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14. ABSTRACT

This document presents the Facility-Wide Groundwater Monitoring Program Plan Addendum for the RVAAP-66 groundwater services project at the Ravenna Army Ammunition Plant. This 3-part document includes an addendum to the FWGWMPP for the installation of additional monitoring wells at the facility in support of the Remedial Investigation/Feasibility Study to be conducted under EQM's PBA-11 contract. Additionally this addendum includes proposed revision to the FWGWMPP QAPP and Site Safety and Health Plan.

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FINAL

FACILITY-WIDE GROUNDWATER MONITORING PROGRAM PLAN
RVAAP-66 FACILITY-WIDE GROUNDWATER ADDENDUM

RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO

GSA Contract Number GS-10F-0293K
Delivery Order W912QR-11-F-0266

Prepared for

U.S. Army Corps of Engineers
600 Martin Luther King Jr. Place
Louisville, Kentucky 40202

Prepared by

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Final

RVAAP-66 Facility-Wide Groundwater
FWGWMPP Addendum
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NGB Cleanup Program Manager	0	1
EQM	1	1

RVAAP – Ravenna Army Ammunition Plant
USACE – U.S. Army Corps of Engineers
USAEC – U.S. Army Environmental Center
OHARNG – Camp Ravenna/ENV – Ohio Army National Guard Site/Environmental
NGB – National Guard Bureau
Ohio EPA – Ohio Environmental Protection Agency
EQM – Environmental Quality Management, Inc.

CONTRACTOR'S STATEMENT OF INDEPENDENT TECHNICAL REVIEW

Environmental Quality Management, Inc. (EQM) has completed the *Final Facility-Wide Groundwater Monitoring Program Plan RVAAP 66 Facility-Wide Groundwater Addendum.* Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in this project. During the independent technical review, compliance with established policy principles and procedures, utilizing justified and valid assumptions was verified. This included review of data quality objectives; technical assumptions, methods, procedures, and materials used; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the customer's needs consistent with law and existing United States Corps of Engineers policy.

John M. Miller, CHMM
Senior Project Manager

Date: 1/5/12

Scott A. Spesshardt, CPG
Senior Geologist

Date: 1/5/2012

PART I

FINAL

FACILITY-WIDE GROUNDWATER MONITORING PROGRAM RVAAP-66 FACILITY-WIDE GROUNDWATER SAMPLING AND ANALYSIS PLAN FOR ENVIRONMENTAL INVESTIGATION SERVICES ADDENDUM

RAVENNA ARMY AMMUNITION PLANT,
RAVENNA, OHIO

GSA Contract Number GS-10F-0293K
Delivery Order W912QR-11-F-0266

Prepared for

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January 6, 2012

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APPENDICES

LIST OF GENERAL ACRONYMS

AOC	Area of Concern
ASTM	American Society for Testing and Materials
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CHMM	Certified Hazardous Materials Manager
CLP	Contract Laboratory Program
cm	Centimeter
CPG	Certified Professional Geologist
CR	Compliance Restoration
CUGs	Cleanup Goals
^{o}C	Degrees Celsius
DLA	Defense Logistics Agency
DO	Dissolved Oxygen
DOD	Department of Defense
DOT	Department of Transportation
EQM	Environmental Quality Management, Inc.
EPA	Environmental Protection Agency
FS	Feasibility Study
ft	Feet
FWGWMP	Facility-Wide Groundwater Monitoring Plan
FWGWMPP	Facility-Wide Groundwater Monitoring Program Plan
gal	Gallon
GC	Gas Chromatograph
GOCO	Government Owned, Contractor Operated
gpm	Gallons per Minute
GPS	Global Positioning Satellite
GSA	Government Services Administration
HPLC	High-Performance Liquid Chromatography
I.D.	Inner Diameter
IDW	Investigation-Derived Waste
in.	Inch
IRP	Installation Restoration Program
lb	Pound
LG	Licensed Geologist
ml/min	Milliliter per Minute
mm	Millimeter
MRS	Munitions Response Sites
MS	Mass Spectrometer
No.	Number
O&M	Operations and Maintenance
OHARNG	Ohio Army National Guard
ORP	Oxidation Reduction Potential
OVA	Organic Vapor Analyzer
PBA	Performance Based Acquisition
PCB	Polychlorinated biphenyl
%	Percent

LIST OF GENERAL ACRONYMS
(continued)

PID	Photoionization Detector
PPE	Personal Protective Equipment
PVC	Polyvinyl Chloride
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RI	Remedial Investigation
ROD	Record of Decision
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
SAP	Sampling and Analysis Plan
sec	Second
SSHP	Site Safety and Health Plan
SVOC	Semi-volatile Organic Compound
TCLP	Toxicity Characteristic Leaching Procedure
U.S.	United States
USACE	U.S. Army Corps of Engineers
USATHAMA	United States Army Toxic and Hazardous Materials Agency
USP&FO	United States Property and Fiscal Officer
UV	Ultraviolet
UXO	Unexploded Ordnance
VOC	Volatile Organic Compound

LIST OF AREA OF CONCERN ACRONYMS

ASY	Atlas Scrap Yard
B12	Building 1200
BKG	Background
CBL	C-Block
CBP	Central Burn Pits
CP	Cobbs Pond
DA2	Demolition Area #2
EBG	Erie Burning Grounds
FBQ	Fuze and Booster Quarry
LNW	Landfill North of Winklepeck
LL	Load Line
MBS	Mustard Burial Site
NACA	National Advisory Committee for Aeronautics
NTA	NACA Test Area
RQL	Ramsdell Quarry Landfill
SCF	Sharon Conglomerate Formation
WBG	Winklepeck Burning Grounds

EXECUTIVE SUMMARY

This document is intended as a follow-up to the *Draft 2010 Addendum to the Facility-Wide Groundwater Monitoring Program Plan (FWGWMPP) RVAAP-66 Facility-Wide Groundwater* (USACE, November 15, 2010). As such it provides updates and proposed modifications to the current *Facility-Wide Groundwater Monitoring Program Plan* (USACE, 2004).

The United States Army Corps of Engineers (USACE), Louisville District, is performing Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) closure at the former Ravenna Army Ammunition Plant (RVAAP) located near Ravenna, Ohio. CERCLA closure is occurring under the Installation Restoration Program (IRP). Activities include monitoring of an extensive network of groundwater monitoring wells. During the time period of 2005 through 2007, the USACE developed a database of groundwater quality information based on the sampling of approximately 36 monitoring wells. Beginning in fiscal year 2008, the USACE expanded the Facility-Wide Groundwater Monitoring Program (FWGWMP) to include the characterization of groundwater from 243 existing monitoring wells at the facility, which includes those wells monitored prior to 2005.

The USACE, under a Government Services Administration (GSA) Performance Based Acquisition (PBA) contract, retained Environmental Quality Management, Inc. (EQM) (Contract No. GS-10F-0293K – Delivery Order W912QR-11-F-0266) to obtain a signed Record of Decision (ROD) for the Facility-Wide groundwater (RVAAP-66) at the former RVAAP. In support of completion of a Remedial Investigation/Feasibility Study (RI/FS) necessary to supplement the ROD, EQM has reviewed the currently available groundwater data, including the *Draft 2010 Addendum to the Facility-Wide Groundwater Monitoring Program Plan (FWGWMPP) RVAAP-66 Facility-Wide Groundwater* (USACE, November 15, 2010). Based on this review, EQM has determined that additional monitoring wells are needed at the facility to complete the RI/FS and eventual ROD. EQM believes that additional wells are necessary to complete hydrogeologic system modeling and to conduct contaminant fate-and-transport modeling for a Facility-Wide groundwater approach. The additional wells include, but are not limited to, those recommended by the USACE in the *Draft 2010 Addendum* for characterizing the nature and extent of Facility-Wide groundwater impacts in shallow and deep groundwater aquifers beneath the site.

This document includes three different sections intended to initiate activities in support of the Facility-Wide groundwater ROD. These sections are as follows:

- Part I – an amendment to the *Final Facility-Wide Sampling and Analysis Plan for Environmental Investigations, Ravenna Army Ammunition Plant, Ravenna, Ohio, Field Sampling Plan* (SAIC, 2011), which describes the activities and procedures to be conducted for the installation and sampling of the proposed new wells at the facility.
- Part II – an amendment to the *Final Facility-Wide Sampling and Analysis Plan for Environmental Investigations, Ravenna Army Ammunition Plant, Ravenna, Ohio, Quality Assurance Project Plan* (SAIC, 2011).

- Part III – an amendment to the *Facility-Wide Safety and Health Plan for Environmental Investigations* (SAIC, 2011) detailing the health and safety procedures for the field activities to be conducted in support of the Remedial Investigation.

SECTION 1. INTRODUCTION

1.1 Background

The United States Army Corps of Engineers (USACE), Louisville District, is performing Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) closure at the former Ravenna Army Ammunition Plant (RVAAP) located near Ravenna, Ohio. CERCLA closure is occurring under the Installation Restoration Program (IRP). Activities include monitoring of an extensive network of groundwater monitoring wells. During the time period of 2005 through 2007, the USACE developed a database of groundwater quality information based on the sampling of approximately 36 monitoring wells. Beginning in fiscal year 2008, the USACE expanded the Facility-Wide Groundwater Monitoring Program (FWGWMP) to include the characterization of groundwater from 243 existing monitoring wells at the facility, which includes those wells monitored prior to 2005.

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1.2 Site Description/History

Past Department of Defense (DOD) activities at the 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 2-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 Camp Ravenna Joint Military Training Center (Camp Ravenna). The RVAAP and Camp Ravenna are collocated on contiguous parcels

of property and the Camp Ravenna perimeter fence completely encloses the remaining parcels of the RVAAP.

Camp Ravenna 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 1-1). The RVAAP portions of the property are solely located within Portage County. Camp Ravenna (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 1-1 and 1-2). Camp Ravenna 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 Camp Ravenna did not exist and the entire 21,683-acre parcel was a government-owned, contractor-operated (GOCO) industrial facility. The RVAAP 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 Camp Ravenna and RVAAP, unless otherwise specifically stated.

1.3 Site Geology

The regional geology at RVAAP consists of horizontal to gently dipping sedimentary bedrock strata of Mississippian- and Pennsylvanian-age overlain by varying thicknesses of Pleistocene-age unconsolidated glacial deposits. Water and associated environmental contamination in fine-grained glacial and alluvial materials travel down from the surface to underlying groundwater aquifers principally through fractures (termed secondary porosity) and flow between the grains (termed primary porosity).

1.3.1 Unconsolidated Deposits

Bedrock at RVAAP is overlain by deposits of the Wisconsin-aged Lavery Till in the western portion of the facility and the younger Hiram Till and associated outwash deposits in the eastern two-thirds of the facility. Unconsolidated glacial deposits vary considerably in their character and thickness across RVAAP, from zero (0) in some of the eastern portions of the facility to an estimated 46 meters (150 feet) in the south-central portion. The glacial till found at RVAAP was deposited as a more or less uniform sheet covering the bedrock surface as a ground moraine. Where the bedrock is reasonably level, the surface of the till cover is smooth and gently undulating. Where the bedrock surface has more relief, the till cover produces a masked erosional topography. There is some evidence that varved clays, indicative of lake deposits, exist in some of the deeper bedrock valleys (USACE, 1970, 2005a). The Hiram Till is the most extensive till in northeast Ohio and covers approximately the eastern two-thirds of RVAAP. It is material from which the silty-clay loam and clay-loam soil of much of the northern part of northeastern Ohio is derived. The Hiram Till is the most clay-rich till of northeastern Ohio and

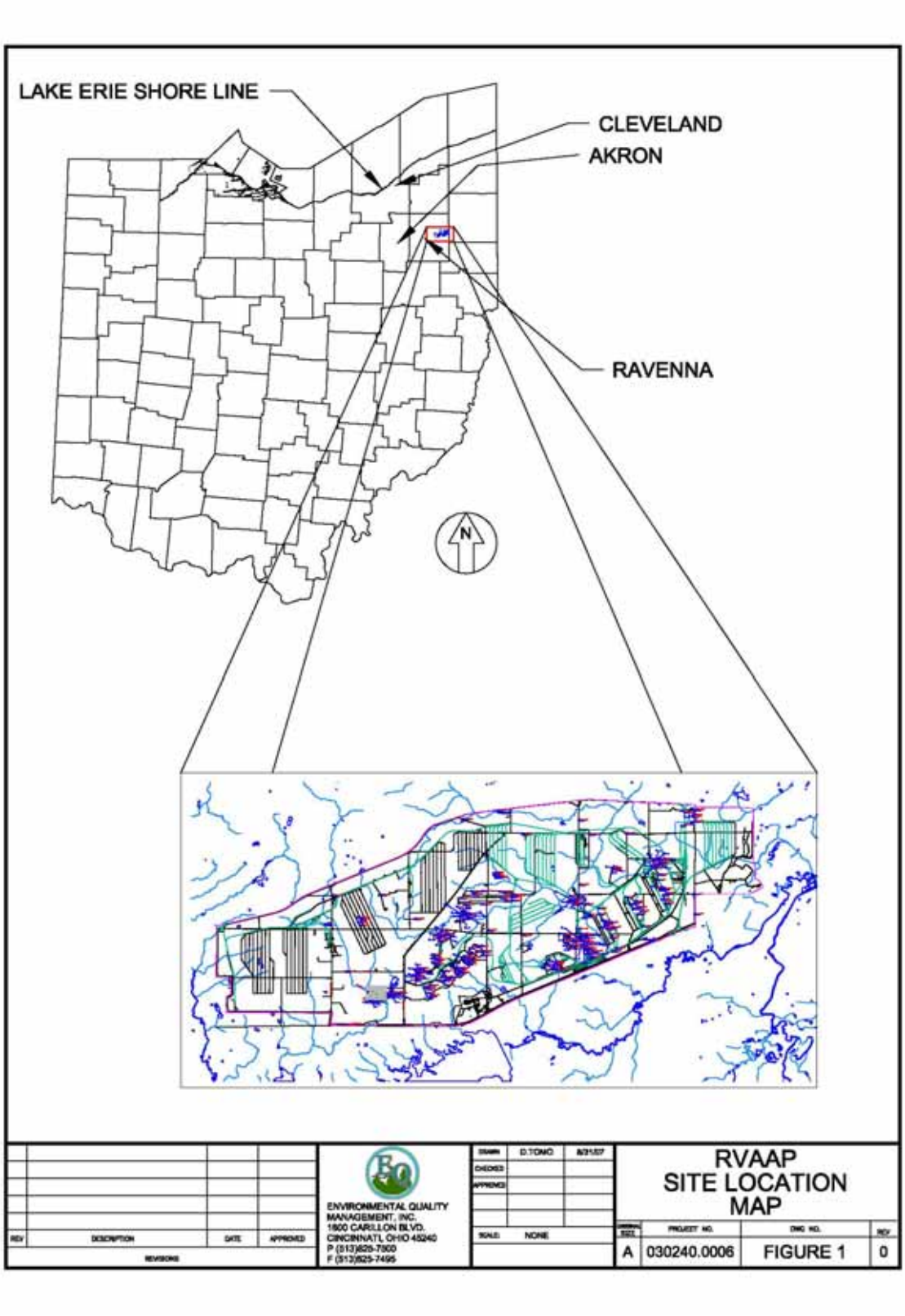


Figure 1-1. General Location Map

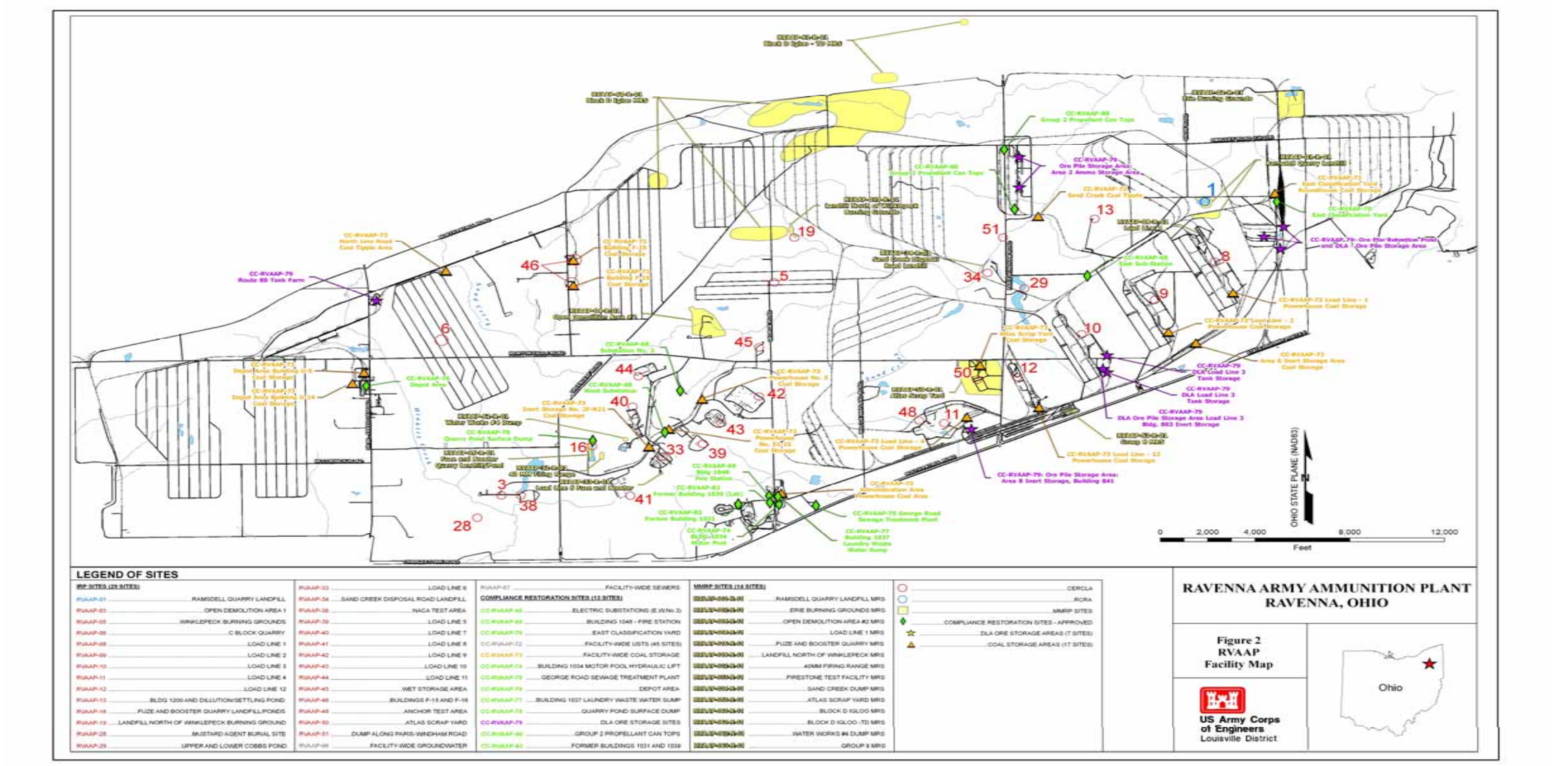


Figure 1-2. RVAAP Facility Map

is only sparsely pebbly with boulders and cobbles rarely found. The Hiram Till is characteristically thin with a median thickness of 5 feet in the eastern portion of RVAAP. The Lavery Till is a surface till that is found in a large portion of central Portage County. It is comprised of a clayey-silt that contains approximately 28 percent sand and 30 percent clay. The Lavery Till contains few pebbles and only a few cobbles and boulders in marked contrast to earlier tills found in this area. In the subsurface, below the Hiram Till, the Lavery Till is almost always present with maximum thicknesses up to 40 feet in the western portion of the facility; although, its median thickness is only 4 feet. The Lavery Till can be found exposed across the western third of RVAAP. The till is reported to be somewhat impermeable, with hydraulic conductivities greater than 10^{-6} cm/sec.

It is unclear whether the glacial outwash deposits located in the northeast corner of RVAAP area of the Hiram, Lavery, or another glacial episode in origin. No gravel deposits of the Hiram age have been positively identified in Portage County. Likewise, Lavery outwash is scanty and inconspicuous. Only the most meager gravel deposits were formed in this age.

In addition to the glacial deposits, other unconsolidated deposits include alluvium associated with the surface drainages that may or may not be continuous with the surrounding glacial tills.

1.3.2 Bedrock

The bedrock underlying the glacial deposits comprises sedimentary deposits, predominantly Pennsylvanian in age, with minor deposits of Mississippian-age rocks. The *Preliminary Assessment for the Ravenna Army Ammunition Plant* (USACE, 1996) reports that the bedrock units at RVAAP display a gentle southward dip of 5 to 10 ft/mile. In the subsurface bedrock below the glacial deposits, earlier erosion has exposed progressively older bedrock units in an eastern direction across RVAAP. The *Installation Assessment of Ravenna Army Ammunition Plant* (USATHAMA, 1978) provides a map that illustrates the subsurface geology at RVAAP. The youngest bedrock unit found on RVAAP is the Homewood Sandstone Member (Homewood) of the Pottsville Formation. The Homewood is the shallowest bedrock in the western half of RVAAP and is missing in the eastern half. The Homewood comprises coarse- to fine-grained clay-bonded micaceous sandstone with thin shale lenses. The Mercer Member of the Pottsville Formation directly underlies the Homewood and consists of gray to black micaceous shale, thin sandstones, and coal. The Connoquenessing Sandstone Member underlies the Mercer Member and comprises coarse- to fine-grained sandstone and silty to sandy shale. The Sharon Member Shale unit (Sharon Shale) consists of gray to black sand and micaceous shale with thin coal and separates the Connoquenessing Sandstone Member from the underlying Sharon Conglomerate (Sharon). Comprised of tan, coarse- to fine-grained orthoquartzite sandstone, the Sharon is loosely cemented and is the most important aquifer found at RVAAP. The Sharon is the shallowest bedrock in the eastern portion of RVAAP. The Mississippian bedrock units found in the eastern portion of RVAAP comprise the Meadville Shale, a blue-gray shale, and the Berea Sandstone, a massive, moderately hard, medium- to fine-grained sandstone.

1.4 Site Hydrogeology

1.4.1 Groundwater in Unconsolidated Deposits

Groundwater in the unconsolidated deposits is limited to sandy lenses in the glacial tills, saturated lake clays and outwash material, and the alluvium deposits associated with the numerous surface drainages at RVAAP. Groundwater is also present at the glacial till-bedrock contact. Outside of the facility boundaries, unconsolidated deposits can be an important source of groundwater, as many of the domestic wells and small public water supplies located near the facility obtain reasonable quantities of water from wells completed in unconsolidated deposits. There is evidence that a buried valley tributary to the Mahoning River is present in the west-central portion of RVAAP (USATHAMA, 1978). Although buried valleys can be important aquifers, there is no evidence to support the occurrence of significant water-bearing material in this buried valley tributary. The main buried valley aquifer associated with the Mahoning River does not yield significant quantities of water (USATHAMA, 1978). Because the buried valley aquifer that may be found on RVAAP is a tributary, finer-grained sediment would be expected in this stream valley compared to the main buried valley aquifer, culminating in potentially lower water yields in the tributary sediments. Water production wells previously drilled in the area (Barnes, 1950) also support the insignificance of a buried valley aquifer at RVAAP. Figure 1-3 shows the potentiometric surface of unconsolidated sediment within the facility from October 2010 (USACE, 2010a). Groundwater in the unconsolidated aquifer predominantly flows in an eastward direction; however, the unconsolidated zone shows numerous local flow variations influenced by topography and drainage patterns. The local variations in flow direction suggest: (1) groundwater in the unconsolidated deposits is generally in direct hydraulic communication with surface water; and (2) surface water drainage ways may also act as groundwater discharge locations. In addition, topographic ridges between surface water drainage features act as groundwater divides in the unconsolidated deposits.

1.4.2 Groundwater in Bedrock Deposits

The principle water-bearing aquifer at RVAAP is the Sharon Conglomerate. Depending on the existence and depth of overburden, the Sharon ranges from an unconfined to a leaky artesian aquifer. Water yields from area wells completed in the Sharon range from 30 to 400 gallons per minute (gpm) (USATHAMA, 1978). Well yields of 5 to 200 gpm were reported for on-site bedrock wells completed in the Sharon (Kammer, 1982). Other local bedrock units capable of producing water include the Homewood Sandstone, which is generally thinner and only capable of well yields less than 10 gpm, and the Connoquenessing Sandstone. The Connoquenessing Sandstone is a good aquifer where it occurs, but it is less productive than the Sharon Conglomerate (Kammer, 1982).

Figure 1-4 shows the potentiometric surface of bedrock groundwater within the facility from October 2010 (USACE, 2010a). The bedrock potentiometric map shows a regional eastward flow direction that is not affected by local surface topography. For much of the eastern half of RVAAP, the bedrock potentiometric surface is higher than the overlying unconsolidated potentiometric surface, thus indicating an upward hydraulic potential. This evidence suggests that there is a confining layer that separates the two aquifers. In the far eastern area, the two

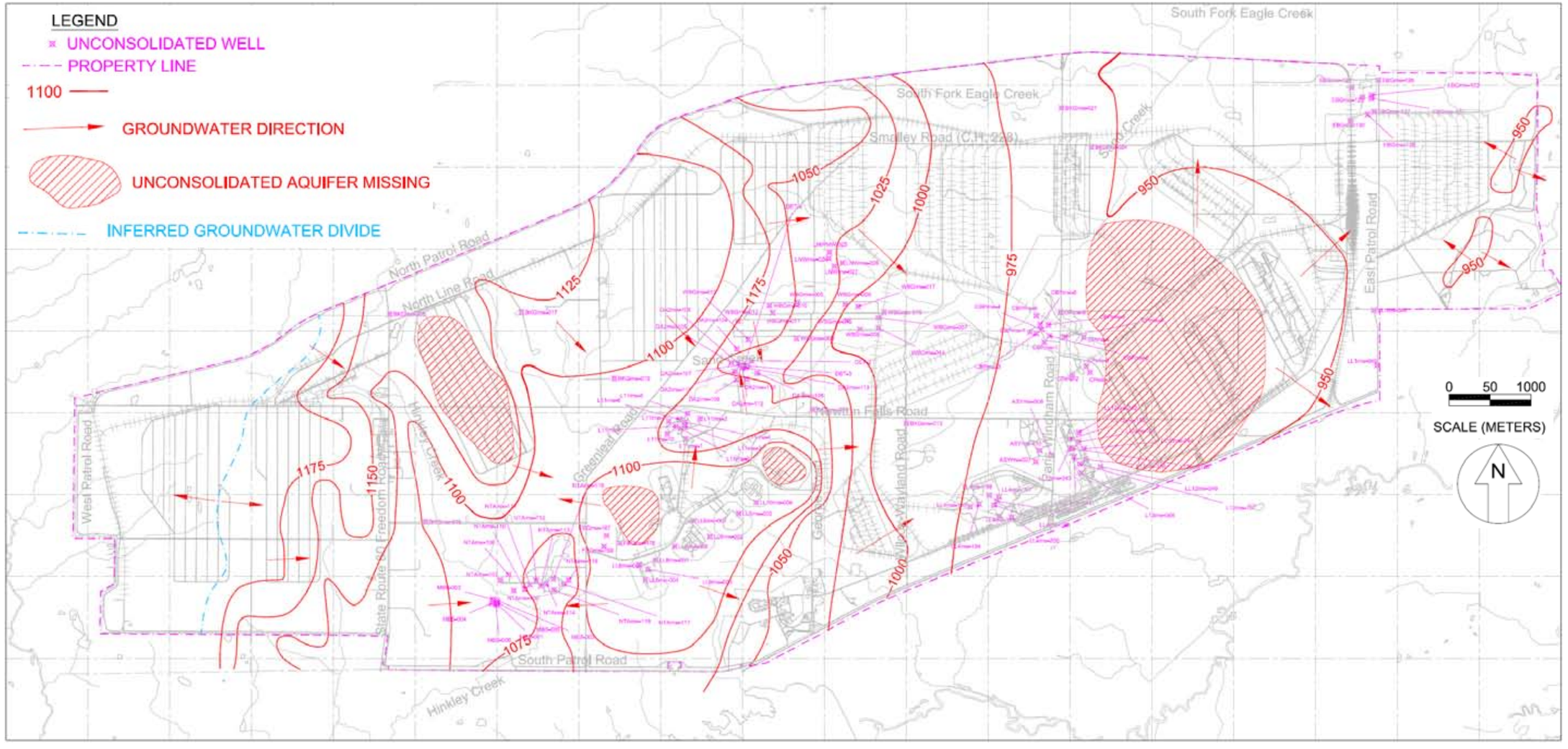


Figure 1-3. Potentiometric Surface of Unconsolidated Aquifer (Oct. 2010)

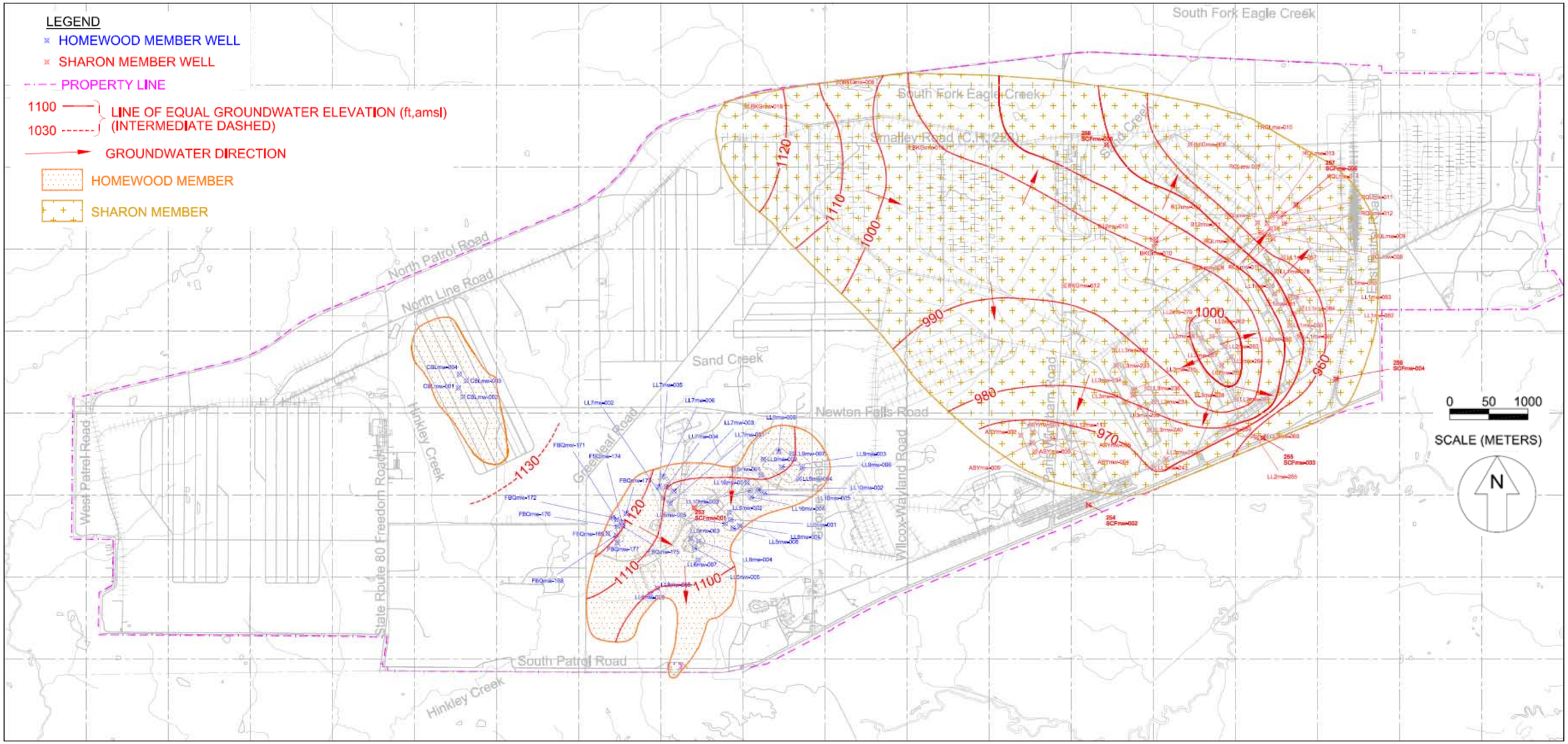


Figure 1-4. Potentiometric Surface of Bedrock – Homewood and Sharon (Oct. 2010)

potentiometric surfaces are approximately at the same elevation, thus suggesting that hydraulic communication between the two aquifers is occurring.

1.5 Project Organization and Schedule

1.5.1 Project Organization and Responsibilities

EQM's overall project organization and responsibilities are presented in the Project Management Plan prepared for this PBA. The project manager for this project will be John M. Miller, CHMM. Field geologists will be Colleen Lear, LG, Scott Spesshardt, CPG, and a geologist supplied by our Team contractor, SAIC. Drilling activities will be conducted by Frontz Drilling, and clearance of unexploded ordnance (UXO) will be conducted by PIKA International. Health and safety requirements are addressed in Part III of this amendment.

1.5.2 Schedule

Tasks to be completed under this milestone are described in this amendment to the *Facility-Wide Sampling and Analysis Plan for Environmental Investigations* (SAP) dated February 24, 2011. The schedule for this effort assumes installation and development of the wells to be completed by the end of March 2012 while still allowing for the 45-day Ohio Environmental Protection Agency (EPA) review cycle. This task is on a separate track from the RI Work Plan.

EQM's schedule to complete this project is as follows:

- Prepare and submit amendment for the Facility-Wide SAP – September 1, 2011.
- Approval of amendment – January 6, 2012.
- Install and develop wells – January 30 through March 17, 2012.
- Sample wells – Quarterly (April, July, and October 2012 and January 2013).

SECTION 2. FIELD ACTIVITIES

2.1 Scope and Objective

Additional monitoring wells are needed at the facility to complete hydrogeologic system modeling and to conduct contaminant fate-and-transport modeling for a Facility-Wide groundwater approach in support of the RI/FS and eventual ROD. The additional wells include, but are not limited to, those recommended by the USACE in the *Draft 2010 Addendum* for characterizing the nature and extent of Facility-Wide groundwater impacts in shallow and deep groundwater aquifers beneath the site.

2.2 Sample Network and Rationale

To achieve the objectives, EQM has identified 39 new wells to be installed at the facility. The *Draft 2010 Addendum* only specifically identified 13 new wells. As mentioned previously, the additional wells are necessary to complete hydrogeologic system modeling and to conduct contaminant fate-and-transport modeling for a facility-wide groundwater approach. In this regard, permeability testing will be performed on test cores obtained from 20 of the new wells. Twelve (12) of these wells also will be used to further evaluate potential exit pathways, especially along the southern and eastern borders. Although the primary focus of the new wells is to provide additional input in support of the Facility-Wide groundwater models, 13 of the new wells have been placed in the vicinity of current Compliance Restoration (CR) sites to secondarily assess potential groundwater impacts from these units. One stainless steel well will be installed to assess whether the occurrence of bis(2-ethylhexyl)phthalate is the result of leaching from PVC well materials. Lastly, placement of many of the new wells within the RVAAP is proximate to AOCs to evaluate vertical contaminant distribution and/or particle inflow/outflow through the central portion of the facility. Nineteen (19) wells will be completed in the first water-bearing zone encountered, which is expected to be in the unconsolidated overburden; five (5) wells in the western portion of the site are expected to be completed in the Homewood Member; and 15 wells will be completed in the Sharon Member (Sharon). Completion depths of the wells will vary based on the topographic changes across RVAAP and the depth at which the water-bearing strata are encountered. EQM predicts that the Homewood Member will be the first bedrock aquifer encountered in the western portion of the property based on well data from nearby AOCs (e.g., C-Block, and Fuze and Booster). In general terms, the Homewood is the shallowest bedrock to the west, and the Sharon is the shallowest bedrock to the east at RVAAP (i.e., the Homewood is missing in the eastern half of the site). There is a small potential that the shallowest bedrock unit to be encountered in the western portion of RVAAP may be the Mercer Member or the Connoquenessing Sandstone, which are exposed on the flanks of pre-glacial valley walls. These two units are depositionally between the Homewood and Sharon. If no groundwater is encountered in the upper portion (i.e., the upper 20 feet) of the Sharon Conglomerate, the boring will be terminated and considered a dry hole. The next water-bearing unit below the top of the Sharon Conglomerate is located at the base of this formation. Six wells (SCFmw-001 through SCFmw-006) were previously installed at the base of the Sharon and provide facility-wide coverage for this lowermost aquifer; consequently,

installation of additional wells to the base of the Sharon Member is unwarranted. Due to the lack of hydrogeologic information in the western third of the site, some of the overburden wells may be completed in bedrock, if the overburden material is thin (less than 5-feet thick) or absent or the groundwater yield is negligible (i.e., less than 1 gpm) in the unconsolidated material. Note that paired wells will be placed a minimum of 5 feet apart to reduce the potential impact of "grout bleed" from the newly installed well. Table 2-1 provides justification for the new wells, and Table 2-2 presents the well locations, estimated well depths, and further rationale for each selected location. Figures 2-1 through 2-3 show the proposed well locations in reference to current site features and existing well locations.

The new wells will be installed in accordance with Section 5.4 of the Facility-Wide SAP and as described herein. Additionally, EQM will request a meeting with all stakeholders prior to beginning drilling activities. The purpose of this meeting will be to obtain stakeholder approval, at each location, for the placement of each well. This will allow for stakeholder input based on actual field conditions at each location.

2.3 Utility Clearance

As described in Section 5.3 of FWGWMP SAP, prior to all subsurface activities EQM will notify and coordinate a utility clearance with the RVAAP Operation and Maintenance (O&M) Contractor and RVAAP Environmental Manager. Ten (10) business days prior to subsurface activities on site, a request for utility clearance will be submitted in writing to the RVAAP O&M Contractor, OHARNG Environmental Coordinator, and the RVAAP Environmental Manager. The request will describe and illustrate sample locations and activities to be performed so utilities can be adequately marked or cleared prior to drilling. To expedite this effort, EQM personnel will mark the well locations at least one (1) week prior to mobilization of the drilling crew. EQM will mark the locations using painted wood slats, stakes, and or pin flags. Well locations positioned in paved areas will be marked using spray paint.

In addition, EQM will also use an UXO-Qualified Technician to conduct a surface clearance and borehole clearance for UXO for each of the proposed wells positioned in the Munitions Response Site (MRS) AOCs and/or other areas where requested by the Army or where site conditions are encountered that warrant surface/borehole clearance. If buried utilities or UXO are present at the selected sample location, the boring will be field adjusted to ensure the safety of the sampling team. Additional details concerning UXO clearance and avoidance are presented in Section 10.2 of the Site Safety and Health Plan (SSHP) Addendum located in Part III of this amendment.

2.4 Clearing and Grubbing

Several of the proposed well locations are located in portions of the property that are overgrown with small trees and underbrush. Consequently, access to these locations may require clearing and grubbing. EQM will coordinate all brush/vegetation clearing with OHARNG personnel. After the well locations have been marked in the manner described in Section 2.3, EQM

Table 2-1. Justification for New Wells

Map I.D.	Vertical Delineation	Horizontal Delineation	Used in Groundwater Model	Exit Pathway	CR Site Evaluation	First-water Bearing Zone Well	Bedrock Well[a]	Initial Investigation of GW Quality at AOC/Area	Permeability Testing
1	x		x	x			Sharon		x
2	x		x	x			Sharon		x
3		x	x	x		x			
4		x	x	x		x			x
5	x		x				Sharon		x
6	x	x	x	x			Sharon		x
7	x	x	x				Sharon		
8	x		x				Sharon		x
9			x		CR-79, CR-80	x		x	
10		x	x				Sharon		
11	x		x	x			Sharon		x
12			x		CR-73	x		x	
13		x	x			x			x
14	x		x				Sharon		x
15	x		x				Sharon		
16	x		x				Sharon		
17		x	x			x			x
18	x		x				Sharon		x
19	x		x				Sharon		
20			x	x	CR-83	x		x	
21			x		CR-73, CR-76	x		x	
22			x			x		x	
23			x	x		x		x	
24			x		CR-73, CR-76	x		x	
25			x		CR-73, CR-76	x		x	x
26	x		x				Homewood		x
27		x	x			x			x
28	x		x				Homewood		x
29		x	x			x			
30	x		x				Homewood		x
31			x		CR-79	x		x	
32			x	x	CR-70, CR-73	x		x	
33			x	x	CR-70, CR-73		Sharon	x	x
34			x		IRP-45		Sharon	x	
35			x		CR-79	x		x	
36		x	x				Homewood		x
37			x	x	CR-69, CR-73, CR-74, CR-77, & CR-83	x		x	x
38			x	x	CR-69, CR-73, CR-74, CR-77, & CR-83		Homewood	x	x
39			x			x			

[a] Rock coring will be performed on all bedrock wells.

Table 2-2. Proposed Wells and Rationale.

Map ID*	RVAAP Area	Well Location	Est. Depth (ft)	Rationale / Comments
1	SE/Load Line 1	Between LL1mw-064 & LL1mw-065	30	Groundwater samples from the Sharon wells located within Load Line 1 have been identified as containing elevated concentrations of metals, explosives, and pesticides. The downgradient wells (LL1mw-064 and LL1mw-065) are screened in the shallower unconsolidated aquifer. A Sharon well installed between downgradient wells LL1mw-064 and LL1mw-065 will be used to assess GW impact vertically at this location, to monitor the potential GW exit pathway off of RVAAP, and for permeability testing.
2	Erie Burning Grounds	Paired with EBGmw-125	30	Groundwater samples collected within the Erie Burning Grounds have been identified as containing elevated concentrations of metals and phthalates. The wells in this AOC are completed in the unconsolidated aquifer. A Sharon well will be installed near well EBGmw-125 to assess GW impact vertically at this location, to monitor the potential GW exit pathway off of RVAAP, and for permeability testing.
3	SE	Paired with SCFmw-004	15-20	Well SCFmw-004 is completed at the base of the Sharon Conglomerate Member. Groundwater samples from wells in Load Line 1 and Load Line 2 have been found to contain elevated concentrations of metals, explosives, pesticides, and/or PCBs. The wells in these AOCs are completed in the upper part of the Sharon. A well installed near SCFmw-004 will be used to assess first GW downgradient of Load Lines 1 and 2, and to monitor the potential GW exit pathway off of RVAAP.
4	SE	Paired with SCFmw-002	15-20	Well SCFmw-002 is completed at the base of the Sharon Conglomerate Member. Groundwater samples from wells in Load Lines 1, 2, 3, 4, and 12 have been found to contain elevated concentrations of metals, explosives, pesticides, nitrate, and/or PCBs. The wells in these AOCs are completed in the first water-bearing zone encountered. A well installed near SCFmw-002 will be used to assess first GW downgradient of these load lines, to monitor the potential GW exit pathway off of RVAAP, and for permeability testing.
5	S/Load Line 4	Paired with LL4mw-199	35	Groundwater samples collected within Load Line 4 have been identified as containing elevated concentrations of metals. All the wells in this area are screened in the unconsolidated aquifer. A Sharon well will be installed downgradient of focus well LL4mw-193 and paired with well LL4mw-199 to assess GW impact vertically and for permeability testing.
6	Load Line 3	South-southwest of LL3mw-243	25	Groundwater samples collected within Load Line 3 have been identified as containing elevated concentrations of metals, explosives, and pesticides. A Sharon well will be installed downgradient of Load Line 3 and potentially downgradient of Load Line 12 near South Perimeter Road to assess GW impact vertically and horizontally, to monitor the potential GW exit pathway, and for permeability testing.

Table 2-2 (continued). Proposed Wells and Rationale.

7	Load Line 3	Southwest of LL3mw-241	25	Groundwater samples collected within Load Line 3 have been identified as containing elevated concentrations of metals, explosives, and pesticides. The west adjoining AOC (Load Line 12) only has wells screened in the unconsolidated aquifer and the Sharon Shale interval. Consequently, an additional downgradient well is needed west of LL3mw-241 to assess the extent of groundwater impact in the Sharon. A Sharon well will be installed southwest of well LL3mw-241 between Load Lines 3 and 12 to assess GW impact vertically and horizontally.
8	Central Burn Pits	Near CBPmw-001	50	Groundwater samples collected at the Central Burn Pits have been identified as containing elevated concentrations of metals. All the wells in this AOC are screened in the unconsolidated formation. A Sharon well will be installed between CBPmw-001 and CBPmw-002 to assess GW impacts vertically and for permeability testing.
9	Group 2 DLA Ore Storage Area	-	25	No GW data has been generated in this area of the site, which formerly housed two ore pile storage areas and propellant can tops. Brass ingots were historically stored on the ground surface of the ore pile storage sites. A well will be installed on the downgradient side of these CR units to assess potential impact to first groundwater in this area.
10	Building 1200	Near B12mw-012	25	Groundwater samples collected within the Building 1200 Area have been identified as containing elevated concentrations of metals. The wells are screened in the Sharon aquifer. The horizontal extent of impact has not been fully defined. A Sharon well will be installed north-northwest of focus wells B12mw-010/012 to assess downgradient GW impacts.
11	North Perimeter	Paired with BKGmw-21	40	A Sharon well paired with BKGmw-021 will be installed to provide additional coverage in this unit along the northern perimeter of the site. This location has also been selected for permeability testing.
12	North Line Road Coal Tipple	-	45-50	This area was formerly used as a coal tipple. Coal dust and particles are currently present at the ground surface. No GW data has been generated in this area of the site. One well will be installed to assess GW quality in the first water-bearing zone encountered in this area located just south of North Line Road.
13	Winklepeck	Near WBGmw-007	20	Groundwater samples collected at Winklepeck Burning Grounds have been identified as containing elevated concentrations of metals and explosives. The wells are screened in the unconsolidated aquifer. The extent of GW impact is not defined east of WBGmw-007. An unconsolidated well will be installed east of well WBGmw-007 and south of WBGmw-016 to assess the horizontal and downgradient extent of affected GW and for permeability testing.
14	Winklepeck	Near WBGmw-007	40-45	To evaluate the vertical extent of impact in GW in this AOC, a Sharon well will be installed east of well WBGmw-007 and south of WBGmw-016. This well will be paired with the new unconsolidated well. Permeability testing will also be performed on this well.

Table 2-2 (continued). Proposed Wells and Rationale.

15	Winklepeck	Paired with WBGmw-009	40-45	A Sharon well will be installed and paired with well WBGmw-009 to assess the vertical extent of GW impact in this area of the AOC.
16	Winklepeck	Paired with WBGmw-006	40-45	A Sharon well will be installed and paired with well WBGmw-006 to assess the vertical extent of GW impact in this portion of the AOC.
17	Demo. Area 2	Near DA2mw-108	15-20	Groundwater samples collected at Open Demolition Area 2 have been identified as containing elevated concentrations of hexavalent chromium and PCBs. The wells are screened in the unconsolidated aquifer. The extent of GW impact is not defined east of well DA2mw-108. An unconsolidated/ Sharon well pair will be installed east of wells DA2mw-108/ DA2mw-110 to assess the horizontal, vertical, and downgradient extent of GW impact. We understand the proximity to Rocket Ridge Removal activities and will coordinate as necessary. Permeability testing will be performed on both wells.
18	Demo. Area 2	Near DA2mw-108	40-45	
19	Demo. Area 2	Paired with DETmw-003	40	To assess the vertical of impact in GW in this AOC, a Sharon well will be installed and paired with well DETmw-003.
20	Admin/ George Road	Post 1/ fence line area	20-30	This location is near the south property line and downgradient of several Compliance Restoration sites. A well will be installed to intercept first groundwater south-southwest of the administration and Post 1 areas to assess the potential GW exit pathway off of the RVAAP.
21	West NW	-	30	Several depots and coal storage facilities were previously located along State Route 80 Freedom Road immediately south of Newton Falls Road. No wells have been installed in this area. A well will be completed in the first water-bearing zone to assess potential GW impacts near Newton Falls Road to the northwest of these facilities.
22	West SW	-	25	The westernmost portion of the RVAAP has not been evaluated for potential GW impact. A well will be completed in the first water-bearing zone to assess the extent of western GW impact near McCormick Road.
23	South SW	-	15	A well will be completed in the first water-bearing zone to assess the extent of GW impact about 1000 meters east of SR80/Charlestown Road in alignment with the Sharon Conglomerate bedrock surface low and the Hinkley Creek exit pathway.
24	Depot Area	-	25	Several depots and coal storage facilities were previously located along State Route 80 Freedom Road. No wells have been installed in this area. A well will be completed in the first water-bearing zone to assess potential GW impacts near Route 80 to the east of the southernmost depot facility.
25	Depot Area	-	25	A second well will be completed in the first water-bearing zone to assess potential GW impacts near Route 80 to the east of the northernmost depot facility. Permeability testing will be performed at this location.

Table 2-2 (continued). Proposed Wells and Rationale.

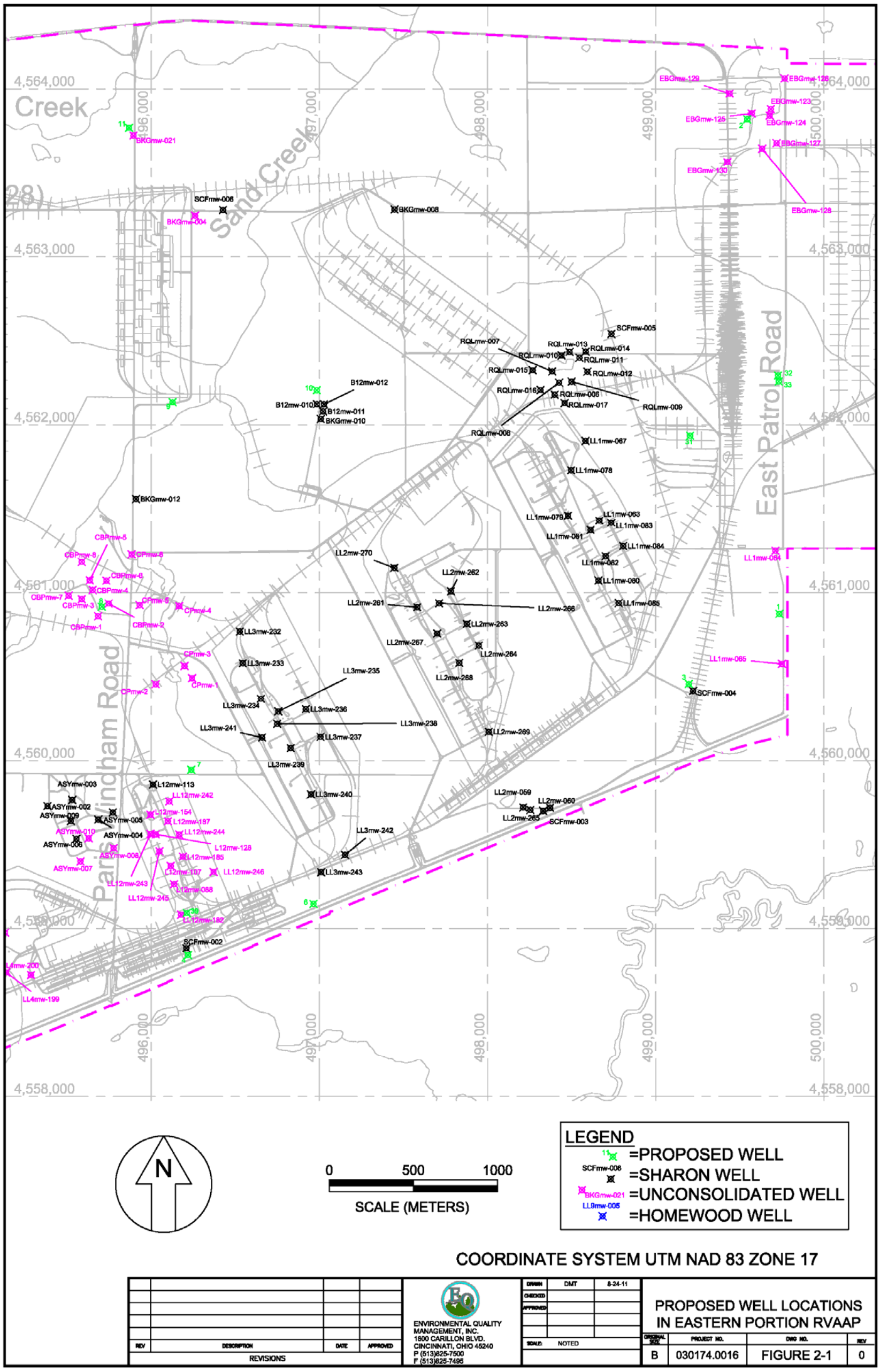
26	NACA Test	Paired with NTAmw-109	40-45	Groundwater samples collected at the NACA Test Area have been identified as containing elevated concentrations of metals and PCBs. The wells are screened in the unconsolidated aquifer. Deeper groundwater has not been evaluated. A Homewood well will be installed and paired with well NTAmw-109 to assess the vertical extent of GW at this location and for permeability testing.
27	Load Line 6	Near LL6mw-002	15-20	Groundwater samples collected within Load Line 6 have been identified as containing elevated concentrations of metals. All the wells are screened in the unconsolidated or Homewood units. A well pair will be installed in the unconsolidated and Homewood units southeast of Load Line 6 to assess the horizontal and vertical GW quality downgradient of this AOC. Permeability testing will be conducted on both wells.
28		Near LL6mw-002	45-50	
29	Load Line 11	Near LL11mw-007	25	Groundwater samples collected within Load Line 11 have been identified as containing elevated concentrations of SVOCs and metals. All the wells are screened in the unconsolidated formation. A well pair will be installed in the unconsolidated and Homewood formations north-northwest and downgradient of well LL11mw-007 (along Newton Falls Road) to assess the horizontal and vertical GW quality. Permeability testing will be performed on the deeper well.
30		Near LL11mw-007	45	
31	DLA Main Ore Storage Yard Area	-	15-30	One well will be installed to assess GW quality in the first water-bearing zone encountered in the DLA Main Ore Storage Yard area, which is a CR site located in the eastern portion of the facility.
32	East Classification Yard	-	15	The East Classification Yard is a Compliance Restoration site. Groundwater has not been evaluated in this area. A well pair will be installed in the first water-bearing zone and in the underlying Sharon formation east and downgradient of this AOC (near East Patrol Road) to assess GW quality. Permeability testing will be performed on the Sharon well.
33		-	30	
34	Wet Storage	-	30	A Sharon well will be installed near Powerhouse No. 5 to evaluate groundwater quality near this former coal storage unit. This well will also be side-gradient to Demolition Area 2.
35	Route 80 Tank Farm	-	45-50	This area was formerly used as a DLA Ore Storage Area. Aboveground storage tanks reportedly existed in this area. Gamma radiation has also been identified in soils in this area. One well will be installed to assess GW quality in the first water-bearing zone encountered near the former Route 80 Tank Farm located just south of North Line Road.
36	C Block	S of CBLmw-002	50	Groundwater samples collected at the C-Block Quarry have been identified as containing elevated concentrations of SVOCs and PCBs. The wells are screened in the Homewood aquifer. The extent of groundwater impact has not been defined to the south. One Homewood well will be installed south-southeast of well CBLmw-002 at Newton Falls Road to assess the extent of GW impact and for permeability testing.

Table 2-2 (continued). Proposed Wells and Rationale.

37	Admin/ George Road	Post 1/ fence line area	20-30	This location is near the south property line and downgradient of several Compliance Restoration sites. One well will be installed to intercept the first water-bearing zone. This well will be positioned southeast of the administration and Post 1 areas to assess the potential GW exit pathway off of the RVAAP and for permeability testing.
38	Admin/ George Road	Post 1/ fence line area	45-50	This well will be paired with well #37 to intercept the underlying bedrock aquifer (Homewood). This well will be positioned southeast of the administration and Post 1 areas to assess potential vertical contaminant distribution, the potential GW exit pathway off of the RVAAP, and for permeability testing.
39	Load Line 12	Near LL12mw-182	35	Well LL12mw-182 has been found to contain bis(2-ethylhexyl)phthalate above site screening criteria on four separate occasions. A stainless steel well will be installed near this location to verify whether the presence of bis(2-ethylhexyl)phthalate is leaching from the PVC well materials.

*Map ID # is correlated to proposed location on site map.

The Sharon Conglomerate wells will not be completed as basal wells for the formation (refer to Section 2).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BKGmw-004
BKGmw-008
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EBGmw-124
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EBGmw-128
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BKGmw-021 =UNCONSOLIDATED WELL
LL9mw-005 =HOMEWOOD WELL
COORDINATE SYSTEM UTM NAD 83 ZONE 17
REV
DESCRIPTION
DATE
APPROVED
REVISIONS
ENVIRONMENTAL QUALITY MANAGEMENT, INC.
1800 CARILLON BLVD.
CINCINNATI, OHIO 45240
P (513)825-7500
F (513)825-7495
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CHECKED
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PROPOSED WELL LOCATIONS IN EASTERN PORTION RVAAP
ORIGINAL SIZE
PROJECT NO.
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FIGURE 2-1
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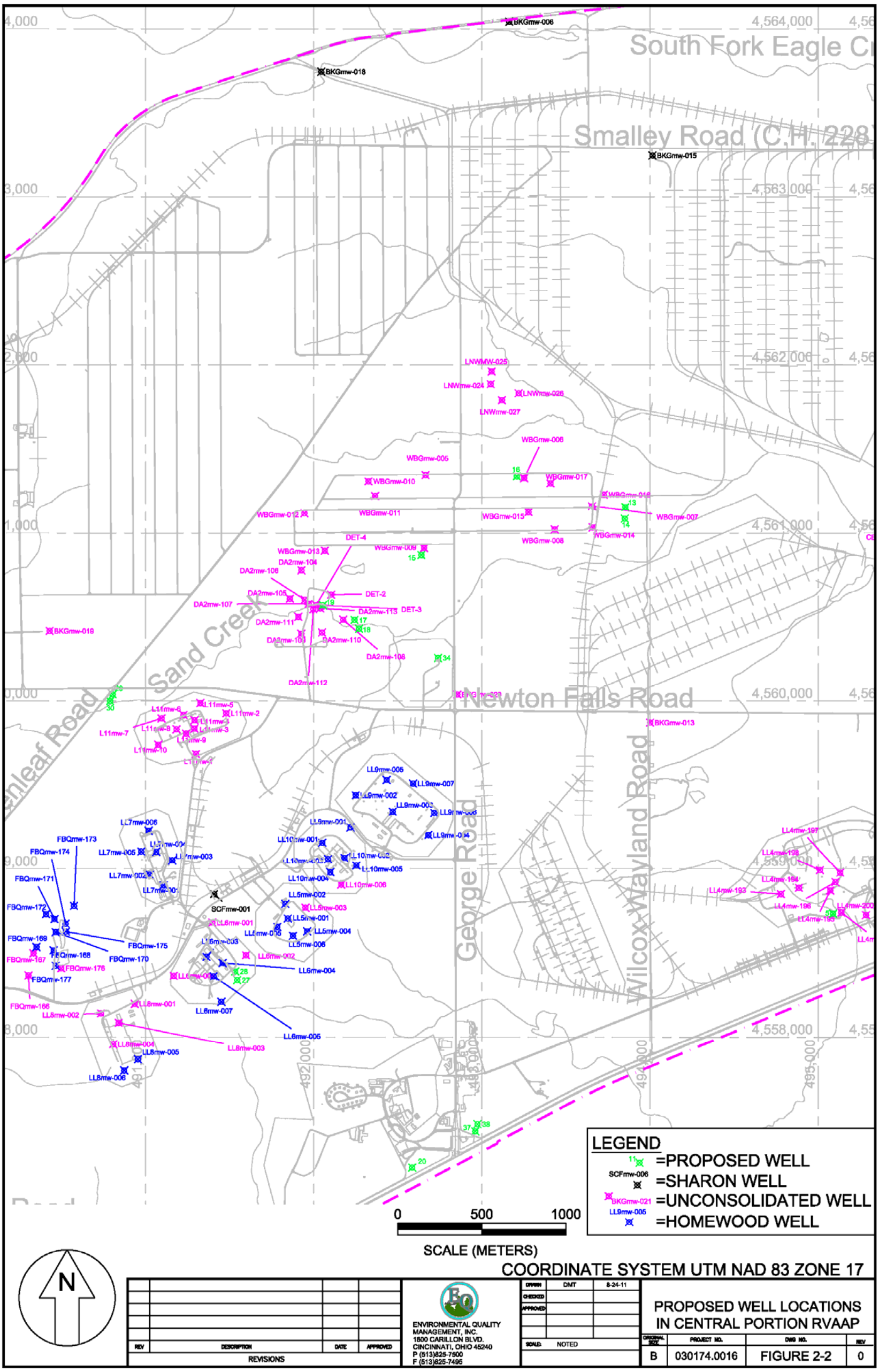
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P (513)825-7500
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PROPOSED WELL LOCATIONS IN CENTRAL PORTION RVAAP
ORIGINAL SIZE
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DWG NO.
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FIGURE 2-2
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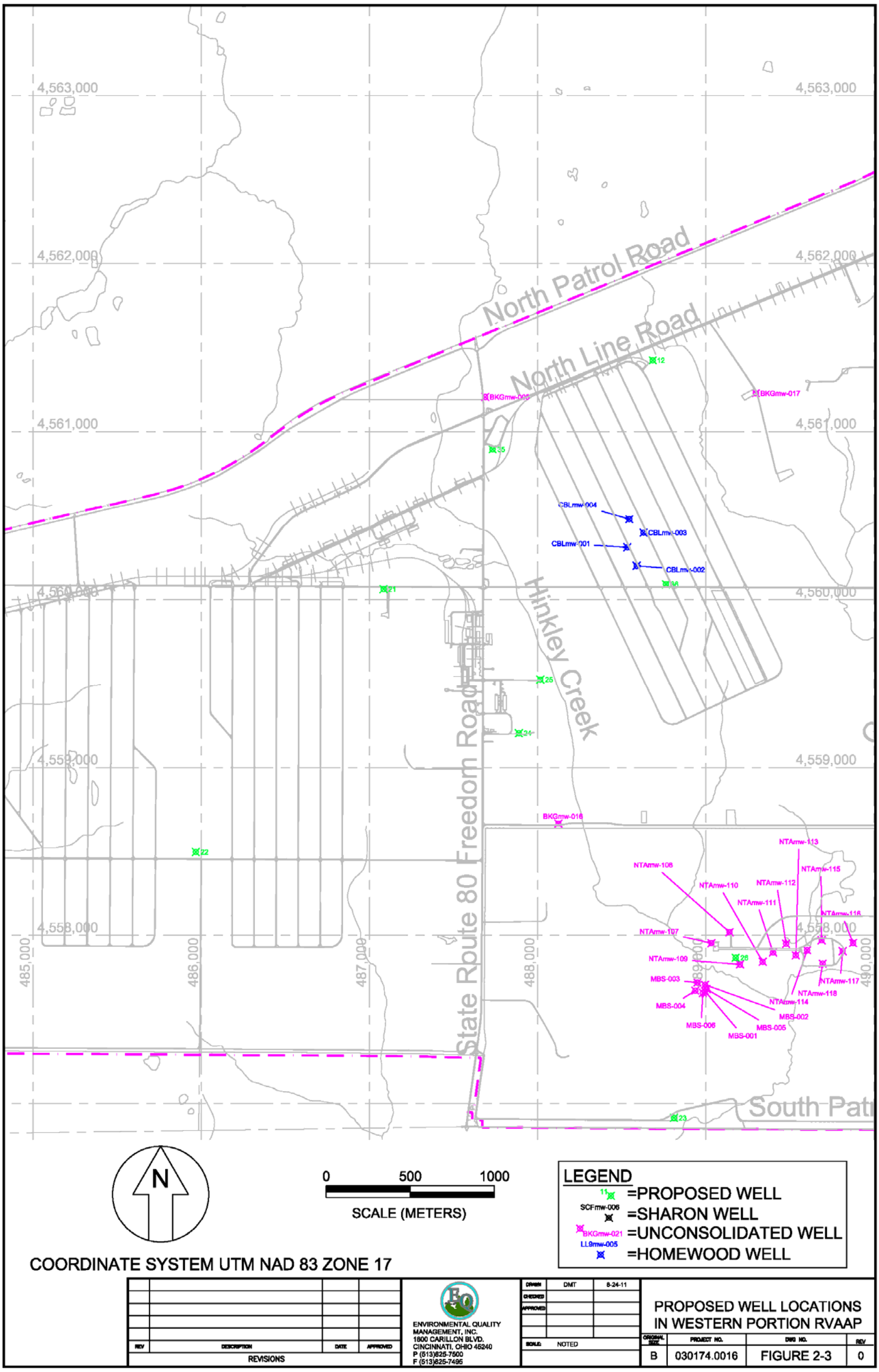
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CHECKED
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SCALE:
NOTED
PROPOSED WELL LOCATIONS IN WESTERN PORTION RVAAP
ORIGINAL SIZE
PROJECT NO.
DWG NO.
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FIGURE 2-3
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personnel will identify those areas that will require clearing for drill rig access. EQM has a subcontract in place with Frank's Maintenance to perform clearing and grubbing at the site. They have all the necessary equipment to fulfill this function and will be used to provide access to the various well locations, as needed. However, every effort will be made to leave larger trees (i.e., greater than 6-in. diameter) in place. EQM will not proceed with any brush/vegetation clearing without prior approval from the OHARNG.

2.5 Drilling Methods and Equipment

2.5.1 Equipment Condition and Cleaning

Requirements for the condition and cleaning of equipment used for well installation are described in Section 5.4.2.1.1 of the Facility-Wide SAP. These requirements, as applicable, will apply for equipment used to install monitoring wells.

2.5.2 Drilling Methods

Drilling through the overburden will be accomplished using 4.25-in.-I.D. or 6.25-in.-I.D. hollow stem augers. Soil samples will be collected continuously from the surface to the total depth of the boring or bedrock by driving a clean 2-in. by 24-in. split-spoon sampling device in advance of the auger string using a 140-lb drop hammer (ASTM Method D-1586). Upon retrieval of the sampling device, the percentage of recovery will be recorded and the contained soil core will be split in half, lengthwise, using a stainless steel knife. Each split-spoon sample will be screened using a photoionization detector (PID) for gross measurement of volatile organic compounds in the vapor headspace. Soil samples will be placed in zipper-sealed bags and allowed to warm to ambient temperatures prior to screening. Soil clumps will be broken down using a gloved hand. The tip of the PID probe will be inserted into the bag, and the result will be recorded on the boring log at the time of screening. The onsite geologist will log and describe the soil cores in a field logbook or Soil Boring Log as the boring is advanced. No chemical analysis of the soil samples is proposed.

At six of the proposed overburden well locations, 3-in.-I.D. by 24-in.-long, thin-walled Shelby Tube samples will be collected from the approximate center of the water-bearing zone to be monitored. The well locations subject to Shelby Tube testing will be selected in the field. The Shelby Tube will be attached to the sampling rods and hydraulically pushed the length of the tube. The thin-wall sampler will be extracted through the auger string and immediately capped at both ends upon retrieval pursuant to ASTM Method D-1587. The tube will be labeled and marked to orientation (i.e., top of core). The Shelby Tubes will be submitted to a geotechnical laboratory for permeability testing using ASTM Method D-5084, "Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter." Table 2-1 shows the wells (4, 13, 17, 25, 27, and 37) that have been selected for Shelby Tube (i.e., permeability) testing. The six unconsolidated wells were selected to provide permeability data in the eastern (well 4), central (wells 13, 17, 27, and 37), and western (well 25) portions of RVAAP, along potential exit pathways (proposed wells 4 and 37), and for

comparison with permeability data from paired Sharon (proposed wells 13 and 17) and/or Homewood (proposed wells 27 and 37) wells.

Wells to be completed into bedrock will be advanced from the top of the bedrock surface using rock coring and air rotary methods. Initially, the upper 3 to 5 feet of bedrock will be drilled, and a steel surface casing extending from the ground surface to the bottom of the borehole will be installed. The annulus between the casing and borehole will be sealed using a grout mixture comprising Portland cement and 6 percent bentonite. After the seal has cured for a minimum of 12 hours, drilling of the bedrock portion of the borehole will be completed. The surface casing will remain in place following installation of the monitoring well. Each of the well borings to be completed into bedrock will be cored using an "N" series or 2-in.-diameter core to assess the lithologies and the degree and nature of weathering and fracturing in bedrock. Rock cores will be screened for gross volatiles at the time of extraction by passing the PID wand over the core. N-series coring will be performed prior to reaming the borehole using air rotary methods to install the well. Overdrilling of the borehole will be accomplished with air rotary drilling using a truck-mounted air rotary rig. The rig will advance a tricone roller bit to the required drilling depth.

Rock cores will be stored in 10-ft intervals in covered wooden core boxes to preserve their relative position by depth. Intervals of lost core will be noted in the core sequence. Boxes will be marked on the cover (both inside and outside) and on the ends to provide project name, borehole number, cored interval, and box number. The core within each completed box will be photographed using a 35-mm digital camera after the core surface has been cleaned and wetted. The core will be oriented so that the top of the core will be at the top of the photograph. A legible scale will be placed along the core during filming, and each photograph will document the project name, well/borehole number, core box number, cored depths, and date. The cores will be retained and stored at the site. The onsite geologist will record the lithologic description of each core in the field logbook or boring log.

Fifteen field-selected rock core segments from the well screen interval will be removed and submitted to a geotechnical laboratory for permeability testing using ASTM Method D-5084. The selected core segments will range from 1 to 3 feet in length. Five of these cores will be obtained from wells completed in the Homewood Member, and the remaining 10 cores will be obtained from wells completed in the Sharon Formation. The cores will be labeled and marked for orientation, secured in bubble wrap, and placed in a protective cylinder (e.g., Lexan tube, map cylinder). The cylinder will be sealed at both ends and secured with packing tape and custody seals. The outside of the cylinder will be labeled with the core information. The packed core will then be placed in a cooler for transport to the geotechnical laboratory for permeability testing.

If a proposed monitoring well location does not encounter water during drilling, it will be abandoned in accordance with Army and Ohio EPA requirements and the location moved to a suitable alternate drilling location determined by RVAAP stakeholders (anticipated to be within a 50-ft radius of the original location). Drilling will continue until either 1) a well can be installed at the desired water-bearing depth, or 2) no water-bearing zone has been encountered at the desired depth at three locations, including the original sample point, within the 50-ft radius.

Soil and bedrock cuttings will be removed from the borehole during drilling via augering or high-pressure air. In the latter case, the drill cuttings will be directed into a diverter and then through a discharge vent directly into a container next to the borehole. Soil and rock cuttings will be containerized in Department of Transportation (DOT)-approved 55-gal drums, labeled, and staged on site pending future characterization and disposal.

Should newly installed wells produce formation fluids during drilling activities, the fluids will be captured, where possible, and containerized in DOT-approved 55-gal drums. The drummed fluids will be staged on site pending proper characterization and disposal.

2.6 Materials

2.6.1 Casing/Screen

The casing and screen materials for monitoring wells will be Schedule 40 polyvinyl chloride (PVC), depending on field conditions as presented in Section 5.4.2.2.1 of the Facility-Wide SAP. Note that one well will be completed using stainless steel casing and screen. Default screen lengths will be 10 feet, unless subsurface conditions warrant the use of a shorter or longer screen (e.g., 5 or 20 feet). Shorter screen lengths may be used if the first water-bearing unit is encountered within 10 to 15 feet of the ground surface. A longer length screen may be used for lower yielding formations or if the exact depth of the water-bearing formation cannot be accurately obtained from the rock core record. Use of screen lengths other than 10 feet will be subject to approval by USACE and the Ohio EPA.

2.6.2 Filter Pack, Bentonite, and Grout

The filter pack, bentonite, and grout materials for monitoring wells will be approved and used as presented in Section 5.4.2.2.2 of the Facility-Wide SAP.

2.6.3 Surface Completion

All monitoring wells will be constructed as above-grade installations, as presented in Section 5.4.2.2.3 of the Facility-Wide SAP, unless flush-mounted completions are specifically requested by OHARNG.

2.6.4 Water Source

The potable water source used for monitoring well installation and decontamination purposes will be identified by RVAAP personnel and approved by USACE and Ohio EPA before use. The collection and evaluation of the water source will follow Section 5.4.2.2.4 of the Facility-Wide SAP.

2.6.5 Delivery, Storage, and Handling of Materials

All monitoring well construction materials will be delivered, stored, and handled according to Section 5.4.2.2.5 of the Facility-Wide SAP.

2.7 Monitoring Well Installation

In general, monitoring wells will be constructed of new, 2-in.-diameter Schedule 40 PVC casing and screen. However, a 2-in.-diameter stainless steel well will be installed at location 39 (see Table 2-2) to assess whether the presence of bis(2-ethylhexyl)phthalate in well LL12mw-182 at Load Line 12 is an artifact from the PVC wells. The well screens will be commercially fabricated with 0.010-in. slotted openings. The well screens will be 5 to 10 feet in length depending on the subsurface conditions and flush-threaded to the solid casing. Granular filter pack (Global Supply No. 7) will be inserted into the annular space around the screen and extend at least 3 feet above the top of the screen interval unless subsurface conditions (e.g., overburden thickness) dictate that this qualification be field modified. In addition, approximately 6 inches of filter pack will be placed under the bottom of the well screen to provide a firm footing.

A bentonite seal will be placed atop the filter pack in accordance with Section 5.4.3.2.6 of the Facility-Wide SAP. The bentonite seal will be a minimum of 3-ft-thick unless subsurface conditions require that the thickness of this seal be field modified. The top of the bentonite seal will be measured with a weighted tape immediately after placement.

A grout mixture of cement and bentonite will be inserted via tremie pipe above the bentonite seal to near surface as described in Sections 5.4.2.2.2 and 5.4.2.3.7 of the Facility-Wide SAP.

The well will be completed at the surface with a locking 6-in.-diameter steel protective casing set in a concrete pad measuring approximately 30-in. square. The wells will extend approximately 3 feet above the ground surface and be protected by three to four steel bollards as described in Section 5.4.2.3.8 of the Facility-Wide SAP. Flush-mount covers may be substituted for the above-grade well installations where requested by OHARNG.

2.8 Well and Borehole Abandonment

If abandonment of a monitoring well or borehole is required during the investigation, it will be abandoned according to the procedures presented in Section 5.4.2.5 of the Facility-Wide SAP. A record of all abandoned well borings along with the Global Positioning Satellite (GPS) coordinates will be recorded in the field logbook.

2.9 Field Measurement Procedures and Criteria

All field measurement procedures and criteria will follow Section 5.4.3 of the Facility-Wide SAP. All monitoring wells will be field screened for volatile organic compounds (VOCs) using

a PID or organic vapor analyzer (OVA) during groundwater sample collection. Screening will be accomplished by monitoring the headspace vapors at the top of the riser pipe.

2.9.1 Static Water Level

Water-level measurements will follow the procedure presented in Section 5.4.3.1 of the Facility-Wide SAP.

2.9.2 pH, Conductivity, Dissolved Oxygen, and Temperature

Groundwater parameters will be obtained using a combination meter with flow-through cell designed to measure these parameters. The readings will be recorded when the meter reading reaches equilibrium. Groundwater field parameters will be collected in accordance with Section 5.4.3.2 of the Facility-Wide SAP.

Additional parameters, such as turbidity, may also be obtained, where required.

2.10 Well Development

Development of the newly installed monitoring wells will be performed no sooner than 48 hours after nor longer than 7 days beyond final installation of the wells. Prior to well development, the depth to water and well depth will be measured using a decontaminated water level indicator. Monitoring well development will be accomplished using a non-dedicated bottom discharge/filling stainless steel bailer, a submersible pump, or a peristaltic pump. Development will proceed until the criteria specified in the Facility-Wide SAP are met:

- The water is clear to the unaided eye;
- The sediment thickness in the well is less than 1% of the screen length or <3.0 cm (0.1 ft);
- A minimum of five times the standing water volume in the well (to include the well screen and casing plus saturated annulus, assuming 30% porosity); and
- Indicator parameters (pH, temperature, and specific conductance) have stabilized according to procedures presented in Section 4.1.1 of the *Facility-Wide Groundwater Monitoring Program* (USACE 2004) over three successive well volumes.
- In addition to the "five times the standing water volume" criteria, five times the amount of any unrecovered water used during well installation will also be removed. Under specific circumstances, such as bedrock coring in dry rock, potable water may be introduced to the formation.

For each monitoring well developed during the field investigation a record will be prepared to include information specified in Section 5.4.2.3.10.2 of the Facility-Wide SAP. Well development activities shall be completed at least 14 days before groundwater sampling.

All well development water will be containerized, characterized, stored, and disposed of pursuant to Section 8.0 of the Facility-Wide SAP for investigation-derived waste (IDW).

2.11 Well Survey

A topographical survey for horizontal and vertical locations will be prepared for all new wells. The survey will be conducted by a currently licensed individual in the State of Ohio. Top-of-casing elevations will be surveyed to the nearest 0.01 feet, and horizontal control will be established to within 1.0 feet of the appropriate coordinate system. The new wells will also be located using a GPS with sub-meter accuracy.

2.12 Groundwater Purging and Sampling

The 39 new wells will be sampled and analyzed as part of the normal quarterly monitoring event. The new wells will be sampled and analyzed for the parameters presented in Table 2-3 for four consecutive quarters except where noted. In this latter regard, all of the new wells (except for the stainless steel well) will be sampled for hexavalent chromium (EPA Method 7196A) and perchlorate (EPA Method 6860) during one monitoring event only. The new well (#35) installed near the Route 80 Tank Farm Area and the upgradient background well (BKGmw-005) to this location will also be sampled and analyzed for alpha/beta and gamma radionuclides since gamma radiation was previously identified in soil in this area of the site. The new stainless steel well (#39) will be sampled for bis(2-ethylhexyl)phthalate only.

Static water-level measurements will be made using an electronic water-level indicator prior to well purging. The distance between the top of the casing and the groundwater surface will be recorded in the field logbook or Groundwater Sampling Log to within 0.01 feet. Relative groundwater elevations for each well will be calculated by deducting the depth to groundwater from the top-of-casing elevation. This information will be used to estimate flow direction. A map presenting this information and interpretation will be generated for the sampling event.

2.12.1 Purging

Prior to sampling, each well will be purged using bailing or micropurge techniques following those procedures specified in the FWSAP. The bailing method will be used for those wells that have poor yields or contain minimal water (i.e., less than 2 feet). For this method a disposable Teflon™ bailer will be used to purge and sample. The well will be purged to dryness and allowed to recover prior to sampling. The bailer will be attached to new polyethylene rope and slowly lowered until it contacts the groundwater surface. The bailer will be allowed to sink and fill with a minimum of surface disturbance and then raised slowly to the surface. The sample will be transferred from the bailer to the appropriate sample bottles. A minimum of one set of water quality indicators [e.g., pH, specific conductance, turbidity, dissolved oxygen (DO), oxidation reduction potential (ORP), and temperature] will be obtained during this procedure.

Table 2-3. Current Analytical Suite of Chemicals

Constituents	Method[1]
Polychlorinated biphenyls (PCBs)	Gas Chromatograph (GC) – Semivolatile Organics (SVOCs) (8082)
Pesticides	GC Semivolatile Organics (8081A)
Base/Neutrals and Acids (SVOCs)	GC/Mass Spectrograph (MS) Semivolatile Organics (8270C)
Volatile Organic Compounds (VOCs)	GC/MS Volatile Organics (8260B)
Nitroguanidine (Propellant)	Organic compounds by UV/HPLC (8330 modified)
Nitroaromatics & Nitramines (Explosives)	GC Semivolatile Organics Explosives (8330)
Nitrocellulose as N (Propellant)	General Chemistry (WS-WC-0050)
Nitrate/Nitrites	General Chemistry (353.2)[2]
Cyanide (Total)	General Chemistry (9012A)
Metals (Magnesium, Manganese, Barium, Nickel, Potassium, Silver, Sodium, Vanadium, Chromium, Calcium, Cobalt, Copper, Arsenic, Lead, Selenium)	Inductively Coupled Plasma (6010B)
Metals (Antimony, Iron, Beryllium, Thallium, Zinc, Cadmium, Aluminum)	Inductively Coupled Plasma Mass Spectrometry (6020)
Perchlorates	Method 6860 (1 quarter only)
Hexavalent Chromium	Method 7196A (1 quarter only)
Mercury	(7470A, Cold Vapor) - Liquid
Alpha/beta screen	Method 900.0[3] – Route 80 Tank Farm Area only.
Gamma radionuclides	Method 901.1[3] – Route 80 Tank Farm Area only.

1 = USEPA SW846
2 = EPA Methods for Chemical Analysis of Water and Waste
3 = Prescribed Test Procedures for Measurement of Radioactivity in Drinking Water, EPA-600/4-80-032, August 1980

For micropurging, the purge rate will be between 100 and 500 ml/min; however, the higher rate will only be used if it can be shown that the increased rate will not disturb the stagnant water column above the well screen (i.e., will not result in drawdown greater than 1 foot). The maximum flow rate shall not exceed 500 ml/min. Water quality indicators will be collected every 3 to 5 minutes to monitor stabilization of the water quality parameters. A minimum of three readings will be collected from each well during purging. Each parameter is consistent with the requirements of the FWSAP, with the exception of ORP and turbidity. Oxidation reduction potential and turbidity are required as additional field parameters to assist in the geochemical study for groundwater.

Water generated during purging activities and decontamination fluids will be containerized in a Department of Transportation (DOT)-approved 55-gal drum or poly tank for future treatment and

disposal. Purging activities will be recorded on the Groundwater Sampling Log or equivalent for each well. Immediately following purging, each well will be sampled. (If separate-phase liquid is present, no purging or sampling of the groundwater will be performed.)

2.12.2 Sampling

Once purging activities are complete, groundwater samples will be collected from below the top of the well screen using a bladder pump (or bailer if there is low yield). Samples will be transferred directly to laboratory precleaned sample containers. EQM's field personnel will wear new, disposable nitrile gloves during sample collection. The gloves will be changed between wells and the used gloves will be discarded appropriately. Sample aliquots will be placed in the appropriate sample containers, pre-preserved (if required), sealed with Teflon-lined septa, and labeled with a unique sample identification number. Samples will then be placed in a cooler with ice and submitted to an offsite laboratory for analysis. A chain-of-custody form will accompany the sample shipment. Groundwater sampling activities will be documented on a Groundwater Sampling Log or equivalent for each monitoring well.

Each well (except the stainless steel well) will be sampled for filtered metals. The list of metals to be analyzed is consistent with Table 4.8 of the *Quality Assurance Project Plan for Environmental Investigations at the Ravenna Army Ammunition Plant* (SAIC, February 2011). The wells identified for hexavalent chromium analysis will also be field filtered. Sampling and analysis procedures will follow the FWSAP. A 0.45-micron in-line filter will be used to filter samples. The filtered sample will be transferred directly into pre-preserved sample containers supplied by the laboratory.

2.13 Sample Containers, Preservatives, and Holding Times

Upon collection, samples will be transferred directly into the appropriate sample container. Only pre-cleaned sampling containers supplied by the laboratory will be used. Pre-preserved bottles will be provided by the analytical laboratory. Care will be taken to obtain representative samples for volatile organic analysis. To prevent unnecessary stripping of volatile constituents from the sample, the water sample will be added slowly to minimize turbulence and aeration when filling the container until a positive meniscus is achieved above the rim of the container. The container will be capped immediately and checked for the presence of air bubbles. If bubbles are detected, additional sample will be added until a positive meniscus is re-established. Care will be taken not to overfill and wash out the preservative. All samples will be cooled to 4°C immediately upon collection and maintained at this temperature during sample shipment. Table 5-1 of the Quality Assurance Project Plan (QAPP) Addendum located in Part II of this amendment summarizes the container types and sizes, preservatives, and sample holding times.

2.14 Field Quality Control Sampling Procedures

Since no soil or groundwater samples are being collected for chemical analysis during installation of the 39 new wells (groundwater sampling will be performed as part of the quarterly

monitoring program), no quality control samples will be collected during well installation activities. However, quality control samples will be collected during quarterly groundwater monitoring of the new and existing monitoring wells. These quality control samples will include duplicates and split groundwater samples (10 percent of total field samples), matrix spike and matrix spike duplicates (5 percent of total field samples), equipment rinsates (daily), and trip blanks (with each cooler containing samples for VOC analysis) as described in Section 5.4.7 of the Facility-Wide SAP. Split samples will be submitted to the approved USACE contract laboratory for independent analyses.

2.15 Equipment Decontamination

Soil sampling equipment (e.g., split spoons, augers, shovels, trowels, and mixing bowls) will be cleaned using steps 1, 2, and 4 below since no soil chemical analysis is being performed for this investigation. Drilling equipment will be pressure washed between well locations. Well development equipment (e.g., bailers and pumps) and portable groundwater sampling equipment (e.g., bladder pumps) will be cleaned prior to collecting each sample to prevent cross-contamination using the following eight-step procedure:

1) Scrub and wash with laboratory-grade detergent.
2) Rinse with approved potable water.
3) Rinse thoroughly with hydrochloric acid (2% solution) or nitric acid (10% solution).
4) Rinse with American Society for Testing and Materials (ASTM) Type I or equivalent deionized/distilled water.
5) Rinse with pesticide-grade isopropanol or methanol (wash bottle).
6) Rinse with ASTM Type I or equivalent deionized/distilled water.
7) Allow equipment to air dry.
8) Place equipment on clean, dry plastic if it is to used immediately or wrap in aluminum foil if storage is required.

Field measurement equipment (e.g., water level indicators, pH meters, etc.) will also be decontaminated between well locations. Due to the sensitive nature of these measuring devices, the decontamination procedure will involve a non-phosphate detergent wash, followed by a potable water rinse, and a final rinse using ASTM Type I or equivalent water.

SECTION 3. SAMPLE MANAGEMENT

Field personnel are responsible for the identification, preservation, packaging, handling, shipping, and storage of samples obtained in the field such that all samples can be readily identified and will retain, to the extent possible, *in situ* characteristics to be determined through analysis. All samples collected will be tracked by preparing and using a sample chain-of-custody form as described in Section 6.4.3 of the Facility-Wide SAP.

3.1 Field Logbook

A field sample logbook will be initiated at the start of the first onsite sampling activity and maintained to record sampling activities throughout the project. The field sample logbook is a controlled document that becomes part of the permanent site file. The logbook will consist of a bound notebook with consecutively numbered pages that cannot be removed. All data entries will be recorded using a non-erasable ink pen.

All information pertinent to on-site environmental task activities will be recorded in field logbooks or field forms, including:

- Date of activities
- Arrival and departure of sampling personnel and observers
- Field sample activities
- Individual sample description (color, consistency, odor, etc.)
- Sample pickup, including chain-of-custody form number, carrier, date, and time
- Unusual events during sampling
- Health and safety issues related to sampling
- Weather conditions

All field logbook information will follow procedures identified in Section 6.1 of the Facility-Wide SAP.

3.2 Logs and Well Installation Diagrams

3.2.1 Boring Logs

Boring logs will be completed for all monitoring well boreholes, as documented in Section 5.4.2.4.1.1 of the Facility-Wide SAP. Descriptions recorded on each boring log for soil and rock cores will be in accordance with Table 5-2 in the Facility-Wide SAP. Permeability test results will also be recorded on the boring logs, where appropriate. In addition, the final

locations of the new wells will be documented using GPS. This information will be recorded in the field logbook and on the boring logs.

3.2.2 Well Construction Diagrams

As-built well construction will be documented according to the procedures presented in Section 5.4.2.4.1.2 of the Facility-Wide SAP.

3.3 Photographs

Information regarding the documentation of photographs for the monitoring well installation is presented in Section 5.4.2.4.2 of the Facility-Wide SAP. Representative photographs will be taken during fieldwork activities and with particular attention to any special features of interest that are identified during the field effort (e.g., bedrock fractures or unusual geologic features). New well locations will also be photographed. Photographs will be suitable for presentation in a public forum, as well as for documenting scientific information.

3.4 Sample Identification System

Each sample (including QC samples) will be identified with a unique sample number. This number will provide easy identification of the sample in field logs, field data sheets, analytical reports, chain-of-custody forms, and project reports. The sample numbering system that will be used to identify samples collected during the groundwater sampling is explained in Section 6.3 of the Facility-Wide SAP. Samples collected will be identified sequentially by following the numbering system. If a sample is not collected or is reassigned to another location, a specific reason and notation will be written in the project field books. The sample number system is presented in Figure 3-1 and presents the sample numbers that will be used during this project.

3.5 Sample Labeling

Samples will be labeled at the time of sample collection by affixing a self-stick label to the sample container unless the container was already shipped with a pre-affixed label. At a minimum, all sample labels will include the following information:

- Project name
- Unique sample identification number (see Section 3.4)
- Date and time the sample was collected
- Initials of the sample collector
- Sampling location and sample description
- Preservation and analysis

Sampling Location Identification: XXXmm-NNN(n)				
XXX	=	Area Designator	Examples LL4 - DA2 -	 Load Line 4 Demolition Area 2
mm	=	Sample Location Type	Examples MW SB	 Monitoring Well Soil Boring
NNN	=	Sequential Sample Location Number: Unique, sequential number for each sample location beginning with the following number from the last number used from previous investigation stations and extending into any subsequent phases.	Examples 004 012 099 107	
(n)	=	Special Identifier: Optional use (as needed) to identify special sample matrices of sample location characteristics.	Examples D B A	 Deep zone aquifer Background location Abandoned well
Sample Identification: XXXmm-NNN(n)-####-tt				
###	=	Sequential Sample Number [must be unique for entire project site/AOC]	Examples 0001 0002 0003	
tt	=	Sample Type	Examples GW GF SO GT TB FB ER	 Groundwater (unfiltered) Groundwater (filtered) Soil Sample Geotechnical Sample Trip Blank Field Blank Equipment Rinsate

Figure 3-1. Sample Identification System

Additional information that may be recorded on the labels is described in Section 6.4.1 of the Facility-Wide SAP.

3.6 Sample Custody

Sample chain of custody tracks the life of a sample from collection to analysis. A record of the sample custody will be maintained to establish and document sample possession during collection, shipment, laboratory receipt, and laboratory analysis. This documentation will be evidenced on a chain-of-custody record by the signatures of the individuals collecting, shipping, and receiving each sample. Section 6.4.3 of the Facility-Wide SAP describes the sample custody procedures in detail.

3.7 Documentation Procedures

Documentation and tracking of samples and field information will follow the series of steps identified in Section 6.5 of the Facility-Wide SAP.

3.8 Corrections to Documentation

Any corrections to documentation will follow guidance established in Section 6.6 of the Facility-Wide SAP. Specifically, errors in any document will be corrected by the individual responsible for the entry by crossing out the error with a single strike, entering the correct information or data, and dating and initialing the change.

3.9 Groundwater Monitoring Well Installation Reports

It is anticipated that the reporting for the well installation and subsequent groundwater sampling and analysis will be included in the current FWGWMP reports. The analytical data will initially be compared to the following screening levels:

- 40 CFR Part 141 National Primary Drinking Water Regulations, Maximum Contaminant Levels (MCLs); and
- USEPA Regional Screening Levels (RSLs).
- Also used as screening levels for metals are the RVAAP Facility-Wide Background Criteria.

3.10 Monthly Reports

Monthly reports will be submitted during implementation of the field investigation activities. Monthly reports will be submitted on the 5th day of the following month to the USACE. The

content of the reports will have content similar to that specified in Section 6.7 of the Facility-Wide SAP.

In addition to the monthly project reports, a fieldwork letter report will be submitted to USACE and Ohio EPA by EQM thirty (30) days following conclusion of all drilling fieldwork activities. This letter report will serve as a transmittal of field documents including a site map showing well installation locations and corresponding electronic drill logs, which notate the boring description and well installation diagram.

SECTION 4. SAMPLE PACKAGING AND SHIPPING REQUIREMENTS

Packaging and shipping procedures will be followed in accordance with Section 7.0 of the Facility-Wide SAP. All samples collected during this study will be properly labeled and packaged for shipment by overnight courier to the offsite laboratory. Glass containers will be secured in sturdy coolers to prevent breakage during transport. Ice will be placed in the coolers to preserve the samples at 4°C. Coolers will be secured with tape and labeled to ensure the samples are not disturbed during transportation. A chain-of-custody seal(s) will be attached so that any attempts at opening or tampering will result in a broken seal.

Shelby tubes and rock cores for permeability testing will be placed in coolers and transported to the geotechnical testing laboratory by EQM personnel at the conclusion of the field investigation activities. These samples do not require refrigeration or chemical preservation prior to analysis.

SECTION 5. INVESTIGATION-DERIVED WASTE

All IDW, including auger cuttings, personal protective equipment (PPE), disposable sampling equipment, and decontamination fluids, will be properly handled, labeled, characterized, and managed in accordance with Section 8.0 of the Facility-Wide SAP. At the conclusion of field activities for the well installation, a letter report will be submitted to USACE and the RVAAP Environmental Coordinator documenting the characterization and classification of the wastes. Upon approval of the IDW classification report, all solid and liquid IDW will be removed from the site and disposed of by a licensed waste disposal contractor. All shipments of IDW offsite will be coordinated through the RVAAP Environmental Coordinator.

Four types of IDW are anticipated, which will be contained separately. The types and estimated quantities for each include:

- Soil, specifically drill cuttings from the unconsolidated surficial material;
- Development and purge water from monitoring wells;
- Decontamination fluids, including those derived from decontamination of sampling equipment and drilling equipment; and
- Expendables/solid wastes, including PPE and disposable sampling equipment.

Characterization and classification of the different types of IDW will be based on the specific protocols described below. Expendable solid waste will be not sampled for characterization purposes.

- **Soil:** Drill cuttings will be placed in 55-gal drums. Soil cuttings generated from individual AOCs will be consolidated in the drums. Partial drums may be moved to a different AOC with similar COPCs (e.g., the various load lines). Composite samples will be collected from drums generated from similar AOCs (e.g., the load lines, the western facility wells). Disposition of the drummed soil will be based on analytical results from toxicity characteristic leaching procedure (TCLP) samples collected. Additional waste characterization parameters will be analyzed as required by the selected disposal facility.

- **IDW Water:** Development water from newly installed wells, purge water, and excess water not used for environmental samples will be placed in 55-gal drums or a poly tank up to 1,500 gallons in size, as needed. Disposition will be based on the analytical results of the environmental samples. If results indicate that IDW water is potentially hazardous, TCLP samples will be collected.

- **Decontamination Fluids:** Decontamination fluids will be placed in drums or a polytank up to 1,500 gallons in size as needed. Disposition of decontamination liquid will be based on the collection and analysis of TCLP liquid sample(s).

Drummed soil, sediment, and IDW water will be transported to a location designated by the RVAPP Environmental Coordinator, where it will be staged on wooden pallets. Drummed IDW water will be placed directly on pallets inside a storage building pending characterization and disposal. Water collected in poly tanks will be transferred from the tank using a transfer pump to drums or a second poly tank staged inside the storage building. Decontamination fluids and field laboratory wastes will also be staged at the identified location within secondary containment structures. To avoid potential drum rupture due to freezing conditions, drums containing liquid IDW will be filled only to 75 percent capacity.

5.1 Wastewater Sampling

Accumulated IDW decontamination water and purge water will be containerized in 55-gal drums on site pending transport and treatment at an offsite wastewater treatment facility. Wastewater samples, if needed, will be collected by gently lowering a new, disposable bailer attached to new polypropylene rope into the holding vessel. The bailer has a bottom check valve that seats over the bottom opening during retrieval, thereby keeping the water within the bailer column as the bailer is withdrawn from the poly tank or drum. Water collected in the bailer will be transferred directly from the bailer to a decontaminated 3- to 5-gal glass container for homogenization. Water from the bucket will then be transferred into the appropriate sample containers. The bailer will be lowered into the drums several times, and to different depths, to collect a sufficient representative sample of the water to submit to the laboratory for waste characterization analysis in accordance with the disposal facility's characterization requirements. New, disposable nitrile gloves will be donned prior to each wastewater sample event. The used gloves, bailer, and rope will be discarded appropriately after each event.

5.2 Sampling of Soil IDW

Accumulated IDW soil cuttings will be containerized in 55-gal drums on site pending transport and disposal to an offsite disposal facility. Soil drums will be segregated in the onsite staging area by AOC. Grab samples will be collected using a hand auger or by manually driving a decontaminated split-spoon sampler to the bottom of each container. The retrieved sample will be placed in a decontaminated stainless steel bowl or aluminum pan for homogenization. Rocks and loose twigs will be removed and discarded. Clumps of soil will be broken down using a gloved hand and mixed in the bowl. The mixture will be visually divided into quadrants, and soil from the opposite quadrants in the bowl or pan will be collected using a gloved hand and placed directly into the laboratory pre-cleaned container. Duplicate or split samples of the composite will be formed from the two remaining quadrants in the bowl. The composite samples will be sealed, labeled, and placed in a cooler with ice. New, disposable nitrile gloves will be donned prior to each sample event. The used gloves and disposable pans will be discarded appropriately after each event. Stainless steel bowls, hand augers, and split-spoon samplers will be decontaminated in accordance with Section 2.13 of this plan after collection of each composite sample.

SECTION 6. REFERENCES

Barnes, G.E. 1950. *A Report on Water Conservation and Development at the Ravenna Arsenal, Apco, Ohio*. Consulting Engineer. Cleveland, Ohio.

Kammer, H.W. 1982. *A Hydrologic Study of the Ravenna Arsenal, Eastern Portage and Western Trumbull Counties, Ohio*. Master Thesis, Kent State University.

USACE (U.S. Army Corps of Engineers). October 1970. *West Branch Reservoir Dam Final Report on Special Foundation and Embankment Treatment.* U.S. Army Engineer District Corps of Engineers. Pittsburgh, Pennsylvania.

USACE. February 1996. *Preliminary Assessment for the Ravenna Army Ammunition Plant, Ravenna, Ohio.*

USACE. February 2001. *Requirements for the Preparation of Sampling and Analysis Plans*. EM 200-1-3.

USACE. March 2001. *Quality Assurance Project Plan for Environmental Investigations at the Ravenna Army Ammunition Plant, Ravenna, Ohio*.

USACE. September 2004. *Facility-Wide Groundwater Monitoring Program Plan for the Ravenna Army Ammunition Plant, Ravenna, Ohio*.

USACE. March 2005a. *Phase III Remedial Investigation Report for Winklepeck Burning Grounds at the Ravenna Army Ammunition Plant, Ravenna, Ohio.*

USACE. November 2010. *Draft 2010 Addendum to the Facility-Wide Groundwater Monitoring Program Plan RVAAP-66 Facility-Wide Groundwater, Ravenna Army Ammunition Plant, Ravenna, Ohio*.

SAIC. February 2011. *Final Facility-Wide Sampling and Analysis Plan for Environmental Investigations, Ravenna Army Ammunition Plant, Ravenna, Ohio*.

SAIC. February 2011. *Quality Assurance Project Plan for Environmental Investigations at the Ravenna Army Ammunition Plant*.

USATHAMA (United States Army Toxic and Hazardous Materials Agency). 1978. *Installation Assessment of Ravenna Army Ammunition Plant*. Report No. 132.

APPENDIX A

CORRESPONDENCE/COMMENT RESPONSES

Ohio | Environmental Protection Agency
John R. Kasich, Governor
Mary Taylor, Lt. Governor
Scott J. Nally, Director

January 24, 2012

RE: RAVENNA ARMY AMMUNITION PLANT, PORTAGE/TRUMBULL COUNTIES, FWGWMP, FINAL, RVAAP-66 FACILITY-WIDE GROUNDWATER ADDENDUM, DATED JANUARY 6, 2012 (# 267000859036)

Mr. Mark Patterson
Installation Manager
Ravenna Army Ammunition Plant
8451 State Route 5
Ravenna, OH 44266

CERTIFIED MAIL
7010 3090 0000 3936 6276

Dear Mr. Patterson:

The Ohio Environmental Protection Agency (Ohio EPA) has received and reviewed the "Final, Facility-Wide Groundwater Monitoring Program (FWGWMP), RVAAP-66 Facility-Wide Groundwater Addendum" document. The document was received at Ohio EPA, Northeast District Office (NEDO), Division of Environmental Response and Revitalization (DERR), on January 9, 2012, and is dated January 6, 2012. The document was prepared for the U.S. Army Corps of Engineers (USACE) – Louisville District, by Environmental Quality Management, Inc. (EQM), under contract No. GS-10F-0293K.

This document is intended as a follow-up to the "Draft 2010 Addendum to FWGWMP" from the USACE, dated November 15, 2010, which is still outstanding. The second Ohio EPA comment letter, dated May 13, 2010, has not been responded to. This document still needs to be closed out. It is the understanding of Ohio EPA that USACE is in the process of forwarding a letter to Ohio EPA to close this project. The approval of the 2011 Addendum, as a stand-alone document, can supersede the closeout of the 2010 Addendum.

Ohio EPA hereby approves the document titled "Final, Facility-Wide Groundwater Monitoring Program (FWGWMP), RVAAP-66 Facility-Wide Groundwater Addendum," as it pertains to current groundwater conditions and goals. Pursuant to the CERCLA process, the property owner usually can provide the expected land use to assist in ensuring the investigation addresses all receptors for both current and future land uses. However, it is the understanding of Ohio EPA that the end use for groundwater has not yet been finalized. Therefore, please be advised that future modifications may be required by Ohio EPA to address incompatible land uses with the findings of this report.

If you have any questions, please call me at (330) 963-1207.

Sincerely,

Vicki Deppisch
Hydrogeologist/Project Coordinator
Division of Environmental Response and Revitalization

VD/kss

cc: Eileen Mohr, Ohio EPA, NEDO, DERR

ec: Katie Tait, OHARNG RTLS
LTC Ed Meade, OHARNG RTLS
Glen Beckham, USACE Louisville
Mark Eldridge, AEC
John Miller, EQM
Mark Nichter, USACE Louisville
Conni McCambridge, Ohio EPA, NEDO, DDAGW
Kim Harriz, NGB
Nancy Zikmanis, Ohio EPA, NEDO, DERR
Christy Esler, Vista/RVAAP
Todd Fisher, Ohio EPA, NEDO, DERR
Bob Guthrie, Management Solutions
Rod Beals, Ohio EPA, NEDO, DERR

Ohio | Environmental Protection Agency
John R. Kasich, Governor
Mary Taylor, Lt. Governor
Scott J. Nally, Director

December 21, 2011

RE: RAVENNA ARMY AMMUNITION PLANT, PORTAGE/TRUMBULL COUNTIES, FWGWMP, DRAFT RVAAP-66 FACILITY-WIDE GROUNDWATER ADDENDUM, RESPONSE TO OHIO EPA COMMENTS, DATED DECEMBER 14, 2011, # 267000859036

Mr. Mark Patterson
Installation Manager
Ravenna Army Ammunition Plant
8451 State Route 5
Ravenna, OH 44266

CERTIFIED MAIL
7010 3090 0000 3936 6368

Dear Mr. Patterson:

The Ohio Environmental Protection Agency (Ohio EPA) has received and reviewed the "Draft, Facility-Wide Groundwater Monitoring Program (FWGWMP), RVAAP-66 Facility-Wide Groundwater Addendum, Response to Ohio EPA Comments" document. The document was received at Ohio EPA, Northeast District Office (NEDO), Division of Environmental Response and Revitalization (DERR), on December 15, 2011, and is dated December 14, 2011. The document was prepared for the U.S. Army Corps of Engineers (USACE) – Louisville District, by Environmental Quality Management, Inc. (EQM), under contract No. GS-10F-0293K.

This document is intended as a follow-up to the "Draft 2010 Addendum to FWGWMP" from the USACE, dated November 15, 2010, which is still outstanding. The second Ohio EPA comment letter, dated May 13, 2010, has not been responded to. This document still needs to be closed out.

EQM has been contracted by USACE to obtain a signed Record of Decision (ROD) for the FWGWMP. In support of completion of a Remedial Investigation/Feasibility Study (RI/SF) necessary to supplement the ROD, EQM reviewed available groundwater documents and determined that additional monitoring wells are needed to complete the RI/FS and eventual ROD. The additional monitoring wells are needed to complete modeling and contaminant fate-and-transport modeling for a facility-wide groundwater approach. Additional tasks are included and specified.

Pursuant to the CERCLA process, the property owner usually can provide the expected land use to assist in ensuring the investigation addresses all receptors for both current and future land uses. However, it is the understanding of Ohio EPA that the end use for groundwater has not yet been finalized. Therefore, please be advised that future modifications may be required by Ohio EPA to address incompatible land uses with the findings of this report.

It is the understanding of Ohio EPA that the location of the stainless steel well, to detect the presence or absence of bis(2-ethylhexyl)phthalate, will be installed close to monitoring well LL12mw-182, due to reoccurring, consistent detections of this constituent in this well. The new well will be installed at the same depth and close to the LL12mw-182 well. Both wells will be sampled during the same sampling event. Ohio EPA recommends sampling multiple times, at least for four (4) quarters, to evaluate presence or absence.

Northeast District Office
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Twinsburg, OH 44087-1924

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The document is approved. Please forward final binder covers, text changes, etc. If you have any questions, please call me at (330) 963-1207.

Sincerely,

Vicki Deppisch
Hydrogeologist/Project Coordinator
Division of Environmental Response and Revitalization

VD/kss

cc: Eileen Mohr, Ohio EPA, NEDO, DERR

ec: Katie Tait, OHARNG RTLS
Maj. Ed Meade, OHARNG RTLS
Glen Beckham, USACE Louisville
Mark Eldridge, AEC
John Miller, EQM
Mark Nichter, USACE Louisville
Conni McCambridge, Ohio EPA, NEDO, DDAGW
Kim Harriz, NGB
Nancy Zikmanis, Ohio EPA, NEDO, DERR
Christy Esler, Vista/RVAAP
Todd Fisher, Ohio EPA, NEDO, DERR

Environmental Quality Management, Inc.
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December 14, 2011

Ms. Vicki Deppisch
Ohio Environmental Protection Agency, NE District Office
Division of Emergency and Remedial Response
2110 E. Aurora Road
Twinsburg, OH 44087

Re: Facility-Wide Groundwater Monitoring Program
RVAAP-66 Facility-Wide Groundwater Addendum

Dear Ms. Deppisch:

On behalf of the US Army Corps of Engineers (USACE) Environmental Quality Management, Inc. (EQM) is submitting to the Ohio EPA the responses to Ohio EPA comments (dated December 6, 2011) on the *Draft Facility-Wide Groundwater Monitoring Program Plan RVAAP-66 Facility-Wide Groundwater Addendum* for the Ravenna Army Ammunition Plant. Enclosed please find two (2) printed copies of the responses. An electronic copy of the responses has also been sent via email. Note that the Ohio EPA cover letter noted the lack of proposed new wells in the east substation vicinity, powerhouse coal storage and west substation area, and the area of substation 3 (located in the central area). No wells are currently planned for the three substation areas. From a facility-wide groundwater perspective, EQM believes that these areas are covered by downgradient wells located in the nearby load lines.

Additionally, please note EQM's discussion concerning the stainless steel well to be installed at the end of the comment/responses.

If you have any questions, please call me at (513) 825-7500, or Mr. Mark Nichter of the USACE at (502) 315-6375.

Sincerely,

ENVIRONMENTAL QUALITY MANAGEMENT, INC.

John M. Miller, CHMM
Project Manager

cc: M. Nichter – USACE
M. Patterson – RVAAP (BRAC)

Comment Response Table
Draft, Facility-Wide Groundwater Addendum dated October 24, 2011
Ohio EPA Comments-Conni McCambridge and Vicki Deppisch
(December 6, 2011)

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
			Ohio EPA (V. Deppisch/C. McCambridge)		
1	Part I, Sec. 1.3.2		This section does not mention that the Homewood SS is missing in the eastern half of the RVAAP.	For continuity and clarity, please add.	This information was incorporated into Section 2.2 in the Draft version of the addendum. EQM will also add this information into Section 1.3.2 for clarity. In general terms, the Homewood is the shallowest bedrock to the west and Sharon is the shallowest bedrock to the east of RVAAP (i.e., the Homewood is missing in the eastern half of the site). There is a small potential that the shallowest bedrock unit may be the Mercer Member or the Connoquenessing Sandstone, which are exposed on the flanks of pre-glacial valley walls. These two units are depositionally between the Homewood and Sharon.
2	Part I, pg. 11		Re: A meeting with all stakeholders to jointly choose the well locations prior to beginning drilling activities.	Ohio EPA suggests this task be accomplished as ASAP, due to impending winter weather conditions.	EQM intends to field locate the proposed well locations on December 19-20, 2011. We recommend a follow-up meeting with the stakeholders in early January to show and discuss the proposed field locations.
3	Part I, Pages 13 – 17, Sec. 2.2		The submittal indicates that several new wells will be paired with existing wells (i.e., Wells 2, 3, 4, etc.). However, the physical distance, which will separate these wells, was not discussed.	Ohio EPA recommends that no less than five feet distance separate the new and existing well locations, to reduce the potential impact of "grout bleed" from the newly installed well. Please provide a brief	EQM agrees that the paired wells should be minimally separated by at least 5 feet. The following statement will be added to Section 2.2: *Note that paired wells will be placed a minimum of 5 feet apart to reduce the potential impact of 'grout bleed' from the newly installed well.*

Comment Response Table
Draft, Facility-Wide Groundwater Addendum dated October 24, 2011
Ohio EPA Comments-Conni McCambridge and Vicki Deppisch
(December 6, 2011)

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
			Ohio EPA (V. Deppisch/C. McCambridge)		
				explanation of the estimated distances that will be used during well installation.	
4	Part I, Sec. 2.5.2, Drilling Methods, pg. 21		No screening tools (PID, etc.) regarding the well cores are proposed.	Please discuss.	Since no soil or bedrock samples were going to be submitted for chemical analysis, EQM did not include screening of the well cores. However, for safety and completeness, the following language will be included in Section 2.5.2: *Each split-spoon sample will be screened using a photoionization detector (PID) for gross measurement of volatile organic compounds in the vapor headspace. Soil samples will be placed in zipper-sealed bags and allowed to warm to ambient temperatures prior to screening. Soil clumps will be broken down using a gloved hand. The tip of the PID probe will be inserted into the bag, and the result will be recorded on the boring log at the time of screening. Rock cores will be screened at the time of extraction by passing the PID wand over the core.*
5	Part I, Sec.2.5.2, pg. 21		The submittal indicates that five well locations will be selected in the field for Shelby Tube testing. It is unclear what criteria will be used to select these well	Please provide a brief explanation of the criteria that will be used to select the Shelby Tube locations.	There will be six Shelby Tube samples collected. The addendum will be revised to reflect this change. In addition, the following text will be added to Section

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
			Ohio EPA (V. Deppisch/C. McCambridge)		
			locations.		2.5.2: *Table 2-1 shows the wells (4, 13, 17, 25, 27, and 37) that have been selected for Shelby Tube (i.e., permeability) testing. The five unconsolidated wells were selected to provide permeability data in the eastern (well 4), central (wells 13, 17, 27, and 37), and western (well 25) portions of RVAAP, along potential exit pathways (proposed wells 4 and 37), and for comparison with permeability data from paired Sharon (proposed wells 13 and 17) and/or Homewood (proposed wells 27 and 37) wells.*
6	Part I, Sec. 2.8, pg. 24, well abandonment		A record of all abandoned wells should be recorded, along with the GPS coordinates.	Please add.	The following sentence will be added to Section 2.8: *A record of all abandoned well borings along with the GPS coordinates shall be recorded in the field logbook.*
7	Part I, Sec. 2.12.2, pg. 28		The submittal indicates that filtering will be done on ground water samples collected for metals analysis. It is unclear whether hexavalent chromium samples will be filtered.	Clarification is needed on whether hexavalent chromium samples will be filtered. If these samples will be filtered, an explanation should be provided as to why this procedure will be necessary.	The hexavalent chromium samples are field filtered. Filtering is part of the SW-846 Method 7996 for analyzing for hexavalent chromium. The following text will be added to Section 2.12.2: *The wells identified for hexavalent chromium analysis will also be field filtered.*
8	Part I, Sec.		Section 3.5 (Table 3-1) does not indicate	Clarification is needed as to	Section 2.13 of Part I does not state that

Comment Response Table
Draft, Facility-Wide Groundwater Addendum dated October 24, 2011
Ohio EPA Comments-Conni McCambridge and Vicki Deppisch
(December 6, 2011)

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
			Ohio EPA (V. Deppisch/C. McCambridge)		
	2.13, Table 5-1, pg. 28		if some ground water sampling containers will be pre-preserved. In some sampling cases, it may be necessary to use non-preserved vials for VOC sampling due to effervescence.	whether some sampling vials/bottles will be pre-preserved. Cautions for sampling with this type of containers should be noted in the text (i.e., overfilling and/or washing out of the preservatives).	pre-preserved bottles will be used. The laboratory supplies pre-preserved vials for VOC samples and pre-preserved bottles for metals and cyanide. To date, EQM has not noted a chemical reaction at RVAAP when filling VOA vials. The following text will be added to Section2.13*: Pre-preserved bottles will be provided by the analytical laboratory. Care will be taken to obtain representative samples for volatile organic analysis. To prevent unnecessary stripping of volatile constituents from the sample, the water sample will be added slowly to minimize turbulence and aeration when filling the container until a positive meniscus is achieved above the rim of the container. The container will be capped immediately and checked for the presence of air bubbles. If bubbles are detected, additional sample will be added until a positive meniscus is re-established. Care will be taken not to overfill and wash out the preservative.*
9	Part I, Section 3.2.1, boring logs, pg.		Does EQM plan on using GPS for all borings/wells? Will this be included on the boring logs?	Please discuss.	EQM intends to document the final locations of the new wells using GPS. This information will be recorded in the field logbook and on the boring logs. Section 3.2.1 will be modified to incorporate this

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
Ohio EPA (V. Deppisch/C. McCambridge)					
	30				information.
10	Part I, Sec. 3.9, pg. 33		The submittal does not indicate what screening standards will be applied to ground water sample results.	Clarification is needed as to what screening criteria will be used for comparison to the ground water results obtained from the new wells. This information should be provided in the submittal.	The following text will be added to Section 3.9: *The analytical data will initially be compared to the following screening levels:* • *40 CFR Part 141 National Primary Drinking Water Regulations, Maximum Contaminant Levels (MCLs); and* • *USEPA Regional Screening Levels (RSLs)* • *Also used as screening levels for metals are the RVAAP Facility-Wide Background Criteria USEPA Regional Screening Level (RSL).* Note that comparison to the Facility-Wide Cleanup Goals (FWCUGs) will be part of the RI process once we have completed the quarterly sampling of the new wells. Additionally, the described groundwater review and evaluation will be conducted consistent with the groundwater screening process agreed to/approved by the RVAAP stake holders during the October 19, 2010, meeting at Geneva on the Lake, Ohio.

Comment Response Table
Draft, Facility-Wide Groundwater Addendum dated October 24, 2011
Ohio EPA Comments-Conni McCambridge and Vicki Deppisch
(December 6, 2011)

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
			Ohio EPA (V. Deppisch/C. McCambridge)		
11	Part I, Sec. 5, IDW Water		Document states all purged, etc., water will be placed in 55-gal drums. During the installation of the deeper bedrock wells, much water was generated and stored in larger tanks.	Please discuss why larger tanks are not proposed and how disposal will work during freezing conditions or if disposal is planned for the spring.	The following text will be added to Section 5, IDW Water: *…will be placed in 55-gal drums or a poly-tank up to 1,500 gallons in size as needed.* As mentioned later in Section 5, the soil, sediment, and IDW water will be transported to a staging area and placed on pallets. This paragraph will be modified with the following text: *Drummed IDW water will be placed directly on pallets inside a storage building pending characterization and disposal. Water collected in poly tanks will be transferred from the tank using a transfer pump to drums or a second poly tank staged inside the storage building.*
12	Part III, pg.2 and other related sections		Although ticks are included under the heading of insects, it is not emphasized.	Please emphasis to all personnel that ticks are prevalent and precautions should be taken if field work extents into spring and warmer weather.	Agreed.

Comment Response Table
Draft, Facility-Wide Groundwater Addendum dated October 24, 2011
Ohio EPA Comments-Conni McCambridge and Vicki Deppisch
(December 6, 2011)

EQM Comment					
13	Part I, Section 2.7, pg 23, lines 41-43.		The text currently indicates that a stainless steel well will be installed at proposed location 34 to assess whether the presence of bis(2-ethylhexyl) phthalate at Load Line 11 is an artifact from PVC wells. However, the proposed location is more than 1000 meters east of Load Line 11 and, as such, it will probably not be adequate for this evaluation.		EQ has performed a cursory review of the bis(2-ethylhexyl)phthalate data from the REIMS and EQ databases, and we recommend that a stainless steel well be installed near location LL12mw-182, where this constituent has been identified in groundwater above PRG and/or MCL levels on at least four separate occasions since October 2004. Note that the elevated concentration at LL11mw-001 in October 2009 appears anomalous compared to the three earlier detections in this well, which ranged from 1.0 to 1.6 µg/L, and the most recent non-detect result in October 2010. The additional proposed well (#39) near LL12mw-182 will be installed in the unconsolidated aquifer. Section 2.7 and Tables 2-1 and 2-2 will be revised accordingly.

PBA-11 FOR RVAAP-66 FACILITY-WIDE GROUNDWATER
"DRAFT" FWGWMP PLAN ADDENDUM
RAVENNA ARMY AMMUNITION PLANT – RAVENNA, OH
COMMENT RESPONSE TABLE
EQM Draft Submittal – 24 October 2011
USACE Review Comments – 25 October 2011

Comment Number	Page / Line	New age or Sheet	Comment	Recommendation	Response
USACE (Mark Nichter, PG)					
1	Figure 2-1, and Tables 2-1 & 2-2		The proposed location for new well location #9 is incorrect. This well is proposed for installation in the Group 2 DLA Ore Storage Area (CC-RVAAP-79) to assess possible impacts from the former storage of brass ingots. The former Group 2 Propellant Can Tops area (CC-RVAAP-80) is located approximately 600-800 meters south of the Group 2 DLA Ore Storage Area (CC-RVAAP-79). If additional investigation is required to address groundwater quality at the Propellant Can Tops area, then an additional well may be required. *[Note: This may be beyond the requirements of the Ravenna stake holders at this time. Existing surface soil quality information (laboratory data) suggests the soils are minimally impacted by trace concentrations of arsenic and vanadium, which exceed Federal RSLs. Trace concentrations of propellants were also detected. All analytes were detected at reported concentrations below the FWCUGs.]*	This proposed well location should be moved to the eastern portion of the Group 2 Area in the vicinity of the current gravel parking lots. This is the area of the former DLA ore storage at Group 2. The USACE will provide additional maps and aerial photographs to assist EQM with selecting this well location. All references to this well in the draft document should be revised accordingly.	EQ's original purpose in placing well #9 at the southern end of the Group 2 DLA Ore Storage and former Group 2 Propellant Can Tops area (CC-RVAAP-79 and -80) was to simultaneously assess groundwater quality for both areas relative to the Facility-Wide groundwater model. However, EQ will re-locate well #9 to the east side of the DLA Ore Storage Area in the gravel parking lot. This well will be field located with input from USACE.
2	12 / Table 2-1		The installation of proposed well location #9 represents the first well (and initial investigation of groundwater quality) within the Group 2 Ore Storage Area (CC-RVAAP-79).	To further strengthen the justification for new wells, Table 2-1 might be revised to include a column for "Initial Investigation of Groundwater Quality at AOC/Area." This recommendation is made for EQM's consideration, and is not a requirement of the USACE.	EQ will add the suggested column to Table 2-1 for clarity.

PBA-11 FOR RVAAP-66 FACILITY-WIDE GROUNDWATER
"DRAFT" FWGWMP PLAN ADDENDUM
RAVENNA ARMY AMMUNITION PLANT – RAVENNA, OH
COMMENT RESPONSE TABLE
EQM Draft Submittal – 24 October 2011
USACE Review Comments – 25 October 2011

Comment Number	Page / Line	New age or Sheet	Comment	Recommendation	Response
3	12 / Table 2-1		The installation of proposed well location #12 represents the first well (and initial investigation of groundwater quality) within the North Line Road Coal Tipple (CC-RVAAP-73).	To further strengthen the justification for new wells, Table 2-1 might be revised to include a column for "Initial Investigation of Groundwater Quality at AOC/Area." This recommendation is made for EQM's consideration, and is not a requirement of the USACE.	EQ will add the suggested column to Table 2-1 for clarity.
4	12 / Table 2-1		The installation of proposed well location #20 represents the first well (and initial investigation of groundwater quality) within the former Administration Area. This well location is located hydraulically down-gradient of the former Building 1031Infirmary (CC-RVAAP-83).	To further strengthen the justification for new wells, Table 2-1 might be revised to include a column for "Initial Investigation of Groundwater Quality at AOC/Area." This recommendation is made for EQM's consideration, and is not a requirement of the USACE.	EQ will add the suggested column to Table 2-1 for clarity.
5	12 / Table 2-1		The installation of proposed well location #21 represents the first well (and initial investigation of groundwater quality) west of the Depot Area (CC-RVAAP-76). This well location appears to be located hydraulically up-gradient of the Depot Area; however, a localized groundwater divide in this area may actually place the well in a hydraulically down-gradient location.	To further strengthen the justification for new wells, Table 2-1 might be revised to include a column for "Initial Investigation of Groundwater Quality at AOC/Area." This recommendation is made for EQM's consideration, and is not a requirement of the USACE.	EQ will add the suggested column to Table 2-1 for clarity.
6	12 / Table 2-1		The installation of proposed well location #22 represents the first well (and initial investigation of groundwater quality) on the western most portion of the former RVAAP facility.	To further strengthen the justification for new wells, Table 2-1 might be revised to include a column for "Initial Investigation of Groundwater Quality at AOC/Area." This recommendation is made for EQM's consideration, and is not a requirement of the USACE.	EQ will add the suggested column to Table 2-1 for clarity.

PBA-11 FOR RVAAP-66 FACILITY-WIDE GROUNDWATER
"DRAFT" FWGWMP PLAN ADDENDUM
RAVENNA ARMY AMMUNITION PLANT – RAVENNA, OH
COMMENT RESPONSE TABLE
EQM Draft Submittal – 24 October 2011
USACE Review Comments – 25 October 2011

Comment Number	Page / Line	New age or Sheet	Comment	Recommendation	Response
7	12 / Table 2-1		The installation of proposed well location #23 represents the first well (and initial investigation of groundwater quality) at the Hinkley Creek exit pathway.	To further strengthen the justification for new wells, Table 2-1 might be revised to include a column for "Initial Investigation of Groundwater Quality at AOC/Area." This recommendation is made for EQM's consideration, and is not a requirement of the USACE.	EQ will add the suggested column to Table 2-1 for clarity.
8	12 / Table 2-1		The installation of proposed well location #24 represents the first well (and initial investigation of groundwater quality) within the Depot Area (CC-RVAAP-76). This well location appears to be located on the hydraulically down-gradient side of the Depot Area, and is also located within close proximity to the former Depot Sewage Treatment Plant.	To further strengthen the justification for new wells, Table 2-1 might be revised to include a column for "Initial Investigation of Groundwater Quality at AOC/Area." This recommendation is made for EQM's consideration, and is not a requirement of the USACE.	EQ will add the suggested column to Table 2-1 for clarity.
9	12 / Table 2-1		The installation of proposed well location #25 represents the first well (and initial investigation of groundwater quality) within the Depot Area (CC-RVAAP-76). This well location appears to be located on the hydraulically down-gradient side of the Depot Area, and is also located within close proximity to the former Depot Building U-20 Incinerator.	To further strengthen the justification for new wells, Table 2-1 might be revised to include a column for "Initial Investigation of Groundwater Quality at AOC/Area." This recommendation is made for EQM's consideration, and is not a requirement of the USACE.	EQ will add the suggested column to Table 2-1 for clarity.
10	Figure 2-1		On the map, proposed well location #10 appears to be located approximately 50 meters north of other existing wells. This is insufficient for the purpose of defining the horizontal extent of groundwater impact.	To better define the horizontal extent of groundwater impact, the USACE recommends proposed well location #10 be moved to a location approximately 200-300 meters north to northwest of the existing wells in the Building 1200 area. Groundwater	The placement of well #10 will be field located to ensure adequate coverage of the Building 1200 area and Sand Creek flow pathway, as well as drill rig accessibility.

PBA-11 FOR RVAAP-66 FACILITY-WIDE GROUNDWATER
"DRAFT" FWGWMP PLAN ADDENDUM
RAVENNA ARMY AMMUNITION PLANT – RAVENNA, OH
COMMENT RESPONSE TABLE
EQM Draft Submittal – 24 October 2011
USACE Review Comments – 25 October 2011

Comment Number	Page / Line	New age or Sheet	Comment	Recommendation	Response
				in the vicinity of Building 1200 is anticipated to flow (preferential flow path) in a north to northwest direction toward Sand Creek. An area of sparse vegetation is located north of the Building 1200 Area.	
11	12 / Table 2-1		The installation of proposed well location #32 and #33 represents the first wells (and initial investigation of groundwater quality) within the East Classification Yard, which was formerly used as a Coal Storage area (CC-RVAAP-73).	To further strengthen the justification for new wells, Table 2-1 might be revised to include a column for "Initial Investigation of Groundwater Quality at AOC/Area." This recommendation is made for EQM's consideration, and is not a requirement of the USACE.	EQ will add the suggested column to Table 2-1 for clarity.
12	12 / Table 2-1		The installation of proposed well location #34 represents the first well (and initial investigation of groundwater quality) within the Wet Storage Area (RVAAP-45).	To further strengthen the justification for new wells, Table 2-1 might be revised to include a column for "Initial Investigation of Groundwater Quality at AOC/Area." This recommendation is made for EQM's consideration, and is not a requirement of the USACE.	EQ will add the suggested column to Table 2-1 for clarity.
13	12 / Table 2-1		The installation of proposed well location #35 represents the first well (and initial investigation of groundwater quality) within the DLA Route 80 Tank Farm (CC-RVAAP-79).	To further strengthen the justification for new wells, Table 2-1 might be revised to include a column for "Initial Investigation of Groundwater Quality at AOC/Area." This recommendation is made for EQM's consideration, and is not a requirement of the USACE.	EQ will add the suggested column to Table 2-1 for clarity.

PBA-11 FOR RVAAP-66 FACILITY-WIDE GROUNDWATER
"DRAFT" FWGWMP PLAN ADDENDUM
RAVENNA ARMY AMMUNITION PLANT – RAVENNA, OH
COMMENT RESPONSE TABLE
EQM Draft Submittal – 24 October 2011
USACE Review Comments – 25 October 2011

Comment Number	Page / Line	New age or Sheet	Comment	Recommendation	Response
14	16 / Table 2-2		The Route 80 Tank Farm was historically used as a DLA Aboveground Storage Tank Area, and not an underground storage tank area.	Revise comments section accordingly.	EQ will revise accordingly.
15	12 / Table 2-1		The installation of proposed well locations #37 and #38 represents the first wells (and initial investigation of groundwater quality) within the former Administration Area. These well locations are located hydraulically down-gradient of the former Building 1048 Fire Station (CC-RVAAP-69), the Administration Coal Storage Area (CC-RVAAP-73), the Building 1034 Motor Pool Hydraulic Lift (CC-RVAAP-74), the Building 1037 former Laundry Waste Water Sump (CC-RVAAP-77), and form Buildings 1031 and 1039 (CC-RVAAP-83).	To further strengthen the justification for new wells, Table 2-1 might be revised to include a column for "Initial Investigation of Groundwater Quality at AOC/Area." This recommendation is made for EQM's consideration, and is not a requirement of the USACE.	EQ will add the suggested column to Table 2-1 for clarity.

PART II

FINAL

FACILITY-WIDE GROUNDWATER MONITORING PROGRAM
RVAAP-66 FACILITY-WIDE GROUNDWATER QUALITY ASSURANCE PROJECT PLAN ADDENDUM

RAVENNA ARMY AMMUNITION PLANT,
RAVENNA, OHIO

GSA Contract Number GS-10F-0293K
Delivery Order W912QR-11-F-0266

Prepared for

U.S. Army Corps of Engineers
600 Martin Luther King Jr. Place
Louisville, Kentucky 40202

Prepared by

Environmental Quality Management, Inc.
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January 6, 2012

CONTRACTOR'S STATEMENT OF INDEPENDENT TECHNICAL REVIEW

Environmental Quality Management, Inc. (EQM) has completed the *Final Quality Assurance Project Plan.* Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in this project. During the independent technical review, compliance with established policy principles and procedures, utilizing justified and valid assumptions were verified. This included review of data quality objectives; technical assumptions, methods, procedures, and materials used; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the customer's needs consistent with law and existing United States Corps of Engineers policy.

Angye Dragotta
Chemist

1/5/2012
Date

John M. Miller, CHMM
Senior Project Manager

1/5/12
Date

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ACRONYMS AND ABBREVIATIONS

ADR	Automated Data Review
AOC	Area of Concern
BHC	Benzene Hexachloride
COC	Chain-of-Custody
COPCs	Chemicals of Potential Concern
DoD	United States Department of Defense
EDD	Electronic Data Deliverable
ELAP	Environmental Laboratory Accreditation Program
EQM	Environmental Quality Management, Inc.
FWGWMP	Facility-Wide Groundwater Monitoring Program
FWSAP	Facility-Wide Sampling and Analysis Plan
FWQAPP	Facility-Wide Quality Assurance Project Plan
GSA	Government Services Administration
HMX	1,3,5,7-tetranitro-1,3,5,7-tetrazocane
IDW	Investigation-Derived Waste
L	Liter
LCG	Louisville Chemistry Guidelines
LCS	Laboratory Control Samples
LOD	Limit of Detection
LOQ	Limit of Quantization
LS	Louisville District Quality Systems Manual Supplement
mg/L	milligram per liter
mL	milliliter
MDL	Method Detection Limit
MRL	Minimum Reporting Limit
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NEIC	National Enforcement Investigations Center
OVA	Organic Vapor Analyzer
PAHS	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PID	Photoionization Detector
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
QSM	Quality Services Manual
RDX	1,3,5-trinitro-1,3,5-triazine
RLs	Reporting Limits
RPD	Relative Percent Difference
RVAAP	Ravenna Army Ammunition Plant
SAP	Sampling and Analysis Plan
SAIC	Science Applications International Corporation
SOPs	Standard Operating Procedures

ACRONYMS AND ABBREVIATIONS (con't)

SVOCs	Semivolatile Organic Compounds
TAL	Target Analyte List
TCLP	Toxicity Characteristic Leaching Procedure
TNT	Trinitrotoluene
µg/L	Microgram per Liter
µm	Micrometer
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
VOCs	Volatile Organic Compounds

SECTION 1.0

INTRODUCTION

In order to ensure that any data generated under the Facility-Wide Groundwater Monitoring Program (FWGWMP) at the former Ravenna Army Ammunition Plant (RVAAP) is of known and documented quality, the following Quality Assurance Project Plan (QAPP) addendum has been generated by Environmental Quality Management, Inc. (EQM). This QAPP addendum will specify the requirements for precision, accuracy, completeness, and representativeness of data that is expected to be achieved by any parties generating data under this program.

All quality assurance/quality control (QA/QC) procedures are in accordance with applicable professional technical standards, United States Environmental Protection Agency (USEPA) requirements, government regulations and guidelines, and specific project goals and requirements. EQM prepared this QAPP addendum in accordance with USEPA QAPP guidance documents, such as the United States Department of Defense (DoD) Quality Services Manual (QSM) for Environmental Laboratories, Version 4.1, and the United States Army Corps of Engineers (USACE), Louisville District Quality Systems Manual Supplement (LS).

SECTION 2.0

PROJECT DESCRIPTION

This QAPP Addendum is part II of the Facility-Wide Groundwater Monitoring Program Plan RVAAP-66 Facility-Wide Groundwater Addendum. For information on site history, past and current data collection activities, schedule, scope of the project, and sample design and rationale, Part I of the Facility-Wide Groundwater Monitoring Program Plan RVAAP-66 Facility-Wide Groundwater Addendum should be referenced. Part II of this addendum specifically pertains to the requirements of analytical data generation. The groundwater samples collected under this addendum will be analyzed for the Target Analyte List (TAL) metals, explosives (including nitroglycerin), propellants (nitroguanidine and nitrocellulose), semivolatile organic compounds (SVOCs), volatile organic compounds (VOCs), pesticides, and cyanide. Other analyses, such as polychlorinated biphenyls (PCBs), perchlorate, hexavalent chromium, nitrate as nitrite (N), or polycyclic aromatic hydrocarbons (PAHs), will be performed on an as-needed basis as data quality objectives and historical data from each area of concern (AOC) are evaluated. Table 2-1 lists the methods to be used by the analytical laboratories. For information on the methods typically used in reporting each analyte, reference Table 4.1 of this addendum.

Table 2-1. Parameter and Methods Table

	Parameter	Methods (Analytical/ Prep)
Confirmation of Contamination Extent	Metals	SW-846 6020/3005A
		SW-846 6010B/3005A
		SW-846 7470A
	PCBs	SW-846 8082/3520C
	Pesticides	SW-846 8081A/3520C
	SVOCs	SW-846 8270C/3520C
	VOCs	SW-846 8260B/5030B
	Perchlorate	SW-846 6860
	Cyanide	SW-846 9012A
	Explosives& Propellants	SW-846 8330/SW8330 Modified/ 3535
	Nitrocellulose	Laboratory SOP WS-WC-0050
	Hexavalent Chromium	SW-846 7196A
	Nitrate as N	EPA method 353.2
Investigation-Derived Waste (IDW) Characterization	TCLP Metals	SW-846 6020/1311
		SW-846 6010B/1311
		SW-846 7470A/1311
	TCLP VOCs	SW-846 8260
	TCLP SVOCs	SW-846 8270
	TCLP Pesticides	SW-846 8081
	TCLP Herbicides	SW-846 8151
	Total Cyanide	SW-846 9012
	Total Sulfide	SW-846 9034
	pH	SW-846 9040B
	Flashpoint	EPA method 1010

TCLP=Toxicity Characteristic Leaching Procedure
EPA- Environmental Protection Agency
SW-846=United States EPA Hazardous Waste Test Methods

SECTION 3.0

PROJECT ORGANIZATION AND RESPONSIBILITIES

The sampling effort will be coordinated by EQM. Test America (North Canton, Ohio) is the primary analytical laboratory that will be providing analytical results and RTI Laboratories (Livonia, Michigan), or another Environmental Laboratory Accreditation Program (ELAP)-approved laboratory, will be analyzing split samples for USACE. All laboratories performing work under this addendum will be ELAP approved to perform work for the DoD under the QSM.

Once samples are collected by EQM, the samples are packaged as indicated in Part I of this document. Samples are then either transported via express services to RTI or picked up by a Test America courier. Once the samples arrive at the North Canton facility, they are handled per documented laboratory procedures. Three of the laboratories within the Test America network will be analyzing samples collected at RVAAP, under the coordination of the Test America, North Canton Project Manager. Table 3.1 specifies the parameters that will be handled by each laboratory.

Table 3-1. Laboratory Locations

Test America Location	Parameter
North Canton	Metals
	PCBs
	Pesticides
	SVOCs/PAHs
	VOCs
	Hexavalent Chromium
	Cyanide
	IDW Characterization
Denver	Perchlorate
West Sacramento	Explosives & Propellants
	Nitrate

SECTION 4.0

QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

All analytical data generated must be of known and documented quality. To generate data of known and documented quality, laboratories are required to comply with the requirements presented in the DoD QSM 4.2, the USACE LS, and method-specific requirements unless specified by project-specific requirements or if written approval has been obtained from the USACE through EQM. In order to maintain consistency, variances previously accepted for samples analyzed at RVAAP will be applied to samples analyzed under this quality plan addendum. The variances previously approved for use on the FWGWMP at RVAAP under the Louisville Chemistry Guidelines (LCG) are as follows:

1) The method blank, initial calibration blank and continuing calibration blank acceptance criteria to be less than the minimum reporting limit (MRL).
2) The laboratory control samples (LCS) lower control limit for hexachlorocyclopentadiene at 10%.
3) The LS states" USACE recommends the MRLs be established at or below approximately one-half the project action level and at or above 3x the method detection limit (MDL)." In some cases, Test America has had to adjust their reporting limit (RL) to less than 3x the MDL in order to achieve an RL at or below the project action limit. Therefore, EQM proposes that the laboratory set the MRL standard at the project action limit. This action would demonstrate that laboratory instrumentation can measure potential concentrations of target analytes at, or above, the ranges most important to this project for the project action limit.

In order to assess whether the QA objectives have been met, laboratory and field QC samples are required. Field QC samples required under Part II of this document are equipment rinses, trip blanks, and field duplicates. Laboratory QC used to assess analytical accuracy includes the LCS, method blanks, MRL checks, sample duplicates, and matrix spikes. Appendix 6 of the QSM specifies frequency of the laboratory QC. Field QC is to be collected at the frequency specified in Part I of this document. The facility-wide QAPP (FWQAPP) addresses the quality parameters each QC sample (field or lab) is used to assess.

The fundamental QA objectives for accuracy, precision, and sensitivity of laboratory analytical data are the QC acceptance criteria of the analytical protocols. Analytical accuracy will be measured by the recoveries of the laboratory control sample (LCS) analysis. The calculated relative percent difference (RPD) between duplicate analyses [matrix spike and matrix spike duplicate (MS/MSD)] is an indication of the precision of the method being employed. The accuracy and precision requirements for each analytical method are incorporated in Tables 4-1 and 4-2 of the FWQAPP and are consistent with the analytical requirements found in the DoD QSM. The sensitivities required for the analyses conducted at RVAAP are identified in Tables 4-1 through 4-7 in Part II of this document as RLs. The RLs are current as of the time of the generation of this addendum. Reporting limits are subject to change based on changes in

instrumentation, annual MDL studies, and sample volume/preparation corrections. See the FWQAPP for definitions and examples of completeness, representativeness, and comparability. The completeness goal for the samples analyzed under this addendum is 90%.

Table 4-1. Metals

Analyte Name	Lab Method	Laboratory Reporting Limits (µg/L)	Project Action Requirements (µg/L)
Aluminum	SW846 6020	50.0	50.0
Antimony	SW846 6020	2.0	2.0
Beryllium	SW846 6020	1.0	1.0
Cadmium	SW846 6020	0.50	0.50
Iron	SW846 6020	50.0	100
Sodium	SW846 6020	1000	200
Thallium	SW846 6020	1.0	1.0
Zinc	SW846 6020	10.0	10.0
Arsenic	SW846 6010B	5.0	5.0
Barium	SW846 6010B	10.0	10.0
Calcium	SW846 6010B	1000	100
Chromium	SW846 6010B	5.0	5.0
Cobalt	SW846 6010B	5.0	5.0
Copper	SW846 6010B	5.0	5.0
Lead	SW846 6010B	3.0	3.0
Magnesium	SW846 6010B	1000	100
Manganese	SW846 6010B	10.0	10.0
Nickel	SW846 6010B	10.0	10.0
Potassium	SW846 6010B	1000	200
Selenium	SW846 6010B	5.0	5.0
Silver	SW846 6010B	5.0	5.0
Vanadium	SW846 6010B	10.0	10.0
Mercury	SW846 7470A	0.20	0.20
Hexavalent Chromium	SW846 7196	0.02 mg/L	0.02 mg/L

Table 4-2. Perchlorate

Analyte Name	Lab Method	Laboratory Reporting Limits (µg/L)	Project Action Requirements (µg/L)
Perchlorate	SW846 6860	0.050	0.1

Table 4-3. PCBs and Pesticides

Analyte Name	Lab Method	Laboratory Reporting Limit (µg/L)	Project Action Requirements (µg/L)
Aroclor 1016	SW846 8082	0.50	0.20
Aroclor 1221	SW846 8082	0.50	0.20
Aroclor 1232	SW846 8082	0.50	0.20
Aroclor 1242	SW846 8082	0.50	0.20
Aroclor 1248	SW846 8082	0.50	0.20
Aroclor 1254	SW846 8082	0.50	0.20
Aroclor 1260	SW846 8082	0.50	0.20
4,4-DDD	SW846 8081A	0.030	0.050
4,4-DDD	SW846 8081A	0.030	0.050
4,4-DDT	SW846 8081A	0.030	0.050
Aldrin	SW846 8081A	0.030	0.030
alpha-BHC	SW846 8081A	0.030	0.030
alpha-Chordane	SW846 8081A	0.030	0.050
beta-BHC	SW846 8081A	0.030	0.050
delta-BHC	SW846 8081A	0.030	0.050
Dieldrin	SW846 8081A	0.030	0.030
Endosulfan I	SW846 8081A	0.025	0.05
Endosulfan II	SW846 8081A	0.025	0.05
Endosulfan sulfate	SW846 8081A	0.030	0.05
Endrin	SW846 8081A	0.030	0.05
Endrin aldehyde	SW846 8081A	0.030	0.05
Endrin ketone	SW846 8081A	0.030	0.05
gamma-BHC	SW846 8081A	0.030	0.05
gamma-Chlordane	SW846 8081A	0.030	0.050
Heptachlor	SW846 8081A	0.030	0.030
Heptachlor epoxide	SW846 8081A	0.030	0.030
Methoxychlor	SW846 8081A	0.10	0.10
Toxaphene	SW846 8081A	2.0	2.0

BHC = benzene hexachloride
4,4-DDD = 4,4-Dichlorodiphenyldichloroethane
4,4-DDT = 4,4-Dichlorodiphenyltrichloroethane
4,4-DDE = 4,4-Dichlorodiphenyldichloroethylene

Table 4-4. Explosives and Propellants

Analyte Name	Lab Method	Laboratory Reporting Limit (µg/L)	Project Action Requirements (µg/L)
1,3,5-Trinitrobenzene	SW846 8330	0.097	0.2
1,3-Dinitrobenzene	SW846 8330	0.097	0.2
2,4,6-TNT	SW846 8330	0.097	0.2
2,4-Dinitrotoluene	SW846 8330	0.097	0.1
2,6-Dinitrotoluene	SW846 8330	0.097	0.1
2-Amino-4,6-dinitrotoluene	SW846 8330	0.097	0.2
2-Nitrotoluene	SW846 8330	0.48	0.2
3-Nitrotoluene	SW846 8330	0.48	0.2
4-Amino-2,6-Dinitrotoluene	SW846 8330	0.097	0.2
4-Nitrotoluene	SW846 8330	0.48	0.2
HMX	SW846 8330	0.097	0.5
Nitrobenzene	SW846 8330	0.097	0.2
Nitrogylcerin	SW846 8330	0.63	3
Pentaerythritol Tetranitrate	SW846 8330	0.63	3
RDX	SW846 8330	0.097	0.5
Tetryl	SW846 8330	0.097	0.2
Nitrocellulose	WS-WC-0050	2.0	500
Nitroguanidine	SW846 8330 Modified	20	20

TNT = trinitrotoluene
HMX = 1,3,5,7-tetranitro-1,3,5,7-tetrazocane
RDX = 1,3,5-trinitro-1,3,5-triazine

Table 4-5. Volatiles

Analyte Name	Lab Method	Laboratory Reporting Limit (µg/L)	Project Action Requirements (µg/L)
1,1,1-Trichloroethane	SW846 8260B	1.0	1.0
1,1,2,2-Tetrachloroethane	SW846 8260B	1.0	1.0
1,1,2-Trichloroethane	SW846 8260B	1.0	1.0
1,1-Dichloroethane	SW846 8260B	1.0	1.0
1,1-Dichloroethene	SW846 8260B	1.0	1.0
1,2-Dibromoethane	SW846 8260B	1.0	1.0
1,2-Dichloroethane	SW846 8260B	1.0	1.0
1,2-Dichloroethene (total)	SW846 8260B	1.0	1.0
1,2-Dichloropropane	SW846 8260B	1.0	1.0
2-Butanone	SW846 8260B	10	10
2-Hexanone	SW846 8260B	10	10
4-Methyl-2-pentanone	SW846 8260B	10	10
Acetone	SW846 8260B	10	10
Benzene	SW846 8260B	1.0	1.0
Bromochloromethane	SW846 8260B	1.0	1.0
Bromodichloromethane	SW846 8260B	1.0	1.0
Bromoform	SW846 8260B	1.0	1.0
Bromomethane	SW846 8260B	1.0	1.0
Carbon disulfide	SW846 8260B	1.0	1.0
Carbon tetrachloride	SW846 8260B	1.0	1.0
Chlorobenzene	SW846 8260B	1.0	1.0
Chloroethane	SW846 8260B	1.0	1.0
Chloroform	SW846 8260B	1.0	1.0
Chloromethane	SW846 8260B	1.0	1.0
cis-1,2-Dichloroethene	SW846 8260B	1.0	1.0
cis-1,3-Dichloropropene	SW846 8260B	1.0	1.0
Dibromochloromethane	SW846 8260B	1.0	1.0
Ethylbenzene	SW846 8260B	1.0	1.0
M&P-Xylenes	SW846 8260B	2.0	2.0
Methylene chloride	SW846 8260B	2.0	1
o-Xylene	SW846 8260B	1.0	1.0
Styrene	SW846 8260B	1.0	1.0
Tetrachloroethene	SW846 8260B	1.0	1.0
Toluene	SW846 8260B	1.0	1.0

Table 4-5. Volatiles (continued)

Analyte Name	Lab Method	Laboratory Reporting Limit (µg/L)	Project Action Requirements (µg/L)
trans-1,2-Dichloroethene	SW846 8260B	1.0	1.0
Total Xylenes	SW846 8260B	2.0	2.0
Trichloroethene	SW846 8260B	1.0	1.0
Vinyl chloride	SW846 8260B	1.0	1.0

Table 4-6. Semivolatiles

Analyte Name	Lab Method	Laboratory Reporting Limit (µg/L)	Project Action Requirements (µg/L)
1,2,4-Trichlorobenzene	SW846 8270C	1.0	10
1,2-Dichlorobenzene	SW846 8270C	1.0	10
1,3-Dichlorobenzene	SW846 8270C	1.0	10
1,4-Dichlorobenzene	SW846 8270C	1.0	1.0
2,2-Oxybis (1-Chloropropane)	SW846 8270C	1.0	10
2,4,5-Trichlorophenol	SW846 8270C	5.0	25
2,4,6-Trichlorophenol	SW846 8270C	5.0	5.0
2,4-Dichlorophenol	SW846 8270C	2.0	10
2,4-Dimethylphenol	SW846 8270C	2.0	10
2,4-Dinitrophenol	SW846 8270C	5.0	25
2,4-Dinitrotoluene	SW846 8270C	5.0	10
2,6-Dinitrotoluene	SW846 8270C	5.0	10
2-Chloronaphthalene	SW846 8270C	1.0	10
2-Chlorophenol	SW846 8270C	1.0	10
2-Methylnaphthalene	SW846 8270C	0.20	10
2-Methylphenol	SW846 8270C	1.0	10
2-Nitroaniline	SW846 8270C	2.0	25
2-Nitrophenol	SW846 8270C	2.0	10
3,3'-Dichlorobenzidine	SW846 8270C	5.0	5.0
3-Nitroaniline	SW846 8270C	2.0	25
4,6-Dinitro-2-methylphenol	SW846 8270C	5.0	25
4-Bromophenyl phenyl ether	SW846 8270C	2.0	10
4-Chloro-3-methylphenol	SW846 8270C	2.0	10
4-Chloroaniline	SW846 8270C	2.0	10

Table 4-6. Semivolatiles (continued)

Analyte Name	Lab Method	Laboratory Reporting Limit (µg/L)	Project Action Requirements (µg/L)
4-Chlorophenyl phenyl ether	SW846 8270C	2.0	10
3 &4-Methylphenol	SW846 8270C	1.0	10
4-Nitroanaline	SW846 8270C	2.0	25
4-Nitrophenol	SW846 8270C	5.0	25
Acenaphthene	8270C	0.20	10
Acenaphthylene	8270C	0.2	10
Anthracene	8270C	0.20	10
Benzo(a)anthracene	8270C	0.20	0.20
Benzo(a)pyrene	8270C	0.20	0.20
Benzo(b)fluoranthene	8270C	0.20	0.20
Benzo(g,h,i)perylene	8270C	0.20	10
Benzo(k)fluoranthene	8270C	0.20	0.20
Benzoic acid	8270C	10	25
Benzyl alcohol	8270C	5.0	10
bis(2-Chloroethoxy)methane	8270C	1.0	10
Bis (2-chloroethyl)ether	8270C	1.0	1.0
bis(2-Ethylhexyl)phthalate	8270C	10	10
Butylbenzyl phthalate	8270C	1.0	10
Carbazole	8270C	1.0	10
Chrysene	8270C	0.20	10
Dibenzo(a,h)anthracene	8270C	0.20	50
Dibenzofuran	8270C	1.0	10
Diethyl phthalate	8270C	1.0	10
Dimethyl phthalate	8270C	1.0	10
Di-n-butyl phthalate	8270C	1.0	10
Di-n-octyl phthalate	8270C	1.0	10
Fluoranthene	8270C	0.20	10
Fluorene	8270C	0.20	10
Hexachlorobenzene	8270C	0.20	10
Hexachlorobutadiene	8270C	1.0	10
Hexachlorocyclopentadiene	8270C	10	10
Hexachloroethane	8270C	1.0	10
Indeno(1,2,3-cd)pyrene	8270C	0.20	0.2
Isophorone	8270C	1.0	10
Naphthalene	8270C	0.20	10
Nitrobenzene	8270C	1.0	10

Table 4-6. Semivolatiles (continued)

Analyte Name	Lab Method	Laboratory Reporting Limit (µg/L)	Project Action Requirements (µg/L)
N-nitroso-di-n-propylamine	8270C	1.0	10
N-Nitrosodiphenylamine	8270C	1.0	10
Pentachlorophenol	8270C	5.0	5.0
Phenanthrene	8270C	0.20	10
Phenol	8270C	1.0	10
Pyrene	8270C	0.20	10

Table 4-7. General Chemistry

Analyte Name	Lab Method	Laboratory Reporting Limit (mg/L)	Project Action Requirements (mg/L)
Cyanide	9012A	0.010	0.01
Nitrate as N (NO3-N)	353.2	0.1	0.1

SECTION 5.0

SAMPLE PROCEDURES

Sampling procedures are outlined in Part I of this document. See Table 5-1 below for container and preservation requirements. Requirements listed in Table 5-1 are on a per sample basis. The exact number of samples to be collected and the chemicals to be analyzed for each AOC will be conducted in accordance with Section 2 of Part I of this document.

Table 5-1. Sample Requirements

Analyte Group	Containers*	Minimum Sample Size	Preservative	Holding Time (days)
VOCs	(3) 40-mL glass vials with Teflon-lined septa	80 mL	HCl to pH<2, Cool, 4°C	14 days
SVOCs	(2) 1-liter amber bottles with Teflon-lined lid for each analyte group	1 L	Cool, 4°C	7 days extraction 40 days analysis
Pesticides				
PCBs				
Metals	500-mL polybottle	300 mL	0.45 µm filter HNO_3 to pH<2, Cool, 4°C	180 days, Hg at 28 days
Perchlorate	250-mL polybottle	250 mL	0.2 µm filter with prefilter, Cool, 4°C	28 days
Cyanide	250-mL polybottle	250 mL	NaOH to pH>12, Cool, 4°C	14 days
Explosives & Propellants	(3) 1-liter amber bottles with Teflon-lined lid	2 L	Cool, 4°C	7 days extraction, 40 days analysis
Hexavalent Chromium	250-mL polybottle	200 mL	Cool, 4°C	24 hours
Nitrate	250-mL polybottle	250 mL	H_2SO_4 to pH<2, Cool, 4°C	28 days
TCLP Metals	(4) 1-L amber Glass (1) 250 mL polybottle	1 L	Cool, 4°C	180 days, Hg at 28 days
TCLP VOCs		1 L		14 days
TCLP SVOCs		1 L		14 days
Reactive Cyanide		250 ml		14 days
Reactive Sulfide				7 days
pH		1 L		As soon as possible
Flashpoint				N/A

*Container requirements as listed are for one sample, the MS/MSD analyses are each considered a sample

SECTION 6.0

SAMPLE CUSTODY

This project will follow Section 6.0 of the FWQAPP and USEPA policy regarding sample custody and chain-of-custody (COC) protocols as described in *National Enforcement Investigations Center (NEIC) Policies and Procedures*. This custody is in three parts: sample collection, laboratory analysis, and final evidence files. The sample custody procedures are set forth in Section 6.0 of the FWQAPP and further described in the Sections 6.0 and 7.0 of Part I of this document. The Contractor Project Manager or designee will review all field activities to determine whether proper custody procedures were followed during the fieldwork and to decide if additional samples are required.

Coolers picked up by the laboratory rather than transported via shipping company will be signed under separate team designated COCs with cooler identification numbers listed. A custody seal will be attached to the "access" side of each cooler. When the courier arrives to pick up samples, the sample custody will be transferred from EQM personnel to Test America. The sample custody transfer will be documented on each COC.

SECTION 7.0

CALIBRATION PROCEDURES AND FREQUENCY

Calibration and maintenance of field and laboratory instrumentation will be conducted prior to and during continued use to establish that the equipment is functioning to the desired sensitivity.

7.1 Field Instruments/Equipment

Field instruments and equipment calibrations will follow procedures described in Section 7.0 of the FWQAPP. A project Material and Testing Equipment logbook will not be utilized. At a minimum, the following information will be recorded electronically or on calibration logs as identified in Part III of this document:

- Equipment name/identifier
- Date/time of calibration
- Name of calibration personnel
- Reference standard/results
- Procedures used or other pertinent information

7.2 Laboratory Instruments

Procedures and records of calibration will follow direction as stated in the DoD QSM and LS. For modified methods (8330M) and methods that are governed by laboratory standard operating procedures (SOPs) (i.e., nitrocellulose), refer to the appropriate SOP for the required calibration procedures and frequencies.

SECTION 8.0

ANALYTICAL PROCEDURES

8.1 Laboratory Analysis

The total number of samples to be collected and chemical groups to be analyzed for this investigation are presented in Part I, Section 2 of this document. The new wells will be sampled and analyzed for the parameters presented in Table 2-2 of Part I of this document for four (4) consecutive quarters. In addition, all of the new wells are anticipated to be sampled for hexavalent chromium during one of the 2012 monitoring events. Section 2.2 of Part III of this document, presents the chemicals of potential concern (COPCs) for RVAAP. Section 5.0 of this document summarizes the container types, container sizes, preservatives, and sample holding times. Typical RLs for samples are listed in Section 4 of this addendum. The contract laboratory will provide sufficient containers of the proper size and with the proper chemical preservatives for the parameters to be collected.

8.2 Field Screening Analytical Protocols

All field measurement procedures and criteria will follow Section 7.0 of this addendum and Section 5.4.3 of the FWSAP. Tabulation of the methodologies appears in Tables 4-1 and 4-2 of the FWQAPP. All monitoring wells will be field screened for VOCs using a photoionization detector (PID) or organic vapor analyzer (OVA) during groundwater sample collection. Screening will be accomplished by monitoring the headspace vapors at the top of the riser pipe. Only screening of drill cuttings and core samples for organic vapors using a PID will be conducted; headspace analyses of drill cuttings or core samples will not be conducted.

SECTION 9.0

INTERNAL QUALITY CONTROL CHECKS

Internal quality control checks are in place to ensure the production of analytical data is of known and documented quality as documented in Section 9.0 of the FWQAPP. Field sample procedures are checked by assessing field duplicate and field QC samples. Field equipment is checked as specified in Part I of this document. Samples are prepped and analyzed as directed in the DoD QSM and LS. The data generated through the analysis is verified to be of known quality through the use of analytical QC, such as method blanks, calibration checks, LCS, matrix spikes, MRL checks, internal standards, and surrogates In addition, all Test America laboratories (North Canton, West Sacramento, and Denver) involved with generating data have a written QA plan providing rules and guidelines to ensure the reliability and validity of work conducted at the laboratory.

SECTION 10.0

DATA REDUCTION, VALIDATION, AND REPORTING

Field data recorded electronically will be reviewed following the conclusion of each sampling event by the EQM Project Manager or designee. Laboratory data shall be reviewed by laboratory personnel so as to concur with requirements stated in the DOD QSM, LS, and laboratory quality plan. The contractor shall be notified of any discrepancies via email and resolutions will be documented through the case narrative. Following the conclusion of laboratory review, assignment of data qualifiers, and sign off by the laboratory project manager, an analytical data package shall be supplied by the laboratory to the contractor. The data package maybe in electronic or hard copy format. The data package shall consist of the elements outlined in Section 10.3 of the FWQAPP, including ADR EDD, with the exclusion of LCS control charts. The LCS control charts shall be generated by the laboratory as directed by the laboratory quality manual and made available to EQM as requested. Analytical data will then be reviewed by qualified EQM personnel and a report generated according to Step-2 of the Louisville Supplement to the QSM, with any deviations/outliers noted in the summary report. A typical summary report generated by the EQM reviewer will be by laboratory workorder and consist of a verification summary report, a list of samples included in the review process, associated chains of custody, summaries of results and QC, checklists used in data review and a summary of qualified results.

SECTION 11.0

PERFORMANCE AND SYSTEM AUDITS

Performance and system audits of both field and laboratory activities will be conducted to verify that sampling and analysis are performed in accordance with the procedures established in the FWSAP and FWQAPP. Audits of field and laboratory activities will include both internal and external audits. A minimum of one field surveillance for the investigation will be performed by EQM. This surveillance will encompass the performance of monitoring well installation and completion of field logs or of monitoring well sampling and completion of field logs. Laboratory audits will be in the form of onsite system audits by DoD ELAP accrediting agency and internal QA audits as stated in the FWQAPP.

SECTION 12.0

PREVENTATIVE MAINTENANCE PROCEDURES

Preventative maintenance procedures are presented in the Section 12.0 of the FWQAPP. Calibration checks and calibrations will be documented on a calibration log or equivalent. Any maintenance conducted on field equipment must be documented in the logbook or electronic logs. All laboratory instruments will be maintained in accordance with manufacturers' specifications and the requirements of the specific method employed. Emergency repair or scheduled manufacturer's maintenance will be provided under a repair and maintenance contract with factory representatives or qualified in-house technical personnel.

SECTION 13.0

SPECIFIC ROUTINE PROCEDURES TO ASSESS DATA PRECISION, ACCURACY AND COMPLETENESS

Field data will be assessed by the site QC Officer, or designee. The site QC Officer or his/her designee will review the field results for accuracy by reviewing daily instrument calibrations. In addition, completeness will be assessed by the site QC Officer or his/her designee by verifying all samples planned for collection are collected within the sampling event.

Laboratory data will be assessed for precision, accuracy, completeness, sensitivity and representativeness/comparability. Precision will be assessed by evaluating duplicate sample difference RPD.

$$RPD = \frac{|S - D|}{\frac{(S + D)}{2}} \times 100$$

Where:

S = First sample value (original or matrix spike value),
D = Second sample value (duplicate or matrix spike duplicate value).

Accuracy will be evaluated by comparing the recovered values for the LCS and matrix spikes to the documented true values (percent recovery, % R).

$$\% R = 100 (x_s - x_u)/K$$

Where:
x_s = measured value for the spiked sample
x_u = measured value of the unspiked sample
K=the known value of spike in the sample

Completeness will be evaluated by the following equation and documented in the verification report.

$$\text{Completeness} = \frac{\text{Number of Valid Laboratory Measurements Made}}{\text{Number of Laboratory Measurements Planned}} \times 100\%$$

Sensitivity will be assessed by the laboratory in establishing limit of detection (LOD) and limit of quantization (LOQ). The LOD and LOQ are determined at the frequency stated in the laboratory's quality manual. Instrument sensitivity can also be monitored by MRL checks. Representativeness and comparability may be gained through statistical evaluation of data populations, chemical charge balances, compound evaluations, or dual measurement comparisons (e.g., total versus dissolved water analysis and field versus fixed laboratory analyses).

SECTION 14.0

CORRECTIVE ACTIONS

Corrective actions may be required for two major types of problems: analytical/equipment problems and non-compliance with criteria. Analytical and equipment problems may occur during sampling, sample handling, sample preparation, laboratory instrumental analysis, and data review. Analytical/equipment problems will be addressed in accordance with Section 14.0 of the FWQAPP with the exception that any laboratory non-conformances impacting quality of data will be documented via email to the contractor, and the contractor shall direct the laboratory how to proceed with analysis. The contractor will notify the USACE representative, as deemed necessary depending on severity and impact; otherwise, the nonconformance will be noted in the final report.

SECTION 15.0

QUALITY ASSURANCE REPORT

All performance and system audits of laboratory and field operations will be reported directly to project management, program management, and USACE in accordance with Section 11.0 and 15.0 of the FWQAPP.

SECTION 16.0

REFERENCES

DoD. 2009. *United States DoD QSM for Environmental Laboratories,* Version 4.1.

SAIC. *Final Facility-Wide Sampling and Analysis Plan for Environmental Investigations, Ravenna Army Ammunition Plant, Ravenna, Ohio.* February 24, 2011.

USACE. 2002. *USACE Louisville Chemistry Guideline* Version 5.0.

USACE. 2004. *Facility-Wide Groundwater Monitoring Program for the Ravenna Army Ammunition Plant, Ravenna, Ohio,* GS-10F-0350M, D.O. DACA27-03-F-0047.

USACE. 2007. *Perchlorate Analysis Addendum to the Facility-Wide Groundwater Monitoring Program.*

USACE. 2007. *Louisville District Quality Systems Manual Supplement.*

USEPA. 1978. *National Enforcement Investigations Center (NEIC) Policies and Procedures.*

PART III

FINAL

FACILITY-WIDE GROUNDWATER MONITORING PROGRAM
RVAAP-66 FACILITY-WIDE GROUNDWATER
SITE SAFETY AND HEALTH PLAN
ADDENDUM

RAVENNA ARMY AMMUNITION PLANT,
RAVENNA, OHIO

GSA Contract Number GS-10F-0293K
Delivery Order W912QR-11-F-0266

Prepared for

U.S. Army Corps of Engineers
600 Martin Luther King Jr. Place
Louisville, Kentucky 40202

Prepared by

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

January 6, 2012

CONTRACTOR'S STATEMENT OF INDEPENDENT TECHNICAL REVIEW

Environmental Quality Management, Inc. (EQM) has completed the *Final Facility-Wide Groundwater Monitoring Program RVAAP-66 Facility-Wide Groundwater Site Safety and Health Plan.* Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in this project. During the independent technical review, compliance with established policy principles and procedures, utilizing justified and valid assumptions were verified. This included review of data quality objectives; technical assumptions, methods, procedures, and materials used; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the customer's needs consistent with law and existing United States Corps of Engineers policy.

Colleen A. Lear, LG; phone: (513)-218 6244
Plan Preparer/Senior Project Geologist

Date 1/4/12

John R. Kominsky, CIH, CSP; phone: (513)-310-4473
Approval/Senior Safety & Health Manager

Date 1/5/12

John M. Miller, CHMM; phone: (513)-673 4065
Concurrence/Senior Project Manager

Date 1/4/12

STATEMENT OF CONTRACTOR'S SAFETY AND HEALTH POLICY

It is the policy of EQM to provide a safe and healthful workplace for all employees, subcontractors, and consultants in compliance with government regulations and client specifications. Effective programs which protect workers and ensure regulatory compliance are a vital corporate priority. EQM bases all of its operations on the principle that all occupational illnesses, accidents, and injuries are preventable. If an assignment cannot be done safely, it will not be done unless and until work modifications are in place so that the assignment can be done safely. Successful safety performance requires every individual's continuous involvement, teamwork, and leadership. Everyone is responsible and accountable for safety.

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APPENDICES

ACRONYMS AND ABBREVIATIONS

AOCs	Areas of Concern
AHA	Activity Hazard Analysis
Camp Ravenna	Camp Ravenna Joint Military Training Center
CPR	Cardiopulmonary Resuscitation
CEC	Civil & Environmental Consultants
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
COPCs	Chemicals of Potential Concern
CRZ	Contamination Reduction Zone
dBA	DeciBels
eV	electron volts
EQM	Environmental Quality Management, Inc.
F	Fahrenheit
FOM	Field Operations Manager
FP	Flashpoint
ft	feet
FWSAP	Facility-Wide Sampling and Analysis Plan
FWSHP	Facility-Wide Safety and Health Plan
GOCO	Government-owned, contractor-operated
GSA	Government Services Administration
HAZWOPER	Hazardous Waste Operations
H&S	Health and Safety
hr	hour
IDW	Investigation-Derived Waste
IP	Ionization Potential
IRP	Installation Restoration Program
Lbs	pounds
MEC	Munitions and Explosives of Concern
mmHg	millimeters of mercury
mm	millimeter
MSDSs	Material Safety Data Sheet
MRS	Munitions Response Site
NA	Not available
NGB	National Guard Bureau
OHARNG	Ohio Army National Guard
OJT	On the Job Training
Ohio EPA	Ohio Environmental Protection Agency
OSHA	Occupational Safety & Health Administration
PAHs	Polycyclic Aromatic Hydrocarbon
PCBs	Polychlorinated Biphenyls
PID	Photoionization Detector
PM	Project Manager
PPE	Personal Protective Equipment
ppm	parts per million

ACRONYMS AND ABBREVIATIONS (con't)

NIOSH	National Institute of Occupational Safety and Health
RTLS	Ravenna Training and Logistic Site
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
SAP	Sampling and Analysis Plan
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
SVOCs	Semivolatile Organic Compounds
TNT	Trinitrotoluene
USACE	United States Army Corps of Engineers
UXO	Unexploded Ordnance
VOCs	Volatile Organic Compounds
VP	Vapor Pressure

SECTION 1.0

INTRODUCTION

The Ravenna Army Ammunition Plant (RVAAP) Facility-Wide Safety and Health Plan for Environmental Investigations (FWSHP) (SAIC 2011), and this Site Safety and Health Plan (SSHP) Addendum jointly set forth the minimum requirements and specific procedures for protecting personnel involved in Environmental Investigative Services at the RVAAP, specifically the RVAAP-66 Facility-Wide Groundwater activities. Environmental Quality Management, Inc. (EQM) is responsible for implementing and completing comprehensive groundwater monitoring services. This plan provides Contractors with guidance on health and safety hazards and controls. Nothing in this document relieves the Contractor from the requirement to comply with all applicable portions of the *USACE Safety and Health Requirements Manual EM 385-1-1* and Occupational Safety & Health Administration (OSHA) regulations and to provide a safe workplace. All field personnel are required to comply with the requirements set forth within these programs and plans. In addition, subcontractors are responsible for providing their employees with a healthy and safe work place. These plans are to be adopted and do not relieve subcontractors of their responsibilities. If the requirements of these plans are not sufficient to protect the employees of a subcontractor, that subcontractor is required to supplement or modify this information with work practices and procedures that will ensure the safety of its personnel and provide the information to EQM.

This SSHP serves as a lower-tier document addressing the hazards and controls specific to on-site tasks and activities involved in implementing and completing comprehensive groundwater monitoring services per the Government Services Administration (GSA) Contract Number GS-10F-0293K, Delivery Order W912QR-11-F-0266 for the U.S. Army Corps of Engineers (USACE), Louisville District. This addendum references the FWSHP and all those items not duplicated within it. Details such as a description of site conditions, maximum anticipated contaminant concentrations, and investigation-specific variations from the FWSHP are presented in this project-specific addendum. A copy of this FWSHP and the appropriate SSHP Addendum will be present at each work site.

Planned site activities consist of environmental sampling and support tasks. These tasks include well installation at multiple different locations within RVAAP. Final drilling locations may change slightly based on the results of utility clearance by RVAAP and surveys for the presence of Munitions and Explosives of Concern (MEC). Groundwater sampling will be conducted on the newly-installed and existing monitoring wells consistent with the Facility-Wide Sampling and Analysis Plan for Environmental Investigations (FWSAP) (SAIC 2011). Groundwater sampling will be sampled using low-flow methods as specified in the FWSAP and Part I of this document. These documents address the installation and groundwater sampling of monitoring wells at RVAAP.

The most significant potential hazards posed by these tasks include: injury from ordnance and explosives; striking, rotation, and noise hazards from drilling; lifting, noise, and physical strain

associated with operating sampling equipment; fuel or decontamination solvent fires; chemical exposure; temperature extremes; stinging/biting insects; poisonous plants; and snakes.

The potential for chemical overexposure during the performance of the tasks is low based upon the anticipated contaminants, nature of the planned tasks, and review of historical data available. However, there is the potential for adverse health effects resulting from dermal contact with contaminated groundwater, soil, or debris and chemical exposure via inhalation due to drilling operations. This potential hazard will be mitigated through the use of nitrile or equivalent gloves during the handling of potentially-contaminated materials.

Physical hazards are associated with waterborne operations, drilling equipment, soil sampling equipment, and hand-operated power tools. Task-specific hazard controls have been specified for these tasks. This investigation will be performed in Level D personal protective equipment (PPE) plus nitrile or equivalent gloves when handling potentially contaminated materials or heavy duty gloves for pinch/heavy lifting hazards. If necessary, the Site Safety and Health Officer (SSHO) will upgrade the required PPE. An analysis of these hazards and specific appropriate controls is presented in Section 3.0. Details regarding PPE are contained in Section 7.0.

SECTION 2.0

FACILITY DESCRIPTION AND CONTAMINATION CHARACTERIZATION

2.1 Site Description

The current RVAAP consists of 1,280 acres in several distinct parcels scattered throughout the confines of the Ohio Army National Guard (OHARNG) Camp Ravenna Joint Military Training Center (Camp Ravenna). The RVAAP and Camp Ravenna are collocated on contiguous parcels of property and the Camp Ravenna perimeter fence completely encloses the remaining parcels of the RVAAP. Camp Ravenna 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 2-1). The RVAAP portions of the property are solely located within Portage County. Camp Ravenna (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 2-1 and 2-2). When the RVAAP was operational Camp Ravenna 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 Camp Ravenna and RVAAP, unless otherwise specifically stated.

The installation was active from 1941 to 1992. Activities included loading, assembling, storing, and packing military ammunition; demilitarization of munitions; production of ammonium nitrate fertilizer; and disposal of "off-spec" munitions. Various munitions were handled on the installation including artillery rounds of 90 mm or more and bombs up to 2,000 lbs. Industrial operations consisted of 12 munitions-assembly facilities referred to as "load lines." Load Lines 1 through 4 were used to melt and load 2,4,6-trinitrotoluene (TNT) and Composition B into large-caliber shells and bombs. Load Lines 5 through 11 were used to manufacture fuzes, primers, and boosters. Load Line 12 was used to produce ammonium nitrate for explosives and fertilizers prior to use as a weapons demilitarization facility.

In addition to production and demilitarization activities at the load lines, other areas of concern (AOCs) at RVAAP were used for the burning, demolition, and testing of munitions. These burning and demolition grounds consist of large parcels of open space or abandoned quarries. Potential contaminants at these AOCs include explosives, propellants, metals, waste oils, and sanitary waste. Other types of AOCs present at RVAAP include landfills, an aircraft fuel tank testing facility, and various general industrial support and maintenance facilities. The project areas are located throughout the RVAAP facility including multiple AOCs (Figure 2-2).

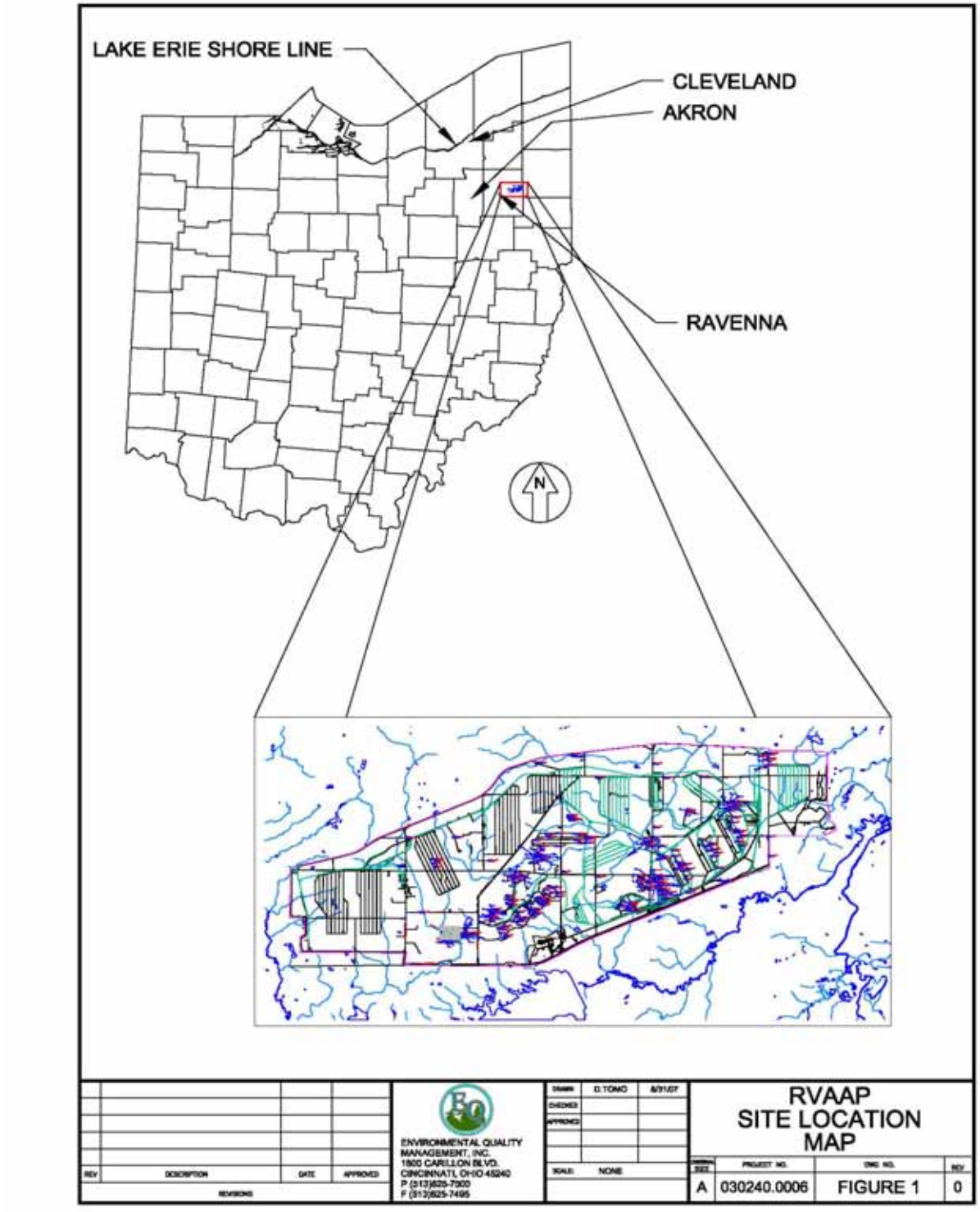


Figure 2-1. RVAAP Site Location Map

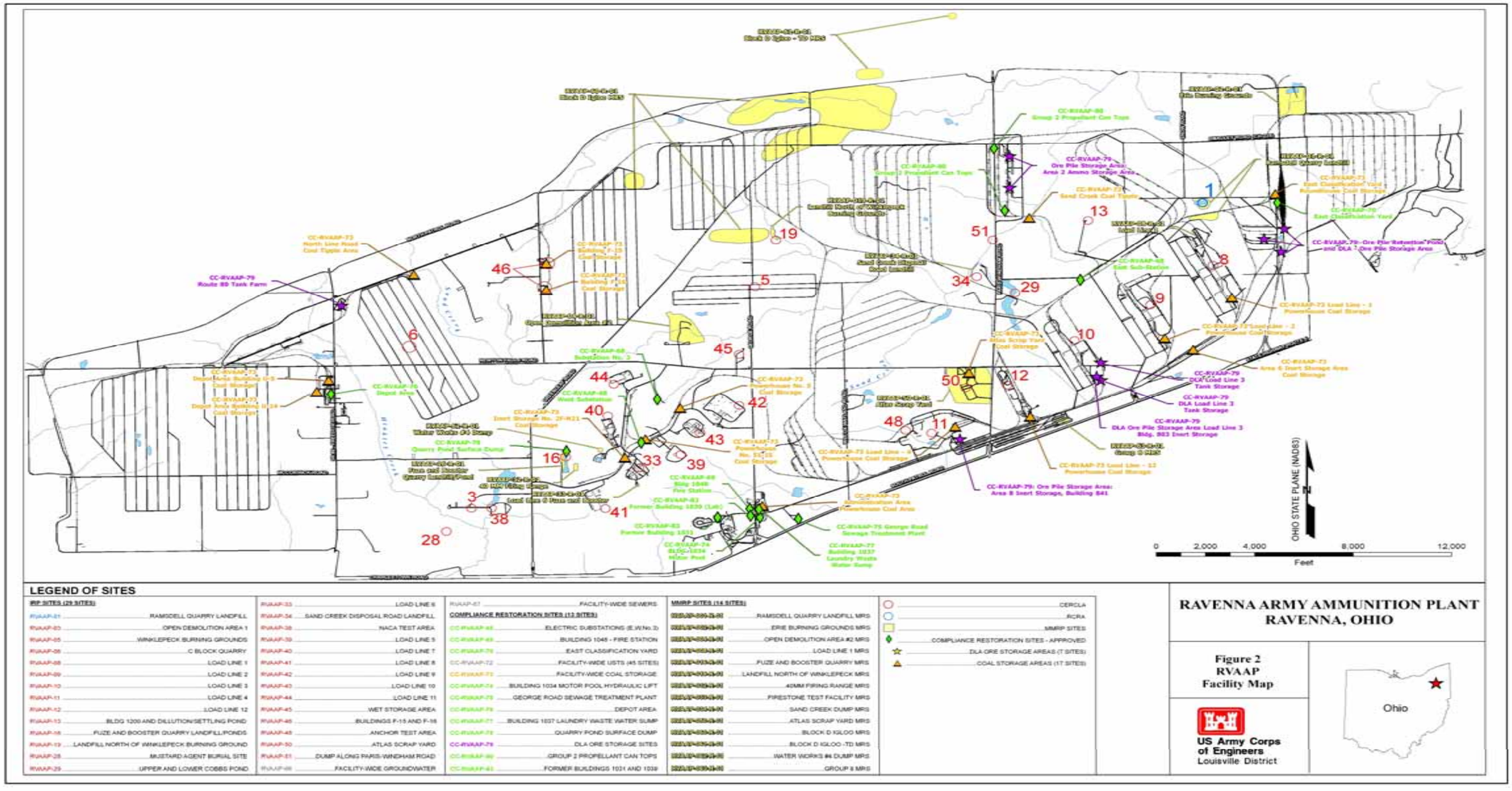


Figure 2-2. RVAAP Facility Map

2.1.1 Munitions Response Sites (MRS)

Some of the sites are considered to potentially have MEC since they are Munitions Response sites (MRS). These sites will use MEC avoidance during soil disturbance tasks (i.e., well installation) and are further described in section 10.2 of this document. For MRS with existing monitoring wells, it is assumed that MEC avoidance activities have previously been cleared for pathways to the wells, and no soil disturbance will occur during groundwater monitoring procedures. Based on historical field work, including the well sampling during the past 10 years, no exposure to MEC is anticipated during sampling activities. Sampling crews will use well established paths to each of the wells in these areas. The MRS pertaining to the project-specific tasks are listed below:

- Ramsdell Quarry Landfill
- Erie Burning Grounds
- Open Demolition Area #2
- Load Line 1
- Fuze and Booster Quarry
- Landfill North of Winklepeck
- Atlas Scrap Yard

2.2 Contaminant Characterization

Information on the potential contaminants at the facility and the reagents and chemicals that will be used for the project is listed below. It is important to note that the contaminants listed below have been detected in a number of locations at RVAAP and may be present at former operations areas. Exposure to these contaminants and reagents/chemicals (such as corrosive sample preservatives, field laboratory reagents, or flammable fuels) is likely and will be controlled through compliance with this addendum. There is a potential to encounter a contaminant during field activities, but it does not necessarily indicate that the contaminant is present in sufficient quantity to pose a health risk to workers.

The major chemicals of potential concern (COPCs) for RVAAP is presented in Table 2-1 and the FWSAP. These major COPCs include explosive-related chemicals (e.g., TNT, dinitrotoluene, and cyclonite), propellants (e.g., nitroglycerine, nitroguanidine, and nitrocellulose), and metals (e.g., arsenic, aluminum, barium, cadmium, chromium, lead, mercury, silver, selenium, and zinc). Additional chemicals, including polychlorinated biphenyls (PCBs) and manganese, have been identified at some AOCs. Most of the COPCs are relatively insoluble, tend to adsorb to soil particles rather than dissolve into water, and are relatively long-lived. Specific concentrations of these chemicals are included as tables in the latest (2010) Annual Groundwater Report for the FWGWMP and a copy of tables will be included in Appendix D.

Chemicals to be used by EQM personnel at the site are listed below as Table 2-2. Inclusion in this list does not necessarily indicate the chemical is present in sufficient quantity to pose a health risk to workers. Materials that are considered hazardous materials under the OSHA Hazard Communication Standard (29 CFR 1910.1200) may be used during this project. Material

Safety Data Sheets (MSDSs) for the hazardous materials are included in Appendix A. Copies of these MSDSs will be made available to any subcontractors on this project.

Table 2-1. Chemicals of Potential Concern

Polychlorinated Biphenyls *(PCBs)*
Base/Neutrals and Acids *(SVOCs)*
Nitroguanidine *(Propellants)*
Nitrocellulose as N *(Propellants)*
Metals (Antimony, Iron, Beryllium, Thallium, Zinc, Cadmium, Aluminum)
Metals (Magnesium, Manganese, Barium, Nickel, Potassium, Silver, Sodium, Vanadium, Chromium, Calcium, Cobalt, Copper, Arsenic, Lead, Selenium)
Perchlorates
Pesticides
Volatile Organic Compounds *(VOCs)*
Nitroaromatics & Nitramines *(Explosives)*
Nitrate/Nitrites
Cyanide, (Total)
Metals (Mercury)

Table 2-2. Chemicals Potentially Used to Conduct Site Work

Hydrochloric acid	Equipment decontamination / Water sample preservative
Sodium Hydroxide	Water sample preservative
Sulfuric acid	Water sample preservative
Nitric acid	Equipment decontamination / Water sample preservative
Alconox	Equipment decontamination
Methanol	Equipment decontamination
Gasoline	Equipment fuel
Diesel	Equipment fuel

SECTION 3.0

HAZARD / RISK ANALYSIS

3-1. Hazards Inventory

Table 3-1 is an inventory of project-specific common hazards that may be posed during environmental investigations at RVAAP and indicates whether a particular major type of hazard is present. The project-specific tasks are expected to consist of clearing vegetation; collecting groundwater samples; installing monitoring wells; decontaminating equipment; and managing Investigation-Derived Waste (IDW). In general, these tasks have a low potential for unacceptable exposure to contaminants. Expected tasks present a variety of physical hazards including biological, contact with equipment or potential MEC, slips/trips/falls, biological, noise, and heat/cold stress.

Table 3-1. Hazards Inventory

YES	NO	HAZARD
	X	Confined space entry
	X	Excavation entry
X		Heavy equipment (i.e., drill rigs)
X		Potential dangerous tools (i.e., brush clearing with machetes, sling blades)
X		Heavy lifting (cooler shipping, IDW handling)
X		Fire (fuels)
X		Spills or leaks
	X	Drowning
X		Explosion (MEC)
X		Electrical shock (electrical equipment)
X		Exposure to chemicals (e.g., site contaminants & chemicals used during work)
X		Temperature extremes
X		Biological hazards (i.e., poison ivy, Lyme disease, Histoplasmosis, & West Nile)
	X	Gunfire (No work is anticipated during OHARNG hunts)
X		Noise (equipment)
	X	Radiation or radioactive contamination

3-2. Activity Hazard Analysis

The FWSHP includes Activity Hazard Analysis (AHA) tables (Table 3-2 of the FWSHP). These tables identify and assess potential hazards that may be encountered by personnel and prescribes the required controls. Each applicable project-specific AHA has been reviewed and revised as necessary to incorporate stricter requirements established by EQM. Each AHA is included in Appendix B, and listed below:

- Site mobilization and demobilization;
- Site walk and/or civil survey
- Soil boring and sampling, monitoring well installation using a drill rig and groundwater sampling;
- Monitoring well and borehole abandonment;
- Vegetation clearing with chainsaw, machetes and sling blades;
- IDW handling; and
- Equipment decontamination.

3-3. Potential Exposure

Information on the reagents and chemicals potentially present at the facility are described in Section 3.2 of the FWSAP. Soil and groundwater contaminants are possible, but unlikely. Exposure to chemicals, such as corrosive sample preservatives, field laboratory reagents, or flammable fuels, is a possibility and will be controlled through standard safe handling practices. Project specific reagents and chemicals are presented in Table 3-2. In case of conflicts between American Conference of Government Industrial Hygienists (ACGIH) and other standards or regulations the more stringent standard shall prevail.

Table 3-2. Potential Exposures

Chemical	Health Effects [b]	Physical Characteristics [b]	Exposure Route(s)[b]	Exposure Limit(s) [c]
Potential Chemical Exposures [a]				
Arsenic	Ulceration of nasal septum, dermatitis, gastrointestinal disturbances, peripheral neuropathy, respiratory irritation, hyperpigmentation of skin, [potential occupational carcinogen]	Metal: Noncombustible Solid in bulk form, but a slight explosion hazard in the form of dust when exposed to flame. VP: 0mmHg	Inhalation Absorption Ingestion Contact	TWA 0.01 mg/m^3
Barium	irritation eyes, nose, upper respiratory system; benign pneumoconiosis (baritosis)	Noncombustible Solid. VP: Low; FP: NA	Inhalation Contact	TWA 0.5 mg/m^3
Cadmium	pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia; [potential occupational carcinogen]	Metal: Noncombustible Solid in bulk form, but will burn in powder form. VP: 0 mmHg	Inhalation Ingestion	TWA 0.01 mg/m^3
Chromium	irritation eyes, skin; lung fibrosis (histologic)	Noncombustible Solid in bulk form, but finely divided dust burns rapidly if heated in a flame. properties vary dependant on specific compound	Inhalation Ingestion Contact	TWA 0.5 mg/m^3 (Metals CrIII) TWA 0.05 mg/m^3 (Water soluble CrVI) TWA 0.1 mg/m^3 (Insoluble CrVI)
Dinitrotoluene	Anoxia, cyanosis; anemia, jaundice; reproductive effects; [potential occupational carcinogen]	Orange-yellow crystalline solid with a characteristic odor VP: 1 mmHg: FP: 404F	Inhalation Absorption Ingestion Contact	TWA 0.2 mg/m^3
Lead	lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypertension	Noncombustible Solid in bulk form.	Inhalation Ingestion Contact	TWA 0.05 mg/m^3
Mercury	irritation eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, indecision, headache, lassitude (weakness, exhaustion); stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria	Metal: Silver-white, heavy, odorless liquid VP: 00012 mmHg; FP: NA	Inhalation Absorption Ingestion Contact	TWA 0.01 mg/m^3 Alkyl STEL 0.03 mg/m^3 Alkyl TWA 0.1 mg/m^3 Aryl TWA 0.025 mg/m^3 Elemental/Inorganic

PAHs and SVOCs	Suspected human carcinogens	Colorless, white, pale. Properties vary dependant on specific compound	Inhalation Ingestion Contact	
Propellants (potentially nitrocellulose and nitroglycerin)	Faintness, rapid pulse, dizziness, muscle twitch, damage to blood cells, vomiting	Solid; VP: 0 mmHg; FP: NA May burn or explode if exposed to high temperatures or shock	Inhalation Absorption Ingestion Contact	TWA 0.05 mg/m^3
Cyclonite	irritation eyes, skin; headache, irritability, lassitude (weakness, exhaustion), tremor, nausea, dizziness, vomiting, insomnia, convulsions	White, crystalline powder, Combustible Solid. VP: 0.0004 mmHg;	Inhalation Absorption Ingestion Contact	TWA 0.05 mg/m^3
Selenium	irritation eyes, skin, nose, throat; visual disturbance; headache; chills, fever; dyspnea (breathing difficulty), bronchitis; metallic taste, garlic breath, gastrointestinal disturbance; dermatitis; eye, skin burns; in animals: anemia; liver necrosis, cirrhosis; kidney, spleen damage	Amorphous or crystalline, red to gray, combustible solid. VP: LOW; FP: NA.	Inhalation Ingestion Contact	TWA 0.2 mg/m^3
Smokeless powder (nitrocellulose)	Low toxicity	Amorphous solid; FP: 55°F		
Trinitrotoluene	irritation skin, mucous membrane; liver damage, jaundice; cyanosis; sneezing; cough, sore throat; peripheral neuropathy, muscle pain; kidney damage; cataract; sensitization dermatitis; leukocytosis (increased blood leukocytes); anemia; cardiac irreg	Colorless to pale-yellow, odorless combustible solid or crushed flakes. VP: 0.0002 mmHg; IP: 10.59 eV	Inhalation Absorption Ingestion Contact	TWA 0.1 mg/m^3
VOCs (trichloroethene example; however, properties vary depending upon the specific compound)	irritation eyes, skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; [potential occupational carcinogen]	Colorless liquid (unless dyed blue) with a chloroform-like odor, burns with difficulty. VP: 58 mmHg; IP: 9.45 eV	Inhalation Absorption Ingestion Contact	TWA 10 ppm STEL 25 ppm
Decontamination Chemicals and Sample Preservatives				
Hydrochloric Acid (Preservative and equipment decontamination)	irritation nose, throat, larynx; cough, choking; dermatitis; solution: eye, skin burns; liquid: frostbite; in animals: laryngeal spasm; pulmonary edema	Colorless liquid with acrid odor; VP: 40.5 atm; IP: 12.74 eV.	Inhalation Absorption Ingestion Contact	STEL 2 ppm ceiling
Alconox (used for decontamination)	Inhalation of powder may cause local irritation of mucus membranes	White powder, odorless, nonflammable. Biodegradable detergent	Inhalation Ingestion	None

Methanol (equipment decontamination)	irritation eyes, skin, upper respiratory system; headache, drowsiness, dizziness, nausea, vomiting; visual disturbance, optic nerve damage (blindness); dermatitis	Liquid; VP: 96 mmHg; FP: 52°F; IP: 10.84 eV	Inhalation Absorption Ingestion Contact	TWA 200 ppm STEL 250 ppm
Sulfuric Acid (H_2SO_4)	irritation eyes, skin, nose, throat; pulmonary edema, bronchitis; emphysema; conjunctivitis; stomatis; dental erosion; eye, skin burns; dermatitis	Liquid, colorless to dark brown, oily, odorless. VP: 0.001 mmHg, FP: NA	Inhalation Ingestion Contact	TWA 0.2 mg/m^3
Sodium Hydroxide (NaOH)	irritation eyes, skin, mucous membrane; pneumonitis; eye, skin burns; temporary loss of hair	Colorless to white, odorless solid (flakes, beads, granular form). VP: 0 mmHg; FP: NA, IP: NA	Inhalation Ingestion Contact	STEL 2 mg/m^3 ceiling
Nitric Acid (HNO_3)	irritation eyes, skin, mucous membrane; delayed pulmonary edema, pneumonitis, bronchitis; dental erosion	Liquid, fuming, colorless, yellow, or red; acrid, suffocating odor. VP: 48 mmHg; FP: NA; IP: 11.95eV	Inhalation Ingestion Contact	TWA 2 ppm STEL 4 ppm
Other Potential Exposures				
Diesel (used for fuel for heavy equipment)	Irritation of eyes, skin, respiratory system; dizziness; headache; nausea; central nervous system	Brown, slightly viscous liquid, with characteristic odor. FP: 125.6°F	Inhalation Ingestion Contact	TWA 100 mg/m^3
Gasoline (used for fuel)	irritation eyes, skin, mucous membrane; dermatitis; headache, lassitude (weakness, exhaustion), blurred vision, dizziness, slurred speech, confusion, convulsions; chemical pneumonitis (aspiration liquid); possible liver, kidney damage; [potential occupational carcinogen]	Clear flammable liquid with aromatic odor. FP: -45°F; VP: 38-300 mm	Inhalation Absorption Ingestion Contact	TWA 300ppm STEL 500 ppm

[a] The potential chemicals on this list reflect a partial compilation based on historical investigations conducted at RVAAP. Project-specific addenda must address specific potential exposure based on AOC operational history and anticipated activities to be conducted.

[b] From 2010 NIOSH Pocket Guide to Chemical Hazards, the Condensed Chemical Dictionary. FP = Flash point. IP = Ionization potential. NA = Not available. NIOSH = National Institute for Occupational Safety and Health. PAHs = Polycyclic aromatic hydrocarbon. SVOCs = Semi-volatile organic compounds. VOCs = Volatile organic compounds. VP = Vapor pressure.

[c] From 2011 ACGIH Threshold Limit Values. ppm = parts per million. STEL = Short-term exposure limit. TWA = Time-weighted average

SECTION 4.0

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. The EQM Project Team assembled to complete the RVAAP-66 groundwater project includes the following:

EQM – overall project management, direction of all subcontractors, and responsibility for completion of all deliverables. EQM will also provide field crews for sampling and well installation, geology/hydrogeology expertise, engineering evaluation, and oversight for all groundwater modeling and risk assessment activities.

Science Applications International Corporation (SAIC) – will provide field support, groundwater modeling, risk assessment, and regulatory support.

Civil & Environmental Consultants (CEC) – will provide field support, including surveying, groundwater sampling support, GIS analysis, risk assessment and groundwater modeling support, and geotechnical expertise.

PIKA International – will provide unexploded ordnance (UXO) support primarily for clearance of any subsurface excavation activities associated with this project.

TestAmerica – will conduct analysis of groundwater samples.

Figure 4-1 is the project organizational chart showing the principal project-specific roles and lines of communication/reporting. Key contractor positions are:

- Program Manager;
- Project Manager (PM);
- Certified Industrial Hygienist (CIH);
- Field Operations Manager (FOM); and
- Site Safety and Health Officer (SSHO).

Table 4-1 identifies the responsible parties, responsibility summary, and the associated telephone numbers for each of the key positions responsible for site safety and health and emergency responses. See the FWSHP for more detailed information on the roles and responsibilities of key positions.

Table 4-1. Staff Organization

Responsible Party	Responsibility Summary	Telephone Number
Program Manager James G. Zody, P.E.	Ensure conformance with corporate and USACE policies and procedures.	Direct: 513-742 7298 Mobile: 513-315-5351
Senior Project Manager John Miller, CHMM	Responsible for overall project execution.	Direct: 513-619-7330 Mobile: 513-673-4065
Senior Safety & Health Manager John R. Kominsky, CIH, CSP	Manages the H&S program, establishing H&S policies / procedures, supporting all activities, and verifying safe work practices and conditions.	Direct: 513-742 7216 Mobile: 513-310-4473
Field Operations Manager Scott Spesshardt, CPG	Oversees the project field activities and is responsible for site accessibility, safety, and quality assurance.	Direct: 513-619-7343 Mobile: 513-603-0213
Site Safety and Health Officer Colleen Lear, LG	Manages H&S decisions for specific H&S activities and verifies the effectiveness of the H&S program.	Direct: 513-742 7262 Mobile: 513-218-6244
MEC Avoidance PIKA: Brian Stockwell	Provide UXO support primarily for clearance of any subsurface excavation activities.	Direct: 330-358-7135 Mobile: 330-352-6955

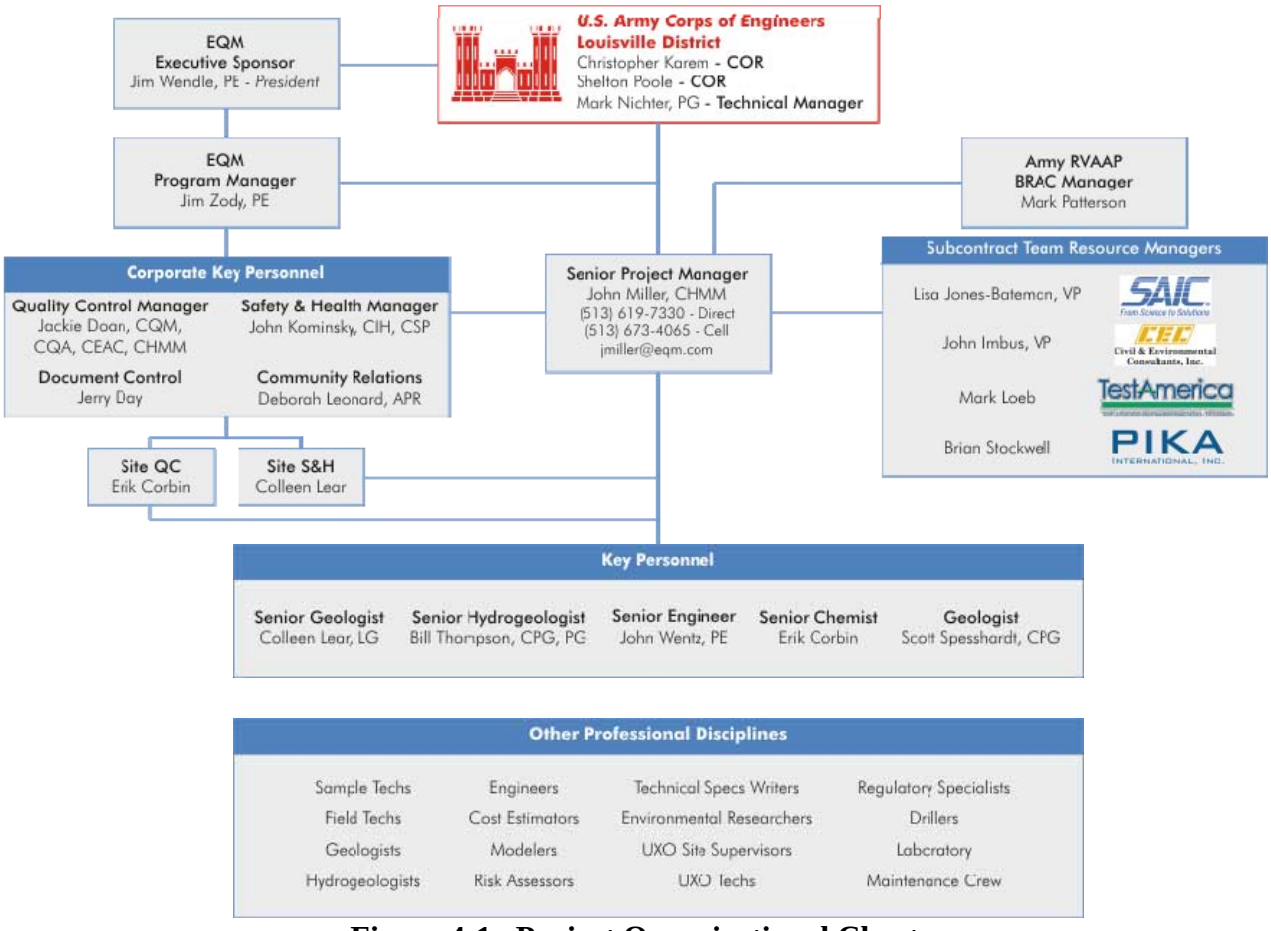


Figure 4-1. Project Organizational Chart

SECTION 5.0

TRAINING

The FWSHP training requirements are summarized for this project in Table 5-1. Documentation of the required training will be maintained in the on-site project files. This documentation will include copies of Hazardous Waste Operations and Emergency Response (HAZWOPER) 40-hr, 8-hr refresher, Cardiopulmonary Resuscitation (CPR), first aid training, and signatures of those attending on-site training. Other training, as necessary, will be maintained onsite. This includes respirator fit-test certifications and supervisor training certificates; copies of medical clearance reports; and entries in project logs showing the topics covered and trainer. Certifications for key personnel are included in Appendix E.

Table 5-1. Training Requirements

Training	Worker	Supervisor	Site Visitor (exclusion zone)
HAZWOPER (40-hr, 3-day OJT)	√	√	√
HAZWOPER Annual Refresher (8-hr)	√	√	√
HAZWOPER Supervisors Training (8-hr)		√	
CPR and First Aid Training (minimum requirement: two personnel at facility & one person per field team)	√	√	
General Hazard Communication Training (contained in 40- and 8-hr courses)	√	√	√
Hearing Conservation Training (hearing conservation program; contained in 40- and 8-hr courses)	√	√	√
Pre-entry Briefing	√	√	√
Site-specific Hazard Communication (contained in pre-entry briefing)	√	√	√
Safety Briefing (daily and whenever conditions or tasks change)	√	√	√
Equipment-specific Training (drilling operators)	√	√	

√ = Required
OJT = On-the-Job Training

SECTION 6.0

PERSONAL PROTECTIVE EQUIPMENT

General guidelines for PPE are presented in the FWSHP. This investigation will be performed primarily in Level D and Level D+ PPE. PPE for handling potentially-contaminated materials includes nitrile or equivalent gloves, while handling drums and lifting will include heavy duty gloves. Level D and Level D+ PPE are as follows:

Level D+ Protective Equipment
— Tyvek® or equivalent coveralls;
— Boot covers;
— Level D Protective Equipment.

Level D Protective Equipment
— Coveralls/field clothes;
— Safety shoes/Boots [with steel-toe/steel shank (or comparable material)];
— Safety glasses with side shields;
— Hard hat (if overhead hazards are present);
— Nitrile or equivalent gloves if contaminated materials are handled; and
— Heavy duty leather, Kevlar, or equivalent gloves (in addition to chemical-resistant gloves) for materials handling or other tasks that pose physical hazards to the hands.

If the potential for increased risk becomes apparent during the investigation, protective procedures, including protective clothing, will be upgraded, as necessary, by the SSHO. Specific tasks, such as soil sampling, drum handling, decontamination using a pressure washer, and soil chemical preparation, require additional PPE (e.g., hardhats, leather gloves, and face shield), as depicted in the AHAs.

SECTION 7.0

MEDICAL SURVEILLANCE

Medical Surveillance requirements are summarized in the FWSHP. All employees performing on-site RVAAP work activities are to be enrolled in a medical surveillance program, per 29 CFR 1910.120, 1910.134, and 1910.1020. The EQM Corporate Health and Safety program ensures that personnel and all team subcontractor personnel, who are performing hazardous waste site work, are required to be included in a medical surveillance program and undergo medical examinations in accordance with 29 CFR 1910.120(f), Hazardous Waste Operations and Emergency Response - Medical Surveillance. Certifications for key personnel participation in the medical surveillance program are included in Appendix E.

SECTION 8.0

EXPOSURE MONITORING / AIR SAMPLING PROGRAM

Assessment of airborne chemical concentrations will be performed, as appropriate, to ensure that exposures do not exceed acceptable levels. Based on historical site contaminant concentrations, action levels with appropriate responses have been established for monitoring. The minimum monitoring requirements and action levels are presented in Table 8-1. This information served as the basis for selecting the appropriate monitoring equipment and Level D PPE for use when conducting site activities. The usage of monitoring equipment [e.g., photoionization detector (PID)] will depend on the activities being conducted and the potential exposures. All personal exposure monitoring records will be maintained in accordance with 29 CFR 1910.1020. In addition to the specified monitoring, the SSHO may perform or require additional monitoring, such as organic vapor monitoring in the equipment decontamination area or personnel exposure monitoring for specific chemicals.

Monitoring for IDLH is the first step and should be conducted to identify any IDLH conditions, such as highly toxic levels of airborne contaminants via PID readings. Based on historical field work, regarding well sampling during the past 10 years, no additional monitoring is anticipated. It is not anticipated air monitoring will be required during sampling. However, the SSHO will examine site conditions and will contact the H&S Manager and initiate air monitoring if there is any indication of potential airborne exposure. Most of the field activities are not expected to pose airborne exposure hazards for the following reasons:

- Work will be performed in open areas with natural ventilation;
- Prior site sampling indicated that contaminant concentrations are unlikely to pose an airborne hazard; and
- The most probable contaminants (metals and PAHs are materials with relatively low vapor pressures and exposure can be controlled through dust suppression techniques.

Table 8-1. Monitoring Requirements and Action Levels

Contaminant/ Parameter	Frequency/Location	Action Levels	Required Action
Organic Vapors – Generic (PID or equivalent)	Periodic during remediation activities (drilling and intrusive work) as Breathing zone monitoring	<1.0 ppm (sustained) above background >1.0 ppm (sustained) above background	Level D – No Action Withdraw & evaluate • evaluate PPE upgrade • identify contaminants • notify PM and H&S manager
Noise	General areas during remediation activities around power or motorized equipment	≥ 85 dBA or Mandatory around drill rigs	Hearing protection
Nuisance Particulates (visible)	Continuos observation	Visible dust	Stop work; use dust suppression techniques such as wetting surface

H&S = health and safety
ppm = parts per million

SECTION 9.0

HEAT / COLD STRESS

General requirements for heat/cold stress monitoring are contained in the FWSHP. During this project ambient temperatures may decrease to below 40°F and site briefings on preventing cold stress will be instated. Contrary conditions of warmer ambient temperatures will include briefings on controlling heat stress.

During severe weather, Building 1036 will serve as the assembly point if it becomes necessary to evacuate one or more remedial locations, while the facility-wide assembly point is Guard Post 1. Severe weather triggers the SSHO to monitor weather conditions with Guard Post 1 and/or off site personnel. Site briefings on severe weather precautions, actions, and usage of shelter-in-place locations will be conducted as necessary. Section 13 of this SSHP includes further details for emergencies and evacuation, if necessary.

SECTION 10.0

STANDARD OPERATING AND SAFETY PROCEDURES

The FWSHP presents the general safety rules mandatory for all on-site employees and visitors. The following standard procedures set forth in the FWSHP are sufficient for the site tasks:

- Site rules (all site activities)
- Driving requirements (speed limits, hands-free)
- Permit requirements (digging permits/clearance from local utilities prior to any drilling or excavation)
- IDW waste handling (drums)
- Electrical safety (portable equipment and conductive materials)
- Machine guarding and lockout/tagout (equipment repair)
- Fall protection (personal fall protection will be used if drilling personnel must climb the upright mast or derrick.)
- Hazard communication (hazardous material labeling, training, and MSDSs)
- Illumination (natural illumination usage)
- Sanitation (washing, drinking water, facilities)
- Biological (ticks/mosquitos)
- Fuels (storage)
- Drill rig operations (well installation)
- MEC avoidance (well installation)

Additional information for drill rig operations and MEC are detailed in the following sections to ensure that the appropriate and sufficient procedures are used to protect employees.

10.1 Drill Rig Operations

Drill rig operations will be performed by qualified subcontractors. General drilling practices will comply with Section 18H of the *USACE Safety and Health Requirement Manual EM 385-1-1*. All switches (including a minimum of two functioning safety switches); gauges; and other electrical, mechanical, pneumatic, and hydraulic systems will be in a safe and operable condition before arrival and during operation. The Drill Rig Operational Checklist (Figure 5-1 of the FWSAP) will be completed prior to commencement of drilling and at a minimum frequency of once per week after drilling commences. All safety switches or "kill switches" will be tested and documented every working day prior to activities on site. All safety switches must be operational prior to drilling activities. General hoisting operations comply with the *USACE Safety and Health Requirement Manual EM 385-1-1*.

10.2 Munitions and Explosives of Concern Avoidance

For drilling activities within the MRS, MEC avoidance protocols will be implemented, as discussed below, and a qualified UXO subcontractor, approved by the USACE Louisville District, will provide MEC avoidance support for this project. In general all on-site workers will be trained to recognize and avoid the types of MEC that may be present. Contractors and their subcontractors will not handle, move, or otherwise disturb MEC or any items that cannot be identified as non-MEC without specific authorization from Army. If MEC or potential MEC is discovered, the area will be marked and avoided and work will continue. The UXO Technician will use a hand-held magnetometer to clear an area prior to surface soil disturbance.

For soil disturbance activities the subcontractor's UXO technician will employ a Schonstedt Model GA-52 and/or GA-72 (or equivalent) magnetic locator for surface anomaly surveys, and a Schonstedt Model MG-220 (or equivalent) magnetic gradiometer for any downhole surveys. The UXO Team Leader will train all field personnel to recognize and stay away from propellants and MEC. Safety briefings for MEC avoidance will also be provided to all site personnel and site visitors. At all well locations and off-road access routes to the locations located in MRS areas (or other areas designated by the Army), ground surface surveys will be conducted prior to entry using visual inspection and hand-held magnetometers. Surveys of ingress and egress routes will be at least twice as wide as the widest vehicle that will use the route (normally a minimum of 20 feet). A work area having a radius of approximately 100 feet will be surveyed around each well location. The UXO technician will clearly mark the boundaries of the cleared work area and access routes. If MEC is encountered at the ground surface, the approach path will be diverted away from the MEC, the area clearly marked with red flagging, and the area will be avoided. Any identified magnetic anomaly will also be clearly marked and the anomaly will be avoided. The cleared approach paths will be the only ingress/egress routes to a particular drilling location.

At each staked well location [located in MRS areas (or other areas designated by the Army)], the UXO technician will use a magnetic gradiometer to clear the locations prior to drilling operations commencing. The UXO technician shall use hand auger tools to advance a small pilot hole. At not more than a 2-feet depth, the magnetometer will be lowered into the hole. This procedure will be used to ensure that smaller items of UXO, undetectable from the surface, can be detected. If no magnetic anomalies are located, the procedure will be repeated at approximately 2-ft to 3-ft intervals to the maximum depth required (10 feet or until bedrock is encountered, whichever is less). The UXO technician will remain onsite and provide support to the project team until all access surveys are completed and the work areas are cleared as described above. Because all drilling locations are outside of designated environmental areas of concern and military munitions response program sites, the UXO technician will not be required to maintain a continuous presence onsite. In the event a monitoring well cannot subsequently be constructed at the planned location and drilling at an alternate location is necessary, the same MEC avoidance protocol will be followed prior to moving to the new location. Should any MEC be discovered, it will be avoided. The UXO subcontractor will not be tasked with disposal of MEC under this specific well installation task. The UXO technician will notify the FOM, who will, in turn, contact the PM, USACE, and RVAAP Environmental Coordinator, who will initiate the appropriate response actions.

Work that involves, or may involve, exposure to MEC will comply EM 385-1-1, section 33 per the FWSHP. A MEC Avoidance plan will be completed for surface and MEC anomaly avoidance procedures to be used while conducting hazardous, toxic, radioactive waste (HTRW)-related activities during drilling actions to be completed at EBG and DA2. The MEC anomaly avoidance procedures contained in the plan will be developed in accordance with the EP 75-1-2 "MEC Support During HTRW and Construction Activities USACE, 2004.

SECTION 11.0

SITE CONTROL MEASURES

No formal site control is expected to be necessary for this project, as the work areas are somewhat remote and bystanders are not anticipated. Public access to RVAAP is currently controlled with limitations, and only authorized personnel are allowed in the AOCs; therefore, access by bystanders and the public is limited. If the 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 FWSHP. The SSHO will monitor the implementation of the required site control work rules and will report any deviations from prescribed practice to the FOM or stop work, as appropriate. An exclusion zone may not be practical at all investigative locations. The SSHO will be responsible for determining the need for establishing site controls and exclusion zones. An exclusion zone will be established if the work site will be left intact and unattended for an extended period of time (e.g., leaving an open excavation or drill rig in place overnight).

An exclusion zone will be established around the drilling sites. At a minimum, the exclusion zone will extend 25 feet from the hazard and also be at least equal to the mast height in radius so that no part of an overturned drill rig will fall outside the zone. Contamination reduction zone (CRZ) will not be necessary unless a higher level (A, B, C) of PPE is used or significant surface contamination is present or suspected. A formal support zone will not be necessary unless a CRZ is utilized. Building 1036 will be used as an alternative for staging clean equipment and supplies and serves as a location for support services (e.g., staging, storing, parking, visitor area).

SECTION 12.0

PERSONAL HYGIENE AND DECONTAMINATION

The FWSHP presents examples of basic requirements for personnel decontamination keyed to the level of protective clothing in use. This investigation will be performed primarily in Level D and Level D+ PPE, therefore limiting the use of protection decontamination. Level D does not require personal decontamination. Gross (muddy conditions) decontamination may necessitate Level D+ PPE. The procedures listed below would then be followed:

1. Remove all tape (if used) from outer clothing and place in appropriate waste container.
2. Carefully remove boot covers, outer contamination-resistant garment, and chemical-resistant gloves.
3. Wash hands and face prior to eating, drinking, or smoking. This step may be accomplished with soap and water or disposable disinfectant wipes.

SECTION 13.0

EMERGENCY PROCEDURES AND EQUIPMENT

Emergency contacts, telephone numbers, directions to the nearest medical facility, and general procedures are described in this section and in Section 13.0 of the FWSHP. Emergency phone numbers and the hospital route map are also included in this section.

13.1 Emergency Phone Numbers

In the event of an accident or incident, the SSHO ***must first notify Guard Post 1 (330-358-2017)*** who will coordinate the response. Each field team shall have a cellular phone and/or a 2-way radio capable of contacting Guard Post 1 for communications purposes. The radio must be tested each morning before the start of work by radioing Security with a communication check. Each team must have direct radio or telephone communication with the PM or FOM. Table 13-1 lists the emergency groups and their telephone numbers.

Table 13-1. Emergency Phone Numbers

Contact	Phone Number
RVAAP Guard Post 1	(330) 358-2017
Hospital (Robinson Memorial, Ravenna)	(330) 297-0811/2449
RVAAP Facility Manager, Mark Patterson	(330) 358-7311
RVAAP Operation and Maintenance Contractor Jim McGee, Vista	(330) 358-3005
USACE, Mark Nichter	(502) 315-6375
EQM PM, John Miller	(513) 673-4065
EQM Corporate H&S, Todd Valli	(513) 310-8419
Ohio EPA, Eileen Mohr	(330) 963-1221
Ohio EPA Spill Hotline	(800) 282-9378
Fire Department (City of Ravenna)	(330) 297-5738
Hazardous Materials Response	(330) 358-7406/7409

13.2 Emergency Procedures

The SSHO will remain in charge of all personnel during emergency activities. Robinson Memorial Hospital is located approximately 32 km (20 miles) from the site at 6847 N. Chestnut Street in Ravenna, Ohio. Figure 13-1 contains a map and directions to Robinson Memorial Hospital. Building 1036 will serve as the assembly point if it becomes necessary to evacuate one or more remedial locations. The facility-wide assembly point, Guard Post 1, and evacuation routes are indicated on Figure 13-2.

Automated External Defibrillators are located at Building 1037 and Guard Post 1. Contaminated injured personnel will be decontaminated to the extent feasible. Decontamination may be bypassed in the event of life-threatening injuries or illnesses.

Robinson Memorial Hospital
6847 N. Chestnut Street
Ravenna, Ohio
(330) 297-0811

Directions: West on State Route 5. Stay straight onto OH-59 West. Turn Right onto OH-14/OH-44. Turn Left onto North Chestnut St.

Figure 13-1. Hospital Route Map

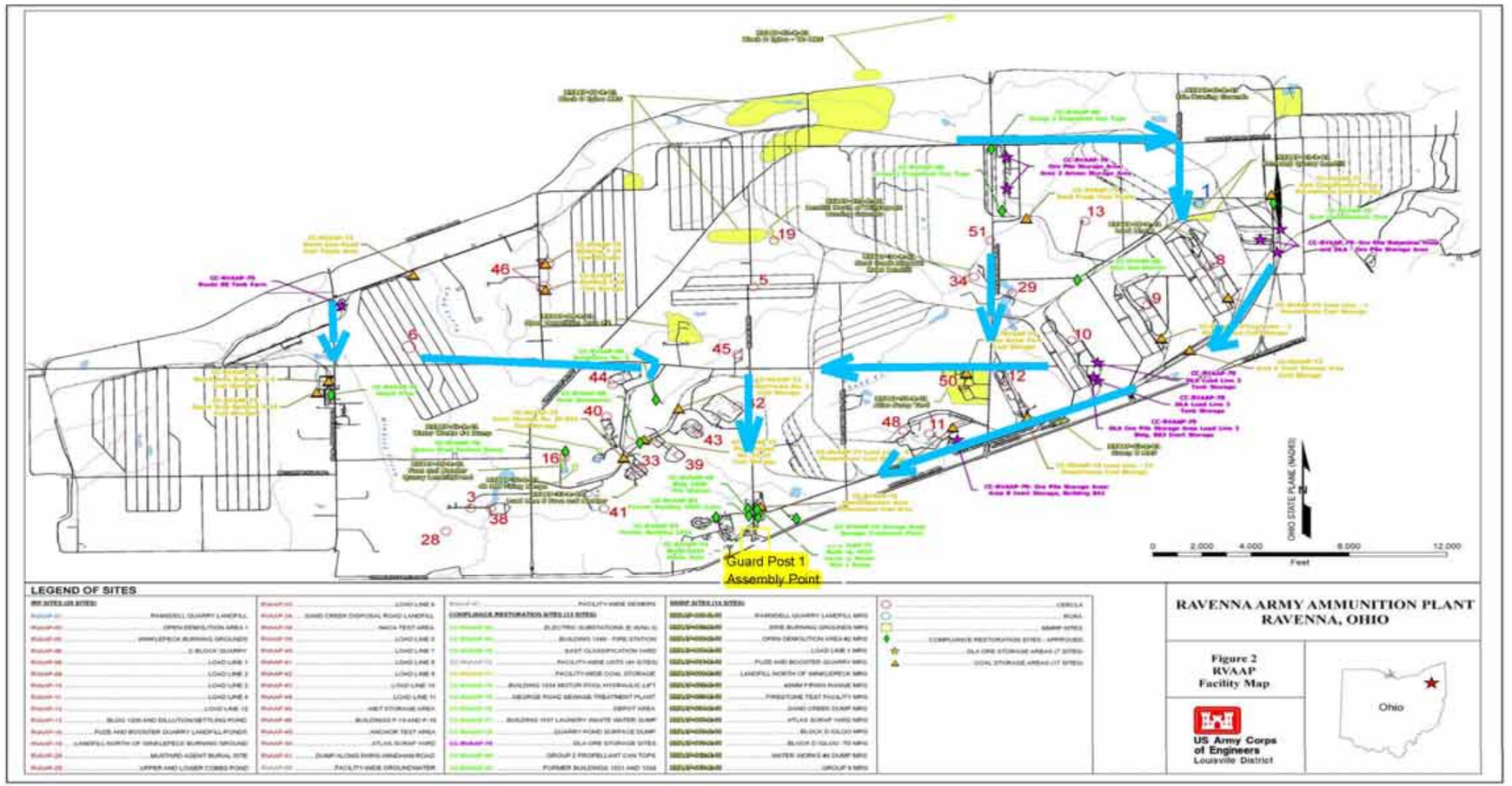


Figure 13-2. Facility Assembly / Evacuation Map

SECTION 14.0

LOGS, REPORTS, AND RECORDKEEPING

EQM adheres to the documenting activities related to daily logs, reporting, and record keeping requirements as described in the FWSHP.

- Training logs will contain information covered and the signatures of the trainer and those attending. These logs will contain documentation of pre-entry (project start) training, routine ("tailgate") safety briefings, and visitor training.

- Daily safety inspection logs will contain the dates of inspections, identity of the person doing the inspection, the examined areas/activities/equipment, any deficiencies, and any corrective actions taken. If necessary, tracking, follow-up, and external inspections will be conducted.

- Equipment maintenance logs will contain the dates and types of routine maintenance performed on site equipment.

- The FOM will add all employees/visitors to the on-site access roster that is maintained by the RVAAP O&M Contractor. The roster includes the names of all personnel who will perform on-site work or visit the site and certification of required training. It will not contain the names of delivery or similar personnel.

- Environmental and personal exposure monitoring/sampling results will be maintained in a log that will contain monitoring data, location and time of monitoring, types of work being done, calibration records, and the identities of personnel performing monitoring.

- EQM personnel and EQM subcontractors will adhere to EQM's corporate injury/illness reporting requirements. In addition, EQM will complete and submit the USACE Accident Investigation Report, as required. All accident reporting will contain all parties involved and personnel responsible plus dates, identity of the person doing the investigation, the examined areas, any deficiencies, and any corrective actions taken. If necessary, tracking, follow-up, and external inspections will be conducted.

Samples of reporting forms are included in Appendix C but any similar or equivalent forms may be used.

SECTION 15.0

REFERENCES

NIOSH. 1997. *NIOSH Pocket Guide to Chemical Hazards, the Condensed Chemical Dictionary,* Tenth Edition.

NIOSH. 2005. *NIOSH Pocket Guide to Chemical Hazards*.

Ohio Environmental Protection Agency (Ohio EPA). 2004. *Director's Final Findings and Orders for the Ravenna Army Ammunition Plant.*

Science Applications International Corporation. 2011. *Final Facility-Wide Safety and Health Plan for Environmental Investigations, Ravenna Army Ammunition Plant, Ravenna, Ohio*. February 24, 2011.

Science Applications International Corporation. 2011. *Final Facility-Wide Sampling and Analysis Plan for Environmental Investigations, Ravenna Army Ammunition Plant, Ravenna, Ohio*. February 24, 2011.

U.S. Army Corps of Engineers. 2004. *Facility-Wide Groundwater Monitoring Program for the Ravenna Army Ammunition Plant, Ravenna, Ohio.* GS-10F-0350M, D.O. DACA27-03-F-0047.

U.S. Army Corps of Engineers. 2008. *USACE Safety and Health Requirements Manual*. EM 385-1-1.

U.S. Army Corps of Engineers. 2004. *USACE MEC Support During HTRW and Construction Activities.* EP 75-1-2.

U.S. Army Corps of Engineers. 2007. *USACE Safety and Occupational Health Requirements for Safety and Occupational Health Requirements for Hazardous Toxic and Radioactive (HTRW) Activities.* ER 385-1-92.

APPENDIX A

Material Safety Data Sheets

List of Material Safety Data Sheets

- Liquinox
- Alconox
- Gasoline
- Hydrochloric Acid
- Insect Repellant
- Methanol
- Nitric Acid
- Type 1 Deionized water
- Diesel

LIQUINOX MSDS

Section 1 : MANUFACTURER INFORMATION

Supplier: Same as manufacturer.

Manufacturer: Alconox, Inc.
30 Glenn St.
Suite 309
White Plains, NY 10603.

Manufacturer emergency phone number: 800-255-3924.
813-248-0585 (outside of the United States).

Manufacturer: Alconox, Inc.
30 Glenn St.
Suite 309
White Plains, NY 10603.

Supplier MSDS date: 2005/02/24

D.O.T. Classification: Not regulated.

Section 2 : HAZARDOUS INGREDIENTS

C.A.S.	CONCENTRATION %	Ingredient Name	T.L.V.	LD/50	LC/50
25155-30-0	10-30	SODIUM DODECYLBENZENESULFONATE	NOT AVAILABLE	438 MG/KG RAT ORAL 1330 MG/KG MOUSE ORAL	NOT AVAILABLE

Section 3 : PHYSICAL / CHEMICAL CHARACTERISTICS

Physical state: Liquid.

Appearance & odor: Odourless.
Pale yellow.

Odor threshold (ppm): Not available.

Vapour pressure (mmHg): @ 20°C (68°F).
17

Vapour density (air=1): >1

Volatiles (%)

By volume: Not available.

Evaporation rate (butyl acetate = 1): < 1.

Boiling point (°C):	100 (212F)
Freezing point (°C):	Not available.
pH:	8.5
Specific gravity @ 20 °C:	(water = 1). 1.083
Solubility in water (%):	Complete.
Coefficient of water\oil dist.:	Not available.
VOC:	None

Section 4 : FIRE AND EXPLOSION HAZARD DATA

Flammability:	Not flammable.
Conditions of flammability:	Surrounding fire.
Extinguishing media:	Carbon dioxide, dry chemical, foam. Water Water fog.
Special procedures:	Self-contained breathing apparatus required. Firefighters should wear the usual protective gear. Use water spray to cool fire exposed containers.
Auto-ignition temperature:	Not available.
Flash point (°C), method:	None
Lower flammability limit (% vol):	Not applicable.
Upper flammability limit (% vol):	Not applicable.

Not available.

Sensitivity to mechanical impact:	Not available.
Hazardous combustion products:	Oxides of carbon (COx). Hydrocarbons.
Rate of burning:	Not available.
Explosive power:	Containers may rupture if exposed to heat or fire.

Section 5 : REACTIVITY DATA

Chemical stability:	Product is stable under normal handling and storage conditions.
Conditions of instability:	Extreme temperatures.
Hazardous polymerization:	Will not occur.
Incompatible substances:	Strong acids. Strong oxidizing agents.
Hazardous decomposition products:	See hazardous combustion products.

Section 6 : HEALTH HAZARD DATA

Route of entry:	Skin contact, eye contact, inhalation and ingestion.
Effects of Acute Exposure	
Eye contact:	May cause irritation.
Skin contact:	Prolonged and repeated contact may cause irritation.
Inhalation:	May cause headache and nausea.
Ingestion:	May cause vomiting and diarrhea. May cause gastric distress.
Effects of chronic exposure:	See effects of acute exposure.
LD50 of product, species & route:	> 5000 mg/kg rat oral.
LC50 of product, species & route:	Not available.
Exposure limit of material:	Not available.
Sensitization to product:	Not available.
Carcinogenic effects:	Not listed as a carcinogen.
Reproductive effects:	Not available.
Teratogenicity:	Not available.
Mutagenicity:	Not available.
Synergistic materials:	Not available.
Medical conditions aggravated by exposure:	Not available.
First Aid	
Skin contact:	Remove contaminated clothing. Wash thoroughly with soap and water. Seek medical attention if irritation persists.
Eye contact:	Check for and remove contact lenses. Flush eyes with clear, running water for 15 minutes while holding eyelids open: if irritation persists, consult a physician.
Inhalation:	Remove victim to fresh air. If irritation persists, seek medical attention.
Ingestion:	Do not induce vomiting, seek medical attention. Dilute with two glasses of water. Never give anything by mouth to an unconscious person.

Section 7 : PRECAUTIONS FOR SAFE HANDLING AND USE

Leak / Spill:	Contain the spill. Prevent entry into drains, sewers, and other waterways. Wear appropriate protective equipment. Small amounts may be flushed to sewer with water. Soak up with an absorbent material. Place in appropriate container for disposal. Notify the appropriate authorities as required.
Waste disposal:	In accordance with local and federal regulations.
Handling procedures and equipment:	Protect against physical damage. Avoid breathing vapors/mists. Wear personal protective equipment appropriate to task.

Wash thoroughly after handling.
Keep out of reach of children.
Avoid contact with skin, eyes and clothing.
Avoid extreme temperatures.
Launder contaminated clothing prior to reuse.

Storage requirements: Store away from incompatible materials.
Keep containers closed when not in use.

Section 8 : CONTROL MEASURES

Precautionary Measures

Gloves / Type:

Wear appropriate gloves.

Respiratory / Type: None required under normal use.

Eye / Type:

Safety glasses recommended.

Footwear / Type: Safety shoes per local regulations.

Clothing / Type: As required to prevent skin contact.

Other / Type: Eye wash facility should be in close proximity.
Emergency shower should be in close proximity.

Ventilation requirements: Local exhaust at points of emission.

ALCONOX MSDS

Section 1 : MANUFACTURER INFORMATION

Product name: Alconox

Supplier: Same as manufacturer.

Manufacturer: Alconox, Inc.
30 Glenn St.
Suite 309
White Plains, NY 10603.

Manufacturer emergency phone number: 800-255-3924.
813-248-0585 (outside of the United States).

Manufacturer: Alconox, Inc.
30 Glenn St.
Suite 309
White Plains, NY 10603.

Supplier MSDS date: 2009/04/20

D.O.T. Classification: Not regulated.

Section 2 : HAZARDOUS INGREDIENTS

C.A.S.	CONCENTRATION %	Ingredient Name	T.L.V.	LD/50	LC/50
25155-30-0	10-30	SODIUM DODECYLBENZENESULFONATE	NOT AVAILABLE	438 MG/KG RAT ORAL 1330 MG/KG MOUSE ORAL	NOT AVAILABLE
497-19-8	7-13	SODIUM CARBONATE	NOT AVAILABLE	4090 MG/KG RAT ORAL 6600 MG/KG MOUSE ORAL	2300 MG/M3/2H RAT INHALATION 1200 MG/M3/2H MOUSE INHALATION
7722-88-5	10-30	TETRASODIUM PYROPHOSPHATE	5 MG/M3	4000 MG/KG RAT ORAL 2980 MG/KG MOUSE ORAL	NOT AVAILABLE
7758-29-4	10-30	SODIUM PHOSPHATE	NOT AVAILABLE	3120 MG/KG RAT ORAL 3100 MG/KG MOUSE ORAL >4640 MG/KG RABBIT DERMAL	NOT AVAILABLE

Section 2A : ADDITIONAL INGREDIENT INFORMATION

Note: (supplier).
CAS# 497-19-8: LD50 4020 mg/kg - rat oral.
CAS# 7758-29-4: LD50 3100 mg/kg - rat oral.

Section 3 : PHYSICAL / CHEMICAL CHARACTERISTICS

Physical state: Solid

Appearance & odor: Almost odourless.
White granular powder.

Odor threshold (ppm): Not available.

Vapour pressure (mmHg): Not applicable.

Vapour density (air=1): Not applicable.

By weight: Not available.

Evaporation rate (butyl acetate = 1): Not applicable.

Boiling point (°C): Not applicable.

Freezing point (°C): Not applicable.

pH: (1% aqueous solution).
9.5

Specific gravity @ 20 °C: (water = 1).
0.85 - 1.10

Solubility in water (%): 100 - > 10% w/w

Coefficient of water\oil dist.: Not available.

VOC: None

Section 4 : FIRE AND EXPLOSION HAZARD DATA

Flammability: Not flammable.

Conditions of flammability: Surrounding fire.

Extinguishing media: Carbon dioxide, dry chemical, foam.
Water
Water fog.

Special procedures: Self-contained breathing apparatus required.
Firefighters should wear the usual protective gear.

Auto-ignition temperature: Not available.

Flash point (°C), method: None

Lower flammability limit (% vol): Not applicable.

Upper flammability limit (% vol): Not applicable.

Not available.

Sensitivity to mechanical impact: Not applicable.

Hazardous combustion products: Oxides of carbon (COx).
Hydrocarbons.

Rate of burning: Not available.

Explosive power: None

Section 5 : REACTIVITY DATA

Chemical stability: Stable under normal conditions.

Conditions of instability: None known.

Hazardous polymerization: Will not occur.

Incompatible substances: Strong acids.
Strong oxidizers.

Hazardous decomposition products: See hazardous combustion products.

Section 6 : HEALTH HAZARD DATA

Route of entry: Skin contact, eye contact, inhalation and ingestion.

Effects of Acute Exposure

Eye contact: May cause irritation.

Skin contact: Prolonged contact may cause irritation.

Inhalation: Airborne particles may cause irritation.

Ingestion: May cause vomiting and diarrhea.
May cause abdominal pain.
May cause gastric distress.

Effects of chronic exposure: Contains an ingredient which may be corrosive.

LD50 of product, species & route: > 5000 mg/kg rat oral.

LC50 of product, species & route: Not available for mixture, see the ingredients section.

Exposure limit of material: Not available for mixture, see the ingredients section.

Sensitization to product: Not available.

Carcinogenic effects: Not listed as a carcinogen.

Reproductive effects: Not available.

Teratogenicity: Not available.

Mutagenicity: Not available.

Synergistic materials: Not available.

Medical conditions aggravated by exposure: Not available.

First Aid

Skin contact: Remove contaminated clothing.
Wash thoroughly with soap and water.
Seek medical attention if irritation persists.

Eye contact: Check for and remove contact lenses.
Flush eyes with clear, running water for 15 minutes while holding eyelids open: if irritation persists, consult a physician.

Inhalation: Remove victim to fresh air.
Seek medical attention if symptoms persist.

Ingestion: Dilute with two glasses of water.
Never give anything by mouth to an unconscious person.
Do not induce vomiting, seek immediate medical attention.

Section 7 : PRECAUTIONS FOR SAFE HANDLING AND USE

Leak / Spill: Contain the spill.
Recover uncontaminated material for re-use.
Wear appropriate protective equipment.
Contaminated material should be swept or shoveled into appropriate waste container for disposal.

Waste disposal: In accordance with municipal, provincial and federal regulations.

Handling procedures and equipment: Protect against physical damage.
Avoid breathing dust.
Wash thoroughly after handling.
Keep out of reach of children.
Avoid contact with skin, eyes and clothing.
Launder contaminated clothing prior to reuse.

Storage requirements: Keep containers closed when not in use.
Store away from strong acids or oxidizers.
Store in a cool, dry and well ventilated area.

Section 8 : CONTROL MEASURES

Precautionary Measures

Gloves / Type:

Neoprene or rubber gloves.

Respiratory / Type:

If exposure limit is exceeded, wear a NIOSH approved respirator.

Eye / Type:

Safety glasses with side-shields.

Footwear / Type: Safety shoes per local regulations.

Clothing / Type: As required to prevent skin contact.

Other / Type: Eye wash capability should be in close proximity.

Ventilation requirements: Local exhaust at points of emission.

CITGO Gasolines, All Grades Unleaded

Material Safety Data Sheet

CITGO Petroleum Corporation
P.O. Box 4689
Houston, TX 77210

MSDS No. UNLEAD
Revision Date 10/14/2008

IMPORTANT: This MSDS is prepared in accordance with 29 CFR 1910.1200. Read this MSDS before transporting, handling, storing or disposing of this product and forward this information to employees, customers and users of this product.

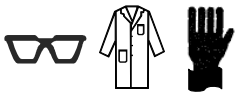
Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	1
Fire Hazard	3	3
Reactivity	0	0

*** = Chronic Health Hazard**

Protective Equipment

Minimum Recommended
See Section 8 for Details



Emergency Overview

Physical State Liquid.

Color Transparent, clear to amber or red. **Odor** Pungent, characteristic gasoline.

DANGER:
Extremely flammable liquid; vapor may cause flash fire or explosion.
Vapor may travel considerable distance to source of ignition and flash back.
Use Only as a Motor Fuel. Do Not Siphon by Mouth.
Harmful or fatal if swallowed - Can enter lungs and cause damage.
High concentrations of vapor reduce oxygen available for breathing and may cause suffocation.
May be harmful if inhaled or absorbed through the skin.
Mist or vapor may irritate the eyes, mucous membranes, and respiratory tract.
Liquid contact may cause eye and skin irritation.
Overexposures may cause central nervous system (CNS) depression and target organ effects (See Section 3).
Harmful or fatal if swallowed - Can enter lung and cause damage.
Inhalation overexposure can increase the heart's susceptibility to arrhythmias (irregular beats).
Contains Benzene - Cancer Hazard.
Long term exposure to gasoline vapor has caused cancer in laboratory animals.
Avoid Spills. Spills may present both a physical and an environmental hazard.

SECTION 1. PRODUCT IDENTIFICATION

Trade Name	CITGO Gasolines, All Grades Unleaded	**Technical Contact**	(832) 486-5940
Product Number	Various	**Medical Emergency**	(832) 486-4700
CAS Number	Mixture.	**CHEMTREC Emergency (United States Only)**	(800) 424-9300
Product Family	Motor fuels.		

Synonyms Unleaded Gasolines; Conventional Unleaded Gasoline with Ethanol; Unleaded Gasoline with Ethanol; Reformulated Unleaded Gasoline with Ethanol; Motor Gasolines; Petrol; Automobile Motor Fuels; Finished Gasolines; Gasoline, Regular Unleaded; Gasoline, Mid-grade Unleaded; Gasoline, Premium Unleaded; Reformulated Gasolines (RFG); Reformulated Motor Fuels; Oxygenated Motor Spirits; Gasoline, Regular Reformulated; Gasoline, Mid-grade Reformulated; Gasoline, Premium Reformulated; CBOB; RBOB; GTAB; Clean Burning Gasoline (CBG); CARB Gasoline with Ethanol.

SECTION 2. COMPOSITION

Gasoline is a complex and variable mixture that originates from finished refinery streams. These streams can contain the components listed below that are regulated or are associated with certain potential health effects. The typical concentration of ethanol in gasoline does not exceed 10% (v/v).

Component Name(s)	CAS Registry No.	Concentration (%)
Toluene	108-88-3	<25
Pentanes, all isomers	Mixture	<20
Octanes, all isomers	Mixture	<20
Xylene, all isomers	1330-20-7	<18
Hexane, other isomers	Mixture	<15
Heptane, all isomers	142-82-5	<15
Ethanol	64-17-5	<10
n-Hexane	110-54-3	<8
Benzene	71-43-2	<5
Trimethylbenzenes, all isomers	25551-13-7	<5
2,2,4-Trimethylpentane	540-84-1	<5
Cumene	98-82-8	<4
Ethylbenzene	100-41-4	<4
1, 2, 4 Trimethylbenzene	95-63-6	<3
Cyclohexane	110-82-7	<3
Cyclopentane	287-92-3	<2
Naphthalene	91-20-3	<2
Styrene	100-42-5	<1

SECTION 3. HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin contact. Eye contact. Inhalation. Ingestion.

Signs and Symptoms of Acute Exposure

Inhalation Breathing high concentrations may be harmful. Mist or vapor can irritate the throat and lungs. Breathing this material may cause central nervous system depression with symptoms including nausea, headache, dizziness, fatigue, drowsiness, or unconsciousness. Breathing high concentrations of this material, for example, in an enclosed space or by intentional abuse, can cause irregular heartbeats which can cause death.

Eye Contact This product can cause eye irritation with short-term contact with liquid, mists or vapor. Symptoms include stinging, watering, redness, and swelling. In severe cases, permanent eye damage can result.

Skin Contact This material can cause skin irritation. The severity of irritation will depend on the amount of material that is applied to the skin and the speed and thoroughness that it is removed. It is likely that some components of this material are able to pass into the body through the skin and may cause similar effects as from breathing or swallowing it. If the skin is damaged or abraded, absorption increases.

Ingestion

If swallowed, this material may irritate the mucous membranes of the mouth, throat, and esophagus. It can be readily absorbed by the stomach and intestinal tract. Symptoms include a burning sensation of the mouth and esophagus, nausea, vomiting, dizziness, staggered gait, drowsiness, loss of consciousness and delirium, as well as additional central nervous system (CNS) effects.

Due to its light viscosity, there is a danger of aspiration into the lungs during swallowing and subsequent vomiting. Aspiration can result in severe lung damage or death. Cardiovascular effects include shallow rapid pulse with pallor (loss of color in the face) followed by flushing (redness of the face). Also, progressive CNS depression, respiratory insufficiency and ventricular fibrillation leads to death.

Chronic Health Effects Summary

Intentional misuse by deliberately concentrating and inhaling gasoline can be harmful or fatal. Altered mental state, drowsiness, peripheral motor neuropathy, irreversible brain damage ("Petrol Sniffers Encephalopathy"), delirium, seizures and sudden death are associated with repeated abuse of gasoline or naphtha.

Chronic effects of ingestion and subsequent aspiration into the lungs may include pneumatocele (lung cavity) formation and chronic lung dysfunction.

Benzene, a component of this product, is associated with blood disorders and may damage bone marrow, causing certain types of anemia. The International Agency for Research on Cancer (IARC) (1987, 2004, 2007) and the U.S. EPA (IRIS 2007) have determined that benzene is a human carcinogen. It is also capable of causing changes in living cells' genetic material (chromosomes) and is considered to be a mutagen.

Repeated and prolonged overexposure to n-hexane has been associated with peripheral nerve tissue damage. Adverse effects include numbness, tingling, pain, and loss of muscle control in the extremities, disorientation, impaired vision and reflexes, decline in motor function and paralysis.

Prolonged or repeated overexposure to toluene, a component of this product, has been associated with reproductive effects in experimental animals and in long-term chemical abuse situations. Long-term overexposure to toluene has been associated with impaired color vision. Also, long-term overexposure to toluene in occupational environments have been associated with hearing damage.

Prolonged or repeated overexposure to xylene, a component of this product, has been associated with hearing damage in laboratory animals. Repeated overexposure may cause injury to bone marrow, blood cells, kidney, and liver.

Refer to Section 11 of this MSDS for additional health-related information.

Conditions Aggravated by Exposure

Disorders of the following organs or organ systems that may be aggravated by significant exposure to this material or its components include: Skin, Respiratory System, Liver, Kidneys, Central Nervous System (CNS), Cardiovascular System, Blood-forming system.

Target Organs

May cause damage to the following organs: blood, kidneys, lungs, the reproductive system, liver, mucous membranes, heart, peripheral nervous system, cardiovascular system, upper respiratory tract, skin, auditory system, bone marrow, central nervous system (CNS), eye, lens or cornea

Carcinogenic Potential

This material may contain benzene, ethylbenzene, naphthalene or styrene at concentrations above 0.1%. Benzene is considered to be a known human carcinogen by OSHA, IARC and NTP. IARC has identified ethylbenzene, styrene, naphthalene, gasoline and gasoline engine exhaust as possibly carcinogenic to humans (Group 2B) based on laboratory animal studies.

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	X	Sensitizer		Combustible		Explosive		Pyrophoric	
Toxic		Highly Toxic		Flammable	X	Oxidizer		Water-reactive	
Corrosive		Carcinogenic	X	Compressed Gas		Organic Peroxide		Unstable	

SECTION 4. FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation Immediately move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately. If exposed to benzene in an emergency situation, a medical evaluation should be completed at the end of the work-shift in accordance with OSHA requirements.

Eye Contact Flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. If easily accomplished, check for and remove contact lenses. If contact lenses cannot be removed, seek immediate medical attention. Do not use eye ointment. Seek medical attention.

Skin Contact Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.

Ingestion Do not induce vomiting. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.

Notes to Physician INHALATION: Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Administer supplemental oxygen with assisted ventilation, as required.

This material (or a component) sensitizes the heart to the effects of sympathomimetic amines. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in individuals exposed to this material. Administration of sympathomimetic drugs should be avoided.

INGESTION: If ingested, this material presents a significant aspiration and chemical pneumonitis hazard. Induction of emesis is not recommended. Consider activated charcoal and/or gastric lavage. If patient is obtunded, protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position.

SECTION 5. FIRE FIGHTING MEASURES

NFPA Flammability Classification NFPA Class-IB flammable liquid.

Flash Point Closed cup: -43°C (-45°F). (Tagliabue [ASTM D-56])

Lower Flammable Limit AP 1.4 % **Upper Flammable Limit** AP 7.6 %

Autoignition Temperature	AP 280°C (536°F)
Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, fumes, unburned hydrocarbons, aldehydes and other products of incomplete combustion.
Special Properties	Flammable Liquid! This material releases vapors at or below ambient temperatures. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. A vapor and air mixture can create an explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.
Extinguishing Media	SMALL FIRE: Use dry chemicals, carbon dioxide, foam, or inert gas (nitrogen). Carbon dioxide and inert gas can displace oxygen. Use caution when applying carbon dioxide or inert gas in confined spaces. LARGE FIRE: Use foam, water fog, or water spray. Water may be ineffective. Water may not extinguish the fire. Water fog and spray are effective in cooling containers and adjacent structures. However, water can be used to cool the external walls of vessels to prevent excessive pressure, autoignition or explosion. DO NOT use a solid stream of water directly on the fire as the water may spread the fire to a larger area.
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities of potential fire and explosion hazard if liquid enter sewers or waterways.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Flammable Liquid! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel from immediate area and establish a "regulated zone" with site control and security. A vapor-suppressing foam may be used to reduce vapors. Eliminate all ignition sources. All equipment used when handling this material must be grounded. Stop the leak if it can done without risk. Do not touch or walk through spilled material. Remove spillage immediately from hard, smooth walking areas. Prevent spilled material from entering waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

For large spills, secure the area and control access. Prevent spilled material from entering sewers, storm drains, other drainage systems, and natural waterways. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors; but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbant pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all applicable local, state and federal laws and regulations.

SECTION 7. HANDLING AND STORAGE

Handling

FLAMMABLE LIQUID AND VAPOR. **USE ONLY as a motor fuel.** DO NOT siphon by mouth. DO NOT use as a lighter fluid, solvent or cleaning fluid. Prior to handling or refueling, stop all engines and auxillary equipment. Turn off all electronic equipment including cellular telephones. DO NOT leave nozzle unattended during filling or refueling a vehicle. DO NOT re-enter vehicle while refueling. Keep nozzle spout in contact with the container during the entire filling operations.

A static electrical charge can accumulate when this material is flowing through pipes, nozzles or filters and when it is agitated. A static spark discharge can ignite accumulated vapors particularly during dry weather conditions. Always bond receiving containers to the fill pipe before and during loading, following NFPA-704 and /or API RP 2003 requirements. Always keep nozzle in contact with the container throughout the loading process. Do not fill any portable container in or on a vehicle. Special precautions, such as reduced loading rates and increased monitoring, must be observed during "switch loading" operations (i.e., loading this material in tanks or shipping compartments that previously contained middle distillates or similar products).

A spill or leak can cause an immediate fire or explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Avoid contact with oxidizing agents. Do NOT breathe vapor. Use only with adequate ventilation and personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food and tobacco products. Do NOT take internally.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Follow proper entry procedures, including compliance with 29 CFR 1910.146 prior to entering confined spaces such as tanks or pits. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Use appropriate respiratory protection when concentrations exceed any established occupational exposure level (See Section 8) Promptly remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.

Non-equilibrium conditions may increase the fire hazard associated with this product. A static electrical charge can accumulate when this material is flowing through pipes, nozzles or filters and when it is agitated. A static spark discharge can ignite accumulated vapors particularly during dry weather conditions. Always bond receiving containers to the fill pipe before and during loading. Always confirm that receiving container is properly grounded. Bonding and grounding alone may be inadequate to eliminate fire and explosion hazards associated with electrostatic charges. Carefully review operations that may increase the risks associated with static electricity such as tank and container filling, tank cleaning, sampling, gauging, loading, filtering, mixing, agitation, etc. In addition to bonding and grounding, efforts to mitigate the hazards of an electrostatic discharge may include, but are not limited to, ventilation, inerting and/or reduction of transfer velocities. Dissipation of electrostatic charges may be improved with the use of conductivity additives when used with other mitigation efforts, including bonding and grounding. Always keep nozzle in contact with the container throughout the loading process.

Do NOT fill any portable container in or on a vehicle. Do NOT use compressed air for filling, discharging or other handling operations. Product container is NOT designed for elevated pressure. Do NOT pressurize, cut, weld, braze solder, drill, or grind on containers. Do NOT expose product containers to flames, sparks, heat or other potential ignition sources. Empty containers may contain material residues which can ignite with explosive force. Observe label precautions.

Protect the environment from releases of this material. Prevent discharges to surface waters and groundwater. Maintain handling, transfer and storage equipment in proper working order.

Misuse of empty containers can be dangerous. Empty containers may contain material residues which can ignite with explosive force. **Cutting or welding of empty containers**

can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Storage

Keep container tightly closed. Store in a cool, dry, well-ventilated area. Store only in approved containers. Do not store with oxidizing agents. Do not store at elevated temperatures or in direct sunlight. Protect containers against physical damage. Head spaces in tanks and other containers may contain a mixture of air and vapor in the flammable range. Vapor may be ignited by static discharge. Storage area must meet OSHA requirements and applicable fire codes. Additional information regarding the design and control of hazards associated with the handling and storage of flammable and combustible liquids may be found in professional and industrial documents including, but not limited to, the National Fire Protection Association (NFPA) publications NFPA 30 ("Flammable and Combustible Liquid Code"), NFPA 77 ("Recommended Practice on Static Electricity") and the American Petroleum Institute (API) Recommended Practice 2003, ("Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents").

Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling or disposing of empty containers or waste residues of this product.

SECTION 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Provide ventilation or other engineering controls to keep the airborne concentrations of vapor or mists below the applicable workplace exposure limits indicated below. All electrical equipment should comply with the National Electrical Code. An emergency eye wash station and safety shower should be located near the work-station.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.

Eye Protection

Safety glasses equipped with side shields are recommended as minimum protection in industrial settings. Chemical goggles should be worn during transfer operations or when there is a likelihood of misting, splashing, or spraying of this material. A suitable emergency eye wash water and safety shower should be located near the work station.

Hand Protection

Avoid skin contact. Use gloves (e.g., disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR). Wash hands with plenty of mild soap and water before eating, drinking, smoking, use of toilet facilities or leaving work. DO NOT use this material as a skin cleaner.

Body Protection

Avoid skin contact. Wear long-sleeved fire-retardant garments (e.g., Nomex®) while working with flammable and combustible liquids. Additional chemical-resistant protective gear may be required if splashing or spraying conditions exist. This may include an apron, boots and additional facial protection. If product comes in contact with clothing, immediately remove soaked clothing and shower. Promptly remove and discard contaminated leather goods.

Respiratory Protection For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirators should be used in accordance with OSHA requirements (29 CFR 1910.134). For airborne vapor concentrations that exceed the recommended protection factors for organic vapor respirators, use a full-face, positive-pressure, supplied air respirator. Due to fire and explosion hazards, do not enter atmospheres containing concentrations greater than 10% of the lower flammable limit of this product.

General Comments Warning! Use of this material in spaces without adequate ventilation may result in generation of hazardous levels of combustion products and/or inadequate oxygen levels for breathing. Odor is an inadequate warning for hazardous conditions.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
Gasoline	**ACGIH (United States).** TWA: 300 ppm 8 hour(s). STEL: 500 ppm 15 minute(s).
Pentanes, all isomers	**ACGIH (United States).** TWA: 600 ppm 8 hour(s). **OSHA (United States).** TWA: 1000 ppm 8 hour(s).
Octanes, all isomers	**ACGIH (United States).** TWA: 300 ppm 8 hour(s). **OSHA (United States).** TWA: 500 ppm 8 hour(s).
Toluene	**ACGIH (United States). Skin** TWA: 20 ppm 8 hour(s). **OSHA (United States).** TWA: 200 ppm 8 hour(s). CEIL: 300 ppm PEAK: 500 ppm 1 times per shift, 10 minute(s).
Hexane, other isomers	**ACGIH (United States).** TWA: 500 ppm 8 hour(s). STEL: 1000 ppm 15 minute(s).
Heptane, all isomers	**ACGIH (United States).** TWA: 400 ppm 8 hour(s). STEL: 500 ppm 15 minute(s). **OSHA (United States).** TWA: 500 ppm 8 hour(s).
Xylene, all isomers	**ACGIH (United States).** TWA: 100 ppm 8 hour(s). STEL: 150 ppm 15 minute(s). **OSHA (United States).** TWA: 100 ppm 8 hour(s).
Ethanol	**ACGIH (United States).** TWA: 1000 ppm 8 hour(s). **OSHA (United States).** TWA: 1000 ppm 8 hour(s).
Benzene	**ACGIH (United States). Skin** TWA: 0.5 ppm 8 hour(s). STEL: 2.5 ppm 15 minute(s). **OSHA (United States). Skin Notes: See Table Z-2 for exclusions in 20 CFR 1910.1028 to the PEL.** TWA: 1 ppm 8 hour(s). STEL: 5 ppm 15 minute(s).
n-Hexane	**ACGIH (United States). Skin** TWA: 50 ppm 8 hour(s). **OSHA (United States).** TWA: 500 ppm 8 hour(s).
Cumene	**ACGIH (United States).** TWA: 50 ppm 8 hour(s). **OSHA (United States). Skin**

	TWA: 50 ppm 8 hour(s).
Trimethylbenzenes, all isomers	**ACGIH (United States).** TWA: 25 ppm 8 hour(s).
Ethylbenzene	**ACGIH (United States).** TWA: 100 ppm 8 hour(s). STEL: 125 ppm 15 minute(s). **OSHA (United States).** TWA: 100 ppm 8 hour(s).
Cyclohexane	**ACGIH (United States).** TWA: 100 ppm 8 hour(s). **OSHA (United States).** TWA: 300 ppm 8 hour(s).
Cyclopentane	**ACGIH (United States).** TWA: 600 ppm 8 hour(s).
Naphthalene	**ACGIH (United States). Skin** TWA: 10 ppm 8 hour(s). STEL: 15 ppm 15 minute(s). **OSHA (United States).** TWA: 10 ppm 8 hour(s).
Styrene	**ACGIH (United States).** TWA: 20 ppm 8 hour(s). STEL: 40 ppm 15 minute(s). **OSHA (United States).** TWA: 100 ppm 8 hour(s). STEL: 200 ppm 15 minute(s). PEAK: 600 ppm

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES (TYPICAL)

Physical State	Liquid.	**Color**	Transparent, clear to amber or red.	**Odor**	Pungent, characteristic gasoline.
Specific Gravity	0.72 - 0.77 (Water = 1)	**pH**	Not applicable	**Vapor Density**	3 to 4 (Air = 1)

Boiling Range	38 to 204°C (100 to 400°F)	**Melting/Freezing Point**	Not available.
Vapor Pressure	220 to 450 mm Hg at 20°C (68°F) or 6 to 15 Reid-psia at 37.8°C (100°F).	**Volatility**	720 to 770 g/l VOC (w/v)
Solubility in Water	Very slightly soluble in cold water. (<0.1 % w/w)	**Viscosity (cSt @ 40°C)**	<1

Flash Point	Closed cup: -43°C (-45°F). (Tagliabue [ASTM D-56])
Additional Properties	Average Density at 60°F = 6.0 to 6.4 lbs./gal. (ASTM D-2161)

SECTION 10. STABILITY AND REACTIVITY

Chemical Stability	Stable.	**Hazardous Polymerization**	Not expected to occur.
Conditions to Avoid	Keep away from heat, flame and other potential ignition sources. Keep away from strong oxidizing conditions and agents.		
Materials Incompatibility	Strong acids, alkalies and oxidizers such as liquid chlorine, other halogens, hydrogen peroxide and oxygen.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

SECTION 11. TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Gasoline:
VAPOR (TELo) Acute: 140 ppm (Human) (8 hours) - Mild eye irritant.
VAPOR (TELo) Acute: 500 ppm (Human) (1 hour) - Moderate eye irritant.
INHALATION (TCLo) Acute: 900 ppm (Human) (1 hour) - CNS and pulmonary effects.
DERMAL (TDLo) Acute: 53 mg/kg (Human) - Skin allergy effects.
INHALATION (LC50) Acute: 101,200 ppm (Rat, Mouse, & Guinea Pig) (5 minutes).

A major epidemiological study concluded that there was no increased risk of kidney cancer associated with gasoline exposures for petroleum refinery employees or neighboring residents. Another study identified a slight trend in kidney cancers among service station employees following a 30-year latency period. Two-year inhalation toxicity studies with fully vaporized unleaded gasoline (at concentrations of 67, 292 and 2,056 ppm in air) produced kidney damage and kidney tumors in male rats, but not in female rats or mice of either sex. Results from subsequent scientific studies suggest that the kidney damage, and probably the kidney tumor response, is limited to the male rat. The kidney tumors apparently were the result of the formation of alpha-2u-globulin, a protein unique to male rats. This finding is not considered relevant to human exposure. Under conditions of the study, there was no evidence that exposure to unleaded gasoline vapor is associated with developmental toxicity. Experimental studies with laboratory animals did suggest that overexposure to gasoline may adversely effect male reproductive performance. Also, in laboratory studies with rats, the maternal and developmental "no observable adverse effect level" (NOAEL) was determined to be 9,000 ppm (75% of the LEL value). Female mice developed a slightly higher incidence of liver tumors compared to controls at the highest concentration. In a four week inhalation study of Sprague Dawley® rats, gasoline vapor condensate was determined to induce sister chromatid exchanges in peripheral lymphocytes. IARC has listed gasoline as possibly carcinogenic to humans (Group 2B).

Pentanes, all isomers
Studies of pentane isomers in laboratory animals indicate exposure to extremely high levels (roughly 10 vol.%) may induce cardiac arrhythmias (irregular heartbeats) which may be serious or fatal.

Toluene:
Effects from Acute Exposure:
Deliberate inhalation of toluene at high concentrations (e.g., glue sniffing and solvent abuse) has been associated with adverse effects on the liver, kidney and nervous system and can cause CNS depression, cardiac arrhythmias and death. Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects.

Effects from Repeated or Prolonged Exposure:
Studies of workers indicate long-term exposure may be related to impaired color vision and hearing. Some studies of workers suggest long-term exposure may be related to neurobehavioral and cognitive changes. Some of these effects have been observed in laboratory animals following repeated exposure to high levels of toluene. Several studies of workers suggest long-term exposure may be related to small increases in spontaneous abortions and changes in some gonadotropic hormones. However, the weight of evidence does not indicate toluene is a reproductive hazard to humans. Studies in laboratory animals indicate some changes in reproductive organs following high levels of exposure, but no significant effects on mating performance or reproduction were observed. Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects. Findings in laboratory animals were largely negative. Positive findings include small increases in minor skeletal and visceral malformations and developmental delays following very high levels of maternal exposure. Studies of workers indicate long-term exposure may be related to effects on the liver, kidney and blood, but these appear to be limited to changes in serum enzymes and decreased leukocyte counts. Studies in laboratory

animals indicate some evidence of adverse effects on the liver, kidney, thyroid, and pituitary gland following very high levels of exposure. The relevance of these findings to humans is not clear at this time.

Heptane, all isomers
n-Heptane was not mutagenic in the Salmonella/microsome (Ames) assay and is not considered to be carcinogenic.

Xylene, all isomers
Effects from Acute Exposure:
ORAL (LD_{50}), Acute: 4,300 mg/kg [Rat].
INHALATION (LC_{50}), Acute: 4,550 ppm for four hours [Rat].
DERMAL (LD_{50}), Acute: 14,100 uL/kg [Rabbit].
Overexposure to xylene may cause upper respiratory tract irritation, headache, cyanosis, blood serum changes, CNS damage and narcosis. Effects may be increased by the use of alcoholic beverages. Evidence of liver and kidney impairment were reported in workers recovering from a gross over-exposure.

Effects from Prolonged or Repeated Exposure:
Impaired neurological function was reported in workers exposed to solvents including xylene. Studies in laboratory animals have shown evidence of impaired hearing following high levels of exposure. Studies in laboratory animals suggest some changes in reproductive organs following high levels of exposure but no significant effects on reproduction were observed. Studies in laboratory animals indicate skeletal and visceral malformations, developmental delays, and increased fetal resorptions following extremely high levels of maternal exposure. Adverse effects on the liver, kidney, bone marrow (changes in blood cell parameters) were observed in laboratory animals following high levels of exposure. The relevance of these observations to humans is not clear at this time.

Ethanol:
Inhalation exposure to ethanol vapor at concentrations above applicable workplace exposure levels is expected to produce eye and mucus membrane irritation. Human exposure at concentrations from 1000 to 5000 ppm produced symptoms of narcosis, stupor and unconsciousness. Subjects exposed to ethanol vapor in concentrations between 500 and 10,000 ppm experienced coughing and smarting of the eyes and nose. At 15,000 ppm there was continuous lacrimation and coughing. While extensive acute and chronic effects can be expected with ethanol consumption, ingestion is not expected to be a significant route of exposure to this product.

Benzene:

ORAL (LD50):	Acute: 930 mg/kg [Rat]. 4700 mg/kg [Mouse].
INHALATION (LC50):	
(VAPOR):	Acute: 10000 ppm 7 hour(s) [Rat]. 9980 ppm 8 hour(s) [Mouse].

Studies of Workers Over-Exposed to Benzene:
Studies of workers exposed to benzene show clear evidence that over-exposure can cause cancer of the blood forming organs (acute myelogenous leukemia) and aplastic anemia, an often fatal disease. Studies also suggest over-exposure to benzene may be associated with other types of leukemia and other blood disorders. Some studies of workers exposed to benzene have shown an association with increased rates of chromosome aberrations in circulating lymphocytes. One study of women workers exposed to benzene suggested a weak association with irregular menstruation. However, other studies of workers exposed to benzene have not demonstrated clear evidence of an effect on fertility or reproductive outcome in humans. Benzene can cross the placenta and affect the developing fetus. Cases of aplastic anemia have been reported in the offspring of persons severely over-exposed to benzene.

Studies in Laboratory Animals:
Studies in laboratory animals indicate that prolonged, repeated exposure to high levels of benzene vapor can cause bone marrow suppression and cancer in multiple organ systems. Studies in laboratory animals show evidence of adverse effects on male reproductive organs following high levels of exposure but no significant effects on reproduction have been observed. Embryotoxicity has been reported in studies of laboratory animals but effects were

limited to reduced fetal weight and skeletal variations.

n-Hexane:
This material contains n-hexane. Long-term or repeated exposure to n-hexane can cause permanent peripheral nerve damage. Initial symptoms are numbness of the fingers and toes. Also, motor weakness can occur in the digits, but may also involve muscles of the arms, thighs and forearms. The onset of these symptoms may be delayed for several months to a year after the beginning of exposure. Co-exposure to methylethyl ketone or methyl isobutyl ketone increases the neurotoxic properties of n-hexane. In laboratory studies, prolonged exposure to elevated concentrations of n-hexane was associated with decreased sperm count and degenerative changes in the testicles of rats.

Cumene:
Effects from Acute Exposure:
Overexposure to cumene may cause upper respiratory tract irritation and severe CNS depression.

Effects from Prolonged or Repeated Exposure:
Studies in laboratory animals indicate evidence of adverse effects on the kidney and adrenal glands following high level exposure. The relevance of these findings to humans is not clear at this time.

Trimethylbenzenes, all isomers
Studies of Workers:
Levels of total hydrocarbon vapors present in the breathing atmosphere of these workers ranged from 10 to 60 ppm. The TCLo for humans is 10 ppm, with somnolence and respiratory tract irritation noted.

Studies in Laboratory Animals:
In inhalation studies with rats, four of ten animals died after exposures of 2400 ppm for 24 hours. An oral dose of 5 mL/kg resulted in death in one of ten rats. Minimum lethal intraperitoneal doses were 1.5 to 2.0 mL/kg in rats and 1.13 to 12 mL/kg in guinea pigs. Mesitylene (1, 3, 5 Trimethylbenzene) inhalation at concentrations of 1.5, 3.0, and 6.0 mg/L for six hours was associated with dose-related changes in white blood cell counts in rats. No significant effects on the complete blood count were noted with six hours per day exposure for five weeks, but elevations of alkaline phosphatase and SGOT were observed. Central nervous system depression and ataxia were noted in rats exposed to 5,100 to 9,180 ppm for two hours.

Ethylbenzene:
Effects from Acute Exposure:
ORAL (LD50), Acute: 3,500 mg/kg [Rat].
DERMAL (LD50), Acute: 17,800 uL/kg [Rabbit].
INTRAPERITONEAL (LD50), Acute: 2,624 mg/kg [Rat].

Effects from Prolonged or Repeated Exposure:
Findings from a 2-year inhalation study in rodents conducted by NTP were as follows: Effects were observed only at the highest exposure level (750 ppm). At this level the incidence of renal tumors was elevated in male rats (tubular carcinomas) and female rats (tubular adenomas). Also, the incidence of tumors was elevated in male mice (alveolar and bronchiolar carcinomas) and female mice (hepatocellular carcinomas). IARC has classified ethyl benzene as “possibly carcinogenic to humans” (Group 2B). Studies in laboratory animals indicate some evidence of post-implantation deaths following high levels of maternal exposure. The relevance of these findings to humans is not clear at this time. Studies in laboratory animals indicate limited evidence of renal malformations, resorptions, and developmental delays following high levels of maternal exposure. The relevance of these findings to humans is not clear at this time. Studies in laboratory animals indicate some evidence of adverse effects on the liver, kidney, thyroid, and pituitary gland.

Cyclohexane:
ORAL (LD50): Acute: 12705 mg/kg [Rat]. 813 mg/kg [Mouse].

Cyclohexane can cause eye, skin and mucous membrane irritation, CNS depressant and

narcosis at elevated concentrations. In experimental animals exposed to lethal concentrations by inhalation or oral route, generalized vascular damage and degenerative changes in the heart, lungs, liver, kidneys and brain were identified.

Cyclohexane has been the focus of substantial testing in laboratory animals. Cyclohexane was not found to be genotoxic in several tests including unscheduled DNA synthesis, bacterial and mammalian cell mutation assays, and in vivo chromosomal aberration. An increase in chromosomal aberrations in bone marrow cells of rats exposed to cyclohexane was reported in the 1980's. However, a careful re-evaluation of slides from this study by the laboratory which conducted the study indicates these findings were in error, and that no significant chromosomal effects were observed in animals exposed to cyclohexane. Findings indicate long-term exposure to cyclohexane does not promote dermal tumorigenesis.

Naphthalene
Studies in Humans Overexposed to Naphthalene:
Severe jaundice, neurotoxicity (kernicterus) and fatalities have been reported in young children and infants as a result of hemolytic anemia from over-exposure to naphthalene. Persons with Glucose 6-phosphate dehydrogenase (G6PD) deficiency are more prone to the hemolytic effects of naphthalene. Adverse effects on the kidney have also been reported from over-exposure to naphthalene but these effects are believed to be a consequence of hemolytic anemia, and not a direct effect.

Studies in Laboratory Animals:
Hemolytic anemia has been observed in laboratory animals exposed to naphthalene. Laboratory rodents exposed to naphthalene vapor for 2 years (lifetime studies) developed non-neoplastic and neoplastic tumors and inflammatory lesions of the nasal and respiratory tract. Cataracts and other adverse effects on the eye have been observed in laboratory animals exposed to high levels of naphthalene. Findings from a large number of bacterial and mammalian cell mutation assays have been negative. A few studies have shown chromosomal effects (elevated levels of Sister Chromatid Exchange or chromosomal aberrations) *in vitro.*

Styrene
Neurological injury associated with chronic styrene exposure include distal hypesthesia, decreased nerve conduction velocity, and altered psychomotor performance. These effects did not occur with exposures to airborne concentrations that were less than 100 ppm. Increased deaths from degenerative neurological disorders were found in a comprehensive epidemiological study of Danish reinforced plastics workers. These workers were reported to have a 2.5-fold increased risk for myeloid leukemia with clonal chromosome aberrations. Also, there are several studies that suggest potential reproductive effects in humans and experimental animals from overexposure to styrene. Styrene was not mutagenic in the standard (liquid phase) Ames Salmonella/microsome assay, but was weakly positive when tested in the vapor phase. IARC has listed styrene as possibly carcinogenic to humans (Group 2B).

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Unleaded gasoline is potentially toxic to freshwater and saltwater ecosystems. Various grades of gasoline exhibited range of lethal toxicity (LC_{100}) from 40 PPM to 100 PPM in ambient stream water with Rainbow Trout (*Salmo irideus*). A 24-hour TLm (Median Toxic Limit) was calculated to be 90 PPM with juvenile American Shad (*Squalius cephalus*). In Bluegill Sunfish (*Lepomis macrochirus*), Grey Mullet (*Chelon labrosus*) and Gulf Menhaden (*Brevoortia patronus*), gasoline exhibited a 96-hour LC_{50} of 8 PPM, 2 PPM, and 2 PPM, respectively.

Environmental Fate

Biodegradability: Readily biodegradable in aerobic conditions. Residual components most recalcitrant to biodegration are branched alkanes.

Partition Coefficient (log Kow): 2.13 to 4.85.

Photodegration: Gasoline will partition to air, with the atmospheric half-life for constituents ranging from 0.8 days to 16 days.

Stability in water: Gasoline is not readily susceptible to hydrolysis under aquatic conditions, and the constituents readily partition to air.

SECTION 13. DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or its toxic (D018) characteristics. Conditions of use may cause this material to become a "hazardous waste", as defined by federal or state regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR 260 through 40 CFR 271). State and/or local regulations may be more restrictive. Contact your regional US EPA office for guidance concerning case specfic disposal issues.

SECTION 14. TRANSPORT INFORMATION

The shipping description below may not represent requirements for all modes of transportation, shipping methods or locations outside of the United States.

US DOT Status A U.S. Department of Transportation regulated material.

Proper Shipping Name Gasoline, 3, UN 1203, PG II
Gasohol, 3, NA 1203, PGII (Use only for gasoline blended with less than 20% ethanol)

Hazard Class 3 DOT Class: Flammable liquid.

Packing Group II

UN/NA Number UN1203 or NA1203

Reportable Quantity A Reportable Quantity (RQ) has not been established for this material.

Placard(s)

Emergency Response Guide No. 128

MARPOL III Status Not a DOT "Marine Pollutant" per 49 CFR 171.8.

SECTION 15. REGULATORY INFORMATION

TSCA Inventory This product and/or its components are listed on the Toxic Substances Control Act (TSCA) inventory.

SARA 302/304 Emergency Planning and Notification The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.

SARA 311/312 Hazard Identification The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories:

Fire, Acute (Immediate) Health Hazard, Chronic (Delayed) Health Hazard

SARA 313 Toxic Chemical Notification and Release Reporting

This product contains the following components in concentrations above *de minimis* levels that are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA:
Toluene [CAS No.: 108-88-3] Concentration: <25%
Xylene, all isomers [CAS No.: 1330-20-7] Concentration: <18%
n-Hexane [CAS No.: 110-54-3] Concentration: <8%
Benzene [CAS No.: 71-43-2] Concentration: <5%
Cumene [CAS No.: 98-82-8] Concentration: <4%
Ethylbenzene [CAS No.: 100-41-4] Concentration: <4%
1,2,4--Trimethylbenzene [CAS No.: 95-63-6] Concentration: <3%
Cyclohexane [CAS No.: 110-82-7] Concentration: <3%
Naphthalene [CAS No.: 91-20-3] Concentration: <2%
Styrene [CAS No.: 100-42-5] Concentration: <1%

CERCLA

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this product or refinery stream that may be subject to this statute are:
Toluene [CAS No.: 108-88-3] RQ = 1000 lbs. (453.6 kg) Concentration: <25%
Xylene, all isomers [CAS No.: 1330-20-7] RQ = 100 lbs. (45.36 kg) Concentration: <18%
n-Hexane [CAS No.: 110-54-3] RQ = 5000 lbs. (2268 kg) Concentration: <8%
Benzene [CAS No.: 71-43-2] RQ = 10 lbs. (4.536 kg) Concentration: <5%
2,2,4-Trimethylpentane [CAS No.: 540-84-1] RQ = 1000 lbs. (453.6 kg) Concentration: <5%
Cumene [CAS No.: 98-82-8] RQ = 5000 lbs. (2268 kg) Concentration: <4%
Ethylbenzene [CAS No.: 100-41-4] RQ = 1000 lbs. (453.6 kg) Concentration: <4%
Cyclohexane [CAS No.: 110-82-7] RQ = 1000 lbs. (453.6 kg) Concentration: <3%
Naphthalene [CAS No.: 91-20-3] RQ = 100 lbs. (45.36 kg) Concentration: <2%
Styrene [CAS No.: 100-42-5] RQ = 1000 lbs. (453.6 kg) Concentration: <1%

Clean Water Act (CWA)

This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.

California Proposition 65

This material may contain the following components which are known to the State of California to cause cancer, birth defects or other reproductive harm, and may be subject to the requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5):
Gasoline (Wholly Vaporized and Engine Exhaust), Benzene [CAS No. 71-43-3], Toluene [CAS No. 108-88-3], Ethylbenzene [CAS No.100-41-4] and Naphthalene [CAS No.91-20-3]

New Jersey Right-to-Know Label

Gasoline [NJDEP CAS No. 8006-61-9]

Additional Remarks

As minimum requirements, CITGO recommends that the following advisory information be displayed on equipment used to dispense gasoline in motor vehicles. Additional warnings specified by various regulatory authorities may be required: "DANGER: Extremely Flammable. Use as a Motor Fuel Only. No Smoking. Stop Engine. Turn Off All Electronic Equipment including Cellular Telephones. Do Not Overfill Tank. Keep Away from Heat and Flames. Do Not leave nozzle unattended during refueling. **Static Sparks Can Cause a Fire, especially when filling portable containers.** Containers must be metal or other material approved for storing gasoline. PLACE CONTAINER ON GROUND. DO NOT FILL ANY PORTABLE CONTAINER IN OR ON A VEHICLE. Keep nozzle spout in contact with the container during the entire filling operation. **Harmful or Fatal if Swallowed. Long Term-Exposure Has Caused Cancer in Laboratory Animals.** Avoid prolonged breathing of vapors. Keep face away from nozzle and gas tank. Never siphon by mouth."
WHMIS Class B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
WHMIS Class D-2B: Material causing other toxic effects (TOXIC).

SECTION 16. OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 9.1

Revision Date 10/14/2008

ABBREVIATIONS

AP: Approximately EQ: Equal >: Greater Than <: Less Than

NA: Not Applicable ND: No Data NE: Not Established

ACGIH: American Conference of Governmental Industrial Hygienists

AIHA: American Industrial Hygiene Association

IARC: International Agency for Research on Cancer

NIOSH: National Institute of Occupational Safety and Health

NPCA: National Paint and Coating Manufacturers Association

EPA: US Environmental Protection Agency

HMIS: Hazardous Materials Information System

OSHA: Occupational Safety and Health Administration

NTP: National Toxicology Program

NFPA: National Fire Protection Association

DISCLAIMER OF LIABILITY

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* * * * * END OF MSDS * * * * *

QEC MATERIAL SAFETY DATA SHEET

QUALITY ENVIRONMENTAL CONTAINERS
P.O. Box 1160, Beaver, WV 25813 800/255-3950*304/255-3900*Fax: 304/255-3901

J.T. BAKER, INC., 222 Red School Lane, Phillipsburg, NJ 08865

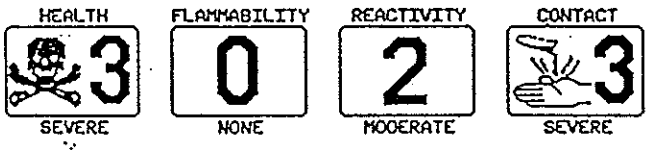
24-Hour Emergency Telephone 908/859-2151
National Response Center 800/424-8802
Chemtec 800/424-9300

SECTION I - PRODUCT IDENTIFICATION

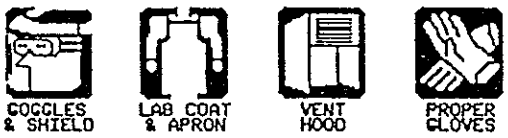
Product Name: Hydrochloric Acid
Common Synonyms: Muriatic Acid; Chlorohydric Acid; Hydrogen Chloride, Aqueous
Chemical Family: Inorganic Acids
Formula: HCl
Formula Wt.: 36.46
CAS No.: 7647-01-0
NIOSH/RTECS No.: MW4025000
Product Use: Laboratory Reagent
Product Codes: 7831,9548,9547,9537,5839,9543,9544,5367,9549,9534,9538,5214 5814,9540,6900,5537,9536,9539,9529,5593,9542,9535,5575,9546 9530,5800,4800

PRECAUTIONARY LABELING

BAKER SAF-T-DATA* System



Laboratory Protective Equipment



U.S. Precautionary Labeling

POISON! DANGER!
CAUSES SEVERE BURNS. MAY BE FATAL IF SWALLOWED OR INHALED.
Do not get in eyes, on skin, on clothing. Do not breathe vapor. Causes damage to Respiratory system (lungs), eyes and skin. Keep in tightly closed container. Loosen closure cautiously. Use with adequate ventilation. Wash thoroughly after handling. In case of spill neutralize with soda ash or lime and place in dry container.

Continued on Page: 2

PRECAUTIONARY LABELING (CONTINUED)

International Labeling

Irritating to eyes and skin.
Keep out of reach of children. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

SAF-T-DATA* Storage Color Code: White (corrosive)

SECTION II - COMPONENTS

Component	CAS No.	Weight %	OSHA/PEL	ACGIH/TLV
Hydrochloric Acid	7647-01-0	33-40	5 ppm	5 ppm
Water	7732-18-5	60-67	N/E	N/E

SECTION III - PHYSICAL DATA

Boiling Point: 149°C (300°F) (at 760 mm Hg)

Melting Point: -25°C (-13°F) (at 760 mm Hg)

Specific Gravity: 1.18 (H_2O=1)

Solubility(H_2O): Complete (100%)

pH: 1.0 (0.1M solution)

Odor Threshold (ppm): N/A

Coefficient Water/Oil Distribution: N/A

Vapor Pressure (mmHg): N/A

Vapor Density (air=1): 1.3

Evaporation Rate: N/A

% Volatiles by Volume: 100 (21°C)

Physical State: Liquid

Appearance & Odor: Clear, colorless fuming liquid. Pungent odor.

Continued on Page: 3

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

ash Point (Closed Cup): N/A NFPA 704M Rating: 3-0-0

toignition Temperature: N/A

ammable Limits: Upper - N/A Lower - N/A

re Extinguishing Media
Use extinguishing media appropriate for surrounding fire.

ecial Fire-Fighting Procedures
Firefighters should wear proper protective equipment and self-contained breathing apparatus with full facepiece operated in positive pressure mode. Move containers from fire area if it can be done without risk. Use water to keep fire-exposed containers cool. Do not get water inside containers.

usual Fire & Explosion Hazards
May emit hydrogen gas upon contact with metal. which can form an explosive mixture with air.

xic Gases Produced
hydrogen chloride, hydrogen, chlorine

plosion Data-Sensitivity to Mechanical Impact
None identified.

plosion Data-Sensitivity to Static Discharge
None identified.

SECTION V - HEALTH HAZARD DATA

hreshold Limit Value (TLV/TWA): 7 mg/m^3 (5 ppm)

LV (Ceiling) is for Hydrogen chloride.

hort-Term Exposure Limit (STEL): Not Established

ermissible Exposure Limit (PEL): 7 mg/m^3 (5 ppm)

EL (Ceiling) is for Hydrogen chloride.

Continued on Page: 4

SECTION V - HEALTH HAZARD DATA (CONTINUED)

Toxicity of components

Intraperitoneal Mouse LD_{50} for Hydrochloric Acid	40	mg/kg
Oral Rabbit LD_{50} for Hydrochloric Acid	900	mg/kg
Inhalation-1Hr Rat LC_{50} for Hydrochloric Acid	3124	ppm
Intraperitoneal Mouse LD_{50} for Water	190	g/kg
Intravenous Mouse LD_{50} for Water	25	g/kg

Carcinogenicity: NTP: No IARC: No Z List: No OSHA Reg: No

Carcinogenicity
None identified.

Reproductive Effects
None identified.

Effects of Overexposure

INHALATION: pulmonary edema, circulatory failure, respiratory system damage, collapse, coughing, difficult breathing

SKIN CONTACT: severe burns

EYE CONTACT: severe burns

SKIN ABSORPTION: none identified

INGESTION: is harmful and may be fatal. severe burns to mouth, throat, and stomach, nausea, vomiting

CHRONIC EFFECTS: may cause teeth damage

Target Organs
respiratory system, eyes, skin

Medical Conditions Generally Aggravated by Exposure
none identified

Primary Routes of Entry
ingestion, inhalation, skin contact, eye contact

Continued on Page: 5

SECTION V - HEALTH HAZARD DATA (CONTINUED)

Emergency and First Aid Procedures

INGESTION: CALL A PHYSICIAN. If swallowed, do NOT induce vomiting. If conscious, give water, milk, or milk of magnesia.

INHALATION: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Prompt action is essential.

SKIN CONTACT: In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before re-use.

EYE CONTACT: In case of eye contact, immediately flush with plenty of water for at least 15 minutes.

SARA/TITLE III HAZARD CATEGORIES and LISTS

Acute: Yes Chronic: Yes Flammability: No Pressure: No Reactivity: No

Extremely Hazardous Substance:	Yes	Contains Hydrogen Chloride (RQ = 1 LB, TPQ = 500 LBS)
CERCLA Hazardous Substance:	Yes	Contains Hydrochloric Acid (RQ = 5000 LBS)
SARA 313 Toxic Chemicals:	Yes	Contains Hydrochloric Acid
Generic Class:		Generic Class Removed from CFR: 7/1/91
TSCA Inventory:	Yes	

SECTION VI - REACTIVITY DATA

Stability: Stable

Hazardous Polymerization: Will not occur

Conditions to Avoid: heat, moisture.

Incompatibles: most common metals, water, amines, metal oxides, acetic anhydride, propiolactone, vinyl acetate, mercuric sulfate, calcium phosphide, formaldehyde, alkalies, carbonates, strong bases, sulfuric acid, chlorosulfonic acid

Decomposition Products: hydrogen chloride, hydrogen, chlorine

Continued on Page: 6

SECTION VII - SPILL & DISPOSAL PROCEDURES

Steps to be Taken in the Event of a Spill or Discharge

Wear self-contained breathing apparatus and full protective clothing. Stop leak if you can do so without risk. Ventilate area. Neutralize spill with soda ash or lime. With clean shovel, carefully place material into clean, dry container and cover; remove from area. Flush spill area with water.

J. T. Baker NEUTRASORB^{R} or TEAM^{R} 'Low Na+' acid neutralizers are recommended for spills of this product.

Disposal Procedure

Dispose in accordance with all applicable federal, state, and local environmental regulations.

EPA Hazardous Waste Number: D002 (Corrosive Waste)

SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT

Ventilation:	Use general or local exhaust ventilation to meet TLV requirements.
Respiratory Protection:	Respiratory protection required if airborne concentration exceeds TLV. At concentrations up to 100 ppm, a chemical cartridge respirator with acid cartridge is recommended. Above this level, a self-contained breathing apparatus is advised.
Eye/Skin Protection:	Safety goggles and face shield, uniform, protective suit, neoprene gloves are recommended.

A safety shower, an eye bath, and washing facilities should be available.

SECTION IX - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATA* Storage Color Code: White (corrosive)

Storage Requirements

Keep container tightly closed. Store in corrosion-proof area. Isolate from incompatible materials. Do not store near oxidizing materials.

Continued on Page: 7

SECTION IX - STORAGE AND HANDLING PRECAUTIONS (CONTINUED)

Special Precautions

Contact with common metals produces hydrogen which may form explosive mixtures with air. Thermal decomposition may release corrosive hydrogen chloride gas. Contact with strong oxidizers may produce chlorine gas.

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

Domestic (D.O.T.)

Proper Shipping Name: Hydrochloric acid, solution
Hazard Class: 8
UN/NA: UN1789 Reportable Quantity: 5000 LBS. Packaging Group: II
Labels: 8 CORROSIVE
Regulatory References: 49CFR 172.101

International (I.M.O.)

Proper Shipping Name: Hydrochloric acid, solution
Hazard Class: 8 I.M.O. Page: 8183
UN: UN1789 Marine Pollutants: No Packaging Group: II
Labels: 8 CORROSIVE
Regulatory References: 49CFR PART 176; IMDG Code

AIR (I.C.A.O.)

Proper Shipping Name: Hydrochloric acid, solution
Hazard Class: 8
UN: UN1789 Packaging Group: II
Labels: 8 CORROSIVE
Regulatory References: 49CFR PART 175; ICAO=== We believe the transportation data and references contained herein to be factual and the opinion of qualified experts. The data is meant as a guide to the overall classification of the product and is not package size specific, nor should it be taken as a warranty or representation for which the company assumes legal responsibility.=== The information is offered solely for your consideration, investigation, and verification. Any use of the information must be determined by the user to be in accordance with applicable Federal, State, and Local laws and regulations. See shipper requirements 49CFR 171.2, Certification 172.204, and employee training 49 CFR 173.1(b).

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QEC MATERIAL SAFETY DATA SHEET

QUALITY ENVIRONMENTAL CONTAINERS
P.O. Box 1160, Beaver, WV 25813 800/255-3950*304/255-3900*Fax: 304/255-3901

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24-Hour Emergency Telephone 908/859-2151
National Response Center 800/424-8802
Chemtec 800/424-9300

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION (CONTINUED)

U.S. Customs Harmonization Number: 28061000000

NOTE: When handling liquid products, secondary protective containers must be used for carrying.
-N/A = Not Applicable, or not Available;
N/E = Not Established.-
The information in this Material Safety Data Sheet meets the requirements of the United States OCCUPATIONAL SAFETY AND HEALTH ACT and regulations promulgated thereunder (29 CFR 1910.1200 et. seq.) and the Canadian WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM. This document is intended only as a guide to the appropriate precautionary handling of the material by a person trained in, or supervised by a person trained in, chemical handling. The user is responsible for determining the precautions and dangers of this chemical for his or her particular application. Depending on usage, protective clothing including eye and face guards and respirators must be used to avoid contact with material or breathing chemical vapors/fumes.
Exposure to this product may have serious adverse health effects. This chemical may interact with other substances. Since the potential uses are so varied, Baker cannot warn of all of the potential dangers of use or interaction with other chemicals or materials. Baker warrants that the chemical meets the specifications set forth on the label.
BAKER DISCLAIMS ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED WITH REGARD TO THE PRODUCT SUPPLIED HEREUNDER, ITS MERCHANTABILITY OR ITS FITNESS FOR A PARTICULAR PURPOSE.
The user should recognize that this product can cause severe injury and even death, especially if improperly handled or the known dangers of use are not heeded. READ ALL PRECAUTIONARY INFORMATION. As new documented general safety information becomes available, Baker will periodically revise this Material Safety Data Sheet.
Note: CHEMTREC, CANUTEC, and NATIONAL RESPONSE CENTER emergency telephone numbers are to be used ONLY in the event of CHEMICAL EMERGENCIES involving a spill, leak, fire, exposure, or accident involving chemicals. All non-emergency questions should be directed to Customer Service (1-300-JTBAKER) for assistance.

===
Approved by Quality Assurance Department.

WPC Brands, Inc.
P.O. Box 4406
Bridgeton, MO 63044-0406

Material Safety Data Sheet

Complies with OSHA's Hazard Communication Standard, 29 CFR 1910.1200

Hazardous Material Identification System – (HMIS)	
HEALTH – 2	REACTIVITY – 0
FLAMMABILITY – 2	PERSONAL – None

I Trade Name: Repel® 100 Insect Repellent

Product Type: Insect Repellent

Product Item Number: 402000

Formula Code Number: 01-4040

EPA Registration Number	Manufacturer	Emergency Telephone Numbers
305-30	Chemsico Division of United Industries Corporation 8494 Chapin Industrial Drive St. Louis, MO 63114	**For Chemical Emergency:** 1-800-633-2873 **For Information:** 1-888-880-1181 **Prepared by:** C. A. Duckworth **Date Prepared:** March 12, 2009

II Hazards Ingredient/Identity Information

Chemical	%	OSHA PEL	ACGIH TLV
DEET (N,N-diethyl-m-toluamide) CAS# 134-62-3	98.11	NA	NA

III Physical and Chemical Characteristics

Appearance & Odor: Clear liquid, slight odor
Boiling Point: 160 C
Vapor Pressure: 1.67×10^{-3}
Specific Gravity: 0.996
Vapor Density: 6.7
% Volatile (by vol.): 100%
Solubility in Water: NA
Evaporation Rate: Approximately 1 (Butyl Acetate = 1)

IV Fire and Explosive Hazards Data

Flash Point: 311 F(pmcc)
Flame Extension: NA
Autoignition Temperature: N/A
Fire Extinguishing Media: Carbon dioxide, Foam, Dry chemical
Decomposition Temperature: NA
Special Fire-Fighting Procedures: *For Small Fires:* Use Carbon dioxide or dry chemical extinguisher. *For Large Fires:* Use copious amounts of water.
Unusual Fire and Explosion Hazards: Also see Section VII

V Reactivity Data

Stability: Stable
Polymerization: Will not occur
Conditions to Avoid: None
Incompatible Materials: May soften or damage some synthetics such as rayon. May damage leather.
Hazardous Decomposition or Byproducts: None

VI Health Hazard Data

Ingestion (Swallowing): Harmful if swallowed. ***First Aid:*** Call a Poison Control Center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by a Poison Control Center or doctor. Do not give anything by mouth to an unconscious person.
Eye Contact: Causes substantial but temporary eye injury. ***First Aid:*** Hold eyelids open and flush slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.
Special Notes: Probable mucosal damage may contradict the use of gastric lavage. Use of this product may cause skin reactions in rare cases. If you suspect a reaction to this product, discontinue use. Take off contaminated clothing. Rinse immediately with plenty of water for 15-20 minutes. Contact a Poison Control Center or doctor. Have the product container with you when calling or going for treatment.
Health conditions Aggravated by Exposure: None known
Ingredients listed by NTP, OSHA, or IARC as Carcinogens or Potential Carcinogens: None

VII Precautions for Safe Handling and Use

Steps to be Taken in Case Material is Released or Spilled:
Soak up with absorbent material. Wash small quantities away with soapy water.

Waste Disposal: Do not puncture or incinerate. If empty: Place in trash or offer for recycling. If partially filled: Call your local solid waste disposal agency or 1-800-CLEANUP for disposal instructions. Never place unused product down an indoor or outdoor drain.

Handling & Storage Precautions:
Keep away from heat, sparks, or open flame. Exposure to temperatures higher than 130^0F may cause bursting.

VIII Control Measures

Read and follow label directions. They are your best guide to using this product effectively, and give necessary safety precautions to protect your health.

IX Transportation Data

DOT Shipping Name: Not regulated by DOT
DOT Hazard Class: NONE

RICCA CHEMICAL COMPANY

MSDS

Material Safety Data Sheet

Section 1: Chemical Product and Company Identification

Catalog Number:

34485, 34488, 34500, 4829, R4828000, SSOM0010

Product Identity:
METHANOL

Manufacturer's Name: RICCA CHEMICAL COMPANY LLC	**Emergency Contact(24 hr) --** CHEMTREC® Domestic: 800-424-9300 International: 703-527-3887
CAGE Code: 4TCW6, 0V553, 4XZQ2	
Address: 448 West Fork Dr Arlington, TX 76012	**Telephone Number For Information:** 817-461-5601
Date Prepared: 3/25/99	**Revision:** 6 Last Revised: 05/18/2011 Date Printed: 08/24/2011 12:35:31 pm

Section 2. Composition/Information on Ingredients

Component	CAS Registry #	Concentration	ACGIH TLV	OSHA PEL
Methanol (Methyl Alcohol)	67-56-1	100	200 ppm 262 mg/m3	200 ppm 260 mg/m3

Section 3: Hazard Identification

Emergency Overview: Flammable liquid. Primarily toxic by ingestion. Cannot be made non-poisonous. If ingested, give large quantity of water and induce vomiting. Call a physician. Contact may cause dryness and cracking of the skin. May cause irritation to the eyes. Wash areas of contact with water. May cause irritation of the respiratory system.

Target Organs: eyes, skin, respiratory system, central nervous system, gastrointestinal tract, liver.

Eye Contact: May cause irritation with burning and stinging with possible damage to the cornea and conjunctiva.

Inhalation: May cause irritation of the eyes, nose, throat, upper respiratory tract and associated mucosa. Central nervous system effects include headache, nervousness, tremors, acidosis, convulsions, dizziness, tearing, fatigue, nausea, somnolence, narcosis with stupor and loss of consciousness, circulatory collapse, respiratory failure and death.

Skin Contact: Results in drying and cracking which can lead to secondary infections and dermatitis. Dermal absorption causes many of the symptoms of inhalation.

Ingestion: Affects the brain, lungs, kidneys, gastrointestinal tract, eyes and respiratory system and can cause coma, blindness and death. Usual fatal dose: 100 - 125 milliliters.

Chronic Effects/Carcinogenicity: None

IARC - No.

NTP - No.

OSHA - No.

Reproductive Information: Reproductive effects cited in 'Registry of Toxic Effects of Chemical Substances' for Methanol (Methyl Alcohol).
Reproductive effects cited in 'Registry of Toxic Effects of Chemical Substances' for Methanol (Methyl Alcohol).

Teratology (Birth Defect) Information: Mutation data cited in 'Registry of Toxic Effects of Chemical Substances' for Methanol (Methyl Alcohol).
Mutation data cited in 'Registry of Toxic Effects of Chemical Substances' for Methanol (Methyl Alcohol).

Section 4: First Aid Measures - In all cases, seek qualified evaluation.

Eye Contact: Irrigate immediately with large quantity of water for at least 15 minutes. Call a physician if irritation develops.
Inhalation: Remove to fresh air. Give artificial respiration if necessary. If breathing is difficult, give oxygen.
Skin Contact: Wash areas of contact with soap and water for at least 15 minutes. Call a physician if irritation develops.
Ingestion: Dilute immediately with water or milk. Induce vomiting. Call a physician.

Section 5: Fire Fighting Measures

Flash Point: approximately 11°C
Method Used: CC
LFL: 7%
UFL: 36%
Extinguishing Media: Water, dry chemical, foam, or carbon dioxide. Water spray may be used to keep fire-exposed containers cool.
Fire & Explosion Hazards: Moderate explosion hazard and dangerous fire hazard when exposed to heat, sparks and open flames. Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Sensitive to static discharge.
Fire Fighting Instructions: Vapors can flow along surfaces to distant ignition source and flash back . Use water spray to blanket fire, cool fire exposed containers, and to flush non-ignited spills or vapors away from fire.
Fire Fighting Equipment: Wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

Section 6: Accidental Release Measures

Remove all sources of ignition. Contain spill. Do not flush to sewer. Absorb with suitable inert material (vermiculite, dry sand, etc) and place in a chemical waste container for proper disposal in an approved waste disposal facility. Ventilate area of spill. Have extinguishing agent available in case of fire. Use non-sparking tools and equipment. Dispose of in accordance with local regulations.

Section 7. Handling and Storage

As with all chemicals, wash hands thoroughly after handling. Avoid contact with eyes and skin. Protect from freezing and physical damage. Store in secure, flammable storage area away from all sources of ignition. Empty containers may be hazardous since they retain product residues.
Safety Storage Code: Flammable

Section 8: Exposure Control/Personal Protection

Engineering Controls: A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limit . Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source. Use explosion proof equipment.
Respiratory Protection: If engineering controls do not maintain airborne concentrations below recommended exposure limits, an approved atmosphere supplied respirator must be worn.
Skin Protection: Chemical resistant gloves.
Eye Protection: Safety glasses or goggles.

Section 9: Physical and Chemical Properties

Appearance: Clear, colorless liquid
Odor: characteristic alcohol
Solubility in Water: Infinite
Specific Gravity: Approximately 0.8
pH: Not Available.
Boiling Point(°C): approximately 64.5
Melting Point(°C): approximately -98
Vapor Pressure: Not Applicable.

Section 10: Stability and Reactivity

Chemical Stability: Stable under normal conditions of use and storage.
Incompatibility: Strong oxidizing agents such as Nitrates, Perchlorates or Sulfuric Acid, heat, sparks, open flame. Will attack some forms of plastics, rubber and coatings. May react with metallic aluminum and generate hydrogen gas.

Hazardous Decomposition Products: Acrid and irritating fumes, including toxic formaldehyde and oxides of carbon, when heated to decomposition.
Hazardous Polymerization: Will not occur.

Section 11. Toxicological Information

LD50, Oral, Rat: (Methanol) 5628 mg/kg, details of toxic effects not reported other than lethal dose value. Investigated as a mutagen and reproductive effector.

Section 12. Ecological Information

Ecotoxicological Information: Methanol has slight acute and chronic toxicity to aquatic life.
Chemical Fate Information: Methanol is slightly persistent in water, with a half-life of between 2 to 20 days. When released into the soil or water, this material is expected to readily biodegrade. When released into the soil, this material is expected to leach into groundwater; this material is expected to quickly evaporate. When released into the air, this material is expected to be readily removed from the atmosphere by wet deposition.

Section 13. Disposal Considerations

Absorb with suitable inert material (vermiculite, dry sand, earth) and place in a chemical waste container for proper disposal in an approved waste disposal facility for incineration in a chemical incinerator equipped with scrubber and afterburner. Ventilate area of spill. Have extinguishing agent available in case of fire. Eliminate all sources of ignition. Use non-sparking tools and equipment. Always dispose of in accordance with local, state and federal regulations.

Section 14. Transport Information

Part Numbers: 34485 20-LT, 34485 4LT, 34485 500ML, 34485C 4-LT, 34488 4LT, 34488 LT, 34488C 4-LT, 34500 20-LT, 34500 200-LT, 34500 4LT, 34500 500ML, 34500C 4-LT, 4829-1, 4829-16, 4829-25, 4829-32, 4829-41, 4829-5, 4829-5HP, R4828000-4C, SSOM0010-1C, SSOM0010-4C, SSOM0010-4CS, SSOM0010-500C

D.O.T. Shipping Name: Methanol
D.O.T. Hazard Class: 3
U.N. / N.A. Number: UN1230
Packing Group: II
D.O.T. Label: 3

Section 15. Regulatory Information (Not meant to be all inclusive - selected regulation represented)

OSHA Status: These items meet the OSHA Hazard Communication Standard (29 CFR 1910.1200) definition of a hazardous material.
TSCA Status: All components of this solution are listed on the TSCA Inventory or are mixtures (hydrates) of items listed on the TSCA Inventory.

Sara Title III:

Section 302 Extremely Hazardous Substances: Not Applicable.
Section 311/312 Hazardous Catagories: Acute, Chronic, Fire: Yes; Pressure, Reactivity: No
Section 313 Toxic Chemicals: Not Applicable.

California: None Reported.
Pennsylvania: Methanol (Methyl Alcohol) is listed as an Environmental Hazard on the state's Hazardous Substances List. Methanol (Methyl Alcohol) is listed as an Environmental Hazard on the state's Hazardous Substances List.
RCRA Status: U154,U154
CERCLA Reportable Quantity: Methanol (Methyl Alcohol) - 5,000 pounds. Methanol (Methyl Alcohol) - 5,000 pounds.

WHMIS: B-2: Flammable and Combustible Material. Flammable Liquid. D-1B Poisonous and Infectious Material. Materials causing immediate and serious toxic effects - Toxic Material. D-2A: Poisonous and Infectious Material. Materials causing other toxic effects - Very Toxic Material.



Section 16. Other Information

MSDS

NFPA Ratings:

Health: 1	Flammability: 3	Reactivity: 0	Special Notice Key:None

HMIS Ratings:

Health: 1	Flammability: 3	Reactivity: 0	Protective Equipment:B (Protective Eyewear, Gloves)

Rev 1, 12-10-99: (Section 1) Revised emergency telephone number to CHEMTREC® 800-424-9300.
Rev 2, 6-15-2001: Reformatted from WordPerfect® to Microsoft Word®; (Section 7) added storage code; (Section 15) added Florida and Pennsylvania state references.
Rev 3, 10-09-2001: Reformatted to electronic data format.
Rev 4, 10-13-2005: (Section 1) added Red Bird catalog umbers 34485, 34488, 34500 and SpectroPure catalog number SSOM0010; (Section 15) updated WHMIS information.
Rev 5, 06-14-2006: (Section 1) added catalog number R4828000.
Rev 6, 05-18-2011: (Section 8) revised respiratory protection to include atmosphere supplied respirator if necessary.

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION (CONTINUED)

laws and regulations. See shipper requirements 49CFR 171.2, Certification 172.204, and employee training 49 CFR 173.1(b).

U.S. Customs Harmonization Number: 28080000000

NOTE: When handling liquid products, secondary protective containers must be used for carrying.
-N/A = Not Applicable, or not Available; -N/E = Not Established

Mallinckrodt Baker provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose.
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Note: CHEMTREC, CANUTEC and NATIONAL RESPONSE CENTER emergency telephone numbers are to be used ONLY in the event of CHEMICAL EMERGENCIES involving a spill, leak, fire, exposure, or accident involving chemicals. All non-emergency questions should be directed to Customer Service (1-800-JTBAKER) for assistance.

Approved by Quality Assurance Department.

SECTION IX - STORAGE AND HANDLING PRECAUTIONS (CONTINUED)

Special Precautions

Nitric acid increases the flammability of, and can ignite many organic materials such as wood, solvents, etc., and can release toxic oxides of nitrogen. In addition certain mixtures of strong nitric acid with benzene, 1,2-dichloroethane, or dichloromethane may be detonatable. Spillage may cause fire.

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

Domestic (D.O.T.)

Proper Shipping Name: Nitric acid (other than red fuming, with not more than 70 percent nitric acid)
Hazard Class: 8
UN/NA: UN2031 Reportable Quantity: 1000 LBS. Packaging Group: II
Labels: 8 CORROSIVE
Regulatory References: 49CFR 172.101

International (I.M.O.)

Proper Shipping Name: NITRIC ACID (other than red fuming, all concentrations)
Hazard Class: 8 I.M.O. Page: 8195
UN: UN2031 Marine Pollutants: No Packaging Group: II
Labels: 8 CORROSIVE
Regulatory References: 49CFR PART 176; IMDG Code

AIR (I.C.A.O.)

Proper Shipping Name: NITRIC ACID, other than red fuming, with not more than 70 percent nitric acid
Hazard Class: 8
UN: UN2031 Packaging Group: II
Labels: 8 CORROSIVE
Regulatory References: 49CFR PART 175; ICAO=== We believe the transportation data and references contained herein to be factual and the opinion of qualified experts. The data is meant as a guide to the overall classification of the product and is not package size specific, nor should it be taken as a warranty or representation for which the company assumes legal responsibility.=== The information is offered solely for your consideration, investigation, and verification. Any use of the information must be determined by the user to be in accordance with applicable Federal, State, and Local

Continued on Page: 8

SECTION VII - SPILL & DISPOSAL PROCEDURES

Steps to be Taken in the Event of a Spill or Discharge

Wear self-contained breathing apparatus and full protective clothing. Stop leak if you can do so without risk. Ventilate area. Neutralize spill with soda ash or lime. With clean shovel, carefully place material into clean, dry container and cover; remove from area. Flush spill area with water.
Prevent run-off from entering drains, sewers, or streams.
Keep combustibles (wood, paper, oil, etc.) away from spilled material.

J. T. Baker NEUTRASORB^{R} or TEAM^{R} 'Low Na+' acid neutralizers are recommended for spills of this product.

Disposal Procedure

Dispose in accordance with all applicable federal, state, and local environmental regulations.

EPA Hazardous Waste Number: D002, D003 (Corrosive, Reactive Waste)

Aqu atic Toxicity

Mosquito Fish 96 Hr-TLm = 72 mg/L

SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT

Ventilation:	Use general or local exhaust ventilation to meet TLV requirements.
Respiratory Protection:	At any detectable concentration, any self-contained breathing apparatus that has a full facepiece and is operated in a pressure- demand or other positive-pressure mode.
Eye/Skin Protection:	Safety goggles and face shield, uniform,protective suit, neoprene gloves are recommended.

SECTION IX - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATA* Storage Color Code: Yellow (reactive)

Storage Requirements

Keep container tightly closed. Store separately and away from flammable and combustible materials. Isolate from incompatible materials. Keep product out of light.

Continued on Page: 7

SECTION V - HEALTH HAZARD DATA (CONTINUED)

Emergency and First Aid Procedures

INGESTION: CALL A PHYSICIAN. If swallowed, do NOT induce vomiting. If conscious, give water, milk, or milk of magnesia.

INHALATION: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Prompt action is essential.

SKIN CONTACT: In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before re-use.

EYE CONTACT: In case of eye contact, immediately flush with plenty of water for at least 15 minutes.

SARA/TITLE III HAZARD CATEGORIES and LISTS

Acute: Yes Chronic: Yes Flammability: No Pressure: No Reactivity: Yes

Extremely Hazardous Substance:	Yes	Contains Nitric Acid (RQ = 1,000 LBS, TPQ = 1,000 LBS)
CERCLA Hazardous Substance:	Yes	Contains Nitric Acid (RQ = 1000 LBS)
SARA 313 Toxic Chemicals:	Yes	Contains Nitric Acid
Generic Class:		Generic Class Removed from CFR: 7/1/91
TSCA Inventory:	Yes	

SECTION VI - REACTIVITY DATA

Stability: Stable

Hazardous Polymerization: Will not occur

Conditions to Avoid: heat, light, moisture.

Incompatibles: strong bases, carbonates, sulfides, cyanides, combustible materials, organic materials, strong reducing agents, most common metals, powdered metals, carbides, ammonium hydroxide, water, alcohols

Decomposition Products: oxides of nitrogen, hydrogen

Continued on Page: 6

SECTION V - HEALTH HAZARD DATA (CONTINUED)

Inhalation-1Hr Rat LC_{50} for Nitric Acid	2500	ppm
Unreported route; man; LD_{Lo} Nitric Acid	110	mg/kg
Oral human TDLo Nitric Acid	430	mg/kg
Intraperitoneal Mouse LD_{50} for Water	190	g/kg
Intravenous Mouse LD_{50} for Water	25	g/kg

Carcinogenicity: NTP: No IARC: No Z List: No OSHA Reg: No

Carcinogenicity
None identified.

Reproductive Effects
None identified.

Effects of Overexposure

INHALATION: severe irritation or burns of respiratory system, coughing, difficult breathing, chest pains, pulmonary edema, lung inflammation, unconsciousness, and may be fatal.

SKIN CONTACT: severe irritation or burns

EYE CONTACT: severe irritation or burns

SKIN ABSORPTION: none identified

INGESTION: nausea, vomiting, severe burns, ulceration - mouth, throat, stomach, and may be fatal.

CHRONIC EFFECTS: damage to lungs, teeth

Target Organs
eyes, skin, mucous membranes, respiratory system, lungs, teeth, GI tract

Medical Conditions Generally Aggravated by Exposure
damaged skin, eye disorders, cardiopulmonary disease, lung disease

Primary Routes of Entry
inhalation, ingestion, eye contact, skin contact

Continued on Page: 5

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point (Closed Cup): N/A NFPA 704M Rating: 3-0-0 OXY

Autoignition Temperature: N/A

Flammable Limits: Upper - N/A Lower - N/A

Fire Extinguishing Media

Use water, dry chemical, or soda ash.

Special Fire-Fighting Procedures

Firefighters should wear proper protective equipment and self-contained breathing apparatus with full facepiece operated in positive pressure mode. Move exposed containers from fire area if it can be done without risk. Use water to keep fire-exposed containers cool; do not get water inside containers.

Unusual Fire & Explosion Hazards

Strong oxidizer. Contact with combustible materials, flammable materials, or powdered metals can cause fire or explosion. Reacts with most metals to produce hydrogen gas, which can form an explosive mixture with air. A violent exothermic reaction occurs with water. Sufficient heat may be produced to ignite combustible materials.

Toxic Gases Produced

oxides of nitrogen, hydrogen

Explosion Data-Sensitivity to Mechanical Impact

None identified.

Explosion Data-Sensitivity to Static Discharge

None identified.

SECTION V - HEALTH HAZARD DATA

Threshold Limit Value (TLV/TWA): 5.2 mg/m^3 (2 ppm)

Short-Term Exposure Limit (STEL): 10 mg/m^3 (4 ppm)

Permissible Exposure Limit (PEL): 5 mg/m^3 (2 ppm)

Toxicity of components

Continued on Page: 4

PRECAUTIONARY LABELING (CONTINUED)

spray. In case of spill, neutralize with soda ash or lime.

International Labeling

Causes severe burns.
Keep out of reach of children. Do not breathe vapor. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Take off immediately all contaminated clothing.

SAF-T-DATA* Storage Color Code: Yellow (reactive)

SECTION II - COMPONENTS

Component	CAS No.	Weight %	OSHA/PEL	ACGIH/TLV
Nitric Acid	7697-37-2	65-70	2 ppm	2 ppm
Water	7732-18-5	29-35	N/E	N/E

SECTION III - PHYSICAL DATA

Boiling Point: 121°C (249°F)
(at 760 mm Hg)

Melting Point: -42°C (-43°F)
(at 760 mm Hg)

Specific Gravity: 1.41
(H_2O=1)

Solubility(H_2O): Complete (100%)

pH: 1.0 (0.1M solution)

Odor Threshold (ppm): 0.27

Coefficient Water/Oil Distribution: N/A

Vapor Pressure (mmHg): 9
(20°C)

Vapor Density (air=1): N/A

Evaporation Rate: N/A

% Volatiles by Volume: 100
(21°C)

Physical State: Liquid

Appearance & Odor: Clear, colorless liquid. Suffocating odor.

Continued on Page: 3

QEC MATERIAL SAFETY DATA SHEET

QUALITY ENVIRONMENTAL CONTAINERS
P.O. Box 1160, Beaver, WV 25813 800/255-3950*304/255-3900*Fax: 304/255-3901

N3660 -12 Nitric Acid Page: 1
Effective: 09/15/95 Issued: 12/04/96

J.T. BAKER, INC., 222 Red School Lane, Phillipsburg, NJ 08865

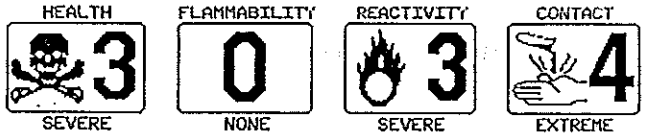
24-Hour Emergency Telephone 908/859-2151
National Response Center 800/424-8802
Chemtec 800/424-9300

SECTION I - PRODUCT IDENTIFICATION

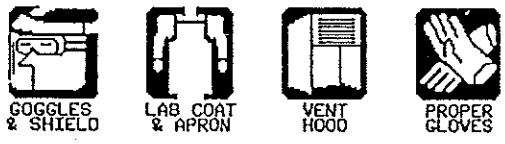
Product Name: Nitric Acid
Common Synonyms: Hydrogen Nitrate; Azotic Acid
Chemical Family: Inorganic Acids
Formula: HNO_3
Formula Wt.: 63.01
CAS No.: 7697-37-2
NIOSH/RTECS No.: QU5775000
Product Use: Laboratory Reagent
Product Codes: 9604,6901,5371,9616,5555,9600,9597,9601,5113,9606,9607,9602 4801,9605,9598,5801,5876

PRECAUTIONARY LABELING

BAKER SAF-T-DATA* System



Laboratory Protective Equipment



U.S. Precautionary Labeling

POISON! DANGER!
HARMFUL IF INHALED AND MAY CAUSE DELAYED LUNG INJURY. LIQUID AND VAPOR CAUSE SEVERE BURNS. MAY BE FATAL IF SWALLOWED OR INHALED. STRONG OXIDIZER. CONTACT WITH COMBUSTIBLE MATERIALS, FLAMMABLE MATERIALS, OR POWDERED METALS CAN CAUSE FIRE OR EXPLOSION. SPILLAGE MAY CAUSE FIRE OR LIBERATE DANGEROUS GAS.
Keep from contact with clothing and other combustible materials. Do not store near combustible materials. Do not get in eyes, on skin, on clothing. Do not breathe vapor. Keep in tightly closed container. Use with adequate ventilation. Wash thoroughly after handling. In case of fire, use water

Continued on Page: 2

Material Safety Data Sheet

Creation Date 29-Dec-2009 **Revision Date** 29-Dec-2009 **Revision Number** 1

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name **Deionized Water**

Cat No. **290-065, 23-290-065, 751-610, 23-751-610, 751-628, 23-751-628, 25065A**

Synonyms No information available.

Recommended Use In vitro diagnostic

Company
Fisher Diagnostics
A Division of Fisher Scientific Company, LLC
A Part of Thermo Fisher Scientific, Inc.
8365 Valley Pike
Middletown, VA 22645-1905
Tel: (800) 528-0494

Emergency Telephone Number
Chemtrec US: (800) 424-9300
Chemtrec EU: (202) 483-7616

2. HAZARDS IDENTIFICATION

Emergency Overview

The product contains no substances which at their given concentration are considered to be hazardous to health

Appearance Colorless **Physical State** Liquid **Odor** odorless

Target Organs None known.

Potential Health Effects

Acute Effects
Principle Routes of Exposure

Eyes	No hazard from product as supplied.
Skin	No hazard from product as supplied.
Inhalation	Low hazard for usual industrial or commercial handling.
Ingestion	Low hazard for usual industrial or commercial handling.

Chronic Effects None known.

See Section 11 for additional Toxicological information.

Aggravated Medical Conditions No information available.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Haz/Non-haz

Component	CAS-No	Weight %
Water	7732-18-5	100.0

4. FIRST AID MEASURES

Eye Contact Flush eyes with water as a precaution. Get medical attention immediately if symptoms occur.

Skin Contact Rinse with water. Get medical attention immediately if symptoms occur.

Inhalation Move to fresh air. Get medical attention immediately if symptoms occur.

Ingestion Do not induce vomiting. Get medical attention immediately if symptoms occur.

Notes to Physician Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Flash Point Not applicable
Method No information available.

Autoignition Temperature No information available.

Explosion Limits
Upper No data available
Lower No data available

Suitable Extinguishing Media Substance is nonflammable; use agent most appropriate to extinguish surrounding fire..

Unsuitable Extinguishing Media No information available.

Hazardous Combustion Products No information available.

Sensitivity to mechanical impact No information available.
Sensitivity to static discharge No information available.

Specific Hazards Arising from the Chemical
None known.

Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear

NFPA **Health** 0 **Flammability** 0 **Instability** 0 **Physical hazards** N/A

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions Use personal protective equipment.

Environmental Precautions Should not be released into the environment.

Methods for Containment and Clean Up Soak up with inert absorbent material. Keep in suitable and closed containers for disposal.

7. HANDLING AND STORAGE

Handling Handle in accordance with good industrial hygiene and safety practice.

Storage Keep containers tightly closed in a dry, cool and well-ventilated place.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering Measures Ensure that eyewash stations and safety showers are close to the workstation location.

Exposure Guidelines This product does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.

NIOSH IDLH: *Immediately Dangerous to Life or Health*

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166

Skin and body protection Wear appropriate protective gloves and clothing to prevent skin exposure

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid
Appearance	Colorless
Odor	odorless
Odor Threshold	No information available.
pH	5.5 - 7.5@ 25°C
Vapor Pressure	No information available.
Vapor Density	0.694
Viscosity	No information available.
Boiling Point/Range	100°C / 212°F
Melting Point/Range	0°C / 32°F
Decomposition temperature °C	No information available.
Flash Point	Not applicable
Evaporation Rate	> 1 (Butyl Acetate = 1.0)
Specific Gravity	1.00
Solubility	No information available.
log Pow	No data available
Molecular Weight	20.14
Molecular Formula	H2O

10. STABILITY AND REACTIVITY

Stability Stable under normal conditions.

Conditions to Avoid None known.

Incompatible Materials	None known
Hazardous Decomposition Products	None known
Hazardous Polymerization	Hazardous polymerization does not occur
Hazardous Reactions .	None under normal processing.

11. TOXICOLOGICAL INFORMATION

Acute Toxicity

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Water	90 mL/kg (Rat)	Not listed	Not listed

Irritation	No information available.
Toxicologically Synergistic Products	No information available.

Chronic Toxicity

Carcinogenicity	There are no known carcinogenic chemicals in this product

Sensitization	No information available.
Mutagenic Effects	No information available.
Reproductive Effects	No information available.
Developmental Effects	No information available.
Teratogenicity	No information available.
Other Adverse Effects	See actual entry in RTECS for complete information.
Endocrine Disruptor Information	No information available

12. ECOLOGICAL INFORMATION

Ecotoxicity

Contains no substances known to be hazardous to the environment or that are not degradable in waste water treatment plants.

Persistence and Degradability	No information available
Bioaccumulation/ Accumulation	No information available
Mobility	No information available

13. DISPOSAL CONSIDERATIONS

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification

14. TRANSPORT INFORMATION

DOT Not regulated

TDG Not regulated

IATA Not regulated

IMDG/IMO Not regulated

15. REGULATORY INFORMATION

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	CHINA	KECL
Water	X	X	-	231-791-2	-		X	-	X	X	KE-35400 X

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313
Not applicable

SARA 311/312 Hazardous Categorization

Acute Health Hazard	No
Chronic Health Hazard	No
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

Clean Water Act
Not applicable

Clean Air Act
Not applicable

OSHA
Not applicable

CERCLA
Not Applicable

California Proposition 65
This product does not contain any Proposition 65 chemicals.

State Right-to-Know
Not applicable

U.S. Department of Transportation

Reportable Quantity (RQ):	N
DOT Marine Pollutant	N
DOT Severe Marine Pollutant	N

U.S. Department of Homeland Security
This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

WHMIS Hazard Class
Non-controlled

16. OTHER INFORMATION

Prepared By	Regulatory Affairs Thermo Fisher Scientific Tel: (412) 490-8929
Creation Date	29-Dec-2009
Print Date	29-Dec-2009
Revision Summary	"***", and red text indicates revision

Disclaimer

The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of MSDS

CITGO No. 1 Diesel Fuel, All Grades
Material Safety Data Sheet

CITGO Petroleum Corporation
P.O. Box 4689
Houston, TX 77210

MSDS No. AG1DF
Revision Date 12/31/2007

IMPORTANT: This MSDS is prepared in accordance with 29 CFR 1910.1200. Read this MSDS before transporting, handling, storing or disposing of this product and forward this information to employees, customers and users of this product.

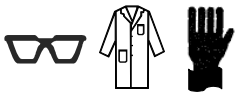
Hazard Rankings

	HMIS	NFPA
Health Hazard	* 1	0
Fire Hazard	2	2
Reactivity	0	0

*** = Chronic Health Hazard**

Protective Equipment

Minimum Recommended
See Section 8 for Details



Emergency Overview

Physical State Liquid.
Color Clear to light amber. **Odor** Characteristic, kerosene-like.

WARNING!
Combustible liquid; vapor may cause flash fire.
Harmful or fatal if swallowed - can enter lungs and cause damage.
Mist or vapor can irritate the respiratory tract.
Liquid contact can cause eye or skin irritation.
May be harmful if inhaled or absorbed through the skin.
Overexposure can cause central nervous system (CNS) depression and/or other target organ effects.
Diesel engine exhaust can cause upper respiratory tract irritation and reversible pulmonary effects.
Spills may create a slipping hazard.

SECTION 1. PRODUCT IDENTIFICATION

Trade Name	CITGO No. 1 Diesel Fuel, All Grades	**Technical Contact**	(832) 486-5940
Product Number	Various	**Medical Emergency**	(832) 486-4700
CAS Number	8008-20-6	**CHEMTREC Emergency (United States Only)**	(800) 424-9300
Product Family	Fuels.		
Synonyms	None		

SECTION 2. COMPOSITION

This product may be composed, in whole or in part, of any of the following refinery streams:

Kerosene [CAS No.: 8008-20-6]
Hydrodesulfurized Kerosine (Petroleum) [CAS No.: 64742-81-0]
Hydrodesulfurized Middle Distillate (petroleum) [CAS No.: 64742-80-9]
Straight-run Middle Distillate (Petroleum) [CAS No.: 64741-44-2]
Hydrodesulfurized Light Catalytic Cracked Distillate (Petroleum) [CAS No.: 68333-25-5]
Light Catalytic Cracked Distillate (Petroleum) [CAS No.: 64741-59-9]

This product contains the following chemical components:

Component Name(s)	CAS Registry No.	Concentration (%)

Nonane, all isomers	Mixture.	20 - 30
Ethylmethylbenzenes (Ethyltoluenes)	25550-14-5	1 - 3
Naphthalene	91-20-3	0 - 3
Trimethylbenzenes, all isomers	25551-13-7	0 - 2
Ethylbenzene	100-41-4	0 - 1
Xylene, all isomers	1330-20-7	0 - 1
1, 2, 4 Trimethylbenzene	95-63-6	0 - 1
Cumene	98-82-8	0 - 1

SECTION 3. HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin contact. Eye contact. Inhalation.

Signs and Symptoms of Acute Exposure

Inhalation

Breathing mist or vapors concentrations well above occupational exposure levels can irritate the mucous membranes of the nose, throat, bronchi, and lungs and can cause transient central nervous system (CNS) depression. Signs and symptoms of CNS depression include headache, dizziness, nausea, blurred vision, slurred speech, flushed face, confusion, weakness, fatigue or loss of consciousness depending upon the concentration and/or duration of exposure. In severe cases, overexposure by inhalation can cause convulsions, coma, or death.

Eye Contact

This product can cause eye irritation with short-term contact with liquid, mists or vapor. Symptoms include stinging, watering, redness, and swelling. In severe cases, permanent eye damage can result.

Skin Contact

Animal test results on similar materials suggest that this product can cause moderate to severe skin irritation. Symptoms include redness, itching, and burning of the skin. Also, certain components of this material may be absorbed through the skin and produce CNS depression effects (see "Inhalation" above). If the skin is damaged, absorption increases. Prolonged and/or repeated contact may cause severe dermatitis and/or more serious skin disorders. Chronic symptoms may include drying, swelling, scaling, blistering, cracking, and/or severe tissue damage.

Ingestion

If swallowed, this material may irritate the mouth, throat, and esophagus. It can be absorbed into the blood stream through the stomach and intestinal tract. Symptoms may include a burning sensation of the mouth and esophagus, nausea and vomiting. In addition, it can cause central nervous system effects characterized by dizziness, staggering, drowsiness, delirium and/or loss of consciousness.

Because of the low viscosity, this material can enter the lungs directly by aspiration during swallowing or subsequent vomiting. Aspiration of a small amount of liquid can cause severe lung damage and/or death.

Chronic Health Effects Summary

Secondary effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction.

This product contains petroleum middle distillates similar to those shown to produce skin tumors on laboratory rodents following repeated application. All tumors appeared during the latter portion of the typical 2-year lifespan of the animals. Certain studies have shown that washing the exposed skin of the test animal with soap and water between treatments greatly reduces the potential tumorigenic effects. These data suggest that good personal hygiene is effective in reducing the risk of this potential adverse health effect.

This material and/or its components have been associated with developmental toxicity, reproductive toxicity, genotoxicity, immunotoxicity, and/or carcinogenicity. Refer to Section 11 of this MSDS for additional health-related information.

Conditions Aggravated by Exposure

Medical conditions aggravated by exposure to this material may include skin disorders, chronic respiratory diseases, neurological conditions, liver or kidney dysfunction.

Target Organs

May cause damage to the following organs: kidneys, liver, upper respiratory tract, skin, eyes, central nervous system (CNS).

Carcinogenic Potential This material contains ethylbenzene and naphthalene at concentrations at or above 0.1%. Ethylbenzene is considered possibly carcinogenic to humans by IARC. (See Section 11.) NTP has determined that exposure to diesel exhaust particulates, a complex mixture of combustion products of diesel fuel, is reasonably anticipated to be a human carcinogen.

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	X	Sensitizer		Combustible	X	Explosive		Pyrophoric	
Toxic		Highly Toxic		Flammable		Oxidizer		Water-reactive	
Corrosive		Carcinogenic		Compressed Gas		Organic Peroxide		Unstable	

SECTION 4. FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation Move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately. Keep the affected individual warm and at rest.

Eye Contact Check for and remove contact lenses. Flush eyes with cool, clean, low-pressure water for at least 15 minutes while occasionally lifting and lowering eyelids. Do not use eye ointment unless directed to by a physician. Seek medical attention if excessive tearing, irritation, or pain persists.

Skin Contact Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.

Ingestion Do not induce vomiting. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.

Notes to Physician Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.

If ingested, this material presents a significant aspiration/lipoid or chemical pneumonitis hazard. As a result, induction of emesis is not recommended. Consider administration of an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing. Protect the airway by placement in Trendelenburg and left lateral decubitus position or by cuffed endotracheal intubation. If vital signs become abnormal or symptoms develop, obtain a chest x-ray and liver function tests. Antibiotics are indicated if pulmonary bacterial infection occurs. Monitor for cardiac function and arterial blood gases in severe exposure cases.

SECTION 5. FIRE FIGHTING MEASURES

NFPA Flammability Classification NFPA Class-II combustible liquid.

Flash Point Closed cup: 38°C (100°F). (Pensky-Martens. (Minimum))

Lower Flammable Limit AP 0.7 % **Upper Flammable Limit** AP 5 %

Autoignition Temperature >254°C (489.2°F)

Hazardous Combustion Products Carbon dioxide, carbon monoxide, smoke, fumes, unburned hydrocarbons and oxides of sulfur and/or nitrogen.

Special Properties Combustible Liquid! This material releases vapors when heated above ambient temperatures. Vapors can cause a flash fire. Vapors can travel to a source of ignition and flashback. A vapor and air mixture can create an explosion hazard in confined spaces such as sewers. Use only with adequate ventilation. If container is not properly cooled, it can rupture in the heat of a fire.

Extinguishing Media SMALL FIRE: Use dry chemicals, carbon dioxide, foam, water fog, or inert gas (nitrogen). LARGE FIRE: Use foam, water fog, or water spray. Water fog and spray are effective in cooling containers and adjacent structures. However, water can cause frothing and/or may not extinguish the fire. Water can be used to cool the external walls of vessels to prevent excessive pressure, autoignition or explosion. DO NOT use a solid stream of water directly on the fire as the water may spread the fire to a larger area.

Protection of Fire Fighters Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities of potential fire and explosion hazard if liquid enter sewers or waterways.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Combustible Liquid! Release can result in a fire hazard. Evacuate all non-essential personnel from release area. Establish a regulated zone with site control and security. Eliminate all ignition sources. Stop the leak if it can done without risk. A vapor-suppressing foam may be used to reduce vapors. Properly bond or ground all equipment used when handling this material. Avoid skin contact. Do not walk through spilled material. Verify that responders are properly trained and wearing appropriate personnel protective equipment. Dike far ahead of a liquid spills. Do not allow released material to entry waterways, sewers, basements, or confined areas. This material will float on water. Absorb or cover with dry earth, sand or other non-combustible material. Use clean, non-sparking tools to collect absorbed material. Place spent sorbent materials, free liquids and other clean-up debris into proper waste containers for appropriate disposal. Certain releases must be reported to the National Response Center (800/424-8802) and state or regulatory authorities. Comply with all laws and regulations.

SECTION 7. HANDLING AND STORAGE

Handling

Combustible Liquid!
A static electrical charge can accumulate when this material is flowing through pipes, nozzles or filters and when it is agitated. A static spark discharge can ignite accumulated vapors particularly during dry weather conditions. Always bond receiving containers to the fill pipe before and during loading. Always keep nozzle in contact with the container throughout the loading process. Do not fill any portable container in or on a vehicle. Special precautions, such as reduced loading rates and increased monitoring, must be observed during "switch loading" operations (i.e., loading this material in tanks or shipping compartments that previously containing gasoline or similar low flash point products).

Fire hazard increases as product temperature approaches its flash point. Keep container closed and drum bungs in place. Remove spillage immediately from walking areas. Do not handle or store near heat, sparks or other potential ignition sources. Do not handle or store with oxidizing agents. Avoid breathing mist or vapor. Never siphon by mouth. Do not taste or swallow. Avoid contact with eyes, skin and clothing. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure levels. Avoid water contamination. Wash thoroughly after handling. Prevent contact with food or tobacco products.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons from hazard area. Eliminate heat, flame and other potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.

Storage

Store in a cool, dry, well-ventilated place. Keep containers tightly closed. Do not store this product near heat, flame or other potential ignition sources. Do not store with oxidizers. Do not store this product in unlabeled containers. Do not puncture or incinerate containers. Ground all equipment containing this material. All electrical equipment in areas where this material is stored or handled must meet all applicable requirements of the NFPA's National Electrical Code (NEC). Store and transport in accordance with all applicable laws.

SECTION 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Provide ventilation or other engineering controls to keep the airborne concentrations of vapor or mists below the applicable workplace exposure limits indicated below. All electrical equipment should comply with the National Electric Code. An emergency eye wash station and safety shower should be located near the work-station.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.

Eye Protection

Safety glasses equipped with side shields are recommended as minimum protection in industrial settings. Chemical goggles should be worn during transfer operations or when there is a likelihood of misting, splashing, or spraying of this material. A suitable emergency eye wash water and safety shower should be located near the work station.

Hand Protection

Avoid skin contact. Use heavy duty gloves constructed of chemical resistant materials such as Viton® or heavy nitrile rubber. Wash hands with plenty of mild soap and water before eating, drinking, smoking, use of toilet facilities or leaving work. DO NOT use gasoline, kerosene, solvents or harsh abrasives as skin cleaners.

Body Protection

Avoid skin contact. Wear long-sleeved fire-retardant garments (e.g., Nomex®) while working with flammable and combustible liquids. Additional chemical-resistant protective gear may be required if splashing or spraying conditions exist. This may include an apron, boots and additional facial protection. If product comes in contact with clothing, immediately remove soaked clothing and shower. Promptly remove and discard contaminated leather goods.

Respiratory Protection

Airborne concentration will determine the level of respiratiory protection required. Respiratory protection is normally not required unless the product is heated or misted. For known or anticipated vapor or mist concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator equipped with a dust/mist prefilter if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirators should be used in accordance with OSHA requirements (29 CFR 1910.134).

General Comments

Warning! Use of this material in spaces without adequate ventilation may result in generation of hazardous levels of combustion products and/or inadequate oxygen levels for breathing. Odor is an inadequate warning for hazardous conditions.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
Nonane, all isomers	**ACGIH (United States).** TWA: 200 ppm 8 hour(s).
Ethylmethylbenzene, all isomers	Not available.
Naphthalene	**ACGIH (United States). Skin** TWA: 10 ppm 8 hour(s). STEL: 15 ppm 15 minute(s). **OSHA (United States).** TWA: 10 ppm 8 hour(s).
Trimethylbenzenes, all isomers	**ACGIH (United States).** TWA: 25 ppm 8 hour(s).
Ethylbenzene	**ACGIH (United States).** TWA: 100 ppm 8 hour(s). STEL: 125 ppm 15 minute(s). **OSHA (United States).** TWA: 100 ppm 8 hour(s).
Xylene, all isomers	**ACGIH (United States).** TWA: 100 ppm 8 hour(s). STEL: 150 ppm 15 minute(s). **OSHA (United States).** TWA: 100 ppm 8 hour(s).
1, 2, 4 Trimethylbenzene	Not available.
Cumene	**ACGIH (United States).** TWA: 50 ppm 8 hour(s). **OSHA (United States). Skin** TWA: 50 ppm 8 hour(s).
Sulfur	**ACGIH (United States, 1996).** TWA: 2 ppm STEL: 5 ppm **OSHA (United States).** TWA: 5 ppm **NIOSH** TWA: 2 ppm STEL: 5 ppm
Diesel exhaust particulate	**ACGIH (United States, 2001).** TWA: 0.05 mg/m^3
Toluene	**ACGIH (United States). Skin** TWA: 20 ppm 8 hour(s). **OSHA (United States).**

	TWA: 200 ppm 8 hour(s). CEIL: 300 ppm PEAK: 500 ppm
Benzene	**ACGIH (United States). Skin** TWA: 0.5 ppm 8 hour(s). STEL: 2.5 ppm 15 minute(s). **OSHA (United States). Skin Notes: See Table Z-2 for exclusions in 20 CFR 1910.1028 to the PEL.** TWA: 1 ppm 8 hour(s). STEL: 5 ppm 15 minute(s).
Middle distillates, petroleum	Not available.
Kerosene	**NIOSH REL (United States).** TWA: 100 mg/m^3 8 hour(s).
Hydrodesulfurized Kerosine (Petroleum)	Not available.
Hydrodesulfurized middle distillate (petroleum)	Not available.
Straight-run middle distillate (petroleum)	**ACGIH (United States, 1998). Skin** TWA: 100 mg/m^3
Distillates, petroleum, hydrodesulfurized light catalytic cracked	Not available.
Distillates, petroleum, light catalytic cracked	Not available.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES (TYPICAL)

Physical State	Liquid.	**Color**	Clear to light amber.	**Odor**	Characteristic, kerosene-like.
Specific Gravity	0.82 (Water = 1)	**pH**	Not Applicable.	**Vapor Density**	4 (Air = 1)
Boiling Range	AP 150º C (AP 302º F)			**Melting/Freezing Point**	Not available.
Vapor Pressure	<0.3 kPa (<2 mm Hg) (at 20°C)			**Volatility**	AP 825 g/l VOC (W%) (ASTM D2369) =
Solubility in Water	Very slightly soluble in cold water.			**Viscosity (cSt @ 40°C)**	AP 3

Flash Point Closed cup: 38°C (100°F). (Pensky-Martens. (Minimum))

Additional Properties Density = AP 6.8 lbs/gal.;
Viscosity (ASTM D2161) = 30 - 40 SUS @ 100º F

SECTION 10. STABILITY AND REACTIVITY

Chemical Stability Stable. **Hazardous Polymerization** Not expected to occur.

Conditions to Avoid Keep away from heat, flame and other potential ignition sources. Keep away from strong oxidizing conditions and agents.

Materials Incompatibility Strong acids, alkalies, and oxidizers such as liquid chlorine, other halogens, hydrogen peroxide and oxygen.

Hazardous Decomposition Products No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.

SECTION 11. TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Naphthalene

Studies in Humans Overexposed to Naphthalene:
Severe jaundice, neurotoxicity (kernicterus) and fatalities have been reported in young children and infants as a result of hemolytic anemia from over-exposure to naphthalene. Persons with Glucose 6-phosphate dehydrogenase (G6PD) deficiency are more prone to the hemolytic effects of naphthalene. Adverse effects on the kidney have also been reported from over-exposure to naphthalene but these effects are believed to be a consequence of hemolytic anemia, and not a direct effect.

Studies in Laboratory Animals:
Hemolytic anemia has been observed in laboratory animals exposed to naphthalene. Laboratory rodents exposed to naphthalene vapor for 2 years (lifetime studies) developed non-neoplastic and neoplastic tumors and inflammatory lesions of the nasal and respiratory tract. Cataracts and other adverse effects on the eye have been observed in laboratory animals exposed to high levels of naphthalene. Findings from a large number of bacterial and mammalian cell mutation assays have been negative. A few studies have shown chromosomal effects (elevated levels of Sister Chromatid Exchange or chromosomal aberrations) *in vitro.*

Trimethylbenzenes, all isomers

Studies of Workers:
Levels of total hydrocarbon vapors present in the breathing atmosphere of these workers ranged from 10 to 60 ppm. The TCLo for humans is 10 ppm, with somnolence and respiratory tract irritation noted.

Studies in Laboratory Animals:
In inhalation studies with rats, four of ten animals died after exposures of 2400 ppm for 24 hours. An oral dose of 5 mL/kg resulted in death in one of ten rats. Minimum lethal intraperitoneal doses were 1.5 to 2.0 mL/kg in rats and 1.13 to 12 mL/kg in guinea pigs. Mesitylene (1, 3, 5 Trimethylbenzene) inhalation at concentrations of 1.5, 3.0, and 6.0 mg/L for six hours was associated with dose-related changes in white blood cell counts in rats. No significant effects on the complete blood count were noted with six hours per day exposure for five weeks, but elevations of alkaline phosphatase and SGOT were observed. Central nervous system depression and ataxia were noted in rats exposed to 5,100 to 9,180 ppm for two hours.

Ethylbenzene

Effects from Acute Exposure:
ORAL (LD50), Acute: 3,500 mg/kg [Rat].
DERMAL (LD50), Acute: 17,800 uL/kg [Rabbit].
INTRAPERITONEAL (LD50), Acute: 2,624 mg/kg [Rat].

Effects from Prolonged or Repeated Exposure:
Findings from a 2-year inhalation study in rodents conducted by NTP were as follows: Effects were observed only at the highest exposure level (750 ppm). At this level the incidence of renal tumors was elevated in male rats (tubular carcinomas) and female rats (tubular adenomas). Also, the incidence of tumors was elevated in male mice (alveolar and bronchiolar carcinomas) and female mice (hepatocellular carcinomas). IARC has classified ethyl benzene as “possibly carcinogenic to humans” (Group 2B). Studies in laboratory animals indicate some evidence of post-implantation deaths following high levels of maternal exposure. The relevance of these findings to humans is not clear at this time. Studies in laboratory animals indicate limited evidence of renal malformations, resorptions, and developmental delays following high levels of maternal exposure. The relevance of these findings to humans is not clear at this time. Studies in laboratory animals indicate some evidence of adverse effects on the liver, kidney, thyroid, and pituitary gland.

Diesel exhaust particulate
Lung tumor and lymphomas were identified in rats and mice exposed to unflitered diesel fuel exhaust in chronic inhalation studies. Further, epidemiological studies have identified increase incidences of lung cancer in US railroad workers and bladder cancer in bus and truck drivers possibly associated with exposure to diesel engine exhaust. NTP has determined that exposure to diesel exhaust particulates, a complex mixture of combustion products of diesel fuel, is reasonably anticipated to be a human carcinogen. In addition, NIOSH has identified complete diesel exhaust as a potential carcinogen.

Hydrodesulfurized middle distillate (petroleum)
INHALATION LC50, Acute: 4.6 to 7.64 mg/L for four hours [Rat] - Dyspnea, nasal discharge, alopecia and excessive salivation.
ORAL LD50, Acute >500 g/kg [Rat Screening Level] Diarrhea, hyperactivity, ptosis and somnolence.
DERMAL LD50, Acute: >2,000 mg/kg [Rabbit Screening Level]
BUEHLER DERMAL, Acute: Non-sensitizing [Guinea Pig].
14-Day DERMAL, Subchronic: 0.05 ml/kg applied 3 times per week [Mouse, Human skin grafted to Athymic nude Mice] - Irritation and epidermal hyperplasia.
62-Week DERMAL, Chronic: 0.05 ml/kg applied 3 times per week [Mouse] - Extreme skin irritation; moderate increase in contact-point skin tumors.

Straight-run middle distillate (petroleum)
INHALATION, LC50, Acute: 1.72 mg/L for four hours [Male Rat].
INHALATION, LC50, Acute: 1.82 mg/L for 4 hours [Female Rat].
ORAL, LD50, Acute: >5,000 mg/kg [Rat screening level] - Diarrhea, hypoactivity and somnolence.
DERMAL, LD50, Acute: >2,000 mg/kg [Rabbit screen].
BUEHLER DERMAL, Acute: Non-sensitizing [Guinea Pig].
28-Day DERMAL, Subchronic: Moderate irritation at 200 to 2,000 mg/kg with no other treatment-related clinical effects observed.

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Freshwater Toxicity:
Concentration: 2400 ppm Exposure: 48 hrs. Species: Juven. Am. Shad (*Squalius cephalus*) Effect: TLM
Concentration: >127 ppm Exposure: 96 hrs. Species: Bluegill (*Lepomis macrochirus*) Effect: LC50

Saltwater Toxicity
Concentration: 10 ppm Exposure: 96 hrs. Species: Menhaden (*Brevoortia patronus*) Effect: LC50
Concentration: 10 ppm Exposure: 96 hrs. Species: Grass Shrimp Effect: LC50

Environmental Fate

If spilled, this material will normally evaporate. Hydrocarbon components may contribute to atmospheric smog. If released to the subsoils, petroleum middle distillate fuels will strongly adsorb to soils. Groundwater should be considered as an exposure pathway. Liquid and vapor can migrate through the subsurface and preferential pathways (such as utility line backfill) to downgradient receptors.

Middle distillates are potentially toxic to freshwater and saltwater ecosystems. Distillate fuels will normally float on water. In stagnant or slow-flowing waterways, a hydrocarbon layer can cover a large surface area. As a result, this oil layer can limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway can cause a fish kill or create an anaerobic environment. Also, this coating action can also kill plankton, algae, and water birds.

SECTION 13. DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. If spilled material is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase. Vapor emissions from a bio-oxidation process contaminated with this material might be a potential health hazard.

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility characteristic (D001). In addition, conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a hazardous waste at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). Contact your regional US EPA office for guidance concerning case specific disposal issues. State and/or local regulations might be even more restrictive.

SECTION 14. TRANSPORT INFORMATION

The shipping description below may not represent requirements for all modes of transportation, shipping methods or locations outside of the United States.

US DOT Status A U.S. Department of Transportation (DOT) regulated material. The following U. S. DOT hazardous materials shipping description applies to bulk packaged material that is transported by highway or rail. Alternate shipping descriptions may be required for product transported by marine vessel, air or other method and for non-bulk packaged material.

Proper Shipping Name Diesel Fuel, No. 1, Combustible liquid, NA1993, PG III

Hazard Class DOT Class: Combustible liquid with a flash point greater than 37.8°C (100°F).

Packing Group III

UN/NA Number NA 1993 or UN 1202

Reportable Quantity A Reportable Quantity (RQ) has not been established for this material.

Placard(s)

Emergency Response Guide No. 128

MARPOL III Status Not a DOT "Marine Pollutant" per 49 CFR 171.8.

SECTION 15. REGULATORY INFORMATION

TSCA Inventory This product and/or its components are listed on the Toxic Substances Control Act (TSCA) inventory.

SARA 302/304 Emergency Planning and Notification The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.

SARA 311/312 Hazard Identification The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories:

fire, Acute (Immediate) Health Hazard, Chronic (Delayed) Health Hazard

SARA 313 Toxic Chemical Notification and Release Reporting

This product contains the following components in concentrations above *de minimis* levels that are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA:
Naphthalene [CAS No.: 91-20-3] Concentration: 1.5%
Ethylbenzene [CAS No.: 100-41-4] Concentration: 0.5%

CERCLA

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this product or refinery stream that may be subject to this statute are:
Naphthalene [CAS No.: 91-20-3] RQ = 100 lbs. (45.36 kg) Concentration: 1.5%
Ethylbenzene [CAS No.: 100-41-4] RQ = 1000 lbs. (453.6 kg) Concentration: 0.5%
Xylene, all isomers [CAS No.: 1330-20-7] RQ = 100 lbs. (45.36 kg) Concentration: 0.5%
Cumene [CAS No.: 98-82-8] RQ = 5000 lbs. (2268 kg) Concentration: 0.5%
Benzene [CAS No.: 71-43-2] RQ = 10 lbs. (4.536 kg) Concentration: 0.045%

Clean Water Act (CWA)

This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.

California Proposition 65

This material may contain the following components which are known to the State of California to cause cancer, birth defects or other reproductive harm, and may be subject to the requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5):
Naphthalene: 1.5%
Ethylbenzene: 0.5%
Diesel exhaust particulate
Toluene: 0.045%
Benzene: 0.045%

New Jersey Right-to-Know Label

Diesel Fuel

Additional Remarks

Federal Hazardous Substances Act, related statutes, and Consumer Product Safety Commission regulations, as defined by 16 CFR 1500.14(b)(3) and 1500.83(a)(13): This product contains "Petroleum Distillates" which may require special labeling if distributed in a manner intended or packaged in a form suitable for use in the household or by children. Precautionary label dialogue should display the following: **DANGER: Contains Petroleum Distillates! Harmful or fatal if swallowed! Call Physician Immediately. KEEP OUT OF REACH OF CHILDREN!**

SECTION 16. OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 2.1
Revision Date 12/31/2007

ABBREVIATIONS

AP: Approximately EQ: Equal >: Greater Than <: Less Than NA: Not Applicable ND: No Data NE: Not Establishe
ACGIH: American Conference of Governmental Industrial Hygienists AIHA: American Industrial Hygiene Associatior
IARC: International Agency for Research on Cancer NTP: National Toxicology Program
NIOSH: National Institute of Occupational Safety and Health OSHA: Occupational Safety and Health Administration

NPCA: National Paint and Coating Manufacturers Association
NFPA: National Fire Protection Association
HMIS: Hazardous Materials Information System
EPA: US Environmental Protection Agency

DISCLAIMER OF LIABILITY

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THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

* * * * * END OF MSDS * * * * *

APPENDIX B

Activity Hazard Analysis

Table 3-2. Activity Hazard Analysis

Date Prepared: July 1, 2010
Project: RVAAP Facility-Wide Environmental Investigation Activities
Job: Site Mobilization and Demobilization
Prepared By: Colleen A. Lear, LG (9-27-11)
Reviewed By: Todd M. Valli, CIH (9-27-11)

Risk Assessment Code (RAC): L

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Severity	Probability: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Recommended Protective Clothing & Equipment:
Level D PPE

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
General	Biological hazards (bees, mosquitoes, ticks, Lyme disease, histoplasmosis, poisonous plants, wasps, and snakes)	Level D PPE Insect repellant, as necessary. Pant legs tucked into boots or otherwise closed to minimize tick entry or contact with harmful plants Inspect for ticks during the day and at the end of each work day (see Section 10.18) Avoidance of accumulations of bird or bat droppings (see Section 10.17) Protective ointments and/or specialized cleaners if working in areas with poisonous plants Site-specific instruction in recognition and avoidance of harmful plants and/or animals	EM 385-1-1 06.D
	Temperature extremes	Administrative controls (see Section 9.0) Cooled (shaded) or warmed break area depending on the season Routine breaks in established break area and unscheduled breaks, if needed (see Section 9.0) Chilled water if temperature exceeds 70°F Monitoring – ambient temperature measurements at least twice daily. Temperatures greater than 80°F, temperatures less than 30°F, and the use of impermeable clothing require additional controls (see Section 9.0) Site- and season-specific instruction in weather hazards and hazard controls	EM 385-1-1 06.I
	Contact with MEC	On-site training in ordnance recognition for all field personnel. Any investigation work within a MRS will follow MEC avoidance protocol. MEC surveys will be conducted in MRSs by a UXO technician for intrusive work and a UXO technician will accompany investigation teams. Avoid areas or withdraw all personnel from area, as directed by UXO technician, if ordnance or suspected ordnance is discovered. Monitoring - visual surveys for ordnance. Instrument surveys by UXO technicians in MRS. Follow requirements of governing Explosive Safety Submittal, if required, for the project.	EM 385-1-1 33.A

Table 3-2. Activity Hazard Analysis (continued)

Date Prepared: July 1, 2010
Project: RVAAP Facility-Wide Environmental Investigation Activities
Job: Site Mobilization and Demobilization

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
General	Exposure to chemicals	Wash face and hands and any other exposed areas prior to taking anything by mouth. HAZWOPER training and medical clearance	EM 385-1-1 06.A and B, and Section 28
	Severe weather	Locate nearest severe weather shelter/strong structure before beginning fieldwork. Suspend fieldwork if lightning within 10 miles of site or tornado warning issued. Do not work in areas subject to flash flooding	EM 385-1-1 06.I
Vehicle Operation	Vehicle accidents	Vehicle operation (valid driver's license, seat belt use, routine vehicle inspections, no cell phone use while driving, compliance with applicable laws and regulations, and defensive driving). Visual inspection includes the vehicle and any associated items such as trailers or external cargo carriers. The operator verifies that the following items are present and functional: seatbelt(s), lights, turn signals, operating brakes, speedometer, fuel gage, horn, windshield, windshield wiper, defrosting/defogging system, rear view mirror, cab, non-slip surfaces on steps, and tires (approximately proper inflation) While driving on RVAAP, facility personnel shall take necessary precautions to avoid hitting deer. Observe and maintain posted speed limits for both day and night driving conditions.	EM 385-1-1 18
Moving Equipment	Musculoskeletal injuries (lifting heavy items)	Maximum 50 lb per individual, safety shoes, mechanical assistance >50 lb An evaluation of potential pinch points and/or weight strain should be conducted. Clear area of all unnecessary equipment and slip/trip hazards. Additional help will be obtained by workers or mechanical assistance used on-site if equipment to be moved is unwieldy, has a weight >50 lb, or has to be moved by maneuvering through awkward positioning Plan activities so body is not twisted/contorted	EM 385-1-1 14.A
	General safety hazards (slips, trips, and falls)	Clean and organized work areas, keeping walkways and working areas clear, including snow, ice, and standing water	EM 385-1-1 2.B

Table 3-2. Activity Hazard Analysis (continued)

Date Prepared: July 1, 2010

Project: RVAAP Facility-Wide Environmental Investigation Activities

Job: Site Mobilization and Demobilization

Equipment to be Used	Inspection Requirements	Training Requirements
Vehicles General hand tools, if necessary	Daily safety inspections of operations. Initial and at least weekly inspections of equipment All tools must be inspected daily and taken out of service if damaged Daily vehicle inspection	HAZWOPER 40-hr training and current refresher training Medical clearance Properly trained personnel to operate equipment Valid driver's licenses Site-specific training including site hazard communication training CPR and first aid training for at least two on-site personnel and at least one person per field team

L

Table 3-2. Activity Hazard Analysis (continued)

Date Prepared: July 1, 2010
Project: RVAAP Facility-Wide Environmental Investigation Activities
Job: Site Walk and/or Civil Survey
Prepared By: Colleen A. Lear, LG (9-27-11)
Reviewed By: Todd M. Valli, CIH (9-27-11)

Recommended Protective Clothing & Equipment:
Level D PPE

Risk Assessment Code (RAC):

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Severity	Probability: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	***L***

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
General	Biological hazards (bees, mosquitoes, ticks, Lyme disease, histoplasmosis, poisonous plants, wasps, and snakes)	Level D PPE Insect repellant, as necessary Pant legs tucked into boots or otherwise closed to minimize tick entry and contact with harmful plants Inspect for ticks during the day and at the end of each work day (see Section 10.18) Avoidance of accumulations of bird or bat droppings (see Section 10.17) Protective ointments and/or specialized cleaners if working in areas with poisonous plants Site-specific instruction in recognition and avoidance of harmful plants and/or animals	EM 385-1-1 06.D
	Temperature extremes	Administrative controls (see Section 9.0) Cooled (shaded) or warmed break area depending on the season Routine breaks in established break area and unscheduled breaks if needed (see Section 9.0) Chilled water if temperature exceeds 70°F Monitoring – ambient temperature measurements at least twice daily. Temperatures greater than 80°F, temperatures less than 30°F, and the use of impermeable clothing require additional controls (see Section9.0) Site- and season-specific instruction in weather hazards and hazard controls	EM 385-1-1 06.I
	Contact with MEC	On-site training in ordnance recognition for all field personnel. Any investigation work within a MRS will follow MEC avoidance protocol. MEC surveys will be conducted in MRSs by a UXO technician for intrusive work and a UXO technician will accompany investigation teams. Avoid areas or withdraw all personnel from area, as directed by UXO technician, if ordnance or suspected ordnance is discovered. Monitoring - visual surveys for ordnance. Instrument surveys by UXO technicians in MRS. Follow requirements of governing Explosive Safety Submittal, if required, for the project.	EM 385-1-1 33.A

Table 3-2. Activity Hazard Analysis (continued)

Date Prepared: July 1, 2010
Project: RVAAP Facility-Wide Environmental Investigation Activities
Job: Site Walk and/or Civil Survey

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
General	Exposure to chemicals	Wash face and hands and any other exposed areas prior to taking anything by mouth. HAZWOPER training and medical clearance	EM 385-1-1 06.A and B and Section 28
	Severe weather	Locate nearest severe weather shelter/strong structure before beginning fieldwork. Suspend fieldwork if lightning within 10 miles of site or tornado warning issued. Do not work in areas subject to flash flooding	EM 385-1-1 06.I
Vehicle Operation	Vehicle accidents	Vehicle operation (valid driver's license, seat belt use, routine vehicle inspections, no cell phone use while driving, compliance with applicable laws and regulations, and defensive driving). The visual inspection includes the vehicle and any associated items such as trailers or external cargo carriers. The operator verifies that the following items are present and functional: seatbelt(s), lights, turn signals, operating brakes, speedometer, fuel gage, horn, windshield, windshield wiper, defrosting/defogging system, rear view mirror, cab, non-slip surfaces on steps, and tires (approximately proper inflation) While driving on RVAAP, facility personnel shall take necessary precautions to avoid hitting wildlife. Observe and maintain posted speed limits for both day and night driving conditions.	EM 385-1-1 06

Equipment to be Used	Inspection Requirements	Training Requirements
Vehicles	Daily safety inspections of operations. Initial and at least weekly inspections of equipment Daily vehicle inspection	HAZWOPER 40-hr training and current refresher training Medical clearance Properly trained personnel to operate equipment Valid driver's licenses Site-specific training including site hazard communication training CPR and first aid training for at least two on-site personnel and at least one person per field team

M

Table 3-2. Activity Hazard Analysis (continued)

Risk Assessment Code (RAC):

Date Prepared: July 1, 2010
Project: RVAAP Facility-Wide Environmental Investigation Activities
Job: Soil Boring and Sampling, Monitoring Well Installation Using a Drill Rig, and Groundwater Sampling
Prepared By: Colleen A. Lear, LG (9-27-11)
Reviewed By: Todd M. Valli, CIH (9-27-11)

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Severity	Probability: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	***M***
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Recommended Protective Clothing & Equipment:
Level D + PPE including hardhat plus nitrile or equivalent gloves for contact with contaminated material and hearing protection during drill rig operations

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
General	Biological hazards (bees, mosquitoes, ticks, Lyme disease, histoplasmosis, poisonous plants, wasps, and snakes)	Level D PPE Insect repellant, as necessary Pant legs tucked into boots or otherwise closed to minimize tick entry and contact with harmful plants Inspect for ticks during the day and at the end of each work day (see Section 10.18) Avoidance of accumulations of bird or bat droppings (see Section 10.17) Protective ointments or specialized cleaners if working in areas with poisonous plants Site-specific instruction in recognition and avoidance of harmful plants and animals	EM 385-1-1 06.D
	Temperature extremes	Administrative controls (see Section 9.0) Cooled (shaded) or warmed break area depending on the season Routine breaks in established break area and unscheduled breaks if need (see Section 9.0) Chilled water if temperature exceeds 70°F Monitoring – ambient temperature measurements at least twice daily. Temperatures greater than 80°F, temperatures less than 30°F, and impermeable clothing require additional controls Site- and season-specific instruction in weather hazards and hazard controls	EM 385-1-1 06.I
	Contact with MEC	On-site training in ordnance recognition for all field personnel. Any investigation work within a MRS will follow MEC avoidance protocol. MEC surveys will be conducted in MRSs by a UXO technician for intrusive work and a UXO technician will accompany investigation teams. Avoid areas or withdraw all personnel from area, as directed by UXO technician, if ordnance or suspected ordnance is discovered. Monitoring - visual surveys for ordnance. Instrument surveys by UXO technicians in MRS. Follow requirements of governing Explosive Safety Submittal, if required, for the project.	EM 385-1-1 33.A

Table 3-2. Activity Hazard Analysis (continued)

Date Prepared: July 1, 2010
Project: RVAAP Facility-Wide Environmental Investigation Activities
Job: Soil Boring and Sampling, Monitoring Well Installation Using a Drill Rig, and Groundwater Sampling

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
General	Lifting heavy items	Evaluation of potential pinch points and/or weight strain. Clear area of all unnecessary equipment and slip/trip hazards. Additional help will be obtained by workers or mechanical assistance used on-site if equipment to be moved is unwieldy, has a weight >50 lb, or has to be moved by maneuvering through awkward positioning	EM 385-1-1 14.A
	Severe weather	Locate nearest severe weather shelter/strong structure before beginning fieldwork. Suspend fieldwork if lightning within 10 miles of site or tornado warning issued. Do not work in areas subject to flash flooding	EM 385-1-1 06.I
Drilling	General safety hazards (rotating machinery, suspended loads, moving equipment, slips, and falls)	Level D PPE (see Section 6.0) plus hard hat No employees under lifted loads At least two functional kill switches Functional back-up alarm Drill rig manual on-site Only experienced operators Exclusion zone at least equal to mast height Hazardous waste safety training Monitoring - daily site safety inspections. Weekly drill rig inspections	EM 385-1-1 18.H
	Noise	Hearing protection within 7.6 m (25 ft) of rig unless rig-specific monitoring indicates noise exposure of less than 90 dB Monitoring - daily safety inspections	EM 385-1-1 05.C
	Fire (vehicle fuels or subsurface contaminants)	Fuels stored in safety containers labeled/listed by nationally recognized testing laboratory Bonding and grounding during fuel transfers Fuel storage areas marked with “No Smoking” or “Open Flame” signs No ignition sources within 50 ft of fuel storage areas Fire extinguishers in all fuel use areas and inspected monthly Monitoring - combustible gas indicator if buried organic material or other source of flammable gas is suspected	EM 385-1-1 09.A
	Contact with buried or overhead electrical or other hazards	Identification and clearance of overhead and underground utilities Monitoring - visual of all work areas	EM 385-1-1 05.I

Table 3-2. Activity Hazard Analysis (continued)

Date Prepared: July 1, 2010
Project: RVAAP Facility-Wide Environmental Investigation Activities
Job: Soil Boring and Sampling, Monitoring Well Installation Using a Drill Rig, and Groundwater Sampling

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
Drilling	Operating hand tools or power tools	Clean and organized work areas, keeping walkways and working areas clear. 110-V portable tools will be connected through GFCI	EM 385-1-1 13.A
Soil and Groundwater Sampling	Exposure to chemicals	PPE (Level D) plus nitrile or equivalent gloves for contact with contaminated material. Washing face and hands prior to taking anything by mouth. Staying upwind of any dust-generating activities. Minimal contact Hazard communication training MSDS for chemical tools on-site Chemical containers labeled to indicate contents and hazard Medical clearance for hazardous waste work Decontamination of potentially contaminated equipment prior to servicing Monitoring - photoionization detector or other monitoring as appropriate	EM 385-1-1 06.A and B
	Cuts or other injuries from opening sampling tubes	Use dedicated tube cutter or hooked safety blades when using polymer sample tubes. Wear heavy cut-resistant gloves when opening polymer sample tubes. Keep fingers from between split spoon halves	EM 385-1-1 13.A
Shipping and Packing Samples	Hazardous material shipping/transportation regulatory violation or spill (soil and groundwater samples)	Ensure DOT/IATA compliance if shipping chemicals or other hazardous materials or samples Hazardous materials shippers must be trained and certified	EM 385-1-1 6.B.03.f

Equipment to be Used	Inspection Requirements	Training Requirements
Drill rig Support truck Sampling equipment if necessary	Daily safety inspections of operations. Initial and at least weekly inspections of excavation equipment Daily vehicle inspection All tools must be inspected daily and taken out of service if damaged	HAZWOPER 40-hr training and current refresher training Medical clearance Properly trained personnel to operate drill rig Site-specific training including site hazard communication training CPR and first aid training for at least two on-site personnel and at least one person per field team

Table 3-2. Activity Hazard Analysis (continued)

Date Prepared: July 1, 2010
Project: RVAAP Facility-Wide Environmental Investigation Activities
Job: Monitoring Well and Borehole Abandonment
Prepared By: Colleen A. Lear, LG (9-27-11)
Reviewed By: Todd M. Valli, CIH (9-27-11)

Risk Assessment Code (RAC): M

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Severity	Probability: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	***M***
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Recommended Protective Clothing & Equipment:
Level D + PPE including hardhat plus nitrile or equivalent gloves for contact with contaminated material + hearing protection during drill rig operation

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
General	Biological hazards (bees, mosquitoes, ticks, Lyme disease, histoplasmosis, poisonous plants, wasps, and snakes)	Level D PPE Insect repellant, as necessary Pant legs tucked into boots or otherwise closed to minimize tick entry and contact with harmful plants Inspect for ticks during the day and at the end of each work day (see Section 10.18) Avoidance of accumulations of bird or bat droppings (see Section 10.17) Protective ointments or specialized cleaners if working in areas with poisonous plants Site-specific instruction in recognition and avoidance of harmful plants and animals	EM 385-1-1 06.D
	Temperature extremes	Administrative controls (see Section 9.0) Cooled (shaded) or warmed break area depending on the season Routine breaks in established break area and unscheduled breaks if needed (see Section 9.0) Chilled water if temperature exceeds 70°F Monitoring – ambient temperature measurements at least twice daily Temperatures greater than 80°F, temperatures less than 30°F, and impermeable clothing require additional controls Site- and season-specific instruction in weather hazards and hazard controls	EM 385-1-1 06.I
	Contact with MEC	On-site training in ordnance recognition for all field personnel. Any investigation work within a MRS will follow MEC avoidance protocol. MEC surveys will be conducted in MRSs by a UXO technician for intrusive work and a UXO technician will accompany investigation teams. Avoid areas or withdraw all personnel from area, as directed by UXO technician, if ordnance or suspected ordnance is discovered. Monitoring - visual surveys for ordnance. Instrument surveys by UXO technicians in MRS. Follow requirements of governing Explosive Safety Submittal, if required, for the project.	EM 385-1-1 33.A

Table 3-2. Activity Hazard Analysis (continued)

Date Prepared: July 1, 2010

Project: RVAAP Facility-Wide Environmental Investigation Activities

Job: Monitoring Well and Borehole Abandonment

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
General	Lifting heavy items	Evaluate the lift and potential pinch points and/or weight strain. Clear area of all unnecessary equipment and slip/trip hazards. Additional help will be obtained by workers or mechanical assistance used on-site if equipment to be moved is unwieldy, has a weight >50 lb, or has to be moved by maneuvering through awkward positioning	EM 385-1-1 14.A
	Severe weather	Locate nearest severe weather shelter/strong structure before beginning fieldwork. Suspend fieldwork if lightning within 10 miles of site or tornado warning issued. Do not work in areas subject to flash flooding	EM 385-1-1 06.I
Drilling to Abandon Wells	General safety hazards (rotating machinery, suspended loads, moving equipment, slips, and falls)	Level D PPE (see Section 6.0) plus hard hat No employees under lifted loads At least two functional kill switches or switches that require continuous force to activate Functional back-up alarm Drill rig manual on-site Only experienced operators Exclusion zone at least equal to mast height	EM 385-1-1 18.H
	Noise	Hearing protection within 7.6 m (25 ft) of rig unless rig-specific monitoring indicates noise exposure of less than 90 dB Monitoring - daily safety inspections	EM 385-1-1 05.C
	Fire (vehicle fuels or subsurface contaminants)	Fuels stored in safety containers labeled/listed by nationally recognized testing laboratory Bonding and grounding during fuel transfers Fuel storage areas marked with “No Smoking” or “Open Flame” signs No ignition sources within 50 ft of fuel storage areas Fire extinguishers in all fuel use areas and inspected monthly Monitoring - combustible gas indicator if buried organic material or other source of flammable gas is suspected	EM 385-1-1 09.A
	Electric shock	Identification and clearance of overhead and underground utilities Monitoring - visual of all work areas 110-V electrical tools connected through GFCI	EM 385-1-1 05.I
	Struck by equipment, cables, drill rods	Level D+ PPE with hard hat. Maintain general work area awareness, separate work area from drill rig and moving parts where possible. Drilling subcontractor will operate per their own health and safety programs, plans, and procedures and will provide trained and qualified personnel. Driller will inspect the rig at the start of each shift. Drill rig will be equipped with at least two kill switches or will be operated by dead man switches. No workers under suspended heavy loads	EM 385-1-1 18.H
	Operating hand tools or power tools	Clean and organized work areas, keeping walkways and working areas clear. 110-V portable tools will be connected through GFCI	EM 385-1-1 13.A

Table 3-2. Activity Hazard Analysis (continued)

Date Prepared: July 1, 2010
Project: RVAAP Facility-Wide Environmental Investigation Activities
Job: Monitoring Well and Borehole Abandonment

Equipment to be Used	Inspection Requirements	Training Requirements
Drill rig Support truck Hand tools, if necessary	Daily safety inspections of operations. Initial and at least weekly inspections of excavation equipment Daily vehicle inspection All tools must be inspected daily and taken out of service if damaged	HAZWOPER 40-hr training and current refresher training Medical clearance Properly trained personnel to operate drill rig Site-specific training including site hazard communication training CPR and first aid training for at least two on-site personnel and at least one person per field team

Table 3-2. Activity Hazard Analysis (continued)

Risk Assessment Code (RAC): L

Date Prepared: July 1, 2010
Project: RVAAP Facility-Wide Environmental Investigation Activities
Job: Vegetation Clearing with Chainsaws, Machetes, and Sling Blades
Prepared By: Colleen A. Lear, LG (9-27-11)
Reviewed By: Todd M. Valli, CIH (9-27-11)

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Severity	Probability: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	***L***	L
Negligible	M	L	L	L	L

Recommended Protective Clothing & Equipment:
Level D + PPE with hardhat and nitrile or equivalent gloves for contact with contaminated material. Faceshield, leg protection, and combination earplugs/earmuffs required when operating chainsaw.

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
General	Biological hazards (bees, mosquitoes, ticks, Lyme disease, histoplasmosis, poisonous plants, wasps, and snakes)	PPE (boots, work clothes – long pants and shirts with sleeves) Insect repellant, as necessary Pant legs tucked into boots or otherwise closed to minimize tick entry or contact with harmful plants Inspect for ticks during the day and at the end of each work day (see Section 10.18) Avoidance of accumulations of bird or bat droppings (see Section 10.17) Protective ointments and/or specialized cleaners if working in areas with poisonous plants Site-specific instruction in recognition and avoidance of harmful plants and/or animals	EM 385-1-1 06.D
	Temperature extremes	Administrative controls (see Section 9.0) Cooled (shaded) or warmed break area depending on the season Routine breaks in established break area and unscheduled breaks if needed (see Section 9.0) Chilled water if temperature exceeds 70°F Monitoring – ambient temperature measurements at least twice daily. Site- and season-specific instruction in weather hazards and hazard controls. Temperatures greater than 80°F, temperatures less than 30°F, and the use of impermeable clothing require additional controls (see Section 9.0)	EM 385-1-1 06.I
	Contact with MEC	On-site training in ordnance recognition for all field personnel. Any investigation work within a MRS will follow MEC avoidance protocol. MEC surveys will be conducted in MRSs by a UXO technician for intrusive work and a UXO technician will accompany investigation teams. Avoid areas or withdraw all personnel from area, as directed by UXO technician, if ordnance or suspected ordnance is discovered. Monitoring - visual surveys for ordnance. Instrument surveys by UXO technicians in MRS. Follow requirements of governing Explosive Safety Submittal, if required, for the project.	EM 385-1-1 33.A

Table 3-2. Activity Hazard Analysis (continued)

Date Prepared: July 1, 2010

Project: RVAAP Facility-Wide Environmental Investigation Activities

Job: Vegetation Clearing with Chainsaws, Machetes, and Sling Blades

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
General	Lifting heavy items	Evaluate potential pinch points and/or weight strain. Clear area of all unnecessary equipment and slip/trip hazards. Additional help will be obtained by workers or mechanical assistance used on-site if equipment to be moved is unwieldy, has a weight >50 lb, or has to be moved by maneuvering through awkward positioning	EM 385-1-1 14.A
	Severe weather	Locate nearest severe weather shelter/strong structure before beginning fieldwork. Suspend fieldwork if lightning within 10 miles of site or tornado warning issued. Do not work in areas subject to flash flooding	EM 385-1-1 06.I
Operating Machinery	General safety hazards (rotating machinery, contact with sharp edges, slips, and falls)	Level D PPE (see Section 6.0) plus hard hat Only experienced operators Personnel operating brush-clearing tools must maintain separation of at least 4.5 m (15 ft) Tools must be inspected daily and taken out of service if damaged Exclusion zone if there is a potential for entry of unauthorized personnel	EM 385-1-1 13.A and F
	Chainsaw kickback and related hazards	Level D protection including safety glasses or goggles, safety shoes, heavy duty work gloves, chainsaw chaps 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 EM 385-1-1, Section 31	EM 385-1-1 13.F
	Noise (chainsaw)	Hearing protection within 7.6 m (25 ft) of operating chainsaw unless equipment-specific monitoring indicates noise exposure of less than 90 dB	EM 385-1-1 05.C
	Fire (fuels)	Fuels stored in safety containers labeled/listed by a nationally recognized testing laboratory Bonding and grounding during fuel transfers Fuel storage areas marked with “No Smoking” or “Open Flame” signs No ignition sources within 50 ft of fuel storage areas Fire extinguishers in all fuel use areas and inspected monthly Gasoline-powered equipment turned off and allowed to cool for at least 5 min prior to fueling	EM 385-1-1 09.A
	Exposure to chemicals	PPE (Level D) plus nitrile or equivalent gloves for contact with contaminated material. Washing face and hands prior to taking anything by mouth. Minimal contact Chemical containers labeled to indicate contents and hazard	EM 385-1-1 06.A and B
	Electric shock	Electrical tools (110 V) must be connected through heavy duty power cord to GFCI	EM 385-1-1 05.I

Table 3-2. Activity Hazard Analysis (continued)

Date Prepared: July 1, 2010
Project: RVAAP Facility-Wide Environmental Investigation Activities
Job: Vegetation Clearing with Chainsaws, Machetes, and Sling Blades

Equipment to be Used	Inspection Requirements	Training Requirements
Chainsaws, Machetes, and Sling Blades	Daily safety inspections of operations All tools must be inspected daily and taken out of service if damaged	HAZWOPER 40-hr training and current refresher training Medical clearance Properly trained personnel to operate tools Site-specific training including site hazard communication training CPR and first aid training for at least two on-site personnel and at least one person per field team

Table 3-2. Activity Hazard Analysis (continued)

Date Prepared: July 1, 2010
Project: RVAAP Facility-Wide Environmental Investigation Activities
Job: IDW Handling
Prepared By: Colleen A. Lear, LG (9-27-11)
Reviewed By: Todd M. Valli, CIH (9-27-11)

Risk Assessment Code (RAC): L

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Severity	Probability: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Recommended Protective Clothing & Equipment:
Level D + PPE and nitrile or equivalent gloves for contact with contaminated material

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
General	Biological hazards (bees, mosquitoes, ticks, Lyme disease, histoplasmosis, poisonous plants, wasps, and snakes)	PPE (boots, work clothes – long pants and shirts with sleeves) Insect repellant, as necessary Pant legs tucked into boots or otherwise closed to minimize tick entry or contact with harmful plants Inspect for ticks during the day and at the end of each work day (see Section 10.18 Avoidance of accumulations of bird or bat droppings (see Section 10.17) Protective ointments and/or specialized cleaners if working in areas with poisonous plants Site-specific instruction in recognition and avoidance of harmful plants and/or animals	EM 385-1-1 06.D
	Temperature extremes	Administrative controls (see Section 9.0) Cooled (shaded) or warmed break area depending on the season Routine breaks in established break area and unscheduled breaks if needed (see Section 9.0) Chilled water if temperature exceeds 70°F Monitoring – ambient temperature measurements at least twice daily Temperatures greater than 80°F, temperatures less than 30°F, and use of impermeable clothing require additional controls Site- and season-specific instruction in weather hazards and hazard controls	EM 385-1-1 06.I
	Contact with MEC	On-site training in ordnance recognition for all field personnel. Any investigation work within a MRS will follow MEC avoidance protocol. MEC surveys will be conducted in MRSs by a UXO technician for intrusive work and a UXO technician will accompany investigation teams. Avoid areas or withdrawal of all personnel from area, as directed by UXO technician, if ordnance or suspected ordnance is discovered. Monitoring - visual surveys for ordnance. Instrument surveys by UXO technicians in MRS. Follow requirements of governing Explosive Safety Submittal, if required, for the project.	EM 385-1-1 33.A

Table 3-2. Activity Hazard Analysis (continued)

Date Prepared: July 1, 2010
Project: RVAAP Facility-Wide Environmental Investigation Activities
Job: IDW Handling

3**JOB STEPS**	**HAZARDS**	**ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS**	**EM 385-1-1 (PARA REF)**
General	Lifting heavy items	Evaluate lifts in advance. Clear area of all unnecessary equipment and slip/trip hazards. Additional help will be obtained by workers or mechanical assistance used on-site if equipment to be moved is unwieldy, has a weight >50 lb, or has to be moved by maneuvering through awkward positioning	EM 385-1-1 14.A
	Severe weather	Locate nearest severe weather shelter/strong structure before beginning fieldwork. Suspend fieldwork if lightning within 10 miles of site or tornado warning issued. Do not work in areas subject to flash flooding	EM 385-1-1 06.I
Operating equipment	General hazards (lifting equipment, manual lifting, and slips)	Level D PPE including heavy duty gloves for materials handling (see Section 6.0) Unnecessary personnel will stay well clear of operating equipment Functional back-up alarm on fork trucks, bobcats, trucks, etc. Documented forklift training for forklift operators Only experienced operators will be allowed to operate equipment No personnel allowed under lifted loads Lifts of over 50 lb will be made with two or more personnel or with lifting equipment Hazardous waste safety training Compliance with EM 385-1-1, Sections 14 and 16	EM 385-1-1 14.A and 18.G.29
	Load stability	All loads will be secured to the forklift with locking strap or equivalent. Whenever possible, loads will be transported without stacking	EM 385-1-1 14.A and 18.G.29
	Visibility	Ensure maximum visibility is available when transporting drums. If vision is obscured, drive in reverse if possible	EM 385-1-1 14.A
	Pinch points	Be aware of all pinch points when handling drums or containers. Heavy duty gloves	EM 385-1-1 14.A
	Musculoskeletal injuries (opening/closing drums)	Plan activities so body is not twisted/contorted. Evaluate potential pinch points. Use proper tools for the task. Lifts of more than 50 lb require mechanical assistance or buddy lift	EM 385-1-1 13.A
	Fire (vehicle fuels and flammable contaminants)	Fuels stored in safety containers labeled/listed by a nationally recognized testing laboratory Bonding and grounding during fuel transfers Fuel storage areas marked with “No Smoking” or “Open Flame” signs Fire extinguishers in all fuel use areas and inspected monthly No ignition sources within 50 ft of areas where flammable materials are stored	EM 385-1-1 09.A
	Noise	Hearing protection within 7.6 m (25 ft) of any noisy drum moving equipment unless equipment-specific monitoring indicates exposures less than 90 dB	EM 385-1-1 05.C
	Electric shock	Identification and clearance of overhead utilities. Maintain at least 10 ft from all electrical wiring, more for high-voltage systems. Electrical tools must be connected through GFCI	EM 385-1-1 05.I
	Exposure to chemicals	PPE (Level D) plus nitrile or equivalent gloves for contact with contaminated material. Washing face and hands prior to taking anything by mouth Minimal contact	EM 385-1-1 06.A and B

Table 3-2. Activity Hazard Analysis (continued)

Date Prepared: July 1, 2010
Project: RVAAP Facility-Wide Environmental Investigation Activities
Job: IDW Handling

Equipment to be Used	Inspection Requirements	Training Requirements
Fork trucks, bobcats, and trucks, if necessary	Daily safety inspections of operations. Initial and at least weekly inspections of equipment	HAZWOPER 40-hr training and current refresher training Medical clearance
Hand tools	All tools must be inspected daily and taken out of service if damaged	Properly trained personnel to operate equipment Site-specific training including site hazard communication training CPR and first aid training for at least two on-site personnel and at least one person per field team

Table 3-2. Activity Hazard Analysis (continued)

Date Prepared: July 1, 2010
Project: RVAAP Facility-Wide Environmental Investigation Activities
Job: Equipment Decontamination (Hot or Pressurized Water Washing, Soap and Water Washing, HCl, and Methanol or Isopropanol Rinse)
Prepared By: Colleen A. Lear, LG (9-27-11)
Reviewed By: Todd M. Valli, CIH (9-27-11)

Risk Assessment Code (RAC): L

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Severity	Probability: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	***L***	L
Negligible	M	L	L	L	L

Recommended Protective Clothing & Equipment:
Level D + PPE and nitrile or equivalent gloves for contact with contaminated material

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
General	Biological hazards (bees, mosquitoes, ticks, Lyme disease, histoplasmosis, poisonous plants, wasps, and snakes)	PPE (boots, work clothes – long pants and shirts with sleeves) Insect repellant, as necessary Pant legs tucked into boots or otherwise closed to minimize tick entry or contact with harmful plants Inspect for ticks during the day and at the end of each work day (see Section 10.18) Avoidance of accumulations of bird or bat droppings (see Section 10.17) Protective ointments and/or specialized cleaners if working in areas with poisonous plants Site-specific instruction in recognition and avoidance of harmful plants and/or animals	EM 385-1-1 06.D
	Temperature extremes	Administrative controls (see Section 9.0) Cooled (shaded) or warmed break area depending on the season Routine breaks in established break area and unscheduled breaks if needed (see Section 9.0) Chilled drinks if temperature exceeds 70°F Monitoring – ambient temperature measurements at least twice daily. Temperatures greater than 80°F, temperatures less than 30°F, and the use of impermeable clothing require additional controls	EM 385-1-1 06.I
	Contact with MEC	On-site training in ordnance recognition for all field personnel. Any investigation work within a MRS will follow MEC avoidance protocol. MEC surveys will be conducted in MRSs by a UXO technician for intrusive work and a UXO technician will accompany investigation teams. Avoid areas or withdraw all personnel from area, as directed by UXO technician, if ordnance or suspected ordnance is discovered. Monitoring - visual surveys for ordnance. Instrument surveys by UXO technicians in MRS. Follow requirements of governing Explosive Safety Submittal, if required, for the project.	EM 385-1-1 33.A
	Electric shock	GFCIs for electrical equipment/tools used in decontamination. Inspect electrical equipment for damaged or missing insulation and remove unsafe equipment from use	EM 385-1-1 11.E

Table 3-2. Activity Hazard Analysis (continued)

Date Prepared: July 1, 2010

Project: RVAAP Facility-Wide Environmental Investigation Activities

Job: Equipment Decontamination (Hot or Pressurized Water Washing, Soap and Water Washing, HCl, and Methanol or Isopropanol Rinse)

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
General	Lifting heavy items	Evaluate potential pinch points and/or weight strain prior to lifting. Clear area of all unnecessary equipment and slip/trip hazards. Additional help will be obtained by workers or mechanical assistance used on-site if equipment to be moved is unwieldy, has a weight >50 lb, or has to be moved by maneuvering through awkward positioning	EM 385-1-1 14.A
	Severe weather	Locate nearest severe weather shelter/strong structure before beginning fieldwork. Suspend fieldwork if lightning within 10 miles of site or tornado warning issued. Do not work in areas subject to flash flooding	EM 385-1-1 06.I
Equipment Decontamination	Hot water, slips, falls, and equipment handling	Level D PPE (see Section 6.0) plus nitrile or PVC gloves Face shield and Saranax or rain suit (when operating steam washer)	EM 385-1-1 13.A
	Noise (spray washer)	Hearing protection when washer is operating unless equipment-specific monitoring indicates that exposure is less than 90 dB	EM 385-1-1 05.C
	Fire (decontamination solvents and gasoline)	Flammable material stored in original containers or in safety containers labeled/listed by a nationally recognized testing laboratory. Fuel storage areas marked with “No Smoking” or “Open Flame” signs Fire extinguisher kept near decontamination area and inspected monthly No ignition sources within 50 ft of areas where flammable materials are stored or used for decontamination	EM 385-1-1 09.A
	Exposure to chemicals	PPE (Level D) plus nitrile or equivalent gloves for contact with contaminated material. Washing face and hands prior to taking anything by mouth. Minimal contact. When using volatile chemicals, work should be performed under conditions of adequate ventilation. Hazard communication training for chemical tools MSDS on-site All chemical containers labeled to indicate contents and hazard Suitable facilities/equipment for flushing eyes of harmful chemicals	EM 385-1-1 06.A and B

Equipment to be Used	Inspection Requirements	Training Requirements
Hand tools	Daily safety inspections of operations. Initial and at least weekly inspections of equipment Daily test of GFCIs All tools must be inspected daily and taken out of service if damaged	HAZWOPER 40-hr training and current refresher training Medical clearance Site-specific training including site hazard communication training CPR and first aid training for at least two on-site personnel and at least one person per field team

APPENDIX C

Forms

RVAAP Contractors to provide this form listing all personnel performing duties on the facility prior to starting work.

All contractor personnel performing Environmental work or entering a AOC MUST provide current HAZWOPER training certificate to Operating Contractor

RVAAP CONTRACTOR ACCESS ROSTER

Date

Contractor: **Environmental Quality Management, Inc.**

No.	Name	In	Out	In	Out	HAZWOPER Training On File			
						Completed by Oper. Contractor			
						Y	N	Initials	Comment
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									

Former Ravenna Army Ammunition Plant

H&S Pre-Event Sign In

Fill all appllicable boxes if you have or have reviewed

Print Name, Company	Signature	Date	40hr	Current 8hr	First Aid/CPR	H&S Plan & briefing	Medical Surveillance	Other
John Doe, ABC Corp		*12/06/11-*	*X*	*X*	*X*	*X*	*X*	

MONITORING LOG

DATE/TIME	SAMPLING LOCATION	INSTRUMENT (Mfg./Model)	MEASURED AGENT	RESULTS ( )	SAMPLED BY	COMMENTS/ ACTIVITIES

CALIBRATION LOG

DATE/TIME	INSTRUMENT (Mfg./Model)	CALIBRATION MATERIAL	STANDARD ( )	RESULTS ( )	COMMENTS/ CALIBRATOR

DAILY SAFETY INSPECTION

PROJECT:_____ Page 1 of 2

N	Y	NA	Item
			Daily safety briefing conducted
			Emergency numbers and route to hospital posted
			SSHP onsite, available to employees, and complete
			Required exposure monitoring conducted and documented
			Monitoring instruments (PID, OVA, CGI) calibrated daily against known standard and documented
			First aid kit available and inspected weekly
			Personnel wearing PPE required by SSHP for field work (at least safety shoes or boots, safety glasses with side shields, and nitrile or similar gloves to handle potentially contaminated material)
			Personnel using buddy system (maintain visual or verbal contact and able to render aid)
			If temperature >70□F: heat stress training conducted, cool fluids available, pulse rates of personnel wearing Tyvek are being monitored, work/rest cycle in SSHP being followed
			If temperature <40□F: cold stress training conducted, controls in SSHP implemented
			Personnel using appropriate biological hazard controls (See SSHP)
			Drill rig operating manual on site
			Drill rigs inspected weekly and documented
			Personnel near drill rig or other overhead hazards wearing hardhats
			Each of two drill rig kill switches tested daily
			Employees excluded from under lifted loads
			Unnecessary personnel excluded from hazardous areas, specifically near drill rigs
			Radius of exclusion zone around drill rig at least equal to mast height
			Personnel wearing hearing protection when within 25 feet of drill rigs, generators, or other noisy equipment
			Containers of flammable liquids closed and labeled properly
			Fully charged fire extinguisher available 25 to 50 feet from flammables storage area and inspected monthly
			Personnel exiting potentially contaminated areas washing hands and face before eating
			Personnel using steam washer wearing faceshield, hearing protection, heavy duty waterproof gloves, Saranax or rainsuit

DAILY SAFETY INSPECTION

PROJECT: _____ Page 2 of 2

			Portable electrical equipment double insulated or plugged to a GFCI
			Electrical wiring covered by insulation or enclosure
			Three wire, UL approved, extension cords used
			Housekeeping adequate (walkways clear of loose, sharp or dangerous objects and trip hazards, work areas clear of objects that might fall on employees)
			Walking/working surfaces safe (not slippery, no unguarded holes, no trip hazards)
			Excavations deeper than 5 feet shored or sloped (if personnel will enter) and in compliance with SSHP
			Moving (rotating) machinery guarded to prevent employee contact
			Fall protection provided for work at elevations greater than 4 feet
			All containers of hazardous material labeled to indicate contents and hazards
			MSDSs for hazardous materials on site
			If work is conducted in areas open to hunting (and during season) high visibility vests and other alerting systems such as lights, noise devices (radios) in use
			15-minute eyewash (accessible and full) within 100 feet of areas where corrosive sample preservatives are poured
			Potable and non-potable water labeled
			Chainsaws have anti kick-back protection, personnel wearing cut resistant gloves, protective chaps
			Visitor access controlled
			Site hazards and controls consistent with SSHP
			Site hazard controls appropriate and sufficient

Actions taken to correct or control any "N" responses

Name Signature Date

DAILY HEALTH AND SAFETY SUMMARY PROJECT NAME: PROJECT NO:
NAME: DATE: M Tu W Th F Sa Su TIME:
TASKS PERFORMED:
OFF-NORMAL EVENTS:

TAILGATE SAFETY MEETING LOG PROJECT NAME: PROJECT NO:		
DATE: M Tu W Th F Sa Su TIME:		
WEATHER:		
WORKING CONDITIONS:		
PPE:		
ITEMS DISCUSSED:		
THE FOLLOWING INDIVIDUALS ATTENDED THE DAILY TAILGATE SAFETY MEETING (SIGNATURES)		

SITE SAFETY AND HEALTH OFFICER

(For Safety Staff only)	REPORT NO.	EROC CODE	UNITED STATES ARMY CORPS OF ENGINEERS ACCIDENT INVESTIGATION REPORT (For Use of this Form See Help Menu and USACE Suppl to AR 385-40)	REQUIREMENT CONTROL SYMBOL: CEEC-S-8(R2)

1. ACCIDENT CLASSIFICATION

PERSONNEL CLASSIFICATION	INJURY/ILLNESS/FATAL	PROPERTY DAMAGE	MOTOR VEHICLE INVOLVED	DIVING
GOVERNMENT ☐ CIVILIAN ☐ MILITARY	☐	☐ FIRE INVOLVED ☐ OTHER	☐	☐
☐ CONTRACTOR	☐	☐ FIRE INVOLVED ☐ OTHER	☐	☐
☐ PUBLIC	☐ FATAL ☐ OTHER		☐	

2. PERSONAL DATA

a. Name (Last, First, MI)	b. AGE	c. SEX ☐ MALE ☐ FEMALE	d. SOCIAL SECURITY NUMBER	e. GRADE

f. JOB SERIES/TITLE	g. DUTY STATUS AT TIME OF ACCIDENT	h. EMPLOYMENT STATUS AT TIME OF ACCIDENT
	☐ ON DUTY ☐ TDY ☐ OFF DUTY	☐ ARMY ACTIVE ☐ ARMY RESERVE ☐ VOLUNTEER ☐ PERMANENT ☐ FOREIGN NATIONAL ☐ SEASONAL ☐ TEMPORARY ☐ STUDENT ☐ OTHER (Specify)

3. GENERAL INFORMATION

a. DATE OF ACCIDENT (month/day/year)	b. TIME OF ACCIDENT (Military time)	c. EXACT LOCATION OF ACCIDENT	d. CONTRACTOR'S NAME
	hrs		(1) PRIME: (2) SUBCONTRACTOR:

e. CONTRACT NUMBER	f. TYPE OF CONTRACT	g. HAZARDOUS/TOXIC WASTE ACTIVITY
☐ CIVIL WORKS ☐ MILITARY ☐ OTHER (Specify)	☐ CONSTRUCTION ☐ SERVICE ☐ A/E ☐ DREDGE ☐ OTHER (Specify)	☐ SUPERFUND ☐ DERP ☐ IRP ☐ OTHER (Specify)

4. CONSTRUCTION ACTIVITIES ONLY *(Fill in line and corresponding code number in box from list - see help menu)*

a. CONSTRUCTION ACTIVITY	(CODE)	b. TYPE OF CONSTRUCTION EQUIPMENT	(CODE)
	#		#

5. INJURY/ILLNESS INFORMATION *(Include name on line and corresponding code number in box for items a, f & g - see help menu)*

a. SEVERITY OF ILLNESS/INJURY	(CODE)	b. ESTIMATED DAYS LOST	c. ESTIMATED DAYS HOSPITALIZED	d. ESTIMATED DAYS RESTRICTED DUTY
	#			

e. BODY PART AFFECTED	(CODE)	g. TYPE AND SOURCE OF INJURY/ILLNESS	(CODE)
PRIMARY	#		
SECONDARY	#	TYPE	#
f. NATURE OF ILLNESS/INJURY	(CODE)	SOURCE	(CODE) #
	#		

6. PUBLIC FATALITY *(Fill in line and correspondence code number in box - see help menu)*

a. ACTIVITY AT TIME OF ACCIDENT	(CODE)	b. PERSONAL FLOATATION DEVICE USED?
	#	☐ YES ☐ NO ☐ N/A

7. MOTOR VEHICLE ACCIDENT

a. TYPE OF VEHICLE	b. TYPE OF COLLISION	c. SEAT BELTS	USED	NOT USED	NOT AVAILABLE
☐☐ PICKUP/VAN ☐☐ AUTOMOBILE ☐☐ TRUCK ☐☐ OTHER (Specify)	☐ SIDE SWIPE ☐ HEAD ON ☐ REAR END ☐ BROADSIDE ☐ ROLL OVER ☐ BACKING ☐ OTHER (Specify)	(1) FRONT SEAT			
		(2) REAR SEAT			

8. PROPERTY/MATERIAL INVOLVED

a. NAME OF ITEM	b. OWNERSHIP	c. $ AMOUNT OF DAMAGE
(1)		
(2)		
(3)		

9. VESSEL/FLOATING PLANT ACCIDENT *(Fill in line and correspondence code number in box from list - see help menu)*

a. TYPE OF VESSEL/FLOATING PLANT	(CODE)	b. TYPE OF COLLISION/MISHAP	(CODE)
	#		#

10. ACCIDENT DESCRIPTION *(Use additional paper, if necessary)*

11. CAUSAL FACTOR(S) *(Read Instruction Before Completing)*

a. (Explain YES answers in item 13)	YES	NO
DESIGN: Was design of facility, workplace or equipment a factor?	☐	☐
INSPECTION/MAINTENANCE: Were inspection & maintenance procedures a factor?	☐	☐
PERSON'S PHYSICAL CONDITION: In your opinion, was the physical condition of the person a factor?	☐	☐
OPERATING PROCEDURES: Were operating procedures a factor?	☐	☐
JOB PRACTICES: Were any job safety/health practices not followed when the accident occurred?	☐	☐
HUMAN FACTORS: Did any human factors such as, size or strength of person, etc., contribute to accident?	☐	☐
ENVIRONMENTAL FACTORS: Did heat, cold, dust, sun, glare, etc., contribute to the accident?	☐	☐

a. *(CONTINUED)*	YES	NO
CHEMICAL AND PHYSICAL AGENT FACTORS: Did exposure to chemical agents, such as dust, fumes, mists, vapors or physical agents, such as, noise, radiation, etc., contribute to accident?	☐	☐
OFFICE FACTORS: Did office setting such as, lifting office furniture, carrying, stooping, etc., contribute to the accident?	☐	☐
SUPPORT FACTORS: Were inappropriate tools/resources provided to properly perform the activity/task?	☐	☐
PERSONAL PROTECTIVE EQUIPMENT: Did the improper selection, use or maintenance of personal protective equipment contribute to the accident?	☐	☐
DRUGS/ALCOHOL: In your opinion, was drugs or alcohol a factor to the accident	☐	☐

b. WAS A WRITTEN JOB/ACTIVITY HAZARD ANALYSIS COMPLETED FOR TASK BEING PERFORMED AT TIME OF ACCIDENT?

☐ YES *(If yes, attach a copy.)* ☐ NO

12. TRAINING

a. WAS PERSON TRAINED TO PERFORM ACTIVITY/TASK?	b. TYPE OF TRAINING.	c. DATE OF MOST RECENT FORMAL TRAINING.
☐ YES ☐ NO	☐ CLASSROOM ☐ ON JOB	(Month) (Day) (Year)

13. FULLY EXPLAIN WHAT ALLOWED OR CAUSED THE ACCIDENT; INCLUDE DIRECT AND INDIRECT CAUSES *(See instruction for definition of direct and indirect causes.) (Use additional paper, if necessary)*

a. DIRECT CAUSE

b. INDIRECT CAUSE(S)

14. ACTION(S) TAKEN, ANTICIPATED OR RECOMMENDED TO ELIMINATE CAUSE(S).

DESCRIBE FULLY:

15. DATES FOR ACTIONS IDENTIFIED IN BLOCK 14.

a. BEGINNING (Month/Day/Year)	b. ANTICIPATED COMPLETION (Month/Day/Year)

c. SIGNATURE AND TITLE OF SUPERVISOR COMPLETING REPORT	d. DATE *(Mo/Da/Yr)*	e. ORGANIZATION IDENTIFIER *(Div, Br, Sect)*	f. OFFICE SYMBOL
CORPS _____			
CONTRACTOR _____			

16. MANAGEMENT REVIEW *(1st)*

a. ☐ CONCUR b. ☐ NON CONCUR c. COMMENTS

SIGNATURE	TITLE	DATE

17. MANAGEMENT REVIEW *(2nd - Chief Operations, Construction, Engineering, etc.)*

a. ☐ CONCUR b. ☐ NON CONCUR c. COMMENTS

SIGNATURE	TITLE	DATE

18. SAFETY AND OCCUPATIONAL HEALTH OFFICE REVIEW

a. ☐ CONCUR b. ☐ NON CONCUR c. ADDITIONAL ACTIONS/COMMENTS

SIGNATURE	TITLE	DATE

19. COMMAND APPROVAL

COMMENTS

COMMANDER SIGNATURE	DATE

*U.S. GOVERNMENT PRINTING OFFICE: 1993-0-791-757

10.	**ACCIDENT DESCRIPTION** *(Continuation)*

13a.	**DIRECT CAUSE** *(Continuation)*

13b.	INDIRECT CAUSES *(Continuation)*

14.	ACTION(S) TAKEN, ANTICIPATED, OR RECOMMENDED TO ELIMINATE CAUSE(S) *(Continuation)*

APPENDIX D

Chemical Concentration Tables

Table 4-2. Summary of Constituents Detected October 2009-July 2010

Area	Well Number	Monitored Zone	Analyte	Oct-09 Level (µg/L)		Jan-10 Level (µg/L)		Jul-10 Level (µg/L)		MCL (µg/L)	Region 9 PRG (µg/L)	Facility-Wide Background (µg/L)
Atlas Scrap Yard	ASYmw-001	Bedrock	Aluminum	46.1	J	50.0	U	NT		200	36000	0
			Barium	*15.7*		*16.6*		NT		2000	2600	256
			bis(2-Ethylhexyl) phthalate	10	U	1.0	J	NT		NS	4.8	*
			Calcium	144000		170000		NT		NS	NS	53100
			Iron	*631*	J	50.0	U	NT		300	11000	1430
			Magnesium	47100		55400		NT		NS	NS	15000
			Manganese	*1040*		*1140*		NT		50	880	1340
			Nickel	2.8	J	10.0	U	NT		NS	730	83.4
			Potassium	*1190*		*1120*		NT		NS	NS	5770
			Sodium	*6340*		*7020*		NT		NS	NS	51400
			Zinc	*7.6*	*JB*	10.0	U	NT		5000	11000	52.3
Atlas Scrap Yard	ASYmw-002	Bedrock	Acetone	1.7	JB	10.0	UJ	NT		NS	5500	*
			Aluminum	50.0	U	67.3		NT		200	36000	0
			Barium	*12.3*		*14.7*		NT		2000	2600	256
			bis(2-Ethylhexyl) phthalate	10	U	0.97	J	NT		NS	4.8	*
			Calcium	94800		96800		NT		NS	NS	53100
			Magnesium	19800		20000		NT		NS	NS	15000
			Manganese	10	U	4	J	NT		50	880	1340
			Sodium	*2260*		*2130*		NT		NS	NS	51400
			Zinc	*3.3*	*JB*	10.0	U	NT		5000	11000	52.3
Atlas Scrap Yard	ASYmw-003	Bedrock	Acetone	2.1	JB	10.0	UJ	NT		NS	5500	*
			Arsenic	8.6		5.0	U	NT		10	0.045	0
			Barium	*15.4*		*18.9*		NT		2000	2600	256
			Calcium	196000		175000		NT		NS	NS	53100
			Iron	2580		50.0	U	NT		300	11000	1430
			Magnesium	68900		55800		NT		NS	NS	15000
			Manganese	*529*		*45*		NT		50	880	1340
			Potassium	*1730*		*1070*		NT		NS	NS	5770
			Sodium	*21700*		*29000*		NT		NS	NS	51400
			Zinc	*2.4*	*JB*	10.0	U	NT		5000	11000	52.3
Atlas Scrap Yard	ASYmw-004	Bedrock	Acetone	10	U	1.2	JB	NT		NS	5500	*
			Arsenic	28		23.2		NT		10	0.045	0
			Barium	*12.7*		*12.7*		NT		2000	2600	256
			bis(2-Ethylhexyl) phthalate	1.3	J	0.9	J	NT		NS	4.8	*
			Calcium	163000		157000		NT		NS	NS	53100
			Iron	1940	J	1490	J	NT		300	11000	1430
			Magnesium	81600		79600		NT		NS	NS	15000
			Manganese	*201*		*211*		NT		50	880	1340
			Potassium	*3480*		*2850*		NT		NS	NS	5770
			Sodium	52300		51600		NT		NS	NS	51400
			Zinc	*7*	*JB*	10.0	U	NT		5000	11000	52.3
Atlas Scrap Yard	ASYmw-005	Bedrock	2,6-Dinitrotoluene	5.0	U	0.06	J	NT		NS	36	*
			Acetone	1.5	JB	10	UJ	NT		NS	5500	*
			Aluminum	43.6	J	50.0	U	NT		200	36000	0
			Barium	*32.7*		*28.5*		NT		2000	2600	256
			beta-BHC	0.017	J	0.030	UJ	NT		NS	0.037	*
			bis(2-Ethylhexyl) phthalate	10	U	1	J	NT		NS	4.8	*
			Calcium	153000		146000		NT		NS	NS	53100
			Cobalt	3.4	J	5.0	U	NT		NS	730	0
			Iron	*289*		50.0	U	NT		300	11000	1430
			Magnesium	45100		42600		NT		NS	NS	15000
			Manganese	*618*		*207*		NT		50	880	1340
			Nickel	*2.2*	*J*	10.0	U	NT		NS	730	83.4
			Potassium	*2580*		*1740*		NT		NS	NS	5770
			Sodium	*42100*		*32300*		NT		NS	NS	51400

Area	Well Number	Monitored Zone	Analyte	Oct-09 Level (µg/L)		Jan-10 Level (µg/L)		Jul-10 Level (µg/L)		MCL (µg/L)	Region 9 PRG (µg/L)	Facility-Wide Background (µg/L)
Atlas Scrap Yard	ASYmw-006	Bedrock	1,3,5-Trinitrobenzene	0.099	U	0.032	JB	NT		NS	1100	*
			Acetone	2.3	JB	10	UJ	NT		NS	5500	*
			Arsenic	17		16.1		NT		10	0.045	0
			Barium	*14.3*		*14.8*		NT		2000	2600	256
			bis(2-Ethylhexyl) phthalate	1.6	J	1.1	J	NT		NS	4.8	*
			Calcium	113000		116000		NT		NS	NS	53100
			Iron	*1360*		*1120*	*J*	NT		300	11000	1430
			Magnesium	71500		72300		NT		NS	NS	15000
			Manganese	*177*		*169*		NT		50	880	1340
			Potassium	*3240*		*2860*		NT		NS	NS	5770
			Sodium	*38000*		*39900*		NT		NS	NS	51400
			Zinc	*3*	*JB*	10.0	U	NT		5000	11000	52.3
Atlas Scrap Yard	ASYmw-007	Unconsolidated	Barium	*20.6*		*18.5*		NT		2000	2600	82.1
			Calcium	138000		126000		NT		NS	NS	115000
			Magnesium	54500		47300		NT		NS	NS	43300
			Manganese	*205*		*188*		NT		50	880	1020
			Potassium	*1450*		*1170*		NT		NS	NS	2890
			Sodium	*36400*		*33500*		NT		NS	NS	45700
			Zinc	*4.1*	*JB*	10.0	U	NT		5000	11000	60.9
Atlas Scrap Yard	ASYmw-008	Unconsolidated	1,3,5-Trinitrobenzene	0.098	JB	0.033	JB	NT		NS	1100	*
			3-Nitrotoluene	0.49	U	0.16	J	NT		NS	120	*
			Acetone	1.2	JB	10	UJ	NT		NS	5500	*
			Aluminum	6300		1160	J	NT		200	36000	0
			Arsenic	26.4		*10.3*	J	NT		10	0.045	11.7
			Barium	*45.3*		*18.8*		NT		2000	2600	82.1
			Calcium	208000		167000		NT		NS	NS	115000
			Chromium	9.3		*2.1*	*J*	NT		100	110	7.3
			Cobalt	8.7		1.6	UJ	NT		NS	730	0
			Copper	15		5.0	U	NT		1300	1500	0
			Iron	17000	J	3210	J	NT		300	11000	279
			Lead	5.8		3.0	U	NT		15	NS	0
			Magnesium	97900		78100		NT		NS	NS	43300
			Manganese	*412*		*64.7*		NT		50	880	1020
			Nickel	16.9	B	4.4	J	NT		NS	730	0
			Phenol	1.0	U	1.1		NT		NS	11000	*
			Potassium	5410		3660		NT		NS	NS	2890
			Sodium	*36300*		*31000*		NT		NS	NS	45700
			Vanadium	10.7		10.0	U	NT		NS	36	0
			Zinc	*36.5*	*J*	*11.5*	*B*	NT		5000	11000	60.9
Atlas Scrap Yard	ASYmw-009	Bedrock	1,3,5-Trinitrobenzene	0.10	U	0.033	JB	NT		NS	1100	*
			Aluminum	142		496		NT		200	36000	0
			Barium	*26.9*		*27.1*		NT		2000	2600	256
			bis(2-Ethylhexyl) phthalate	10	U	0.95	J	NT		NS	4.8	*
			Calcium	196000		188000		NT		NS	NS	53100
			Iron	*323*	*J*	*811*	*J*	NT		300	11000	1430
			Magnesium	72700		69900		NT		NS	NS	15000
			Manganese	*607*		*624*		NT		50	880	1340
			Potassium	*1560*		*1500*		NT		NS	NS	5770
			Sodium	*23400*		*22500*		NT		NS	NS	51400
			Zinc	*3.5*	*JB*	*5*	*JB*	NT		5000	11000	52.3

Area	Well Number	Monitored Zone	Analyte	Oct-09 Level (µg/L)		Jan-10 Level (µg/L)		Jul-10 Level (µg/L)		MCL (µg/L)	Region 9 PRG (µg/L)	Facility-Wide Background (µg/L)
Atlas Scrap Yard	ASYmw-010	Unconsolidated	1,3,5-Trinitrobenzene	0.1	U	0.044	JB	NT		NS	1100	*
			Aluminum	50.0	U	1160		NT		200	36000	0
			Arsenic	49.8		148		NT		10	0.045	11.7
			Barium	*56.1*		*56.4*		NT		2000	2600	82.1
			beta-BHC	0.014	J	0.030	UJ	NT		NS	0.037	*
			bis(2-Ethylhexyl) phthalate	10.0	U	1.2	J	NT		NS	4.8	*
			Calcium	119000		*94400*		NT		NS	NS	115000
			Iron	2530		6760	J	NT		300	11000	279
			Magnesium	86700		80300		NT		NS	NS	43300
			Manganese	*139*		*96.2*		NT		50	880	1020
			Nickel	10.0	U	2.6	J	NT		NS	730	0
			Potassium	2730		2760		NT		NS	NS	2890
			Sodium	45900		*43800*		NT		NS	NS	45700
			Zinc	*2.6*	*JB*	*12.3*	*B*	NT		5000	11000	60.9
Demolition Area 2	DETmw-003	Unconsolidated	1,3,5-Trinitrobenzene	0.099	JB	NT		NT		NS	1100	*
			Arsenic	*11.5*		NT		NT		10	0.045	11.7
			Barium	*48.5*		NT		NT		2000	2600	82.1
			Calcium	*87900*		NT		NT		NS	NS	115000
			Iron	1440		NT		NT		300	11000	279
			Magnesium	*32800*		NT		NT		NS	NS	43300
			Manganese	*266*		NT		NT		50	880	1020
			Potassium	*1780*		NT		NT		NS	NS	2890
			Sodium	*12000*		NT		NT		NS	NS	45700
			Zinc	*5.4*	*JB*	NT		NT		5000	11000	60.9
Demolition Area 2	DETmw-004	Unconsolidated	Acetone	2.2	JB	NT		NT		NS	5500	*
			Barium	*63.4*		NT		NT		2000	2600	82.1
			bis(2-Ethylhexyl) phthalate	0.9	J	NT		NT		NS	4.8	*
			Calcium	145000		NT		NT		NS	NS	115000
			HMX	1.5		NT		NT		NS	1800	*
			Magnesium	*28600*		NT		NT		NS	NS	43300
			Manganese	*21.9*		NT		NT		50	880	1020
			Potassium	*1820*		NT		NT		NS	NS	2890
			RDX	0.43	J	NT		NT		NS	0.61	*
			Sodium	*3100*		NT		NT		NS	NS	45700
			Zinc	*10.6*	*B*	NT		NT		5000	11000	60.9
Load Line 10	LL10mw-001	Bedrock	Aluminum	53.7		NT		NT		200	36000	0
			Calcium	66100		NT		NT		NS	NS	53100
			Carbon tetrachloride	1.6	J	NT		NT		5	0.17	*
			Chloroform	0.26	J	NT		NT		NS	0.17	*
			Iron	*133*		NT		NT		300	11000	1430
			Magnesium	23800		NT		NT		NS	NS	15000
			Manganese	*2.6*	*J*	NT		NT		50	880	1340
			Potassium	*1030*		NT		NT		NS	NS	5770
			RDX	0.078	J	NT		NT		NS	0.61	*
			Sodium	*8320*		NT		NT		NS	NS	51400
			Zinc	*3*	*JB*	NT		NT		5000	11000	52.3
Load Line 10	LL10mw-002	Bedrock	Barium	*17.3*		NT		NT		2000	2600	256
			bis(2-Ethylhexyl) phthalate	8.1	J	NT		NT		NS	4.8	*
			Calcium	*36300*		NT		NT		NS	NS	53100
			Magnesium	*10700*		NT		NT		NS	NS	15000
			Potassium	*910*	*J*	NT		NT		NS	NS	5770
			Sodium	*6320*		NT		NT		NS	NS	51400

Area	Well Number	Monitored Zone	Analyte	Oct-09 Level (µg/L)		Jan-10 Level (µg/L)		Jul-10 Level (µg/L)		MCL (µg/L)	Region 9 PRG (µg/L)	Facility-Wide Background (µg/L)
Load Line 10	LL10mw-003	Bedrock	Calcium	*51200*		NT		NT		NS	NS	53100
			Carbon tetrachloride	2.8		NT		NT		5	0.17	*
			Chloroform	0.26	J	NT		NT		NS	0.17	*
			Magnesium	*14500*		NT		NT		NS	NS	15000
			Nitrocellulose	0.13	JB	NT		NT		NS	4.8	*
			Sodium	*10300*		NT		NT		NS	NS	51400
Load Line 10	LL10mw-004	Bedrock	Barium	*3.1*	*J*	NT		NT		2000	2600	256
			Calcium	68400		NT		NT		NS	NS	53100
			Magnesium	20200		NT		NT		NS	NS	15000
			Manganese	*24.4*		NT		NT		50	880	1340
			Sodium	*4210*		NT		NT		NS	NS	51400
			Zinc	*4.2*	*JB*	NT		NT		5000	11000	52.3
Load Line 10	LL10mw-005	Bedrock	Barium	*3.3*	*J*	NT		NT		2000	2600	256
			Calcium	62200		NT		NT		NS	NS	53100
			Magnesium	*14500*		NT		NT		NS	NS	15000
			Manganese	*15.8*		NT		NT		50	880	1340
			Sodium	*3400*		NT		NT		NS	NS	51400
			Zinc	*2.5*	*JB*	NT		NT		5000	11000	52.3
Load Line 10	LL10mw-006	Unconsolidated	Barium	*12.2*		NT		NT		2000	2600	82.1
			Calcium	17800		NT		NT		NS	NS	115000
			Magnesium	*6980*		NT		NT		NS	NS	43300
			Manganese	*4.5*	*J*	NT		NT		50	880	1020
			Potassium	*1020*		NT		NT		NS	NS	2890
			Sodium	*2730*		NT		NT		NS	NS	45700
			Zinc	*3.9*	*JB*	NT		NT		5000	11000	60.9
Load Line 11	LL11mw-001	Unconsolidated	Barium	*76.1*		NT		NT		2000	2600	82.1
			bis(2-Ethylhexyl) phthalate	350		NT		NT		NS	4.8	*
			Calcium	88500		NT		NT		NS	NS	115000
			Magnesium	*29000*		NT		NT		NS	NS	43300
			Manganese	*960*		NT		NT		50	880	1020
			Potassium	*954*	*J*	NT		NT		NS	NS	2890
			Sodium	*12400*		NT		NT		NS	NS	45700
			Zinc	*2.9*	*JB*	NT		NT		5000	11000	60.9
Load Line 11	LL11mw-003	Unconsolidated	Barium	*29.9*		NT		NT		2000	2600	82.1
			beta-BHC	0.012	J	NT		NT		NS	0.037	*
			bis(2-Ethylhexyl) phthalate	8.6	J	NT		NT		NS	4.8	*
			Calcium	*101000*		NT		NT		NS	NS	115000
			Iron	*143*	*J*	NT		NT		300	11000	279
			Magnesium	*30500*		NT		NT		NS	NS	43300
			Manganese	*498*		NT		NT		50	880	1020
			Potassium	*981*	*J*	NT		NT		NS	NS	2890
			Sodium	*10800*		NT		NT		NS	NS	45700
			Zinc	*5.6*	*JB*	NT		NT		5000	11000	60.9
Load Line 11	LL11mw-004	Unconsolidated	Barium	*53.3*		NT		NT		2000	2600	82.1
			bis(2-Ethylhexyl) phthalate	1.8	J	NT		NT		NS	4.8	*
			Cadmium	1.7		NT		NT		5	18	0
			Calcium	*78900*		NT		NT		NS	NS	115000
			Magnesium	*25700*		NT		NT		NS	NS	43300
			Manganese	*272*		NT		NT		50	880	1020
			Potassium	*1100*		NT		NT		NS	NS	2890
			Sodium	*12700*		NT		NT		NS	NS	45700

Area	Well Number	Monitored Zone	Analyte	Oct-09 Level (µg/L)		Jan-10 Level (µg/L)		Jul-10 Level (µg/L)		MCL (µg/L)	Region 9 PRG (µg/L)	Facility-Wide Background (µg/L)
Load Line 11	LL11mw-005	Unconsolidated	Aluminum	102		NT		NT		200	36000	0
			Barium	*28.1*		NT		NT		2000	2600	82.1
			bis(2-Ethylhexyl) phthalate	1.5	J	NT		NT		NS	4.8	*
			Cadmium	0.26	J	NT		NT		5	18	0
			Calcium	*8580*		NT		NT		NS	NS	115000
			Cobalt	1.5	J	NT		NT		NS	730	0
			Iron	*225*		NT		NT		300	11000	279
			Magnesium	*4510*		NT		NT		NS	NS	43300
			Manganese	*43.8*		NT		NT		50	880	1020
			Nickel	12.2		NT		NT		NS	730	0
			Sodium	*3030*		NT		NT		NS	NS	45700
			Zinc	*22.4*	*B*	NT		NT		5000	11000	60.9
Load Line 11	LL11mw-006	Unconsolidated	Barium	*28.3*		NT		NT		2000	2600	82.1
			Calcium	*81100*		NT		NT		NS	NS	115000
			Magnesium	*17300*		NT		NT		NS	NS	43300
			Potassium	*860*	*J*	NT		NT		NS	NS	2890
			Selenium	5.3		NT		NT		50	180	0
			Sodium	*7890*		NT		NT		NS	NS	45700
Load Line 11	LL11mw-008	Unconsolidated	Aluminum	25.3	J	NT		NT		200	36000	0
			Barium	*49.4*		NT		NT		2000	2600	82.1
			bis(2-Ethylhexyl) phthalate	0.83	J	NT		NT		NS	4.8	*
			Calcium	115000		NT		NT		NS	NS	115000
			Iron	*26.6*	*J*	NT		NT		300	11000	279
			Magnesium	*33800*		NT		NT		NS	NS	43300
			Manganese	*29.4*		NT		NT		50	880	1020
			Potassium	*1130*		NT		NT		NS	NS	2890
			Sodium	*4920*		NT		NT		NS	NS	45700
			Zinc	*3.7*	*JB*	NT		NT		5000	11000	60.9
Load Line 11	LL11mw-009	Unconsolidated	1,3,5-Trinitrobenzene	0.098	U	0.036	JB	NT		NS	1100	*
			2,6-Dinitrotoluene	0.098	JB	0.1	U	NT		NS	36	*
			Aluminum	41.7	J	26		NT		200	36000	0
			Barium	*66.3*		*76.4*		NT		2000	2600	82.1
			bis(2-Ethylhexyl) phthalate	0.95	J	10		NT		NS	4.8	*
			Calcium	*82400*		*85400*		NT		NS	NS	115000
			Magnesium	*28500*		*27800*		NT		NS	NS	43300
			Manganese	*706*		*856*		NT		50	880	1020
			Nickel	2.3	J	10.0	U	NT		NS	730	0
			Nitrobenzene	0.098	U	0.064	J	NT		NS	3.4	*
			Potassium	*956*	*J*	*905*	*J*	NT		NS	NS	2890
			Sodium	*12800*		*11600*		NT		NS	NS	45700
			Tetrachloroethene	4.1		3.8		NT		5	0.1	*
			Zinc	*2.9*	*JB*	10.0	U	NT		5000	11000	60.9
Load Line 11	LL11mw-010	Unconsolidated	Aluminum	26.3	J	NT		NT		200	36000	0
			Barium	*66.3*		NT		NT		2000	2600	82.1
			bis(2-Ethylhexyl) phthalate	0.88	J	NT		NT		NS	4.8	*
			Calcium	*80200*		NT		NT		NS	NS	115000
			Chromium	*1.7*	*J*	NT		NT		100	110	7.3
			Iron	*249*	*J*	NT		NT		300	11000	279
			Magnesium	*31300*		NT		NT		NS	NS	43300
			Manganese	*430*		NT		NT		50	880	1020
			Potassium	*1380*		NT		NT		NS	NS	2890
			Sodium	*27600*		NT		NT		NS	NS	45700

Area	Well Number	Monitored Zone	Analyte	Oct-09 Level (µg/L)		Jan-10 Level (µg/L)		Jul-10 Level (µg/L)		MCL (µg/L)	Region 9 PRG (µg/L)	Facility-Wide Background (µg/L)
Load Line 6	LL6mw-005	Bedrock	1,3,5-Trinitrobenzene	0.039	J	NT		NT		NS	1100	*
			Arsenic	14.4		NT		NT		10	0.045	0
			Barium	*64.2*		NT		NT		2000	2600	256
			Calcium	78300		NT		NT		NS	NS	53100
			Iron	*946*	*J*	NT		NT		300	11000	1430
			Magnesium	24400		NT		NT		NS	NS	15000
			Manganese	*501*		NT		NT		50	880	1340
			Potassium	*1040*		NT		NT		NS	NS	5770
			Sodium	*8640*		NT		NT		NS	NS	51400
Load Line 6	LL6mw-006	Unconsolidated	1,3,5-Trinitrobenzene	0.037	J	NT		NT		NS	1100	*
			2,6-Dinitrotoluene	0.09	J	NT		NT		NS	36	*
			Aluminum	180	J	NT		NT		200	36000	0
			Barium	*26.5*		NT		NT		2000	2600	82.1
			Cadmium	0.47	J	NT		NT		5	18	0
			Calcium	*73100*		NT		NT		NS	NS	115000
			Iron	363	J	NT		NT		300	11000	279
			Magnesium	*29100*		NT		NT		NS	NS	43300
			Manganese	*72.4*		NT		NT		50	880	1020
			Potassium	*1850*		NT		NT		NS	NS	2890
			Sodium	*8220*		NT		NT		NS	NS	45700
			Zinc	*3.9*	*JB*	NT		NT		5000	11000	60.9
Load Line 6	LL6mw-007	Bedrock	Aluminum	117	J	NT		NT		200	36000	0
			Barium	*15.4*		NT		NT		2000	2600	256
			bis(2-Ethylhexyl) phthalate	1	J	NT		NT		NS	4.8	*
			Cadmium	0.46	J	NT		NT		5	18	0
			Calcium	55400		NT		NT		NS	NS	53100
			Iron	*185*	*J*	NT		NT		300	11000	1430
			Magnesium	22700		NT		NT		NS	NS	15000
			Manganese	*394*		NT		NT		50	880	1340
			Potassium	*869*	*J*	NT		NT		NS	NS	5770
			Sodium	*7790*		NT		NT		NS	NS	51400
			Zinc	*2.4*	*JB*	NT		NT		5000	11000	52.3
Load Line 7	LL7mw-001	Bedrock	1,1,1-Trichloroethane	11		NT		NT		NS	3200	*
			1,1-Dichloroethane	3.3		NT		NT		NS	810	*
			1,1-Dichloroethene (total)	8.4		NT		NT		7	340	*
			Barium	*22.1*		NT		NT		2000	2600	256
			Calcium	*33600*		NT		NT		NS	NS	53100
			Cobalt	7		NT		NT		NS	730	0
			Iron	8360	J	NT		NT		300	11000	1430
			Magnesium	*11600*		NT		NT		NS	NS	15000
			Manganese	*460*		NT		NT		50	880	1340
			Nickel	*9.6*	*J*	NT		NT		NS	730	83.4
			Potassium	*1020*		NT		NT		NS	NS	5770
			Sodium	*5800*		NT		NT		NS	NS	51400
			Zinc	*50.2*	*J*	NT		NT		5000	11000	52.3
Load Line 7	LL7mw-002	Bedrock	Barium	*51.7*		NT		NT		2000	2600	256
			Cadmium	0.4	J	NT		NT		5	18	0
			Calcium	*37100*		NT		NT		NS	NS	53100
			Magnesium	*7830*		NT		NT		NS	NS	15000
			Manganese	*311*		NT		NT		50	880	1340
			Nickel	*8.4*	*J*	NT		NT		NS	730	83.4
			Potassium	*1830*		NT		NT		NS	NS	5770
			Sodium	*2590*		NT		NT		NS	NS	51400
			Zinc	*8*	*JB*	NT		NT		5000	11000	52.3

Area	Well Number	Monitored Zone	Analyte	Oct-09 Level (µg/L)		Jan-10 Level (µg/L)		Jul-10 Level (µg/L)		MCL (µg/L)	Region 9 PRG (µg/L)	Facility-Wide Background (µg/L)
Load Line 7	LL7mw-003	Bedrock	1,3,5-Trinitrobenzene	0.042	J	NT		NT		NS	1100	*
			Barium	*48.1*		NT		NT		2000	2600	256
			bis(2-Ethylhexyl) phthalate	10		NT		NT		NS	4.8	*
			Calcium	*15800*	J	NT		NT		NS	NS	53100
			Cobalt	4.6	J	NT		NT		NS	730	0
			Iron	17200		NT		NT		300	11000	1430
			Magnesium	*5700*		NT		NT		NS	NS	15000
			Manganese	*1340*		NT		NT		50	880	1340
			Nickel	*5.8*	J	NT		NT		NS	730	83.4
			Nitrobenzene	0.13	J	NT		NT		NS	3.4	*
			Potassium	*1160*		NT		NT		NS	NS	5770
			Sodium	*5240*		NT		NT		NS	NS	51400
			Thallium	0.41	JB	NT		NT		2	2.4	0
			Zinc	*14.3*	*B*	NT		NT		5000	11000	52.3
Load Line 7	LL7mw-004	Bedrock	1,3,5-Trinitrobenzene	0.035	J	NT		NT		NS	1100	*
			Barium	*40.5*		NT		NT		2000	2600	256
			bis(2-Ethylhexyl) phthalate	2.3	J	NT		NT		NS	4.8	*
			Calcium	*8400*		NT		NT		NS	NS	53100
			Cobalt	5.5		NT		NT		NS	730	0
			HMX	0.048	J	NT		NT		NS	1800	*
			Iron	*17000*	*J*	NT		NT		300	11000	1430
			Magnesium	*6260*		NT		NT		NS	NS	15000
			Manganese	*1230*		NT		NT		50	880	1340
			Nickel	*5.3*	*J*	NT		NT		NS	730	83.4
			Potassium	*1390*		NT		NT		NS	NS	5770
			Sodium	*15100*		NT		NT		NS	NS	51400
			Zinc	*14.4*	*B*	NT		NT		5000	11000	52.3
Load Line 7	LL7mw-005	Bedrock	1,3,5-Trinitrobenzene	0.032	J	NT		NT		NS	1100	*
			Aluminum	81.1	J	NT		NT		200	36000	0
			Barium	*150*		NT		NT		2000	2600	256
			beta-BHC	0.014	J	NT		NT		NS	0.037	*
			bis(2-Ethylhexyl) phthalate	1.9	J	NT		NT		NS	4.8	*
			Calcium	*9040*		NT		NT		NS	NS	53100
			Cobalt	8.2		NT		NT		NS	730	0
			Iron	*1290*	*J*	NT		NT		300	11000	1430
			Magnesium	*5150*		NT		NT		NS	NS	15000
			Manganese	2320		NT		NT		50	880	1340
			Nickel	*10.6*		NT		NT		NS	730	83.4
			Nitrobenzene	0.051	J	NT		NT		NS	3.4	*
			Potassium	*1120*		NT		NT		NS	NS	5770
			Sodium	*2070*		NT		NT		NS	NS	51400
			Zinc	*8.9*	*JB*	NT		NT		5000	11000	52.3
Load Line 7	LL7mw-006	Bedrock	1,3,5-Trinitrobenzene	0.039	J	NT		NT		NS	1100	*
			Barium	*15.5*		NT		NT		2000	2600	256
			bis(2-Ethylhexyl) phthalate	2.2	J	NT		NT		NS	4.8	*
			Cadmium	0.3	J	NT		NT		5	18	0
			Calcium	*8010*		NT		NT		NS	NS	53100
			HMX	0.085	J	NT		NT		NS	1800	*
			Iron	2880	J	NT		NT		300	11000	1430
			Magnesium	*5070*		NT		NT		NS	NS	15000
			Manganese	*1240*		NT		NT		50	880	1340
			Nickel	*7.3*	*J*	NT		NT		NS	730	83.4
			Potassium	*902*	*J*	NT		NT		NS	NS	5770
			RDX	0.78	J	NT		NT		NS	0.61	*
			Sodium	*7650*		NT		NT		NS	NS	51400
			Zinc	*12.6*	*B*	NT		NT		5000	11000	52.3

Area	Well Number	Monitored Zone	Analyte	Oct-09 Level (µg/L)		Jan-10 Level (µg/L)		Jul-10 Level (µg/L)		MCL (µg/L)	Region 9 PRG (µg/L)	Facility-Wide Background (µg/L)
Load Line 8	LL8mw-001	Unconsolidated	Aluminum	65		NT		NT		200	36000	0
			Barium	*33.6*		NT		NT		2000	2600	82.1
			Calcium	*81900*		NT		NT		NS	NS	115000
			Iron	*942*		NT		NT		300	11000	279
			Magnesium	43600		NT		NT		NS	NS	43300
			Manganese	*125*		NT		NT		50	880	1020
			Potassium	*1670*		NT		NT		NS	NS	2890
			Sodium	*29100*		NT		NT		NS	NS	45700
Load Line 8	LL8mw-002	Unconsolidated	Arsenic	*6.6*	*J*	NT		NT		10	0.045	11.7
			Barium	*38.9*		NT		NT		2000	2600	82.1
			Calcium	*95300*		NT		NT		NS	NS	115000
			Iron	3850		NT		NT		300	11000	279
			Magnesium	*38600*		NT		NT		NS	NS	43300
			Manganese	*333*		NT		NT		50	880	1020
			Potassium	*2070*		NT		NT		NS	NS	2890
			Sodium	*29400*		NT		NT		NS	NS	45700
Load Line 8	LL8mw-003	Unconsolidated	Aluminum	47.5	J	NT		NT		200	36000	0
			Arsenic	*4.1*	*J*	NT		NT		10	0.045	11.7
			Barium	*24.3*		NT		NT		2000	2600	82.1
			Calcium	129000		NT		NT		NS	NS	115000
			Iron	929		NT		NT		300	11000	279
			Magnesium	46000		NT		NT		NS	NS	43300
			Manganese	*677*		NT		NT		50	880	1020
			Nitrocellulose	0.15	JB	NT		NT		NS	4.8	*
			Potassium	*2520*		NT		NT		NS	NS	2890
			Sodium	*45400*		NT		NT		NS	NS	45700
Load Line 8	LL8mw-004	Unconsolidated	Aluminum	23.3	J	NT		NT		200	36000	0
			Arsenic	*3.3*	*J*	NT		NT		10	0.045	11.7
			Barium	*10.7*		NT		NT		2000	2600	82.1
			Calcium	*88900*		NT		NT		NS	NS	115000
			Chromium	*1.4*	*J*	NT		NT		100	110	7.3
			Magnesium	43500		NT		NT		NS	NS	43300
			Manganese	*31.5*		NT		NT		50	880	1020
			Potassium	*1290*		NT		NT		NS	NS	2890
			Sodium	*23300*		NT		NT		NS	NS	45700
Load Line 8	LL8mw-005	Bedrock	Aluminum	170		NT		NT		200	36000	0
			Barium	*11.7*		NT		NT		2000	2600	256
			bis(2-Ethylhexyl) phthalate	2.8	J	NT		NT		NS	4.8	*
			Calcium	64400		NT		NT		NS	NS	53100
			Iron	*1180*		NT		NT		300	11000	1430
			Magnesium	21600		NT		NT		NS	NS	15000
			Manganese	2690		NT		NT		50	880	1340
			Nickel	*2.6*	*J*	NT		NT		NS	730	83.4
			Sodium	*11000*		NT		NT		NS	NS	51400
			Zinc	*3*	*JB*	NT		NT		5000	11000	52.3
Load Line 8	LL8mw-006	Bedrock	Barium	*15.5*		NT		NT		2000	2600	256
			Calcium	70700		NT		NT		NS	NS	53100
			Magnesium	28800		NT		NT		NS	NS	15000
			Nitrocellulose	0.13	JB	NT		NT		NS	4.8	*
			Potassium	*1620*		NT		NT		NS	NS	5770
			Sodium	*4760*		NT		NT		NS	NS	51400

Area	Well Number	Monitored Zone	Analyte	Oct-09 Level (µg/L)		Jan-10 Level (µg/L)		Jul-10 Level (µg/L)		MCL (µg/L)	Region 9 PRG (µg/L)	Facility-Wide Background (µg/L)
Load Line 9	LL9mw-001	Bedrock	Acetone	1.7	JB	NT		NT		NS	5500	*
			Barium	*8.1*	*J*	NT		NT		2000	2600	256
			bis(2-Ethylhexyl) phthalate	5.3	J	NT		NT		NS	4.8	*
			Calcium	*37100*		NT		NT		NS	NS	53100
			Magnesium	*11300*		NT		NT		NS	NS	15000
			Manganese	*3.6*	*J*	NT		NT		50	880	1340
			Potassium	*888*	*J*	NT		NT		NS	NS	5770
			Sodium	*2940*		NT		NT		NS	NS	51400
Load Line 9	LL9mw-002	Bedrock	Aluminum	38	J	NT		NT		200	36000	0
			Barium	*3.3*	*J*	NT		NT		2000	2600	256
			bis(2-Ethylhexyl) phthalate	5.6	J	NT		NT		NS	4.8	*
			Calcium	*17400*		NT		NT		NS	NS	53100
			Magnesium	*7520*		NT		NT		NS	NS	15000
			Manganese	*9.2*	*J*	NT		NT		50	880	1340
			Nickel	*5.5*	*J*	NT		NT		NS	730	83.4
			Potassium	*1300*		NT		NT		NS	NS	5770
			Sodium	*1940*		NT		NT		NS	NS	51400
			Zinc	*4.5*	*JB*	NT		NT		5000	11000	52.3
Load Line 9	LL9mw-003	Bedrock	Aluminum	357		NT		NT		200	36000	0
			Barium	*12.9*		NT		NT		2000	2600	256
			Calcium	*18100*		NT		NT		NS	NS	53100
			Iron	3240		NT		NT		300	11000	1430
			Magnesium	*5220*		NT		NT		NS	NS	15000
			Manganese	*111*		NT		NT		50	880	1340
			Nickel	*6.6*	*J*	NT		NT		NS	730	83.4
			Potassium	*2180*		NT		NT		NS	NS	5770
			Sodium	*2770*		NT		NT		NS	NS	51400
			Zinc	*21.2*	*B*	NT		NT		5000	11000	52.3
Load Line 9	LL9mw-004	Bedrock	Barium	*31*		NT		NT		2000	2600	256
			Calcium	*12000*		NT		NT		NS	NS	53100
			Cobalt	4.9	J	NT		NT		NS	730	0
			Iron	10600		NT		NT		300	11000	1430
			Magnesium	*9850*		NT		NT		NS	NS	15000
			Manganese	*2290*		NT		NT		50	880	1340
			Nickel	*6.9*	*J*	NT		NT		NS	730	83.4
			Sodium	*4650*		NT		NT		NS	NS	51400
			Thallium	0.33	J	NT		NT		2	2.4	0
			Zinc	*12.9*	*B*	NT		NT		5000	11000	52.3
Load Line 9	LL9mw-005	Bedrock	Aluminum	50.5		NT		NT		200	36000	0
			Calcium	*9220*		NT		NT		NS	NS	53100
			Iron	*157*		NT		NT		300	11000	1430
			Magnesium	*4710*		NT		NT		NS	NS	15000
			Manganese	*24.8*		NT		NT		50	880	1340
			Nickel	*5.3*	*J*	NT		NT		NS	730	83.4
			Sodium	*3870*		NT		NT		NS	NS	51400
			Zinc	*58.1*	*J*	NT		NT		5000	11000	52.3

Area	Well Number	Monitored Zone	Analyte	Oct-09 Level (µg/L)		Jan-10 Level (µg/L)		Jul-10 Level (µg/L)		MCL (µg/L)	Region 9 PRG (µg/L)	Facility-Wide Background (µg/L)
Load Line 9	LL9mw-006	Bedrock	Aluminum	23.5	J	NT		NT		200	36000	0
			Barium	*43.6*		NT		NT		2000	2600	256
			bis(2-Ethylhexyl) phthalate	1.7	J	NT		NT		NS	4.8	*
			Calcium	*5280*		NT		NT		NS	NS	53100
			Iron	1930		NT		NT		300	11000	1430
			Magnesium	*5800*		NT		NT		NS	NS	15000
			Manganese	*677*		NT		NT		50	880	1340
			Nickel	*11.2*		NT		NT		NS	730	83.4
			Potassium	*1130*		NT		NT		NS	NS	5770
			Sodium	*2660*		NT		NT		NS	NS	51400
			Zinc	*10.8*	*B*	NT		NT		5000	11000	52.3
Load Line 9	LL9mw-007	Bedrock	2,6-Dinitrotoluene	0.098	JB	NT		NT		NS	36	*
			Barium	*14.8*		NT		NT		2000	2600	256
			Calcium	*12000*		NT		NT		NS	NS	53100
			Cobalt	9.3		NT		NT		NS	730	0
			Iron	9900		NT		NT		300	11000	1430
			Magnesium	*6450*		NT		NT		NS	NS	15000
			Manganese	*1050*		NT		NT		50	880	1340
			Nickel	*19.2*		NT		NT		NS	730	83.4
			Potassium	*1270*		NT		NT		NS	NS	5770
			Sodium	*3090*		NT		NT		NS	NS	51400
			Zinc	*25.9*	*B*	NT		NT		5000	11000	52.3
Ramsdell Quarry Landfill	RQLmw-007	Bedrock	Arsenic	71.4		NT		NT		10	0.045	0
			Barium	*51.8*		NT		NT		2000	2600	256
			beta-BHC	0.015	J	NT		NT		NS	0.037	*
			Calcium	144000		NT		NT		NS	NS	53100
			Cobalt	6.2		NT		NT		NS	730	0
			HMX	1.5		NT		NT		NS	1800	*
			Iron	23900	J	NT		NT		300	11000	1430
			Magnesium	86600		NT		NT		NS	NS	15000
			Manganese	1740		NT		NT		50	880	1340
			Nickel	*12.6*		NT		NT		NS	730	83.4
			Potassium	7220		NT		NT		NS	NS	5770
			RDX	0.43	J	NT		NT		NS	0.61	*
			Sodium	*9590*		NT		NT		NS	NS	51400
			Zinc	*16.8*	*B*	NT		NT		5000	11000	52.3
Ramsdell Quarry Landfill	RQLmw-008	Bedrock	alpha-BHC	0.023	J	NT		NT		NS	0.011	*
			Arsenic	29.9		NT		NT		10	0.045	0
			Barium	*89*		NT		NT		2000	2600	256
			beta-BHC	0.0095	J	NT		NT		NS	0.037	*
			Calcium	57700		NT		NT		NS	NS	53100
			Chromium	1.5	J	NT		NT		100	110	0
			delta-BHC	0.025	J	NT		NT		NS	NS	*
			Iron	49600	J	NT		NT		300	11000	1430
			Magnesium	62900		NT		NT		NS	NS	15000
			Manganese	*408*		NT		NT		50	880	1340
			Potassium	*3690*		NT		NT		NS	NS	5770
			Sodium	*8350*		NT		NT		NS	NS	51400
			Zinc	*18.5*	*B*	NT		NT		5000	11000	52.3

Area	Well Number	Monitored Zone	Analyte	Oct-09 Level (µg/L)		Jan-10 Level (µg/L)		Jul-10 Level (µg/L)		MCL (µg/L)	Region 9 PRG (µg/L)	Facility-Wide Background (µg/L)
Ramsdell Quarry Landfill	RQLmw-009	Bedrock	1,3,5-Trinitrobenzene	0.1	JB	NT		NT		NS	1100	*
			Arsenic	8.9		NT		NT		10	0.045	0
			Barium	*36.1*		NT		NT		2000	2600	256
			Calcium	*22600*		NT		NT		NS	NS	53100
			Chromium	1.8	J	NT		NT		100	110	0
			Cobalt	4.6	J	NT		NT		NS	730	0
			Iron	5280	J	NT		NT		300	11000	1430
			Magnesium	20200		NT		NT		NS	NS	15000
			Manganese	*1260*		NT		NT		50	880	1340
			Potassium	*3900*		NT		NT		NS	NS	5770
			Sodium	*1870*		NT		NT		NS	NS	51400
			Zinc	*6.9*	*JB*	NT		NT		5000	11000	52.3
Load Line 1	LL1mw-064	Unconsolidated	Barium	NT		NT		*44.5*		2000	2600	82.1
			bis(2-Ethylhexyl) phthalate	NT		NT		0.88	JB	NS	4.8	*
			Calcium	NT		NT		*54300*		NS	NS	115000
			Iron	NT		NT		517		300	11000	279
			Magnesium	NT		NT		*9330*		NS	NS	43300
			Manganese	NT		NT		*112*		50	880	1020
			PETN	NT		NT		1.3		NS	NS	*
			Sodium	NT		NT		*4890*		NS	NS	45700
Load Line 1	LL1mw-065	Unconsolidated	Barium	NT		NT		*48.6*		2000	2600	82.1
			bis(2-Ethylhexyl) phthalate	NT		NT		1.4	JB	NS	4.8	*
			Calcium	NT		NT		*79300*		NS	NS	115000
			Iron	NT		NT		*127*		300	11000	279
			Magnesium	NT		NT		*19900*		NS	NS	43300
			Manganese	NT		NT		*256*		50	880	1020
			Potassium	NT		NT		*845*	*J*	NS	NS	2890
			Sodium	NT		NT		*10700*		NS	NS	45700
Load Line 1	LL1mw-067	Bedrock	1,3,5-Trinitrobenzene	NT		NT		0.038	JB	NS	1100	*
			Barium	NT		NT		*11.2*		2000	2600	256
			bis(2-Ethylhexyl) phthalate	NT		NT		2.1	JB	NS	4.8	*
			Calcium	NT		NT		*29400*		NS	NS	53100
			Magnesium	NT		NT		*10400*		NS	NS	15000
			Manganese	NT		NT		*13.1*		50	880	1340
			Nickel	NT		NT		*21.5*		NS	730	83.4
			Sodium	NT		NT		*1590*		NS	NS	45700
Load Line 1	LL1mw-078	Bedrock	1,3,5-Trinitrobenzene	NT		NT		0.047	JB	NS	1100	*
			Aluminum	NT		NT		110		200	36000	0
			Barium	NT		NT		*16.2*		2000	2600	256
			bis(2-Ethylhexyl) phthalate	NT		NT		1.5	JB	NS	4.8	*
			Calcium	NT		NT		*47300*		NS	NS	53100
			Di-n-butyl phthalate	NT		NT		0.8	J	NS	NS	*
			Magnesium	NT		NT		*7390*		NS	NS	15000
			Manganese	NT		NT		*71*		50	880	1340
			Nickel	NT		NT		*4.5*	*J*	NS	730	83.4
			Potassium	NT		NT		*3100*		NS	NS	5770
			RDX	NT		NT		0.095	J	NS	0.61	*
			Sodium	NT		NT		*3770*		NS	NS	45700

Area	Well Number	Monitored Zone	Analyte	Oct-09 Level (µg/L)		Jan-10 Level (µg/L)		Jul-10 Level (µg/L)		MCL (µg/L)	Region 9 PRG (µg/L)	Facility-Wide Background (µg/L)
Load Line 1	LL1mw-080	Bedrock	1,3,5-Trinitrobenzene	NT		NT		1.3	J	NS	1100	*
			1,3-Dinitrobenzene	NT		NT		0.93		NS	3.6	*
			2,4,6-Trinitrolouene	NT		NT		0.92		NS	2.2	*
			2,4-Dinitrotoluene	NT		NT		0.71		NS	73	*
			2,6-Dinitrotoluene	NT		NT		0.89		NS	36	*
			2-Amino-4,6-dinitrotoluene	NT		NT		5.6		NS		*
			4-Amino-2,6-Dinitrotoluene	NT		NT		7.9		NS		*
			Aluminum	NT		NT		45.2	J	200	36000	0
			Barium	NT		NT		*26.5*		2000	2600	256
			beta-BHC	NT		NT		0.048	J	NS	0.037	*
			bis(2-Ethylhexyl) phthalate	NT		NT		4.2	JB	NS	4.8	*
			Calcium	NT		NT		130000		NS	NS	53100
			delta-BHC	NT		NT		0.019	J	NS	NS	*
			HMX	NT		NT		14		NS	1800	*
			Magnesium	NT		NT		*9180*		NS	NS	15000
			Manganese	NT		NT		*25.5*		50	880	1340
			Potassium	NT		NT		*3310*		NS	NS	5770
			RDX	NT		NT		88	J	NS	0.61	*
			Sodium	NT		NT		*4320*		NS	NS	51400
Load Line 1	LL1mw-081	Bedrock	2,4-Dinitrotoluene	NT		NT		0.058	JB	NS	73	*
			2-Amino-4,6-dinitrotoluene	NT		NT		1.6		NS	NS	*
			4-Amino-2,6-Dinitrotoluene	NT		NT		2.2		NS	NS	*
			Barium	NT		NT		*18.2*		2000	2600	256
			beta-BHC	NT		NT		0.011	J	NS	0.037	*
			bis(2-Ethylhexyl) phthalate	NT		NT		1.6	JB	NS	4.8	*
			Calcium	NT		NT		54300		NS	NS	53100
			Cobalt	NT		NT		6.2		NS	730	0
			HMX	NT		NT		0.44	B	NS	1800	*
			Iron	NT		NT		4200		300	11000	1430
			Magnesium	NT		NT		*12000*		NS	NS	15000
			Manganese	NT		NT		1830		50	880	1340
			Nickel	NT		NT		*11*		NS	730	83.4
			Potassium	NT		NT		*2350*		NS	NS	5770
			RDX	NT		NT		1		NS	0.61	*
			Sodium	NT		NT		*2050*		NS	NS	51400
			Zinc	NT		NT		*48.5*		5000	11000	52.3
Load Line 1	LL1mw-082	Bedrock	Barium	NT		NT		*9.9*	*J*	2000	2600	256
			bis(2-Ethylhexyl) phthalate	NT		NT		2	JB		4.8	*
			Cadmium	NT		NT		0.18	J	5	18	0
			Calcium	NT		NT		*29800*		NS	NS	53100
			Cobalt	NT		NT		8.2		NS	730	0
			Iron	NT		NT		5150		300	11000	1430
			Magnesium	NT		NT		*12300*		NS	NS	15000
			Manganese	NT		NT		*1080*		50	880	1340
			Nickel	NT		NT		*17.9*		NS	730	83.4
			Potassium	NT		NT		*1460*		NS	NS	5770
			Sodium	NT		NT		*1190*		NS	NS	51400
			Zinc	NT		NT		*49.1*		5000	11000	52.3

Area	Well Number	Monitored Zone	Analyte	Oct-09 Level (µg/L)		Jan-10 Level (µg/L)		Jul-10 Level (µg/L)		MCL (µg/L)	Region 9 PRG (µg/L)	Facility-Wide Background (µg/L)
Load Line 1	LL1mw-083	Bedrock	1,3,5-Trinitrobenzene	NT		NT		9.2	J	NS	1100	*
			2,4,6-Trinitrolouene	NT		NT		5	J	NS	2.2	*
			2,4-Dinitrotoluene	NT		NT		3.1	J	NS	73	*
			2,4-Dinitrotoluene	NT		NT		1.5	J	NS	73	*
			2,6-Dinitrotoluene	NT		NT		1.3	J	NS	36	*
			2-Amino-4,6-dinitrotoluene	NT		NT		16	J	NS	NS	*
			2-Nitrotoluene	NT		NT		0.18	J	NS	0.049	*
			4-Amino-2,6-Dinitrotoluene	NT		NT		36	J	NS	NS	*
			Aluminum	NT		NT		813		200	36000	0
			Barium	NT		NT		*15.8*		2000	2600	256
			Beryllium	NT		NT		0.33	J	4	73	0
			bis(2-Ethylhexyl) phthalate	NT		NT		0.96	JB	NS	4.8	*
			Cadmium	NT		NT		0.7		5	18	0
			Calcium	NT		NT		*23200*		NS	NS	53100
			Cobalt	NT		NT		11.1		NS	730	0
			HMX	NT		NT		0.061	JB	NS	1800	*
			Magnesium	NT		NT		*4910*		NS	NS	15000
			Manganese	NT		NT		*497*		50	880	1340
			Nickel	NT		NT		*34.1*		NS	730	83.4
			Potassium	NT		NT		*2230*		NS	NS	5770
			Sodium	NT		NT		*9730*		NS	NS	51400
			Zinc	NT		NT		*40.1*		5000	11000	52.3
Load Line 1	LL1mw-084	Bedrock	1,3,5-Trinitrobenzene	NT		NT		5.9	J	NS	1100	*
			1,3-Dinitrobenzene	NT		NT		0.37	J	NS	3.6	*
			2,4,6-Trinitrolouene	NT		NT		9.2	J	NS	2.2	*
			2,4-Dinitrotoluene	NT		NT		1.8	J	NS	73	*
			2,6-Dinitrotoluene	NT		NT		0.82	J	NS	36	*
			2-Amino-4,6-dinitrotoluene	NT		NT		14	J	NS	NS	*
			4-Amino-2,6-Dinitrotoluene	NT		NT		32	J	NS	NS	*
			4-Nitrotoluene	NT		NT		0.18	J	NS	0.66	*
			Aluminum	NT		NT		335		200	36000	0
			Barium	NT		NT		*14*		2000	2600	256
			beta-BHC	NT		NT		0.26	J	NS	0.037	*
			bis(2-Ethylhexyl) phthalate	NT		NT		3.4	JB	ns	4.8	*
			Cadmium	NT		NT		1.6		5	18	0
			Calcium	NT		NT		*45600*		NS	NS	53100
			Cobalt	NT		NT		15.7		NS	730	0
			Copper	NT		NT		5.4		1300	1500	0
			HMX	NT		NT		0.25	JB	NS	1800	*
			Magnesium	NT		NT		*2710*		NS	NS	15000
			Manganese	NT		NT		*196*		50	880	1340
			Nickel	NT		NT		*26.8*		NS	730	83.4
			Potassium	NT		NT		*2260*		NS	NS	5770
			RDX	NT		NT		0.76	J	NS	0.61	*
			Sodium	NT		NT		*2630*		NS	NS	51400
			Zinc	NT		NT		*58.5*		5000	11000	52.3

Area	Well Number	Monitored Zone	Analyte	Oct-09 Level (µg/L)		Jan-10 Level (µg/L)		Jul-10 Level (µg/L)		MCL (µg/L)	Region 9 PRG (µg/L)	Facility-Wide Background (µg/L)
Load Line 1	LL1mw-085	Bedrock	Barium	NT		NT		*13.4*		2000	2600	256
			bis(2-Ethylhexyl) phthalate	NT		NT		2.5	JB	NS	4.8	*
			Calcium	NT		NT		64600		NS	NS	53100
			Cobalt	NT		NT		2.8	J	NS	730	0
			Iron	NT		NT		*435*		300	11000	1430
			Magnesium	NT		NT		18300		NS	NS	15000
			Manganese	NT		NT		*564*		50	880	1340
			Nickel	NT		NT		*11.4*		NS	730	83.4
			Potassium	NT		NT		*1690*		NS	NS	5770
			Sodium	NT		NT		*1380*		NS	NS	51400
			Zinc	NT		NT		*4.1*	*J*	5000	11000	52.3
Load Line 12	LL12mw-088	Unconsolidated	Arsenic	NT		NT		29.4		10	0.045	11.7
			Barium	NT		NT		383		2000	2600	82.1
			bis(2-Ethylhexyl) phthalate	NT		NT		2.4	JB	NS	4.8	*
			Calcium	NT		NT		159000		NS	NS	115000
			Iron	NT		NT		3890		300	11000	279
			Magnesium	NT		NT		55700		NS	NS	43300
			Manganese	NT		NT		*428*		50	880	1020
			Potassium	NT		NT		*2820*	*J*	NS	NS	2890
			Sodium	NT		NT		*13500*		NS	NS	45700
			Zinc	NT		NT		*5.6*	*JB*	5000	11000	60.9
Load Line 12	LL12mw-107	Unconsolidated	1,3,5-Trinitrobenzene	NT		NT		0.058	J	NS	1100	*
			Arsenic	NT		NT		*9.7*		10	0.045	11.7
			Barium	NT		NT		*24.2*		2000	2600	82.1
			beta-BHC	NT		NT		0.018	J	NS	0.037	*
			bis(2-Ethylhexyl) phthalate	NT		NT		3	JB	NS	4.8	*
			Calcium	NT		NT		162000		NS	NS	115000
			Cobalt	NT		NT		1.8	J	NS	730	0
			Iron	NT		NT		2640	J	300	11000	279
			Magnesium	NT		NT		67100		NS	NS	43300
			Manganese	NT		NT		*242*		50	880	1020
			Potassium	NT		NT		*2230*	*J*	NS	NS	2890
			Sodium	NT		NT		*17300*		NS	NS	45700
			Tetryl	NT		NT		0.074	J	NS	360	*
Load Line 12	LL12mw-113	Unconsolidated	Aluminum	NT		NT		103000		200	36000	0
			Antimony	NT		NT		1.1	J	6	15	0
			Arsenic	NT		NT		249		10	0.045	11.7
			Barium	NT		NT		381		2000	2600	82.1
			Beryllium	NT		NT		5		4	73	0
			bis(2-Ethylhexyl) phthalate	NT		NT		1.9	JB	NS	4.8	*
			Cadmium	NT		NT		0.54		5	18	0
			Calcium	NT		NT		284000		NS	NS	115000
			Chromium	NT		NT		163		100	110	7.3
			Cobalt	NT		NT		121		NS	730	0
			Copper	NT		NT		257		1300	1500	0
			Iron	NT		NT		354000		300	11000	279
			Lead	NT		NT		127		15	NS	0
			Magnesium	NT		NT		151000		NS	NS	43300
			Manganese	NT		NT		5730		50	880	1020
			Nickel	NT		NT		283		NS	730	0
			Nitrate-Nitrite[1]	NT		NT		0.2		1	1	*
			Phenol	NT		NT		0.83	J	NS	11000	*
			Potassium	NT		NT		23700	J	NS	NS	2890
			Sodium	NT		NT		*24800*		NS	NS	45700
			Thallium	NT		NT		1.9		2	2.4	0
			Vanadium	NT		NT		179		NS	36	0
			Zinc	NT		NT		656	J	5000	11000	60.9

Area	Well Number	Monitored Zone	Analyte	Oct-09 Level (µg/L)		Jan-10 Level (µg/L)		Jul-10 Level (µg/L)		MCL (µg/L)	Region 9 PRG (µg/L)	Facility-Wide Background (µg/L)
Load Line 12	LL12mw-128	Unconsolidated	Aluminum	NT		NT		1960		200	36000	0
			Antimony	NT		NT		0.16	J	6	15	0
			Arsenic	NT		NT		47.5		10	0.045	11.7
			Barium	NT		NT		*61.3*		2000	2600	82.1
			bis(2-Ethylhexyl) phthalate	NT		NT		2.3	JB	NS	4.8	*
			Calcium	NT		NT		183000		NS	NS	115000
			Chromium	NT		NT		*2.8*	*J*	100	110	7.3
			Cobalt	NT		NT		2.8	J	NS	730	0
			Iron	NT		NT		6890	J	300	11000	279
			Lead	NT		NT		2.3	J	15	NS	0
			Magnesium	NT		NT		109000		NS	NS	43300
			Manganese	NT		NT		*242*		50	880	1020
			Nickel	NT		NT		*4.8*	*J*	NS	730	0
			Potassium	NT		NT		*2770*	*J*	NS	NS	2890
			Sodium	NT		NT		*22100*		NS	NS	45700
			Vanadium	NT		NT		2.5	J	NS	36	0
			Zinc	NT		NT		*19.8*	*J*	5000	11000	60.9
Load Line 12	LL12mw-153	Unconsolidated	Arsenic	NT		NT		21.4		10	0.045	0
			Barium	NT		NT		*64.4*		2000	2600	82.1
			beta-BHC	NT		NT		0.1	J	NS	0.037	*
			bis(2-Ethylhexyl) phthalate	NT		NT		1.3	JB	NS	4.8	*
			Calcium	NT		NT		140000		NS	NS	115000
			Chromium	NT		NT		*2*	*J*	100	110	7.3
			Cobalt	NT		NT		2	J	NS	730	0
			HMX	NT		NT		0.055	J	NS	1800	*
			Iron	NT		NT		3420		300	11000	279
			Magnesium	NT		NT		76800		NS	NS	43300
			Manganese	NT		NT		*188*		50	880	1020
			Nickel	NT		NT		*2.7*	*J*	NS	730	0
			Potassium	NT		NT		*2010*	*J*	NS	NS	2890
			Sodium	NT		NT		*23400*		NS	NS	45700
			Zinc	NT		NT		*9*	*JB*	5000	11000	60.9
Load Line 12	LL12mw-154	Unconsolidated	Arsenic	NT		NT		16.2		10	0.045	11.7
			Barium	NT		NT		*44.1*		2000	2600	82.1
			beta-BHC	NT		NT		0.011	J	NS	0.037	*
			bis(2-Ethylhexyl) phthalate	NT		NT		1.5	JB	NS	4.8	*
			Calcium	NT		NT		147000		NS	NS	115000
			Iron	NT		NT		1760		300	11000	279
			Magnesium	NT		NT		70000		NS	NS	43300
			Manganese	NT		NT		*85.9*		50	880	1020
			Potassium	NT		NT		*1820*	*J*	NS	NS	2890
			Sodium	NT		NT		*24300*		NS	NS	45700

Area	Well Number	Monitored Zone	Analyte	Oct-09 Level (µg/L)		Jan-10 Level (µg/L)		Jul-10 Level (µg/L)		MCL (µg/L)	Region 9 PRG (µg/L)	Facility-Wide Background (µg/L)
Load Line 12	LL12mw-182	Unconsolidated	1,3,5-Trinitrobenzene	NT		NT		0.031	J	NS	1100	*
			Aluminum	NT		NT		29.5	J	200	36000	0
			Arsenic	NT		NT		*25.6*		10	0.045	11.7
			Barium	NT		NT		*62.7*		2000	2600	82.1
			Benzo(a)anthracene	NT		NT		0.23		NS	0.092	*
			Benzo(b)fluoranthene	NT		NT		0.22		NS	0.092	*
			Benzo(g,h,i)perylene	NT		NT		0.22		NS		*
			Benzo(k)fluoranthene	NT		NT		0.32		NS	0.92	*
			bis(2-Ethylhexyl) phthalate	NT		NT		4.9	JB	NS	4.8	*
			Calcium	NT		NT		*65500*		NS	NS	115000
			Chrysene	NT		NT		0.21		NS	9.2	*
			Dibenzo(a,h)anthracene	NT		NT		0.21		NS	0.0093	*
			Di-n-butyl phthalate	NT		NT		0.89	JB	NS	NS	*
			Fluoranthene	NT		NT		0.23		NS	NS	*
			Indeno(1,2,3-cd)pyrene	NT		NT		0.22		NS	0.092	*
			Iron	NT		NT		766	J	300	11000	279
			Magnesium	NT		NT		51500		NS	NS	43300
			Manganese	NT		NT		*43.7*		50	880	1020
			Nitrate-Nitrite[1]	NT		NT		0.03	JB	1	1	*
			Potassium	NT		NT		4080	J	NS	NS	2890
			Pyrene	NT		NT		0.21		NS	NS	*
			Sodium	NT		NT		*25100*		NS	NS	45700
			Tetryl	NT		NT		0.068	J	NS	360	*
Load Line 12	LL12mw-183	Unconsolidated	Arsenic	NT		NT		29.8		10	0.045	11.7
			Barium	NT		NT		*65*		2000	2600	82.1
			bis(2-Ethylhexyl) phthalate	NT		NT		2.4	JB	NS	4.8	*
			Calcium	NT		NT		*87600*		NS	NS	115000
			Heptachlor	NT		NT		0.027	J	0.4	0.015	*
			Iron	NT		NT		867		300	11000	279
			Magnesium	NT		NT		*36400*		NS	NS	43300
			Manganese	NT		NT		*47.7*		50	880	1020
			Potassium	NT		NT		*6050*	*J*	NS	NS	2890
			Sodium	NT		NT		*19800*		NS	NS	45700
Load Line 12	LL12mw-184	Unconsolidated	Arsenic	NT		NT		15.8		10	0.045	11.7
			Barium	NT		NT		*8.7*	*J*	2000	2600	82.1
			bis(2-Ethylhexyl) phthalate	NT		NT		3.8	JB	NS	4.8	*
			Calcium	NT		NT		203000		NS	NS	115000
			Iron	NT		NT		2300	J	300	11000	279
			Magnesium	NT		NT		150000		NS	NS	43300
			Manganese	NT		NT		*469*		50	880	1020
			Nitrate-Nitrite[1]	NT		NT		0.07	JB	1	1	*
			Potassium	NT		NT		*2410*	*J*	NS	NS	2890
			Sodium	NT		NT		*35600*		NS	NS	45700
			Tetryl	NT		NT		0.055	J	NS	360	*

Area	Well Number	Monitored Zone	Analyte	Oct-09 Level (µg/L)		Jan-10 Level (µg/L)		Jul-10 Level (µg/L)		MCL (µg/L)	Region 9 PRG (µg/L)	Facility-Wide Background (µg/L)
Load Line 12	LL12mw-185	Unconsolidated	Barium	NT		NT		*49.4*		2000	2600	82.1
			bis(2-Ethylhexyl) phthalate	NT		NT		2.6	JB	NS	4.8	*
			Butyl benzyl phthalate	NT		NT		1.4		NS	7300	*
			Cadmium	NT		NT		0.26	J	5	18	0
			Calcium	NT		NT		665000		NS	NS	115000
			Di-n-butyl phthalate	NT		NT		0.75	JB	NS	NS	*
			HMX	NT		NT		0.076	J	Nns	1800	*
			Magnesium	NT		NT		287000		NS	NS	43300
			Manganese	NT		NT		1380		50	880	1020
			Nickel	NT		NT		6.2	J	NS	730	0
			Nitrate-Nitrite[1]	NT		NT		160	J	1	1	*
			Nitrocellulose	NT		NT		0.54		NS	NS	*
			Potassium	NT		NT		7120	J	NS	NS	2890
			Sodium	NT		NT		52300		NS	NS	45700
			Tetryl	NT		NT		0.075	J	NS	360	*
Load Line 12	LL12mw-186	Unconsolidated	Antimony	NT		NT		0.45	J	6	15	0
			Barium	NT		NT		*49*		2000	2600	82.1
			beta-BHC	NT		NT		0.013	J	NS	0.037	*
			bis(2-Ethylhexyl) phthalate	NT		NT		3.3	JB	NS	4.8	*
			Calcium	NT		NT		139000		NS	NS	115000
			Cobalt	NT		NT		1.7	J	NS	730	0
			Di-n-butyl phthalate	NT		NT		0.76	JB	NS	NS	*
			Endrin ketone	NT		NT		0.0091	J	NS	NS	*
			Magnesium	NT		NT		64700		NS	NS	43300
			Manganese	NT		NT		*275*		50	880	1020
			Nickel	NT		NT		2.2	J	NS	730	0
			Nitrate-Nitrite[1]	NT		NT		0.04	JB	1	1	*
			Potassium	NT		NT		*1690*	*J*	NS	NS	2890
			Sodium	NT		NT		*14700*		NS	NS	45700
			Tetryl	NT		NT		0.054	J	NS	360	*
Load Line 12	LL12mw-187	Unconsolidated	Barium	NT		NT		281		2000	2600	82.1
			bis(2-Ethylhexyl) phthalate	NT		NT		1.2	JB	NS	4.8	*
			Calcium	NT		NT		960000		NS	NS	115000
			Cobalt	NT		NT		10.2		NS	730	0
			Magnesium	NT		NT		301000		NS	NS	43300
			Manganese	NT		NT		2020		50	880	1020
			Nickel	NT		NT		15.3		NS	730	0
			Nitrate-Nitrite[1]	NT		NT		1400		1	1	*
			Nitrocellulose	NT		NT		5.7		NS	NS	*
			Potassium	NT		NT		54200	J	NS	NS	2890
			Sodium	NT		NT		*35600*		NS	NS	45700
			Zinc	NT		NT		*11*	*J*	5000	11000	60.9
Load Line 12	LL12mw-188	Unconsolidated	Aluminum	NT		NT		65		200	36000	0
			Barium	NT		NT		*41.4*		2000	2600	82.1
			bis(2-Ethylhexyl) phthalate	NT		NT		2.4	JB	NS	4.8	*
			Calcium	NT		NT		134000		NS	NS	115000
			Cobalt	NT		NT		1.5	J	NS	730	0
			Heptachlor	NT		NT		0.017	J	0.4	0.015	*
			HMX	NT		NT		0.052	J	NS	1800	*
			Iron	NT		NT		*246*		300	11000	279
			Magnesium	NT		NT		108000		NS	NS	43300
			Manganese	NT		NT		*433*		50	880	1020
			Nitrate-Nitrite[1]	NT		NT		0.2		1	1	*
			Potassium	NT		NT		*1930*	*J*	NS	NS	2890
			RDX	NT		NT		0.067	J	NS	0.61	*
			Sodium	NT		NT		*32200*		NS	NS	45700

Area	Well Number	Monitored Zone	Analyte	Oct-09 Level (µg/L)		Jan-10 Level (µg/L)		Jul-10 Level (µg/L)		MCL (µg/L)	Region 9 PRG (µg/L)	Facility-Wide Background (µg/L)
Load Line 12	LL12mw-189	Unconsolidated	Aluminum	NT		NT		298		200	36000	0
			Arsenic	NT		NT		*5.1*		10	0.045	11.7
			Barium	NT		NT		*18.5*		2000	2600	82.1
			beta-BHC	NT		NT		0.014	J	NS	0.037	*
			bis(2-Ethylhexyl) phthalate	NT		NT		2.8	JB	NS	4.8	*
			Calcium	NT		NT		152000		NS	NS	115000
			Cobalt	NT		NT		1.9	J	NS	730	0
			Di-n-butyl phthalate	NT		NT		0.75	JB	NS	NS	*
			Iron	NT		NT		1320	J	300	11000	279
			Magnesium	NT		NT		72200		NS	NS	43300
			Manganese	NT		NT		*310*		50	880	1020
			Naphthalene	NT		NT		0.29		NS	6.2	*
			Nitrate-Nitrite[1]	NT		NT		0.07	JB	1	1	*
			Nitrocellulose	NT		NT		0.12	J	NS	NS	*
			Potassium	NT		NT		*1800*	*J*	NS	NS	2890
			Sodium	NT		NT		49200		NS	NS	45700
			Tetryl	NT		NT		0.059	J	NS	360	*
Load Line 12	LL12mw-242	Unconsolidated	Arsenic	NT		NT		21.3		10	0.045	11.7
			Barium	NT		NT		*22*		2000	2600	82.1
			bis(2-Ethylhexyl) phthalate	NT		NT		1.7	JB	NS	4.8	*
			Butyl benzyl phthalate	NT		NT		0.89	J	NS	7300	*
			Calcium	NT		NT		*69300*		NS	NS	115000
			Iron	NT		NT		833		300	11000	279
			Isophorone	NT		NT		0.38	J	NS	71	*
			Magnesium	NT		NT		46500		NS	NS	43300
			Manganese	NT		NT		*56*		50	880	1020
			Potassium	NT		NT		*1630*	*J*	NS	NS	2890
			Silver	NT		NT		1.9	J	100	180	0
			Sodium	NT		NT		*33800*		NS	NS	45700
			Tetryl	NT		NT		0.057	JB	NS	360	*
Load Line 12	LL12mw-243	Unconsolidated	2-Butanone	NT		NT		1.3	JB	NS	7000	*
			Antimony	NT		NT		0.63	J	6	15	0
			Arsenic	NT		NT		*6.5*		10	0.045	11.7
			Barium	NT		NT		*27.6*		2000	2600	82.1
			beta-BHC	NT		NT		0.012	J	NS	0.037	*
			bis(2-Ethylhexyl) phthalate	NT		NT		4.4	JB	NS	4.8	*
			Calcium	NT		NT		124000		NS	NS	115000
			Cobalt	NT		NT		1.5	J	NS	730	0
			Magnesium	NT		NT		81500		NS	NS	43300
			Manganese	NT		NT		*281*		50	880	1020
			Nickel	NT		NT		2.7	J	NS	730	0
			Nitroglycerin	NT		NT		0.38	J	NS	4.8	*
			Potassium	NT		NT		3320	J	NS	NS	2890
			Sodium	NT		NT		*22800*		NS	NS	45700

Area	Well Number	Monitored Zone	Analyte	Oct-09 Level (µg/L)		Jan-10 Level (µg/L)		Jul-10 Level (µg/L)		MCL (µg/L)	Region 9 PRG (µg/L)	Facility-Wide Background (µg/L)
Load Line 12	LL12mw-244	Unconsolidated	2-Butanone	NT		NT		1.6	JB	NS	7000	*
			Acetone	NT		NT		1.1	JB	NS	5500	*
			Aluminum	NT		NT		33700		200	36000	0
			Antimony	NT		NT		0.73	J	6	15	0
			Arsenic	NT		NT		51.1		10	0.045	11.7
			Barium	NT		NT		221		2000	2600	82.1
			Beryllium	NT		NT		1.4		4	73	0
			bis(2-Ethylhexyl) phthalate	NT		NT		1.8	JB	NS	4.8	*
			Calcium	NT		NT		*95400*		NS	NS	115000
			Chromium	NT		NT		43		100	110	7.3
			Cobalt	NT		NT		28.5		NS	730	0
			Copper	NT		NT		48.3		1300	1500	0
			Iron	NT		NT		78800	J	300	11000	279
			Lead	NT		NT		26		15	NS	0
			Magnesium	NT		NT		*40500*		NS	NS	43300
			Manganese	NT		NT		*955*		50	880	1020
			Nickel	NT		NT		72.1		NS	730	0
			Nitrate-Nitrite[1]	NT		NT		0.07	JB	1	1	*
			Potassium	NT		NT		9500	J	NS	NS	2890
			Sodium	NT		NT		*9250*		NS	NS	45700
			Toluene	NT		NT		0.22	J	1000	720	*
			Vanadium	NT		NT		*49*		NS	36	0
			Zinc	NT		NT		165	J	5000	11000	60.9
Load Line 12	LL12mw-245	Unconsolidated	1,3,5-Trinitrobenzene	NT		NT		0.057	J	NS	1100	*
			Antimony	NT		NT		0.29	J	6	15	0
			Arsenic	NT		NT		9.1		10	0.045	0
			Barium	NT		NT		*34.6*		2000	2600	82.1
			bis(2-Ethylhexyl) phthalate	NT		NT		1.8	JB	NS	4.8	*
			Calcium	NT		NT		134000		NS	NS	115000
			Cobalt	NT		NT		3.2	J	NS	730	0
			Cyanide[1]	NT		NT		0.008	J	0.2	0.73	*
			Magnesium	NT		NT		65400		NS	NS	43300
			Manganese	NT		NT		103		50	880	1020
			Nickel	NT		NT		5.1	J	NS	730	0
			Nitrate-Nitrite[1]	NT		NT		0.1		1	1	*
			Potassium	NT		NT		3140	J	NS	NS	2890
			Sodium	NT		NT		*23200*		NS	NS	45700
Load Line 12	LL12mw-246	Unconsolidated	Arsenic	NT		NT		29.7		10	0.045	11.7
			Barium	NT		NT		*35.5*		2000	2600	82.1
			bis(2-Ethylhexyl) phthalate	NT		NT		1.8	JB	NS	4.8	*
			Calcium	NT		NT		*102000*		NS	NS	115000
			Iron	NT		NT		1190	J	300	11000	279
			Magnesium	NT		NT		50400		NS	NS	43300
			Manganese	NT		NT		*74.5*		50	880	1020
			Naphthalene	NT		NT		1.4		NS	6.2	*
			Nitrate-Nitrite[1]	NT		NT		0.08	JB	1	1	*
			Potassium	NT		NT		6380	J	NS	NS	2890
			Sodium	NT		NT		*22000*		NS	NS	45700

Area	Well Number	Monitored Zone	Analyte	Oct-09 Level (µg/L)		Jan-10 Level (µg/L)		Jul-10 Level (µg/L)		MCL (µg/L)	Region 9 PRG (µg/L)	Facility-Wide Background (µg/L)
Load Line 2	LL2mw-059	Bedrock	1,3,5-Trinitrobenzene	NT		NT		0.11		NS	1100	*
			2,4-Dinitrotoluene	NT		NT		0.25		NS	73	*
			2-Amino-4,6-dinitrotoluene	NT		NT		0.31		NS	NS	*
			4-Amino-2,6-Dinitrotoluene	NT		NT		0.29		NS	NS	*
			Aluminum	NT		NT		21.5	J	200	36000	0
			Arsenic	NT		NT		6.4		10	0.045	0
			Barium	NT		NT		*208*		2000	2600	256
			Calcium	NT		NT		*30000*		NS	NS	53100
			Cobalt	NT		NT		29.1		NS	730	0
			Cyanide[1]	NT		NT		0.0058	J	0.2	0.73	*
			HMX	NT		NT		0.14	JB	NS	1800	*
			Iron	NT		NT		7090		300	11000	1430
			Magnesium	NT		NT		*8290*		NS	NS	15000
			Manganese	NT		NT		5530		50	880	1340
			Nickel	NT		NT		*22.4*		NS	730	83.4
			Potassium	NT		NT		*883*	*J*	NS	NS	5770
			Sodium	NT		NT		*5170*		NS	NS	51400
			Zinc	NT		NT		*4*	*JB*	5000	11000	52.3
Load Line 2	LL2mw-060	Bedrock	2-Amino-4,6-dinitrotoluene	NT		NT		0.45		NS	NS	*
			4-Amino-2,6-Dinitrotoluene	NT		NT		0.54		NS	NS	*
			Antimony	NT		NT		0.17	J	6	15	0
			Barium	NT		NT		*23.9*		2000	2600	256
			Calcium	NT		NT		*45200*		NS	NS	53100
			Magnesium	NT		NT		*8470*		NS	NS	15000
			Manganese	NT		NT		*25.7*		50	880	1340
			Sodium	NT		NT		*2400*		NS	NS	51400
Load Line 2	LL2mw-261	Bedrock	2,4,6-Trinitrolouene	NT		NT		0.058	J	NS	2.2	*
			Arsenic	NT		NT		11.2		10	0.045	0
			Barium	NT		NT		*19.1*		2000	2600	256
			bis(2-Ethylhexyl) phthalate	NT		NT		0.87	JB	NS	4.8	*
			Calcium	NT		NT		59200		NS	NS	53100
			Cobalt	NT		NT		2.2	J	NS	730	0
			Iron	NT		NT		2290		300	11000	1430
			Magnesium	NT		NT		21700		NS	NS	15000
			Manganese	NT		NT		*375*		50	880	1340
			Nickel	NT		NT		*3.9*	*J*	NS	730	83.4
			Potassium	NT		NT		*1070*		NS	NS	5770
			Sodium	NT		NT		*10800*		NS	NS	51400
Load Line 2	LL2mw-262	Bedrock	Aluminum	NT		NT		24.9	J	200	36000	0
			Barium	NT		NT		*16.2*		2000	2600	256
			bis(2-Ethylhexyl) phthalate	NT		NT		1.1	JB	NS	4.8	*
			Calcium	NT		NT		*47100*		NS	NS	53100
			Magnesium	NT		NT		34200		NS	NS	15000
			Manganese	NT		NT		*77.4*		50	880	1340
			Nickel	NT		NT		*10.7*		NS	730	83.4
			Potassium	NT		NT		*1770*		NS	NS	5770
			Sodium	NT		NT		*7430*		NS	NS	51400
Load Line 2	LL2mw-263	Bedrock	Arsenic	NT		NT		15.4		10	0.045	0
			Barium	NT		NT		*21.5*		2000	2600	256
			Calcium	NT		NT		*30900*		NS	NS	53100
			Cobalt	NT		NT		3.2	J	NS	730	0
			HMX	NT		NT		0.078	JB	NS	1800	*
			Iron	NT		NT		4670		300	11000	1430
			Magnesium	NT		NT		*13800*		NS	NS	15000
			Manganese	NT		NT		1450		50	880	1340
			Nickel	NT		NT		*5.6*	*J*	NS	730	83.4
			Sodium	NT		NT		*3930*		NS	NS	51400

Area	Well Number	Monitored Zone	Analyte	Oct-09 Level (µg/L)		Jan-10 Level (µg/L)		Jul-10 Level (µg/L)		MCL (µg/L)	Region 9 PRG (µg/L)	Facility-Wide Background (µg/L)
Load Line 2	LL2mw-265	Bedrock	Aluminum	NT		NT		26.4	J	200	36000	0
			Barium	NT		NT		*8.8*	*J*	2000	2600	256
			bis(2-Ethylhexyl) phthalate	NT		NT		2.5	JB	NS	4.8	*
			Calcium	NT		NT		76100		NS	NS	53100
			Cobalt	NT		NT		5.6		NS	730	0
			Iron	NT		NT		*614*		300	11000	1430
			Magnesium	NT		NT		*22700*		NS	NS	15000
			Manganese	NT		NT		1430		50	880	1340
			Nickel	NT		NT		*19*		NS	730	83.4
			Sodium	NT		NT		*10400*		NS	NS	51400
Load Line 2	LL2mw-266	Bedrock	Acetone	NT		NT		2.5	JB	NS	5500	*
			Aluminum	NT		NT		1060		200	36000	0
			Arsenic	NT		NT		5.6		10	0.045	0
			Barium	NT		NT		*19.1*		2000	2600	256
			beta-BHC	NT		NT		0.029	J	NS	0.037	*
			bis(2-Ethylhexyl) phthalate	NT		NT		5.8	JB	NS	4.8	*
			Cadmium	NT		NT		0.24	J	5	18	0
			Calcium	NT		NT		*18400*		NS	NS	53100
			Cobalt	NT		NT		17		NS	730	0
			Iron	NT		NT		5080		300	11000	1430
			Magnesium	NT		NT		*9620*		NS	NS	15000
			Manganese	NT		NT		1390		50	880	1340
			Nickel	NT		NT		*16.5*		NS	730	83.4
			Potassium	NT		NT		*1270*		NS	NS	5770
			Sodium	NT		NT		*9520*		NS	NS	51400
			Zinc	NT		NT		*10.6*	*B*	5000	11000	52.3
Load Line 2	LL2mw-267	Bedrock	2,4,6-Trinitrolouene	NT		NT		0.27		NS	2.2	*
			2,4-Dinitrotoluene	NT		NT		0.22		NS	73	*
			2-Amino-4,6-dinitrotoluene	NT		NT		1.3		NS	NS	*
			4-Amino-2,6-Dinitrotoluene	NT		NT		1.1		NS	NS	*
			Barium	NT		NT		*14.9*		2000	2600	256
			bis(2-Ethylhexyl) phthalate	NT		NT		2.3	JB	NS	4.8	*
			Calcium	NT		NT		*37900*		NS	NS	53100
			Cobalt	NT		NT		4.5	J	NS	730	0
			HMX	NT		NT		1.1		NS	1800	*
			Iron	NT		NT		*1240*		300	11000	1430
			Magnesium	NT		NT		18900		NS	NS	15000
			Manganese	NT		NT		*622*		50	880	1340
			Nickel	NT		NT		*3.6*	*J*	NS	730	83.4
			RDX	NT		NT		1.1		NS	0.61	*
			Sodium	NT		NT		*16500*		NS	NS	51400
Load Line 2	LL2mw-269	Bedrock	Barium	NT		NT		*215*		2000	2600	256
			bis(2-Ethylhexyl) phthalate	NT		NT		1.4	JB	NS	4.8	*
			Calcium	NT		NT		*30300*		NS	NS	53100
			Iron	NT		NT		5990		300	11000	1430
			Magnesium	NT		NT		15200		NS	NS	15000
			Manganese	NT		NT		1540		50	880	1340
			Potassium	NT		NT		*2970*		NS	NS	5770
			Sodium	NT		NT		*5930*		NS	NS	51400

Area	Well Number	Monitored Zone	Analyte	Oct-09 Level (µg/L)		Jan-10 Level (µg/L)		Jul-10 Level (µg/L)		MCL (µg/L)	Region 9 PRG (µg/L)	Facility-Wide Background (µg/L)
Load Line 2	LL2mw-270	Bedrock	Barium	NT		NT		*13.1*		2000	2600	256
			Butyl benzyl phthalate	NT		NT		13		ns	7300	*
			Calcium	NT		NT		*44400*		NS	NS	53100
			Cobalt	NT		NT		7.2		NS	730	0
			Endrin ketone	NT		NT		0.009	J	NS	NS	*
			Iron	NT		NT		*1420*		300	11000	1430
			Magnesium	NT		NT		16800		NS	NS	15000
			Manganese	NT		NT		*384*		50	880	1340
			Nickel	NT		NT		*12.7*		NS	730	83.4
			Phenol	NT		NT		1.4		NS	11000	*
			Potassium	NT		NT		1070		NS	NS	5770
			Sodium	NT		NT		2190		NS	NS	51400
			Tetryl	NT		NT		0.07	JB	NS	360	*
			Zinc	NT		NT		*3.5*	*J*	5000	11000	52.3
Load Line 3	LL3mw-232	Bedrock	Arsenic	NT		NT		3.5	J	10	0.045	0
			Barium	NT		NT		*26.1*		2000	2600	256
			bis(2-Ethylhexyl) phthalate	NT		NT		1.5	JB	NS	4.8	*
			Calcium	NT		NT		60300		NS	NS	53100
			Magnesium	NT		NT		39800		NS	NS	15000
			Manganese	NT		NT		*308*		50	880	1340
			Nickel	NT		NT		*7.8*	*J*	NS	730	83.4
			Potassium	NT		NT		*3650*		NS	NS	5770
			Sodium	NT		NT		*8570*		NS	NS	51400
			Zinc	NT		NT		*7.8*	*JB*	5000	11000	52.3
Load Line 3	LL3mw-234	Bedrock	2,6-Dinitrotoluene	NT		NT		0.062	J	NS	36	*
			2-Amino-4,6-dinitrotoluene	NT		NT		0.41	J	NS	NS	*
			4-Amino-2,6-Dinitrotoluene	NT		NT		0.78	J	NS	NS	*
			Barium	NT		NT		*9.8*	*J*	2000	2600	256
			Benzyl alcohol	NT		NT		0.84	JB	NS	11000	*
			Butyl benzyl phthalate	NT		NT		2		NS	7300	*
			Calcium	NT		NT		*51100*	*J*	NS	NS	53100
			Cobalt	NT		NT		1.5	J	NS	730	0
			HMX	NT		NT		0.083	JB	NS	1800	*
			Iron	NT		NT		*1210*		300	11000	1430
			Magnesium	NT		NT		19800	J	NS	NS	15000
			Manganese	NT		NT		2190	J	50	880	1340
			Nickel	NT		NT		*7*	*J*	NS	730	83.4
			Potassium	NT		NT		*1750*		NS	NS	5770
			RDX	NT		NT		0.58	J	NS	0.61	*
			Sodium	NT		NT		*8990*		NS	NS	51400
Load Line 3	LL3mw-236	Bedrock	1,3,5-Trinitrobenzene	NT		NT		0.032	J	NS	1100	*
			2,4,6-Trinitrolouene	NT		NT		0.31	J	NS	2.2	*
			2-Amino-4,6-dinitrotoluene	NT		NT		0.17		NS	NS	*
			4-Amino-2,6-Dinitrotoluene	NT		NT		0.33		NS	NS	*
			Antimony	NT		NT		0.15	J	6	15	0
			Calcium	NT		NT		*22200*		NS	NS	53100
			Magnesium	NT		NT		13700		NS	NS	15000
			Manganese	NT		NT		*235*		50	880	1340
			Nickel	NT		NT		*7.9*	*J*	NS	730	83.4
			Potassium	NT		NT		*1330*		NS	NS	5770
			Sodium	NT		NT		*3620*		NS	NS	51400
			Zinc	NT		NT		*15.9*	*B*	5000	11000	52.3

Area	Well Number	Monitored Zone	Analyte	Oct-09 Level (µg/L)		Jan-10 Level (µg/L)		Jul-10 Level (µg/L)		MCL (µg/L)	Region 9 PRG (µg/L)	Facility-Wide Background (µg/L)
Load Line 3	LL3mw-239	Bedrock	1,3,5-Trinitrobenzene	NT		NT		0.34	J	NS	1100	*
			2,4,6-Trinitrolouene	NT		NT		0.26	J	NS	2.2	*
			2,4-Dinitrotoluene	NT		NT		0.11		NS	73	*
			2-Amino-4,6-dinitrotoluene	NT		NT		0.63		NS	NS	*
			4-Amino-2,6-Dinitrotoluene	NT		NT		0.95		NS	NS	*
			Aluminum	NT		NT		46.6	J	200	36000	0
			Barium	NT		NT		*10.4*		2000	2600	256
			bis(2-Ethylhexyl) phthalate	NT		NT		8.7	JB	NS	4.8	*
			Calcium	NT		NT		*9730*		NS	NS	53100
			Carbon tetrachloride	NT		NT		0.37	J	5	0.17	*
			Chloroform	NT		NT		0.52	J	NS	0.17	*
			HMX	NT		NT		0.19	B	NS	1800	*
			Iron	NT		NT		*218*		300	11000	1430
			Magnesium	NT		NT		*5160*		NS	NS	15000
			Manganese	NT		NT		*101*		50	880	1340
			Nickel	NT		NT		*6.1*	*J*	NS	730	83.4
			Potassium	NT		NT		*1280*		NS	NS	5770
			RDX	NT		NT		1.7		NS	0.61	*
			Sodium	NT		NT		*18700*		NS	NS	51400
			Zinc	NT		NT		*6*	*JB*	5000	11000	52.3
Load Line 4	LL4mw-196	Unconsolidated	Aluminum	NT		NT		22.8	J	200	36000	0
			Barium	NT		NT		*33.4*		2000	2600	82.1
			bis(2-Ethylhexyl) phthalate	NT		NT		8.2	JB	NS	4.8	*
			Calcium	NT		NT		*57700*		NS	NS	115000
			Iron	NT		NT		393		300	11000	279
			Magnesium	NT		NT		*18100*		NS	NS	43300
			Manganese	NT		NT		*183*		50	880	1020
			Sodium	NT		NT		*1460*		NS	NS	45700
Load Line 4	LL4mw-197	Unconsolidated	Antimony	NT		NT		0.16	J	6	15	0
			Barium	NT		NT		*15.1*		2000	2600	82.1
			bis(2-Ethylhexyl) phthalate	NT		NT		1.1	JB	NS	4.8	*
			Calcium	NT		NT		139000		NS	NS	115000
			HMX	NT		NT		0.041	JB	NS	1800	*
			Magnesium	NT		NT		*21400*		NS	NS	43300
			Potassium	NT		NT		*1250*		NS	NS	2890
			Sodium	NT		NT		*1130*		NS	NS	45700

Notes:

NS = no standard NT = not tested

All inorganics are filtered, all organics are not filtered

* There are no background levels for organic constituents

J = estimated result. Results have been qualified "J" For more details refer to Data Verification/Validation Reports in in the FWGWMP October 2009 and January, and July 2010 Sampling Reports

B = organic or inorganic analysis when the analyte is found in the method blank or any of the field blanks

R = Rejected data

U = analyzed but not detected at or above the reporting limit

Bold = inorganic constituent detected above Facility-Wide background levels

Italics = inorganic constituent detected below the Facility-Wide background levels

Shaded boxes indicate any contituent, which does not have a background value, detected above the reporting limit.

1 = mg/l

Table 4-3 Summary of ConstItuents Detected in the Sharon Conglomerate Wells April 2009 - July 2010

Area	Well Number	Analyte	April-09 Level (µg/L)	July-09 Level (µg/L)	Oct-09 Level (µg/L)	Jan-10 Level (µg/L)	Jul-10 Level (µg/L)	MCL (µg/L)	Region 9 PRG (µg/L)	Facility-Wide Background (µg/L)
Sharon Conglomerate	SCFmw-001	1,3,5-Trinitrobenzene	0.085 J	0.22 U	0.2 U	0.2 U	0.11 U	NS	1100	*
		Aluminum	100 U	100 U	1720	50 U	50 U	200	36000	0
		Antimony	1.6 J	1.5 J	1.5 J	0.34 J	2 U	6	15	0
		Arsenic	3.3 J	5 U	11.7	15.2	13.1	10	0.045	0
		Barium	*51.6*	*62.5*	*83.3*	*48.6*	*39.4*	2000	2600	256
		bis (2-Ethylhexyl) phthalate	1.5 U	6.1 U	1.4	1 U	1.7 JB	NS	4.8	*
		Calcium	58500	89200 J	98000 J	104000	102000	NS	NS	53100
		Carbon disulfide	1 U	1 U	1.9	1 U	0.69 J	NS	1000	*
		Chromium	5 U	5 U	2.1 J	5 U	5 U	100	110	0
		Cobalt	3.1 J	5 U	1.8 J	5 U	5 U	NS	730	0
		Cyanide[2]	0.01 U	0.01 U	0.01 U	0.0076 J	0.01 U	0.2	0.73	0
		Endrin ketone	0.5 U	0.5 U	0.25 R	0.05 U	0.027 J	2	11	*
		Iron	6850 J	2960	4760	1320	814	300	11000	1430
		Magnesium	20000	27800	27800	29300	28600	NS	NS	15000
		Manganese	*767 J*	*449 J*	*336*	*261*	*194*	50	880	1340
		Nickel	7.3 UJ	*6.1 J*	*8.9 J*	*6.5 J*	*3.3 J*	NS	730	83.4
		Perchlorate[2]	NT	0.019 J	NT	NT	NT	NS	3.6	
		Potassium	*2010 J*	*2010 J*	*2060*	*1800*	*1670*	NS	NS	5770
		RDX	0.52 U	0.55 U	0.5 U	0.091 J	0.11 U	NS	0.61	*
		Sodium	*11800*	*12500*	*12700*	*13700*	*13000*	NS	NS	51400
		Thallium	0.17 J	2 U	0.46 J	0.25 UJ	10 U	2	2.4	0
		Zinc	14.8 U	274 J	173 J	*45.4 J*	10 U	5000	11000	52.3

Area	Well Number	Analyte	April-09 Level (µg/L)	July-09 Level (µg/L)	Oct-09 Level (µg/L)	Jan-10 Level (µg/L)	Jul-10 Level (µg/L)	MCL (µg/L)	Region 9 PRG (µg/L)	Facility-Wide Background (µg/L)
Sharon Conglomerate	SCFmw-002	4-Amino-2,6-Dintirotoluene	0.083	0.2 U	0.22 U	0.2 U	0.1 U	NS	73	*
		Aluminum	100 U	100 U	48 J	100 U	50 U	200	36000	0
		Antimony	3.8 J	1.4 J	0.73 J	0.44 J	0.15 J	6	15	0
		Arsenic	12.2	17	18.6	20.6	12.5	10	0.045	0
		Barium	*49.9*	*162*	*42.9*	*40.7*	*38*	2000	2600	256
		bis(2-Ethylhexyl) phthalate	1.3 U	1.8 U	1 U	1 U	2.5 JB	NS	4.8	*
		Calcium	92900	90700 J	88000	87700	83400	NS	NS	53100
		Carbon disulfide	1 U	0.69 J	1.5	0.92 J	0.34 J	NS	1000	*
		Cobalt	1.8 J	5 U	5 U	5 U	5 U	NS	730	0
		Di-n-butyl phthalate	1 U	1 U	1 U	1 U	0.82 J	NS	NS	*
		Iron	100 U	*216*	*645*	*730*	*233*	300	11000	1430
		Magnesium	31500	29300	28200	28300	27000	NS	NS	15000
		Manganese	*82.1 J*	*102 J*	*92*	*96.3*	*67.3*	50	880	1340
		Nickell	*7.9 J*	40 U	40 U	40 U	10 U	NS	730	83.4
		Perchlorate[2]	NT	0.02 J	NT	NT	NT	NS	3.6	*
		Potasium	*4790 J*	*2700 J*	*2370*	*2180 J*	*2190*	NS	NS	5770
		Sodium	*27100*	*25300*	*22300*	*21600*	*50500*	NS	NS	51400
		Tetryl	0.07 J	0.2 U	0.22	0.2 U	0.1 U	NS	360	*
		Zinc	5 U	131 J	*20.6*	*35.3 J*	10 U	5000	11000	52.3
Sharon Conglomerate	SCFmw-003	1,3,5-Trinitrobenzene	0.056 J	0.21 U	0.2 U	0.2 U	0.1 U	NS	1100	*
		Acetone	10 UJ	10 UJ	10 U	10 UJ	3.4 JB	NS	5500	*
		Aluminum	100 U	100 U	74.7 J	100 U	50 U	200	36000	0
		Antimony	0.75 J	1.4	0.32 J	0.34 J	2 U	6	15	0
		Arsenic	3.7 J	5 U	5 U	5 U	5 U	10	0.045	0
		Barium	*77.9*	*81.5*	261	*71.8*	*75.2*	2000	2600	256
		beta-BHC	0.05 U	0.5 U	0.05 U	0.05 U	0.0092 J	NS	4.8	*
		bis(2-Ethylhexyl) phthalate	1.9 U	1.2 U	1 U	1 U	1.5 JB	NS	4.8	*
		Calcium	74900	74500 J	74200	69400	71100	NS	NS	53100
		Iron	187 U	*491*	*610*	*614*	*390*	300	11000	1430
		Magnesium	30500	29800	29900	28400	29000	NS	NS	15000
		Manganese	*269 J*	*271 J*	*248*	*243*	*237*	50	880	1340
		Perchlorate[2]	NT	0.22 J	NT	NT	NT	NS	3.6	*
		Potassium	*1460 J*	*1510 J*	*2300*	*1320 J*	*1420 J*	NS	NS	5770
		Sodium	*7340*	*7320*	*8110*	*6760*	*6860*	NS	NS	51400
		Thallium	2 U	2 U	0.14 JB	2 U	10 U	2	2.4	0
		Zinc	8.9 UJ	*48.4 J*	118	*28.2 J*	10 U	5000	11000	52.3

Area	Well Number	Analyte	April-09 Level (µg/L)	July-09 Level (µg/L)	Oct-09 Level (µg/L)	Jan-10 Level (µg/L)	Jul-10 Level (µg/L)	MCL (µg/L)	Region 9 PRG (µg/L)	Facility-Wide Background (µg/L)
Sharon Conglomerate	SCFmw-004	1,3,5-Trinitrobenzene	0.057 J	0.21 U	0.2 U	0.23 UJ	0.098 U	NS	1100	*
		Aluminum	100 U	100 U	203	100 U	50 U	200	36000	0
		Antimony	1.3 J	0.13 J	0.53 J	0.35 UJ	2 U	6	15	0
		Barium	*142*	*119*	*117*	*102*	*97.9*	2000	2600	256
		bis (2-Ethylhexyl) phthalate	1 UJ	1.3 U	1 U	0.84 J	0.92 JB	NS	4.8	*
		Calcium	153000	139000	144000	146000	135000	NS	NS	53100
		Carbon disulfide	1 U	1 U	0.61 B	0.72 J	1 U	NS	1000	*
		Iron	100 U	100 U	*316*	100 U	50 U	300	11000	1430
		Magnesium	61800	55600	57800	58400	54200	NS	NS	15000
		Manganese	*697 J*	*626*	*646*	*681*	*624*	50	880	1340
		Phenol	1 U	1 U	1 U	1 U	0.81 J	NS	11000	*
		Potassium	2620 J	2340 J	2470	2350	2440	NS	NS	5770
		Sodium	14900	12900	13200	13300	12700	NS	NS	51400
		Zinc	*6.4 UJ*	10 U	67.9	10 U	10 U	5000	11000	52.3
Sharon Conglomerate	SCFmw-005	1,3,5-Trinitrobenzene	0.056 J	0.21 U	0.21 U	0.2 UJ	0.1 U	NS	1100	*
		Aluminum	100 U	100 U	76.8 J	100 U	50 U	200	36000	0
		Antimony	2.5 J	2 J	0.66 J	0.73 J	2 U	6	15	0
		Arsenic	8.7	8.7	11.3	10	5 U	10	0.045	0
		Barium	*37.7*	*44*	*40.9*	*44.1*	*22.4*	2000	2600	256
		Calcium	93700	97600 J	97400	97500	89400	NS	NS	53100
		Carbon disulfide	0.32 J	1 U	0.28 J	1 U	0.64 J	NS	1000	*
		Cobalt	9.7	2.2 J	5 U	5 U	5 U	NS	730	0
		HMX	0.058 J	0.52 U	0.53 U	0.5 U	0.1 U	NS	1800	*
		Iron	2120 J	2120	2970	2610	4440	300	11000	1430
		Magnesium	44800	42800	42900	42600	43100	NS	NS	15000
		Manganese	1660 J	1270 J	1360	1350	1750	50	880	1340
		Nickel	24.8 UJ	*4.2 J*	*4.5 J*	*2.9 J*	10 U	NS	730	83.4
		Perchlorate[2]	NT	0.042 J	NT	NT	NT	NS	3.6	*
		PETN	3.1 U	3.2 U	3.2 U	0.42 J	0.68 U	NS	NS	*
		Potassium	*3650 J*	*2920*	*2420*	*2190 J*	*2180*	NS	NS	5770
		Sodium	*17500*	*13200*	*11700*	*12100*	*8400*	NS	NS	51400
		Thallium	2 U	2 U	0.35 J	0.18 UJ	1 U	2	2.4	0
		Zinc	15.4 U	333 J	*47.7*	57.5	10 U	5000	11000	52.3

Area	Well Number	Analyte	April-09 Level (µg/L)	July-09 Level (µg/L)	Oct-09 Level (µg/L)	Jan-10 Level (µg/L)	Jul-10 Level (µg/L)	MCL (µg/L)	Region 9 PRG (µg/L)	Facility-Wide Background (µg/L)
Sharon Conglomerate	SCFmw-006	1,3,5-Trinitrobenzene	0.047 J	0.2 U	0.2 U	0.2 UJ	0.11	NS	1100	*
		4-Nitrotoluene	0.48 U	0.51 U	0.5 U	0.51 U	0.18 J	MS	0.66	*
		Acetone	10 U	10 UJ	10 U	10 U	4.9 JB	NS	5500	*
		Aluminum	100 U	100 U	21.3 J	100 U	50 U	200	36000	0
		Antimony	1 J	0.98 J	5 U	0.86 J	2 U	6	15	0
		Arsenic	12.9	12.6	14.1	13.8	12.8	10	0.045	0
		Barium	*112*	*118*	*191*	*127*	*107*	2000	2600	256
		beta-BHC	0.05 U	0.05 U	0.5 U	0.05 U	0.02 J	NS	0.037	*
		bis(2-Ethylhexyl) phthalate	3.6 U	1.1 U	1 U	1 U	3.7 JB	NS	4.8	*
		Calcium	63200	64300	64400 J	67400	58300	NS	NS	53100
		Carbon disulfide	1 U	1 U	1 U	0.54 J	1 U	NS	1000	*
		Cobalt	2.2 J	5 U	5 U	5 U	5 U	NS	730	0
		Iron	*318*	*417*	*613*	*569*	*332*	300	11000	1430
		Magnesium	16500	16500	16500	17600	16300	NS	NS	15000
		Manganese	*176 J*	*171*	*171*	*190*	*153*	50	880	1340
		Nitrate-Nitrite[1]	0.1 U	0.1 U	0.04 JB	0.1 U	0.1	1	1	*
		Potassium	*1430*	*1470 J*	*1390 J*	*1670*	*5740*	NS	NS	5770
		Sodium	*9440*	*9900*	*9970*	*10400*	*10900*	NS	NS	51400
		Thallium	2 U	0.15 J	0.6 JB	0.18 UJ	1 U	2	2.4	0
		Zinc	4.8 UJ	36.8 U	*40.9 B*	4.3 UJ	10 U	5000	11000	52.3

NS = no standard NT = not tested

All inorganics are filtered, all organics are not filtered

* There are no background levels for organic constituents

J = estimated result. Results have been qualified "J" For more details refer to Data Verification/Validation Reports in in the FWGWMP October 2009 and January, and July 2010 Sampling Reports

B = organic or inorganic analysis when the analyte is found in the method blank or any of the field blanks

R = rejected data

U = analyzed but not detected at or above the reporting limit

Bold = inorganic constituent detected above Facility-Wide background levels

Italics = inorganic constituent detected below the Facility-Wide background levels

Shaded boxes indicate any contituent, which does not have a background value, detected above the reporting limit.

1 = mg/l

2 = the Region 9 PRG of 3.6 µg/L for the July 2008 event. There is no MCL for perchlorate.

On February 18, 2005 the USEPA establised a Drinking Water Equivalent Level (DWEL) for perchlorate at 24.5 µg/L

Table 4-5. Exceedances of MCLs and Region 9 PRGs

Area	Well Number	Monitored Zone	Analyte	Oct-09 Level (µg/L)	Jan-10 Level (µg/L)	Jul-10 Level (µg/L)	MCL (µg/L)	Region 9 PRG (µg/L)
Atlas Scrap Yard	ASYmw-001	Bedrock	Iron	631 J	50.0 U	NT	300	11000
			Manganese	1040	1140	NT	50	880
Atlas Scrap Yard	ASYmw-003	Bedrock	Arsenic	8.6	5.0 U	NT	10	0.045
			Iron	2580	50.0 U	NT	300	11000
			Manganese	529	45	NT	50	880
Atlas Scrap Yard	ASYmw-004	Bedrock	Arsenic	28	23.2	NT	10	0.045
			Iron	1940 J	1490 J	NT	300	11000
			Manganese	201	211	NT	50	880
Atlas Scrap Yard	ASYmw-005	Bedrock	Manganese	618	207	NT	50	880
Atlas Scrap Yard	ASYmw-006	Bedrock	Arsenic	17	16.1	NT	10	0.045
			Iron	1360	1120 J	NT	300	11000
			Manganese	177	169	NT	50	880
Atlas Scrap Yard	ASYmw-007	Unconsolidated	Manganese	205	188	NT	50	880
Atlas Scrap Yard	ASYmw-008	Unconsolidated	Aluminum	6300	1160 J	NT	200	36000
			Arsenic	26.4	10.3 J	NT	10	0.045
			Iron	17000 J	3210 J	NT	300	11000
			Manganese	412	64.7	NT	50	880
Atlas Scrap Yard	ASYmw-009	Bedrock	Aluminum	142	496	NT	200	36000
			Iron	323 J	811 J	NT	300	11000
			Manganese	607	624	NT	50	880
Atlas Scrap Yard	ASYmw-010	Unconsolidated	Aluminum	50.0 U	1160	NT	200	36000
			Arsenic	49.8	148	NT	10	0.045
			Iron	2530	6760 J	NT	300	11000
			Manganese	139	96.2	NT	50	880
Demolition Area 2	DETmw-003	Unconsolidated	Arsenic	11.5	NT	NT	10	0.045
			Iron	1440	NT	NT	300	11000
			Manganese	266	NT	NT	50	880
Load Line 10	LL10mw-001	Bedrock	Chloroform	0.26 J	NT	NT	NS	0.17
Load Line 10	LL10mw-002	Bedrock	bis(2-Ethylhexyl) phthalate	8.1 J	NT	NT	NS	4.8
Load Line 10	LL10mw-003	Bedrock	Carbon tetrachloride	2.8	NT	NT	5	0.17
			Chloroform	0.26 J	NT	NT	NS	0.17
Load Line 11	LL11mw-001	Unconsolidated	Manganese	960	NT	NT	50	880
Load Line 11	LL11mw-003	Unconsolidated	bis(2-Ethylhexyl) phthalate	8.6 J	NT	NT	NS	4.8
			Manganese	498	NT	NT	50	880
Load Line 11	LL11mw-004	Unconsolidated	Manganese	272	NT	NT	50	880
Load Line 11	LL11mw-009	Unconsolidated	bis(2-Ethylhexyl) phthalate	0.95 J	10	NT	NS	4.8
			Manganese	706	856	NT	50	880
			Tetrachloroethene	4.1	3.8	NT	5	0.1
Load Line 11	LL11mw-010	Unconsolidated	Manganese	430	NT	NT	50	880
Load Line 6	LL6mw-005	Bedrock	Arsenic	14.4	NT	NT	10	0.045
			Iron	946 J	NT	NT	300	11000
			Manganese	501	NT	NT	50	880
Load Line 6	LL6mw-006	Unconsolidated	Iron	363 J	NT	NT	300	11000
Load Line 6	LL6mw-007	Bedrock	Manganese	394	NT	NT	50	880
Load Line 7	LL7mw-001	Bedrock	1,1-Dichloroethene (total)	8.4	NT	NT	7	340
			Iron	8360 J	NT	NT	300	11000
			Manganese	460	NT	NT	50	880
Load Line 7	LL7mw-002	Bedrock	Manganese	311	NT	NT	50	880
Load Line 7	LL7mw-003	Bedrock	bis(2-Ethylhexyl) phthalate	10	NT	NT	NS	4.8
			Iron	17200	NT	NT	300	11000
			Manganese	1340	NT	NT	50	880

Area	Well Number	Monitored Zone	Analyte	Oct-09 Level (µg/L)	Jan-10 Level (µg/L)	Jul-10 Level (µg/L)	MCL (µg/L)	Region 9 PRG (µg/L)
Load Line 7	LL7mw-004	Bedrock	Iron	17000 J	NT	NT	300	11000
Load Line 7	LL7mw-005	Bedrock	Iron	1290 J	NT	NT	300	11000
			Manganese	2320	NT	NT	50	880
Load Line 7	LL7mw-006	Bedrock	Iron	2880 J	NT	NT	300	11000
			Manganese	1240	NT	NT	50	880
			RDX	0.78 J	NT	NT	NS	0.61
Load Line 8	LL8mw-001	Unconsolidated	Iron	942	NT	NT	300	11000
			Manganese	125	NT	NT	50	880
Load Line 8	LL8mw-002	Unconsolidated	Arsenic	6.6 J	NT	NT	10	0.045
			Iron	3850	NT	NT	300	11000
			Manganese	333	NT	NT	50	880
Load Line 8	LL8mw-003	Unconsolidated	Arsenic	4.1 J	NT	NT	10	0.045
			Iron	929	NT	NT	300	11000
			Manganese	677	NT	NT	50	880
Load Line 8	LL8mw-004	Unconsolidated	Arsenic	3.3 J	NT	NT	10	0.045
Load Line 8	LL8mw-005	Bedrock	Iron	1180	NT	NT	300	11000
			Manganese	2690	NT	NT	50	880
Load Line 9	LL9mw-001	Bedrock	bis(2-Ethylhexyl) phthalate	5.3 J	NT	NT	NS	4.8
Load Line 9	LL9mw-002	Bedrock	bis(2-Ethylhexyl) phthalate	5.6 J	NT	NT	NS	4.8
Load Line 9	LL9mw-003	Bedrock	Iron	3240	NT	NT	300	11000
			Manganese	111	NT	NT	50	880
Load Line 9	LL9mw-004	Bedrock	Iron	10600	NT	NT	300	11000
			Manganese	2290	NT	NT	50	880
Load Line 9	LL9mw-006	Bedrock	Iron	1930	NT	NT	300	11000
			Manganese	677	NT	NT	50	880
Load Line 9	LL9mw-007	Bedrock	Iron	9900	NT	NT	300	11000
			Manganese	1050	NT	NT	50	880
Ramsdell Quarry Landfill	RQLmw-007	Bedrock	Arsenic	71.4	NT	NT	10	0.045
			Iron	23900 J	NT	NT	300	11000
			Manganese	1740	NT	NT	50	880
Ramsdell Quarry Landfill	RQLmw-008	Bedrock	alpha-BHC	0.023 J	NT	NT	NS	0.011
			Arsenic	29.9	NT	NT	10	0.045
			Iron	49600 J	NT	NT	300	11000
			Manganese	408	NT	NT	50	880
Ramsdell Quarry Landfill	RQLmw-009	Bedrock	Arsenic	8.9	NT	NT	10	0.045
			Iron	5280 J	NT	NT	300	11000
			Manganese	1260	NT	NT	50	880
Load Line 1	LL1mw-064	Unconsolidated	Iron	NT	NT	517	300	11000
Load Line 1	LL1mw-065	Unconsolidated	Manganese	NT	NT	256	50	880
Load Line 1	LL1mw-078	Bedrock	Manganese	NT	NT	71	50	880
Load Line 1	LL1mw-080	Bedrock	beta-BHC	NT	NT	0.048 J	NS	0.037
			RDX	NT	NT	88 J	NS	0.61
Load Line 1	LL1mw-081	Bedrock	Iron	NT	NT	4200	300	11000
			Manganese	NT	NT	1830	50	880
			RDX	NT	NT	1	NS	0.61
Load Line 1	LL1mw-082	Bedrock	Iron	NT	NT	5150	300	11000
			Manganese	NT	NT	1080	50	880
Load Line 1	LL1mw-083	Bedrock	2,4,6-Trinitrolouene	NT	NT	5 J	NS	2.2
			2-Nitrotoluene	NT	NT	0.18 J	NS	0.049
			Aluminum	NT	NT	813	200	36000
			Manganese	NT	NT	497	50	880

Area	Well Number	Monitored Zone	Analyte	Oct-09 Level (µg/L)	Jan-10 Level (µg/L)	Jul-10 Level (µg/L)	MCL (µg/L)	Region 9 PRG (µg/L)
Load Line 1	LL1mw-084	Bedrock	2,4,6-Trinitrolouene	NT	NT	9.2 J	NS	2.2
			Aluminum	NT	NT	335	200	36000
			beta-BHC	NT	NT	0.26 J	NS	0.037
			Manganese	NT	NT	196	50	880
			RDX	NT	NT	0.76 J	NS	0.61
Load Line 1	LL1mw-085	Bedrock	Iron	NT	NT	435	300	11000
			Manganese	NT	NT	564	50	880
Load Line 12	LL12mw-088	Unconsolidated	Arsenic	NT	NT	29.4	10	0.045
			Iron	NT	NT	3890	300	11000
			Manganese	NT	NT	428	50	880
Load Line 12	LL12mw-107	Unconsolidated	Arsenic	NT	NT	9.7	10	0.045
			Iron	NT	NT	2640 J	300	11000
			Manganese	NT	NT	242	50	880
Load Line 12	LL12mw-113	Unconsolidated	Aluminum	NT	NT	103000	200	36000
			Arsenic	NT	NT	249	10	0.045
			Beryllium	NT	NT	5	4	73
			Chromium	NT	NT	163	100	110
			Iron	NT	NT	354000	300	11000
			Lead	NT	NT	127	15	NS
			Manganese	NT	NT	5730	50	880
			Vanadium	NT	NT	179	NS	36
Load Line 12	LL12mw-128	Unconsolidated	Aluminum	NT	NT	1960	200	36000
			Arsenic	NT	NT	47.5	10	0.045
			Iron	NT	NT	6890 J	300	11000
			Manganese	NT	NT	242	50	880
Load Line 12	LL12mw-153	Unconsolidated	Arsenic	NT	NT	21.4	10	0.045
			beta-BHC	NT	NT	0.1 J	NS	0.037
			Iron	NT	NT	3420	300	11000
			Manganese	NT	NT	188	50	880
Load Line 12	LL12mw-154	Unconsolidated	Arsenic	NT	NT	16.2	10	0.045
			Iron	NT	NT	1760	300	11000
			Manganese	NT	NT	85.9	50	880
Load Line 12	LL12mw-182	Unconsolidated	Arsenic	NT	NT	25.6	10	0.045
			Benzo(a)anthracene	NT	NT	0.23	NS	0.092
			Benzo(b)fluoranthene	NT	NT	0.22	NS	0.092
			bis(2-Ethylhexyl) phthalate	NT	NT	4.9 JB	NS	4.8
			Dibenzo(a,h)anthracene	NT	NT	0.21	NS	0.0093
			Indeno(1,2,3-cd)pyrene	NT	NT	0.22	NS	0.092
			Iron	NT	NT	766 J	300	11000
			Manganese	NT	NT	43.7	50	880
Load Line 12	LL12mw-183	Unconsolidated	Arsenic	NT	NT	29.8	10	0.045
			Heptachlor	NT	NT	0.027 J	0.4	0.015
			Iron	NT	NT	867	300	11000
Load Line 12	LL12mw-184	Unconsolidated	Arsenic	NT	NT	15.8	10	0.045
			Iron	NT	NT	2300 J	300	11000
			Manganese	NT	NT	469	50	880
Load Line 12	LL12mw-185	Unconsolidated	Manganese	NT	NT	1380	50	880
			Nitrate-Nitrite	NT	NT	160 J	1	1
Load Line 12	LL12mw-186	Unconsolidated	Manganese	NT	NT	275	50	880
Load Line 12	LL12mw-187	Unconsolidated	Manganese	NT	NT	2020	50	880
			Nitrate-Nitrite[1]	NT	NT	1400	1	1

Area	Well Number	Monitored Zone	Analyte	Oct-09 Level (µg/L)	Jan-10 Level (µg/L)	Jul-10 Level (µg/L)	MCL (µg/L)	Region 9 PRG (µg/L)
Load Line 12	LL12mw-188	Unconsolidated	Heptachlor	NT	NT	0.017 J	0.4	0.015
			Manganese	NT	NT	433	50	880
Load Line 12	LL12mw-189	Unconsolidated	Aluminum	NT	NT	298	200	36000
			Arsenic	NT	NT	5.1	10	0.045
			Iron	NT	NT	1320 J	300	11000
			Manganese	NT	NT	310	50	880
Load Line 12	LL12mw-242	Unconsolidated	Arsenic	NT	NT	21.3	10	0.045
			Iron	NT	NT	833	300	11000
			Manganese	NT	NT	56	50	880
Load Line 12	LL12mw-243	Unconsolidated	Arsenic	NT	NT	6.5	10	0.045
			Manganese	NT	NT	281	50	880
			Aluminum	NT	NT	33700	200	36000
Load Line 12	LL12mw-244	Unconsolidated	Arsenic	NT	NT	51.1	10	0.045
			Iron	NT	NT	78800 J	300	11000
			Lead	NT	NT	26	15	NS
			Manganese	NT	NT	955	50	880
			Vanadium	NT	NT	49	NS	36
Load Line 12	LL12mw-245	Unconsolidated	Arsenic	NT	NT	9.1	10	0.045
			Manganese	NT	NT	103	50	880
Load Line 12	LL12mw-246	Unconsolidated	Arsenic	NT	NT	29.7	10	0.045
			Iron	NT	NT	1190 J	300	11000
			Manganese	NT	NT	74.5	50	880
Load Line 2	LL2mw-059	Bedrock	Arsenic	NT	NT	6.4	10	0.045
			Iron	NT	NT	7090	300	11000
			Manganese	NT	NT	5530	50	880
Load Line 2	LL2mw-261	Bedrock	Arsenic	NT	NT	11.2	10	0.045
			Iron	NT	NT	2290	300	11000
			Manganese	NT	NT	375	50	880
Load Line 2	LL2mw-262	Bedrock	Manganese	NT	NT	77.4	50	880
Load Line 2	LL2mw-263	Bedrock	Arsenic	NT	NT	15.4	10	0.045
			Iron	NT	NT	4670	300	11000
			Manganese	NT	NT	1450	50	880
Load Line 2	LL2mw-265	Bedrock	Iron	NT	NT	614	300	11000
			Manganese	NT	NT	1430	50	880
Load Line 2	LL2mw-266	Bedrock	Aluminum	NT	NT	1060	200	36000
			Arsenic	NT	NT	5.6	10	0.045
			bis(2-Ethylhexyl) phthalate	NT	NT	5.8 JB	NS	4.8
			Iron	NT	NT	5080	300	11000
			Manganese	NT	NT	1390	50	880
Load Line 2	LL2mw-267	Bedrock	Iron	NT	NT	1240	300	11000
			Manganese	NT	NT	622	50	880
			RDX	NT	NT	1.1	NS	0.61
Load Line 2	LL2mw-269	Bedrock	Iron	NT	NT	5990	300	11000
			Manganese	NT	NT	1540	50	880
Load Line 2	LL2mw-270	Bedrock	Iron	NT	NT	1420	300	11000
			Manganese	NT	NT	384	50	880
Load Line 3	LL3mw-232	Bedrock	Arsenic	NT	NT	3.5 J	10	0.045
			Manganese	NT	NT	308	50	880
Load Line 3	LL3mw-234	Bedrock	Iron	NT	NT	1210	300	11000
			Manganese	NT	NT	2190 J	50	880
Load Line 3	LL3mw-236	Bedrock	Manganese	NT	NT	235	50	880

Area	Well Number	Monitored Zone	Analyte	Oct-09 Level (µg/L)	Jan-10 Level (µg/L)	Jul-10 Level (µg/L)	MCL (µg/L)	Region 9 PRG (µg/L)
Load Line 3	LL3mw-239	Bedrock	bis(2-Ethylhexyl) phthalate	NT	NT	8.7 JB	NS	4.8
			Carbon tetrachloride	NT	NT	0.37 J	5	0.17
			Chloroform	NT	NT	0.52 J	NS	0.17
			Manganese	NT	NT	101	50	880
			RDX	NT	NT	1.7	NS	0.61
Load Line 4	LL4mw-196	Unconsolidated	bis(2-Ethylhexyl) phthalate	NT	NT	8.2 JB	NS	4.8
			Iron	NT	NT	393	300	11000
			Manganese	NT	NT	183	50	880

Notes:
NS = no standard NT = not tested
All inorganics are filtered, all organics are not filtered
* There are no background levels for organic constituents
J = estimated result. Results have been qualified "J" For more details refer to Data Verification/Validation Reports in in the FWGWMP October 2009 and January, and July 2010 Sampling Reports
B = organic or inorganic analysis when the analyte is found in the method blank or any of the field blanks
R = Rejected data
U = analyzed but not detected at or above the reporting limit
Bold = inorganic constituent detected above MCl or Region 9 PRG
1 = mg/l

Table 4-6. Exceedances of MCLs and Region 9 PRGs for the Sharon Conglomerate Wells

Area	Well Number	Analyte	April-09 Level (µg/L)	July-09 Level (µg/L)	Oct-09 Level (µg/L)	Jan-10 Level (µg/L)	Jul-10 Level (µg/L)	MCL (µg/L)	Region 9 PRG (µg/L)
Sharon Conglomerate	SCFmw-001	Aluminum	100 U	100 U	1720	50 U	50 U	200	36000
		Arsenic	3.3 J	5 U	11.7	15.2	13.1	10	0.045
		Iron	6850 J	2960	4760	1320	814	300	11000
		Manganese	767 J	449 J	336	261	194	50	880
Sharon Conglomerate	SCFmw-002	Arsenic	12.2	17	18.6	20.6	12.5	10	0.045
		Iron	100 U	216	645	730	233	300	11000
		Manganese	82.1 J	102 J	92	96.3	67.3	50	880
Sharon Conglomerate	SCFmw-003	Arsenic	3.7 J	5 U	5 U	5 U	5 U	10	0.045
		Iron	187 U	491	610	614	390	300	11000
		Manganese	269 J	271 J	248	243	237	50	880
Sharon Conglomerate	SCFmw-004	Aluminum	100 U	100 U	203	100 U	50 U	200	36000
		Iron	100 U	100 U	316	100 U	50 U	300	11000
		Manganese	697 J	626	646	681	624	50	880
Sharon Conglomerate	SCFmw-005	Arsenic	8.7	8.7	11.3	10	5 U	10	0.045
		Iron	2120 J	2120	2970	2610	4440	300	11000
		Manganese	1660 J	1270 J	1360	1350	1750	50	880
Sharon Conglomerate	SCFmw-006	Arsenic	12.9	12.6	14.1	13.8	12.8	10	0.045
		Iron	318	417	613	569	332	300	11000
		Manganese	176 J	171	171	190	153	50	880

Notes:

NS = no standard NT = not tested

All inorganics are filtered, all organics are not filtered

* There are no background levels for organic constituents

J = estimated result. Results have been qualified "J" For more details refer to Data Verification/Validation Reports

B = organic or inorganic analysis when the analyte is found in the method blank or any of the field blanks

R = Rejected data

U = analyzed but not detected at or above the reporting limit

Bold = inorganic constituent detected above the MCL or Region 9 PRG

APPENDIX E

Key Personnel Certification

Environmental Quality Management, Inc.
1800 Carillon Boulevard
Cincinnati, Ohio 45240
(513) 825-7500
FAX (513) 825-7495
www.eqm.com

APPENDIX E: KEY PERSONNEL CERTIFICATIONS

Environmental Quality Management, Inc. follows all required Medical Surveillance protocols in accordance with 29CFR 1910.120(f), Hazardous Waste Operations and Emergency Response, for all appropriate employees. Specifically, the below listed employees have completed their annual Medical Surveillance, as noted, and are qualified.

Name	Date of Medical Surveillance
Scott Spesshardt	8/29/11
John Miller	8/31/11
Erik Corbin	8/10/11
Colleen Lear	scheduled – October 2011

If you have any questions please contact me at 513-742-7230.

Sincerely,

D. Leah Columbus
Human Resources Manager

THE NATIONAL ENVIRONMENTAL TRAINERS

John Miller

has satisfactorily passed an exam and completed an 8-hour Supervisor annual refresher training course entitled

Hazardous Waste Operations and Emergency Response

meeting the requirements identified in Title 29 CFR 1910.120 (OSHA HAZWOPER Regulations). This course has been awarded 1.34 Industrial Hygiene CM Points by the American Board of Industrial Hygiene-Approval Number 13334. This course is also eligible for .66 Continuance of Certification (COC) points from the Board of Certified Safety Professionals

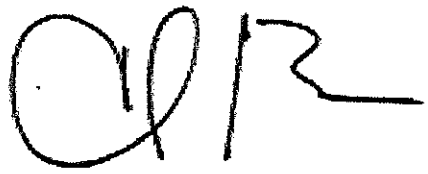
NATIONAL ENVIRONMENTAL TRAINERS, Inc.

November 12, 2010

Course Number 1002, Awarded 8 PDH's
Florida Board of Professional Engineers
CEU Provider Number 0004284

www.nationalenvironmentaltrainers.com

Signature of Instructor



Clay A. Bednarz, MS, RPIH

Certificate of Completion

This Certifies That

John Miller

has completed the

OSHA 40-Hour Personnel Protection & Safety Course

Presented by

PEI Associates, Inc.

May 18-21, 1989
Date

John F. Nobis
John F. Nobis—Director, Safety & Training

HEARTSAVER FIRST AID CPR AED

Heartsaver® First Aid CPR AED

American Heart Association®

John Miller

This card certifies that the above individual has successfully completed the objectives and skills evaluations in accordance with the curriculum of the AHA Heartsaver First Aid CPR AED Program. Optional completed modules are those **NOT** marked out:

Child CPR AED Infant CPR Written test

Issue Date 06/2011

Recommended Renewal Date 06/2013

HEARTSAVER FIRST AID CPR AED

Training Center Name NKEMS

TC ID # KY1346

TC Info City, Thomas, KY 41075 859-572-4511

Course Location NKEMS

Instructor Name Laura Randall

Inst. ID # TCCKY1346

Holder's Signature

 Tampering with this card will alter its appearance. 90-1815

THE NATIONAL ENVIRONMENTAL TRAINERS

Colleen Lear

has satisfactorily passed an exam and completed an 8-hour annual refresher training course entitled

Hazardous Waste Operations and Emergency Response

meeting the requirements identified in Title 29 CFR 1910.120.

This course has been awarded 1.34 Industrial Hygiene CM Points by the American Board of Industrial Hygiene-Approval Number 13334. This course is also eligible for .66 Continuance of Certification (COC) points from the Board of Certified Safety Professionals

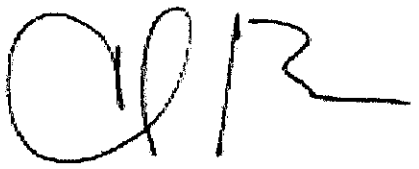
NATIONAL ENVIRONMENTAL TRAINERS, Inc.

June 15, 2011

Course Number 1001, Awarded 8 PDH's
Florida Board of Professional Engineers
CEU Provider Number 0004284

www.nationalenvironmentaltrainers.com

Signature of Instructor



Clay A. Bednarz, MS, RPIH

ONSITE ENVIRONMENTAL

This is to certify that

Colleen A. Kitch

[redacted]

has successfully completed ONSITE's 40 hour HAZWOPER training and is in compliance with 29 CFR 1910.120 (e). This also represents completion of training in Confined Spaces & Level A, B, C, D Ensemble

At
Cincinnati, OH
On
February 20, 1997

Expiration Date: February 19, 1998
Certificate Number: 40-10460

Steffani Fine
Health & Safety Manager

HEARTSAVER FIRST AID CPR AED

Heartsaver® First Aid CPR AED

American Heart Association.

Colleen Lear

This card certifies that the above individual has successfully completed the objectives and skills evaluations in accordance with the curriculum of the AHA Heartsaver First Aid CPR AED Program. Optional completed modules are those **NOT** marked out:

Child CPR AED | Infant CPR | Written test

06/2011
Issue Date

06/2013
Recommended Renewal Date

HEARTSAVER FIRST AID CPR AED

Training Center Name: NKEMS — TC ID #: KY1346

TC Info: Ft. Thomas, KY 41075 — 859-572-4511

Course Location: NKEMS

Instructor Name: Laura Randall — Inst. ID #: TCCKY1346

Holder's Signature

 Tampering with this card will alter its appearance. 90-1815

THE NATIONAL ENVIRONMENTAL TRAINERS

Erik Corbin

has satisfactorily passed an exam and completed an 8-hour annual refresher training course entitled

Hazardous Waste Operations and Emergency Response

meeting the requirements identified in Title 29 CFR 1910.120.

This course has been awarded 1.34 Industrial Hygiene CM Points by the American Board of Industrial Hygiene-Approval Number 13334. This course is also eligible for .66 Continuance of Certification (COC) points from the Board of Certified Safety Professionals

NATIONAL ENVIRONMENTAL TRAINERS, Inc.

May 11, 2011

Course Number 1001, Awarded 8 PDH's
Florida Board of Professional Engineers
CEU Provider Number 0004284

www.nationalenvironmentaltrainers.com

Signature of Instructor

Clay A. Bednarz, MS, RPIH

Certificate of Achievement

awarded by

ENVIRONMENTAL RESOURCE TRAINING CENTER

at

FINDLAY

THE UNIVERSITY OF FINDLAY

to

ERIK C. CORBIN

For Successful Completion Of

OSHA 40-HOUR SAFETY TRAINING WORKSHOP
(FULFILLS THE REQUIREMENTS OF 29 CFR 1910.120 COVERING HAZARDOUS WASTE OPERATIONS)
4.0 CEU'S
APRIL 23, 1994

J. Ralph Van Dyne
Director of Hazardous
Materials Program

Instructor

HEARTSAVER FIRST AID CPR AED

Heartsaver®
First Aid CPR AED

American Heart Association®

Erik Corbin

This card certifies that the above individual has successfully completed the objectives and skills evaluations in accordance with the curriculum of the AHA Heartsaver First Aid CPR AED Program. Optional completed modules are those **NOT** marked out:

Child CPR AED Infant CPR Written test

06/2011
Issue Date

06/2013
Recommended Renewal Date

HEARTSAVER FIRST AID CPR AED

Training Center Name: NKEMS TC ID #: KY1346

TC Info: Ft. Thomas, KY 41075 (City, State / Zip) 859-572-4511 (Phone)

Course Location: NKEMS

Instructor Name: Laura Randall Inst. ID #: TCCKY1346

Holder's Signature

 Tampering with this card will alter its appearance. 90-1815

THE NATIONAL ENVIRONMENTAL TRAINERS

Scott Spesshardt

has satisfactorily passed an exam and completed an 8-hour annual refresher training course entitled

Hazardous Waste Operations and Emergency Response

meeting the requirements identified in Title 29 CFR 1910.120.

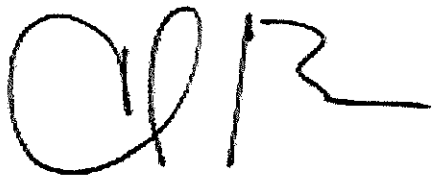
This course has been awarded 1.34 Industrial Hygiene CM Points by the American Board of Industrial Hygiene-Approval Number 13334. This course is also eligible for .66 Continuance of Certification (COC) points from the Board of Certified Safety Professionals

NATIONAL ENVIRONMENTAL TRAINERS, Inc.

Course Number 1001, Awarded 8 PDH's
Florida Board of Professional Engineers
CEU Provider Number 0004284

www.nationalenvironmentaltrainers.com

Signature of Instructor



September 02, 2011

Clay A. Bednarz, MS, RPIH

Certificate of Completion

This Certifies That

Scott A. Spesshardt

has completed the 40-hour Health and Safety training course in accordance with 29 CFR 1910.120.

Presented by:

PSARA

Technologies, Inc.

December 5-8, 1988

Date

Training Director