FINAL
WORK PLAN

GEOPHYSICAL INVESTIGATION
SUSPECTED MUSTARD AGENT BURIAL SITE
RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO

Contract No. W912QR-04-D-0036
Delivery Order No. 0006

Prepared for:

U.S. Army Corps of Engineers
Louisville District
600 Dr. M.L. King Jr. Pl.
Louisville, KY 40202-2230

Prepared by:

Environmental Quality Management, Inc.
1800 Carillon Boulevard
Cincinnati, Ohio 45240

November 15, 2007

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Geophysical Work Plan Distribution List

RVAAP – 2 hard copies, 2 CDs
USACE - 2 hard copies, 3 CDs
USAEC – 1 CD
Ohio EPA – 2 hard copies, 2 CDs
OHARNG – 1 hard copy, 1 CD
EQM – 1 hard copy, 1 CD

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ABBREVIATIONS AND ACRONYMS

COR	Contracting Officer's Representative
EM	Electromagnetic
EQM	Environmental Quality Management, Inc.
GPR	Ground Penetrating Radar
NAD	North American Datum
OHARNG	Ohio Army National Guard
Ohio EPA	Ohio Environmental Protection Agency
QC	Quality Control
QCM	Quality Control Manager
RTLS	Ravenna Training and Logistics Site
RVAAP	Ravenna Army Ammunition Plant
SOW	Scope of Work
USACE	United States Army Corps of Engineers
USGS	United States Geologic Service
UTM	Universal Transverse Mercator

SECTION 1

PROJECT DESCRIPTION

1.1 Statement of Purpose

The objective of the project is to determine if mustard agent test kits have been buried in an approximate one acre area located on the western portion of the Ravenna Army Ammunition Plant (RVAAP) in Ravenna, Ohio. This suspect area is located adjacent to the NACA test strip and is reportedly where mustard agent Chemical Agent Identification Sets (CAIS) may have been buried.

The CAIS are reported to be contained in metal shipping containers as described in Section 1.3. If this is the case, it is anticipated that they will carry a detectable geophysical signature. The purpose of this geophysical survey is to determine if buried metal objects exist in the study area. These objects, if present, are presumably the mustard agent test kits. The survey results will be used determine further action at the site. Further activities could include:

- No further action.
- Installation of groundwater wells with possible inclusion into the Facility-Wide Groundwater program.
- Site access restrictions.
- Additional investigation.

Once the results of the Geophysical Survey have been completed and analyzed the USACE and the Army will work with the Ohio EPA to determine the next appropriate course of action.

1.2 Facility Location and Physiography

Past Department of Defense (DOD) activities at the Ravenna Army Ammunition Plant (RVAAP) date to 1940 and include the manufacturing, loading, handling and storage of military explosives and ammunition. Until 1999, the RVAAP was identified as a 21,419-acre installation. The property boundary was resurveyed by the Ohio Army National Guard (OHARNG) over a two year period from 2002 and 2003 and the actual total acreage of the property was found to be 21,683.289 acres. As of February 2006, a total of 20,403 acres of the

former 21,683 acre RVAAP have been transferred to the United States Property and Fiscal Officer (USP&FO) for Ohio for use by the OHARNG as a military training site. The current RVAAP consists of 1,280 acres in several distinct parcels scattered throughout the confines of the OHARNG Ravenna Training and Logistics Site (RTLS). The RVAAP and the RTLS are collocated on contiguous parcels of property and the RTLS perimeter fence completely encloses the remaining parcels of the RVAAP. The RTLS is in northeastern Ohio within Portage and Trumbull Counties, approximately 4.8 kilometers (3 miles) east-northeast of the city of Ravenna and approximately 1.6 kilometers (1 mile) northwest of the city of Newton Falls (Figure 1). The RVAAP portions of the property are solely located within Portage County. The RTLS (inclusive of the RVAAP) is a parcel of property approximately 17.7 kilometers (11 miles) long and 5.6 kilometers (3.5 miles) wide bounded by State Route 5, the Michael J. Kirwan Reservoir, and the CSX System Railroad on the south; Garret, McCormick, and Berry roads on the west; the Norfolk Southern Railroad on the north; and State Route 534 on the east (see Figures 1 and 2). The RTLS is surrounded by several communities: Windham on the north; Garrettsville 9.6 kilometers (6 miles) to the northwest; Newton Falls 1.6 kilometers (1 mile) to the southeast; Charlestown to the southwest; and Wayland 4.8 kilometers (3 miles) to the south. When the RVAAP was operational the RTLS did not exist and the entire 21,683-acre parcel was a government-owned, contractor-operated (GOCO) industrial facility. The RVAAP Installation Restoration Program (IRP) encompasses investigation and cleanup of past activities over the entire 21,683 acres of the former RVAAP and therefore references to the RVAAP in this document are considered to be inclusive of the historical extent of the RVAAP, which is inclusive of the combined acreages of the current RTLS and RVAAP, unless otherwise specifically stated.

As reported by former employees (reference the *Suspected Mustard Agent Interview, 2006* in Attachment 1), the general location of the mustard agent CAIS is presented in Figure 2. The depth at which the CAIS may have been buried was not reported, however Section 3.1 presents a discussion on suspected burial depths. A more detailed location map is presented in Figure 3. Specific details on the specific study area are presented in Section 3 of this plan.

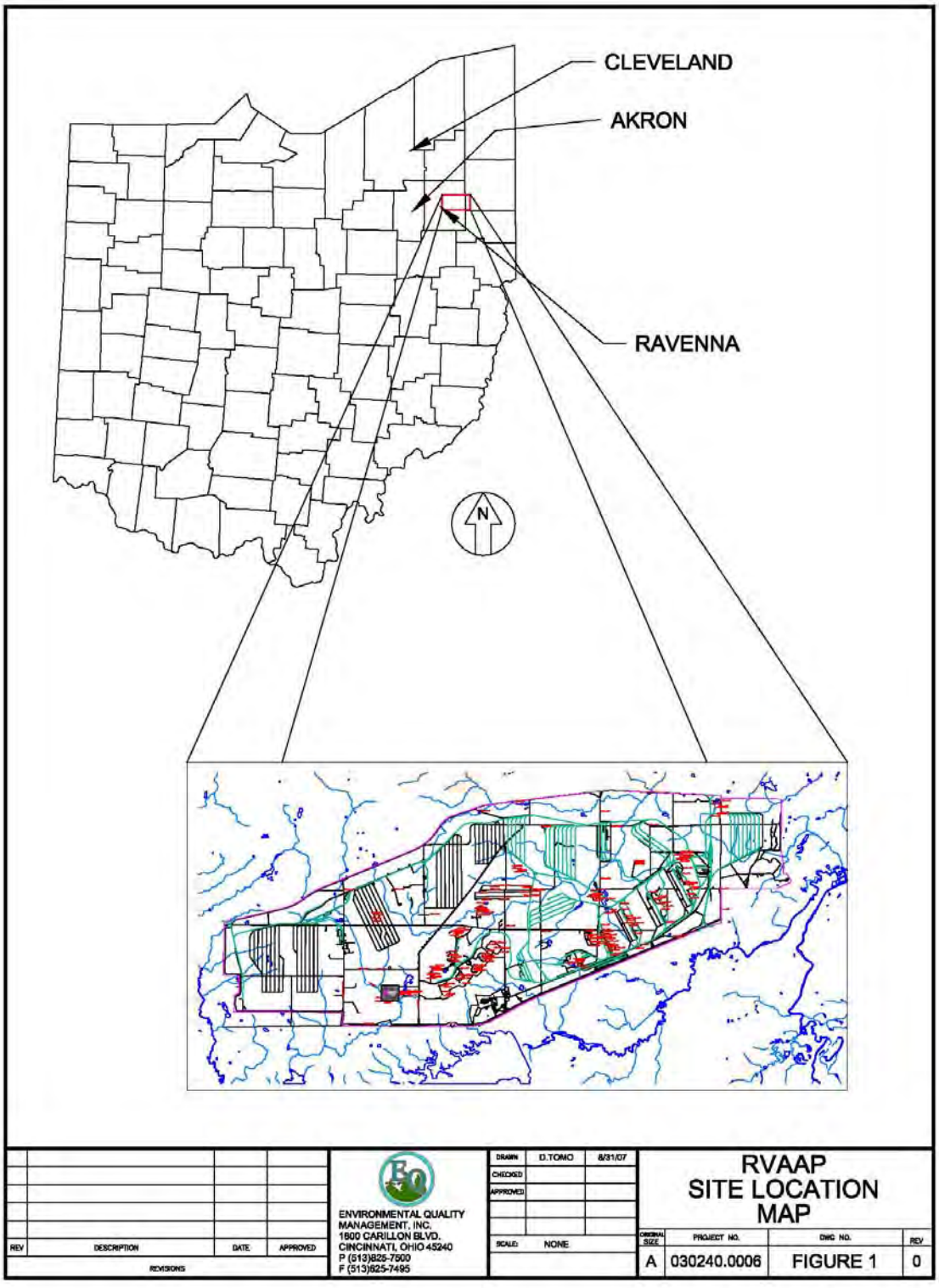

Figure 1. Site Location Map

Figure 2. Site Map

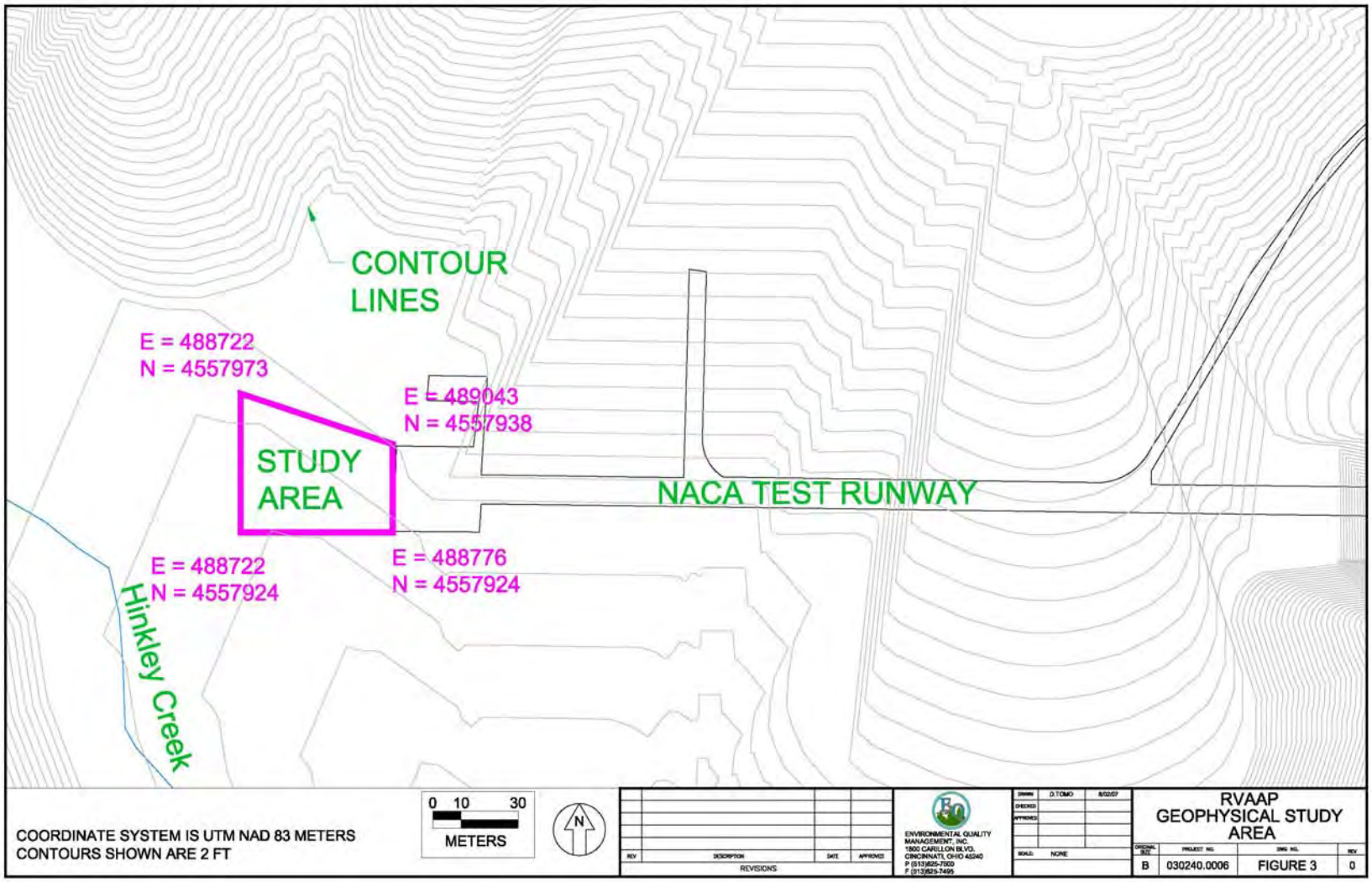

Figure 3. Detailed Site Location Map

The overall facility geology is characterized by sedimentary bedrock overlain by a thin veneer of glacial sediments consisting of tills and outwash deposits. The specific study area is relatively flat, sloping gently towards Hinkley Creek to the west and south. The area is heavily vegetated with scrub brush and trees, some of them greater than 10 inches in diameter.

1.3 Facility History

RVAAP was constructed in 1940 and 1941 for depot storage and ammunition assembly/loading. Production began in 1942 an the facility was placed on standby status in 1950. Production activities resumed from 1954 to 1957 and 1968 to 1972. Demilitarization activities, including disassembly of munitions and explosives melt-out and recovery, continued until 1992. The facility entered Modified Caretaker status in October 1993. The subject project area is reported, by former employees at the facility, to be a possible location of buried mustard agent test kits (*Suspected Mustard Agent Interview, 2006).*

The CAIS mustard agent suspected to have been buried at the facility was developed by the Department of the Army from the 1930s through the 1960s. It was reportedly buried at RVAAP in the 1950's (*Suspected Mustard Agent Interview, 2006).* Of the various types of CAIS glass containers that have been identified as potentially containing mustard agent, all are believed to have been packed in metal, either metal paint/coffee-type cans, 55-gallon drums, or steel shipping cylinders called PIGs as described in *Description of Chemical Agent Identification Set Types, 2004* which is contained in Attachment 1 of this Work Plan (also used to reference the CAIS packaging is the document *Chemical Agent Identification Set (CAIS) Information Package, November 1995).* The references for these documents are presented in Section 5.

According to UXO safety information on the Denix website (https://www.denix.osd.mil/), prior to the early-1970s, one of the approved procedures for disposing of CAIS was burial on training ranges or areas. When buried, CAIS were either buried in their original containers (PIGS) or loose. Normally, CAIS vials were broken before burial and decontaminant was used to neutralize any chemical agent present. Note that the Denix website references wooden containers. Based on the *Description of Chemical Agent Identification Set Types, 2004,* the only CAIS packed

in non-metallic (wooden) containers was K945, however all K945 kits were accounted for by the Army and destroyed.

SECTION 2

PROJECT ORGANIZATION AND RESPONSIBIILITES

Figure 4 is an organizational chart showing the principal project-specific roles and lines of communication for the Geophysics investigation project. The project organization is discussed in the following sections.

2.1 Management Responsibilities

USACE-Louisville Contracting Officer's Representative (COR)—The COR for this project will be Mr. Rick Hockett. Only Mr. Hockett is authorized to take any action, either directly or indirectly, that would change the pricing, quality, quantity, schedule, or other terms or conditions of the basic contracted Scope of Work (SOW).

USACE Technical Manager—The technical lead for this project will be Ms. Kathy Krantz. She is responsible for ensuring that the technical objectives of the project are met.

USACE-Louisville Project Manager—The Project Manager for this project will be Mr. Glen Beckam who will be responsible for overall USACE management.

EQM Program Manager—The EQM Program Manager for this USACE-Louisville contract is Mr. Jim Zody, P.E. Mr. Zody has overall responsibility for work performed by EQM's personnel and its subcontractors. Mr. Zody will ensure high quality work, and make resources available.

EQM Project Manager (PM)—The EQM Project Manager will be Mr. John Miller. Mr. Miller will be responsible for coordinating and implementing all technical work, including plans and field work. He will be responsible for identifying appropriate staff for each task and providing oversight of all work to ensure its successful and timely completion.

Ohio Environmental Protection Agency—Ms. Eileen Mohr will serve as the Ohio EPA Project Manager and will provide regulatory and program review and approval of the project.

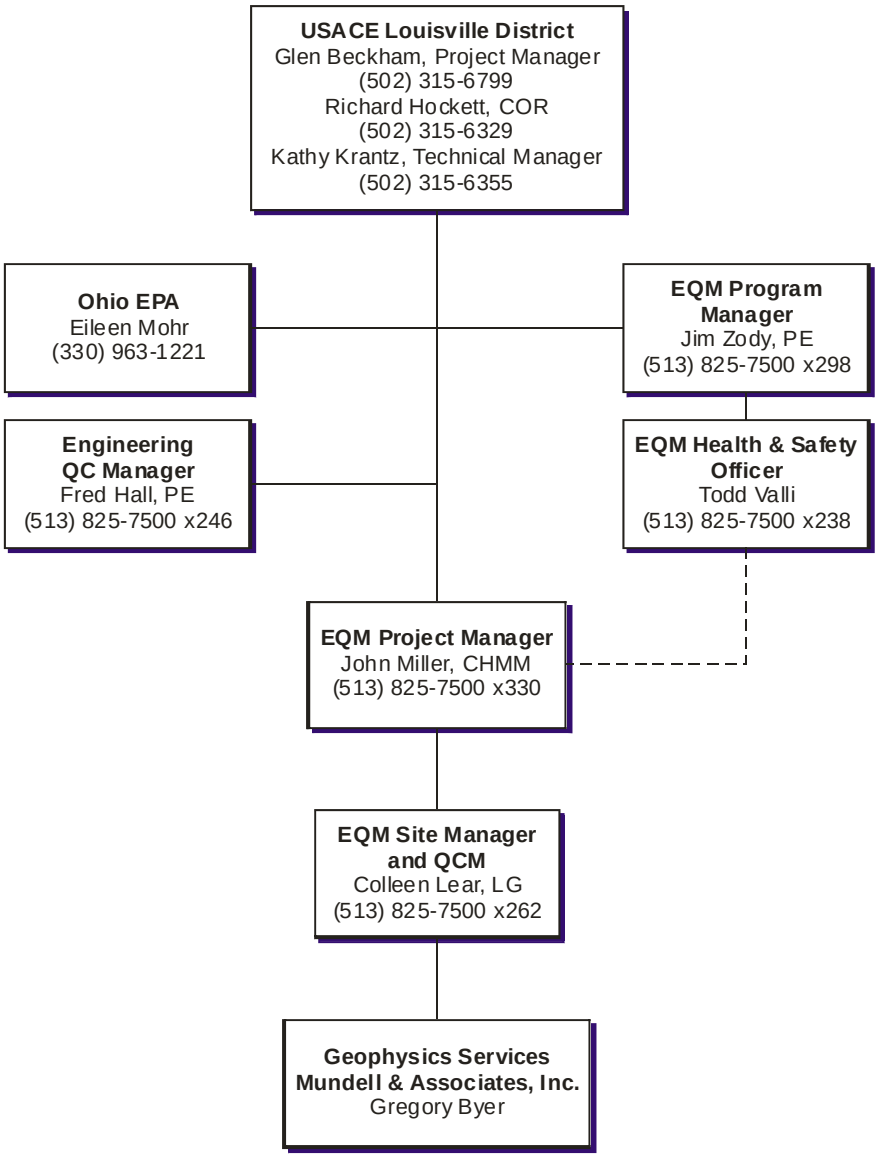

Figure 4. Project Organization

2.2 Quality Assurance Health and Safety Responsibilities

EQM Quality Control Manager (QCM)—EQM's QCM will be Ms. Colleen Lear. Ms. Lear shall perform or direct necessary technical and field audits.

EQM Engineering QC Manager—Mr. Fred Hall, P.E, EQM's corporate Engineering QC Manager, will be responsible for overall engineering QC.

2.3 Project Support Staff Responsibilities

Site Manager—The EQM Site Manager will be Ms. Colleen Lear. Ms. Lear will be responsible for overseeing completion of the field investigation activities of the project. She will be responsible for ensuring the quality of all field activities and that all applicable protocols are observed.

Health and Safety Officer: EQM's corporate Heath and Safety Officer (Todd Valli) is responsible for overseeing and implementing all health and safety issues associated with this project. This will include reviewing the RVAAP Facility-Wide Health and Safety Plan to ensure that all field work conducted under this project is covered. Mr. Valli will review and sign-off on the project specific HASP addendum.

2.4 Subcontractors

EQM will utilize the services of MUNDELL & ASSOCIATES, INC. of Indianapolis, Indiana to conduct the Geophysical survey field work. The *Geophysical Services Division* of MUNDELL & ASSOCIATES, INC is a full-service geophysical consulting firm and provider of high quality surface and borehole geophysical services for engineering and environmental projects since 1995. For this project, Mr. Gregory Byer will direct geophysical services.

2.5 Authority to Grant Variances

If required after approval of this work plan, any modifications to the field requirements will require approval at different management levels of the project team based on significance of the deviation from the approved procedures or protocols. There are four levels of modification as described below.

Level 1—Modifications Approved by Project Support Staff

- Switch investigation equipment for replacement with comparable equipment due to mechanical or performance problems.
- Line spacing changes for the electromagnetic investigation that involve walking around a tree or other obstruction and returning to the original line. It is anticipated that any such change would be less than 1-meter to walk around the tree/obstruction.

Level 2—Modifications Requiring Site Manager Approval

- Shutdown of field activities for health and safety reasons. Note: EQM's corporate Heath and Safety Officer is responsible for overseeing and implementing all health and safety issues associated with this project, however working safely is a condition of employment for all EQM personnel. Site safety and health personnel, supervision and all workers through their supervisors have the responsibility and authority to suspend work activity when health and safety controls are inadequate. In the event of imminent danger, any employee can stop the activity. Imminent danger is an impending or threatening dangerous situation that could be expected to cause death or serious injury to persons in the immediate future unless corrective measures are taken. Additionally, per the Directors Findings and Orders (June 2004), Ohio EPA has stop work authority.
- Changes in startup or shutdown times due to weather conditions.

Level 3—Modifications Requiring Project Manager Approval

- Changes in subcontractors due to poor performance.

Level 4—Modifications Requiring USACE-Louisville/Ohio EPA Approval

- Changes to the approved Geophysical investigation methods.
- Line spacing changes greater than the stated range of 2-5 meters.
- Decisions or situations resulting in an inability to achieve the project data objectives.

SECTION 3

TECHNICAL SCOPE

3.1 Introduction

The proposed scope of work utilizes electromagnetic (EM) mapping using a combination of instruments including an EM-61 and EM-31 manufactured by Geonics Limited, and a GEM-2 broadband electromagnetic sensor manufactured by Geophex Ltd. Calibration procedures for the electromagnetic equipment are presented in Attachment 2.

The EM-61 is a high-resolution time-domain metal detector that transmits and receives a transient electromagnetic pulse with system logic optimally tuned to observe the characteristic signal associated with buried metallic objects. Using receiver coils at two different heights, the system can be used to estimate the size and proximity of metallic objects by the respective signal strengths recorded in millivolts.

The EM-31 is an electromagnetic ground conductivity meter used to map geologic variations, groundwater contaminants, or any subsurface feature associated with changes in ground conductivity. Ground conductivity (quad-phase) and magnetic susceptibility (in-phase) measurements are stored in a field computer for subsequent processing and analysis. The in-phase component is particularly useful for the detection of buried metallic objects and waste material.

According to the manufacturer, Geonics Ltd., the maximum exploration depth is approximately 6 meters for the EM-31, and approximately 3 meters for the EM-61. The GEM-2, another electromagnetic conductivity meter that will be used, has multiple depths of exploration. These depths are dependant on the selected frequencies transmitted in the output signal. For this project it is anticipated that 4 to 5 different GEM-2 frequencies will be used, resulting in exploration depths ranging between approximately 1 and 10 meters. There was no burial depth reported by the employee who initially reported the possibility of the mustard agent burial. However it should be noted that the equipment likely available at the facility in the 1950's was a

backhoe with a maximum dig depth of 8-feet (2.4 meters) (*T. Chandra, personal communication, 2007*), which is well within the exploration depth for the investigation.

The GEM-2 is a hand-held, digital, multi-frequency sensor capable of transmitting and receiving a digitally-synthesized arbitrary waveform containing multiple frequencies. The depth of exploration for a given earth medium is determined by the operating frequency of the sensor. By utilizing multiple frequencies to measure the earth response from several depths, an image of the three-dimensional distribution of subsurface objects can be created. The quad-phase and in-phase instrument response values are stored in a handheld computer for subsequent processing and conversion to apparent conductivity measurements using transform algorithms.

EM mapping is cost effective and highly sensitive for screening large areas for the presence of buried conductive and/or metallic objects. If areas containing conductive metallic objects are found, ground penetrating radar (GPR) will be used to investigate any metal detection and/or conductivity anomalies to further characterize these areas at a higher level of resolution (depending on site-specific soil conditions). This determination will be made after reviewing the data while in the field. The specific scope of services to complete this project is described below.

3.2 Technical Approach

3.2.1 Records Review

The boundary of the suspected mustard burial area has been determined to the extent practicable through a review of available records and photos. The historical records utilized in this review include USGS topographic maps from 1908, 1960, 1970, 1977, and 1994; and USGS aerial photographs from 1952, 1960, 1970, 1982, and 1994. Anecdotal information from former RVAAP employees was also used. Based on site features identified on these maps and photographs, along with information provided by the USACE, a possible burial location has been identified.

3.2.2 Site Location

An outline of the study area is identified on Figure 5. This area is approximately 1-acre and comprises the limits of the geophysical survey. The Universal Transverse Mercator (UTM)

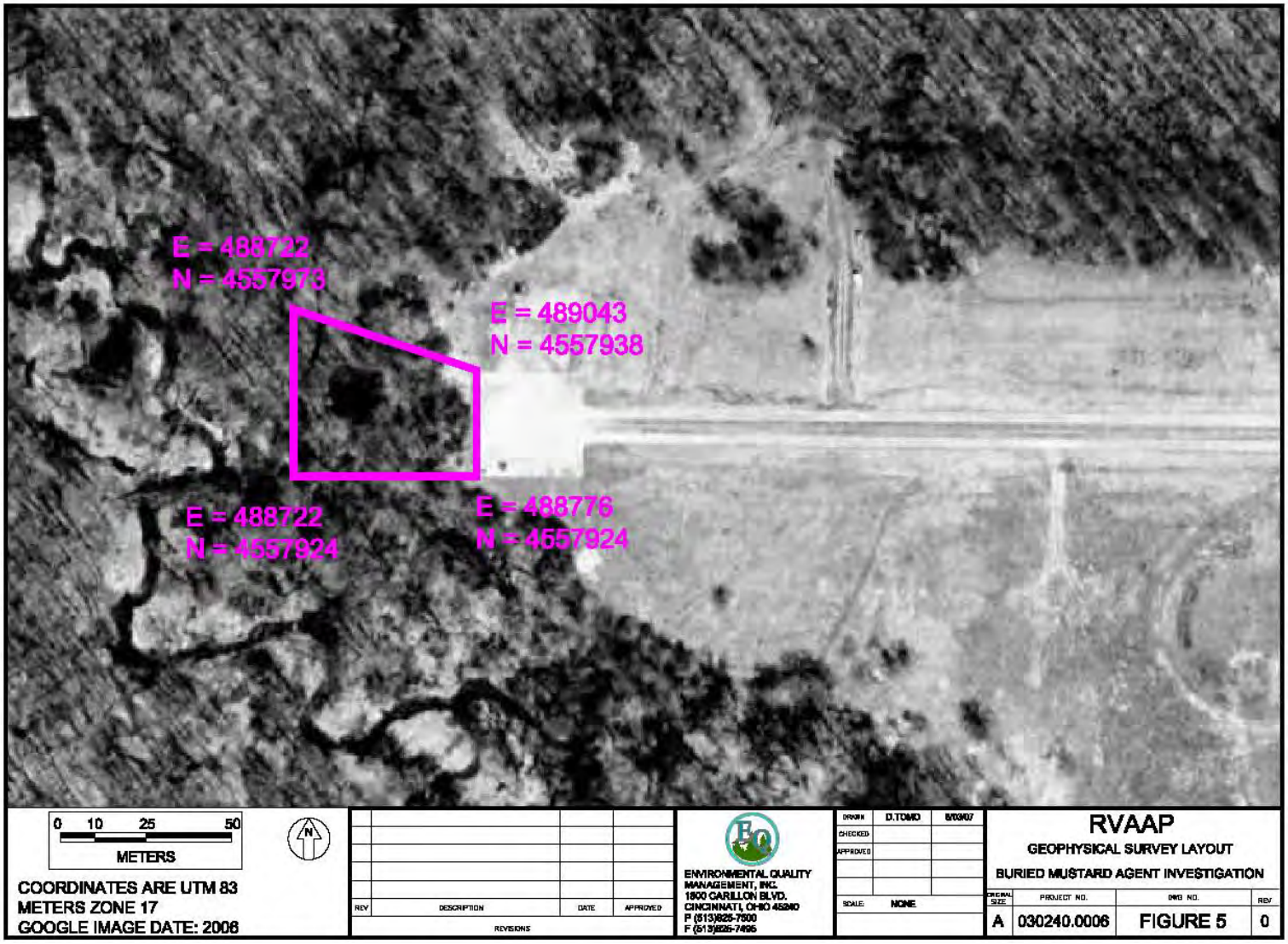

Figure 5. Geophysical Survey Layout

North American Datum (NAD) 83 coordinates for the four corners of the study area are presented on Figure 5. The exact limits of the survey area will be determined based on field conditions encountered prior to initiating field work.

3.2.3 Site Preparation

Prior to implementing the Geophysical study the area will be staked out using GPS coordinates based on the area identified in Figure 5. Vegetation of less than 2" in diameter will be removed prior to the survey. The study area will be mowed using a tractor pulled rotary mower (bush-hog) or smaller mower to the extent possible given the terrain and vegetation. EQM personnel will also use hand tools such as weed whackers to clear the area. Any areas with standing water will be cleared by hand to minimize surficial disturbance. EQM will meet with OHARNG personnel prior to initiating any field clearing activities to identify particular areas of concern. The area of investigation will also be cleared of surface objects, particularly metallic, which would impede data collection. Any moveable sources of potential interference (i.e., cars, trucks, dumpsters or scrap metal) will be removed from the area.

Before initiating any field activities a health and safety briefing will be conducted. A copy of the Geophysical Survey Site Safety and Health Plan Addendum is presented in Attachment 3. All EQM employees working on the geophysical project will have current 8-hour and 40-hour HAZWOPER certificates on file at the facility. All subcontractors to EQM will submit the required certification prior to initiating field work

3.2.4 Mobilization

MUNDELL & ASSOCIATES, INC. will mobilize to the Site from their location in Indianapolis, Indiana. EQM's field supervisor will also be present during the investigation phase. All equipment and associated items to complete the fieldwork portion of the project will be brought to the site. Prior to initiating site activities a health and safety briefing will be conducted. The Ohio EPA will be provided with 14 days notice prior to initiating field activities.

3.2.5 Survey Control

The position of the geophysical data will be recorded through the use of the global positioning system; therefore, a fixed grid survey will not be needed. A Trimble Model Ag 114

GPS receiver with real-time differential correction via OmniSTAR (or equivalent) will be used. With differential correction, the accuracy of the GPS unit (Trimble Ag114) is less than 1-meter. Positioning data will be recorded concurrently with instrument data collection.

3.2.6 Conductivity Data Collection

EM data will be collected along lines spaced approximately 2 to 5 meters apart as site conditions allow. The stated range of 2-5 meters for the spacing of the data collection lines is intended to accommodate uncertainty in what the site conditions will be after clearing. The actual spacing of the data will be dependant on several factors, including:

- The available paths of travel between the standing trees given the various physical configurations of the instruments,
- The quality of the GPS satellite constellation available underneath the tree canopy, and,
- Differences in the size of the exploration area of the various instruments (e.g., along a given line of data collection, the EM-61 has a much narrower swath than the EM-31).

Within these limitations, every effort will be made to investigate the whole of the study area.

Along the lines of data collection, the instrument data logger will record measurements at a constant rate as the equipment operator traverses the Site. It is estimated that the data collection will require one field day to complete.

3.2.7 Conductivity Data Processing

The EM data will be imported into Surfer Version 8.0 for contouring and displaying as color-filled maps. The maps will be interpreted for the presence of metallic objects.

3.2.8 Ground Penetrating Radar

As a final step for evaluation and characterization of EM anomalies (if found), GPR data will be collected in select areas once testing has been done to confirm the efficacy of this method. Under favorable conditions, GPR can provide a highly accurate and detailed subsurface image, which can greatly help to verify the presence of metal objects and to provide specific information about depth of burial, and other dimensional information. GPR data will be collected using a Sensors and Software Noggin Plus GPR System equipped with shielded 250-

megahertz and/or 1,000-megahertz antennae. This system is a rapid, state-of-the-art data acquisition system that collects data continuously as it is operated. The operator has an immediate view of the subsurface, and the data are stored in a computer for later printing and analysis.

3.3 Report Preparation

Verbal results regarding the investigation will be available upon completion of the field activities. Upon final data processing, a survey report will be developed and submitted for review. This report will include a summary of the records research, a site overlay map (11x17 or smaller), color maps of the EM data, data interpretation, and the methods used to generate the data. The report will be submitted as a Preliminary Draft for Army review (per EQM's contract with the USACE), Draft, and Final version with subsequent Ohio EPA and Army reviews and comment resolutions.

SECTION 4

SCHEDULE

Figure 6 presents the proposed schedule to complete this project.

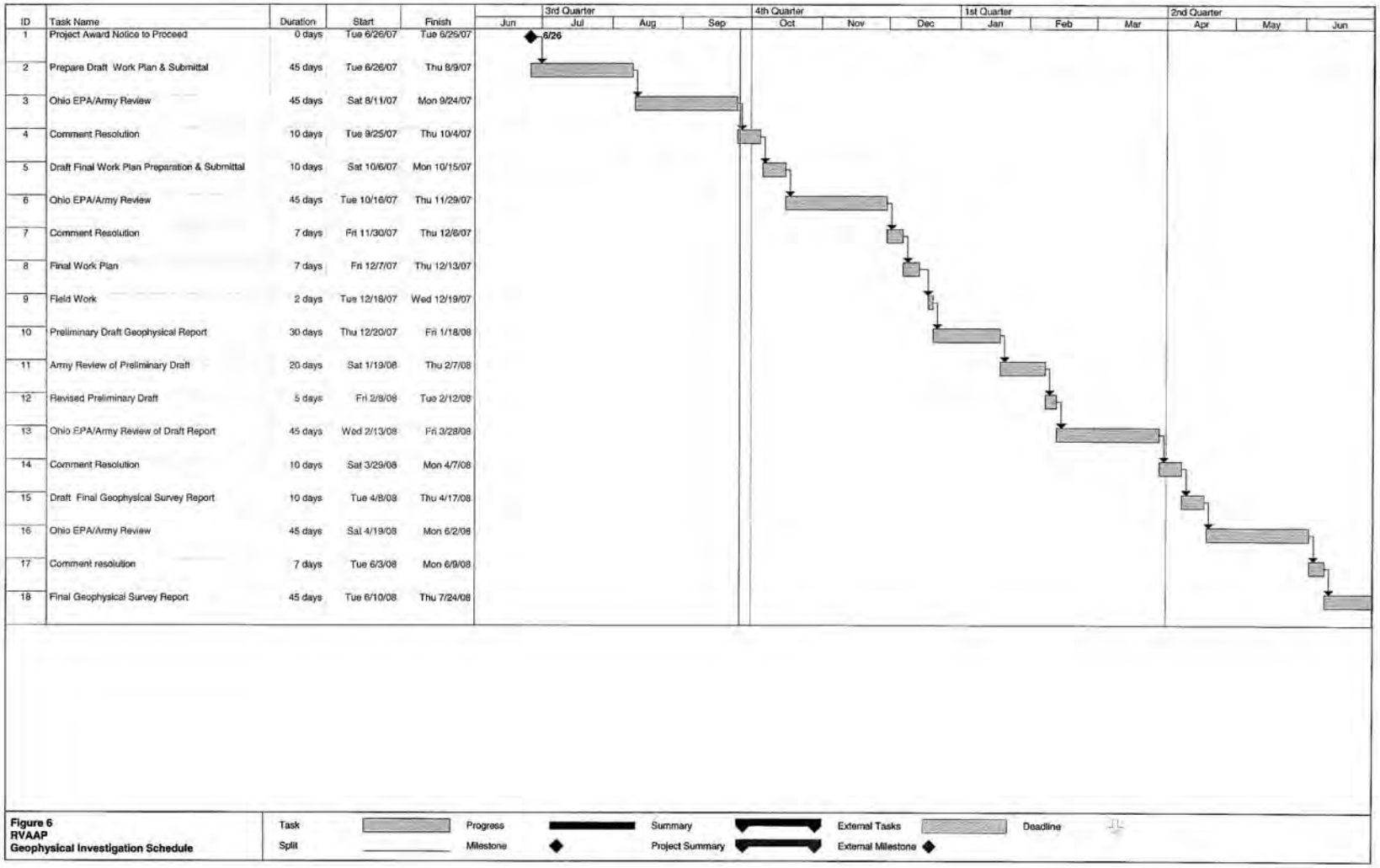

Figure 6. Project Schedule

SECTION 5

REFERENCES

1. U.S. Army 1995. Chemical Agent identification Sets (CAIS) Information Package. Prepared by the Project Manager for Non-Stockpile Chemical Materiel. November 1995. Aberdeen Proving Ground, Md. U.S. Army Program Manager for Chemical Demilitarization

2. Gray, Martin 2007. Personnel Communication referencing the Description of Chemical Agent Identification Types from the Deseret Chemical Depot RCRA Part B Permit Waste Analysis Plan. September 2007. Utah Department of Environmental Quality.

3. U.S. Army 2006. Suspected Mustard Agent Interview. 20 July 2006. Ravenna Army Ammunition Plan, Ravenna, Oh.

4. Chandra, Tom 2007. Personnel communication concerning equipment available for digging at RVAAP in the 1950's. Mr. Chanda's historical understanding of equipment available at RVAAP was based upon the information conveyed by documented record within the Installation Assessment of Ravenna Army Ammunition Plant Report No. 132, page 33, by the U.S. Army Toxic & Hazardous Materials Agency, November 1978; as well as his working relationship with the former resident RVAAP Safety Surveillance Officer, Mr Gary Wolfgang; and by the interviews that Mr. Chanda conducted with the 68th EOD personnel that performed exploratory excavation at the west end of the NACA runway.September 2007. USACE - Louisville District.

5. U.S. Army 1948. Demilitarization of Chemical Agents, Munitions and Other Materiel. January 1948. Office Chief of Chemical Corps Supply and Procurement Division. Washington, CD.

ATTACHMENT 1

SUSPECTED MUSTARD AGENT INTERVIEW/ DESCRIPTION OF AGENT IDENTIFICATION SET TYPES

DRAFT #2

SUSPECTED MUSTARD AGENT INTERVIEW
20 July 2006
At Building 1037, RVAAP

1 On 20 July 2006, the following people met to interview two local members of the public who may have some knowledge of potential mustard agent burial area(s).

Charlene and Ray McDaniel	Public
Jeff Lock and his daughter Sarah (RVAAP RAB member)	Public
LTC Thomas Tadsen	Ohio Army National Guard (OHARNG)
Tim Morgan	OHARNG
Katie Elgin	OHARNG
Eileen Mohr	Ohio EPA
Andrew Kocher	Ohio EPA
Irv Venger	RVAAP
Glen Beckham	Corps of Engineers - Louisville
Dave Brancato	Corps of Engineers - Louisville
Rick Hockett	Corps of Engineers - Louisville
John Jent	Corps of Engineers - Louisville
Paul Zorko	Corps of Engineers - Louisville

2 Ray McDaniel
Started at the RVAAP in 1942 and worked there until 1984, but was in the navy from 1943 to 1945.
Was President of APCO (Atlas Powder Company) Conservation Club for many years.
Was involved in many renovation projects, including the Boy Scout Pond.
Was a foreman of engineering.
Charlene McDaniel (Wife of Ray McDaniel) - Worked at RVAAP and was secretary of the APCO Conservation Club for many years until her retirement.
Ray and Charlene established a scholarship fund of which Tim Morgan was the first recipient.
Ray and Charlene are still very active in the APCO Fish and Wildlife Conservation Club.
The Natural Resources Program dates to a large competitive archery program from which 15 % of proceeds went into the scholarship program.
The scholarship program has a current endowment of about $66,000.

3 LTC Tom Tadsen asked Jeff Lock - What do you know about the Mustard Agent locations ?

4 Jeff Lock
Had been in the army from 1966 – 1969.
After discharge from the army he worked at RVAAP at the east side "round house".
Said that in 1969 a government agency shipped mustard agent across country. - Mr. Lock believed it was secret program. He said the shipment experienced a train derailment, and that was the only way the public knew about it.
His dad, Henry Lock, also worked at the RVAAP.
At that time, the only communications were by radios that had a relatively short range.
One day when Jeff was at the round house, his dad signed off indicating he was also at the round house, but with a real weak signal- (WHICH INDICATED THAT HIS DAD WAS NOT CLOSE BY).
Jeff later told his dad that he didn't believe he had signed off near the round house, and asked his dad what had really happened, and where he was when he signed off.

His dad said he couldn't tell him. Jeff threatened to go to the press if Henry didn't tell him where he was, and what happened.
Henry said that mustard gas containers were buried previously, and they were sent out to dig them up and check on the integrity of the containers.
Henry told him he was informed that the information was classified, and he could never discuss it with anyone.
He said further that Henry told him where they were buried, but that he couldn't check the integrity of all of them, because part of the burial site was now covered by the National Advisory Committee for Aeronautics (NACA) concrete runway.

Tim Morgan - Asked Jeff where was the train derailment you mentioned ?
Jeff Lock- Out west somewhere.. The derailment was reported in newspapers, and he recalled that it occurred during warm weather.

5 Ray McDaniel
When re-doing Water Works 3, they were deciding whether to put in a feed line to Kirwan Reservoir or dam Hinckley Creek where it exits the installation and flood the upstream impounded area to get additional water.
Somebody ask him if he knew where the mustard agent was buried.
He told them that to the best of his knowledge, it was about 1000' west of Hinkley Creek, inside an area fenced with chain link and railroad ties used as fence posts, and totally overgrown with vegetation in side of the fence – while deer ate up vegetation around the outside of the fence.
Railroad ties were also present at Hinckley Creek to facilitate crossing the creek.
He took the Corps of Engineers project personnel to the site.
The decision was made to take the feed line to Kirwan Reservoir, rather than flood Hinckley Creek.
The Kirwan Reservoir feed line was constructed, but never used.

6 LTC Tom Tadsen - Asked if Ray McDaniel could be more definitive about the mustard agent location.
Ray McDaniel - Said it was near the west end of NACA, across Hinkley Creek.
There was a bridge made of railroad ties across Hinckley Creek to access the site.

Eileen Mohr- Asked Ray McDaniel how big the area was.
Ray McDaniel – Said the entire site was less than 100' square.

He said the last time he visited the site, there was log across Hinkley Creek.
He also said the site was about 1000 yards from the end of the NACA runway, and was not a big area.

Tim Morgan - Asked Ray McDaniel if the location was along the old power line right-of-way.
Ray McDaniel said No- It was in the area where he used to hunt deer, known as Barney's (cattle grazing) lease.

LTC Tom Tadsen- Asked what was the time frame of that mustard agent burial ?
Ray McDaniel – Said he thought it occurred while he was away during WW II, not in late 1940's. He added that Open Demolition Area #1 was not active during WW II.

LTC Tom Tadsen - Noted that the originally fenced area is the current site designated RVAAP-28.

Tim Morgan – Asked if Ray McDaniel had any idea of the quantity of mustard agent.
Ray McDaniel- Said he doesn't know, but doesn't suspect that it was very much.

7 Irv Venger- Asked Ray McDaniel if he any idea what was involved ???
Ray McDaniel responded no.
About the same time they were cleaning out the Water Works 3, they took out many 155 mm shrapnel artillery projectiles, metallic debris, ball bearings (shrapnel), grape shot shells (unloaded) from WW I, etc.
They cleaned out the existing pond and turned it into three ponds to treat spent brine solution from water treatment.

8 LTC Tom Tadsen tasked Jeff Lock- What time frame did his dad work there (at RVAAP) ?
Jeff- Said his dad worked from early on- in 1940's, then was activated for service during WW II.

9 Eileen Mohr - Asked Ray McDaniel if the WW3 ponds were cleaned well.
Ray McDaniel - Said they cleaned out the pond pretty well. It looked like they got most of the material out, but wasn't sure.
The APCO stocked the ponds with fish, and did surveys of the ponds with a guy from Princeton, IN.
They certified that the water was good, and had good strong springs in the south pond, 12 – 16 ' deep.
He said the center pond is very shallow.
He also said the north pond is the only pond that ever received spent brine solution from the WW3.

10 LTC Tom Tadsen – Asked Jeff Lock when he had worked at the arsenal.
Jeff Lock – Said from1965 as summer help at the Winklepeck Burning Ground- then (except for a stint in the Army- came back in Feb 1969) to the end of 1969 full time.
He worked at the east round house and left in late 1970 or 71 to attend Kent State.
Jeff said he had been raised until 8 on the Portage Ordnance Depot side of the arsenal, on old Rt 80, near the Bolton farm.

Dave Brancato- Asked Jeff Lock if he could clarify when radio signal was faint, why he noted it.
Jeff Lock - Said the radios had a very short range, and he knew that he was getting the signal from far away from the east round house, even though his dad indicated he was close to the round house.

11 LTC Tom Tadsen – Asked Ray McDaniel what kind of digging equipment the Arsenal had that could dig a hole deep enough to investigate for the mustard agent containers.
Ray McDaniel- Said that the Arsenal had clam shells, but doesn't really remember.

LTC Tom Tadsen- Had asked Ray McDaniel about equipment because he was trying to determine how deep the containers might have been buried.
Ray McDaniel- Said by 1969, he would think that if any containers were excavated, they would only find rust, and perhaps some minor breakdown chemicals.
He said that any container would have rusted, and the chemicals leached out by then.
He could see at the time, how if they flooded the area (instead of the Kirwan feed line) there could have been a problem, because it would have flooded a large area, including the alleged mustard agent burial site.

12 LTC Tom Tadsen - Asked Ray McDaniel when they were considering building the large pond.
Ray McDaniel- Said they had two proposals, a 500 acre lake or put in pipeline to Kirwan Reservoir.
After they started, the environmental people complained about trees and land that might be destroyed or torn up etc, and forced them to bury the lines.
WW3 was the baby of COL Girard, who was in charge at the time.

LTC Tom Tadsen- Asked Ray McDaniel if that was that mid to late 70's
Ray McDaniel - Yes, it was during the late 70's.

Tim Morgan- Says he has seen plans for the 500 acre lake, and also plans for a golf course.
Ray McDaniel - Said the Bolton Barn was used as office, the Portage Ordnance Depot (POD) had upgraded it for $250,000.
He remembers transferring liquor from the Colonel's house to the Bolton Barn.

13 Irv Venger - Asked Jeff Lock what Henry Lock's job was.
Jeff Lock - Said his dad was a fork lift driver, truck driver, supervisor of the railroad track crew, and supervisor of truck repair.
Ray McDaniel said Jeff's dad worked in Roads and Grounds.

14 Irv Venger - Said that if there had been a derailment, EOD (explosives ordnance disposal) people would been called out.
He said there should be a record of the accident with the Army's Technical Escort Unit (TEU).

Jeff Lock - Said it could have involved mustard agent or something else, and that if it was something clandestine, it would be sneaky.

15 Ray McDaniel - Said the Bolton Barn was the headquarters of the Portage Ordnance Depot.
He also said he served as a security guard there.
He remembers heavily armed escorts every week when they went to pick up the cash payroll.
He said the ROD had a lumber yard, and he did much work there.
He said the railroad yard at the west end (POD) was only for shipping materials out.

16 Irv Venger- Asked Jeff Lock if he had any feel for any location on or under the NACA concrete runway.
Jeff Lock – Said he doesn't know, but suspects it would be at one end.

17 Ray McDaniel - Related a funny story about the NACA people who would stay there overnight in campers. Ray had hunted raccoons in the same area one night. They were close to the trailers, shot about 10 raccoons, got into his car, and drove up South Patrol Road to Greenleaf, where he was greeted by two patrol cars that were checking on the shooting.

18 Paul Zorko - Asked Jeff Lock if having worked at the round house, he had heard any mention of buried munitions or underground storage tanks at the round house.
Jeff Lock - Said no.

19 Ray McDaniel asked whatever happened to the asbestos in the tanks at the tank farm ?
Irv Venger - Said the Army sold the material and removed the tanks.

20 LTC Tom Tadsen- Asked Ray McDaniel if he knew when the NACA runway was built.
Ray McDaniel - Said he thought in the early 40's, but at that time he wasn't involved in those activities at all.
Paul Zorko- Said the Corps will look into when construction of NACA facilities took place.
John Jent – Said that the NACA facilities clearly show up on the 1951 aerial photographs.

21 Paul Zorko asked if any NACA personnel would have flown in and out ?
LTC Tom Tadsen- They would have flown in and out in support aircraft.

22 John Jent said that in 1978 the Army was doing environmental assessments of the installations.
A suspected "Mustard Agent Burial Site" was reported and so was included as one of the environmental sites.
He said he had called Huntsville U.S. Army UXO Center of Expertise in late 90's and got much information from them.

23 Paul Zorko: Concerning the recent Archive Search Report, he contacted the Army Chemical Corps historian @ Aberdeen Proving Ground, MD.
The historian provided a bill of lading indicating that one railcar load of mustard went from RVAAP to the Bluegrass Army Depot (BGAD) in 1943, escorted by an Army TEU (Technical Escort Unit).

24 LTC Tom Tadsen: Noted that RVAAP has an isolation track. This track could have been used for safe haven (overnight secure storage of loaded railcars of explosives or chemical agents traveling cross-country) of a mustard agent shipment. The bill of lading itself does not indicate that there was any long-term storage of mustard agent at RVAAP.
Ray McDaniel concurred. He said that safe haven was very common, and that it could have been an overnight stop for a train with mustard agent.
LTC Tom Tadsen – Asked the Corps to check to see if BGAD has a receiving document for the 1943 shipment.
Jeff Lock – Said he thought the material (mustard agent) was probably secretly buried and not removed off from the site.

25 Tim Morgan- Asked Ray McDaniel if he could indicate on an aerial photograph the approximate location of the suspected mustard agent burial site.
Ray McDaniel looked the aerial photograph over and fingered the exact location adjacent to the old NACA power line that is thought to be the site.

After a short break, the group drove to the west end of the NACA runway.

LTC Tom Tadsen took Jeff Lock, Sarah Lock, and Ray McDaniel to the west end of the NACA runway and showed them the 1969 investigation pit where a rusty 55-gallow drum and 7 rusty cans were removed in 1969.

After some discussion, LTC Tom Tadsen and Jeff Lock agreed that a limited geophysical investigation from that pit to the west end of the NACA runway would be beneficial.

Jeff Lock stressed that the Army might want to reiterate to the public that the containers were metal and that in all probability, they rusted out years ago.

LTC Tom Tadsen mentioned that, even if the containers had rusted out, the magnetometer tests would pick up the residual iron oxide. If the burial site extended beneath the west end of the concrete runway, the magnetic trail would lead us there.

ATTACHMENT 4

APPENDIX 1

DESCRIPTION OF CHEMICAL AGENT IDENTIFICATION SET TYPES

4-1-1 BACKGROUND SUMMARY

Chemical agent identification sets (CAIS) were developed and manufactured by the Department of the Army (DA) from the 1930s through the 1960s. Approximately 110,000 sets were manufactured. They were distributed to the Department of Defense (DoD) installations for use by all services in training for identifying the various chemical agents that may be encountered on a battlefield.

In April 1971, the DA declared the CAIS obsolete. In 1978 and 1980, two consolidation efforts were completed to gather existing CAIS that were not expended during training and were still in storage at various DoD installations. The consolidation was accomplished at Rocky Mountain Arsenal, Denver, Colorado. All CAIS located at Rocky Mountain Arsenal were destroyed in the CAIS disposal program. A total of 21,458 CAISs were destroyed in the pilot test program in 1979 and during the actual CAIS disposal program from May 1981 through December 1982. However, not all CAIS were accounted for. To date, some unaccounted CAIS have been discovered at isolated storage locations. Periodically, CAIS will continue to be found in this manner, and will need to be destroyed.

4-1-2 CLASSIFICATIONS OF CHEMICAL AGENT IDENTIFICATION SETS

The 17 different sets of CAIS have been classified by both variety and type or Department of Defense Identification Code (DODIC) number groupings. The following paragraphs explain these various classification systems. One type of CAIS, the K945, which was the only set to have contained the nerve agent GB, was completely accounted for and destroyed at RMA by incineration. The K945 kits were produced in very limited quantities and issued to only a few locations. The K945 CAIS were never used for training purposes. Since no K945 CAIS are believed to have survived, they are not addressed in this attachment.

4-1-2.1 Variety

CAIS has been classified into three varieties, as described in the following paragraphs.

a. *Sniff Set.* One major variety of CAIS was an instructional sniff set that contained agents and industrial chemicals impregnated on charcoal. The set was intended for use indoors to instruct military personnel in recognizing the odors of the agents. These sets contained only small amounts of agent.

b. *Sealed Pyrex™ Tubes.* A second variety, designed for use outdoors, consisted of

agents and industrial chemicals (pure, also known as neat, or in chloroform solution) in sealed Pyrex™ tubes. These glass ampules would be detonated, creating an agent cloud. Soldiers would then try to identify the agent based on its odor and other characteristics. These sets typically contained more total agent than the instructional sniff sets.

c. *Bulk Mustard.* A third variety were those containing larger quantities of mustard. These CAIS were used in decontamination training by purposely contaminating the terrain or equipment with mustard and then teaching the soldiers how to don protective clothing and decontaminate the area or equipment. These CAIS contained relatively large quantities of pure mustard relative to both the sniff sets and sealed Pyrex™ tubes.

4-1-2.2 Type or Department of Defense Identification Code Groupings

CAIS has been grouped into seven types or DODIC groupings. Six types are shown as follows. The seventh was the K945 training set, M72, which has been accounted for completely.

a. K941 - toxic gas set, M1
b. K942 - toxic gas set, M2
c. K951 and K952 - identification sets, M1
d. K953 and K954 - Identification sets, AN-M1A1
e. K955 - Navy training set
f. X302 and X545 through X552 - replacement sets

4-1-3 SUMMARY OF CHEMICAL AGENT IDENTIFICATION SETS

Tables 4-1-1 and 4-1-2 summarize the various CAIS. Table 4-1-1 addresses the classification and packaging, and Table 4-1-2 provides a summary of CAIS chemical agents and industrial chemicals and their applicable state and Resource Conservation and Recovery Act (RCRA) waste codes.

4-1-4 DETAILED DESCRIPTION OF CHEMICAL AGENT IDENTIFICATION SETS

4-1-4.1 Set K941 - Toxic Gas Set, M1 (Figure 4-1-1)

a. *Old stock number:* FSN 1365-219-8574

b. *Timeframe of use:* World War II (WWII) to late 1950s

Table 4-1-1. Summary of Chemical Agent Identification Sets Classifications and Original Packaging

CAIS DODIC	Types(Nomenclature, Model)	Varieties	Outer Container	Agent Container, (Number of Containers)	Containers per Packaging
K941	Toxic gas set, M1	Bulk mustard	PIG	Bottle (24)	4 bottles per pressure sealed can[a] with 6 pressure sealed cans[a] per PIG
K942	Toxic gas set, M2	Bulk mustard	Drum	Heat-sealed bottle (28)	1 heat-sealed bottle per pressure sealed can[a] with 28 pressure sealed cans[a] per drum
K951,K952	Identification set, M1	Sealed Pyrex™ tubes	PIG	Ampule (48)	12 ampules per press-fit can[b] with 4 press-fit cans[b] per PIG
K953, K954	Identification set, AN-M1A1	Sealed Pyrex™ tubes	PIG	Ampule (48)	12 ampules per press-fit can[b] with 4 press-fit cans[b] per PIG
K955	Navy Identification set	Sniff set	Wooden box	Bottle (7)	1 bottle per sealed can[c] with 7 sealed cans[c] per box
X302, X545 through 552	Navy Replacement set	Sniff sets	Wooden box	Bottle (2)	1 bottle per sealed can[c] with 2 sealed cans[c] per box

Notes:

[a] coffee-can-type key
[b] cookie can lid
[c] paint can lid

Table 4-1-2. Summary of Chemical Agent Identification Sets DODIC's and the Chemical Agents/Industrial Chemicals Contents

Chemical Agents/ Industrial Chemicals	N	CC			CHLOROFORM				CC	N		N	SOLIDS		
	H[a]	(H)[a]	(HN)	(L)	H[a] 5%	HN 10%	L 5%	PS 50%	(PS)	CK	GA Sim	CG	CG Sim	CN	DM
Department of Defense Identification Codes (DODIC)	D004-D011, D022, D028, D043; P999	D004-D011, D022, D028, D043; P999	D004-D011, D022, D028, D043; P999	D004-D011, D022, D028, D043; P999	D004-D011, D022, D028, D043; P999	D004-D011, D022, D028, D043; P999	D004-D011, D022, D028, D043; P999			P033		P095			
$K941_{(24)}$	B_{24}														
$K942_{(28)}$	B_{28}														
$K951/2_{(48)}$					A_{12}		A_{12}	A_{12}				A_{12}			
$K953/4_{(48)}$					A_8	A_8	A_8			A_8	A_8	A_8			
$K955_{(7)}$		$(B)_2$		(B)					(B)				B	B	B
$X302_{(2)}$			$(B)_2$												
$X545_{(2)}$													B_2		
$X546_{(2)}$														B_2	
$X547_{(2)}$		$(B)_2$													
$X548_{(2)}$				$(B)_2$											
$X549_{(2)}$															B_2
$X550_{(2)}$			$(B)_2$												
$X551_{(2)}$			$(B)_2$												
$X552_{(2)}$									$(B)_2$						

[----------Chemical Agents to be Neutralized ----------] [---------- Industrial Chemicals to be Repackaged ----------]

Note:
[a] H = H/HS/HD

KEY: $B_{\#}$=Bottle$_{\text{Number of}}$ $A_{\#}$=Ampule$_{\text{Number of}}$ (B)=Bottle with Charcoal A=Ampule with Chloroform

N = Neat CC = Charcoal

c. *Chemical agents and amounts:* Twenty-four bottles, each containing approximately 103 milliliters (ml) of sulfur mustard (H/HS/HD) or distilled mustard (HD) for a total of 2.5 liters per set.

d. *Packaging:*

1. *Bottle:* Twenty-four round, glass, 4-ounce bottles, each with a small plastic screw top. Heat-resistant paint on the bottles indicates "H" or "HD", "TOXIC GAS SET, M1".

2. *Can:* Four bottles are packed in 0.5-inch layers of sawdust within a pressure sealed metal can. The round cans are 5.5 inches in diameter and 6.25 inches high. Each can has a coffee-can-type key on the bottom for opening.

3. *PIG:* Six metal cans are packed into a steel shipping cylinder known as a PIG. The PIG is 6.625 inches in diameter, approximately 40 inches long, and 0.145 inches thick. The open end of the PIG is closed by a flange end-cover called a flange blank. The flange blank is 9.25 inches in diameter and is secured by eight bolts tightened over a 0.125-inch-thick lead gasket. The empty PIG weighs approximately 80 pounds.

4-1-4.2 Set K942 - Toxic Gas Set, M2 (Figure 4-1-2)

a. *Old stock number:* FSN 1365-563-4146

b. *Timeframe of use:* Korean War era

c. *Chemical agents and amounts:* Twenty-eight bottles, each containing approximately 118 mL of mustard (H, HD, or HS) for a total of 3.3 liters per set.

d. *Packaging:*

1. *Bottle:* Twenty-eight round, glass bottles are heat-sealed at one end. Reference is made to this glass container as an ampule; however, it is more similar to a bottle. It is 1.875 inches in diameter and 4.625 inches high.

2. *Can:* Each bottle has its own metal can. The round metal can is 2.68 inches in diameter and 6.34 inches high. Each can has a coffee-can-type key on the bottom for opening.

3. *Drum:* Twenty-eight cans are packed in a cold-rolled carbon steel drum. The drum is 14 inches in diameter, 14 inches high, and 0.0375 inches thick (20 gauge). There are two layers of cans (14 cans per layer). The cans are separated into individual compartments by fiberboard packaging.

Note: Some of CAIS K942 were repackaged into press-fit cans (as found in the K951). There were two bottles per can with vermiculite or sawdust used as a

packing material. Four cans were packaged into a PIG (like the K941 PIG).

4-1-4.3 Set K951 - War Gas Identification Set, Detonation, M1; and Set K952 - War Gas Identification Set, Instructional, M1 (Figure 4-1-3)

a. *Old stock number:* FSN 1365-025-3273 (K951), FSN 1365-025-3783 (K952)

b. *Timeframe of use:* Early 1930s to late 1950s

c. *Chemical agents and amounts:* Forty-eight glass ampules, of which there are 12 ampules each of 4 different chemical agents/industrial chemicals. Sulfur mustard and lewisite (L) chemical agent ampules contain approximately 40 mL of solution (chemical agent in chloroform) for a total of 960 mL of solution with chemical agent per set, or 48 mL of chemical agent per set.

1. Twelve ampules of 5-percent sulfur mustard in chloroform, each with 2 mL sulfur mustard in 38 mL chloroform for a total of 24 mL sulfur mustard and 456 mL chloroform.

2. Twelve ampules of 5-percent L in chloroform, each with 2 mL L in 38 mL chloroform for a total of 24 mL L and 456 mL chloroform.

3. Twelve ampules of 50-percent PS in chloroform, each with 20 mL PS in 20 mL chloroform for a total of 240 mL PS and 240 mL chloroform.

4. Twelve ampules of neat CG, not in chloroform, each with 40 mL CG for a total of 480 mL CG.

d. *Packaging:*

1. *Ampule:* Each ampule is made of Pyrex™ and is hermetically sealed. The ampule is 1 inch in diameter and 7.5 inches long.

2. *Cardboard Tube:* Each ampule is packed in a cardboard container (mailing-tube type) with a metal screw-cap top. Each tube has the agent type indicated by agent symbol on the cardboard container.

3. *Can:* Twelve cardboard containers, each packaged into a press-fit metal can. The can is 5.5 inches in diameter and 9.25 inches high. Originally, three ampules of each of the four chemical agent/industrial chemicals were packaged in each can.

4. *PIG:* Four cans are packed into a steel cylinder known as a PIG. The PIG is 6.625 inches in diameter, approximately 40 inches long, and 0.145 inches thick. The open end of the cylinder is closed by a flange end-cover called a flange blank. The flange blank is 9.25 inches in diameter and is secured by eight bolts tightened over a 0.125 inch-thick lead gasket. The empty PIG weighs approximately 80 pounds.

Note: The only difference between the K951 and K952 sets is that the K951 was issued with blasting caps that were packed and shipped in a separate container. The blasting cap container is not processed by the Rapid Response System.

4-1-4.4 Set K953 - War Gas Identification Set, Detonation, AN-M1A1 and Set K954 - War Gas Identification Set, Instructional, AN-M1A1 (Figure 4-1-3)

a. *Old stock number:* FSN 1365-323-7728 (K953), FSN 1365-338-0735 (K954)

b. *Timeframe of use:* Korean War era

c. *Chemical agents and amounts:* Forty-eight glass ampules of which there are eight ampules each of six different chemical agents/industrial chemicals. Distilled mustard (HD), nitrogen mustard (HN-1) and lewisite (L) agent ampules containing approximately 40 mL of solution (chemical agent in chloroform). This is a total of 960 mL of solution with agent, per set or 64 mL of chemical agent per set.

1. Eight ampules of 5-percent HD in chloroform, each with 2 mL HD in 38 mL chloroform for a total of 16 mL HD and 304 mL chloroform.

2. Eight ampules of 10-percent HN-1 in chloroform, each with 4 mL HN-1 in 36 ml chloroform for a total of 32 mL of HN-1 and 288 mL chloroform.

3. Eight ampules of 5-percent L in chloroform, each with 2 mL L in 38 mL chloroform for a total of 16 mL L and 304 mL chloroform.

4. Eight ampules of neat CG for a total of 320 mL.

5. Eight ampules of neat CK for a total of 320 mL.

6. Eight ampules of GA simulant (mixture of ethyl malonate, oenanthic ether, and benzonitrile) for a total of 320 mL.

d. *Packaging:* These sets are packed in ampules, cans, and PIG containers similar to the K951 and K952 as explained in paragraph C-4.3 d., one difference being that originally just two ampules of each of the six chemical agent/industrial chemicals were packaged in each can.

Note: The only difference between the K953 and K954 sets is that the K953 was issued with blasting caps that were packed and shipped in a separate container. The blasting cap container is not processed by the Rapid Response System.

4-1-4.5 Set K955 - Set, Gas Identification, Instructional, M1 (Navy) (Figure 4-1-4)

a. *Old stock number:* FSN 1365-368-6154

b. *Timeframe of use:* Late 1930s to WWII

c. *Chemical agents and amounts:* Seven glass bottles with three chemical agent bottles, each containing 25 mL of chemical agent, for a total of 75 mL of chemical agent per set. Four of the bottles each contain 3 ounces (90cc) of activated charcoal on which chemical agent/industrial chemical is absorbed (described as follows).

1. Two bottles of sulfur mustard absorbed on charcoal - 25 mL of sulfur mustard each or 50 mL total.

2. One bottle of L absorbed on charcoal - 25 mL of L.

3. One bottle of PS absorbed on charcoal - 25 mL of PS.

4. One bottle of Triphosgene (CG simulant) - 3 grams of solid.

5. One bottle of CN - 15 grams of solid.

6. One bottle of DM - 15 grams of solid.

d. *Packaging:*

1. *Bottle:* The seven, round, glass bottles are 4-ounce bottles with a ground-glass stopper that is usually coated (sealed). As previously noted, the bottles frequently contain charcoal.

2. *Can:* Each bottle has its own green metal can. The sealed cans are 4.25 inches in diameter and 6.75 inches high. They have a paint-can-type lid that is sealed.

3. *Box:* The box is a hinged-cover wooden box that resembles a foot locker and measures 30.375 inches long, 15.5 inches wide, and 11.75 inches high. The inside of the box is divided into eight sections. Seven of the sections contain sealed metal cans in sawdust, and the eighth has instructions.

4-1-4.6 Set X302 - Replacement Set, Gas Identification, Instructional (Navy)
(Figure 4-1-5)

a. *Old stock number:* FSN 1365-038-5183

b. *Timeframe of use:* WWII to Korean War era

c. *Chemical agents and amounts:* Two bottles each contain 3 ounces (90cc) of activated charcoal on which 25 mL of chemical agent is absorbed (described as follows). This is a total of approximately 50 mL of chemical agent per set.

1. One bottle of HN-1 absorbed on charcoal - 25 mL.

2. One bottle of HN-3 absorbed on charcoal - 25 mL.

d. *Packaging:*

1. *Bottle:* Each bottle is a 4-ounce round bottle with a ground-glass stopper that is usually wax coated.

2. *Can:* Each bottle has its own metal can. The cans are 4.25 inches in diameter and 6.75 inches high, with a paint-can-type lid that is sealed. One bottle is packed with sawdust in the can.

3. *Box:* The wooden box has a hinged cover and measures 7.5 inches wide, 16 inches long, and 11.75 inches high. The box is divided into two sections. Each section contains a can with a bottle that is surrounded by packing material.

4-1-4.7 Sets X545 Through X552 - Replacement Sets (Navy) (Figure 4-1-5)

The following eight types of replacement sets were used by the Navy to replace components of the K955 and X302 sets. The replacement sets X545 through X552 contain two bottles with each bottle having either approximately 25 mL of chemical agent/industrial chemical absorbed on activated charcoal, or a solid industrial chemical as outlined below. They were packaged in the same manner as the X302 (paragraph 4-1-4.6).

a. X545 - triphosgene, CG simulant, (no charcoal)
- 6 grams of solid per set
- old FSN 1365-608-5322

b. X546 - CN (no charcoal)
- 30 grams of solid per set
- old FSN 1365-608-5323

c. X547 - H/HS/HD absorbed on charcoal
- 50 mL per set
- old FSN 1365-608-5324

d. X548 - L absorbed on charcoal
- 50 mL per set
- old FSN 1365-608-5325

e. X549 - DM (no charcoal)
- 30 grams of solid per set
- old FSN 1365-608-5326

f. X550 - HN-1 absorbed on charcoal
- 50 mL per set
- old FSN 1365-608-5327

g. X551 - HN-3 absorbed on charcoal
- 50 mL per set
- old FSN 1365-608-5328

h. X552 - PS absorbed on charcoal
- 50 mL per set
- old FSN 1365-608-5328

ATTACHMENT 2

CALIBRATION OF ELECTROMAGNETIC INSTRUMENTS

Calibration of Electromagnetic Instruments

1.0 GEM-2

The GEM-2 is a broadband electromagnetic sensor manufactured by Geophex Ltd. The physical parameters describing the coil and calibration parameters are set at the factory and should never need to be changed. There are two calibration sets with complex values (i.e., inphase and quadrature), each are a function of frequency. The calibration procedures are performed at Geophex and the calibration values are stored in the GEM software. No other calibration procedures are required. The two calibration sets are:

1. Amplitude calibration - this is done using a "Q coil" with known radius, number of turns, resistance, and inductance. It mainly sets the amplitude scale.

2. Free-air calibration - The sensor output must approach zero when you move it away from any conductor. Because this is hard to do on earth, this calibration in performed in the air. The required height is typically 5 to 10 times that of the coil spacing. At the factory, the sensor is raised 6 to 10m above ground in an area known not to contain any conductors, and the sensor response there is known as the "free-air values". This calibration does depend on the ground conductivity, but it is simply a DC offset.

For most applications, a precise calibration is not critical. Normally, the operator is interested only in relative values – deviations from a base value that appear as anomalies in a map or profile. The calibration factors (multiplier and DC offset) affect the absolute values of the data but not the appearance of the anomalies. Because of this, the manufacturer suggests that the operator does not change the amplitude calibration.

However, the offset calibration can be a problem over a very conductive or resistive area, when an absolute conductivity map is desired. In this case, the background conductivity from other measurements (DC resistivity, for instance) is known, one can simply add or subtract a constant from the entire dataset so that it fits the background. Still, the process does not change the map appearance.

Another beneficial feature of the GEM-2 is that it is designed to minimize the temporal drift in a way that is different from all other instruments. The GEM-2 ski contains three coils that are precisely maintained in their relative separations amongst each other. Any small changes in the relative separations can cause a shift (or drift) in the signal level. The GEM-2 coils are permanently entombed in a "ski" structure made of synthetic materials that has a low thermal expansion coefficient and, therefore, their relative locations are firmly fixed. The sensor is designed to "linearly" expand or contract following the ambient temperature. This linear expansion precisely maintains the relative positions and, therefore, the bucking condition. This feature is quite unique for this design. Owing to this careful design and manufacturing, the GEM-2 has not shown any appreciable drift in time or with temperature. Another way the instrument is designed to minimize temporal drift, is the way the console is designed and mounted on the ski. The console, which is encased in a protective metal box, is located where the field gradient is minimum so that its slight displacement would cause little shift in the signal. There are no moving parts in the console. The battery is internal and not removable. If the

operator believes the sensor may be drifting, then the screws that mount the console to the ski can be tightened slightly.

Prior to commencing a survey, the GEM-2 is operated for approximately 5 minutes as a warm-up period. While the instrument is warming up, the operator removes all metal objects including watches, keys, etc from his/her person. Once the machine has warmed up, surveying is begun. To ensure quality data collection, the line lengths are kept short enough to allow easy visibility of one end of the line from the other end. This ensures that the walked lines will be relatively straight. When utilizing dead reckoning positioning (i.e. not GPS-controlled positioning), the operator makes every effort to walk at a constant speed to ensure accurate in-line positions.

2.0 EM-61

The EM-61 is a high-sensitivity, high resolution, time-domain metal detector manufactured by Geonics. To ensure quality data collection using the EM-61, several tests are performed at the start of the survey.

At the start of each day, cables, connectors, harnesses, etc. are inspected for signs of wear or damage. Once the equipment has been inspected, a cable test may be performed. This is completed by powering up the instrument and allowing it to run for five (5) minutes to warm up. Then, with the instrument held in a static position, the cables are shaken from one end and moving to the other to test for shorts and broken wires or pins.

Once it is confirmed that the equipment is working correctly, the static background test and static instrument response tests are then performed. These tests are performed twice a day to determine whether the instrument is collecting stable readings. Improper instrument function, the presence of local sources of ambient noise (such as EM transmissions from high- voltage electric lines), and instability in the earth's magnetic field (as during a magnetic storm) are all potential causes of inconsistent, non-repeatable readings. The operator reviews the readings to confirm their stability prior to beginning the geophysical survey. The background test is completed by first establishing an area for the test that offers convenient access, is free of metal (surface and sub-surface), and is sufficiently far from roads and power lines, transmitters, etc. to avoid these sources of noise. Once the test location has been selected, the instrument is placed at its normal operating height and orientation so that it will remain stationary, and data is collected for a minimum of three minutes. Data collected during static tests should be retained for documentation purposes. The effects of ambient noise may vary across a project site. Therefore, it may be necessary to perform several static tests across the survey area.

Following the static background test, a static instrument test is performed. The static instrument test quantifies the response of the instrument to a standard test item. A standard 2'' diameter steel trailer ball is typically used as a test item, because it is easily acquired and transported. To perform the test, the instrument position is maintained over the test item, and data is collected for a minimum three minute period. The test will document the amplitude of response to the test item and instrument drift.

Once the static tests have been completed, the six-line test may optionally be performed. The process for this test is illustrated in Figure 1. First, an area that has little background noise and

no sources of anomalous responses is selected. Six lines of equal length over which to collect data are marked. The background response over the test area is established in Lines 1 and 2. Next, a standard test item, such as the steel trailer hitch ball used in the static response test is used for Lines 3 through 6. Line 3 and 4 are collected at a normal pace. Line 5 is collected at a fast pace, and Line 6 at a slow pace. Heading effects, repeatability of response amplitude, positional accuracy, and latency are evaluated in these lines.

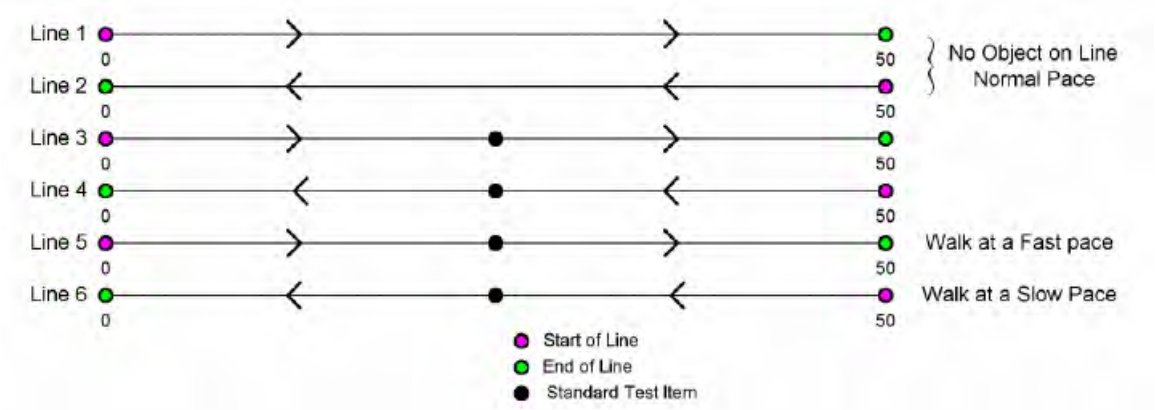

Figure 1. Example Six Line Test Site

3.0 EM-31

The EM-31 is an electromagnetic conductivity meter, manufactured by Geonics. Before a survey is conducted using the EM-31, five (5) instrument tests are performed. These tests are performed in an area free from metal objects and electromagnetic interference.

The first test, a battery check, is performed to ensure proper supply voltage over the duration of the survey. To check the battery, the MODE switch is set to OPER position and the RANGE switch is rotated to BATT position. If meter reads above ±4.4 then batteries are in good condition (C size). If not, they are replaced with fresh C size batteries.

The second test is a DC null adjustment to verify the zero position of the receiver circuitry. To perform this check, the transmitter coil tube is attached. The RANGE switch is set to the least sensitive position (1,000 mS/m), then the MODE switch is set to OPER and the zero reading is checked. The tolerance for this test is ±1 mS/s. If the reading is not within ±1 mS/s of zero, the DC ZERO CONTROL is adjusted accordingly. Once this test done, the instrument is turned off and the receiver coil tube is attached.

The third test is to modify the zero component of the inphase reading. To do this, the RANGE switch is set to 100 mS/m. Then the MODE switch is set to the OPER position and the inphase meter reading is adjusted to zero using the COARSE and FINE COMPENSATION controls. The tolerance for this check is ±1 ppt.

The fourth test checks the phase of the instrument. This is completed by setting the MODE switch to the PHASE position. The meter reading is noted, then the COARSE control is rotated

one step clockwise. If the conductivity meter reading remained the same (tolerance ±0.2), the phase is already correct. If there is a difference in the readings, the PHASE potentiometer is adjusted accordingly. The adjustment is confirmed by repeating the phase check as necessary.

The fifth and final test is to check the sensitivity of the instrument. To do this, the MODE switch is set to the COMP position and the COARSE control is rotated clockwise one step. The conductivity reading should change between 22 to 26 mS/m. This value is recorded for future reference. The coarse switch is then returned to its original setting and the mode switch set to OPER. The EM31 is now ready to make ground conductivity measurements.

ATTACHMENT 3

SITE SAFETY AND HEALTH PLAN ADDENDUM

SITE SAFETY AND HEALTH PLAN ADDENDUM
FOR THE GEOPHYSICAL SURVEY
SUSPECTED MUSTARD AGENT SITE
RAVENNA ARMY AMMUNITION PLANT, RAVENNA, OHIO

Prepared for:

U.S. Army Corps of Engineers
Louisville District
600 Dr. M.L. King Jr. Pl.
Louisville, KY 40202-2230

Contract No. W912QR-04-D-0036
Delivery Order No. 0006

Prepared by:

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1800 Carillon Boulevard
Cincinnati, Ohio 45240

November 2007

APPROVALS

SITE SAFETY AND HEALTH PLAN ADDENDUM
FOR THE GEOPHYSICAL SURVEY
SUSPECTED MUSTARD AGENT SITE
AT THE RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO

Contractor Program Manager	Telephone	Date

Contractor Health & Safety Officer	Telephone	Date

CONTENTS

CONTENTS (continued)

TABLES

FIGURES

ACRONYMS

AOC	Area of Concern
CHSO	Contractor Health & Safety Officer
COC	contaminant of concern
DNT	dinitrotoluene
EOD	explosive ordnance disposal
FSHP	Facility-Wide Safety and Health Plan
GI	gastrointestinal
HCl	hydrochloric acid
H&S	Health and Safety
JMC	Joint Munitions Command
MEC	munitions and explosives of concern
MSDS	Material Safety Data Sheet
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
PPE	personal protective equipment
PVC	polyvinyl chloride
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
RVAAP	Ravenna Army Ammunition Plant
SHP	Safety & Health Plan
SSHO	Site Safety and Health Officer
TNT	2,4,6-trinitrotoluene
USACE	U.S. Army Corps of Engineers

INTRODUCTION

This Safety and Health Plan (SHP) Addendum for the Geophysical Survey at the suspected mustard agent burial area sets forth the minimum requirements for protecting personnel involved in performing work under this program at the Ravenna Army Ammunition Plant (RVAAP). Standard procedures must be used to minimize the potential for personnel injury or illness. These will include on-site training, routine inspections, visual and instrument (as appropriate) surveillance for munitions and explosives of concern, and enforcement of the health and safety requirements by project management. This plan is organized to follow and address the requirements in Appendix B to ER 385-1-92, "Safety and Occupational Health Document Requirements for Hazardous, Toxic, and Radioactive Waste and Ordnance and Explosive Waste Activities." It is designed to comply with the requirements of Environmental Management (EM) 385-1-1, "U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual," and relevant Occupational Safety and Health Administration (OSHA) regulations. This plan was prepared to provide guidance on health and safety hazards and controls. Nothing in this document relieves the contractor from the requirements to comply with all applicable portions of the EM 381-1-1 and OSHA regulations, and to provide a safe workplace.

This SHP Addendum is intended to serve as a lower-tier document to the Facility-Wide Safety and Health Plan (FSHP) and is intended to address the hazards and controls expected to be unique to the anticipated on-site tasks involved in performance of work under the geophysical investigation. A copy of the FSHP and this SHP addendum will be present and available for review at each work site.

Anticipated environmental investigation tasks expected to be performed during implementation of the geophysical investigation work plan include:

- Site visits.
- Vegetation clearing.
- Geophysical Survey

Potential hazards posed by the planned tasks include injury from ordnance and explosives; noise and cut hazards associated with clearing vegetation; lifting, noise, and strain hazards associated with operating sampling equipment; fuel fires; temperature extremes; stinging/biting insects; poisonous plants; and snakes. The potential for chemical overexposure appears to be minimal, given the nature of planned tasks, (i.e. a non-intrusive geophysical survey of the subject area). If necessary, the Contractor Site Safety and Health Officer (SSHO) will upgrade the required PPE to dermal contact with potentially contaminated materials. The Contractor SSHO will observe all site tasks during daily safety inspections and will use professional judgment and appropriate monitoring results to determine if upgrading PPE is required. A detailed analysis of these hazards and specific appropriate controls is presented in Section 2, Table 2-2.

SECTION 1

FACILITY DESCRIPTION AND CHARACTERIZATION

1.1 Facility Description

Past Department of Defense (DOD) activities at the Ravenna Army Ammunition Plant (RVAAP) date to 1940 and include the manufacturing, loading, handling and storage of military explosives and ammunition. Until 1999, the RVAAP was identified as a 21,419-acre installation. The property boundary was resurveyed by the Ohio Army National Guard (OHARNG) over a two year period from 2002 and 2003 and the actual total acreage of the property was found to be 21,683.289 acres. As of February 2006, a total of 20,403 acres of the former 21,683 acre RVAAP have been transferred to the United States Property and Fiscal Officer (USP&FO) for Ohio for use by the OHARNG as a military training site. The current RVAAP consists of 1,280 acres in several distinct parcels scattered throughout the confines of the OHARNG Ravenna Training and Logistics Site (RTLS). The RVAAP and the RTLS are collocated on contiguous parcels of property and the RTLS perimeter fence completely encloses the remaining parcels of the RVAAP. The RTLS is in northeastern Ohio within Portage and Trumbull Counties, approximately 4.8 kilometers (3 miles) east-northeast of the city of Ravenna and approximately 1.6 kilometers (1 mile) northwest of the city of Newton Falls (Figure 1). The RVAAP portions of the property are solely located within Portage County. The RTLS (inclusive of the RVAAP) is a parcel of property approximately 17.7 kilometers (11 miles) long and 5.6 kilometers (3.5 miles) wide bounded by State Route 5, the Michael J. Kirwan Reservoir, and the CSX System Railroad on the south; Garret, McCormick, and Berry roads on the west; the Norfolk Southern Railroad on the north; and State Route 534 on the east (see Figures 1 and 2). The RTLS is surrounded by several communities: Windham on the north; Garrettsville 9.6 kilometers (6 miles) to the northwest; Newton Falls 1.6 kilometers (1 mile) to the southeast; Charlestown to the southwest; and Wayland 4.8 kilometers (3 miles) to the south. When the RVAAP was operational the RTLS did not exist and the entire 21,683-acre parcel was a government-owned, contractor-operated (GOCO) industrial facility. The RVAAP Installation

Restoration Program (IRP) encompasses investigation and cleanup of past activities over the entire 21,683 acres of the former RVAAP and therefore references to the RVAAP in this document are considered to be inclusive of the historical extent of the RVAAP, which is inclusive of the combined acreages of the current RTLS and RVAAP, unless otherwise specifically stated.

The facility was active from 1941 to 1992. On-site activities included loading, assembling, storing and packing military ammunition, demilitarization of munitions, production of ammonium nitrate fertilizer, and disposal of "off-spec" munitions. Munitions handled on the installation included artillery rounds of 90 mm or more and 2,000-pound bombs. A number of Areas of Concern (AOCs) have currently been identified. A description of each AOC is included in the installation Preliminary Assessment (December 1995), the RVAAP Installation Action Plan (2003), and the Relative Risk Site Evaluation (USACHPPM 1998).

The RVAAP AOCs were associated with the assembly, storage, shipment, and/or disposal of a variety of materials including munitions and wastes. The principal munitions assembled on the installation were artillery rounds of 90 mm or more and 2,000-pound bombs. Contaminants of concern that are potentially present include explosive compounds [cyclonite, trinitrotoluene (TNT), smokeless powder], propellants, polychlorinated biphenyls, petroleum hydrocarbons, and metals (aluminum, arsenic, barium, cadmium, chromium, lead, manganese, mercury, selenium, silver, and zinc). The AOCs associated with this project are the former NACA Test Site and the Mustard Agent Burial Site. Potential contaminants at the NACA Test site include low levels of metals, volatile organic compounds (VOCs), and inorganics (e.g., nitrocellulose). The Mustard Agent Burial Site AOC is reported to have buried mustard agent containers. It should be noted that given the non-intrusive nature of the geophysical investigation contact with any mustard agent or associated breakdown products is unlikely.

SECTION 2

HAZARD/RISK ANALYSIS

The purpose of the task hazard analysis is to identify and assess potential hazards that may be encountered by personnel and to prescribe required controls. Table 2-1 is a checklist of common hazards that may be posed during the implementation of the Geophysical Survey. It indicates whether a particular major type of hazard is present. The tasks to be performed as part of the survey are expected to consist of clearing vegetation; and performing a geophysical survey using electromagnetic equipment and ground penetrating radar. In general, given these tasks, the potential for unacceptable exposure to contaminants appears to be low. The expected tasks present a variety of physical hazards including munitions and explosives of concern (MEC) potentially present throughout the facility, contact with equipment, noise, and heat/cold stress. Contact with mustard agent Chemical Agent Identification Sets (CAIS) is not anticipated given the non-intrusive nature of this study.

TABLE 2-1. HAZARDS INVENTORY

Yes	No	Hazard
	X	Confined space entry. [Not anticipated. Any confined space entry will require assessment in the SSHP Addendum and compliance with Section 9.4.]
	X	Excavation entry. [Not anticipated. Any excavation entry will require sloping or shoring excavation and compliance with all other applicable requirements.]
	X	Heavy equipment (drill rigs, backhoes). [Not anticipated.]
X		Potential dangerous tools (brush clearing with chainsaws, machetes, sling blades)
X		Heavy lifting (geophysical survey equipment)
X		Fire (fuels)
	X	Explosion (munitions and explosives of concern)
X		Electrical shock (electrical equipment)
	X	Exposure to chemicals (site contaminants and chemicals used during site work)
X		Munitions and explosives of concern (MEC)
X		Temperature extremes
X		Biological hazards (poison ivy, Lyme disease, Histoplasmosis)
	X	Radiation or radioactive contamination
X		Noise (equipment)

Specific project tasks addressed in this document are as follow:

- Vegetation clearing
- Geophysical survey

2.1 Task-Specific Hazard Analysis

Table 2-2 presents task-specific hazards, minimum hazard controls, and required monitoring, if appropriate, for all of the planned tasks. This assessment is based on the U.S. Army expectations and some assumptions regarding the planned tasks. It is ultimately the Contractor's responsibility to ensure that the hazards of each task are adequately controlled. In cases where the following controls are not appropriate or sufficient for the specific task(s) to be performed by the Contractor, the Contractor must specify additional appropriate and sufficient controls.

TABLE 2-2. HAZARDS ANALYSIS

Safety and Health Hazards	Controls	Monitoring
Geophysical Survey		
General safety hazards (moving or heavy equipment, slips, falls)	Level D PPE. Hazardous waste safety training.	Daily site safety inspections.
Noise	Hearing protection if monitoring indicates noise exposure of greater than 85 decibels.	Daily safety inspections.
Fire (vehicle fuels)	Fuels stored in safety cans with flame arrestors. Bonding and grounding during fuel transfers. Fuel storage areas marked with No Smoking or Open Flames signs. Fire extinguishers in all fuel use areas.	Combustible gas indicator if buried organic material or other source of flammable gas is suspected.
Contact with munitions and explosives of concern	On-site training in ordnance recognition for all field personnel. Clearance of sites by EOD personnel for intrusive work. Withdrawal of all non-EOD personnel if ordnance or suspected ordnance is discovered.	Visual surveys for ordnance. Instrument surveys by EOD technicians in munitions disposal areas.
Temperature extremes	Administrative controls. Cooled (shaded) or warmed break area depending on the season. Routine breaks in established break area. Chilled drinks if temperature exceeds 70 °F.	Temperature measurements at least twice per day. Pulse rates at the start of each break if wearing impermeable clothing.
Biological hazards (bees, ticks, Lyme disease, West Nile Virus, Histoplasmosis, wasps, snakes)	PPE (boots, work clothes). Insect repellant, as necessary. Pant legs tucked into boots or otherwise closed to minimize potential for tick entry. Inspect for ticks during the day and at the end of each work day. Avoidance of accumulations of bird or bat droppings.	Visual survey.

TABLE 2-2. (continued)

Safety and Health Hazards	Controls	Monitoring
Vegetation Clearing with Chainsaws, Machetes, and Sling Blades		
General safety hazards (rotating machinery, contact with sharp edges, slips, falls)	Level D PPE plus hard hat. Only experienced operators. Personnel operating brush-clearing tools must maintain separation of at least 4.5 meters (15 feet). Tools must be inspected daily and taken out of service if damaged. Exclusion zone if there is a potential for entry of unauthorized personnel. Hazardous waste safety training.	Daily site safety inspections.
Chainsaw kickback and related hazards	Saws must have automatic chain brake or kickback device. Idle speed adjusted so chain does not move when idling. Saws must not be used to cut above shoulder height. Saws must be held with both hands when operating. Additional requirements at 385-1-1 Section 31.	Daily inspection.
Noise (chainsaw)	Hearing protection within 7.6 meters (25 feet) of operating chainsaw unless rig-specific monitoring indicates noise exposure of less than 85 decibels.	Daily safety inspections.
Fire (fuels)	Fuels stored in safety cans with flame arrestors. Bonding and grounding during fuel transfers. Fuel storage areas marked with No Smoking or Open Flames signs. Fire extinguishers in all fuel use areas. Gasoline-powered equipment turned off and allowed to cool for at least five minutes prior to fueling.	Daily safety inspection.

TABLE 2-2. (continued)

Safety and Health Hazards	Controls	Monitoring
Contact with munitions and explosives of concern	On-site training in ordnance recognition for all field personnel. Clearance of sites by EOD personnel for intrusive work. Withdrawal of all non-EOD personnel if ordnance or suspected ordnance is discovered.	Visual surveys for ordnance. Instrument surveys by EOD technicians in munitions disposal areas.
Temperature extremes	Administrative controls. Cooled (shaded) or warmed break area depending on the season. Routine breaks in established break area. Chilled drinks if temperature exceeds 70 °F.	Temperature measurements at least twice per day. Pulse rates at the start of each break if wearing impermeable clothing.
Biological hazards (bees, ticks, Lyme disease, West Nile Virus, Histoplasmosis, wasps, snakes)	PPE (boots, work clothes). Insect repellant, as necessary. Pant legs tucked into boots or otherwise closed to minimize potential for tick entry. Inspect for ticks during the day and at the end of each work day. Avoidance of accumulations of bird or bat droppings.	Visual survey.
Electric shock	Electrical tools must be double insulated or connected through heavy-duty power cord to GFCI.	Daily safety inspection.

EOD = explosive ordnance disposal.
GFCI = ground fault circuit interrupter.
PPE = personal protective equipment.

SECTION 3

STAFF ORGANIZATION, QUALIFICATIONS, AND RESPONSIBILITIES

This section presents the general lines of authority, responsibilities, and communication procedures concerning site safety and health and emergency response. It includes key Contractor positions.

3.1 Contractor Program Manager

The Program Manager(James G. Zody, PE) is responsible for ensuring conformance with Corporate, and U.S. Army policies and procedures. Specific responsibilities of the Program Manger include:

- Coordinating with U.S. Army personnel,
- Ensuring that project managers satisfy U.S. Army health and safety requirements,
- Ensuring that project staff implement this SHP Addendum,
- Ensuring that projects have the necessary resources to operate safely, and
- Ensuring that project personnel have the appropriate regard for safe job performance.

3.2 Contractor Health & Safety Officer

The Contractor Health & Safety Officer (Todd Valli, CIH) manages the health and safety program. This includes establishing health and safety policies and procedures, supporting project and office activities, and verification of safe work practices and conditions. The specific responsibilities of the Contractor Health & Safety Officer include:

- Coordinating with U.S. Army health and safety personnel,
- Reviewing and approving SHPs,
- Approving downgrades in PPE or protective procedures, and
- Interfacing with project personnel through routine communications and audits of selected projects.

3.3 Contract Project Manager

The Project Manager (John Miller, CHMM) is responsible for overall project execution. The responsibilities of the Project Manager include:

- Coordinating with U.S. Army and Ohio EPA personnel, including reporting accidents and incidents to the U.S. Army Project Manager immediately and submitting written reports within 2 working days;
- Ensuring implementation of the Facility-wide Safety and Health Plan (FSHP) and this SHP addendum;
- Maintaining auditable project documentation of all required records;
- Ensuring that a qualified SSHO is designated; and
- Maintaining a current copy of the FSHP and this SHP addendum.

3.4 Contractor Field Operations Manager or Task Leader

The Field Operations Manager (Colleen Lear, LG) will oversee the field activities associated with a project and will be responsible for site accessibility, safety, and quality assurance. He/she is responsible for enforcing the field requirements of the FSHP and its addendum. Specific responsibilities of the Field Operations Manager or Task leader are:

- Enforcing compliance with the FSHP and this SHP addendum;
- Coordinating on-site operations, including subcontractor activities;
- Ensuring that subcontractors follow the requirements of the FSHP and this SHP addendum;
- Coordinating and controlling any emergency response actions;
- Ensuring that at least one person currently certified in first aid/cardiopulmonary resuscitation are on-site during site operations; and
- Maintaining current copies of the FSHP and this SHP addendum on site.

3.5 Site Safety and Health Officer

The Contractor SSHO (Colleen Lear, LG) is responsible for implementing the FSHP, making health and safety decisions for specific health and safety activities and for verifying the effectiveness of the health and safety program. The SSHO's qualifications include, at a

minimum, experience with similar projects, knowledge of and understanding of the FSHP and this addendum, and the ability to use the required monitoring equipment. The SSHO has primary responsibility for the following:

- Stopping work or upgrading protective measures (including protective clothing) if uncontrolled health and safety hazards are encountered including an indication that CAIS are present. Indications of uncontrolled health and safety hazards include monitoring instrument readings in excess of the established action limits, heavy equipment without back-up alarms, exposed munitions and explosives of concern, unguarded moving/rotating equipment, exposed electrical connections, non-compliance with Health and Safety (H&S) requirements, encountering liquids other than water, soil staining suggestive of unexpectedly high concentrations of nonvolatile contaminants, etc. The SSHO must also authorize resumption of work following correction of the adverse condition(s);
- Implementing and verifying compliance with this FSHP and this addendum and reporting to the Field Operations Manager or Task Leader, Project Manager, and Health and Safety Manager any deviations from anticipated conditions;
- Conducting daily safety inspections;
- Documenting deficiencies identified in the daily inspections and responsible parties, procedures, and timetables for correction;
- Ensuring that site personnel have access to this plan and are aware of its provisions:
- Conducting a site-specific pre-entry health and safety briefing covering potential chemical and physical hazards, safe work practices, and emergency procedures;

Maintaining on-site auditable documentation of

-- MSDS for applicable materials utilized at the site in Building 1037;
-- training for site workers and visitors;
-- calibration/maintenance of field instruments such as photoionization detectors, combustible gas indicators, etc.;
-- environmental and personal exposure monitoring results;
-- notification of accidents/incidents;
-- reports of any overexposure or excessive levels;
-- notification of employees of exposure data; and
-- medical surveillance.

- Confirming that all on-site personnel have received the training listed in the Training Requirements section (Section 4.0) of the FSHP;
- Issuing respirators as necessary, and ensuring that all respirator users have received medical clearance within the last year, have been properly trained, and have been successfully fitted for respiratory protection;
- Verifying that the FSHP's emergency points of contact are correct and supplying correcting information as necessary;

- Ensuring that all monitoring equipment is operating according to the manufacturer's specifications and performing field checks of instrument calibration;
- Ensuring monitoring for potential on-site exposures is conducted in accordance with the FSHP and this addendum;
- Investigating accidents and near accidents and reporting (in concert with Field Operations Manager or Task Leader) same to Project Manager and Contractor SHO;
- Conducting daily "tailgate" safety briefings; and
- Controlling visitor access to the exclusion zone as necessary.

SECTION 4

TRAINING

Training requirements are outlined in the FSHP and in Table 2-2 of this SHP addendum. On-site personnel shall be first aid/CPR trained. All field personnel will be familiarized with the types of ordnance known to have been disposed of at this site.

SECTION 5

PERSONAL PROTECTIVE EQUIPMENT

General guidelines for selection and use of PPE are presented in the FSHP. Specific PPE requirements for this work are presented in the hazard/risk analysis section (Chapter 2.0).

SECTION 6

MEDICAL SURVEILLANCE

Medical surveillance requirements are presented in the FSHP.

SECTION 7

EXPOSURE MONITORING PROGRAM

Assessment of airborne chemical concentrations is not anticipated to exceed acceptable levels. This is a non-intrusive geophysical study that will not result any subsurface or surficial exposure to airborne contaminants. Ground clearing activities (mowing, brush clearing may result in some dust generation). Minimum monitoring requirements and action levels are presented in Table 7-1.

TABLE 7-1. MONITORING REQUIREMENTS AND ACTION LIMITS

Hazard or Measured Parameter	Area	Interval	Limit	Action	Tasks
Noise	All	Any area where there is some doubt about noise levels	85 dBA and any area perceived as noisy	Require the use of hearing protection	All
Visible contamination	All	Continuously	Visible contamination of skin or personal clothing	Upgrade PPE to preclude contact; may include disposable coveralls, boot covers, etc.	All
Visible airborne dust	All	Continuously	Visible dust generation	Stop work; use dust suppression techniques such as wetting surface	All

PPE = Personal Protective Equipment

SECTION 8

HEAT/COLD STRESS MONITORING

General requirements for heat/cold stress monitoring are contained in Section 8.0 of the FSHP.

SECTION 9

STANDARD OPERATING SAFETY PROCEDURES

Standard operating safety procedures are described in Section 9.0 of the FSHP.

SECTION 10

SITE CONTROL MEASURES

Site control measures are described in Section 10.0 of the FSHP. No formal site control is expected to be necessary for this work, as the work area is somewhat remote and fenced, and bystanders are not anticipated. The RVAAP installation is not open to the public, and only authorized personnel are allowed in the project areas. If the Contractor SSHO determines that a potential exists for unauthorized personnel to approach within 25 feet of a work zone or otherwise be at risk due to proximity, then exclusion zones will be established as described in the FSHP.

SECTION 11

PERSONNEL HYGIENE AND DECONTAMINATION

Personal hygiene and decontamination requirements are described in Section 11.0 of the FSHP and in Chapter 2.0 of this addendum.

SECTION 12

EMERGENCY PROCEDURES AND EQUIPMENT

Emergency contacts, telephone numbers, directions to the nearest medical facility, and general procedures can be found in Section 12.0 of the FSHP. The contractor field operations manager will remain in charge of all contractor and subcontractor personnel during emergency activities. The contractor field office will serve as the assembly point if it becomes necessary to evacuate one or more sampling locations. During mobilization, the SSHO will verify that the emergency information in the FSHP is correct; in addition, directions and a map to the nearest medical facility (Robinson Memorial Hospital, Figure 12-1) will be posted in conspicuous places that are readily available to all on-site workers in case of emergency.

Directions to RAVENNA, OH

YAHOO! LOCAL Maps

Summary and Notes

START A 8451 State Route 5, RAVENNA, OH

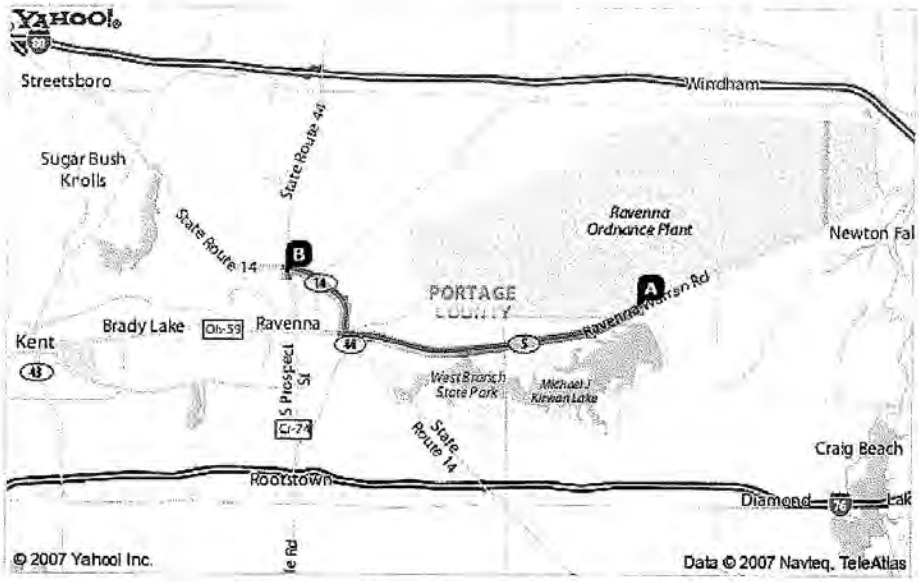
FINISH B 6847 N Chestnut St, RAVENNA, OH

Total Distance: 9.6 miles, Total Time: 14 mins (approx.)

Add your notes here...

	Distance
A 8451 STATE ROUTE 5, RAVENNA, OH	
1. Start at **8451 STATE ROUTE 5, RAVENNA** going toward **NEWTON FALLS RD**	go **6.1** mi
2. Continue on **STATE ROUTE 5(OH-5 W)**	go **0.2** mi
3. Bear R on **STATE ROUTE 59(OH-59 W)**	go **0.2** mi
4. Continue to follow **OH-59 W**	go **0.5** mi
5. Bear R on **CLEVE E LIVERPOOL RD(OH-14)**	go **2.4** mi
6. Turn L on **N CHESTNUT ST**	go **0.1** mi
7. Arrive at **6847 N CHESTNUT ST, RAVENNA**, on the R	
B 6847 N CHESTNUT ST, RAVENNA, OH	

Distance: 9.6 miles, Time: 14 mins



When using any driving directions or map, it's a good idea to do a reality check and make sure the road still exists, watch out for construction, and follow all traffic safety precautions. This is only to be used as an aid in planning.

Figure 12-1. Directions to Robinson Memorial Hospital

SECTION 13

LOGS, REPORTS, AND RECORD KEEPING

Logs, reports, and record keeping requirements are described in Section 13.0 of the FSHP.

SECTION 14

REFERENCES

NIOSH (National Institute for Occupational Safety and Health) 2006. *NIOSH Pocket Guide to Chemical Hazards, the condensed Chemical Dictionary*.

USACE (U.S. Army Corps of Engineers). *Safety and Occupational Health Requirements for Radioactive Waste (HTRW) and Ordnance and Explosive Waste (OEW) Activities.* ER-385-1-92, May 2007.

USACE *Safety and Health Manual.* EM-385-1-1-13, November 2003.

USACE 2001. *Facility-Wide Safety and Health Plan for Environmental Investigations at the Ravenna Army Ammunition Plant, Ravenna, Ohio.* DACA62-00-D-0001, D.O. CY02, March 2003.

USJMC (U.S. Army Joint Munitions Command) 2003, *Installation Action Plan for Ravenna Army Ammunition Plant, Fiscal Year 2003.*

Draft Work Plan – Geophysical Investigation – Suspected Mustard Agent Site
OHARNG RTLS-ENV Comment Response Table
13 August 2007

Cmt. No.	Page or Sheet	Comment	Recommendation	Response
1	Title Pages	Please fix the spelling of Geophysical.	Please fix the spelling of Geophysical.	The spelling of Geophysical on the cover will be corrected.
2	Pg 1, Line 10	"The objective of the project is to determine if mustard agent test kits have been buried in a 0.5 to 1.0 acre portion of the site located at the Ravenna Army Ammunition Plant (RVAAP) in Ravenna, Ohio." This description needs more detail. Suggested rephrase "The objective of the project is to determine if mustard agent test kits have been buried in an approximate one acre area located on the western portion of the Ravenna Army Ammunition Plant (RVAAP) in Ravenna, Ohio. This suspect area is located adjacent to the NACA test strip and is reportedly where mustard agent test kits may have been buried. The kits may have been…"	Suggested rephrase "The objective of the project is to determine if mustard agent test kits have been buried in an approximate one acre area located on the western portion of the Ravenna Army Ammunition Plant (RVAAP) in Ravenna, Ohio. This suspect area is located adjacent to the NACA test strip and is reportedly where mustard agent test kits may have been buried. The kits may have been…"	Agreed, this change will be made.
3	Pg. 1, Line 20	"Site Location and Physiography" Change to "Facility Location and Physiography".	Change to "Facility Location and Physiography".	Agreed.
4	Pg 1, Section 1.2	Paragraph justification should be left justified not centered.	Paragraph justification should be left justified not centered.	This formatting error will be corrected.
5	Pg, 1, Line 23	Change "Town of Ravenna" to "City of Ravenna".	Change "Town of Ravenna" to "City of Ravenna".	Agreed.
6	Pg 1, Section 1.2	Please use the entire facility description that was approved and provided in this section. The provided text is not the complete description.	Please use the entire facility description that was approved and provided in this section.	The entire facility description (as used in the quarterly groundwater reports) will be used in this section.

Draft Work Plan – Geophysical Investigation – Suspected Mustard Agent Site
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7	Pg 4, Figure 3	Recommend zooming closer in on this figure as the site area and project area extents are hard to see.	Recommend zooming closer in on this figure as the site area and project area extents are hard to see.	Figure 3 has been revised to show more detail of the search area. This figure has also been revised to show 2-foot contours.
8	Pg 5, Line 1	Change "site geology" to "Facility geology".	Change "site geology" to "facility geology".	Agreed.
9	Pg. 5 Section1.3, Line 6	Change "Site History" to "Facility History" as it describes the entire facility. I also recommend adding a little more detail to the description. Suggested Rephrase: "RVAAP was constructed in 1940 and 1941 for depot storage and ammunition assembly/loading and placed on standby status in 1950. Production activities resumed from 1954 to 1957 and 1968 to 1972. Demilitarization activities, including disassembly of munitions and explosives melt-out and recovery, continued until 1992. The facility entered Modified Caretaker status in October 1993. The subject project area is reported, by former employees at the facility, to be a possible location of buried mustard agent test kits." In this section, do we need to mention the other mustard agent site (RVAAP-28) and indicate that this site is a second suspect site based on interviews? This may need further discussion.	Suggested Rephrase: "RVAAP was constructed in 1940 and 1941 for depot storage and ammunition assembly/loading and placed on standby status in 1950. Production activities resumed from 1954 to 1957 and 1968 to 1972. Demilitarization activities, including disassembly of munitions and explosives melt-out and recovery, continued until 1992. The facility entered Modified Caretaker status in October 1993. The subject project area is reported, by former employees at the facility, to be a possible location of buried mustard agent test kits."	Agreed this change will be incorporated into the text and the title changed to *Facility History*.
10	Pg 6, Line 8	Please change "communications" to "communication".	Please change "communications" to "communication".	This spelling error will be corrected.

11	General	Is it EQ or EQM? Both acronyms are used for the company in the report but only EQM is identified in the acronym table. Please be consistent throughout the document and use either EQ or EQM, not both.	Please be consistent throughout the document and use either EQ or EQM, not both.	EQM will be used throughout the document.
12	Pg 8, Section 2.2 and 2.3	Health and Safety Manager and responsibilities are not identified in these sections. Provide a description of the Health and Safety Manager's duties and responsibilities.	Provide a description of the Health and Safety Manager's duties and responsibilities.	The following text will be added to Section 2.3: *Health and Safety Officer: EQM's corporate Heath and Safety Officer is responsible for overseeing and implementing all health and safety issues associated with this project. This will include reviewing the RVAAP Facility-Wide Health and Safety Plan to ensure that all field work conducted under this project is covered. It is EQM's intention to conduct the geophysical survey work under the existing Facility-Wide Health and Safety Plan. The purpose of the geophysical survey is to conduct a non-intrusive investigation without the possibility of contacting any mustard agent if present. Therefore the existing facility HASP should cover any heath and safety issues such as slip, trip, fall; mowing safety; insects; heat/cold stress; etc. There are no unique hazards or controls to the anticipated field activities.* *In the event that a project specific HASP addendum is required EQM's Health and Safety Officer will review and sign-off on the addendum prior to initiation of field activities.*

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13	Pg 11, Line 8	"The boundaries of the suspected mustard agent burial areas have been determined to the extent practicable…" There is only one project site here that is being investigated. Change to "The boundary of the suspected mustard burial area has been determined to the extent…"	Change to "The boundary of the suspected mustard burial area has been determined to the extent…"	Agreed
14	Pg 11, Line 25	"Vegetation of less than 2" in diameter will be removed prior to the survey." How will this vegetation be removed? The project area is in a pretty wet area especially since the field activities are planned for December. Using heavy equipment will rip up the area and any wetlands. That area is spotted with wetlands. Also, any vegetation removal or wetland impacts must be coordinated with Tim Morgan and RTLS-ENV staff. The project area is currently owned and managed by the OHARNG. Additional discussion on this item is needed.		The following text will be added to Section 3.2.3: *The study area will be mowed using a tractor pulled rotary mower (bush-hog) or smaller mower to the extent possible given the terrain and vegetation. EQM personnel will also use hand tools such as weed whackers to clear the area. Any areas with standing water will be cleared by hand to minimize surficial disturbance. EQM will meet with OHARNG personnel prior to initiating any field clearing activities to identify particular areas of concern or any threatened and endangered species or habitat.*
15	Pg 12, Figure 5	Please identify the aerial date on the figure.	Please identify the aerial date on the figure.	The date of the aerial photograph will be added to Figure 5.

16	Pg 14, Section 3.3	Last sentence seems like overkill and is a run-on sentence. Also, this section seems like it could be written in a simpler manner. Suggested rephrase: "Verbal results regarding the investigation may be available upon completion of the field activities. Upon final data processing, a survey report will be developed and submitted for review. This report will include a summary of the records research, a site overlay map (11x17 or smaller), color maps of the EM data, data interpretation, and the methods used to generate the data. The report will be submitted as a Preliminary Draft, Draft, and Final version with subsequent reviews and comment resolutions."	Suggested rephrase: "Verbal results regarding the investigation may be available upon completion of the field activities. Upon final data processing, a survey report will be developed and submitted for review. This report will include a summary of the records research, a site overlay map (11x17 or smaller), color maps of the EM data, data interpretation, and the methods used to generate the data. The report will be submitted as a Preliminary Draft, Draft, and Final version with subsequent reviews and comment resolutions."	Agreed with the change *Verbal results regarding the investigation <u>will</u> be…*
17	General	Please note that currently there is a large pile of gravel on the west end of the NACA test strip which if not moved could interfere with the geophysical survey. It covers a portion of the site. At this point, it is scheduled to be used so it should be out of the way by field season time.		EQM and the USACE will coordinate all activities with OHRANG prior to conducting any field work.

"Draft, Work Plan, Geophysical Investigation, Suspected Mustard Agent Burial Site, Ravenna Army Ammunition Plant, Ravenna, Ohio"
Reviewer: Eileen T. Mohr, Ohio EPA, NEDO, DERR
Date: August 22, 2007

Cmt. No.	Page or Sheet	Comment	Recommendation	Response
1	General	The purpose of conducting the geophysical investigation is to determine if there are mustard agent test kits buried in a specified area of RVAAP. CAIS sets generally consisted of 40-ml or 3.5-ounce bottles containing chemical agent, placed in either metal containers or wood boxes. In the event that the CAIS sets were present and in metal containers, there could be remnants of the metal containers. In the event that the CAIS sets were in wood boxes, there is a good possibility that they would not be detected with this initiative.	Please add information to the workplan that details whether or not it is know what type of container the sets (if present) may have been in; how it will be determined that there is no mustard agent present if the outer cases were constructed of wood (and not metal); etc. In terms of getting this area to the point of RC, it is not clear how we will get there in the event that the geophysics evaluation does not turn up any anomalies, and we don't have information that demonstrates that the CAIS were in metal containers.	Additional text (as presented in Attachment 1 to these comments) has been added to Section 1 of the Work Plan clarifying the containers and the future activities potentially required to achieve RC.
2	General	There was no HASP attached to the workplan.	Please provide a HASP for review and comment. Although Ohio EPA does not have regulatory jurisdiction over HASPs, we do review them and provide comments for consideration.	It is EQM's intention to conduct the geophysical survey work under the existing Facility-Wide Health and Safety Plan. The purpose of the geophysical survey is to conduct a non-intrusive investigation without the possibility of contacting any mustard agent if present. Therefore the existing facility HASP would cover any heath and safety issues such as slip, trip, fall; mowing safety; insects; heat/cold stress; etc. There are no unique hazards or controls to the anticipated field activities.
3	1/12-13	The text indicates that the sets may have been buried in tin cans.	Please provide the source of this information.	The reference to tin cans has been deleted. Reference the attached revised text for Section 1.
4	1/12-16	Cross-reference general comment #1 above.	Add additional text to the revised workplan addressing this issue.	Reference the attached revised text for Section 1.
5	1/23	Ravenna is a city.	Change Town to City.	Agreed, this correction will be made.

"Draft, Work Plan, Geophysical Investigation, Suspected Mustard Agent Burial Site, Ravenna Army Ammunition Plant, Ravenna, Ohio"
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Date: August 22, 2007

Cmt. No.	Page or Sheet	Comment	Recommendation	Response
6	1/25	Change for clarity.	Put 2002 and 2003 in parentheses.	This section has been completely revised at the request of OHRANG to include the complete facility description as presented in the quarterly groundwater monitoring reports.
7	2/fig 1	On the site location map, the western side of the installation is basically devoid of any features such as igloos, AOCs, etc.	Please revise the western portion of the map so that it details the features shown on figure 2.	The figure has been revised showing details of the western portion of the facility.
8	4/fig 3	Figure 3 revisions needed.	a. add a scale to the figure. b. add the contour interval that is depicted in the figure to the legend.	A scale and contour interval have been added (this figure is being revised to show 2-foot instead of 10-foot intervals).
9	6 or 7	Text revision requested.	Add the health and safety officer to either section 2.1 or 2.2.	The following text has been added to Section 2.3: *Health and Safety Officer. EQM's corporate Heath and Safety Officer is responsible for overseeing and implementing all health and safety issues associated with this project. This will include reviewing the RVAAP Facility-Wide Health and Safety Plan to ensure that all field work conducted under this project is covered. It is EQM's intention to conduct the geophysical survey work under the existing Facility-Wide Health and Safety Plan. The purpose of the geophysical survey is to conduct a non-intrusive investigation without the possibility of contacting any mustard agent if present. Therefore the existing facility HASP should cover any heath and safety issues such as slip, trip, fall; mowing safety; insects; heat/cold stress; etc. There are no unique hazards or controls to the anticipated field activities.* *In the event that a project specific HASP*

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				addendum is required EQM's Health and Safety Officer will review and sign-off on the addendum prior to initiation of field activities.
10	7/fig 4	Addition requested.	Add Kathy Krantz to the table of organization.	K.Krantz has been added to Figure 4.
11	7/34-35	Text addition requested.	Line spacing changes should also be run through USACE Louisville and Ohio EPA. A field change order should be prepared and approved by both USACE and Ohio EPA. Add this to the text.	The following text will be included in Section 2.5*: Level 4 Modifications Requiring USACE-Louisville and Ohio EPA approval: Line spacing changes greater than the stated range of 2-5 meters.* Note that the Level 1 line spacing changes are to accommodate moving around a tree if it is in the immediate sight line, then moving back on line after walking around the tree. The text for Level 1 modifications will be revised as follows: *Line spacing changes for the electromagnetic investigation that involve walking around a tree or other obstruction and returning to the original line. It is anticipated that any such change would be less than 1-meter to walk around the tree/obstruction.*
12	9/3	Clarification requested.	Don't all EQM employees have "stop work" authority for health and safety reasons? As a FYI, under the Directors Findings and Orders (June 2004), Ohio EPA has stop work authority. Add this to the text.	Section 2.5, Level 2 modifications will be revised to add the following text: *EQM's corporate Heath and Safety Officer is responsible for overseeing and implementing all health and safety issues associated with this project, however working safely is a condition of employment for all EQM personnel. Site safety and health personnel, supervision and all workers through their supervisors*

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				have the responsibility and authority to suspend work activity when health and safety controls are inadequate. In the event of imminent danger, any employee can stop the activity. Imminent danger is an impending or threatening dangerous situation that could be expected to cause death or serious injury to persons in the immediate future unless corrective measures are taken. Additionally, per the Directors Findings and Orders (June 2004), Ohio EPA has stop work authority.
13	9/9	Text addition requested.	Add Ohio EPA to Level 4.	The text in Section 2.5 will be changed to read: *Level 4 – Modifications Requiring USACE-Louisville/Ohio EPA Approval*
14	10/section 3.1	Text addition requested.	Based upon using an EM-31 and an EM-61, please provide additional text in the workplan that discusses the effective exploration depth and whether or not the reported burial depth (per former employee recollections) will be covered by this investigation.	The following text will be added to Section 3.1: *According to the manufacturer, Geonics Ltd., the maximum exploration depth is approximately 6 meters for the EM-31, and approximately 3 meters for the EM-61. The GEM-2, another electromagnetic conductivity meter that will be used, has multiple depths of exploration. These depths are dependant on the selected frequencies transmitted in the output signal. For this project it is anticipated that 4 to 5 different GEM-2 frequencies will be used, resulting in exploration depths ranging between approximately 1 and 10 meters. There was no burial depth reported by the employee who initially reported the possibility of the mustard agent burial.*

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				However it should be noted that the likely equipment available at the facility in the 1950's was a backhoe with a maximum dig depth of 8-feet (2.4 meters) (T. Chandra, personal communication, 2007),which is well within the exploration depth for the investigation.
15	11/1	The text indicates that GPR will optionally be used depending upon whether or not any metallic objects are found.	Please clarify whether or not this determination will be made in consultation with USACE and Ohio EPA, or if it will be done if any metallic signature is detected.	The following text will be added to Section 3.1: *GPR will be used to investigate any metal detection and/or conductivity anomalies. This determination will be made after reviewing the data while in the field.*
16	11/11-21	Reference requested.	Reference the anecdotal information/interviews utilized.	The revised text now presents all references used in the Work Plan. Additionally, Section 5 has been added noting all references used.
17	13/5	Text addition requested.	Please reference the HASP that needs to be developed and tier under the installation-wide HASP. Ensure that the HASP is read and signed off on by all EQM employees and subcontractors.	As noted above it is EQM's intent to conduct this project under the existing Facility-Wide Health and Safety Plan. The following text will be added to Section 3.2.4: *EQM will conduct the geophysical survey work under the existing Facility-Wide Health and Safety Plan. The purpose of the geophysical survey is to conduct a non-intrusive investigation without the possibility of contacting any mustard agent if present subsurface. Therefore the existing facility HASP would cover any heath and safety issues such as slip, trip, fall; mowing safety; insects; heat/cold stress; etc. All EQM employees and subcontractors will be briefed on these hazards and sign off prior to*

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				initiating field activities.
18	13/5	FYI	Please ensure that updated 8-hour certificates and 40-hour HAZWOPER training certificates for all EQM employees and subcontractors are on file at RVAAP. (These need to go to Christy Esler and Debbie Dillon of MKM).	All EQM employees working on the geophysical project have current 8-hour and 40-hour HAZWOPER certificates on file with MKM. All subcontractors to EQM will submit the required certification prior to initiating field work.
19	13/16-17	Text addition requested.	Please add text to the revised workplan that details how the line spacing will be determined and that 100% coverage of the area will be obtained with the selected spacing.	The following text will be added to Section 3.2.6: *The stated range of 2-5 meters for the spacing of the data collection lines is intended to accommodate uncertainty in what the site conditions will be after clearing. The actual spacing of the data will be dependant on several factors, including: 1) the available paths of travel between the standing trees given the various physical configurations of the instruments, 2) the quality of the GPS satellite constellation available underneath the tree canopy, and 3) differences in the size of the exploration area of the various instruments (e.g., along a given line of data collection, the EM-61 has a much narrower swath than the EM-31).* *Within these limitations, every effort will be made to investigate the whole of the study area.*
20	16/fig 6	Schedule revision requested.	a. There should only need to be 2 versions of the workplan: draft and final. This will cut a significant amount of time from the schedule. b. If an Ohio EPA review end date falls on a Sunday, it is bumped to the following	a. Per EQM's contract with the USACE three versions of the Work Plan are required beginning with a Preliminary Draft for Army review followed by draft and final versions. Figure 6 will be revised to clarify this requirement.

"Draft, Work Plan, Geophysical Investigation, Suspected Mustard Agent Burial Site, Ravenna Army Ammunition Plant, Ravenna, Ohio"
Reviewer: Eileen T. Mohr, Ohio EPA, NEDO, DERR
Date: August 22, 2007

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			Monday. c. On item #18 – there should be a 45-day review time. Although it generally does not take that long, with an unknown workload, this is the amount of time that needs to be scheduled (as per the Orders).	It is, however, EQM's and USACE's intention to reach Work Plan approval using a two-draft process if possible, in order to perform the field work during the time frame necessary to collect GPS data (leaf off condition). b. This will be corrected in the revised schedule. c. This change will be made to the corrected schedule.

Draft Final Work Plan for Geophysical Investigation at Suspect Mustard Agent Site
OHARNG RTLS-ENV Comment Response Table
5 October 2007

Cmt. No.	Page or Sheet	Comment	Recommendation	Response
1	Pg 1, Lines 20-25	"The survey results will be used to determine further action at the site. Further activities could include: No Further Action, Installation of groundwater wells with possible inclusion into the FWGWP, Site access restrictions, Additional investigation." Why are we listing these potential future activities when we don't even know what is out there. The first line in this statement says it all. Recommend deleting the second line and bulleted items because they are total speculation.	Recommend deleting the second line and bulleted items because they are total speculation. Just so everyone has an understanding of where my comment came from, here is my explanation. My sensitivity to the listing of potential future activities this early in the process (when we don't know what is out there yet) is that these items (even though just a possibility) have a way of being set in stone after written in a document. I could see maybe listing these items in a summary results report in a Conclusions or Potential Future Activities section. However, this is a Work Plan. At this point, I will let my comment go as long as there is an understanding of where I am coming from. Let's not put the cart before the horse.	Your concerns are noted, the text will remain unchanged.
2	Pg 5, Figure 3	The study area identified on this figure is not specific enough.	Recommend adding a study area boundary and calling out the NACA Test Area crash strip so there is a better sense of where the site is located. Also recommend identifying the tree line. Also a key is needed.	This figure was intended to show the general location of the study area in relation to the NACA Test Area. Figure 5 presents a more detailed map of the study area. Figure 3 will be revised to include an outline of the study area and to include identification of the topographic lines, test strip and creek. The tree line is shown in Figure 5.
3	Pg 6, Section 1.3, Line 9-10	"RVAAP was constructed in 1940 and 1941 for depot storage and ammunition assembly/loading and placed on standby status in 1950." Recommend inserting the year that production started. Suggested Rephrase: "RVAAP was constructed in 1940 and 1941 for depot storage and ammunition	Recommend inserting the year that production started. Suggested Rephrase: "RVAAP was constructed in 1940 and 1941 for depot storage and ammunition assembly/loading. Production began in 1942 and the facility was placed…"	Agreed.

		assembly/loading. Production began in 1942 and the facility was placed…"		
4	Pg 6, Line 19	Change "RVAPP" to "RVAAP".	Change "RVAPP" to "RVAAP".	This typo will be corrected.
5	Pg. 6, Line 31	"Note that the Denix website references wooden containers. Based on the Description of Chemical Agent Identification Set Types, 2004, the only CAIS packed in non-metallic (wooden) containers was K945, however, all K945 kits were accounted for by the Army and destroyed." If all wooden containers were accounted for as stated, then why are we mentioning it here? Recommend deleting this statement.	Recommend deleting this statement. Okay to leave this statement in the document.	Agreed.
6	Pg 13, Line 31	"An outline of the study is identified…" Insert "area" after "study".	Insert "area" after "study".	Agreed.
7	Pg. 15, Line 12-13	"EQM will meet with OHARNG personnel prior to initiating any field clearing activities to identify particular areas of concern or any threatened and endangered species habitat." OHARNG will not be identifying threatened or endangered species habitat. Delete "or any threatened and endangered species habitat."	Delete "or any threatened and endangered species habitat."	Agreed.
8	Attachment 3, Introduction, Pg. xxxiv, Lines 26 and 29	"… to address the hazards and controls expected to be unique to the anticipated onsite tasks involved in performance of work under the FWGWMP…. Anticipated environmental investigation tasks expected to be performed during implementation of the FWGWMP include:" Why are we referencing the FWGWMP here?		Reference to the FWGWMP will be removed from the health and safety plan.
9	Attachment 3, Section 1, Pg. 1.1, Lines 6 and 9	"Section 1 Site Description and Characterization" In this section you are describing the	Change the Section title to "Facility Description" on Lines 6 and 9.	Agreed.

		activities and history of the entire facility. Also you are not "characterizing" the site in this section. Change the Section title to "Facility Description" on Lines 6 and 9.		
10	Attachment 3, Pg. 1-2, Section 1.2 Contaminants	"The RVAAP AOCs were associated with the assembly, storage, shipment, and/or disposal of a variety of materials including munitions and wastes. The principal munitions assembled on the installation were artillery rounds of 90 mm or more and 2,000-pound bombs. Contaminants of concern that are potentially present include explosive compounds [cyclonite, trinitrotoluene (TNT), smokeless powder], propellants, polychlorinated biphenyls, petroleum hydrocarbons, and metals (aluminum, arsenic, barium, cadmium, chromium, lead, manganese, mercury, selenium, silver, and zinc). Contaminants that are potentially present at each AOC are discussed in an investigation-specific addendum prepared for each AOC." Here you are discussing contaminants at each AOC on the facility. This section is misleading because it sounds like you are relating this information to the suspect mustard site that is to be investigated. Contaminants on this site (if any) are unknown. Plus you are conducting a noninvasive geophysical survey. Therefore, this information does not really relate. Since it was already stated in the paragraph above, "A number of AOCs have been identified. A description of each AOC is included in the installation Preliminary	Recommend deleting section 1.2 Contaminants all together as it is confusing to the reader and is unnecessary as it is not related to the proposed activities. Here is my revised suggestion: If the Headers in Sections 1 and 1.1 are changed to "Facility Description", then I recommend deleting the "1.2 Contaminants" header. That way the paragraph about contaminant descriptions falls under the "Facility Description".	Agreed the headers will be changed.

		Assessment, the RVAAP IAP, and the RRSE", I would recommend deleting section 1.2 Contaminants all together as it is confusing to the reader and is unnecessary as it is not related to the proposed activities.		
11	Attachment 3, SSHP, Section 2.0, Pg. 2-2, Lines 2-4	"Specific sampling tasks considered in this document are as follows: Vegetation clearing, Geophysical survey." You will not be conducting any "sampling" as part of this survey. Recommend deleting this statement.		The sentence will be revised as follows: *Specific project tasks addressed in this document…*
	Attachment 3, SSHP, Section 2.0, Table 2-2	In this table, gunfire is identified as a potential hazard on Pgs. 2-3 and 2-5. Since contractors are not allowed to be on the premises during the controlled hunts, I recommend deleting this entire item on both pages. Gunfire is not a hazard because you will not be present onsite during the hunts.		Agreed.

Draft Final Work Plan for Geophysical Investigation at Suspect Mustard Agent Site
Ohio EPA Comment Response Table
12 October 2007

Cmt. No.	Page or Sheet	Comment	Recommendation	Response
1	General	In future submissions, please follow the convention of labeling the various versions, i.e., preliminary draft, draft, and final.		Agreed.
2	General	Remove line numbers from the final document.		Agreed.
3	Figure 3	On Figure 3 please provide the unit of measurement for the presented scale.		The unit of measurement (meters) will be added to the scale.
4	Page 19, Line 6	Change RVAPP to RVAAP		This typo will be corrected.
5	Figure 5.	On Figure 5 please provide the unit of measurement for the presented scale.		The unit of measurement (meters) will be added to the scale.
6	Page 15, line 17	Change filed to field.		This typo will be corrected.
7	Attachment 3	Although Ohio EPA does not have regulatory jurisdiction over health and safety plans, the following are offered for your consideration:		
8	Page xxxiii	Remove the FGWMPP acronym		Reference to the FWGWMP will be deleted.
9	Page xxxiv, Lines 25 and 29	Remove references to the FGWMPP and identify the correct project.		Reference to the FWGWMP will be deleted and the correct project will be identified.
10	Page 1-2, lines 22-33	Remove this sentence and insert the particular contaminants that may be found in this Area of Concern (AOC).		The contaminants associated with the Mustard Agent and NACA Test Site AOCs will be included. The text will be revised to state *The AOCs associated with this project are the former NACA Test Site and the Mustard Agent Burial Site. Potential contaminants at the NACA Test site include low levels of metals, volatile organic compounds (VOCs) and inorganics (e.g., nitrocellulose). The Mustard Agent Burial Site AOC is reported to have buried mustard agent containers. It should be noted that given the non-intrusive nature of the geophysical investigation contact*

				with any mustard agent or associated breakdown products is unlikely.
11	Page 2-1	The text at the beginning of this section indicates that munitions and explosives of concern (MEC) are a potential health and safety issue. The table below does not anticipate MEC as an issue. Rectify the disconnect.		MEC will be added to the table on page 2-1.
12	Section 3	Identify by name who will be occupying the key contractor positions.		Section 3 will be revised to indicate EQM personnel responsible for this project.