVAAP). A thorough records review of historical activities involving MEC was conducted as part of this assessment. In addition, a comprehensive magnetometer-assisted site assessment was conducted by US Army Corps of Engineers Baltimore District (CENAB) Ordnance and Explosives Safety Specialists (OESSs). The site assessment was conducted to visually assess the difficulties posed by site access/egress and to verify specific areas within ODA2 MRS with the highest concentrations of MEC/MPPEH. For potential MEC sites, **references 1(a) and 1(b)** identify two possible categories for encountering MEC: "Moderate to High" and "Low". Each category establishes certain requirements/restrictions for site activities and access. For the purpose of this probability assessment, each category will support recommendations for future removal actions at ODA2 MRS. The categorization of probability for encountering MEC established by this document is in full compliance with the guidance outlined in **references 1(a), 1(b), and 1(c)**.

3. BACKGROUND:

The ODA2 MRS is a former open burning/open detonation (OB/OD) area, dumping ground, and burial site that was used from 1948 to 1991. Large caliber munitions and off-specification bulk explosives that could not be deactivated or demilitarized were detonated within the MRS. Pits were excavated to a minimum depth of 4 feet below ground surface (bgs) and used for demolition activities. After the demolition was complete, the area was policed, metal pieces were removed, and the pits were filled, mulched, and seeded. Each new activity at ODA2 MRS required a new pit

to be excavated. In addition, white phosphorous and unspecified bombs were also reportedly buried within the ODA2 MRS area.

Specific components of the ODA2 MRS include the 40 millimeter (mm) prototype test range, Burial Sites 1 and 2, the Rocket Ridge Area, and the Bomb Disposal Area (**Figure 1**). The 40 mm prototype test range, which is located west of the former Demolition Area, was used to fire test munitions at targets. Burial Site 1 is approximately 2 acres in size and is located in the southwestern corner of the ODA2 MRS. Burial Site 2 is approximately 1 acre in size and is located in the southern portion of ODA2 MRS, Burial Site 2 reportedly contains buried MEC items. At the Rocket Ridge Area, located in the southeastern portion of the ODA2 MRS, rocket bodies and various potential MEC items were discarded on the ground surface and into Sand Creek

The Rocket Ridge Area was remediated under two Time Critical Removal Actions (TCRAs) that occurred in 2009 and 2011. Burial Site 2 is located near the Rocket Ridge Area and was used for sorting and inspection activities in support of the 2011 TCRA. These areas at the ODA2 MRS were remediated under the 2011 TCRA. Following the 2011 TCRA, these areas of the ODA2 MRS were removed as potential source areas requiring further investigation.

The ODA2 MRS was originally identified as a 35.4 acre site (**Figure 1**). A Remedial Investigation (RI) conducted in 2011 identified a significant kick-out area, assumed to be the result of former OB/OD activities, (**reference 1(d)**). The maximum extent of the kick-out area was calculated using the maximum fragmentation distance for the 155mm M107 series projectile. Using this information, the OB/OD boundary was conservatively estimated to be 2,577 feet, calculated from the center of the two primary source areas (Area 1 and Area 2) (**Figure 2**). This added approximately 607 acres to the area of investigation. A non-intrusive magnetometer assisted site survey was conducted on this 607 acre area during the Remedial Investigation. The Final RI Report confirmed a release of MEC/MPPEH/MC had occurred at the site and revised the MRS boundary from 35.4 to 317.4 acres (**Figure 3**).

The principle sources of MEC/MPPEH/MC at theODA2 MRS are the result of intentional detonations and potential burial of MEC and bulk explosives. These activities resulted in the potential for MEC/MPPEH to be present in the both the surface and subsurface soil at ODA2 MRS.

4. DISCUSSION:

Review of the available historical information, specifically the RI Report (**reference 1(d)**) indicates that the initial addition of the kick-out area was an appropriate conservative decision based on historical disposal activities conducted at the site. The additional acreage represented the maximum fragmentation distance of a 155mm high explosive artillery projectile as measured from the center of the demo areas and was initially categorized as moderate to high probability for encountering MEC resulting in an increase of the total area of investigation to 643 acres. The results of the RI concluded that a release of MEC/MPPEH had occurred at the site, but was not as extensive as predicted. The Final RI Report modified the MRS boundary from 35.4 to 317.4 acres. Results of the RI surface and subsurface investigation suggest that the 317.4 acres (currently categorized as moderate to high probability for encountering MEC) should be investigated further. The purpose of this Probability Assessment is to conduct a more thorough analysis of the ODA2

MRS acreage to determine if the entire 317.4 acre site presents a moderate to high probability for MEC, or if areas of low probability exist within the ODA2 MRS boundary.

In August of 2014, CENAB conducted a site assessment to further verify the data presented in the RI report, and to provide recommendations for an interim removal action to reduce the explosive safety hazard at the site. CENAB staff evaluated the 643 acre footprint based on the kick-out area calculations presented in the Preliminary Draft RI Report. An after-action report documented the results of the August 2014 site assessment and provided specific recommendations for a Time Critical Removal Action to include: MEC/MPPEH removal in moderate to high probability areas, and further delineation of probability of MEC within the ODA2 MRS (**reference 1(e)**)

In February 2015, the Final RI Report for ODA2 MRS was published, modifying the boundary from 35.4 to 317.4 acres based on the presence of MEC/MPPEH observed in the field. The Final RI Report confirmed that a release of MEC/MPPEH had occurred at the site and recommended a Feasibility Study (FS) be prepared to evaluate potential remedial alternatives for ODA2.

In May 2015, CENAB conducted a more thorough site assessment (SA) at ODA2 MRS to collect information needed to scope a TCRA. The objectives of the investigation were to: 1) identify areas inaccessible to potential receptors due to terrain and/or vegetation barriers; 2) delineate areas of low probability within the accessible areas of the ODA2 MRS; and 3) identify a suitable location to construct a buried explosion model (BEM). The CENAB team conducted an instrument assisted visual survey of selected areas within the ODA2 MRS in order to delineate the recommended boundaries of both low and moderate to high categories and to determine a recommended path forward for each area.

The results of the May 2015 SA confirmed that specific areas of low probability could be delineated within ODA2 MRS. In addition, some areas of ODA2 MRS were observed to be inaccessible to potential receptors due to heavy/thick vegetation. Further, field observations confirmed that conducting a removal action in the moderate to high probability areas would result in effectively reducing the probability to low probability for encountering MEC for the majority of ODA2 MRS.

5. RECOMMENDATIONS:

Moderate to High Probability – 170.4 acres

Field observations made during the May 2015 SA indicate that a significant release of MEC/MPPEH is centrally located around the Demolition Area. It is recommended that 170.4 acres of the ODA2 MRS be assessed as moderate to high probability for MEC (as illustrated on **Figure 4**).

Low Probability – 147 acres

Field observations made during the May 2015 SA indicate that a significant release of MEC/MPPEH does not exist near the extremities of the ODA2 MRS boundary. It is recommended that 147 acres of the ODA2 MRS be assessed as low probability for MEC (as illustrated on **Figure**

4). Approximately 40 of the 147 acres are considered inaccessible to human receptors due to heavy vegetation/undergrowth. The inaccessible areas are only estimated at this time, and subsequently, not illustrated on **Figure 4**.

Recommended Actions

The following actions are recommended as part of the Time Critical Removal Action:

- Moderate to High Probability – Establish a BEM, conduct a 100% TCRA to remove MEC to depth of detection or approximately 4 feet below ground surface (bgs), and verify and mark the perimeter of known disposal areas. Clearance activities in known disposal areas will be limited to approximately 2 feet bgs. The aerial extent of unknown disposal pits will be delineated, if encountered.

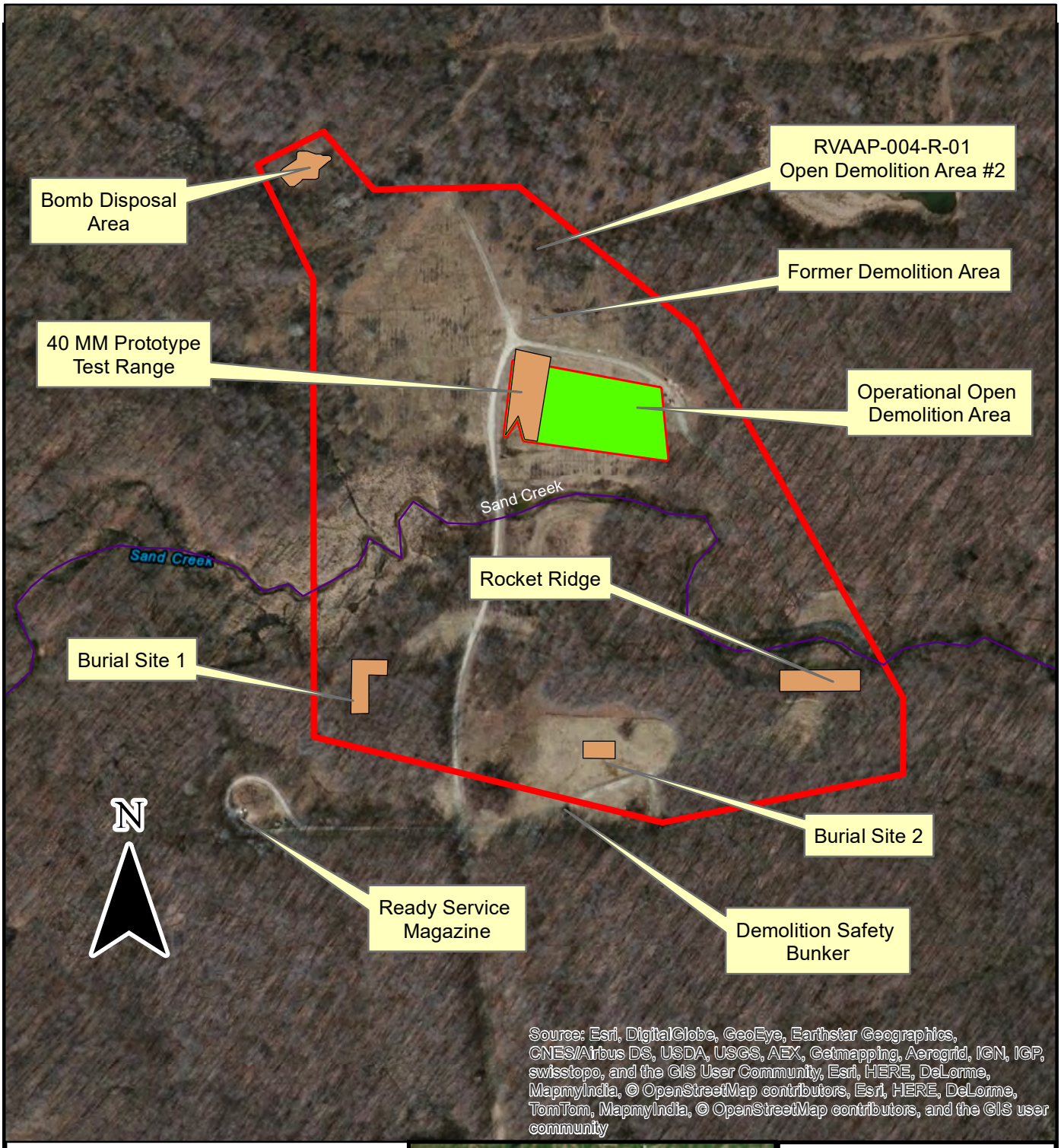
- Low Probability – For the accessible areas, conduct a 100% instrument assisted surface removal. A minimum of 10% of subsurface anomalies will be investigated. In the event a MEC item is discovered, a 50x50 foot grid will be established in this area and 100% of subsurface anomalies will be investigated. Subsurface investigation of additional anomalies may be warranted if large concentrations of MEC/MPPEH are encountered.

6. RE-ASSESSMENT:

a. In the event that MEC is identified and/or recovered during the investigative activities in the low probability area, this area will be reassessed to determine if, in accordance with the provisions outlined in **reference 1(a)** a "moderated to high probability" category is warranted.

Point of Contact for this MFR is Paul Greene, Environmental and Explosive Safety Chief, Baltimore District USACE. paul.e.greene@usace.army.mil or 410-962-6741.

Paul Greene
Chief, Environmental and Explosive Safety
USACE Baltimore District



MRS Sub-Areas/Source Areas

MRS Boundary (2011)

Operational Open Demolition Area

0 250 500 1,000 Feet

US Army Corps of Engineers
Baltimore District

Figure 1
ODA2 MRS Site Features Map

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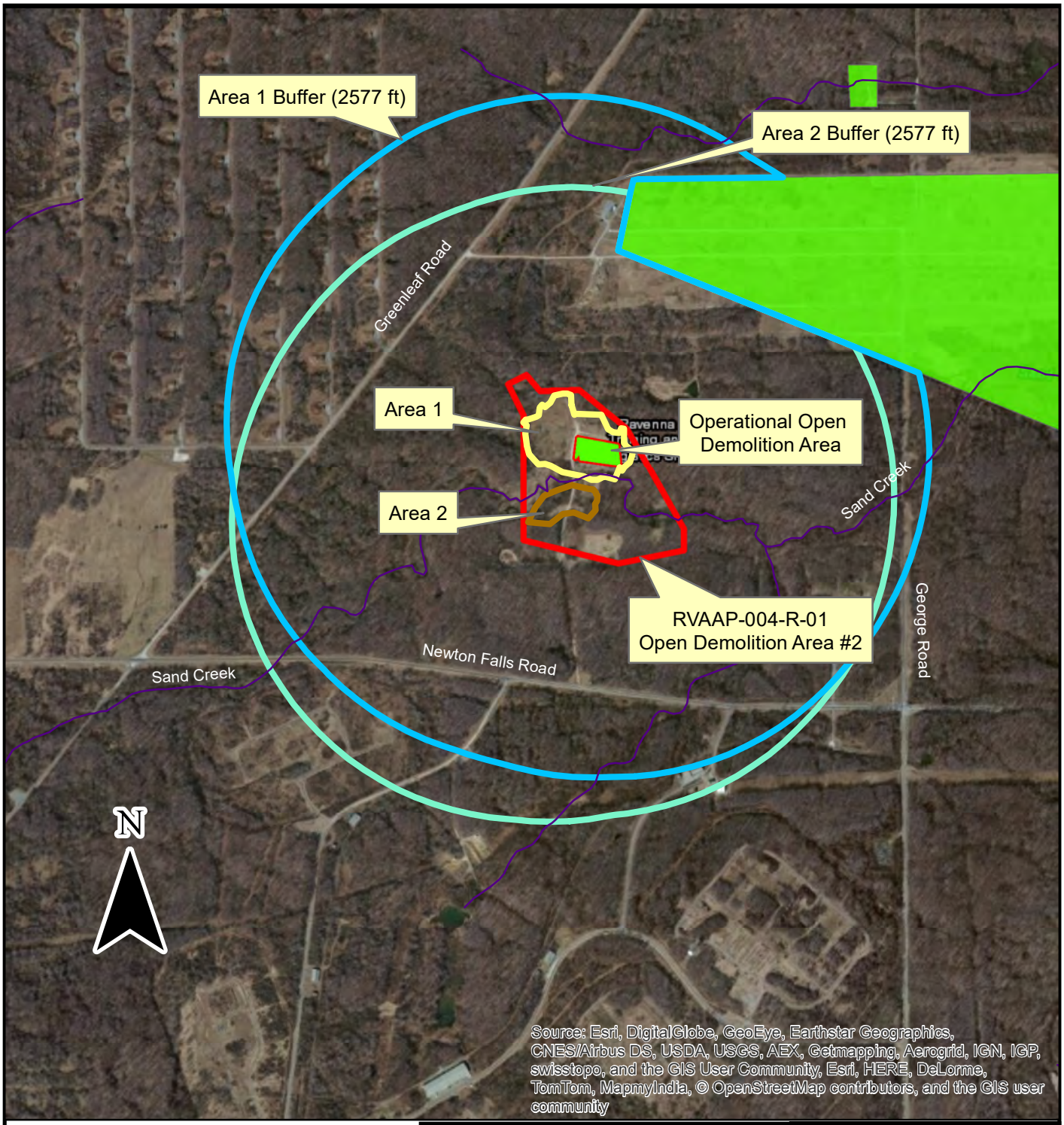

Disposal Areas
- Area 1
- Area 2

Buffer Areas
- Area 1
- Area 2
- Operational Range
- Operational Open Demolition Area
- MRS Boundary (2011)

0 0.125 0.25 0.5 Miles

US Army Corps of Engineers
Baltimore District

Figure 2
ODA2 MRS and Kick-Out Area

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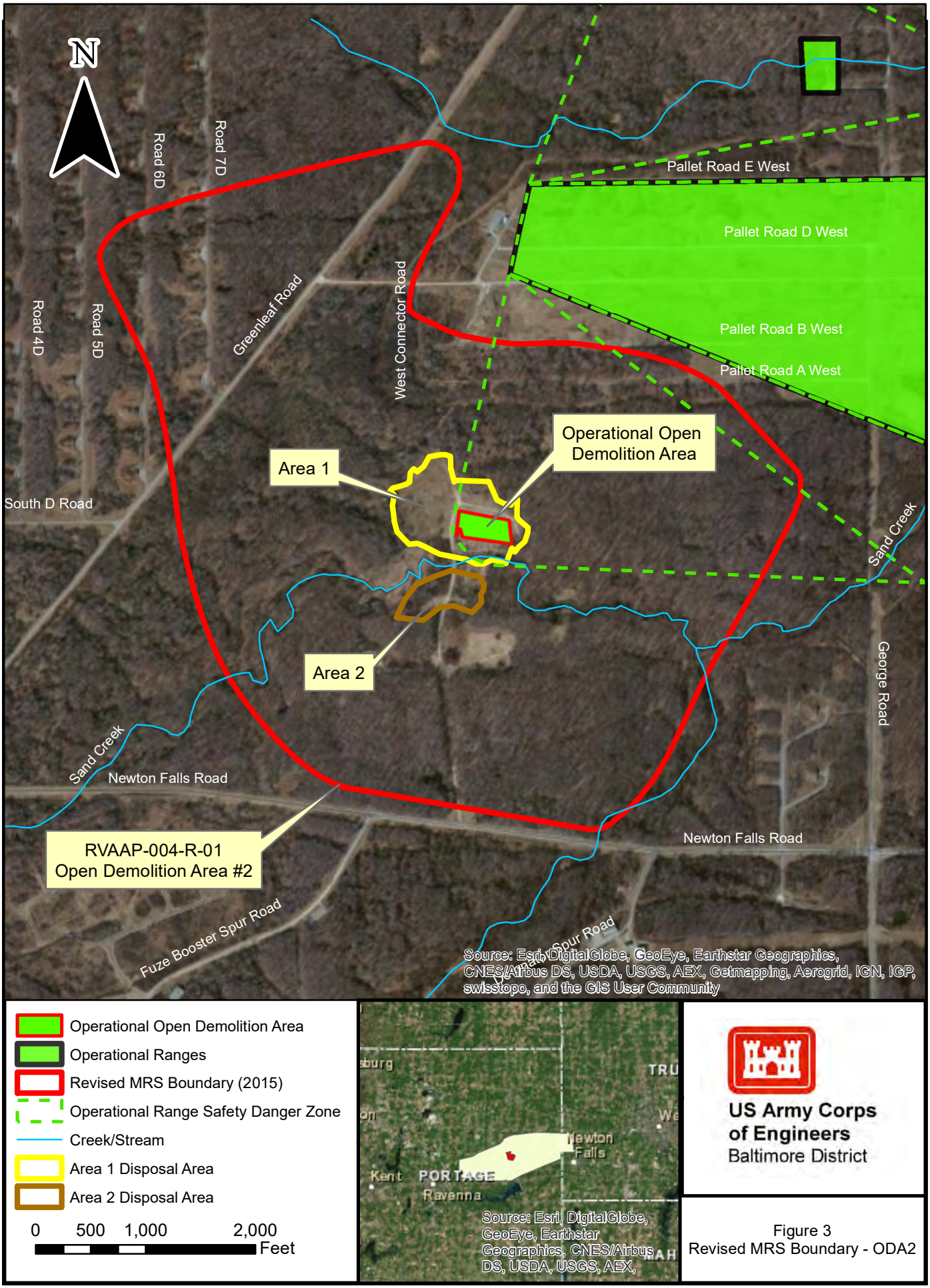

US Army Corps of Engineers
Baltimore District

Figure 3
Revised MRS Boundary - ODA2

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Figure 4
ODA2 MRS Probability Assessment

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Appendix B: Project Organizational Chart

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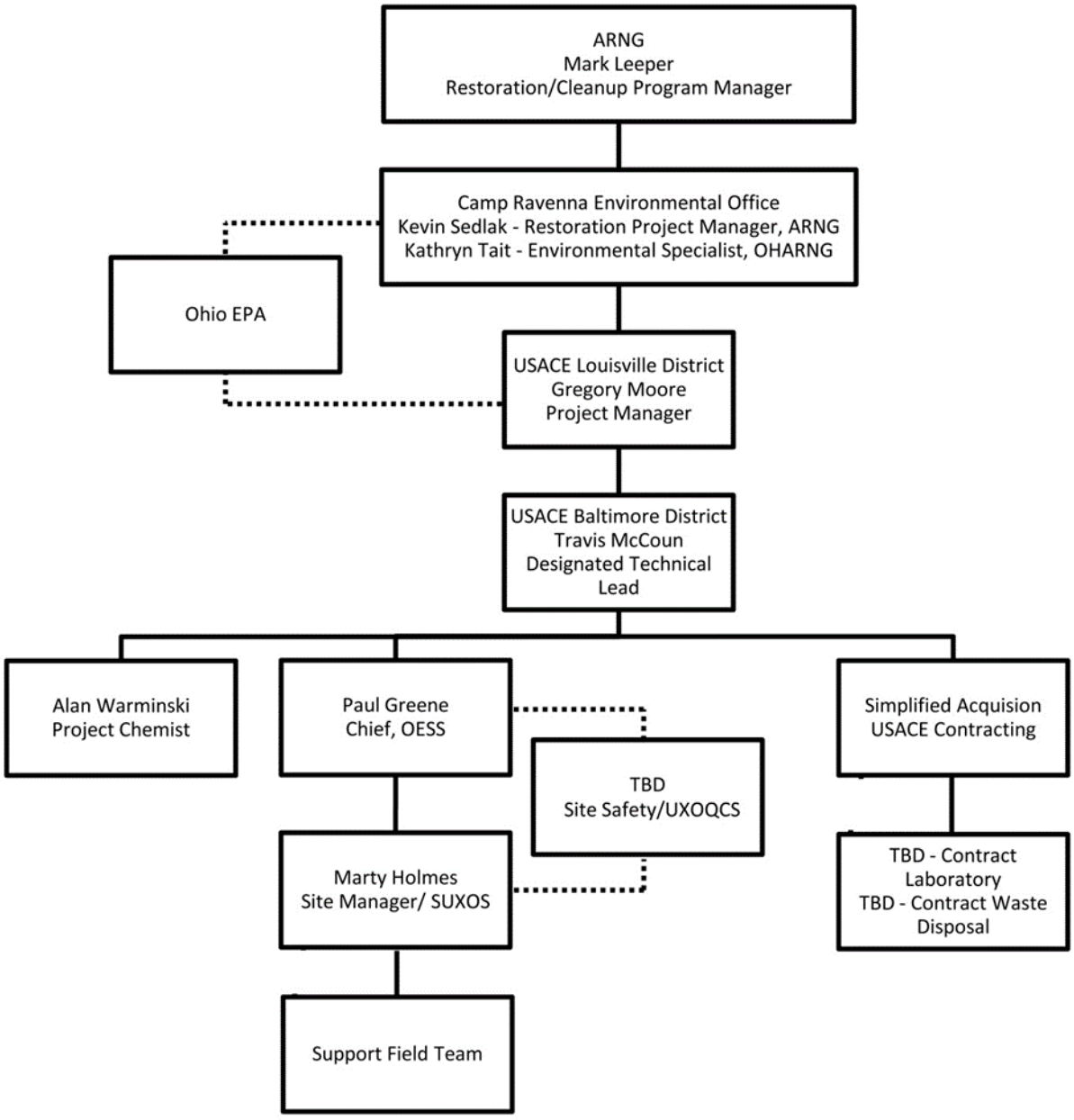
Project Organizational Chart



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Appendix C: SAP Addendum

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Appendix C
SAP Addendum

Preface

A Time Critical Removal Action (TCRA) is being completed at the Open Demolition Area #2 (ODA2) (RVAAP-004-R-01) Munitions Response Site (MRS), located at the Former Ravenna Army Ammunition Plant (RVAAP), now known as the Camp Ravenna Joint Military Training Center (Camp Ravenna), in Ravenna, Ohio. This TCRA is being completed to mitigate significant explosive safety hazards posed to National Guard soldiers/trainees due to exposure to Munitions of Explosive Concern (MEC) and Material Potentially Presenting an Explosive Hazard (MPPEH) in surface and subsurface soil.

This Sampling and Analysis Plan (SAP) Addendum will apply to all site and laboratory activities in accordance with the Work Plan, Time Critical Removal Action at Open Demolition Area #2 (ODA2), Former Ravenna Army Ammunition Plant (hereafter, referred to as the "work plan," which this SAP Addendum supports). Site-specific information presented in this document is intended to supplement the Facility-wide Field Sampling Plan (FWFSP) and the Facility-wide Quality Assurance Project Plan (FWQAPP) for Camp Ravenna (USACE, 2011).

This SAP Addendum provides the guidelines for the systematic data collection and analysis associated with the project. In accordance with the *Uniform Federal Policy for Quality Assurance Project Plans* (UFP-QAPP) (EPA, 2005), this SAP Addendum includes 23 of 37 worksheets that detail various aspects of the environmental investigation process and establishes protocols to allow for comparability and defensibility of sampling and analytical data. The remaining sheets will be included upon the determination of a contract laboratory, as these worksheets are laboratory specific. This SAP Addendum adheres to the program requirements of the *Department of Defense Quality Systems Manual for Environmental Laboratories* (DoD QSM), Version 4.1 (DoD, 2009).

Background

This SAP Addendum is intended to encompass sampling and analysis at one MRS where a TCRA will be conducted. This SAP Addendum will guide the TCRA at the ODA #2 MRS site (RVAAP-004-R-01) in accordance with the RVAAP TCRA Work Plan.

Former demilitarization activities at the former RVAAP resulted in the release of Munition of Explosive Concern (MEC) and Material Potentially Posing an Explosive Hazard (MPPEH) at the ODA2 MRS (RVAAP-004-R-01), referred to hereafter as the ODA2 MRS. The purpose of the TCRA is to mitigate significant explosive safety hazards posed to National Guard Soldiers trainees due to exposure to MEC/MPPEH at the ODA2 MRS. Removal of known MEC/MPPEH from this area will significantly reduce the explosive hazard in a timely and cost-effective manner.

The scope of this TCRA does not include remediation of munitions constituents (MC) in soil at the ODA2 MRS. If evidence of MC in soil is observed during the TCRA, the site will be sampled for MC, and the results will be provided to the installation for evaluation in the Feasibility Study. However, during the TCRA, MEC/MPPEH disposal activities will be monitored for release of MC to the environment. Any soil impacted by MEC/MPPEH disposal activities (to include impacted soils located beneath breached items during excavation) will be characterized, excavated, and containerized for disposal in accordance with the Work Plan.

Worksheet #1 & 2: Title and Approval Page

This worksheet identifies the principal points of contact for all organizations having decision authority in the project and documents their commitment to implement the QAPP. Signatories usually include the lead organization's Project Manager and QA Manager, and individuals with approval or oversight authority from each regulatory agency. Signatures indicate that officials have reviewed the QAPP and concur with its implementation it as written. If separate concurrence letters are issued, the original correspondence should be maintained with the final, approved QAPP in the project file.

1. Project Identifying Information:

   Preliminary Draft ODA2 Time Critical Removal Action (TCRA)
   Former Ravenna Army Ammunition Plant (RVAAP), Ohio

2. Lead Organization

   USACE, Louisville District

   Project Management

   USACE, Baltimore District, Engineering Division, EMDC

   Designated Technical Lead: Mr. Travis McCoun_____

   Quality Manager/Chemist: Mr. Alan S. Warminski _____

3. ARNG Directorate:
   Restoration/Cleanup Program Manager Mark Leeper, P.G.
   Restoration Project Manager: Kevin Sedlak_____

4. Ohio ARNG

   Environmental Specialist: Kathryn Tait_____

5. Regulatory Agency: Ohio EPA
   2110 East Aurora Road
   Twinsburg, Ohio 44087

6. List plans and reports from previous investigations relevant to this project:

   Ravenna Army Ammunition Plant Ravenna, Ohio, Final Work Plan for Military Munitions Response Program Remedial Investigation, Version 1.0, Environmental Services, Shaw Environmental & Infrastructure, Inc., March 1, 2011

Former Ravenna Army Ammunition Plant (RVAAP), Ravenna, OH

Optimized UFP-QAPP Worksheets – Table of Contents

Version 1 (7 July 2015)

Worksheet No. 1 & 2	Title and Approval Page
	Table of Contents
	Project Purpose, Objective and History (see Work Plan Sec 1.0)
Worksheet No. 3 & 5	Project Organization and QAPP Distribution
Worksheet No. 4, 7 & 8	Personnel Qualifications and Sign-off Sheet – NOT USED
Worksheet No. 6	Communication Pathways (See Worksheet No. 3 & 5)
Worksheet No. 9	Project Planning Session Summary
Worksheet No. 10	Conceptual Site Model
Worksheet No. 11	Project/Data Quality Objectives
Worksheet No. 12	Measurement Performance Criteria
Worksheet No. 13	Secondary Data Uses and Limitations
Worksheet No. 14 & 16	Project Tasks & Schedule
Worksheet No. 15	Project Action Limits and Laboratory-Specific Detection / Quantitation Limits
Worksheet No. 17	Sampling Design and Rationale
Worksheet No. 18	Sampling Locations and Methods
Worksheet No. 19 & 30	Sample Containers, Preservation, and Hold Times
Worksheet No. 20	Primary Sample Totals & Field QC Summary
Worksheet No. 21	Field SOPs
Worksheet No. 22	Field Equipment Calibration, Maintenance, Testing, and Inspection (see Work Plan)
Worksheet No. 23	Analytical SOPs
Worksheet No. 24	Analytical Instrument Calibration
Worksheet No. 25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection
Worksheet No. 26 & 27	Sample Handling, Custody, and Disposal
Worksheet No. 28	Analytical Quality Control and Corrective Action
Worksheet No. 29	Project Documents and Records
Worksheet No. 31, 32 & 33 - Assessments and Corrective Action	
Worksheet No. 34	Data Verification and Validation Inputs
Worksheet No. 35	Data Verification Procedures
Worksheet No. 36	Data Validation Procedures
Worksheet No. 37	Data Usability Assessment

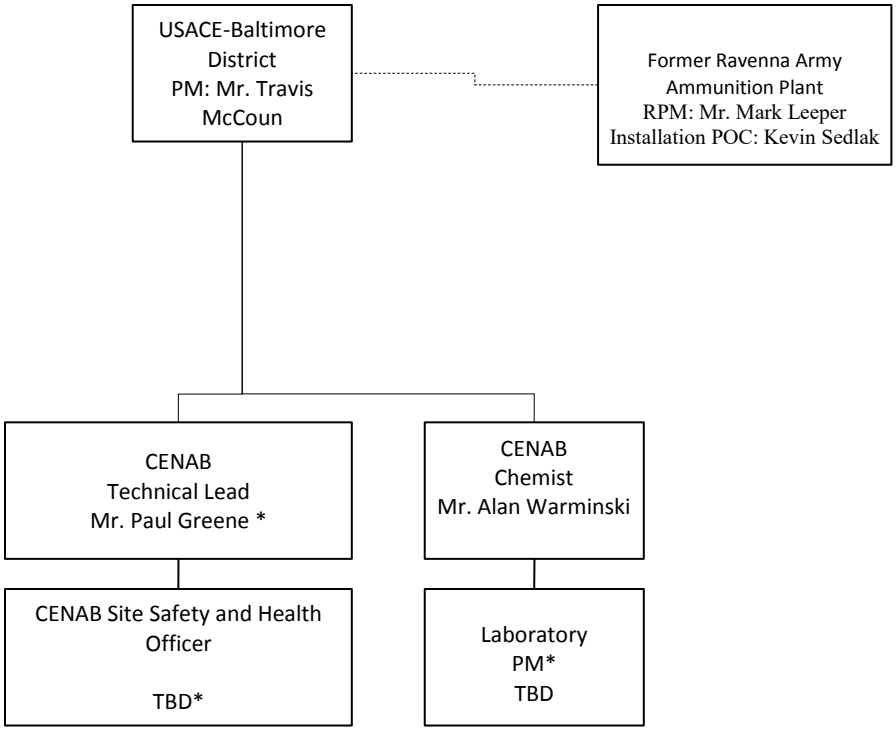
Note: Worksheets that are grayed out are not used. Information pertaining to those worksheets is contained in the Work Plan where noted. Worksheets Nos. 24, 25 and 28 are fundamental parts of the Laboratory's QA Manual and Internal Operating Procedures which have been extensively reviewed during their DoD Environmental Laboratory Accreditation certification process. Labs that are DoD Accredited will be used on this project for chemical analysis of environmental contaminants.

Worksheet #3 & 5: Project Organization and QAPP Distribution

This worksheet identifies key project personnel, as well as lines of authority and lines of communication among the lead agency, prime contractor, subcontractors, and regulatory agencies.

*QAPP recipient

Lines of authority _____ Lines of Communication ----------



Worksheet #10: Problem Definition

(UFP-QAPP Manual Section 2.5.2)

Information in this worksheet summarizes the reasons for conducting the project, including historical information, current site conditions, and other existing data applicable to the project. This information defines the problem and the environmental questions that need to be answered and links anticipated results with possible actions.

Worksheet # 10 – Problem Definition	
Decision Question	Decision Statement
The Objective to be addressed by the project:	ODA2 is one of 14 MRSs being investigated for MEC and MC under DERP. An explosive safety hazard exists at ODA2. Interim removal actions are recommended to reduce the explosive safety hazard at ODA2. Conduct a Time Critical Removal Action (TCRA) in areas having a moderate to high probability for encountering MEC, as identified by the updated Probability Assessment for the ODA2 MRS. The objective of the TCRA will be to reduce the overall potential for exposure to explosive hazards at the ODA2 site. MEC items that are deemed acceptable to move will be moved to the Buried Explosion Module (BEM) for a controlled demolition. This method describes how to use earth cover to reduce the Quantity-distance (QD) from intentional detonations of MEC of any size. Those MEC items that are unacceptable to move will be Blown In Place (BIP). In addition, MC samples will be collected from surface soil if field observations suggest a release of MC is present originating from MEC/MPPEH. MC sampling will not be conducted in known disposal areas (pits).
The environmental questions being asked:	- After demolition of MEC/MPPEH items, will the sand used for the BEM soil cover be contaminated above screening criteria to require disposal as a hazardous material or waste? If yes, disposal as a hazardous substance/waste will be required. - When a MEC/MPPEH item has a BIP detonation performed, is MC being released to surface soil above screening criteria, and will this release require excavation and disposal? If yes, soil excavation and disposal will be required. If no, then no further action is required. - Did a release of MC occur to surface soil from the presence of MEC/MPPEH at the site? If yes, analytical results and geographic location will be provided to the installation for inclusion in the FS. If no, then no further action is necessary. - Will investigation derived waste (IDW) be generated? If so, waste characterization sampling will need to occur.

Observations from any site reconnaissance's or previous investigations:	A site visit was made in August 2014 by USACE CENAB OESS personnel to conduct a munitions and explosives of concern (MEC) assessment of the ODA2. Assessment of the ODA2 area consisted of an instrument assisted visual survey of the area through use of meandering path transect method of area coverage. The site assessment confirmed that a release of MEC/MPPEH had occurred at the site that was consistent with historical OB/OD activities. The assessment observed that the majority of the MEC/MPPEH was located proximate to the range areas and significantly decreased as the distance from the range increased. With the exception of the areas immediately adjacent to the ranges there were very few subsurface anomalies detected. Those that were detected were small and assumed to be pieces of fragmentation from former demolition activities. In May 2015, a site assessment was completed by USACE to support completion of a Probability Assessment for the ODA2 MRS. The Probability Assessment identified areas for MEC as follows: Moderate to High Probability Areas: 170.4 acres; Low Probability Areas: 140 acres (40 of which are inaccessible).
A synopsis of information from previous site reports:	An RI was conducted at ODA2 in July 2011. Soil analysis was done for Explosives and Propellants, Inorganics and SVOCs. In all, 22 site-related chemicals (SRC) were discovered in surface soil (0 to 1 foot bgs). A release of MEC/MPPEH was confirmed at the site, and the MRS acreage was increased to 317.4 acres. Several Disposal Areas (pits) were identified proximate to the Demolition Area. In May 2015, a site assessment was completed by USACE to support completion of a Probability Assessment for the ODA2 MRS. The Probability Assessment identified areas for MEC as follows: Moderate to High Probability Areas: 170.4 acres; Low Probability Areas: 140 acres (40 of which are inaccessible).
The possible classes of contaminants and the affected matrices:	The detected chemicals identified as SRCs in surface soils following the screening process included the following: <u>Surface Soil</u> (0 to 1 foot bgs): – *Explosives and Propellants*: PETN, RDX, tetryl, and nitrocellulose – *Inorganics:* antimony, barium, cadmium, chromium, copper, iron, lead, mercury, strontium, zinc, and perchlorate – *SVOCs:* benzo(b)fluoranthene, benzoic acid, bis(2-ethylhexyl)phthalate, diethyl phthalate, di-n-butyl phthalate, fluoranthene, and hexachlorobenzene

The rational for inclusion of chemical and non-chemical analyses:	Based on site history and previous site reconnaissances and investigations, it indicates that a release of MEC/MPPEH exists at the site in areas identified as Moderate to High Probability for MEC. The potential for MEC/MPPEH exists in areas identified as Low Probability for MEC, however remote. This information is based on the Probability Assessment conducted in May 2015. During the field work on this TCRA, if a MEC/MPPEH item is found that is broken open with exposed explosive filler and evidence of soil staining, then a discrete soil sample will be collected from 0-6 inches below the item and analyzed for explosives, metals, propellants (nitrocellulose), SVOCs, TOC, and pH using the methods for these parameters listed below. If located on the surface, the vegetative cover will be removed, and the soil sample will be collected below this interval. • Metals (aluminum, antimony, barium, cadmium, chromium, hexavalent chromium, copper, iron, lead, mercury, strontium, and zinc), EPA SW846 6010C/7196A Method • Explosives (PETN, RDX, and tetryl) , EPA SW846 8330B Method • Propellants (nitrocellulose), EPA SW846 9056M Method • SVOCs (benzo(b)fluoranthene, benzoic acid, bis(2-ethylhexyl)phthalate, diethyl phthalate, di-n-butyl phthalate, fluoranthene, and hexachlorobenzene), EPA SW846 8270C Method • Total organic carbon (TOC), SW846 9045D • pH, EPA SW846 9045D Method For BIP operations: an MIS surface soil sample (0-6”) consisting of 30 increments will be collected prior to the detonation and after the detonation for analysis of explosives, metals, propellants (nitrocellulose), SVOCs, TOC, and pH using the methods for these parameters listed below. • Metals (aluminum, antimony, barium, cadmium, chromium, hexavalent chromium, copper, iron, lead, mercury, strontium, and zinc), EPA SW846 6010C/7196A Method • Explosives (PETN, RDX, and tetryl) , EPA SW846 8330B Method • Propellants (nitrocellulose), EPA SW846 9056M Method • SVOCs (benzo(b)fluoranthene, benzoic acid, bis(2-ethylhexyl)phthalate, diethyl phthalate, di-n-butyl phthalate, fluoranthene, and hexachlorobenzene), EPA SW846 8270C Method • Total organic carbon (TOC), SW846 9045D • pH, EPA SW846 9045D Method • TCL VOCs (SW846 8260B) • Perchlorates (SW846 6850) • Phosphorous (SW846 6010C)

The rational for inclusion of chemical and non-chemical analyses (cont.):	For the BEM: Prior to construction of the BEM, the area used for the BEM will have an MIS sample collected consisting of 30 increments and after BEM work is completed the base soil of the BEM will have another MIS sample collected. MIS samples collected from the DU surrounding the BEM will be collected from an interval of 0-12". Analysis will be for RVAAP full suite which consists of the following: • Metals (aluminum, antimony, barium, cadmium, chromium, hexavalent chromium, copper, iron, lead, mercury, strontium, and zinc), EPA SW846 6010C/7196A Method • Explosives (PETN, RDX, and tetryl) , EPA SW846 8330B Method • Propellants (nitrocellulose), EPA SW846 9056M Method • SVOCs (benzo(b)fluoranthene, benzoic acid, bis(2-ethylhexyl)phthalate, diethyl phthalate, di-n-butyl phthalate, fluoranthene, and hexachlorobenzene), EPA SW846 8270C Method • PCBs, EPA SW846 8082A Method • Total organic carbon (TOC), SW846 9045D • pH, EPA SW846 9045D Method • VOCs (SW846 8260B) • Perchlorates (SW846 6850) • Phosphorous (SW846 6010C) Sand brought on site for the BEM will be analyzed for the same parameters as above both before entering the site, and before being taken to the contract waste facility. For IDW: Prior to shipping any IDW generated to the contact waste facility (TBD) IDW aqueous samples (related to decontamination of sampling equipment) will be collected using the bailer method, and a composite will be made from increments collected from three drums. Soil IDW generated in these sampling activities will be analyzed from a composite sample, where each composite sample is composed of increments from three drums. IDW samples will be analyzed for the following parameters, as well as any parameters required by the contract waste facility. • TCLP Metals, Method EPA SW846 1311/6010C/7470A • TCLP SVOCs, Method EPA SW846 1311/8270C • Explosives, Method EPA SW846 8330B: (Full list) • Ignitability, Method EPA SW846 1010A/1030 • Corrosivity as pH, Method EPA SW846 9040C/9045D • Total Cyanide, Method EPA SW846 9012/9013 • Total Sulfide, Method EPA SW846 9030B

Information concerning various environmental indicators:	Past historical use of ODA2 and visual observation of MEC/MPPEH items present during previous site visits and investigations.
Project decision conditions:	The primary objective is to check if any soil contamination has occurred or is present from the following: 1. The location used for the BEM 2. The sand used for the BEM 3. If any COCs are present where broken open MEC/MPPEH with exposed filler is found during the TCRA. 4. If any COCs are present from BIP operations.

Worksheet #11: Project/Data Quality Objectives

(UFP-QAPP Manual Section 2.6.1)

This worksheet is used to develop and document data quality objectives (DQOs) using a systematic planning process. Examples of a systematic planning process include: 1) the DQO Process (USEPA 2006a), and 2) the Technical Planning Process (USACE 1998). The following guidelines are based on USEPA's 7-step DQO process.

1. State the problem.
2. Identify the decision.
3. Identify inputs into the decision.
4. Define the study boundaries.
5. Develop a decision rule.
6. Specify limits of decision errors.
7. Optimize the design for obtaining data.

The information presented in Worksheet #11 is intended to satisfy the seven-step iterative planning approach.

Worksheet #11 - Project Quality Objectives/Systematic Planning Process Statements	
Data Quality Objective Decision Statement	Data Quality Objective Decision Statement
State the Problem	MEC/MPPEH items that are able to be moved to the BEM for controlled demolition. Before construction and after de-construction (removal of BEM sand material), the surface soils will need to be analyzed for metals, explosives, propellants (nitrocellulose), SVOCs, PCBs, TOC, pH, VOCs, perchlorates, and phosphorus and assessed to determine if any contamination has resulted from its use. Also, a determination of contaminant levels present in the sand used for the BEM will need to be assessed for disposal purposes upon completion of the TCRA activities. When BIPs are performed on MEC/MPPEH items that are unacceptable to move, the surface soil will be sampled and analyzed for explosives, metals, propellants, SVOCs, TOC, and pH before and after the detonation to assess and determine if any MC contamination resulted from the detonation. For MEC/MPPEH finds, a discrete sample of the surface soil underneath the item will be collected and analyzed for explosives, metals, propellants (nitrocellulose), SVOCs, TOC, and pH.

Identify the Decision	The decision is whether soil concentrations of the COCs under and around the BEM and if the sand used for the BEM are below the Project Action Limits as listed on Worksheets #15 following use of the BEM. If yes, no further action is required. If no then the contaminated soil or sand will need to be disposed of properly. For BIPs, the decision is if soil concentrations of any explosives and metal COCs remain and if detected are they below the Project Action Limits as listed in Worksheets #15. For MEC/MPPEH Finds that are broken open which there is exposed explosive filler and evidence of soil staining will have a discrete soil sample collected from 0-6 inches below the item and analyzed for explosives and metal Contaminants of Concern to determine if any MC contaminants are present above Project Action Limits as listed in Worksheets #15.

Identify Inputs into the Decision	An MIS sample will be collected from surface soil in the area to be used for the BEM prior to use and then afterwards. Also, an MIS sample will be collected from the sand used for the BEM both prior to entering the site, and prior to the sand being transferred to the contract waste facility. Analysis will be for the full analytical suite, as summarized as follows: • Metals (aluminum, antimony, barium, cadmium, chromium, hexavalent chromium, copper, iron, lead, mercury, strontium, and zinc), EPA SW846 6010C/7196A Method • Explosives (PETN, RDX, and tetryl) , EPA SW846 8330B Method • Propellants (nitrocellulose), EPA SW846 9056M Method • SVOCs (benzo(b)fluoranthene, benzoic acid, bis(2-ethylhexyl)phthalate, diethyl phthalate, di-n-butyl phthalate, fluoranthene, and hexachlorobenzene), EPA SW846 8270C Method • PCBs, EPA SW846 8082A Method • Total organic carbon (TOC), SW846 9045D • pH, EPA SW846 9045D Method • VOCs (SW846 8260B) • Perchlorates (SW846 6850) • Phosphorous (SW846 6010C) also included
Define the Study Boundaries	The location of where the BEM will be staged (TBD). For the TCRA, the boundaries of the ODA-2 Area are shown in Figure 1 (attached).

Worksheet #11 - Project Quality Objectives/Systematic Planning Process Statements	
Data Quality Objective Decision Statement	Data Quality Objective Decision Statement
Develop a Decision Rule	See above for Identify the Decision.
Specify Limits of Decision Rule Errors	A minimum of 30 incremental samples will be collected in each DU grid. There will be a collection of MIS replicate samples at a rate of 10% for BIP and MEC items with exposed fillers. Two replicate samples will be collected both before the construction and after demolition of the BEM. A field replicate and matrix spike / matrix spike duplicate (MS/MSD) sample will be collected during pre-construction sampling (see the Appendix to this SAP Addendum). For MIS samples, the collection of the field replicate and MS/MSD samples requires three similar portions of soil. There will be an adequate quantity of soil for the lab to process an MS/MSD sample at the lab in these MIS samples. It will be noted on the chain-of custody that an MS/MSD sample is also to be processed and analyzed. Therefore, three MIS samples will be collected from the BEM site consisting of at least 30 increments each. This will also be sufficient when collecting replicates / MS / MD samples related to BIP operations. A discrete sample will be collected with each MIS sample related to the BEM to analyze for VOCs. In this instance two duplicate samples will also be collected, as well as an MS and MSD, which will require two additional aliquots of sample to be collected. This will also be sufficient when collecting duplicates / MS / MSD samples related to MEC items with exposed filler. Acceptable RPD limits for each primary and duplicate pair vary by analyte, and are defined in worksheet 15.
Optimize the Design for Obtaining Data	An MIS approach will be used for BEM sample analysis and surface soil where the BEM will be staged and used. Discrete samples will be collected if MEC items are encountered with exposed explosive filler for analysis of explosives and MEC metals. An MIS approach will be used for MEC/MPPEH if a large cache of items are discovered and evidence of potential release of dispersed MC is present. An MIS approach will be utilized for post BIP MC sampling.
Who will use the data?	The data will be used by USACE Baltimore District for the Time Critical Removal Action Report and for the evaluation of whether SAP objectives are met.

What will the data be used for?	To evaluate whether COCs are below Project Action Levels (PALs) established for ODA #2 MRS in Table 12 of Attachment F to Appendix D of the RVAAP RI Work Plan. This Table has been added after Worksheet 15 of this SAP Addendum. Also, data will be used to determine proper disposal methods for BEM sand.
What types of data are needed? (target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques)	See above for Identify Inputs into the Decision.
How "good" do the data need to be in order to support the environmental decision?	The data require validation as definitive level data per the USEPA requirements. The COPC must be reported to the method Reporting Limit (RL). All uncensored values will be reported for the metals with data qualifiers provided for values below the Limit of Quantitation.
How much data are needed? (number of samples for each analytical group, matrix, and concentration)	MIS soil samples consisting of 30 increments each will be collected at each identified DU. These samples will be analyzed for the full suite of parameters as identified above. This methodology will be used for the BEM sand, BIPs, and potentially large releases of MEC/MPPEH identified in the field. Discrete samples will collected as needed when a MEC/MPPEH item is encountered that is broken open and has exposed filler leaking out onto the surface soil.

Where, when, and how should the data be collected/generated?	Surface soil samples will be collected prior to and following use of the BEM at the footprint location of the BEM. The soil samples will be collected using MIS. The decision unit for soil sampling will be approximately 50ft x 50ft, centrally located over the BEM. MIS samples will also be collected from the sand pile of the BEM after completion of using the BEM and analyzed for full suite of chemical parameters as done for the RI for ODA2 as well as full suite TCLP analysis for disposal purposes. The BEM sand will be sampled at a rate of 1 sample per 4,000 cubic yards of material. If a MEC/MPPEH item is determined to be unacceptable to move, BIP operations will be conducted. An MIS surface soil sample will be collected before and after demolition operations. A 25x25 foot decision unit will be established, centrally locating the MEC/MPPEH item within the decision unit. An MIS sample will be collected from the decision unit and consist of 30 randomly-located increments.

Worksheet #11 - Project Quality Objectives/Systematic Planning Process Statements	
Data Quality Objective Decision Statement	Data Quality Objective Decision Statement
Who will collect and generate the data?	USACE Baltimore District (field geologists, engineers, and/or technicians) will collect the samples. Soil will be analyzed by a laboratory (TBD) that will be Department of Defense Environmental Laboratory Accreditation certified. Data validation will be conducted by the laboratory and USACE Baltimore District geologists, chemist and/or engineers will compile and analyze the data.
How will the data be reported?	The sample data will be reported in laboratory analytical reports as definitive data packages. The data will be reported in an Electronic Data Deliverables files and Excel format.

How will the data be archived?	The USACE Baltimore District will archive the analytical data, geospatial data, and project reports for no less than five years. USACE Baltimore District will use a database that maintains information regarding sampling locations, coordinates, laboratory analytical results, and field measurements. These data will be managed and maintained internally through the use of database applications including but not limited to: webserver for file sharing and as part of the Administrative Record in the project repositories and Ravenna Environmental Information Management System (REIMS).

Worksheet 12a — Measurement Performance Criteria Table – Semivolatile Organic Compounds (SVOCs) in Soil by SW-846 Method 8270D

Matrix	Soil
Analytical Group	SVOCs (including TCLP)
Concentration Level	Low

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria (MPC)	QC Samples and/or Activity to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S & A)
SVOCs in Soil Sample placed in a glass jar or amber jar with a Teflon-lined cap..	SW-846 8270C	Accuracy/Bias (Contamination)	No target compounds > ½ LOQ	Field Blanks and Equipment/Rinsate Blanks	S & A
		Accuracy/Bias (Contamination)	No target compounds > ½ LOQ	Method Blanks and Instrument Blanks	A
		Precision - Overall	RPD ≤ 50% when detects for both field duplicate samples are ≥ 2 x LOQ.	Field Duplicates	S & A
		Precision - Laboratory	RPD ≤ 30% when detects for both duplicates are > QL per acceptance criteria specified by DoD QSM 5.0, Appendix B, Table 4.	Laboratory Duplicates * LCS/LCSD MS/MSD *	A
		Accuracy - Laboratory	Acceptance criteria specified by DoD QSM 5.0 Appendix B, Table 4. If not specified, laboratory's in-house criteria, not to exceed ± 3 times the standard deviation of the mean LCS recovery (per Appendix C, Table 25).	LCS MS*	A
		Accuracy/Bias	Acceptance criteria specified by DoD QSM 5.0 Appendix C, Table 25. If not specified, laboratory's in-house control limits.	Surrogate spikes	A
		Sensitivity	MDL 3 to 10 times < the LOQ	Annual Method Detection Limit (MDL) Study	A
		Accuracy/Representativeness	4°C ± 2°C	Cooler Temperature Indicator	S
		Data Completeness	90% Overall	Data Completeness Check	S & A

**If information varies within an analytical group, separate by individual analyte.*

Worksheet 12b — Measurement Performance Criteria Table – Metals Analytes in Soil by SW-846 Method 6010B

Matrix	Soil
Analytical Group	Metals (ICP-AES)
Concentration Level	Low

Sampling Procedure	**Analytical Method/ SOP**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Samples and/or Activity Use to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
Metals in Soil Sample placed in a glass jar or amber jar with a Teflon-lined cap.	SW6010B	Accuracy/Bias (Contamination)	No target compounds > ½ LOQ	Field Blanks and Equipment/Rinsate Blanks	S & A
		Accuracy/Bias (Contamination)	No target compounds > ½ LOQ	Method Blanks and Instrument Blanks	A
		Precision - Overall	RPD ≤ 50% when detects for both field duplicate samples are ≥ 5 x LOQ.	Field Duplicates	S & A
		Precision - Laboratory	RPD ≤ 20% when detects for both duplicates are > QL per acceptance criteria specified by DoD QSM 5.0 Appendix B, Table 8. If not specified, laboratory's in-house control limits.	Laboratory Duplicates * LCS/LCSD MS/MSD *	A
		Accuracy - Laboratory	Acceptance criteria specified by DoD QSM 5.0, Appendix C, Table 3.	LCS MS*	A
		Sensitivity	MDL 3 to 10 times < the LOQ	Annual Method Detection Limit (MDL) Study	A
		Accuracy/Representativeness	4°C ± 2°C	Cooler Temperature Indicator	S
		Data Completeness	90% Overall	Data Completeness Check	S & A

**If information varies within an analytical group, separate by individual analyte.*

Worksheet 12.6c — Measurement Performance Criteria Table – Explosives in Soil by SW-846 Method 8330A/B

Matrix	Soil
Analytical Group	Explosive Compounds
Concentration Level	Low

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria (MPC)	QC Samples and/or Activity to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S & A)
Explosives in Soil Sample placed in a glass jar or amber jar with a Teflon-lined cap.	SW8330, SW8330A and SW8330B/ Nitrocellulose: SW-846 9056	Accuracy/Bias (Contamination)	No target compounds > ½ LOQ	Field Blanks and Equipment/Rinsate Blanks	S & A
		Accuracy/Bias (Contamination)	No target compounds > ½ LOQ	Method Blanks, Grinding Blanks, and Instrument Blanks	A
		Precision - Overall	RPD ≤ 50% when detects for both field duplicate samples are ≥ 2 x LOQ.	Field Duplicates	S & A
		Precision - Laboratory	**SW8330 and SW8330A**: RPD ≤ 30% when detects for both duplicates are > QL per acceptance criteria specified by DoD QSM 5.0 Table 37, p.220. **SW8330B**: RPD < 20% when detects for both duplicates are > QL per acceptance criteria specified by DoD QSM 5.0 Table 37 p.220.	Laboratory Duplicates LCS/LCSD MS/MSD * SW8330B: Laboratory triplicates	A
		Accuracy - Laboratory	Acceptance criteria specified by DoD QSM 5.0 Table 37, p. 220. If not specified, laboratory's in-house criteria, not to exceed ± 3 times the standard deviation of the mean LCS recovery (per Table 37, p. 220).	LCS MS*	A
		Accuracy/Bias	Acceptance criteria are not specified by DoD QSM 5.0. Use contract laboratory's in-house control limits.	Surrogate spikes	A
		Sensitivity	MDL 3 to 10 times < the LOQ	Annual Method Detection Limit (MDL) Study	A
		Accuracy/Representativeness	4°C ± 2°C	Cooler Temperature Indicator	S
		Data Completeness	90% Overall	Data Completeness Check	S & A

**If information varies within an analytical group, separate by individual analyte.*

Worksheet 12d — Measurement Performance Criteria Table – Volatile Organic Compounds (VOCs) in Soil by SW-846 Method 8260C

Matrix	Soil
Analytical Group	VOCs
Concentration Level	Low

Sampling Procedure	**Analytical Method/ SOP**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Samples and/or Activity Use to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
VOCs in Soil Sealed-Cap (Encore).	SW8260B/	Accuracy/Bias (Contamination)	No target compounds > ½ LOQ	Trip Blanks, Field Blanks, and Equipment/Rinsate Blanks	S & A
		Accuracy/Bias (Contamination)	No target compounds > ½ LOQ	Method Blanks and Instrument Blanks	A
		Precision - Overall	RPD ≤ 50% when detects for both field duplicate samples are ≥ 2 x LOQ.	Field Duplicates	S & A
		Precision - Laboratory	RPD ≤ 30% when detects for both duplicates are > QL per acceptance criteria specified by DoD QSM 5.0 Appendix B, Table 4.	Laboratory Duplicates * LCS/LCSD MS/MSD *	A
		Accuracy - Laboratory	Acceptance criteria specified by DoD QSM 5.0 Appendix C, Table 23. If not specified, laboratory's in-house criteria (per Appendix B, Table 4).	LCS MS*	A
		Accuracy/Bias	Acceptance criteria specified by DoD QSM 5.0 Appendix C, Table 23. If not specified, laboratory's in-house control limits.	Surrogate spikes	A
		Sensitivity	MDL 3 to 10 times < the LOQ	Annual Method Detection Limit (MDL) Study	A
		Accuracy/Representativeness	4°C ± 2°C	Cooler Temperature Indicator	S
		Data Completeness	90% Overall	Data Completeness Check	S & A

**If information varies within an analytical group, separate by individual analyte.*

Worksheet 12e — Measurement Performance Criteria Table – PCBs in Soil by SW-846 Method 8082

Matrix	Soil
Analytical Group	PCBs (Aroclor-Specific)
Concentration Level	Low

Sampling Procedure	**Analytical Method/SOP**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Samples and/or Activity Use to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
PCBs in Soil Sample placed in a glass jar or amber jar with a Teflon-lined cap.	SW8082/	Accuracy/Bias (Contamination)	No target compounds > ½ LOQ	Field Blanks and Equipment/Rinsate Blanks	S & A
		Accuracy/Bias (Contamination)	No target compounds > ½ LOQ	Method Blanks and Instrument Blanks	A
		Precision - Overall	RPD ≤ 50% when detects for both field duplicate samples are ≥ 2 x LOQ.	Field Duplicates	S & A
		Precision - Laboratory	RPD ≤ 30% when detects for both duplicates are > QL per acceptance criteria specified by DoD QSM 5.0 Appendix B, Table 1.	Laboratory Duplicates * LCS/LCSD MS/MSD *	A
		Accuracy - Laboratory	Acceptance criteria specified by DoD QSM 5.0 Appendix C, Table 17. If not specified, laboratory's in-house criteria, recovery (per QSM 5.0 Appendix B, Table 1).	LCS MS*	A
		Accuracy/Bias	Acceptance criteria specified by DoD QSM 5.0 Appendix C, Table 17. If not specified, laboratory's in-house control limits.	Surrogate spikes	A
		Sensitivity	MDL 3 to 10 times < the LOQ	Annual Method Detection Limit (MDL) Study	A
		Accuracy/Representativeness	4°C ± 2°C	Cooler Temperature Indicator	S
		Data Completeness	90% Overall	Data Completeness Check	S & A

**If information varies within an analytical group, separate by individual analyte.*

Worksheet 12.12f — Measurement Performance Criteria Table – Total Organic Carbon (TOC) in Soil by SW-846 Method 9060

Matrix	Soil
Analytical Group	Total Organic Carbon (TOC)
Concentration Level	Low

Sampling Procedure	**Analytical Method/SOP**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Samples and/or Activity Use to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
TOC in Soil Sample placed in 125 ml Clear Wide Mouth glass jar.	SW9060 or SM 5310B	Accuracy/Bias (Contamination)	No analytes > ½ LOQ	Field Blanks and Equipment/Rinsate Blanks	S & A
		Accuracy/Bias (Contamination)	No analytes > ½ LOQ	Method Blanks and Instrument Blanks	A
		Precision - Overall	RPD ≤ 50% when detects for both field duplicate samples are ≥ 5 x LOQ.	Field Duplicates	S & A
		Precision - Laboratory	Laboratory in-house RPD criteria not to exceed 20% when analyte detects for both laboratory duplicates are ≥ LOQ.	LCS/LCSD Laboratory Duplicates * MS/MSD *	A
		Accuracy/Bias	LCS %R - Laboratory's in-house control limits, not to exceed 80-120%R. MS %R - Laboratory's in-house control limits.	LCS MS*	A
		Sensitivity	MDL 3 to 10 times < the LOQ	Annual Method Detection Limit (MDL) Study	A
		Accuracy/Representativeness	4°C ± 2°C	Cooler Temperature Indicator	S
		Data Completeness	90% Overall	Data Completeness Check	S & A

**If information varies within an analytical group, separate by individual analyte.*

SAP Worksheet #15.1 - Reference Limits and Evaluation Table

MC Sampling

Matrix: Soils and Sediments
Analytical Group: SVOCs - SW-846 8270C

Analyte	CAS Number	Minimum Soil Project Action Limit[1] (µg/kg) *Equal to or Less Than*	Minimum Sediment Project Action Limit[1] (µg/kg) *Equal to or Less Than*	Project Quantitation Limit Goal[1] (µg/kg)	Project Action Limit Reference	Achievable Laboratory Limits[2]		Precision and Accuracy Method Performance Criteria[3]				
						LOD (µg/kg)	LOQ (µg/kg)	LCS Control Limit (%R)	MS/MSD Control Limit (%R)	MS/MSD Precision Limit (RPD)	Surrogate Control Limit (%R)	Project Field Precision Limit (RPD)
1,2,4-Trichlorobenzene	120-82-1	6,200	6,200	400	From Table 12 of Attachment F in the RI Work Plan	100	400	45-110	45-110	30	N/A	50
1,2-Dichlorobenzene	95-50-1	190,000	190,000	400		100	400	45-95	45-95	30	N/A	50
1,3-Dichlorobenzene	541-73-1	2,400	2,400	400		100	400	40-100	40-100	30	N/A	50
1,4-Dichlorobenzene	106-46-7	TBC	TBC	400		100	400	35-105	35-105	30	N/A	50
2,4,5-Trichlorophenol	95-95-4	610,000	610,000	500		400	500	50-110	50-110	30	N/A	50
2,4,6-Trichlorophenol	88-06-2	6,100	6,100	500		400	500	45-110	45-110	30	N/A	50
2,4-Dichlorophenol	120-83-2	18,000	18,000	500		400	500	45-110	45-110	30	N/A	50
2,4-Dimethylphenol	105-67-9	120,000	120,000	400		100	400	30-105	30-105	30	N/A	50
2,4-Dinitrophenol	51-28-5	12,000	12,000	2000		1000	2000	15-130	15-130	30	N/A	50
2-Chloronaphthalene	91-58-7	630,000	630,000	400		100	400	45-105	45-105	30	N/A	50
2-Chlorophenol	95-57-8	39,000	39,000	500		400	500	45-105	45-105	30	N/A	50
2-Methylphenol	95-48-7	310,000	310,000	1000		500	1000	40-105	40-105	30	N/A	50
2-Nitroaniline	88-74-4	61,000	61,000	400		100	400	45-120	45-120	30	N/A	50
2-Nitrophenol	88-75-5	TBC	TBC	500		400	500	40-110	40-110	30	N/A	50
3&4-Methylphenol	30030	TBC	TBC	2000		1000	2000	40-105	40-105	30	N/A	50
3,3'-Dichlorobenzidine	91-94-1	1,100	1,100	500		400	500	10-130	10-130	30	N/A	50
3-Nitroaniline	99-09-2	TBC	TBC	1000		400	1000	25-110	25-110	30	N/A	50
4,6-Dinitro-2-methylphenol	534-52-1	490	490	1000		400	1000	30-135	30-136	30	N/A	50
4-Bromophenyl-phenyl ether	101-55-3	TBC	TBC	400		100	400	45-115	45-115	30	N/A	50
4-Chloro-3-methylphenol	59-50-7	610,000	610,000	500		400	500	45-115	45-115	30	N/A	50
4-Chloroaniline	106-47-8	2.4	2.4	400		100	400	10-95	10-95	30	N/A	50

4-Chlorophenyl-phenyl ether	7005-72-3	TBC	TBC	400		100	400	45-110	45-110	30	N/A	50

SAP Worksheet #15.1 - Reference Limits and Evaluation Table

MC Sampling (continued)

Analyte	CAS Number	Minimum Soil Project Action Limit[1] (µg/kg) *Equal to or Less Than*	Minimum Sediment Project Action Limit[1] (µg/kg) *Equal to or Less Than*	Project Quantitation Limit Goal[1] (µg/kg)	Project Action Limit Reference	Achievable Laboratory Limits[2]		Precision and Accuracy Method Performance Criteria[3]				
						LOD (µg/kg)	LOQ (µg/kg)	LCS Control Limit (%R)	MS/MSD Control Limit (%R)	MS/MSD Precision Limit (RPD)	Surrogate Control Limit (%R)	Project Field Precision Limit (RPD)
4-Nitroaniline	100-01-6	24,000	24,000	1000	From Table 12 of Attachment F in the RI Work Plan	400	1000	35-115	35-115	30	N/A	50
4-Nitrophenol	100-02-7	61,200	TBC	1000		400	1000	15-140	15-140	30	N/A	50
Acenaphthene	83-32-9	340,000	340,000	400		100	400	45-110	45-110	30	NA	50
Acenaphthylene	208-96-8	TBC	TBC	400		100	400	45-105	45-105	30	NA	50
Anthracene	120-12-7	1,700,000	1,700,000	400		100	400	55-105	55-105	30	NA	50
Benzo(a)anthracene	56-55-3	221	221	400		100	400	50-110	50-110	30	NA	50
Benzo(a)pyrene	50-32-8	22	22	400		100	400	50-110	50-110	30	NA	50
Benzo(b)fluoranthene	205-99-2	221	221	400		100	400	45-115	45-115	30	NA	50
Benzo(g,h,i)perylene	191-24-2	TBC	TBC	400		100	400	40-125	40-125	30	NA	50
Benzo(k)fluoranthene	207-08-9	2,210	2,210	400		100	400	45-125	45-125	30	NA	50
Chrysene	218-01-9	22,100	15,000	400		100	400	55-110	55-110	30	NA	50
Dibenzo(a,h)anthracene	53-70-3	22	22	400		100	400	40-125	40-125	30	NA	50
Fluoranthene	206-44-0	163,000	230,000	400		100	400	55-115	55-115	30	NA	50
Fluorene	86-73-7	243,000	230,000	400		100	400	50-110	50-110	30	NA	50
Indeno(1,2,3-cd)pyrene	193-39-5	221	221	400		100	400	40-120	40-120	30	NA	50
2-Methylnaphthalene	91-57-6	30,600	31,000	400		100	400	45-105	45-105	30	NA	50
Naphthalene	91-20-3	122,000	3,600	400		100	400	40-105	40-105	30	NA	50
Phenanthrene	85-01-8	TBC	TBC	400		100	400	50-110	50-110	30	NA	50
Pyrene	129-00-0	122,000	170,000	400		100	400	45-125	45-125	30	NA	50
Benzoic acid	65-85-0	24,000,000	24,000,000	2000		500	2000	0-110	0-110	30	NA	50
Benzyl alcohol	100-51-6	TBC	TBC	1000		500	1000	20-125	20-125	30	N/A	50
Bis(2-chloroethoxy)methane	111-91-1	23.000	18,000	400		100	400	45-110	45-110	30	N/A	50
Bis(2-chloroethyl)ether	111-44-4	210	210	400		100	400	40-105	40-105	30	N/A	50

SAP Worksheet #15.1 - Reference Limits and Evaluation Table

MC Sampling (continued)

Analyte	CAS Number	Minimum Soil Project Action Limit[1] (µg/kg) *Equal to or Less Than*	Minimum Sediment Project Action Limit[1] (µg/kg) *Equal to or Less Than*	Project Quantitation Limit Goal[1] (µg/kg)	Project Action Limit Reference	Achievable Laboratory Limits[2]		Precision and Accuracy Method Performance Criteria[3]				
						LOD (µg/kg)	LOQ (µg/kg)	LCS Control Limit (%R)	MS/MSD Control Limit (%R)	MS/MSD Precision Limit (RPD)	Surrogate Control Limit (%R)	Project Field Precision Limit (RPD)
Bis(2-chloroisopropyl)ether	39638-32-9	4,600	4,600	400	From Table 12 of Attachment F in the RI Work Plan	100	400	20-115	20-115	30	N/A	50
Bis(2-ethylhexyl)phthalate	117-81-7	35,000	35,000	1000		100	400	45-125	45-125	30	N/A	50
Butylbenzylphthalate	85-68-7	260,000	260,000	400		100	400	50-125	50-125	30	N/A	50
Carbazole	86-74-8	44,600	TBC	400		100	400	45-115	45-115	30	N/A	50
Di-n-butylphthalate	84-74-2	610,000	610,000	400		100	400	55-110	55-110	30	N/A	50
Di-n-octylphthalate	117-84-0	TBC	TBC	400		100	400	40-130	40--130	30	N/A	50
Dibenzofuran	132-64-9	15,300	7,800	400		100	400	50-105	50-105	30	N/A	50
Diethylphthalate	84-66-2	4,900,000	4,900,000	400		100	400	50-115	50-115	30	N/A	50
Dimethylphthalate	131-11-3	TBC	TBC	400		100	400	50-110	50-110	30	N/A	50
Hexachlorobenzene	118-74-1	300	300	400		100	400	45-120	45-120	30	N/A	50
Hexachlorobutadiene	87-68-3	6,100	6,100	400		100	400	40-115	40-115	30	N/A	50
Hexachlorocyclopentadiene	77-47-4	37,000	37,000	400		100	400	30-137	30-137	30	N/A	50
Hexachloroethane	67-72-1	6,100	6,100	400		100	400	35-110	35-110	30	N/A	50
Isophorone	78-59-1	510,000	510,000	400		100	400	45-110	45-110	30	N/A	50
N-Nitroso-di-n-propylamine	621-64-7	120	TBC	400		100	400	40-115	40-115	30	N/A	50
N-Nitrosodiphenylamine & Diphn	86-30-6	99,000	99,000	800		200	800	50-115	50-115	30	N/A	50
Pentachlorophenol	87-86-5	2,120	890	1000		400	1000	25-120	25-120	30	N/A	50
Phenol	108-95-2	1,800,000	1,800,000	500		400	500	40-100	40-100	30	N/A	50

Notes:

µg/kg = micrograms per kilogram LCS = laboratory control sample LOD = limit of detection
LOQ = level of quantitation MS = matrix spike
MSD = matrix spike duplicate

NA = Not Applicable.
%R = percent recovery
RPD = relative percent difference

TBC = To be calculated; no available screening level or RSL (EPA, 2010) is available and one will be calculated for risk if it is found in analysis and is considered a munitions constituent.

[1]Only the minimum criteria action limits are shown here for comparison. Further information regarding the criteria and basis for the project action limits and the associated sources is provided in Table 15 of the Attachment F Munitions Constituent Sampling Rationale. Project action limits are based upon on a dry weight basis. The project quantitation limit goals are based upon a wet weight basis. Project Action Limits presented in **bold** represent values below project quantitation limits. Following the receipt of the analytical results, the project team will review the data to ensure that the sampling and data meets the DQOs. Please see Worksheet #37 - Usability Assessment for further discussion.

[2]LODs and LOQs were determined in accordance with *DoD Quality Systems Manual for Environmental Laboratories (DoD QSM), Version 5.0 (2013).*

[3] The laboratory precision and accuracy method performance criteria are based upon the DoD QSM, Version 5.0, July 2013. If a compound/analyte is not listed, then the established laboratory in-house limits are used per DoD QSM

SAP Worksheet #15.2 - Reference Limits and Evaluation Table

MC Sampling

Matrix: Soils and Sediment

Analytical Group: Metals - SW-846 3050B/6010C

Analyte	CAS Number	Minimum Soil Project Action Limit[1]	Minimum Sediment Project Action Limit[1] (mg/kg)	Project Quantitation Limit Goal[1] (mg/kg)	Project Action Limit Reference	Achievable Laboratory		Precision and Accuracy Method Performance Criteria[3]				
						LODs	LOQs	LCS Control Limit (%R)	MS/MSD	MS/MSD	Surrogate	Project Field
Aluminum	7429-90-5	3496	3496	10	From Table 12 of Attachment F in the RI Work Plan	12	0.24	80-120	80-120	20	NA	35
Cadmium	7440-43-9	6.41	6.41	0.20		0.018	0.042	80-120	80-120	20	NA	35
Chromium (as Cr(III))	7440-47-3	8,147	8,147	6.4		2.0	6.4	NA	NA	NA	NA	35
Chromium, hexavalent	7440-47-3	1.64	1.64	6.4		2.0	6.4	83-115	75-125	30	NA	35
Calcium	7440-70-2	NA	NA	250		0.45	0.90	80-120	80-120	20	NA	35
Copper	7440-50-8	311	311	1.3		0.18	0.38	80-120	80-120	20	NA	35
Iron	7439-89-6	2313	2313	5.0		0.9	1.8	80-120	80-120	20	NA	35
Lead	7439-92-1	40	40	5.0		0.12	0.24	80-120	80-120	20	NA	35
Magnesium	7439-95-4	NA	NA	250		0.36	0.72	80-120	80-120	20	NA	35
Manganese	7439-96-5	NA	NA	0.75		0.06	0.12	80-120	80-120	20	NA	35
Zinc	7440-66-6	2321	2321	1.08		0.12	0.48	80-120	80-120	20	NA	35
Antimony	7440-36-0	2.82	2.82	0.54		0.24	0.54	80-120	80-120	20	NA	35
Strontium	7440-24-6	TBC	TBC	0.076		0.018	0.076	80-120	80-120	20	NA	35
Barium	7440-39-3	351	351	0.048		0.024	0.048	80-120	80-120	20	NA	35
Mercury*	7439-97-6	2.27	2.27	0.0079		0.0050	0.0079	80-120	80-120	20	NA	35

Notes:
mg/kg = milligrams per kilogram
LCS = laboratory control sample
LOD = limit of detection
LOQ = level of quantitation
MS = matrix spike
LOQ = level of quantitation
MS = matrix spike
MSD = matrix spike duplicate NA = Not Applicable.
QLs = quantitation limits
%R = percent recovery
RPD = relative percent difference

[1]Only the minimum criteria action limits are shown here for comparison. Further information regarding the criteria and basis for the project action limits and the associated sources is provided in Table 15 of the Attachment F Munitions Constituent Sampling Rationale. Project action limits are based upon a dry weight basis. The project quantitation limit goals are based upon a wet weight basis. Following the receipt of the analytical results, the project team will review the data to ensure that the sampling and data meets the DQOs. Please see Worksheet #37 - Usability Assessment for further discussion.
[2]LODs and LOQs were determined in accordance with *DoD Quality Systems Manual for Environmental Laboratories (DoD QSM), Version 5.0 (2013).*

3 The laboratory precision and accuracy method performance criteria are based upon the DoD QSM. If a compound/analyte is not listed, then the established laboratory in-house limits are used per DoD QSM

SAP Worksheet #15.3 - Reference Limits and Evaluation Table

MC Sampling

Matrix: Soils, Sediments, and Solid IDW Analytical

Group: Explosives - SW-846 8330B

Analyte	CAS Number	Minimum Soil Project Action Limit[1] (µg/kg) *Equal to or Less Than*	Minimum Sediment Project Action Limit[1] (µg/kg) *Equal to or Less Than*	Project Quantitation Limit Goal[1] (µg/kg)	Project Action Limit Reference	Achievable Laboratory Limits[2]				Precision and Accuracy Method Performance Criteria[3]				
						LOD (µg/kg)	LOQ (µg/kg)	MDLs[4] (µg/kg)	QLs[4] (µg/kg)	LCS Control Limit (%R)	MS/MSD Control Limit (%R)	MS/MSD Precision Limit (RPD)	Surrogate Control Limit (%R)	Project Field Precision Limit (RPD)
2,4,6-Trinitrotoluene	118-96-7	3,650	3,650	400	From Table 12 of Attachment F in the RI Work Plan	150	400	90	400	69-129	69-129	30	NA	50
4-Amino-2,6-Dinitrotoluene	19406-51-0	1,540	1,540	250		150	250	70	250	75-122	75-122	30	NA	50
2-Amino-4,6-Dinitrotoluene	35572-78-2	1,540	1,540	250		150	250	50	250	75-118	75-118	30	NA	50
2,4/2,6-Dinitrotoluene Mix	25321-14-6	710	710	250		TBD	TBD	80	270	50-150	50-150	20	NA	50
2,4-Dinitrotoluene	121-14-2	753	753	500		150	500	80	500	80-118	80-118	30	NA	50
2,6-Dinitrotoluene	606-20-2	769	TBC	250		150	250	70	250	74-122	74-122	30	NA	50
HMX	2691-41-0	359,000	3,594	400		150	400	120	400	71-120	71-120	30	NA	50
Nitroguanidine	556-88-7	611,000	611,000	140		120	250	60	250	50-150	50-150	30	NA	50
RDX	121-82-4	8,030	8,030	500		150	500	140	500	63-125	63-125	30	NA	50
Tetryl	479-45-8	24,400	24,400	400		250	400	90	400	10-165	10-165	30	NA	50
Nitroglycerin	55-63-0	610	52,500	200		600	2,000	500	2,000	77-123	77-123	30	NA	50
PETN	78-11-5	TBC	TBC	200		1,000	2,000	500	2,000	74-123	74-123	30	NA	50
1,3,5-Trinitrobenzene	99-35-4	225,000	TBC	500		150	500	130	500	78-121	78-121	30	NA	50
1,3-Dinitrobenzene	99-65-0	765	TBC	400		150	400	80	400	83-115	83-115	30	NA	50
Nitrobenzene	98-95-3	TBC	TBC	250		150	250	40	250	82-116	82-116	30	NA	50
2-Nitrotoluene	88-72-2	3,880	TBC	500		150	500	90	500	77-118	77-118	30	NA	50
3-Nitrotoluene	99-08-1	TBC	TBC	250		150	250	70	250	75-118	75-118	30	NA	50
4-Nitrotoluene	99-99-0	52,500	TBC	400		250	400	70	400	76-118	76-118	30	NA	50
3,5-Dinitroaniline	610-41-3	TBC	TBC	400		150	400	90	400	10-165	10-165	30	NA	50

[1]Only the minimum criteria action limits are shown here for comparison. For example, the minimum sediment project action limit for 2,4,6-TNT is 3,650 µg/kg. The intent of these worksheets is to provide a comparison of the LOD and LOQ to show these parameters are below the lowest action level. Further information regarding the criteria and basis for the project action limits and the associated sources is provided in Table 15 of the Attachment F Munitions Constituent Sampling Rationale. Project action limits are based upon on a dry weight basis. The project quantitation limit goals are based upon a wet weight basis. Project Action Limits presented in

bold represent values below project quantitation limits. Following the receipt of the analytical results, the project team will review the data to ensure that the sampling and data meets the DQOs. Please see Worksheet #37 - Usability Assessment for further discussion.

[2]LODs and LOQs have been determined in accordance with *DoD Quality Systems Manual for Environmental Laboratories (DoD QSM) Version 5.0 (2013).*
[3]The laboratory precision and accuracy method performance criteria are based upon the DoD QSM. If a compound/analyte is not listed, then the established laboratory in-house limits are used per DoD QSM
[4]MDLs and QLs for solid investigative-derived waste (IDW) only

SAP Worksheet #15.4 - Reference Limits and Evaluation Table
MC Sampling

Matrix: Soils and Sediment

Analytical Group: Nitrocellulose - EPA SW-846 9056/CRREL-ECB ERDC SOP M-NC-ECB

Analyte	CAS Number	Minimum Soil Project Action Limit[1] (mg/kg) *Equal to or Less Than*	Minimum Sediment Project Action Limit[1] (mg/kg) *Equal to or Less Than*	Project Quantitation Limit Goal[1] (mg/kg)	Project Action Limit Reference	Achievable Laboratory Limits[2]		Precision and Accuracy Method Performance Criteria[3]				
						MDLs (mg/kg)	QLs (mg/kg)	LCS Control Limit (%R)	MS/MSD Control Limit (%R)	MS/MSD Precision Limit (RPD)	Surrogate Control Limit (%R)	Project Field Precision Limit (RPD)
Nitrocellulose	9004-70-0	TBC	TBC	20	From Table 12 of Attachment F in the RI Work Plan	5.0	20	80-120	80-120	15	NA	50

Notes:

[1]Only the minimum criteria action limits are shown here for comparison. Further information regarding the criteria and basis for the project action limits and the associated sources is provided in Table 15 of the Attachment F Munitions Constituent Sampling Rationale. Project action limits are based upon a dry weight basis. The project quantitation limit goals are based upon a wet weight basis. Following the receipt of the analytical results, the project team will review the data to ensure that the sampling and data meets the DQOs. Please see Worksheet #37 - Usability Assessment for further discussion.

[2]Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. *Laboratory Generated Limits are subject to change, the laboratory will use the most current limits at the time of analysis.* The listed MDLs and QLs are based upon a wet weight basis.

[3] The laboratory precision and accuracy method performance criteria are based upon the *DoD Quality Systems Manual for Environmental Laboratories* (DoD QSM), Version 5.0, July 2013. If a compound/analyte is not listed, then the established laboratory in-house limits are used per DoD QSM.

SAP Worksheet #15.5- Reference Limits and Evaluation Table
MC Sampling

Matrix: Soils and Sediment
Analytical Group: Polychlorinated biphenyls (PCBs)

Analyte	CAS Number	Minimum Soil Project Action Limit[1] (mg/kg) *Equal to or Less Than*	Minimum Sediment Project Action Limit[1] (mg/kg) *Equal to or Less Than*	Project Quantitation Limit Goal[1] (mg/kg)	Project Action Limit Reference	Achievable Laboratory Limits[2]		Precision and Accuracy Method Performance Criteria[3]				
						LODs (mg/kg)	LOQs (mg/kg)	LCS Control Limit (%R)	MS/MSD Control Limit (%R)	MS/MSD Precision Limit (RPD)	Surrogate Control Limit (%R)	Project Field Precision Limit (RPD)
Aroclor 1016	12674-11-2	0.203	0.203	0.1	From Table 12 of Attachment F in the RI Work Plan	0.030	0.1	40-140	40-140	30	NA	50
Aroclor 1221	11104-28-2	0.14	0.14	0.1		0.030	0.1	40-140	40-140	30	NA	50
Aroclor 1232	11141-16-5	0.14	0.14	0.1		0.030	0.1	40-140	40-140	30	NA	50
Aroclor 1242	53469-21-9	0.22	0.22	0.1		0.030	0.1	40-140	40-140	30	NA	50
Aroclor 1248	12672-29-6	0.203	TBC	0.1		0.03	0.1	40-140	40-140	30	NA	50
Aroclor 1254	11097-69-1	0.12	0.12	0.1		0.030	0.1	40-140	40-140	30	NA	50
Aroclor 1260	11096-82-5	0.203	0.203	0.1		0.030	0.1	60-130	60-130	30	NA	50

Notes:

mg/kg = milligrams per kilogram LCS = laboratory control sample LOD = limit of detection
LOQ = level of quantitation MS = matrix spike
MSD = matrix spike duplicate

NA = Not Applicable. QLs = quantitation limits
%R = percent recovery
RPD = relative percent difference

[1]Only the minimum criteria action limits are shown here for comparison. Further information regarding the criteria and basis for the project action limits and the associated sources is provided in Table 15 of the Attachment F Munitions Constituent Sampling Rationale. Project action limits are based upon a dry weight basis. The project quantitation limit goals are based upon a wet weight basis. Following the receipt of the analytical results, the project team will review the data to ensure that the sampling and data meets the DQOs. Please see Worksheet #37 - Usability Assessment for further discussion.

[2]LODs and LOQs were determined in accordance with *DoD Quality Systems Manual for Environmental Laboratories (DoD QSM), Version 5.0 (2013).*

[3] Laboratory precision and accuracy method performance criteria are based upon the DoD QSM. If a compound/analyte is not listed, then the established laboratory in-house limits are used per QSM

SAP Worksheet #15.6 - Reference Limits and Evaluation Table
MC Sampling

Matrix: Soils

Analytical Group: pH SW-846 9045D

Analyte	CAS Number	Minimum Soils Project Action Limit[1] (units) *Equal to or Less Than*	Project Quantitation Limit Goal[1] (units)	Project Action Limit Reference	Achievable Laboratory Limits[2]		Precision and Accuracy Method Performance Criteria[3]				
					LOD (units)	LOQ (units)	LCS Control Limit (%R)	MS/MSD Control Limit (%R)	S/SD Precision Limit (RPD)	Surrogate Control Limit (%R)	Project Field Precision Limit (RPD)
pH	pH	NA	NA	NA	±0.01 pH units	±0.01 pH units	NA	NA	Within 1 pH unit	NA	NA

Notes:

[1]Only the minimum criteria action limits are shown here for comparison. Further information regarding the criteria and basis for the project action limits and the associated sources is provided in Table 15 of the Attachment F Munitions Constituent Sampling Rationale. Project action limits are based upon a dry weight basis. The project quantitation limit goals are based upon a wet weight basis. Project Action Limits presented in **bold** represent values below project quantitation limits and those presented in ***bold italic*** represent values below achievable method detection limits. Following the receipt of the analytical results, the project team will review the data to ensure that the sampling and data meets the DQOs. Please see Worksheet #37 - Usability Assessment for further discussion.

[2]LODs and LOQs were determined in accordance with *DoD Quality Systems Manual for Environmental Laboratories (DoD QSM), Version 5.0 (2013).*

[3] The laboratory precision and accuracy method performance criteria are based upon the DoD QSM. If a compound/analyte is not listed, then the established laboratory in-house limits are used per DoD QSM.

SAP Worksheet #15.7 - Reference Limits and Evaluation Table
MC Sampling

Matrix: Aqueous and Solids IDW

Analytical Group: Cyanide SW-846 9012/9013, Sulfide SW-846 9030B, Ignitability (Flashpoint) SW-846 1010A/1030, Corrosivity as pH SW- OCs (1311/8270C), and TCLP Metals (1311/6010C/7470A)

Analyte	CAS Number	Minimum Soils Project Action Limit[1] (units) *Equal to or Less Than*	Project Quantitation Limit Goal[1] (units)	Project Action Limit Reference	Achievable Laboratory Limits[2]		Precision and Accuracy Method Performance Criteria[3]				
					MDLs (mg/kg)	QLs (mg/kg)	LCS Control Limit (%R)	MS/MSD Control Limit (%R)	MS/MSD Precision Limit (RPD)	Surrogate Control Limit (%R)	Project Field Precision Limit (RPD)
Total Cyanide, ASTM D5049	57-12-5	TBD	50	TBD	20	20	70-130	70-130	20	NA	NA
Total Sulfide	7783-06-4	TBD	50		40	40	70-130	70-130	20	NA	NA
Ignitability (Flashpoint)	Ignitability	<200 Deg. F	NA		NA	NA	70-130	NA	5°F	NA	NA
Corrosivity as pH	pH	≥12.5 and <2.0 pH units	±0.01 pH units		±0.01 pH units	±0.01 pH units	±0.05	NA	NA	NA	NA

SAP Worksheet #15.7- Reference Limits and Evaluation Table
MC Sampling (continued)

Analyte	CAS Number	Regulatory Limit (mg/L) *Equal to or Less Than*	Project Quantitation Limit Goal (mg/L)	Regulatory Limit Reference	MDLs[1] (mg/L)	QLs[1] (mg/L)	LCS Control Limit[2] (%R)	MS/MSD Control Limit[2] (%R)	MS/MSD3 Precision Limit[2] (RPD)	Surrogate Control[2] Limit (%R)	Project Field Precision[2] Limit (RP
TCLP 2-Methylphenol	95-48-7	200	0.004	EPA TCLP Maximum Concentration of Contaminants 40CFR 261 (June, 1996)	0.00086	0.004	40-110	40-110	30	NA	50
TCLP 3&4-Methylphenol	NA	200	0.005		0.0014	0.005	30-110	30-110	30	NA	50
TCLP Pentachlorophenol	87-86-5	100	0.005		0.0011	0.005	40-115	40-115	30	NA	50
TCLP 2,4,5-Trichlorophenol	95-95-4	400	0.005		0.00011	0.005	50-110	50-110	30	NA	50
TCLP 2,4,6-Trichlorophenol	88-06-2	2.0	0.004		0.0001	0.004	50-115	50-115	30	NA	50
TCLP 1,4-Dichlorobenzene	106-46-7	7.5	0.004		0.00019	0.004	30-100	30-100	30	NA	50
TCLP 2,4-Dinitrotoluene	121-14-2	0.13	0.004		0.00021	0.004	50-120	50-120	30	NA	50
TCLP Hexachlorobenzene	118-74-1	0.13	0.004		0.00027	0.004	50-110	50-110	30	NA	50
TCLP Hexachlorobutadiene	87-68-3	0.50	0.004		0.00018	0.004	25-105	25-105	30	NA	50
TCLP Hexachloroethane	67-72-1	3.0	0.0004		0.00022	0.004	35-95	35-95	30	NA	50
TCLP Nitrobenzene	98-95-3	2.0	0.0004		0.00016	0.004	45-110	45-110	30	NA	50
TCLP Pyridine	110-86-1	5.0	0.02		0.00062	0.02	1-78	1-78	30	NA	50
2-Fluorophenol	367-12-4	NA	NA	NA	NA	NA	NA	NA	NA	20-110	50
Phenol-d5	4165-62-2	NA	NA	NA	NA	NA	NA	NA	NA	10-115	50
2,4,6-Tribromophenol	118-79-6	NA	NA	NA	NA	NA	NA	NA	NA	40-125	50
Nitrobenzene-d5	4165-60-0	NA	NA	NA	NA	NA	NA	NA	NA	40-110	50
2-Fluorobiphenyl	321-60-8	NA	NA	NA	NA	NA	NA	NA	NA	50-110	50
Terphenyl-d14	1718-51-0	NA	NA	NA	NA	NA	NA	NA	NA	50-135	50

SAP Worksheet #15.7 - Reference Limits and Evaluation Table
MC Sampling (continued)

Analyte	CAS Number	Regulatory Limit[1] (mg/L) *Equal to or Less Than*	Project Quantitation Limit Goal[1] (mg/L)	Regulatory Limit Reference	MDLs[1] (mg/L)	QLs[1] (mg/L)	LCS Control Limit[2] (%R)	MS/MSD Control Limit[2] (%R)	MS/MSD Precision Limit[2] (RPD)	Surrogate Control Limit[2] (%R)	Project Field Precision Limit[2] (RPD)
TCLP Arsenic	7440-38-2	5.0	0.024	EPA TCLP Maximum Concentration of Contaminants 40CFR 261 (June, 1996)	0.0040	0.024	80-120	80-120	20	NA	25
TCLP Barium	7440-39-3	100	0.0018		0.00026	0.0018	80-120	80-120	20	NA	25
TCLP Cadmium	7440-43-9	1.0	0.0016		0.00011	0.0016	80-120	80-120	20	NA	25
TCLP Chromium	7440-47-3	5.0	0.0042		0.0007	0.0042	80-120	80-120	20	NA	25
TCLP Lead	7439-92-1	5.0	0.0098		0.0015	0.0098	80-120	80-120	20	NA	25
TCLP Mercury	7439-97-6	0.20	0.00014		0.00004	0.00014	80-120	80-120	20	NA	25
TCLP Selenium	7782-49-2	1.0	0.014		0.0023	0.014	80-120	80-120	20	NA	25
TCLP Silver	7440-22-4	5.0	0.008		0.0007	0.008	80-120	80-120	20	NA	25

[1] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Laboratory Generated Limits are subject to change, the laboratory will use *the most current limits at the time of analysis.*

[2] *The laboratory precision and accuracy method performance criteria are based upon the DoD Quality Systems Manual for Environmental Laboratories* (DoD QSM), Version 5.0, July 2013. If a compound/analyte is not listed, then the established laboratory in-house limits are used per DoD QSM. No field duplicate or MS/MSD is required for waste profile analysis.

Table 12

Proposed Human Health and Ecological Screening Level for Ravenna AAP MRSs

				Surface and Subsurface Soil																																	
				Human Health Screening Values [a]																												Ecological Screening Values					
				National Guard Trainee				National Guard Dust/Fire Control Worker				National Guard Range Maintenance Soldier				National Guard Engineering School Instructor				Security Guard/Maintenance Worker				Resident Farmer Adult				Resident Farmer Child									
		Surface Soil	Subsurface Soil	Non-Cancer Risk (HI)		Cancer Risk		Non-Cancer Risk (HI)		Cancer Risk		Non-Cancer Risk (HI)		Cancer Risk		Non-Cancer Risk (HI)		Cancer Risk		Non-Cancer Risk (HI)		Cancer Risk		Non-Cancer Risk (HI)		Cancer Risk		Non-Cancer Risk (HI)		Cancer Risk		USEPA EcoSSLs	ORNL PRGs	Region 5	LANL ESLs	Talmage et al.	Recommended Soil Ecological Screening
Analyte	CAS Number	Background Values	Background Values	0.1	1	10^{-6}	10^{-5}	0.1	1	10^{-6}	10^{-5}	0.1	1	10^{-6}	10^{-5}	0.1	1	10^{-6}	10^{-5}	0.1	1	10^{-6}	10^{-5}	0.1	1	10^{-6}	10^{-5}	0.1	1	10^{-6}	10^{-5}	(2010) [b]	(1997) [d]	ESLs (2003) [c]	(2010) [e]	(1999) [f]	Value [g]
Explosives (USEPA SW-846 8330B)		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
1,3,5-Trinitrobenzene	99-35-4	NA	NA	16,542	165,422	TBC	TBC	144,038	1.00E+06	TBC	TBC	20,584	205,835	TBC	TBC	7,292	72,925	TBC	TBC	6,380	63,800	TBC	TBC	1,528	15,280	TBC	TBC	225	2,252	TBC	TBC	NA	NA	0.376	6.6	9.7	0.376
1,3-Dinitrobenzene	99-65-0	NA	NA	59.6	596	TBC	TBC	641	6,412	TBC	TBC	86.1	861	TBC	TBC	28.7	287	TBC	TBC	37.5	375	TBC	TBC	5.94	59.4	TBC	TBC	0.765	7.65	TBC	TBC	NA	NA	0.655	0.073	0.41	0.655
2,4,6-Trinitrotoluene	118-96-7	NA	NA	249	2,488	464	4,643	1,762	17,616	3,288	32,883	265	2,652	495	4,950	100	996	186	1,859	65.4	654	122	1,222	21.1	211	32.8	328	3.65	36.5	28.4	284	NA	NA	NA	6.4	5.6	6.4
2,4-Dinitrotoluene	121-14-2	NA	NA	652	6,519	13.4	134	2,896	28,957	59.6	596	477	4,772	9.82	98.2	202	2,020	4.16	41.6	85.2	852	1.75	17.5	43.9	439	0.753	7.53	12.8	128	1.1	11	NA	NA	1.28	0.52	NA	1.28
2,6-Dinitrotoluene	606-20-2	NA	NA	331	3,309	13.6	136	1,485	14,853	61.2	612	244	2,444	10.1	101	103	1,032	4.25	42.5	43.9	439	1.81	18.1	22.4	224	0.769	7.69	6.42	64.2	1.1	11	NA	NA	0.0328	0.37	NA	0.0328
Dinitrotoluene (2,4/2,6-) Mixture (ca)	25321-14-6	NA	NA	TBC	TBC	0.71*	7.1*	TBC	TBC	0.71*	7.1*	TBC	TBC	0.71*	7.1*	TBC	TBC	0.71*	7.1*	TBC	TBC	0.71*	7.1*	TBC	TBC	0.71*	7.1*	TBC	TBC	0.71*	7.1*	NA	NA	NA	NA	NA	NA
2-Amino-4,6-dinitrotoluene	35572-78-2	NA	NA	124	1,237	TBC	TBC	1,507	15,069	TBC	TBC	194	1,943	TBC	TBC	62.4	624	TBC	TBC	113	1,134	TBC	TBC	12.8	128	TBC	TBC	1.54	15.4	TBC	TBC	NA	NA	NA	2.1	80	2.1
2-Nitrotoluene	88-72-2	NA	NA	5,961	59,611	72.6	726	64,115	641,154	781	7,805	8,613	86,128	105	1,049	2,869	28,685	34.9	349	3,748	37,482	45.6	456	594	5,945	6.03	60.3	76.5	765	3.88	38.8	NA	NA	NA	2	NA	2
3-Nitrotoluene	99-08-1	NA	NA	0.61*	6.1*	TBC	TBC	0.61*	6.1*	TBC	TBC	0.61*	6.1*	TBC	TBC	0.61*	6.1*	TBC	TBC	0.61*	6.1*	TBC	TBC	0.61*	6.1*	TBC	TBC	0.61*	6.1*	TBC	TBC	NA	NA	NA	2.4	NA	2.4
3,5-Dinitroaniline	618-87-1	NA	NA	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	NA	NA	NA	NA	NA	NA
4-Amino-2,6-dinitrotoluene	19406-51-0	NA	NA	124	1,237	TBC	TBC	1,507	15,069	TBC	TBC	194	1,943	TBC	TBC	62.4	624	TBC	TBC	113	1,134	TBC	TBC	12.8	128	TBC	TBC	1.54	15.4	TBC	TBC	NA	NA	NA	0.73	NA	0.73
4-Nitrotoluene	99-99-0	NA	NA	5,961	59,611	982	9,818	64,115	641,154	10,560	105,602	8,613	86,128	1,419	14,186	2,869	28,685	472	4,725	3,748	37,482	617	6,173	594	5,945	81.6	816	76.5	765	52.5	525	NA	NA	NA	4.4	NA	4.4
HMX	2691-41-0	NA	NA	23,464	234,645	TBC	TBC	151,363	1.00E+06	TBC	TBC	23,265	232,653	TBC	TBC	8,963	89,630	TBC	TBC	5,292	52,917	TBC	TBC	1,909	19,090	TBC	TBC	359	3,594	TBC	TBC	NA	NA	NA	27	5.6	27
Nitrobenzene	98-95-3	NA	NA	13*	130*	4.8*	48*	13*	130*	4.8*	48*	13*	130*	4.8*	48*	13*	130*	4.8*	48*	13*	130*	4.8*	48*	13*	130*	4.8*	48*	13*	130*	4.8*	48*	NA	NA	1.31	2.2	NA	1.31
Nitroglycerin	55-63-0	NA	NA	0.61*	6.1*	982	9,818	0.61*	6.1*	10,560	105,602	0.61*	6.1*	1,419	14,186	0.61*	6.1*	472	4,725	0.61*	6.1*	617	6,173	0.61*	6.1*	81.6	816	0.61*	6.1*	52.5	525	NA	NA	NA	71	NA	71
Nitroguanidine	556-88-7	NA	NA	610*	6,100*	TBC	TBC	610*	6,100*	TBC	TBC	610*	6,100*	TBC	TBC	610*	6,100*	TBC	TBC	610*	6,100*	TBC	TBC	610*	6,100*	TBC	TBC	610*	6,100*	TBC	TBC	NA	NA	NA	NA	NA	NA
PETN	78-11-5	NA	NA	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	NA	NA	NA	8600	NA	8600
RDX	121-82-4	NA	NA	1,711	17,113	145	1,452	16,214	162,136	1,376	13,757	2,263	22,629	192	1,920	782	7,823	66.4	664	790	7,899	67.0	670	163	1,632	11.5	115	22.7	227	8.03	80.3	NA	NA	NA	7.5	15	7.5
Tetryl	479-45-8	NA	NA	24.4*	244*	TBC	TBC	24.4*	244*	TBC	TBC	24.4*	244*	TBC	TBC	24.4*	244*	TBC	TBC	24.4*	244*	TBC	TBC	24.4*	244*	TBC	TBC	24.4*	244*	TBC	TBC	NA	NA	NA	0.99	4.4	0.99
Metals (USEPA SW-846 6010B)		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Aluminum	7429-90-5	17,700	19,500	3,496	34,960	TBC	TBC	1.00E+06	1.00E+06	TBC	TBC	775,289	1.00E+06	TBC	TBC	6,210	62,103	TBC	TBC	366,343	1.00E+06	TBC	TBC	52,923	529,229	TBC	TBC	7,380	73,798	TBC	TBC	Narrative	NA	NA	Narrative	NA	NA
Antimony	7440-36-0	0.96	0.96	175	1,753	TBC	TBC	1,030	10,297	TBC	TBC	161	1,614	TBC	TBC	63.7	637	TBC	TBC	34.2	342	TBC	TBC	13.6	136	TBC	TBC	2.82	28.2	TBC	TBC	0.27	5	0.142	0.05	NA	0.27
Barium	7440-39-3	88.4	124	351	3,506	TBC	TBC	810,909	1.00E+06	TBC	TBC	128,223	1.00E+06	TBC	TBC	627	6,272	TBC	TBC	53,190	531,903	TBC	TBC	8,966	89,656	TBC	TBC	1,413	14,129	TBC	TBC	330	283	1.04	110	NA	330
Cadmium	7440-43-9	0	0	329	3,292	10.9	109	1,473	14,726	94,527	945,273	242	2,424	24,133	241,332	102	1,024	19.7	197	43.5	435	50,364	503,642	22.3	223	1,249	12,491	6.41	64.1	2,677	26,767	0.36	4	0.00222	0.27	NA	0.36
Calcium	7440-70-2	15,800	35,500	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	NA	NA	NA	NA	NA	NA
Copper	7440-50-8	17.7	32.3	25,368	253,680	TBC	TBC	341,235	1.00E+06	TBC	TBC	42,486	424,860	TBC	TBC	13,240	132,401	TBC	TBC	34,449	344,494	TBC	TBC	2,714	27,138	TBC	TBC	311	3,106	TBC	TBC	28	60	5.4	15	NA	28
Chromium (as Cr^{3+})	7440-47-3	17.4	27.2	329,763	1.00E+06	TBC	TBC	1.00E+06	1.00E+06	TBC	TBC	202,189	1.00E+06	TBC	TBC	89,618	896,177	TBC	TBC	32,885	328,852	TBC	TBC	19,694	196,942	TBC	TBC	8,147	81,473	TBC	TBC	26	0.4	0.4	2.3	NA	26
Chromium (as Cr^{6+})	18540-29-9	NA	NA	5.61	5.61E+01	1.64	16.4	6,666	66,659	14,179	141,791	1,103	11,030	3,620	36,200	10	100	2.96	29.6	254	2,537	7,555	75,546	90.4	904	187	1874	19.9	199	401.5	4015	130	NA	NA	0.34	NA	130
Iron	4739-89-6	23,100	35,200	184,370	1.00E+06	TBC	TBC	1.00E+06	1.00E+06	TBC	TBC	285,369	1.00E+06	TBC	TBC	92,205	922,050	TBC	TBC	156,695	1.00E+06	TBC	TBC	19,010	190,104	TBC	TBC	2,313	23,125	TBC	TBC	Narrative	NA	NA	NA	NA	NA
Lead	7439-92-1	26.1	19.1	40*	400*	TBC	TBC	40*	400*	TBC	TBC	40*	400*	TBC	TBC	40*	400*	TBC	TBC	40*	400*	TBC	TBC	40*	400*	TBC	TBC	40*	400*	TBC	TBC	11	40.5	0.0537	14	NA	11
Magnesium	7439-95-4	3,030	8,790	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	NA	NA	NA	NA	NA	NA
Manganese	7439-96-5	1,450	3,030	35.1	351	TBC	TBC	116,634	1.00E+06	TBC	TBC	20,467	204,672	TBC	TBC	63.1	631	TBC	TBC	7,253	72,529	TBC	TBC	1,482	14,817	TBC	TBC	293	2,927	TBC	TBC	220	NA	NA	220	NA	220
Mercury	7439-97-6	0.036	0.044	172	1,722	TBC	TBC	1,659	16,586	TBC	TBC	230	2,304	TBC	TBC	79.3	793	TBC	TBC	82.5	825	TBC	TBC	16.5	165	TBC	TBC	2.27	22.7	TBC	TBC	NA	0.00051	0.1	0.013	NA	NA
Strontium	7440-24-6	NA	NA	4,700*	47,000*	TBC	TBC	4,700*	47,000*	TBC	TBC	4,700*	47,000*	TBC	TBC	4,700*	47,000*	TBC	TBC	4,700*	47,000*	TBC	TBC	4,700*	47,000*	TBC	TBC	4,700*	47,000*	TBC	TBC	NA	NA	NA	96	NA	NA
Zinc	7440-66-0	61.8	93.3	187,269	1.00E+06	TBC	TBC	1.00E+06	1.00E+06	TBC	TBC	301,090	1+E06	TBC	TBC	95,621	956,213	TBC	TBC	195,080	1.00E+06	TBC	TBC	19,659	196,589	TBC	TBC	2,321	23,209	TBC	TBC	46	8.5	6.62	48	NA	46
SVOCs (USEPA SW-846 8270C)		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
1,2,4-Trichlorobenzene	120-82-1	NA	NA	6.2*	62*	22*	220*	6.2*	62*	22*	220*	6.2*	62*	22*	220*	6.2*	62*	22*	220*	6.2*	62*	22*	220*	6.2*	62*	22*	220*	6.2*	62*	22*	220*	NA	20	11.1	0.27	NA	20
1,2-Dichlorobenzene	95-50-1	NA	NA	190*	1,900*	TBC	TBC	190*	1,900*	TBC	TBC	190*	1,900*	TBC	TBC	190*	1,900*	TBC	TBC	190*	1,900*	TBC	TBC	190*	1,900*	TBC	TBC	190*	1,900*	TBC	TBC	NA	NA	2.96	0.92	NA	2.96
1,3-Dichlorobenzene	541-73-1	NA	NA	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	NA	NA	37.7	0.73	NA	37.7
1,4-Dichlorobenzene	106-46-7	NA	NA	350*	3,500*	2.4*	24*	350*	3,500*	2.4*	24*	350*	3,500*	2.4*	24*	350*	3,500*	2.4*	24*	350*	3,500*	2.4*	24*	350*	3,500*	2.4*	24*	350*	3,500*	2.4*	24*	NA	20	0.546	0.88	NA	20
2,4,5-Trichlorophenol	95-95-4	NA	NA	610*	6,100*	TBC	TBC	610*	6,100*	TBC	TBC	610*	6,100*	TBC	TBC	610*	6,100*	TBC	TBC	610*	6,100*	TBC	TBC	610*	6,100*	TBC	TBC	610*	6,100*	TBC	TBC	NA	9	14.1	NA	NA	9
2,4,6-Trichlorophenol	88-06-2	NA	NA	6.1*	61*	44*	440*	6.1*	61*	44*	440*	6.1*	61*	44*	440*	6.1*	61*	44*	440*	6.1*	61*	44*	440*	6.1*	61*	44*	440*	6.1*	61*	44*	440*	NA	4	9.94	NA	NA	4
2,4-Dichlorophenol	120-83-2	NA	NA	18*	180*	TBC	TBC	18*	180*	TBC	TBC	18*	180*	TBC	TBC	18*	180*	TBC	TBC	18*	180*	TBC	TBC	18*	180*	TBC	TBC	18*	180*	TBC	TBC	NA	NA	87.5	NA	NA	87.5
2,4-Dimethylphenol	105-67-9	NA	NA	120*	1,200*	TBC	TBC	120*	1,200*	TBC	TBC	120*	1,200*	TBC	TBC	120*	1,200*	TBC	TBC	120*	1,200*	TBC	TBC	120*	1,200*	TBC	TBC	120*	1,200*	TBC	TBC	NA	NA	0.01	NA	NA	0.01
2,4-Dinitrophenol	51-28-5	NA	NA	12*	120*	TBC	TBC	12*	120*	TBC	TBC	12*	120*	TBC	TBC	12*	120*	TBC	TBC	12*	120*	TBC	TBC	12*	120*	TBC	TBC	12*	120*	TBC	TBC	NA	20	0.0609	NA	NA	20
2-Chloronaphthalene	91-58-7	NA	NA	630*	6,300*	TBC	TBC	630*	6,300*	TBC	TBC	630*	6,300*	TBC	TBC	630*	6,300*	TBC	TBC	630*	6,300*	TBC	TBC	630*	6,300*	TBC	TBC	630*	6,300*	TBC	TBC	NA	NA	0.0122	NA	NA	0.0122
2-Chlorophenol	95-57-8	NA	NA	39*	390*	TBC	TBC	39*	390*	TBC	TBC	39*	390*	TBC	TBC	39*	390*	TBC	TBC	39*	390*	TBC	TBC	39*	390*	TBC	TBC	39*	390*	TBC	TBC	NA	NA	0.243	0.39	NA	0.243
2-Methylnaphthalene	91-57-6	NA	NA	2,384	23,845	TBC	TBC	25,646	256,462	TBC	TBC	3,445	34,451	TBC	TBC	1,147	11,474	TBC	TBC	1,499	14,993	TBC	TBC	238	2,378	TBC	TBC	30.6	306	TBC	TBC	NA	NA	3.24	2.5	NA	3.24
2-Methylphenol	95-48-7	NA	NA	310*	3,100*	TBC	TBC	310*	3,100*	TBC	TBC	310*	3,100*	TBC	TBC	310*	3,100*	TBC	TBC	310*	3,100*	TBC	TBC	310*	3,100*	TBC	TBC	310*	3,100*	TBC	TBC	NA	NA	40.4	0.67	NA	40.4
2-Nitroaniline	88-74-4	NA	NA	61*	610*	TBC	TBC	61*	610*	TBC	TBC	61*	610*	TBC	TBC	61*	610*	TBC	TBC	61*	610*	TBC	TBC	61*	610*	TBC	TBC	61*	610*	TBC	TBC	NA	NA	74.1	5.4	NA	74.1
2-Nitrophenol	88-75-5	NA	NA	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	NA	NA	1.6	NA	NA	1.6
3 & 4-Methylphenol	CASID30030	NA	NA	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	NA	NA	3.49	0.69	NA	3.49
3,3'-Dichlorobenzidine	91-94-1	NA	NA	TBC	TBC	1.1*	11*	TBC	TBC	1.1*	11*	TBC	TBC	1.1*	11*	TBC	TBC	1.1*	11*	TBC	TBC	1.1*	11*	TBC	TBC	1.1*	11*	TBC	TBC	1.1*	11*	NA	NA	0.646	NA	NA	0.646
3-Nitroaniline	99-09-2	NA	NA	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	NA	NA	3.16	NA	NA	3.16
4,6-Dinitro-2-methylphenol	534-52-1	NA	NA	0.49*	4.9*	TBC	TBC	0.49*	4.9*	TBC	TBC	0.49*	4.9*	TBC	TBC	0.49*	4.9*	TBC	TBC	0.49*	4.9*	TBC	TBC	0.49*	4.9*	TBC	TBC	0.49*	4.9*	TBC	TBC	NA	NA	0.144	NA	NA	0.144
4-Bromophenyl-phenyl ether	101-55-3	NA	NA	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	NA	NA	NA	NA	NA	NA
4-Chloro-3-methylphenol	59-50-7	NA	NA	610*	6,100*	TBC	TBC	610*	6,100*	TBC	TBC	610*	6,100*	TBC	TBC	610*	6,100*	TBC	TBC	610*	6,100*	TBC	TBC	610*	6,100*	TBC	TBC	610*	6,100*	TBC	TBC	NA	NA	7.95	NA	NA	7.95
4-Chloroaniline	106-47-8	NA	NA	24*	240*	2.4*	24*	24*	240*	2.4*	24*	24*	240*	2.4*	24*	24*	240*	2.4*	24*	24*	240*	2.4*	24*	24*	240*	2.4*	24*	24*	240*	2.4*	24*	NA	NA	1.1	1	NA	1.1
4-Chlorophenyl-phenyl ether	7005-72-3	NA	NA	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	NA	NA	NA	NA	NA	NA
4-Nitroaniline	100-01-6	NA	NA	24*	240*	24*	240*	24*	240*	24*	240*	24*	240*	24*	240*	24*	240*	24*	240*	24*	240*	24*	240*	24*	240*	24*	240*	24*	240*	24*	240*	NA	NA	21.9	NA	NA	21.9
4-Nitrophenol	100-02-7	NA	NA	4,769	47,689	TBC	TBC	51,292	512,923	TBC	TBC	6,890	68,903	TBC	TBC	2,295	22,948	TBC	TBC	2,999	29,985	TBC	TBC	476	4,756	TBC	TBC	61.2	612	TBC	TBC	NA	7	5.12	NA	NA	7
Acenaphthene	83-32-9	NA	NA	340*	3,400*	TBC	TBC	340*	3,400*	TBC	TBC	340*	3,400*	TBC	TBC	340*	3,400*	TBC	TBC	340*	3,400*	TBC	TBC	340*	3,400*	TBC	TBC	340*	3,400*	TBC	TBC	29	20	682	0.25	NA	29
Acenaphthylene	208-96-8	NA	NA	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	29	NA	682	120	NA	29
Anthracene	120-12-7	NA	NA	1,700*	17,000*	TBC	TBC	1,700*	17,000*	TBC	TBC	1,700*	17,000*	TBC	TBC	1,700*	17,000*	TBC	TBC	1,700*	17,000*	TBC	TBC	1,700*	17,000*	TBC	TBC	1,700*	17,000*	TBC	TBC	29	NA	1480	6.8	NA	29
Benzo(a)anthracene	56-55-3	NA	NA	TBC	TBC	4.77	47.7	TBC	TBC	15.1	151	TBC	TBC	2.62	26.2	TBC	TBC	1.19	11.9	TBC	TBC	0.403	4.03	TBC	TBC	0.221	2.21	TBC	TBC	0.65	6.5	1.1	NA	5.21	3	NA	1.1
Benzo(a)pyrene	50-32-8	NA	NA	TBC	TBC	0.477	4.77	TBC	TBC	1.51	15.1	TBC	TBC	0.262	2.62	TBC	TBC	0.119	1.19	TBC	TBC	0.04	0.403	TBC	TBC	0.022	0.221	TBC	TBC	0.065	0.65	1.1	NA	1.52	53	NA	1.1
Benzo(b)fluoranthene	205-99-2	NA	NA	TBC	TBC	4.77	47.7	TBC	TBC	15.1	151	TBC	TBC	2.62	26.2	TBC	TBC	1.19	11.9	TBC	TBC	0.403	4.03	TBC	TBC	0.221	2.21	TBC	TBC	0.65	6.5	1.1	NA	59.8	18	NA	1.1
Benzo(g,h,i)perylene	191-24-2	NA	NA	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	1.1	NA	119	24	NA	1.1
Benzo(k)fluoranthene	207-08-9	NA	NA	TBC	TBC	47.7	477	TBC	TBC	151	1,513	TBC	TBC	26.2	262	TBC	TBC	11.9	119	TBC	TBC	4.03	40.3	TBC	TBC	2.21	22.1	TBC	TBC	6.5	65	1.1	NA	148	62	NA	1.1
Benzoic acid	65-85-0	NA	NA	24,000*	240,000*	TBC	TBC	24,000*	240,000*	TBC	TBC	24,000*	240,000*	TBC	TBC	24,000*	240,000*	TBC	TBC	24,000*	240,000*	TBC	TBC	24,000*	240,000*	TBC	TBC	24,000*	240,000*	TBC	TBC	NA	NA	NA	1	NA	1
Benzyl alcohol	100-51-6	NA	NA	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	NA	NA	65.8	120	NA	65.8
Bis(2-chloroethoxy)methane	111-91-1	NA	NA	1,788	17,883	TBC	TBC	19,235	192,346	TBC	TBC	2,584	25,839	TBC	TBC	861	8,606	TBC	TBC	1,124	11,244	TBC	TBC	178	1,783	TBC	TBC	23	230	TBC	TBC	NA	NA	0.302	NA	NA	0.302
Bis(2-chloroethyl)ether	111-44-4	NA	NA	TBC	TBC	0.21*	2.1*	TBC	TBC	0.21*	2.1*	TBC	TBC	0.21*	2.1*	TBC	TBC	0.21*	2.1*	TBC	TBC	0.21*	2.1*	TBC	TBC	0.21*	2.1*	TBC	TBC	0.21*	2.1*	NA	NA	23.7	NA	NA	23.7
Bis(2-chloroisopropyl)ether	108-60-1	NA	NA	310*	3,100*	4.6*	46*	310*	3,100*	4.6*	46*	310*	3,100*	4.6*	46*	310*	3,100*	4.6*	46*	310*	3,100*	4.6*	46*	310*	3,100*	4.6*	46*	310*	3,100*	4.6*	46*	NA	NA	19.9	NA	NA	19.9
Bis(2-ethylhexyl)phthalate	117-81-7	NA	NA	120*	1,200*	35*	350*	120*	1,200*	35*	350*	120*	1,200*	35*	350*	120*	1,200*	35*	350*	120*	1,200*	35*	350*	120*	1,200*	35*	350*	120*	1,200*	35*	350*	NA	NA	0.925	0.02	NA	0.925
Butylbenzylphthalate	85-68-7	NA	NA	1,200*	12,000*	260*	2,600*	1,200*	12,000*	260*	2,600*	1,200*	12,000*	260*	2,600*	1,200*	12,000*	260*	2,600*	1,200*	12,000*	260*	2,600*	1,200*	12,000*	260*	2,600*	1,200*	12,000*	260*	2,600*	NA	NA	0.239	90	NA	0.239
Carbazole	86-74-8	NA	NA	TBC	TBC	835	8,346	TBC	TBC	8,976	89,762	TBC	TBC	1,206	12,058	TBC	TBC	402	4,016	TBC	TBC	525	5247	TBC	TBC	69.4	694	TBC	TBC	44.6	446	NA	NA	NA	0.00008	NA	0.00008
Chrysene	218-01-9	NA	NA	TBC	TBC	477	4,774	TBC	TBC	1,513	15,129	TBC	TBC	262	2,619	TBC	TBC	119	1,194	TBC	TBC	40.3	403	TBC	TBC	22.1	221	TBC	TBC	65	650	1.1	NA	4.73	2.4	NA	1.1
Di-n-butylphthalate	84-74-2	NA	NA	610*	6,100*	TBC	TBC	610*	6,100*	TBC	TBC	610*	6,100*	TBC	TBC	610*	6,100*	TBC	TBC	610*	6,100*	TBC	TBC	610*	6,100*	TBC	TBC	610*	6,100*	TBC	TBC	NA	200	0.15	0.011	NA	200
Di-n-octylphthalate	117-84-0	NA	NA	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	NA	NA	709	1.1	NA	709
Dibenzo(a,h)anthracene	53-70-3	NA	NA	TBC	TBC	0.477	4.77	TBC	TBC	1.51	15.1	TBC	TBC	0.262	2.62	TBC	TBC	0.119	1.19	TBC	TBC	0.04	0.403	TBC	TBC	0.022	0.221	TBC	TBC	0.065	0.65	1.1	NA	18.4	12	NA	1.1
Dibenzofuran	132-64-9	NA	NA	1,192	11,922	TBC	TBC	12,823	128,231	TBC	TBC	1,723	17,226	TBC	TBC	574	5,737	TBC	TBC	750	7,496	TBC	TBC	119	1,189	TBC	TBC	15.3	153	TBC	TBC	NA	NA	NA	6.1	NA	6.1
Diethylphthalate	84-66-2	NA	NA	4,900*	49,000*	TBC	TBC	4,900*	49,000*	TBC	TBC	4,900*	49,000*	TBC	TBC	4,900*	49,000*	TBC	TBC	4,900*	49,000*	TBC	TBC	4,900*	49,000*	TBC	TBC	4,900*	49,000*	TBC	TBC	NA	100	24.8	100	NA	100
Dimethylphthalate	131-11-3	NA	NA	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	NA	NA	734	10	NA	734
Fluoranthene	206-44-0	NA	NA	5,087	50,868	TBC	TBC	15,778	157,779	TBC	TBC	2,732	27,316	TBC	TBC	1,249	12,486	TBC	TBC	420	4,202	TBC	TBC	276	2,765	TBC	TBC	163	1,627	TBC	TBC	29	NA	122	10	NA	29
Fluorene	86-73-7	NA	NA	11,458	114,583	TBC	TBC	46,870	468,700	TBC	TBC	7,823	78,227	TBC	TBC	3,374	33,739	TBC	TBC	1,343	13,427	TBC	TBC	737	7,366	TBC	TBC	243	2,433	TBC	TBC	29	NA	122	3.7	NA	29
Hexachlorobenzene	118-74-1	NA	NA	4.9*	49*	0.3*	3.0*	4.9*	49*	0.3*	3.0*	4.9*	49*	0.3*	3.0*	4.9*	49*	0.3*	3.0*	4.9*	49*	0.3*	3.0*	4.9*	49*	0.3*	3.0*	4.9*	49*	0.3*	3.0*	NA	NA	0.199	0.079	NA	0.199
Hexachlorobutadiene	87-68-3	NA	NA	6.1*	61*	6.2*	62*	6.1*	61*	6.2*	62*	6.1*	61*	6.2*	62*	6.1*	61*	6.2*	62*	6.1*	61*	6.2*	62*	6.1*	61*	6.2*	62*	6.1*	61*	6.2*	62*	NA	NA	0.0398	NA	NA	0.0398
Hexachlorocyclopentadiene	77-47-4	NA	NA	37*	370*	TBC	TBC	37*	370*	TBC	TBC	37*	370*	TBC	TBC	37*	370*	TBC	TBC	37*	370*	TBC	TBC	37*	370*	TBC	TBC	37*	370*	TBC	TBC	NA	10	0.755	NA	NA	10
Hexachloroethane	67-72-1	NA	NA	6.1*	61*	35*	350*	6.1*	61*	35*	350*	6.1*	61*	35*	350*	6.1*	61*	35*	350*	6.1*	61*	35*	350*	6.1*	61*	35*	350*	6.1*	61*	35*	350*	NA	NA	0.596	NA	NA	0.596
Indeno(1,2,3-cd)pyrene	193-39-5	NA	NA	TBC	TBC	4.77	47.7	TBC	TBC	15.1	151	TBC	TBC	2.62	26.2	TBC	TBC	1.19	11.9	TBC	TBC	0.403	4.03	TBC	TBC	0.221	2.21	TBC	TBC	0.65	6.5	1.1	NA	109	62	NA	1.1
Isophorone	78-59-1	NA	NA	1,200*	12,000*	510*	5,100*	1,200*	12,000*	510*	5,100*	1,200*	12,000*	510*	5,100*	1,200*	12,000*	510*	5,100*	1,200*	12,000*	510*	5,100*	1,200*	12,000*	510*	5,100*	1,200*	12,000*	510*	5,100*	NA	NA	139	NA	NA	139
N-Nitroso-di-n-propylamine	621-64-7	NA	NA	TBC	TBC	1.88	18.8	TBC	TBC	12.1	121	TBC	TBC	1.86	18.6	TBC	TBC	0.717	7.17	TBC	TBC	0.423	4.23	TBC	TBC	0.127	1.27	TBC	TBC	0.12	1.2	NA	NA	0.544	NA	NA	0.544
N-Nitrosodiphenylamine & Diphn	86-30-6	NA	NA	TBC	TBC	99*	990*	TBC	TBC	99*	990*	TBC	TBC	99*	990*	TBC	TBC	99*	990*	TBC	TBC	99*	990*	TBC	TBC	99*	990*	TBC	TBC	99*	990*	NA	NA	0.545	NA	NA	0.545
Naphthalene	91-20-3	NA	NA	1,541	15,407	TBC	TBC	23,405	234,049	TBC	TBC	3,908	39,081	TBC	TBC	1,169	11,687	TBC	TBC	671	6,713	TBC	TBC	368	3,678	TBC	TBC	122	1,215	TBC	TBC	29	NA	0.0994	1	NA	29
Pentachlorophenol	87-86-5	NA	NA	5,656	56,558	44	440	19,344	193,438	150	1,505	3,309	33,092	25.7	257	1,483	14,833	11.5	115	527	5,271	4.1	41	327	3,269	2.12	21.2	151	1,514	4.91	49.1	2.1	3	0.119	0.36	NA	2.1
Phenanthrene	85-01-8	NA	NA	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	29	NA	45.7	5.5	NA	29
Phenol	108-95-2	NA	NA	1,800*	18,000*	TBC	TBC	1,800*	18,000*	TBC	TBC	1,800*	18,000*	TBC	TBC	1,800*	18,000*	TBC	TBC	1,800*	18,000*	TBC	TBC	1,800*	18,000*	TBC	TBC	1,800*	18,000*	TBC	TBC	NA	30	120	0.79	NA	30
Pyrene	129-00-0	NA	NA	3,815	38,151	TBC	TBC	11,833	118,334	TBC	TBC	2,049	20,487	TBC	TBC	936	9,364	TBC	TBC	315	3,151	TBC	TBC	207	2,074	TBC	TBC	122	1,220	TBC	TBC	1.1	NA	78.5	10	NA	1.1

Table 12
Proposed Human Health and Ecological Screening Level for Ravenna AAP MRSs

Analyte	CAS Number	Surface and Subsurface Soil																																	
		Human Health Screening Values [a]																														Ecological Screening Values					
				National Guard Trainee				National Guard Dust/Fire Control Worker				National Guard Range Maintenance Soldier				National Guard Engineering School Instructor				Security Guard/Maintenance Worker				Resident Farmer Adult				Resident Farmer Child									
		Surface Soil Background Values	Subsurface Soil Background Values	Non-Cancer Risk (HI)		Cancer Risk		Non-Cancer Risk (HI)		Cancer Risk		Non-Cancer Risk (HI)		Cancer Risk		Non-Cancer Risk (HI)		Cancer Risk		Non-Cancer Risk (HI)		Cancer Risk		Non-Cancer Risk (HI)		Cancer Risk		Non-Cancer Risk (HI)		Cancer Risk		USEPA EcoSSLs (2010) [b]	ORNL PRGs (1997) [d]	Region 5 ESLs (2003) [c]	LANL ESLs (2010) [e]	Talmage et al. (1999) [f]	Recommended Soil Ecological Screening Value [g]
		0.1	1	10^{-6}	10^{-5}	0.1	1	10^{-6}	10^{-5}	0.1	1	10^{-6}	10^{-5}	0.1	1	10^{-6}	10^{-5}	0.1	1	10^{-6}	10^{-5}	0.1	1	10^{-6}	10^{-5}	0.1	1	10^{-6}	10^{-5}						
PCBs (Method SW-846 8082A)		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Aroclor 1016	12674-11-2	NA	NA	19.2	192	3.46	34.6	76.8	768	15.4	154	12.9	129	2.57	25.7	5.58	55.8	1.1	11	2.18	21.8	0.437	4.37	1.22	12.2	0.203	2.03	0.419	4.19	0.349	3.49	NA	0.371	0.000332	1	NA	0.371
Aroclor 1221	11104-28-2	NA	NA	TBC	TBC	0.14*	1.4*	TBC	TBC	0.14*	1.4*	TBC	TBC	0.14*	1.4*	TBC	TBC	0.14*	1.4*	TBC	TBC	0.14*	1.4*	TBC	TBC	0.14*	1.4*	TBC	TBC	0.14*	1.4*	NA	0.371	0.000332	NA	NA	0.371
Aroclor 1232	11141-16-5	NA	NA	TBC	TBC	0.14*	1.4*	TBC	TBC	0.14*	1.4*	TBC	TBC	0.14*	1.4*	TBC	TBC	0.14*	1.4*	TBC	TBC	0.14*	1.4*	TBC	TBC	0.14*	1.4*	TBC	TBC	0.14*	1.4*	NA	0.371	0.000332	NA	NA	0.371
Aroclor 1242	53469-21-9	NA	NA	TBC	TBC	0.22*	2.2*	TBC	TBC	0.22*	2.2*	TBC	TBC	0.22*	2.2*	TBC	TBC	0.22*	2.2*	TBC	TBC	0.22*	2.2*	TBC	TBC	0.22*	2.2*	TBC	TBC	0.22*	2.2*	NA	0.371	0.000332	0.041	NA	0.371
Aroclor 1248	12672-29-6	NA	NA	TBC	TBC	3.46	34.6	TBC	TBC	15.4	154	TBC	TBC	2.57	25.7	TBC	TBC	1.1	11	TBC	TBC	0.437	4.37	TBC	TBC	0.203	2.03	TBC	TBC	0.349	3.49	NA	0.371	0.000332	0.0072	NA	0.371
Aroclor 1254	11097-69-1	NA	NA	5.49	54.9	3.46	34.6	21.9	219	15.4	154	3.67	36.7	2.57	25.7	1.59	15.9	1.1	11	0.624	6.24	0.437	4.37	0.348	3.48	0.203	2.03	0.12	1.2	0.349	3.49	NA	0.371	0.000332	0.041	NA	0.371
Aroclor 1260	11096-82-5	NA	NA	TBC	TBC	3.46	34.6	TBC	TBC	15.4	15.4	TBC	TBC	2.57	25.7	TBC	TBC	1.1	11	TBC	TBC	0.437	4.37	TBC	TBC	0.203	2.03	TBC	TBC	0.349	3.49	NA	0.371	0.000332	0.14	NA	0.371
Nitrocellulose (Method MCAWW 353.2 Modified)		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Nitrocellulose	9004-70-0	NA	NA	1.8E+07*	1.8E+08*	TBC	TBC	1.8E+07*	1.8E+08*	TBC	TBC	1.8E+07*	1.8E+08*	TBC	TBC	1.8E+07*	1.8E+08*	TBC	TBC	1.8E+07*	1.8E+08*	TBC	TBC	1.8E+07*	1.8E+08*	TBC	TBC	1.8E+07*	1.8E+08*	TBC	TBC	NA	NA	NA	NA	NA	NA
Total Organic Carbon (Method 9060A Modified/Lloyd Kahn/Walkley Black)																																					
Total Organic Carbon	TOC (mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH	pH (Units)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

[a] Screening levels are from the Science Application International Corporation (SAIC), *Draft Facility-Wide Human Health Remediation Goals at the Ravenna Army Ammunition Plant (RVAAP), Ravenna, Ohio, September 2008* .

* Available Regional Screening Level values for a contaminant were taken from the *EPA Regional Screening Level Resident Soil Supporting Table* (December 2009) in the event no screening level was available in the *Draft Facility-Wide Human Health Remediation Goals at the RVAAP, September 2008* .

[b] Ecological Soil Screening Levels (EcoSSLs), (USEPA, 2011) online updates from http://www.epa.gov/ecotox/ecossl/.

[c] Ecological Screening Levels (ESLs), US EPA Region V, August 2003.

[d] ORNL: Efroymson, R.A., Suter II, G.W., Sample, B.E. and Jones, D.S., 1997. *Preliminary Remediation Goals for Ecological Endpoints* , ES/ER/TM-162/R2.

[e] Los Alamos National Laboratory (LANL), Eco Risk Database, Release 2.5, October 2010.

[f] From *Nitroaromatic Munition Compounds: Environmental Effects and Screening Values* , Talmage et al., 1999, Rev. Environ. Contamin. Toxicol., 161: 1-156. Sediment benchmarks originally reported as mg compound per kg total organic carbon (TOC) in sediment, and 10% TOC assumed.

[yyn] Analyte identified as a persistent, bioaccumulative, and toxic (PBT) compound (OEPA DERR ERA Guidance, April 2008).

[g] The following hierarchy (based on OEPA DERR ERA Guidance, April 2008) was used to select the soil screening values:

1. USEPA EcoSSL (plants, invertebrates, wildlife)
2. ORNL (1997) [plants, invertebrates, wildlife]
3. USEPA Region 5 ESLs (2003)
4. LANL (2010) [various endpoints]
5. Talmage et al. (1999)

[h] MacDonald, D.D., C.G. Ingersoll, and T.A. Berger, 2000, *Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems* , Arch. Environ. Contam. Toxicol. 39:20-31. TEC = threshold effect concentration.

[i] The following hierarchy (based on OEPA DERR ERA Guidance, April 2008) was used to select the sediment screening values:

1. MacDonald et al. (2000)
2. USEPA Region 5 ESLs (2003)
3. ORNL (1997) [plants, invertebrates, wildlife]
4. LANL (2010) [various endpoints]
5. Talmage et al. (1999)

[j] Ohio Administrative Code 3745-1, *Ohio River Basin Aquatic Life Criteria, OMZA, October 20, 2009* . Based on total recoverable metals, assuming a hardness of 100 mg/L for hardness-dependent criteria, and a pH of 7.0 for pH-dependent criteria. Iron criterion is based on protection of agricultural use. PCBs criteria are based on wildlife protection.

[k] The following hierarchy (based on OEPA DERR ERA Guidance, April 2008) was used to select the surface water screening values:

1. Ohio water quality criteria (2009) [aquatic life, OMZA]
2. USEPA Region 5 ESLs (2003)
3. ORNL (1997) [plants, invertebrates, wildlife]
4. LANL (2010) [various endpoints]
5. Talmage et al. (1999)

[L] use 2-nitroaniline as surrogate.

CAS = Chemical Abstract Service.
CUG = cleanup goal.
HI = Hazard Index
MDL = method detection limit.
mg/kg = milligrams per kilogram.
(µg/L) = micrograms per liter
NA = RVAAP-specific screening level or RSL not available.
RVAAP = Ravenna Army Ammunition Plant.
RL = reporting limit.
RSL = Regional screening level
SVOC = semivolatile organic compound
SAP/QAPP = Sampling and Analysis Plan/Quality Assurance Project Plan.
TBC = To be calculated; no available screening level or RSL is available and one will be calculated for risk if it is found in analysis and is considered a munitions constituent.

Worksheet #14/16: Project Tasks & Schedule

(UFP-QAPP Manual Section 2.8.2)

Activity	Responsible party	Planned start date	Planned completion date	Deliverable(s)	Deliverable due date
PD SAP Addendum	USACE – Baltimore District	22 June 2015	18 September 2015	PD	30 September 2015
Mobilization/demobilization	USACE – Baltimore District	TBD	TBD	Field notes	NA
Soil Excavation/Sampling	"	TBD	TBD	Field notes	NA
Analysis	Lab: TBD	21 day TAT Upon Sample Receipt	TBD	Report of Analyses/Data package	21 days after receipt of samples
Data Evaluation	USACE-Baltimore District	1 week after receipt of sample results	3 weeks after receipt of sample results	Data Evaluation and Assessment Summary	TBD
Data Usability assessment	Chemist	14 days after completion of Data Evaluation	14 days after start of Data Usability Assessment	Usability assessment summary report	TBD
Summarize data	Project Team	15 days after receipt of last SDG from lab	30 days after receipt of last SDG from lab	Draft Report	TBD

Worksheet #17: Sampling Design and Rationale

(UFP-QAPP Manual Section 3.1.1)

This worksheet includes a description of the project sampling approach and the rationale for selecting sample locations and matrices for each analytical group and concentration level.

Rationale for choosing the sampling approach:
An explosive safety hazard exists at ODA2. Potential receptors include soldiers (training), installation personnel (range maintenance), and trespassers. In addition, the potential may exist for MEC/MPPEH migration during storm events. Interim removal actions are recommended to reduce the explosive safety hazard at ODA2. A Time Critical Removal Action (TCRA) will be conducted in areas having a moderate to high probability for encountering MEC, as identified in an updated Probability Assessment for the ODA2 MRS. The objective of the TCRA will be to reduce the overall potential for exposure to explosive hazards at the ODA2 site.

- Delineate moderate to high probability areas for encountering MEC that are accessible to human receptors and conduct an instrument assisted surface removal for MEC in these areas.

- Conduct intrusive investigations in targeted areas to identify the potential for MEC in the subsurface. This information will be used to evaluate the explosive hazard present in the subsurface in targeted areas and guide future decisions for the site.

Sampling design and rationale:

MEC items encountered will be moved to the Buried Explosion Module (BEM) for a controlled demolition.

- Sampling of the BEM: All materials being brought onsite i.e. sand and soil to construct the BEM will be sampled and declared clean prior to site arrival. The products brought onsite will be analyzed for the RVAAP full suite (metals, explosives, propellants (nitrocellulose), SVOCs, PCBs, TOC, pH, VOCs, perchlorates, and phosphorous). The products brought on site will be sampled every 4,000 cubic yards using an MIS sampling method with the exception of VOCs, which will be analyzed from a discrete sample collected in conjunction with the MIS sample. The MIS surface soil sample will consist of 30 random samples collected from locations selected in a systematic random pattern throughout the stockpile. Increments will be collected using a hand trowel/spoon due to the unconsolidated nature of the sand material.

- When the BEM work is completed the base soil of the BEM will be sampled for the RVAAP full suite (metals, explosives, propellants (nitrocellulose), SVOCs, PCBs, TOC, pH, VOCs, perchlorates, and phosphorous. The sample will be an MIS from the surface to one foot below the surface. There will be a minimum of 30 aliquots collected for the MIS sample. The VOC portion of the sample will be a discrete sample collected in the center of the BEM from zero to one foot bgs. The sand used in the BEM will be sampled for the same parameters as the soil base and any landfill parameters required for disposal. The sand will only require sampling if it is to be taken off site.

MEC items encountered that are deemed to be unacceptable to move will be blown in place.

If any MEC items are found that are broken open with exposed filler leaching out a discrete sample

will be collected from the surface soil 0-6" under the item for analysis of explosives, metals, propellants (nitrocellulose), SVOCs, TOC, and pH. If located on the surface, the vegetative cover will be removed, and the soil sample will be collected below this interval.

If any BIP operations occur, a MIS sample will be collected from the surface soil and analyzed for explosives, metals, propellants, SVOCs, TOC, and pH. The MIS sample will consist of at least 30 increments and will be collected from a depth of 0-6".

Worksheet #18: Sampling Locations and Methods

(UFP-QAPP Manual Section 3.1.1 and 3.1.2)

Samples will be collected from the following locations:

- at the location of the BEM
- the sand material to be used for the BEM
- Locations where MEC items are found that are broken open with exposed filler leaching out
- At the location of any BIP operation

Exact locations are TBD at this point until field activities are performed for the TCRA.

Worksheet #19 & 30: Sample Containers, Preservation, and Hold Times

(UFP-QAPP Manual Section 3.1.2.2)

Sand Material brought on site for BEM; Soil Base of the BEM – Full Suite Analysis

Incremental Samples (30 individual increments within each Decision Unit)

Analyte/ Analyte Group	Matrix	Conc Level	Prep Method	Analytical Method	Container(s) (number, size & type per sample)	Preservation	Prep Holding Time	Analytical Holding Time
Soil Sieving & Grinding +	*MIS Soil*	*Med*	Appen A to 8330B	-	clean polyethylene bag ≥ 1kg volume of soil	Cool to 4^0C		
SVOCs	*MIS Soil*	*Med*	After Grinding 3540 / 3550 / or 3541	8270C	"	Cool to 4^0C	14 days	40 days to analyze after extraction
Metals (Al, Sb, Ba, Cd, Cr, Cr(VI), Pb, Cu, Fe, Hg, Sr, and Zn) + Phosphorus	*MIS Soil*	*Med*	After Grinding 3050B / 3051A	6010C or 6020A	"	Cool to 4^0C	-	6 months
PCBs	"	*Med*		After Grinding 8082	"	Cool to 4^0C	Extract within 1 yr	Analyze within 1 yr of extraction
Explosives	"	*Med*		After Grinding 8330B	"	"	Extract within 14 days	Analyze within 40 days after extraction
Nitrocellulose	"	*Med*		EPA 9056/CRREL-ECB ERDC SOP M-NC-ECB CC-NC	"	"	"	"

Analyte/ Analyte Group	Matrix	Conc Level	Prep Method	Analytical Method	Container(s) (number, size & type per sample)	Preservation	Prep Holding Time	Analytical Holding Time
				Rev 0 & CC-IC Rev 5 (Without Grinding)				
Perchlorates	"	*Med*		6850	4 oz. Amber Glass Jar	"	-	28 days

Worksheet #19 & 30: Sample Containers, Preservation, and Hold Times

For Collection of Discrete Samples

Analyte/ Analyte Group	**Matrix**	**Conc Level**	**Prep Method**	**Analytical Method**	**Container(s)** (number, size & type per sample)	**Preservation**	**Prep Holding Time**	**Analytical Holding Time**
VOCs	*Soil*	*Med*	5035A	8260C	Use Terra Core Sampler and extrude soil into vial containing preservative (Alternative: EnCore Sampler)	Sodium Bisulfate ($NaHSO_4$) or Methanol / Cool to 4^0C	-	14 days
Explosives	"	*Med*		8330B		Cool to 4^0C	14 days	40 days
Nitrocellulose	"	*Med*		9056M / (see above)		"	"	"
Metals (Al, Sb, Ba, Cd, Cr, Cr(VI), Pb, Cu, Fe, Hg, Sr, and Zn)	*MIS Soil*	*Med*	3050B / 3051A	6010C or 6020A	1 – 4 oz. glass jar	Cool to 4^0C	-	6 months
Total Organic Carbon (TOC)	"	*Med*		9060 (Lloyd Kahn Method)		"		28 days
pH	"	*Med*		9045D		"		ASAP

Worksheet #19 & 30: Sample Containers, Preservation, and Hold Times

Waste Characterization Composite Samples of Stockpile Soils

Analyte/ Analyte Group	Matrix	Conc Level	Prep Method	Analytical Method	Container(s) (number, size & type per sample)	Preservation	Prep Holding Time	Analytical Holding Time
TCLP VOCs	Sand from BEM	Med	1311	8260C	1 250-ml glass jar with Teflon lined lid (or as directed by the lab)	Cool to 4^0C only	48 hr from collection	7 days post extraction
TCLP SVOCs		Med	1311	8270C	"		14 days to extraction	40 days post extraction
TCLP Pesticides/Herbicides		Med	1311	8081A/ 8151	"		14 days to extraction	40 days post extraction
TCLP Metals		Med	1311	6010B or 6020	"		6 months to extraction (28d for Mercury)	6 months post extraction (28d for Mercury)
Other Chemical Tests – Waste Facility Required Acceptance Tests		Med		TBD	TBD			
"		Med		TBD	TBD			

Worksheet #20: Field QC Summary

(UFP-QAPP Section 3.1.1 and 3.1.2)

This worksheet provides a summary of the types of samples to be collected and analyzed for the project. Its purpose is to show the relationship between the number of field samples and associated QC samples for each combination of analyte/analytical group and matrix.

Samples Related to the BEM

Matrix	Analyte/Analytical Group	Field Samples	Field Dups /Replicates	Matrix Spikes	MSDups	Trip Blank	Equip Blanks	Total # analyses
MIS Samples (Sand Material) Prior to Construction	Full Suite: metals, explosives, propellants (nitrocellulose), SVOCs, PCBs, TOC, pH, perchlorates, and phosphorus	1	2	1*	1*	NA	NA	3
MIS Samples (DU Soil) Prior to Construction	Full Suite: metals, explosives, propellants (nitrocellulose), SVOCs, PCBs, TOC, pH, perchlorates, and phosphorus	1	2	1*	1*	NA	NA	3
Discrete Soil Samples Prior to Construction	VOCs	1	2	1	1	NA	NA	5
Discrete Sand Samples Prior to Construction	VOCs	1	2	1	1	NA	NA	5

Matrix	Analyte/Analytical Group	Field Samples	Field Dups /Replicates	Matrix Spikes	MSDups	Trip Blank	Equip Blanks	Total # analyses
MIS Samples (Sand Material) After Deconstruction	Full Suite: metals, explosives, propellants (nitrocellulose), SVOCs, PCBs, TOC, pH, perchlorates, and phosphorus	1	2	1*	1*	NA	NA	3
MIS Samples (DU Soil) After Deconstruction	Full Suite: metals, explosives, propellants (nitrocellulose), SVOCs, PCBs, TOC, pH, perchlorates, and phosphorus	1	2	1*	1*	NA	NA	3
Discrete Sand Samples After Deconstruction	VOCs	1	2	1	1	NA	NA	5
Discrete Soil Samples After Deconstruction	VOCs	1	2	1	1	NA	NA	5

*MS and MSD will be analyzed from excess material collected in replicate samples

Samples Related to BIP Operations

Matrix	Analyte/Analytical Group	Field Samples	Field Dups	Matrix Spikes	MSDups	Trip Blank	Equip Blanks	Total # analyses
MIS Samples (Sand/Soil)	explosives, metals, propellants (nitrocellulose), SVOCs, TOC, and pH	TBD	10%	1	1	NA	NA	TBD

Samples Related to Exposed Filler / Stained Soil / Stressed Vegetation

Matrix	Analyte/Analytical Group	Field Samples	Field Dups	Matrix Spikes	MSDups	Trip Blank	Equip Blanks	Total # analyses
Discrete Soil Samples	explosives, metals, propellants (nitrocellulose), SVOCs, TOC, and pH	TBD	10%	1	1	TBD	NA	TBD

Worksheet #21: Field SOPs

(UFP-QAPP Manual Section 3.1.2)

This worksheet lists standard operating procedures (SOPs) associated with data collection for the project.

SOP# or reference	Title, Revision, Date, and URL (if available)	Originating Organization	SOP option or Equipment Type (if SOP provides different options)	Modified for Project? Y/N	Comments
1	Interim Guidance 09-02 Implementation of Incremental Sampling (IS) of Soil for the Military Munitions Response Program, USACE, 20 July 2009	USACE	MIS sample collection of surface soils with core sampler and sand with a spoon/trowel. See Appendix.	Y	
Shaw SOP EI-FS010	SOP Subject: Sample Homogenization	Shaw E & I	Stainless steel bowl and spoon or trowel	N	For use with discrete samples excluding those being analyszed for VOCs

Shaw SOP EID-FS011	Discipline-Specific Procedure: Compositing	Shaw E & I	Stainless steel bowl and spoon or trowel for soils samples Glass pipet for aqueous samples	N	To be used with IDW samples
Shaw SOP EI-FS012	SOP Subject: Shipping and Packaging of Non-Hazardous Samples	Shaw E & I	Form included in SOP	N	
Shaw SOP EI-FS013	SOP Subject : Packaging and Shipping of DOT/IATA-Hazardous Samples	Shaw E & I	Form included in SOP	N	

Shaw SOP EI-FS014	SOP Subject: Decontamination of contact Sampling Equipment	Shaw E & I	Soap, tap water, deionized water, isopropyl alcohol, and Teflon wash bottles	N	Equipment will not be contaminated between increments with MIS samples, but will be decontaminated between DUs
Shaw SOP EI-FS101	SOP Subject: Trowel/Spoon Surface Soil Sampling	Shaw E & I	Trowel / Spoon	N	Will be used when sampling BEM sand
Shaw SOP EI-FS103	SOP Subject: Soil Sampling using a Soil Probe or Core-Type Sampler	Shaw E & I	Soil Corer or Soil Probe	N	Discrete Sample collection of soil will be performed by using core sampler.
Shaw SOP EI-FS109	SOP Subject: Sampling of Aqueous Liquids via Bailer	Shaw E & I	Single Check Valve Bailer	N	Sampling of aqueous IDW

Worksheet #23: Analytical SOPs

(UFP-QAPP Manual Section 3.2.1)

This worksheet documents specific sample preparation and analytical SOPs to be used by the laboratory. All laboratory procedures must be consistent with DQOs documented on WS #11.

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Lab Performing Analysis	Modified for Project Work (Y/N)
TBD	Acid digestion of sediments, sludges, and soils by USEPA SW-846 Method 3050B Rev. 1; 09/2012 modified per Clausen et al. 2013a (method 3050C; 3051A: Microwave Assisted Digestion of Sediments, Sludges, Soil, and Oils; Laboratory processing (drying, sieving, grinding & subsampling) for use with samples collected using MIS (ITRC 2012)	Definitive	MIS samples, Metals-Soil	NA	TBD	Y
TBD	Inductively coupled plasma – mass spectroscopy by USEPA SW846 Method 6020; Rev. 3; 09/2012; Inductively Coupled Plasma-Atomic Emission Spectrometry 6010C: Rev. 3; 09/2012	Definitive	Metals - Soil	ICP	TBD	N
TBD	USEPA SW846 Sonication extraction of soil, sludge, and solids Method 3550C;	Definitive	MIS samples	NA	TBD	Y

	Rev. 8; 08/2012; Soxhlet Extraction Method 3541 Rev. 8; 08/2012; Supercritical Fluid Extraction of Polynuclear Aromatic Hydrocarbons Method 3562, Rev. 8; 08/2012Laboratory processing (drying, sieving, grinding & subsampling) for use with samples collected using MIS (ITRC 2012)		SVOCs/PAH-Soil			
TBD	SVOCs/PAH by Gas Chromatography Mass Spectrometry in the Selected Ion Monitoring Mode per USEPA Method 8270; Rev. 0; 10/2012	Definitive	SVOCs/PAH - Soil	GC/MS-	TBD	N

TBD – to be determined

Salient differences between Method 3050B and Proposed Method 3050C (Clausen *et al*. 2013b).

Process	Method 3050B/ Conventional Sampling	Proposed Method 3050C/ Incremental Sampling Methodology
Field Sampling	Not explicitly addressed in method. Typically, grab/discrete samples are collected.	An incremental sample consists of 30 -100 "increments" collected randomly over the entire DU (e.g., using systematic sampling). For cohesive surface soils, an "increment" typically consists of a small cylindrical soil core (e.g., 2-5 cm in length) collected with a 2-4 cm diameter coring device.
Sample and mass containers	Approximately 200 g of soil in 4-oz wide-mouth amber glass jars with screw-top lids.	Typically, 1-2 kg of soil in clean large (e.g., 15 by15 inches, 6 mm thick) polyethylene plastic bags sealed with Ty-wraps.
Sample drying	Sample drying is optional and not typically done.	Sample is air-dried at room temperature by spreading onto a tray to form a thin uniform slab.
Sieving	"…sieve, if appropriate and necessary, using a USS #10 sieve…" Soil samples are typically not sieved.	Samples are passed through a #10 (2-mm) sieve. Both size fractions are weighed and < 2 mm fraction is additionally processed.
Milling	"Wet samples may be dried, crushed, and ground to reduce sample variability…" Milling is typically not performed.	Samples are milled using appropriate mechanical grinders such as puck or roller (ball) mills. Milling must result in finely ground material of uniform appearance and texture. Recommend 5 x 60 sec w/ 1min cooling period for the puck mill when metals and energetics are desired. For metals only, a cooling period is not needed. Recommend 8 hrs. for ball mill for metals only.
Laboratory sub-sampling	"Mix the sample thoroughly to achieve homogeneity…" Soil is often stirred with a spatula or similar device (often in original container) and a single aliquot (e.g., scooped from the top of the container) collected as the sub-sample for digestion and analyses.	After milling, the soil is spread onto a large tray to form a thin slab of material of uniform thickness. At least 20 small aliquots are randomly collected over the entire slab with a flat-edged spatula with sides or similar device and combined to prepare a sub-sample for digestion and analysis.
Sub-sample mass	0.5-2 g wet weight or 1 g dry weight	2-10 g dry weight

Worksheet #26 & 27: Sample Handling, Custody, and Disposal
(UFP-QAPP Manual Section 3.3)

Laboratory: TBD
Method of sample delivery (shipper/carrier): FedEx

Number of days from reporting
Until sample disposal: 90 days

Activity	Organization and title or position of person responsible for the activity	SOP reference
Sample labeling	Env Health Tech or Geologist USACE, Baltimore District	See below and SOP Section in the Field Sampling Plan
Chain-of-custody form completion	"	See below and SOP Section in the FSP
Packaging & Shipping	"	See SOP Section in the FSP
Sample receipt, inspection, & log-in	Contract Lab Sample Receipt Custodian	See below / Laboratory Internal SOP
Sample custody and storage	"	"
Sample disposal	"	90 days after Reporting Sample Results

1. QA/QC SAMPLING PROCEDURES

1.1 Bottle Types, Preservation, and Holding Time Requirements

All samples collected at the site will be placed in an appropriate sample container for preservation and transfer to the Contract Laboratory (TBD). All sample containers will be supplied by the laboratory. The laboratory has the responsibility to ensure that all sample containers are properly cleaned before shipping them to the site. Sample preservation requirements are listed on Worksheet #19/30

1.2 Sample Identification

A sample identification system will be used to identify each sample. The system will be a tracking mechanism to allow retrieval of information about a particular location and to ensure that each sample is uniquely identified. A listing of sample identifications will be maintained by the field team leader. This soil sample nomenclature will relate to the Decision Unit and stockpile identification numbers. A list of the sample locations are presented on Worksheet #18.

1.3 Sample Labels

Each sample will be identified with a separate identification label. The label will document:
• Analyses to be performed;
• Sample identification;
• Preservatives used;
• Date;
• Time (a four-digit number indicating the 24-hour-clock time of collection; for example, 1430 for 2:30 P.M.)
• Sampler's initials.

1.4 Quality Control Samples

Two types of field QC samples will be collected during sampling activities for this soil remediation. They are field duplicates/replicates and matrix spike/matrix spike duplicates (MS/MSDs). For MIS samples, field replicate samples are collected.
Worksheets #18 and #20 gives the frequency and totals for each type of QC sample.

1.5 Field Sample Custody

A sample shall be considered to be in the custody of a person if it is in his or her possession, in his or her sight or secured by that person in an approved location accessible only to authorized personnel.

The following procedures will be used to document, establish, and maintain custody of the field samples:

• Sample labels will be completed for each sample using waterproof ink, making sure that the labels are legible and affixed firmly to the sample container.

• All sample-related information will be recorded in the field logbooks.

• The field sample custodian will retain custody of the samples until they are transferred or properly dispatched.

• A chain of custody (COC) document will be completed by the field technician using a waterproof ink. The COC will include to date and time of sample collection, the sample identification, matrix, preservative, requested analytical procedures, site location, field sampler’s name and signature. The field sample custodian will retain custody of the samples until they are transferred or properly dispatched. Upon each transfer of custody, the COC will be signed and dated by the relinquished and receiver of custody.

1.6 Laboratory Sample Custody

A COC record accompanies the sample container from the laboratory to the field where the sample is contained, preserved, and then returned to the laboratory. The laboratory’s sample custody program meets the criteria listed below.

• The laboratory has designated a sample custodian who is responsible for maintaining sample custody and for maintaining all associated records documenting sample custody.

• Upon receipt of the samples, the custodian checks the original COC documents and compares them with the labeled contents of each sample container for correctness and traceability. The custodian signs the COC record and records the date and time the samples are received. In the event of discrepant documentation, the laboratory immediately contacts the USACE Project Manager as part of the corrective action process. The sample temperatures will be recorded; if more than 2 degrees Celsius outside of the 4 degree Celsius target, USACE will be notified.

• A qualitative assessment of each sample container is performed to note any anomalies, such as broken or leaking containers. This assessment will be recorded as part of incoming COC procedures.

• The samples are stored in a secured area at a temperature of approximately 4°C until analyses begin.

• A copy of the COC form accompanies the laboratory report and becomes a permanent part of the project records.

1.7 Documentation

The field logbook is the master field investigation document and is a bound book with sequentially numbered pages. Its primary purpose is to contain within one document references to field activities which have occurred at the site on any given day. Any administrative occurrences, conditions, or activities that have affected the field work will also be recorded. All entries into these logbooks will be signed and dated. Entries in the field logbook will include, at a minimum, the following information:

• Sample type and sampling method

• Location and depth of sample

• Sample identification

• Sample description (e.g., color, odor, clarity)

• Amount of sample

• Time the sample was taken in 24 hour format

• Names of all personnel present for the sampling

• Identification of sampling device and conditions that might affect the representativeness of a sample (e.g., refueling operations)

• Any deviations from established procedures will be documented in the field logbook with the date, time, reason for deviation, and measures to correct the problem identified

• Decontamination and health and safety procedures shall also be documented in the field logbooks

• Documentation of field calibration procedures (e.g., field air monitoring equipment)

• Throughout the day, the names of any visiting personnel and the purpose of their visit will also be recorded

The site manager will complete a daily log to document the activities that took place each day,

including personnel on site, field work completed, samples collected, problems encountered, and significant conversations/decisions that took place.

All documents will be completed in permanent, waterproof ink. None of the field documents are to be destroyed or thrown away, even if they are damaged or contain inaccuracies that require a replacement document. Corrections to the document will be made by crossing out mistakes with a single line and then dating and initialing the correction. The use of correction fluid is not permissible.

This project will require the administration of a central project file. All field and laboratory generated data will be kept in this file. Hard copies of all data will be kept in project-designated files. The data records management protocols will provide adequate controls and retention of all materials related to the project. Record control will include receipt from external sources, transmittals, transfer to storage and indication of record status. Record retention will be one year and will include receipt at storage areas, indexing, filing, storage, maintenance, and retrieval.

All incoming records and materials related to the project will be forwarded to the Project Manager or designated assistant. These documents will be placed in the project file as soon as is practical. All records shall be legible and easily identifiable. Examples of the types of records that will be maintained in the project file include:

- Field documents;
- Correspondences;
- Photographs;
- Laboratory data;
- Reports, and;
- Procurement agreements and contracts.

Outgoing project correspondences and reports will be reviewed and signed by the Project Manager prior to mailing. The office copy of all outgoing documents shall bear distribution information.

Worksheet #35: Data Verification Procedures

(UFP-QAPP Manual Section 5.2.2)

This worksheet documents procedures that will be used to verify project data. It applies to both field and laboratory records.

Records Reviewed	Process Description	Responsible Person, Organization
Field logbook	Verify that records are present and complete for each day of field activities. Verify that all planned samples including field QC samples were collected and that sample collection locations are documented. Verify that meteorological data were provided for each day of field activities. Verify that changes/exceptions are documented and were reported in accordance with requirements. Verify that any required field monitoring was performed and results are documented.	Daily – Field Tech Lead At conclusion of field activities - Project QA Manager/Chemist
Evaluate sample receipt, preservation and holding times on 100% of the data	Review of the following elements for completeness and accuracy per USEPA established standards: • Chain of custody forms; • Sample handling procedures; • Analyses requested; • Sample IDs; • Sample holding times; • Sample Preservation; • Cooler receipt forms.	Contract Lab and USACE Project Chemist
Evaluate Data Deliverables, analytes, chain-of-custody	Review of the following elements for completeness and accuracy per site specific sampling and analysis plan: • Number, type and location of samples collected; • SOP and site specific plan conformance of sampling methods/procedures; • Analyses requested by sample and matrix; • Chain-of-custody procedures	Project Chemist, USACE-Baltimore

Worksheet #36 -- Validation Process Table

Validation Input	Description	Responsible for Validation (name, organization)
Data validation for laboratory internal QA/QC parameters on 100% of the analytical results from the primary laboratory	Review of internal quality control information from the laboratory analytical package for completeness and accuracy, including the following: • Laboratory prep and field blank results; • Recoveries for surrogates, tracers, and labeled compounds; • LCS/LCSD recoveries; • MS/MSD recoveries; • RPD Precision (laboratory and field duplicates).	USACE Project chemist
Data validation for all QA/QC parameters on 100% of the analytical results from the primary laboratory	Review of instrument performance information from the laboratory analytical package for completeness and accuracy, including the following: • Instrument tuning data • Initial calibration data • Initial and continuing calibration verification data • Initial and continuing calibration blank data • Internal standard responses • Project LODs and LOQs • LOD verification standards Review of instrument raw data from the laboratory analytical package for completeness and accuracy, including the following: • Compound identification; • Calculation checks; • Transcription errors	USACE Project Chemist
Rinse, trip, and field blanks.	Review blanks for the presence of target compounds that are above the MDL and qualify associated field samples accordingly – None for this project field sampling.	USACE Project Chemist

Worksheet #36 (continued)

Analytical Data Validation Summary Table

Matrix	**Analytical Group**	**Validation Criteria**	**Data Validator** (title and organizational affiliation)
MIS Sand and Soil for BEM	metals, explosives, nitrocellulose, SVOCs, PCBs, TOC, pH, perchlorates, and phosphorus	QAPP Worksheets #12 and #15	USACE Chemist
MIS Soil for BIP operations	Explosives, TAL metals, propellants, SVOCs, TOC, and pH	"	"
Discrete Sand and Soil Samples for BEM	VOCs,	"	"
Discrete Soil Samples for MEC items with Exposed Filler, Soil Staining, and/or Stressed Vegetation	explosives, metals, propellants, SVOCs, TOC, and pH	"	"

Worksheet #37: Data Usability Assessment

The Data Usability Assessment will be performed by Mr. Alan Warminski, USACE project chemist. Note: The Data Usability Assessment will be conducted on reviewed/validated data only. After the Data Usability Assessment has been performed, data deemed appropriate for use will then be used by the Project Team to make project decisions and recommendations.

The Data Usability Assessment will be presented in the final project report. The following data quality items will be assessed and conclusions drawn based on their results:

- Precision
- Accuracy/Bias Contamination
- Overall Accuracy/Bias
- Sensitivity
- Representativeness
- Comparability
- Completeness

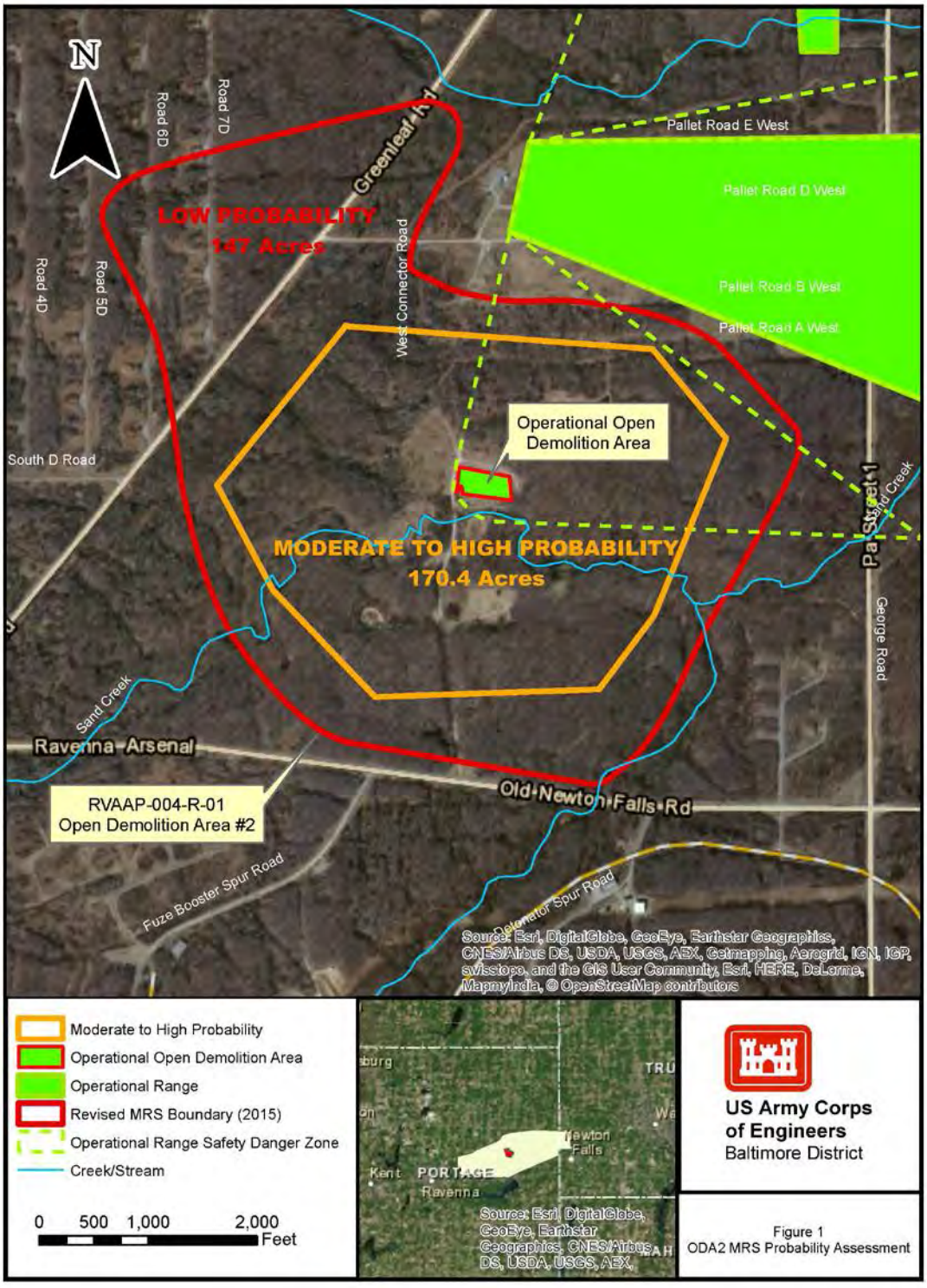


Figure 1
ODA2 MRS Probability Assessment

Appendix

Standard Operation Procedures

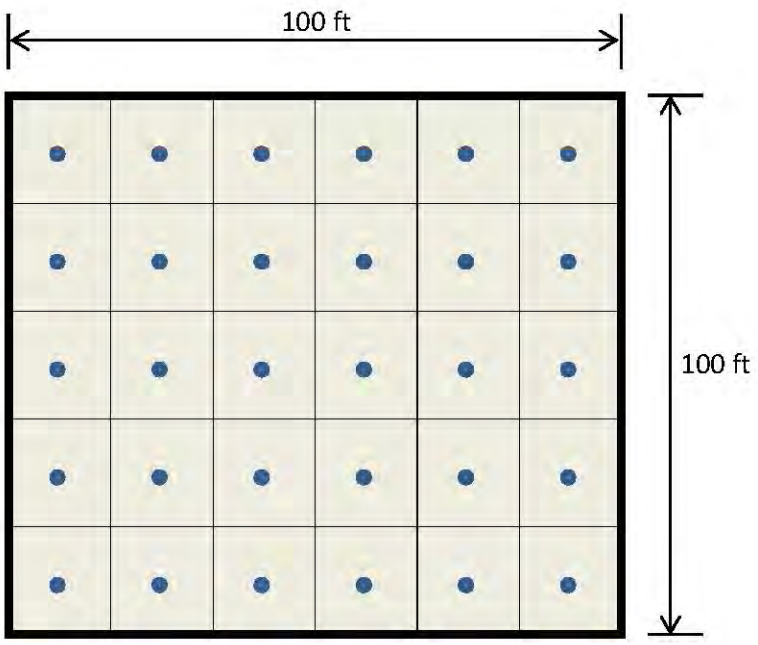
Multi-Incremental Sampling (MIS) Plan

Introduction

A multi-incremental sampling event will be carried out by at the Ravenna ODA2 at the location and footprint for the Buried Explosion Module for the TCRA. This sampling grid shown below is an example of a 100x100ft grid or Decision Units (DUs) split up into 30 cells which will have a sample increment collected from each. The size of the DU can be scaled up or down based on the defined DU. The approximate size of the BEM DU will be 50 ft x 50 ft. For each BIP operation the approximate size of the DU will be 25 x 25 ft. The intent behind the MIS strategy is to obtain a statically representative sample to determine the concentration of chemical compounds or analytes within the defined DU.

The MIS provides representative samples of specific soil volumes defined as DUs by collecting numerous evenly spaced increments of soil combined, processed, and sub-sampled according to specific protocols. The objective of the MIS strategy and systematic random design is to obtain a proportional amount of particulates/residues of every composition and shape. Because of the larger volumes of soil associated with collecting subsurface soil samples 30 increments are to collected per DU. The combined increments (Figure 1) yield a single sample. This single sample then represents the conditions across the entire DU and a not a single sample point.

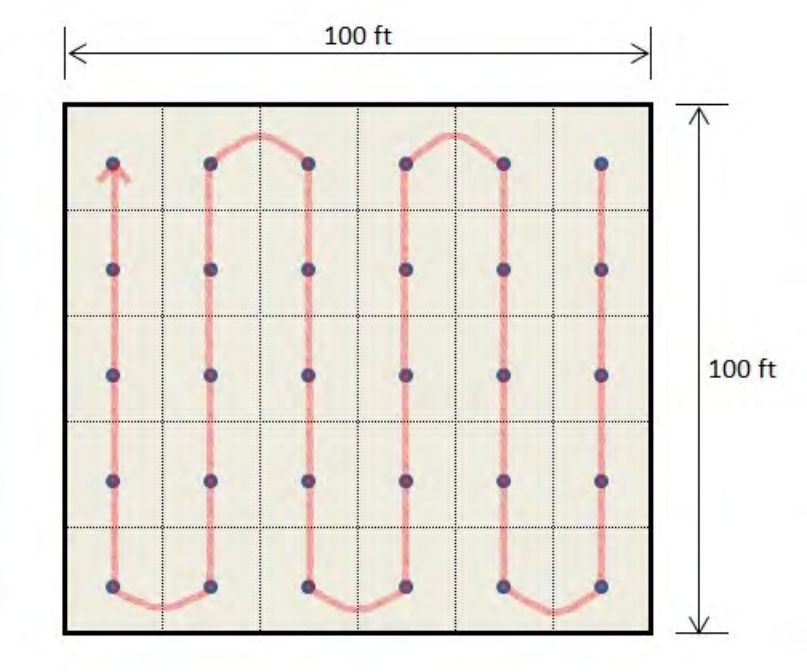
Figure 1: Example systematic random sample points in a 100ft x 100ft grid/decision unit (can be scaled up or down based on the defined DU for the project.



Multi-Incremental Sampling Procedure

The starting point for the first point will be determined randomly within the DU. Once the first position is selected, the following location of the remaining 29 samples within the DU will be selected in a systematic pattern as shown in Figure 2. One sample will be collected from each sampling point. For BIP samples, these samples will be collected from 0-6" below ground surface. For BEM soil samples, these samples will be collected from 0-12" below ground surface. Approximately equal sample volume aliquots will be collected using small-diameter push probes (≤ 1 inch in diameter) via the Soil Probe or Core-Type Sampler method.. The only exception is the sampling of Sand from the BEM both before it is brought on site and before it is taken to the contract waste facility. In this case increments will be collected using the SOP for the spoon/trowel method. The total of 30 sample locations should result in a target volume of soil desired to be shipped to the analytical laboratory which is approximately 1 kilogram.

Figure 2: Systematic pattern and flow path of sample points in the decision unit.



Each sample will be collected in 6-mil thick polyethylene bags, sealed with a lockable zip-tie wraps, and labeled on the bag and on a self-laminating 2.5 x 5-in tags. The type of information to record on the bag and sample tag include: sample identification number, military installation name, number of increments, DU number, date, and sampler initials.

The sampler shall use a unique identifier for each IS collected. Specific MIS sample identifiers will be used for each collected MIS sample and documented in the field logbook.

The MIS samples will be analyzed for the RVAAP full suite of chemical parameters as listed in the SAP Addendum / FWSAP..

Appendix D: Buried Explosion Module Specifications and General Standard Operating Procedure for Demolition Operations

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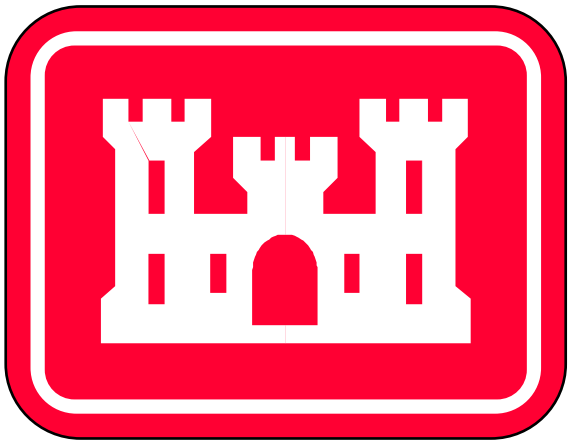

BURIED EXPLOSION MODULE (BEM)

ALTERNATIVE RECOMMENDATION FOR DEMOLITION OPERATIONS

Open Burn Open Demolition Area 2

Former Ravenna Army Ammunition PLant (RVAAP)
Ravenna OH

July 2015

Prepared by

Environmental and Explosives Design Center
Baltimore District
U.S. Army Corps of Engineers

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1.0 Background

The Buried Explosion Module (BEM) is an engineering control that is a calculation that is used as a precision safety tool. Its primary function is to provide a calculated result to prevent fragmentation from traveling great distances when conducting demolition in an area that cannot sustain an unlimited exclusion arc. Through the use of the BEM the hazard fragmentation distance (HFD) exclusion arc can be minimized to zero feet but the Department of Defense Explosives Safety Board (DDESB) requires a minimum HFD of 200 to 220 feet arc as a precaution based on the MEC item.

Specifically, the BEM is a spreadsheet calculator that requires user input related to the specific MEC item being disposed of during demolition operations. This information comes from the DDESB Fragmentation Data Review Forms that are periodically updated with new data. The user input requirements are the fragment weight in pounds, fragment velocity in feet per second, the single item TNT equivalent weight in pounds, total number of items, and total weight of all donor charges in pounds. The last item to input is the depth of burial in feet. The depth of burial input can adjust the HFD exclusion arc requirement from maximum separation to zero feet. For example, if a M107 155mm HE projectile is used for calculation you can adjust the depth of burial from the maximum fragmentation of 2,894 feet to zero feet arc by adding more or less burial of depth material to the demolition shot. This method is also known as tamping which is the process of tightly packing mud, wet sand, clay or other dense material on and around an explosive charge that has been place on the surface of an obstacle, ordnance or the like. It helps with reducing the initial sound of the explosion and in some cases limited the fragmentation exclusion arc. The BEM is a highly evolved tamping method that has been analytically tested and backed by calculations.

The theory behind the BEM is as a buried munition explodes fragments are produced which travel through soil before escaping to the air and presenting a hazard. The soil slows down the fragments and, in some cases, may stop the fragments completely. In most cases the explosion causes a crater. Soil from the crater is also ejected (secondary fragmentation) from the center of the explosion, which results in the soil becoming a debris hazardous. However, if the munition is buried deep enough a camouflet is formed instead and *no soil is ejected from the site*. (Crull, 1998) A camouflet is a cavity or void that is formed within the soil whenever a buried explosive charge is detonated. If the energy release is sufficiently deep below the surface a void is created. The void then collapses back on itself with the loose sand and the energy release does not rapidly vent into the atmosphere. This is demonstrated in the example BEM video.

This leads to the secondary function of the BEM. Because the BEM is calculated to create a camouflet and the energy release does not rapidly vent into the atmosphere it helps with the reduction of noise and the spread of contamination. The main focus of the secondary function is prevention of the spread of contamination. If the BEM is calculated correctly no sand will be ejected from the site. The sand will retain the

residual explosives along with the fragments preventing contamination from being spread over a large area.

When demolition operations are complete the BEM sand can then be placed in a roll-off container and transported to a thermal treatment facility to remove any residual explosives. Once this process is complete, the sand can then be reused.

2.0 Buried Explosion Module (BEM)

155mm HE Projectile

Demo Setup

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M107 155mm HE
Projectile


Demolition Setup
-Detonating Cord
-2 each Jet Perforators (Fuze well and side of casing)
-Total NEW 19.30lbs

BURIED EXPLOSION MODULE

(Version 6.2)

Based on DDESB Technical Paper 16 Revision 3, EARTHEX software, and NSWCDD/TR-92/196

(ENGLISH UNITS)

SELECT BURIAL MEDIUM	Soil	**SELECT ITEM DESCRIPTION**	**M107 155mm HE Projectile**
SELECT SOIL TYPE *(See TP 16, Revision 3 for soil details)*	Dry Sand	OTHER (User Defined)	

USER DEFINED FRAGMENT CHARACTERISTICS

ENTER	FRAGMENT WEIGHT (lbs)	0.700
ENTER	FRAGMENT VELOCITY (ft/s)	3,548.00
ENTER	SINGLE ITEM TNT EQUIVALENT WEIGHT (lbs)	18.00
	ENTER TOTAL NUMBER OF ITEMS	1
	ENTER TOTAL WEIGHT OF ALL DONOR CHARGES (lbs)	1.00
	SINGLE ITEM NEW (lbs)	18.00
	SINGLE ITEM MAXIMUM FRAGMENT WEIGHT (lbs)	0.7000
	FRAGMENT WEIGHT USED IN CALCULATIONS (lbs)	0.7000
	SINGLE ITEM MAXIMUM FRAGMENT VELOCITY (ft/s)	3,548
	FRAGMENT VELOCITY USED IN CALCULATIONS (ft/s)	3,548
	TOTAL TNT WEIGHT USED (lbs)	19.30
	ENTER DEPTH OF BURIAL (ft)	6.75
	ENTER HORIZONTAL RANGE (for pressure calculation) (ft)	600

Recommended minimum burial depth.

CRATER OR CAMOUFLET?

CAMOUFLET

CAMOUFLET CAVITY RADIUS (ft)	3.01

FRAGMENT EXIT VELOCITY (ft/s)	0.0	FRAGMENT LAUNCH ANGLE (°)	0.0
MAXIMUM FRAGMENT DISTANCE (ft)	0.0		

*Distance at which pressure is 0.066 psi=	Blast Withdrawal Distance (buried/undex) (ft)*	N/A*
Open Air Withdrawal Distance, K328 (ft) 879.8	Fragment Hazard Distance (ft) **	0.0
	Pressure at Fragment Hazard Distance (psi)	N/A*
	Pressure at Fragment Hazard Distance (dB)	N/A*
	Pressure at Range Entered (psi)	N/A*
	Pressure at Range Entered (dB)	N/A*

***Airblast methodology not applicable (N/A) for Camouflet conditions!**

****Depth too great--no fragments expected**

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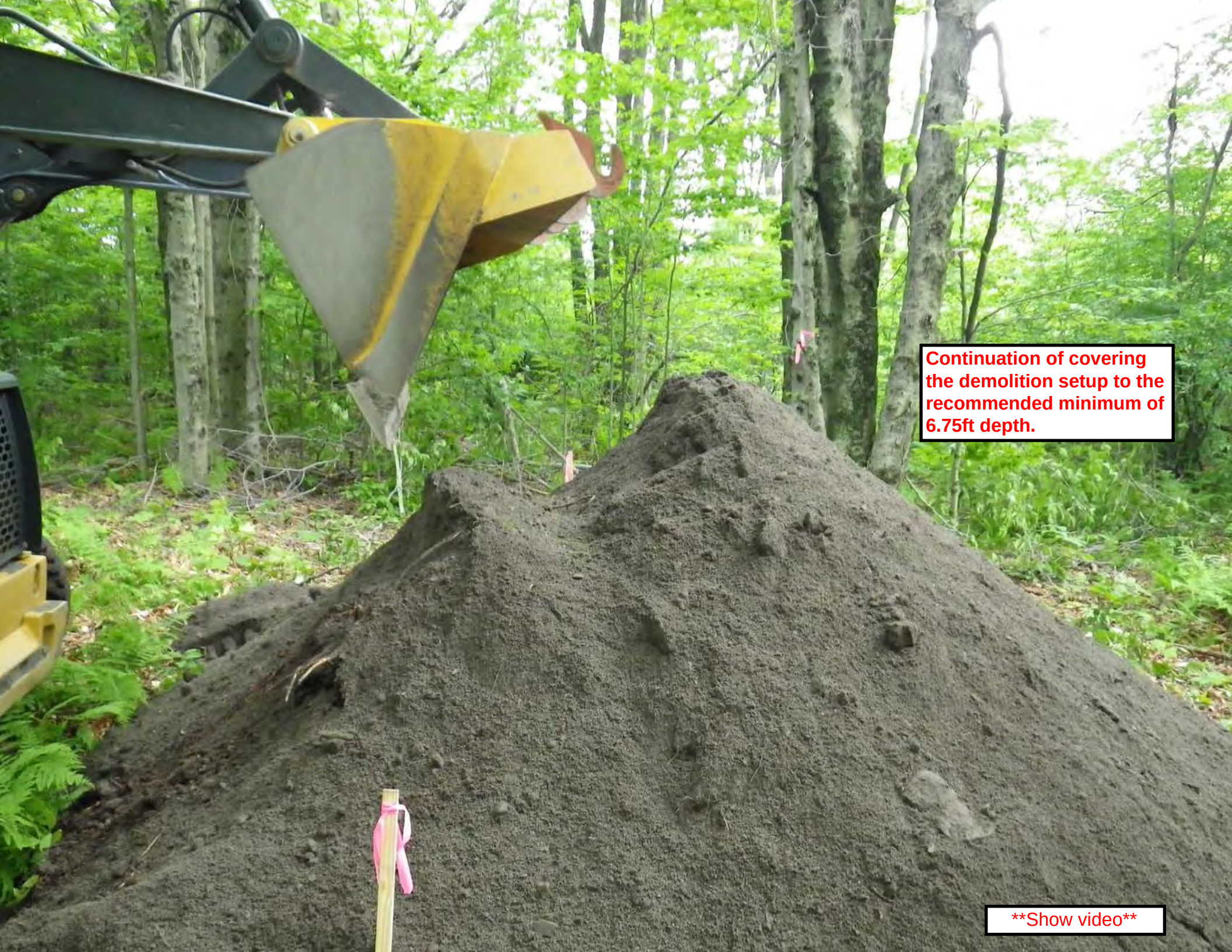
Covering the demolition setup with sand per the recommended depth of the BEM calculator to a minimum of 6.75ft.


Continuation of covering the demolition setup to the recommended minimum of 6.75ft depth.
Show video


Post Blast BEM
-Minimal sand was expelled from the setup.
-All fragmentation and explosive residue would remain in the sand.
-Crater was created from camouflet*. BEM estimated the camouflet to be 3.01ft in diameter.
-Use of heavy equipment to push the sand back to locate and remove fragmentation.
-Sand can be reused by creating a consolidated shot site or moving to next location/BIP.
-When operations complete sand can be transported by roll-off for thermal treatment to remove the explosives residue.
*Camouflet- when explosives detonate below surface it creates a cavity or void within the soil.

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3.0 Buried Explosion Module

Setup Options

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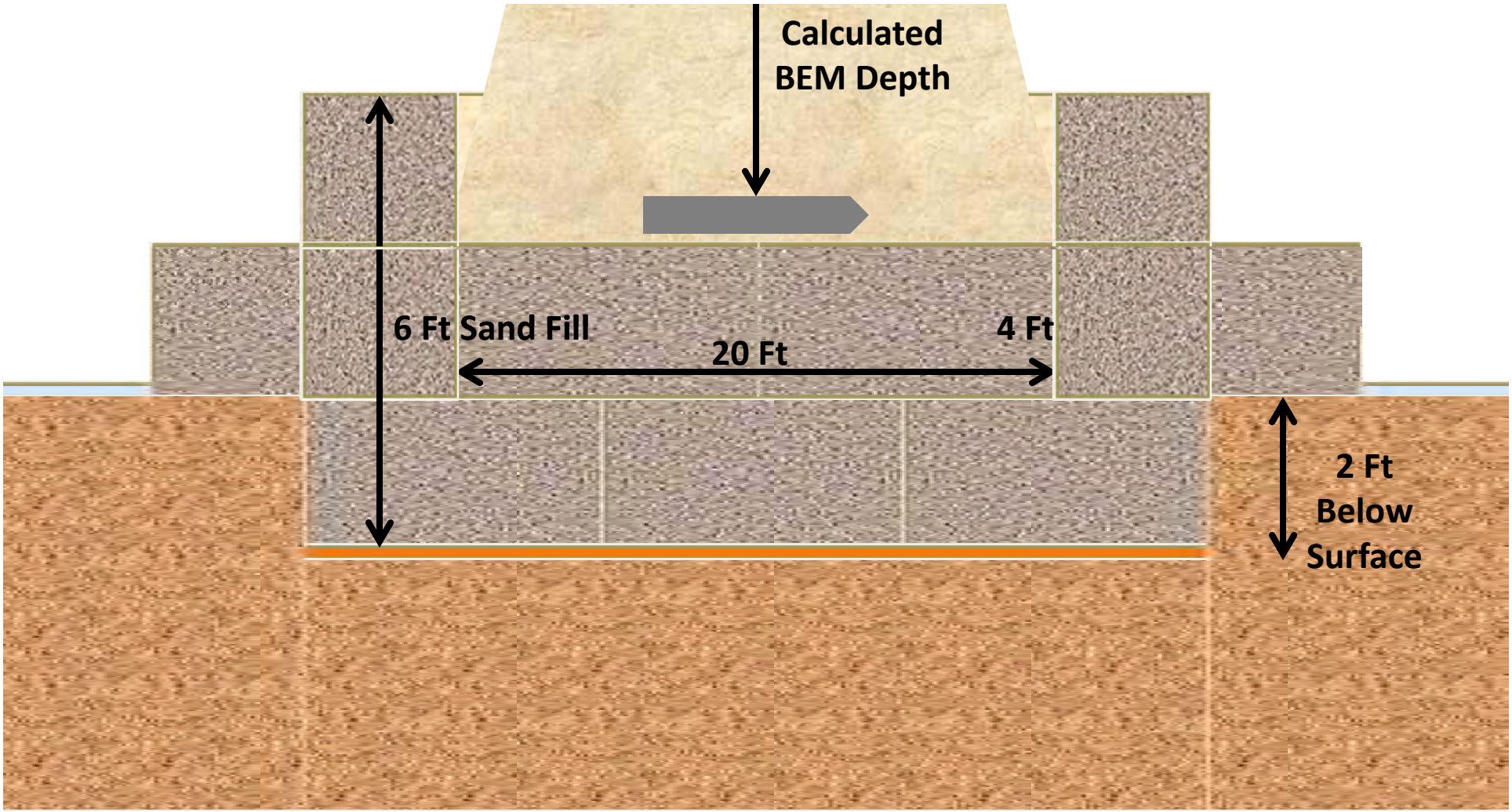
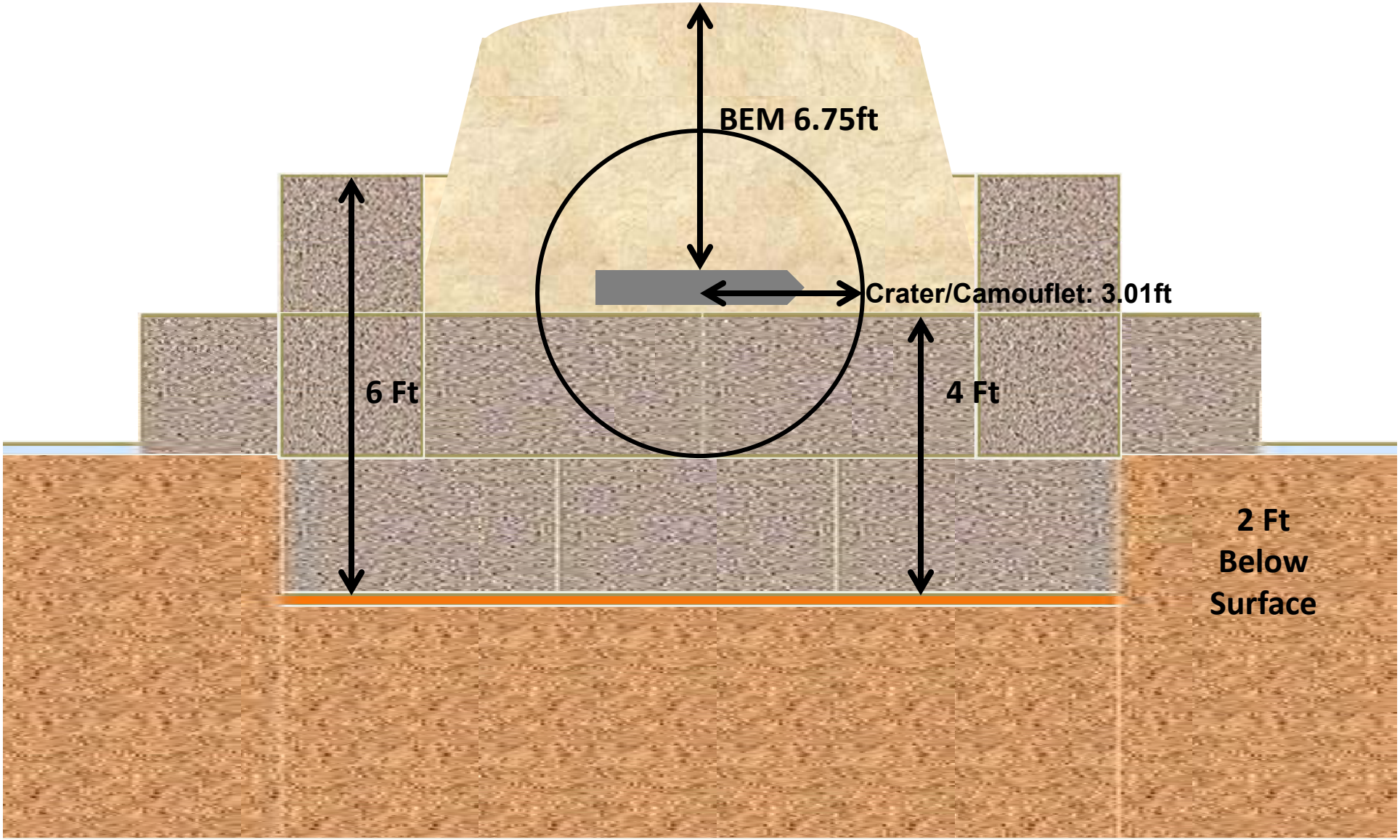
Consolidated Shot Site Box Option

•2ft x 2ft x 4ft Concrete Blocks
•Ground Barrier to separate sand from soil.
•Sand Type (“washed river” judged as “typical” as per HNC-ED-CS-S-98-7).

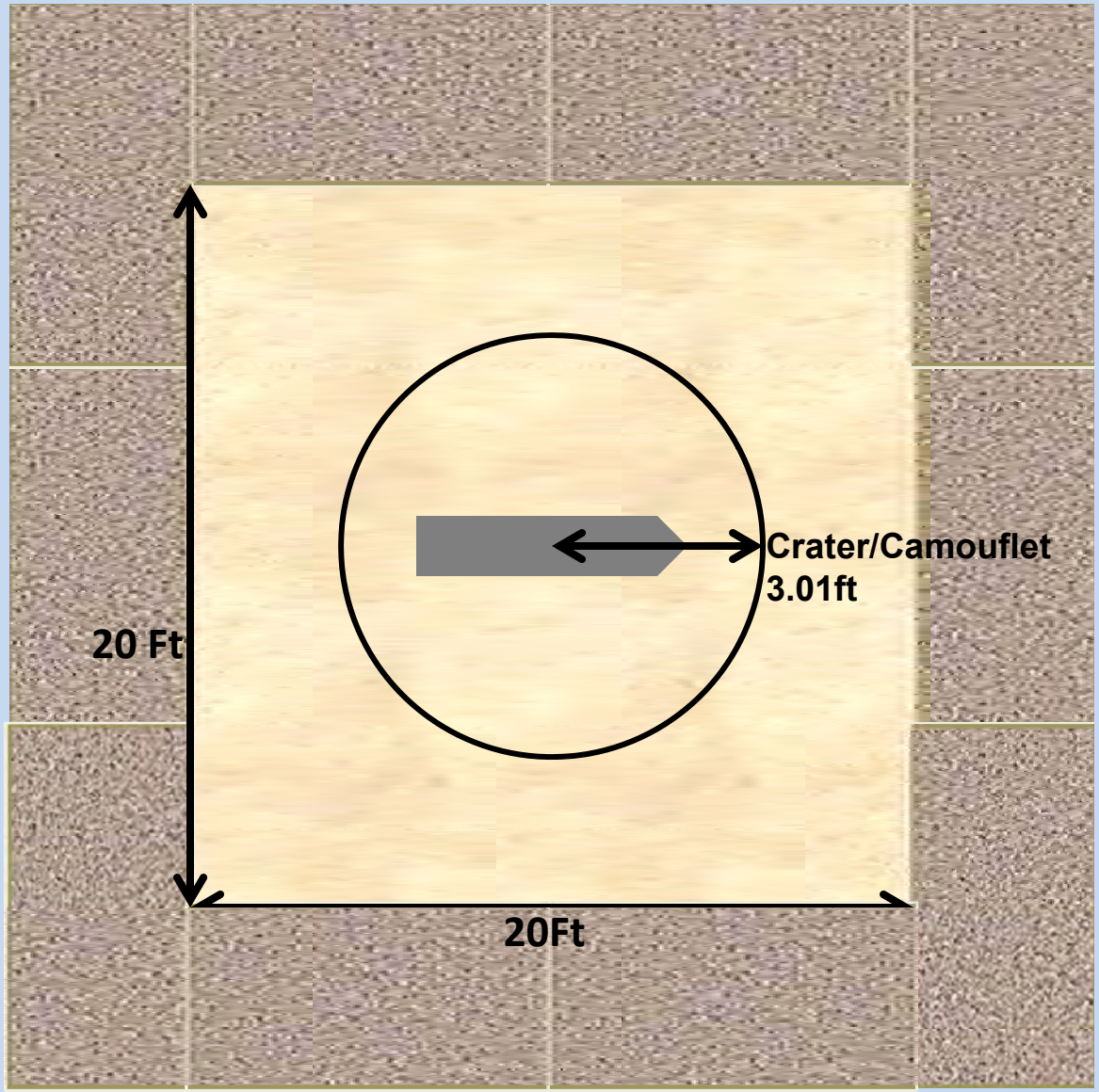


Consolidated Shot Site Box

M107 155mm HE Projectile
BEM: 6.75ft
Crater/Camouflet: 3.01ft

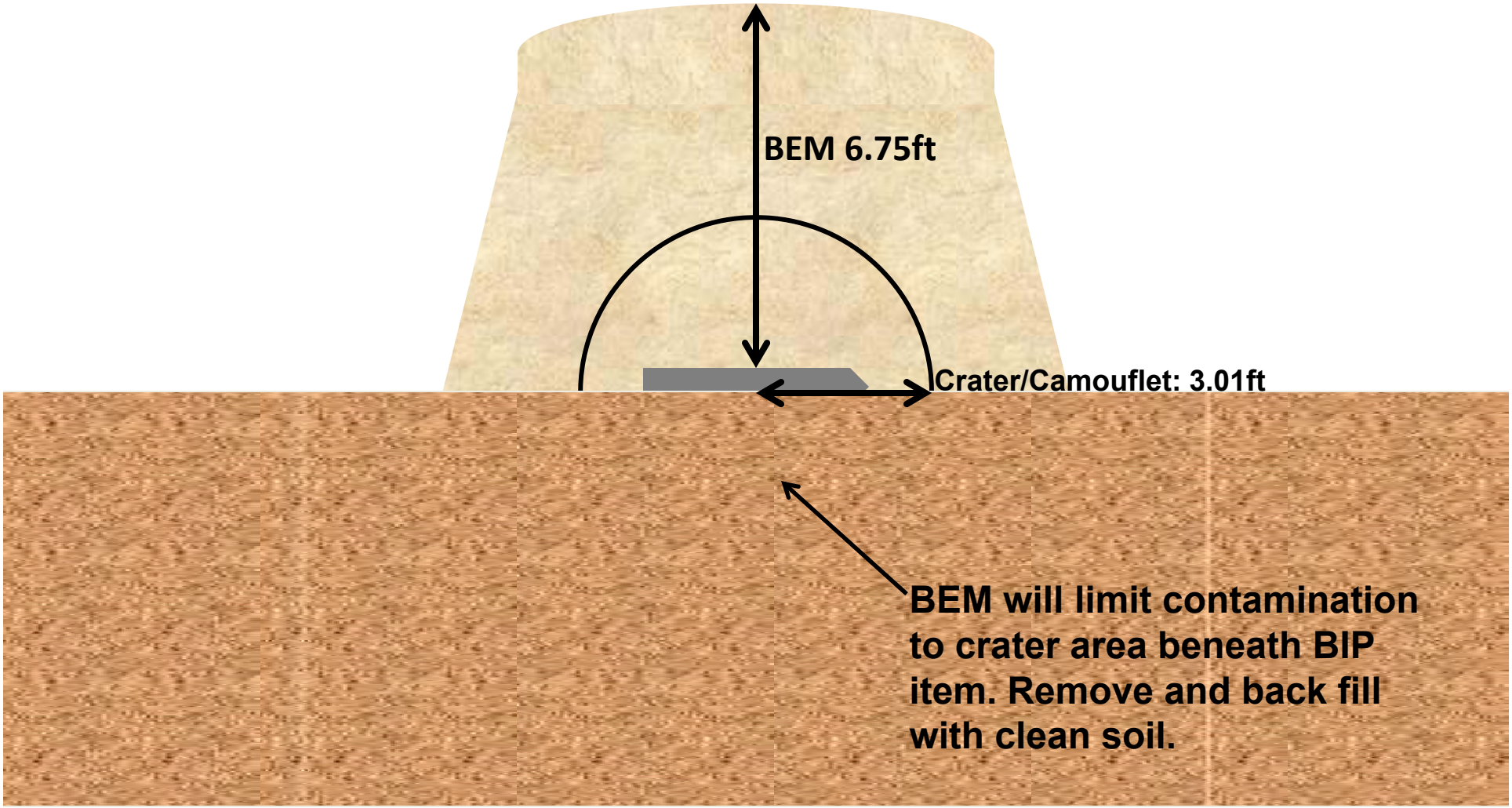


Poly covering around shot box



BIP BEM Option

M107 155mm HE Projectile
BEM: 6.75ft
Crater/Camouflet: 3.01ft



Appendix E: ODA2 MEC Notification Procedures and Reporting Form, Weekly Inspection Form, and Demolition Inventory Form

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Munitions and Explosives of Concern (MEC) at the Ravenna Army Ammunition Plant (RVAAP) – Notification Procedures

Paragraph 9(a) of the Director's Final Findings and Orders (journalized June 10, 2004) allows for the following exemption. "The requirement to obtain a hazardous waste facility installation and operation permit, as required by ORC 3734.02 (E), for the storage and treatment (destruction) of MEC (excluding bulk storage of munitions and chemical and biological warfare materiel) at OD#2, and for the in-place treatment (destruction) of MEC (excluding bulk storage of munitions and chemical and biological warfare materiel) discovered at the RVAAP that cannot be safely transported to OD#2, provided, however, that Respondent shall comply with all applicable requirements of ORC chapter 3734 and OAC chapters 3745-50 through 3745-68, including but not limited to the hazardous waste requirements set forth at Appendix E."

In the absence of obtaining emergency permits, the following is the type of information that should be provided to Ohio EPA Northeast District Office (NEDO), Division of Emergency and Remedial Response (DERR) [attn: Eileen Mohr] and Division of Hazardous Waste Management (DHMW)[attn: Greg Orr]. The information is divided into categories prior to destruction, notification can be made via either letter or email. Subsequent to detonation, the information can be transmitted in a written summary report after each detonation event or at the conclusion of the clearance activities at a particular Area of Concern (AOC).]

Information to be provided prior to Blow in place (BIP) or Detonation at OD#2:

1. Point of Contact (POC)
2. POC's phone number(s) and fax number
3. Location/date/time/person discovering the MEC
4. Description of MEC to be blown: including type and quantity
5. Proposed destruction location, either at OD#2 or BIP
6. Proposed method of destruction
7. Proposed methods to mitigate/abate potential contamination
8. Preparedness and prevention
9. Notifications to be made

Information to be provided subsequent to BIP or detonation at OD#2:

1. Point of Contact (POC)
2. POC's phone number(s) and fax number
3. Description of MEC to be blown: including type and quantity
4. Location/date/time/person responsible for the MEC destruction
5. Location of destruction activities – description and map with GPS locations listed and (if applicable) the depth and number of shot holes utilized at OD#2
6. Method of destruction utilized
7. List of donor charges and amounts
8. Any problems encountered
9. Inspection/disposal of residues
10. Confirmation of adherence to minimum isolation distances specified in OAC 3745-68-82
11. Whether or not any subsequent soil samples were collected and location of available analytical results

Camp Ravenna Joint Military Training Center
Munition of Explosive Concern (MEC)
Demolition Notification and Reporting Form

Date:

Location: Camp Ravenna, OH:

Project Name: Time Critical Removal Action

PRE-DEMOLITION INFORMATION

NOTIFICATIONS

Email notifications have been made to the following Offices:

- Camp Ravenna Range Control:
  - SFC Dave Stragar david.j.stragar.mil@mail.mil (614) 336-6041
- Camp Ravenna Environmental Office
  - Katie Tait kathryn.s.tait.nfg@mail.mil (614) 336-6136
  - Kevin Sedlak kevin.m.sedlak.ctr@mail.mil (614) 336-6000 (x2053)
- ARNG
  - Mark Leeper mark.s.leeper.civ@mail.mil (703) 607-7955
- Ohio EPA
  - Drew Kocher Andrew.Kocher@epa.ohio.gov (330) 963-1207
  - Bob Princic bob.princic@epa.ohio.gov (330) 963-1230

MEC/MPPEH SPECIFIC INFORMATION

1. Point of Contact:

2. Point of Contact email and phone number:

3. Location/date/time/person discovering the MEC:

4. Description of MEC to be blown: including type and quantity:

5. Proposed destruction location, either at OD#2 or BIP:

6. Proposed method of destruction:

7. Proposed methods to mitigate/abate potential contamination:

8. Preparedness and prevention:

9. Notifications to be made:

Camp Ravenna Joint Military Training Center
Munition of Explosive Concern (MEC)
Demolition Notification and Reporting Form

POST-DEMOLITION INFORMATION

Date:

Location: Camp Ravenna, OH:

Project Name: Time Critical Removal Action

MEC/MPPEH DEMOLITION=SPECIFIC INFORMATION

1. Point of Contact (POC):

2. POC's phone number(s) and fax number:

3. Description of MEC to be blown: including type and quantity:

4. Location/date/time/person responsible for the MEC destruction:

5. Location of destruction activities – description and map with GPS locations listed and (if applicable) the depth and number of shot holes utilized at OD#2:

6. Method of destruction utilized:

7. List of donor charges and amounts:

8. Any problems encountered:

9. Inspection/disposal of residues:

10. Confirmation of adherence to minimum isolation distances specified in OAC 3745-68-82:

11. Whether or not any subsequent soil samples were collected and location of available analytical results:

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CAMP RAVENNA JOINT MILITARY TRAINING CENTER
ODA2 MRS TIME CRITICAL REMOVAL ACTION
DAILY QUANTITY TRACKING

DATE		MEC (item)		MPPEH (item)		MDAS (lbs)		DESCRIPTION	Net Explosive Weight DESTROYED		Net Explosive Weight Donor Charges (lbs)		CULTURAL MDAS (lbs)		TOTAL MDAS	
Discovered	Destroyed	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative		Daily	Cumulative	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative
11/5/2015	11/5/2015	0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0	0	0	0	0	0	0	0

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CAMP RAVENNA JOINT MILITARY TRAINING CENTER
DEMOLITION GROUNDS
INSPECTION CHECKLIST

Date: _____
Inspected by: _____
Weather Conditions: _____
Time: _____ AM / PM

	Satisfactory	Unsatisfactory	Not Acceptable	Comment Number
A. Vehicular Access				
1. Entrance road from Newton Falls Rod. To Demolition Site.				
2. Access road to Bldg 1501				
3. Access road to Bldg 1502				
B. Entrance Gate				
1.Entrance gate chain functional and structurally sound				
2. Warning signs and flags				
3. Key lock in place				
C. Building 1501 (Exterior) (if active)				
1. Security of doors				
2. Security of locks				
3. Condition of warning signs				
4. Evidence of tampering				
5. Evidence of damage				
6. Evidence of loose trash/debris				
7. Condition of soil cover				
D. Building 1501 (Interior) (if active)				
1. General concrete integrity				
2. Floor integrity				
3. Ceiling integrity				
4. Check aisle space				
5. Evidence of general spills/leaks				
6. Evidence of loose trash/debris				
E. Building 1502 (Exterior) (if active)				
1. Security of doors				
2. Security of locks				
3. Condition of warning signs				
4. Evidence of tampering				
5. Evidence of damage				
6. Evidence of loose trash/debris				
7. Condition of soil cover				

	Satisfactory	Unsatisfactory	Not Acceptable	Comment Number
F. Building 1502 (Interior) (if active)				
1. General concrete integrity				
2. Floor integrity				
3. Ceiling integrity				
4. Evidence of loose trash/debris				
5. spill control equipment				
G. Building 1503 (Exterior) (if active)				
1. Security of doors				
2. Security of locks				
3. Condition of warning signs				
4. Evidence of tampering				
5. Evidence of damage				
6. Evidence of loose trash/debris				
7. Condition of soil cover				
H. Building 1503 (Interior) (if active)				
1. General concrete integrity				
2. Floor integrity				
3. Ceiling integrity				
4. Check aisle space				
5. Evidence of general spills/leaks				
6. Evidence of loose trash/debris				
I. On-site Storage Trailers				
1. Security of doors				
2. Security of locks				
3. Evidence of tampering				
4. Structural integrity				
5. Trailer level & wheels chocked				
6. Appropriate placarding				
J. Fire extinguishers				
1. Condition				
K. Demolition Site (weekly)				
1. Housekeeping of general area				
2. Condition of drainage / run-off				
3. Condition of lower siltation fencing				
4. Condition of adjacent stream				
5. Evidence of erosion				
L. Site Operation Equipment				
1. Condition of backhoe				
2. Condition of bulldozer				

	Satisfactory	Unsatisfactory	Not Acceptable	Comment Number
3. Condition of material transport vehicle				

M. Water Quality Analysis (Adjacent Stream) Sampled (Date): Upstream _____ Downstream _____

N. Comments:

_____

_____

_____

_____

O. Repairs / Remedial Actions (R/RA)

_____

_____

_____

_____

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Appendix F: Data Quality Control Report Forms

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Daily Site Report

Document #	Project Number	DATE;

Team 1,

Team check out	Equipment check (instrument verification)
Mag and Dig	Equipment Maintenance.
Administrative operations.	Team tailgate safety brief (conducted by team leader)

Team Personnel;

OESS;

Team location:

Worked performed:

Comments:

Team 2,

Team check out	Equipment check (instrument verification)
Mag and Flag	Equipment Maintenance.
Administrative operations.	Team tailgate safety brief (conducted by team leader)

Team Personnel;

OESS;

Sweep personnel;

Team location:

Worked performed:

Comments:

TRACKING DATA:

Total Number of MEC items recovered to date (MD):

.

UXO Items located to date;

Other work performed:
Comments:

PREPARED BY:	SIGNATURE:

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Appendix G: Camp Ravenna Waste Management Guidelines and Inspection Forms

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CAMP RAVENNA WASTE MANAGEMENT GUIDELINES

PURPOSE: Guidelines to be followed by contractors working at Camp Ravenna Joint Military Training Center who are generating/shipping Hazardous, Non-Hazardous, Special or Universal Waste.

POLICY: The policy at Camp Ravenna is to comply with all local, state, federal and installation requirements. Contractor is responsible for waste minimization and is required to recycle materials if possible.

Restoration Program POC: Katie Tait (614) 336-6136 Military & Non-Restoration POC: Brad Kline (614) 336-4918

Coordination:

- Coordinate all waste generation and shipments with the appropriate Camp Ravenna POC listed above or the Environmental Supervisor in their absence at (614) 336-6568.
- Notify Camp Ravenna POC prior to waste sampling for characterization. Details about sampling activities must be included (i.e., number of sample, analyticals, etc.).
- All Hazardous and Non-Hazardous waste management storage locations must be pre-approved prior to generation.
- Ensure all labels include: Date, Contractor, and Waste Type.
- When contractors have waste onsite, a weekly Inspection inventory must be completed and submitted to the appropriate POC in the Camp Ravenna environmental office.
- All wastes shall be tracked and logged throughout the duration of the project. Contractor will provide Camp Ravenna POC with a monthly rollup report of all waste and recycled streams generated by no later than the 10th day of the following month.

Hazardous Waste Treatment, Storage and Disposal Facilities and Waste Haulers: Contractors are required to utilize hazardous waste haulers and Treatment, Storage, and Disposal Facilities on the latest Defense Reutilization Marketing Office (DRMO) approved list. The current qualified waste hauler and TSDF list can be viewed by following the "Qualified Facilities" and "Qualified Transporters" links found on the DLA Hazardous Waste Disposal Homepage, http://www.dispositionservices.dla.mil/newenv/hwdisposal.shtml.

Hazardous or Non-Hazardous manifest form, the following must be included:

- Military and non-restoration operations waste Site Name = Camp Ravenna Joint Military Training Center. Mailing and Site address: Camp Ravenna ENV, 1438 State Route 534 SW, Newton Falls, Ohio 44444, (614) 336-4918. Ohio EPA ID # – OHD981192925.
- Restoration Program waste Site Name = Former Ravenna Army Ammunition Plant. Mailing address is same as address above. Site address: 8451 State Route 5, Ravenna, Ohio 44266, (614) 336-6136. Ohio EPA ID # – OH5210020736.
- Contractor's shipping Hazardous Waste must provide a Land Disposal Restriction (LDR) in accordance with 40 CFR Part 268.
- Profiling:
  - The required shipping documentation (i.e. waste profile and executive summary of lab reports (if available)) need to be submitted to appropriate Camp Ravenna POC or designee(s) for approval and signature prior to shipping.
  - Results of characterization must be submitted to appropriate Camp Ravenna POC within 30 days after collecting sample.
- Manifests - Hazardous and Non-Hazardous:
  - The waste carrier/transporter provides appropriate manifest to the contractor.
  - The contractor is required to:
    - Ensure that Camp Ravenna POC or designee(s) is available to sign the manifest on the scheduled day of shipment;
    - Verify that each manifest is properly completed and signed by Camp Ravenna POC or designee(s);
    - Provide the Generator copy of the manifest to Camp Ravenna POC or designee(s); and
    - Ensure that the original Generator copy of the manifest signed by the treatment storage disposal facility is returned to Camp Ravenna within 30 days of the shipping date for Hazardous and Non-Hazardous Waste.
    - The use of a Bill of Lading, in lieu of a waste manifest, must be approved by the Camp Ravenna environmental office.

All satellite accumulation storage sites and containers will comply with 40CFR 262.34(c)(1):

- Any material that is subject to Hazardous Waste Manifest Requirements of the US Environmental Protection Agency must comply with 40 CFR Part 262.
- From the time any waste is placed in a satellite storage container, proper labeling must be on the container (proper labeling includes date, contractors name and product type).
- Pending analysis label is to be used from the time the sample is taken until the results are received.
- In no case will waste labeled pending analysis exceed 45 days.

All Camp Ravenna Hazardous and Non-Hazardous records are maintained at the Camp Ravenna environmental office, point of contacts are Katie Tait at (614) 336-6136 and Brad Kline at (614) 336-4918.

CAMP RAVENNA WEEKLY NON-HAZARDOUS & HAZARDOUS WASTE INSPECTION/INVENTORY SHEET

Contractor: _____ Month: _____ Year: _____ Waste Description: _____

Container Nos. _____

	WEEK 1	WEEK 2	WEEK 3	WEEK 4
	Date: **Time:**	**Date:** **Time:**	**Date:** **Time:**	**Date:** **Time:**
Point of Contact (Name / Number)				
Project Name:				
Contracting Agency and POC:				
Waste Determination: Pending Analysis, Hazardous, Non-Hazardous, etc.				
*Location on installation:				
Date Generated:				
Projected date of disposal:				
Non-Haz, Satellite, 90 day storage area				
Waste generation site:				
Number of Containers (size / type):				
Condition of Container:				
Containers closed, no loose lids, no loose bungs?	yes / no	yes / no	yes / no	yes / no
Waste labeled properly and visible (40 CFR 262.34 (c) (1):	yes / no	yes / no	yes / no	yes / no
Secondary containment	yes / no	yes / no	yes / no	yes / no
Incompatibles stored together?	yes / no	yes / no	yes / no	yes / no
Any spills?	yes / no	yes / no	yes / no	yes / no
Spill kit available?	yes / no	yes / no	yes / no	yes / no
Fire extinguisher present and charged?	yes / no	yes / no	yes / no	yes / no
Containers grounded if ignitables?	yes / no / na	yes / no / na	yes / no / na	yes / no / na
Emergency notification form/info present?	yes / no	yes / no	yes / no	yes / no
Container log binder present?	yes / no	yes / no	yes / no	yes / no
Signs posted if required?	yes / no	yes / no	yes / no	yes / no
Photo's submitted	yes / no	yes / no	yes / no	yes / no
Printed Name:				
Signature:				

This form is required for Non-Hazardous and Hazardous waste including PCB and special waste.

CONTRACTORS ARE REQUIRED TO SUBMIT THIS FORM WEEKLY TO THE CAMP RAVENNA ENV OFFFICE WHEN WASTE IS STORED ON SITE.

CONTRACTORS ARE ENCOURAGED TO INCLUDE PHOTOS WITH EACH WEEKLY INSPECTION SHEET WHEN WASTE IS STORED ON SITE.

*Draw detailed map showing location of waste within the site.

Appendix H: OHARNG Procedures for Inadvertent Discovery of Cultural Materials at Camp Ravenna

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OHARNG Procedures for Inadvertent Discovery of Cultural Materials at Camp Ravenna Joint Military Training Center (taken from OHARNG ICRMP and modified for CRJMTC)

Contact(s): Kim Ludt, OHARNG Cultural Resources Manager, 614-336-6569
(Alternate contact, CRJMTC Environmental Office, 614-336-6568/6136)
CRJMTC Range Control 614-336-6041 or MARCS radio Channel #1

Scope: This Standard Operating Procedure (SOP) outlines the steps to be taken upon inadvertent discovery of human remains or artifacts at Camp Ravenna Joint Military Training Center (CRJMTC) during construction, demolition, training events, or other ground disturbing activities. If archaeological surveys or excavations become necessary as a result of the inadvertent discovery, they must be conducted by a person meeting the Secretary of Interior's professional qualification standards for archaeology. Anyone who does not meet these standards and engages in any excavations, including probing during metal detecting, shall be considered to be looting the cultural resources of CRJMTC and subject to prosecution under ARPA. This SOP is intended for all OHARNG personnel, contractors and users of CRJMTC.

Statutory Reference(s):

- Native American Graves Protection and Repatriation Act (NAGPRA) and its implementing regulation (43 CFR 10)
- Archaeological Resources Protection Act (ARPA)
- National Historic Preservation Act (NHPA) and its implementing regulation (36 CFR 800).

Procedures: In the event that artifacts or human remains are encountered, the ground disturbing activity should stop immediately and the following steps should be followed.

- Report any observations or discoveries of artifacts or human remains immediately to CRJMTC Range Control (614-336-6041 or MARCS radio Channel #1). Range Control will immediately notify the OHARNG Cultural Resources Manager (CRM)/CRJMTC Environmental Office.
- The Range Control or the CRM will secure any artifacts or human remains, as appropriate. If human remains are suspected, they are not to be disturbed and Range Control will promptly notify Ohio State Highway Patrol or Federal Bureau of Investigation, as appropriate.
- The CRM and Range Control will take measures to protect the location from further disturbance until appropriate parties are notified.
- If a concentration of artifacts or a burial site is identified as the source of materials discovered, the CRM will make arrangements for site recordation and stabilization, in consultation with the OHPO and any interested Native American tribes.
- Once the site has been cleared by the CRM and CRJMTC Range Control, the activity may resume. Depending on the findings, activities may be cleared to resume in 48 hours or up to 6 months.

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Appendix I: First Responder Checklist

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FIRST RESPONDER REPORTING FORM
(Print all information)

Collect as much of the information on the top half of this form as possible before making initial notification. Complete the top and bottom of the form before turning in to Camp Ravenna.

Name of individual reporting spill: _____

When did the spill occur (Date and Time)? _____

Spill Location (Building or area name / number, indoors or out; if vehicle involved, type and bumper number):
_____

What was spilled? _____ How much was spilled? _____

Rate at which material is currently spilling. _____

Extent of spill travel? _____

Did the spill reach water (ditch, creek, stream, pond, well head)? _____

Number of injured personnel and type injuries, if applicable. _____

Do you need the Fire Department to respond to protect life, property, and environment? _____

Unit: _____ State: _____ Report Date & Time: _____

On Scene Coordinator Name and Grade: _____ Phone: _____

How did the spill occur (be specific). _____

_____

What remedial action was taken? _____

_____

Was soil and absorbent material generated? _____ How much? _____

What is the location of the soil and absorbents? _____

Was the Environmental Office contacted (yes or No, date and time)? _____

Who did you talk to in the Environmental Office? _____

Was the site cleared by the Env. Office (Yes or No, date and time)? _____

Who cleared the site (name and grade, date and time)? _____

Initial information is critical. Get as much information as you can, but don't hesitate to make the initial notification if a spill is moving or worsening rapidly!

This form must be completed for all releases and turned-in to Camp Ravenna Range Control within 24 hours.

FIRST RESPONDER SPILL/RELEASE RESPONSE ACTIONS

Units or contractors performing training or other operations at Camp Ravenna shall be responsible for adhering to the provisions identified in the Camp Ravenna Integrated Contingency Plans (ICP). A copy of the ICP may be obtained from the Camp Ravenna Environmental Supervisor. Following discovery of a spill (any size), the procedures outlined below shall be executed where applicable:

1. **If necessary, initiate evacuation of the immediate area.**
2. **Notify Camp Ravenna Range Control via two-way radio or by calling (614) 336-6041, and report information contained on the "First Responder Reporting Form" if it is known or can reasonably be determined. This form has been copied on the opposite side of this page. If Range Control cannot be reached, contact a Camp Ravenna OSC (listed below).**
3. **Stop spill flow when possible without undue risk of personal injury.**
4. **If trained, contain the spill using available spill response equipment or techniques.**
5. **Make spill scene OFF LIMITS to unauthorized personnel.**
6. **Restrict all sources of ignition when flammable substances are involved.**
7. **Report to the OSC upon his/her arrival to the scene.**
8. **Turn in a completed copy of the Camp Ravenna First Responder Form to Camp Ravenna Range Control for ALL releases, even ones cleaned up by the reporter.**

TELEPHONE NUMBER

When **Camp Ravenna Range Control** is ***not available*, the Camp Ravenna OSC *must be contacted* by the discoverer/first responder following a release if it is in water, at or above a reportable quantity (25 gallons or more of POL), a hazardous or extremely hazardous substance, a hazardous waste, or involves fire, explosion, or is otherwise a major incident.**

NAME	JOB TITLE	OFFICE	24 HOUR
Camp Ravenna Range Control	Operations and Training	(614)336-6041	(614) 202-5783
Tim Morgan (Primary OSC)	Environmental Supervisor	(614)336-6568	(330)322-7098
Brad Kline (Alternate OSC)	Environmental Specialist	(614)336-4918	Contact Alternate
Katie Tait (Alternate OSC)	Environmental Specialist	(614)336-6136	Contact Alternate
Joint Forces Command (Alternate POC)	OHARNG Emergency Center	(888)637-9053	(888)637-9053

Off-site (from Camp Ravenna area code 614 phones)

Ravenna Dispatch ....…….…. 9-1-330 296-6486

SEE REVERSE FOR FIRST RESPONDER REPORTING FORM