SUSPECTED MUSTARD AGENT BURIAL AREA OF CONCERN (RVAAP-28)

REPORT ON THE ADDITIONAL GROUNDWATER MONITORING WELL INSTALLATION AND GROUNDWATER SAMPLING at the SUSPECTED MUSTARD AGENT BURIAL AREA OF CONCERN

RAVENNA ARMY AMMUNITION PLANT,
RAVENNA, OHIO

PREPARED FOR:

US ARMY CORPS OF ENGINEERS
LOUISVILLE, KENTUCKY
CONTRACT NO. W912QR-04-M-0116

FINAL REPORT

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Prepared for:

U.S. Army Corps of Engineers
Louisville, Kentucky
Contract No. W912QR-04-M-0116

Prepared by:

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LIST OF ACRONYMS

amsl	above mean sea level
AOC	Area of Concern
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CSM	conceptual site model
CWA	Chemical Warfare Agent
DDD	dichlorodiphenyldichloroethane
DoD	Department of Defense
DQO	data quality objective
DQSR	Data Quality Summary Report
HMX	high melting explosive (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)
IDW	investigation-derived waste
MEC	munitions and explosives of concern
MS/MSD	matrix spike/matrix spike duplicate
MDL	method detection limit
NPL	National Priority List
OE	ordnance and explosives
Ohio EPA	Ohio Environmental Protection Agency
OHARNG	Ohio Army National Guard
OVA	organic vapor analyzer
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PVC	polyvinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
RI	Remedial Investigation
RVAAP	Ravenna Army Ammunition Plant
SAP	Sampling and Analysis Plan
SRC	site related contaminant
SVOC	semi-volatile organic compound
TAL	target analyte list
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
UXO	unexploded ordnance
VOC	volatile organic compound

EXECUTIVE SUMMARY

PURPOSE

The primary objective of this investigation was to determine if mustard agent breakdown products are present in the uppermost groundwater bearing zone adjacent to the suspected mustard agent burial AOC. A secondary objective of this investigation was to sample the groundwater collected from the newly installed downgradient monitoring wells and analyze the samples for explosives, propellants, TAL metals (filtered), cyanide, VOCs, SVOCs, pesticides, and PCBs. SpecPro, Inc., under contract W912QR-04-M-0116 with the US Army Corps of Engineers (USACE), Louisville District, completed the following tasks to meet this objective:

- Installed 2 new groundwater monitoring wells downgradient from the suspected mustard agent burial AOC.
- Analyzed groundwater samples collected from each of the six monitoring wells for mustard agent breakdown products (thiodiglycol, 1,4-dithiane, and 1,4-oxathiane).
- Analyzed the groundwater samples collected from the two new downgradient monitoring well for explosives, propellants, TAL Metals (filtered), cyanide, VOCs, SVOCs, pesticides, and PCBs.
- Collected Shelby tube samples from the screened intervals of the two additional monitoring well borings and analyzed for moisture content, grain size distribution, Unified Soil Classification System (USCS), Atterberg Limits, specific gravity, bulk density, and porosity.
- Surveyed horizontal coordinates and surface elevations of the newly installed monitoring wells.
- Performed slug tests on the newly installed monitoring wells.
- Properly disposed of Investigation-Derived Waste (IDW).

RESULTS

Groundwater samples were collected from all six monitoring wells at the Suspected Mustard Agent Burial AOC. All of the samples were analyzed for mustard agent breakdown products. The groundwater collected from the downgradient wells MBSmw-005 and –MBSmw-006 were additionally analyzed for explosives and propellants, filtered TAL metals and unfiltered cyanide, VOCs, SVOCs, pesticides and PCBs. The results of the laboratory analysis are as follows:

- Mustard agent breakdown products were not detected in any of the groundwater samples collected.

- Nitrocellulose at MBSmw-006 was the only explosive and propellant detected in the samples collected from MBSmw-005 and MBSmw-006. The result (1.4 ug/L) was qualified with a "B" due to method blank contamination.
- Analytical results of groundwater samples tested for Target Analyte List (TAL) Metals were screened against facility wide background levels. Barium (84.0 ug/L at MBSmw-005 and 86.1 ug/L at MBSmw-006) and nickel (1.7 ug/L at MBSmw-006) exceeded the facility wide background levels for these TAL Metals. The facility wide background level for barium is 82.1 ug/L. The facility wide background level for nickel is 0 ug/l.
- 2-butanone at MBSmw-005 (0.95 ug/L) was the only VOC detected. The Region 9 PRG for 2-butanone is 7000 ug/L.
- Benzoic acid (4.5 ug/L at MBSmw-005) was the only SVOC detected. The Region 9 PRG for benzoic acid is 150000 ug/L.
- PCB-1260 (estimated at 0.088 ug/L at MBSmw-006) was the only PCB detected for this investigation. The MCL for PCB-1260 is 0.5 ug/L and the Region 9 PRG is 0.034 ug/L. Pesticides were not detected in the groundwater sampled for this investigation.

CONCLUSIONS

Mustard breakdown products were not detected in the groundwater sampled from the monitoring wells installed at the Suspected Mustard Agent Burial AOC. There are three possible explanations for this:

1. Mustard agent was not buried at the suspected burial AOC and is not present at this location.
2. Mustard agent is present at the suspected burial AOC, but is not leaching into the groundwater.
3. Mustard agent is present at the suspected burial AOC and is leaching into the groundwater, but none of the wells installed for this investigation were placed to intercept the plume.

It would take a substantial investigation to prove or disprove possibilities #'s 1 and 2 listed above. At this time, we do not recommend further investigation to determine if mustard agent is present at the site for the following reasons:

1. An unsubstantiated and undocumented source reported that mustard agent containers may have been buried at the site.
2. Thiodiglycol, a mustard agent breakdown product, was not detected at the AOC in a minimal number of surface soil samples obtained by USACHPPM during a previous investigation.
3. Mustard agent or mustard agent breakdown products were not detected at the AOC during this investigation.

4. In summary, there has never been any evidence or documented indication that mustard agent was ever buried at the AOC to warrant further investigation.

1.0 INTRODUCTION

A suspected mustard agent burial area of concern (AOC) (RVAAP-28) has been identified at the Ravenna Army Ammunition Plant (RVAAP). It was decided that the best and safest path forward to evaluate if mustard agent is present and leaking within the suspected burial AOC was to determine if mustard agent breakdown products are present in the uppermost groundwater bearing zone a short distance outside of the suspected burial AOC. Four monitoring wells (MBSmw-001 through-004) were installed at the site in Fall 2004. Due to the flat relief of the site, the wells were installed without a clear indication of which wells would be the upgradient or downgradient wells. Once the wells were installed, measurements were taken to determine groundwater flow direction. Groundwater collected from all four monitoring wells was analyzed for mustard agent breakdown products. None were detected. Additionally, groundwater from the downgradient well, MBSmw-001 was analyzed for explosives, propellants, Target Analyte List (TAL) metals (filtered), cyanide, Volatile Organic Compounds (VOCs), Semi-Volatile Organic Compounds (SVOCs), pesticides, and Polychlorinated Biphenyls (PCBs). None were detected. The results of this investigation are presented in *Report on the Groundwater Monitoring Well Installation and Groundwater Sampling at the Suspected Mustard Agent Burial Area of Concern, Ravenna Army Ammunition Plant, Ravenna, Ohio (SpecPro, Inc., 2005).*

Based on the results of the investigation described above, it was recommended that two additional permanent monitoring wells be installed at the site in optimal . downgradient locations from the suspected burial site, and that all six monitoring wells be sampled for mustard agent breakdown products. This report documents the results of the additional investigation primarily performed in October and November 2005 at the Suspected Mustard Agent Burial AOC at RVAAP, Ravenna, Ohio (Figures 1-1, 1-2, and 1-3). The investigation was conducted in compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 following work plans reviewed and commented on by the U.S. Army Corps of Engineers (USACE) and the Ohio Environmental Protection Agency (Ohio EPA).

1.1 PURPOSE AND SCOPE

The primary objective of this investigation was to determine if mustard agent breakdown products are present in the uppermost groundwater bearing zone adjacent to the suspected mustard agent burial AOC. A secondary objective of this investigation was to sample the groundwater collected from the newly installed downgradient monitoring wells and analyze the samples for explosives, propellants, TAL metals (filtered), cyanide, VOCs, SVOCs, pesticides, and PCBs. SpecPro, Inc., under contract W912QR-04-M-0116 with the US Army Corps of Engineers (USACE), Louisville District, completed the following tasks to meet this objective:

- Installed 2 new groundwater monitoring wells downgradient from the suspected mustard agent burial AOC.

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- Collected Shelby tube samples from the screened intervals of the two additional monitoring well borings and analyzed for moisture content, grain size distribution, Unified Soil Classification System (USCS), Atterberg Limits, specific gravity, bulk density, and porosity.
- Surveyed horizontal coordinates and surface elevations of the newly installed monitoring wells.
- Performed slug tests on the newly installed monitoring wells.
- Properly disposed of Investigation-Derived Waste (IDW).

To meet the primary project objectives, investigation-specific data quality objectives (DQOs) were developed using the approach presented in the Facility-wide Sampling and Analysis Plan (SAP) (USACE 2001a).

The investigation approach for this project involved a combination of field and laboratory activities to characterize the AOC. Field investigation techniques included soil boring and sampling, and groundwater sampling. The field program was conducted in accordance with the Facility-wide SAP (USACE 2001a) and the *Final Work Plan and Sampling and Analysis Plan Addenda for the Groundwater Monitoring Well Installation and Groundwater Sampling at the Suspected Mustard Agent Burial Site at the Ravenna Army Ammunition Plant, Ravenna, Ohio* (SAP Addendum) (USACE 2004).

1.2 GENERAL SITE DESCRIPTION, HISTORY and PREVIOUS INVESTIGATIONS

Past Department of Defense (DOD) activities at the Ravenna Army Ammunition Plant (RVAAP) date back to 1940 and include the manufacturing, loading, handling and storage of military explosives and ammunition. Up until 1999, the RVAAP was identified as a 21,419-acre installation. The property boundary was resurveyed by the Ohio Army National Guard (OHARNG) over a two year period 2002 and 2003 and the actual total acreage of the property was found to be 21,683.289 acres. As of February 2006, a total of 20,403 acres of the former 21,683 acre RVAAP have been transferred to the United States Property and Fiscal Officer (USP&FO) for Ohio for use by the OHARNG as a military training site. The current RVAAP consists of 1,280 acres in several distinct parcels scattered throughout the confines of the OHARNG Ravenna Training and Logistics Site (RTLS). The RVAAP and the RTLS are collocated on contiguous parcels of property and the RTLS perimeter fence completely encloses the remaining parcels of the RVAAP. The RTLS is in northeastern Ohio within Portage and Trumbull Counties, approximately 4.8 kilometers (3 miles) east northeast of the city of Ravenna and approximately 1.6 kilometers (1 mile) northwest of the city of Newton Falls (Figure 1-1). The RVAAP portions of the property are solely located within Portage County. The RTLS (inclusive of the RVAAP) is a parcel of property

approximately 17.7 kilometers (11 miles) long and 5.6 kilometers (3.5 miles) wide bounded by State Route 5, the Michael J. Kirwan Reservoir, and the CSX System Railroad on the south; Garret, McCormick, and Berry roads on the west; the Norfolk Southern Railroad on the north; and State Route 534 on the east (see Figures 1-1 and 1-2). The RTLS is surrounded by several communities: Windham on the north; Garrettsville 9.6 kilometers (6 miles) to the northwest; Newton Falls 1.6 kilometers (1 mile) to the southeast; Charlestown to the southwest; and Wayland 4.8 kilometers (3 miles) to the south. When the RVAAP was operational the RTLS did not exist and the entire 21,683-acre parcel was a government-owned, contractor-operated (GOCO) industrial facility. The RVAAP Installation Restoration Program (IRP) encompasses investigation and cleanup of past activities over the entire 21,683 acres of the former RVAAP and therefore references to the RVAAP in this document are considered to be inclusive of the historical extent of the RVAAP, which is inclusive of the combined acreages of the current RTLS and RVAAP, unless otherwise specifically stated.

The U.S. Army excavated a possible mustard agent burial site west of the NACA Test Area in 1969. One 50-gallon drum and seven small rusted cans were discovered. All recovered items were empty and no contamination was discovered according to reports (USACHPPM, 1996). An unidentified and undocumented source reported that the first site excavated was incorrectly identified, and that the mustard agent was buried nearby (USACHPPM, 1996). The second proposed site for the mustard agent burial is located in the wooded area approximately 500 feet south of Hinckley Creek along an abandoned power line right-of-way. The location of the suspected mustard agent burial AOC is shown in Figures 1-2 and 1-3. The suspected site was marked and fenced, however only remnants of the fence still exist. The area is currently marked with Seibert stakes.

Two surface soil samples were collected from this area in 1996 during the Hazardous and Medical Waste Study in 1996 (USACHPPM, 1996). No attempts were made to collect subsurface samples due to the potential hazards associated with it. The surface soil samples were tested for thiodiglycol, a mustard agent decomposition product. Thiodiglycol was not detected at or above the method detection limit (22.5 ppm).

As was discussed in Section 1.0, SpecPro, Inc. conducted an investigation at the site in 2004. The investigation involved installing and sampling four groundwater monitoring wells at the site. The results of this investigation are presented in *Report on the Groundwater Monitoring Well Installation and Groundwater Sampling at the Suspected Mustard Agent Burial Area of Concern, Ravenna Army Ammunition Plant, Ravenna, Ohio (SpecPro, Inc., 2005).* SAIC conducted a geophysical survey of the suspected burial site in 1998. Several metallic anomalies were identified during this investigation, but none could be positively identified as a buried container. The results of this investigation are presented in Appendix A of the above referenced report.

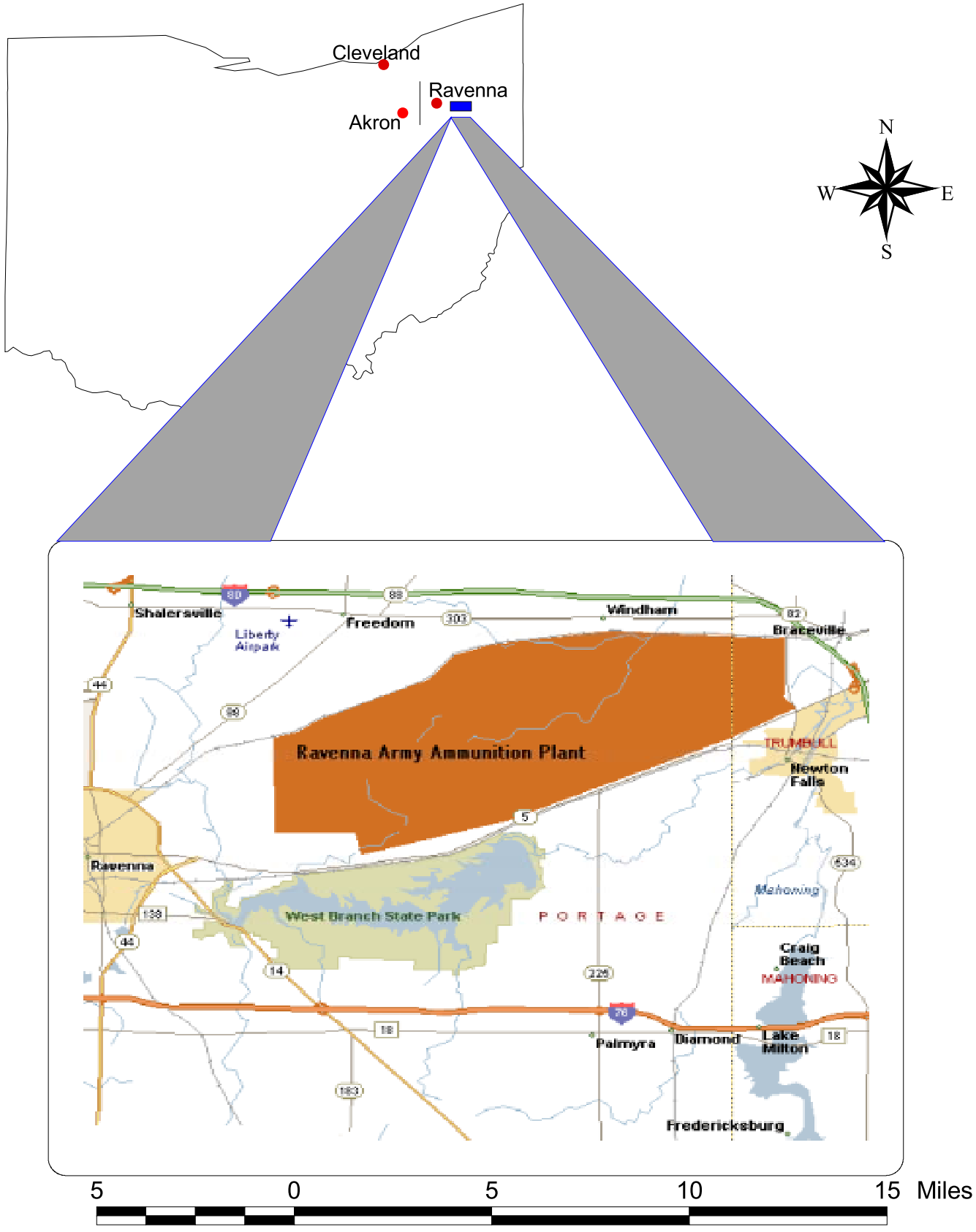
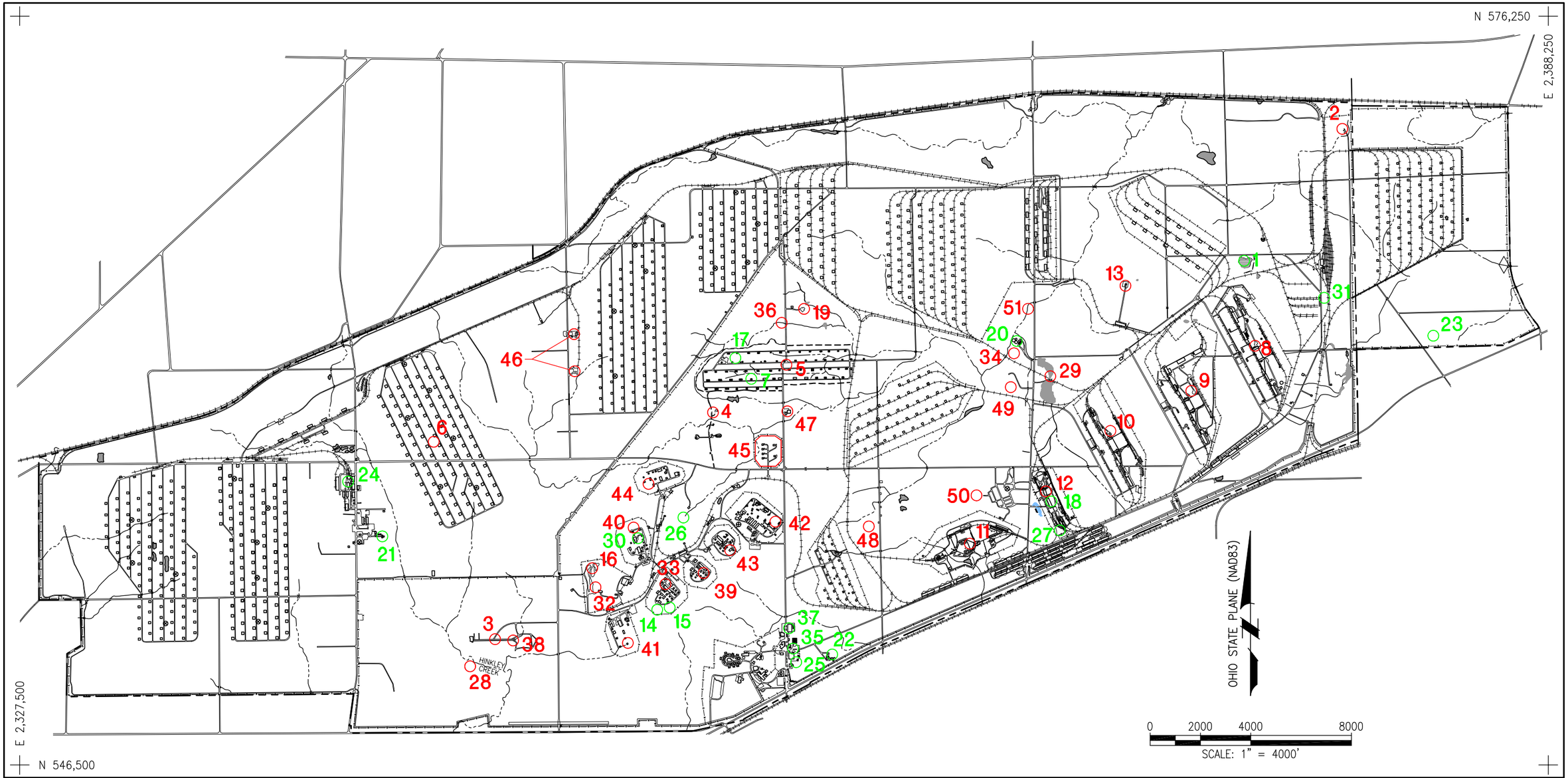


Figure 1-1 General location and Orientation of RTLS/RVAAP.



LEGEND OF SITES:

1 RAMSDELL QUARRY LANDFILL	13 BLDG 1200 AND DILUTION/SETTLING POND	25 BLDG 1034 MOTOR POOL WASTE OIL TANK	37 PESTICIDE STORAGE BUILDING T-4452	49 CENTRAL BURN PITS
2 **ERIE BURNING GROUNDS**	14 LOAD LINE 6, EVAPORATION UNIT	26 FUZE BOOSTER AREA SETTLING TANKS	38 NACA TEST AREA	50 ATLAS SCRAP YARD
3 DEMOLITION AREA #1	15 LOAD LINE 6, TREATMENT PLANT	27 BLDG 854-PCB STORAGE	39 LOAD LINE 5 / FUZE LINE 1	51 DUMP ALONG PARIS-WINDHAM ROAD
4 DEMOLITION AREA #2	16 QUARRY LANDFILL/FORMER FUZE & BOOSTER BURNING PITS	28 MUSTARD AGENT BURIAL SITE	40 LOAD LINE 7 / BOOSTER LINE 1	○ CERCLA
5 WINKLEPECK BURNING GROUNDS	17 DEACTIVATION FURNACE	29 UPPER AND LOWER COBBS POND COMPLEX	41 LOAD LINE 8 / BOOSTER LINE 2	○ RCRA
6 C BLOCK QUARRY	18 LOAD LINE 12 PINK WASTE WATER TREATMENT	30 LOAD LINE 7 PINK WASTEWATER TREATMENT PLANT	42 LOAD LINE 9 / DETONATOR LINE	○ OTHER REGULATORY
7 BLDG 1601 HAZARDOUS WASTE STORAGE	19 LANDFILL NORTH OF WINKLEPECK BURNING GROUND	31 ORE PILE RETENTION POND	43 LOAD LINE 10 / PERCUSSION ELEMENT	○ ***Fuze and Booster Area***
8 LOAD LINE 1 AND DILUTION/SETTLING POND	20 SAND CREEK SEWAGE TREATMENT PLANT	32 40 AND 60 MM FIRING RANGE	44 LOAD LINE 11 / ARTILLERY PRIMER	
9 LOAD LINE 2 AND DILUTION/SETTLING POND	21 DEPOT SEWAGE TREATMENT PLANT	33 FIRESTONE TEST FACILITY	45 WET STORAGE AREA	
10 LOAD LINE 3 AND DILUTION/SETTLING POND	22 GEORGE ROAD SEWAGE TREATMENT PLANT	34 SAND CREEK DISPOSAL ROAD LANDFILL	46 BUILDINGS F-15 AND F-16	
11 LOAD LINE 4 AND DILUTION/SETTLING POND	23 UNIT TRAINING SITE WASTE OIL TANK	35 1037 BUILDING-LAUNDRY WASTEWATER SUMP	47 BUILDING T-5301 DECONTAMINATION	
12 LOAD LINE 12 AND DILUTION/SETTLING POND	24 RESERVE UNIT MAINTENANCE AREA WASTE OIL TANK	36 PISTOL RANGE	48 ANCHOR TEST AREA	

US Army Corps of Engineers Louisville District

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
LOUISVILLE, KENTUCKY

RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO
FACILITY MAP

DRAWN BY:	REV. NO./DATE:	CAD FILE:
R. BEELER	0 / 09-02-03	/03025/DWGS/S80RVAP1

Figure 1-2. RVAAP/RTLS Installation Map

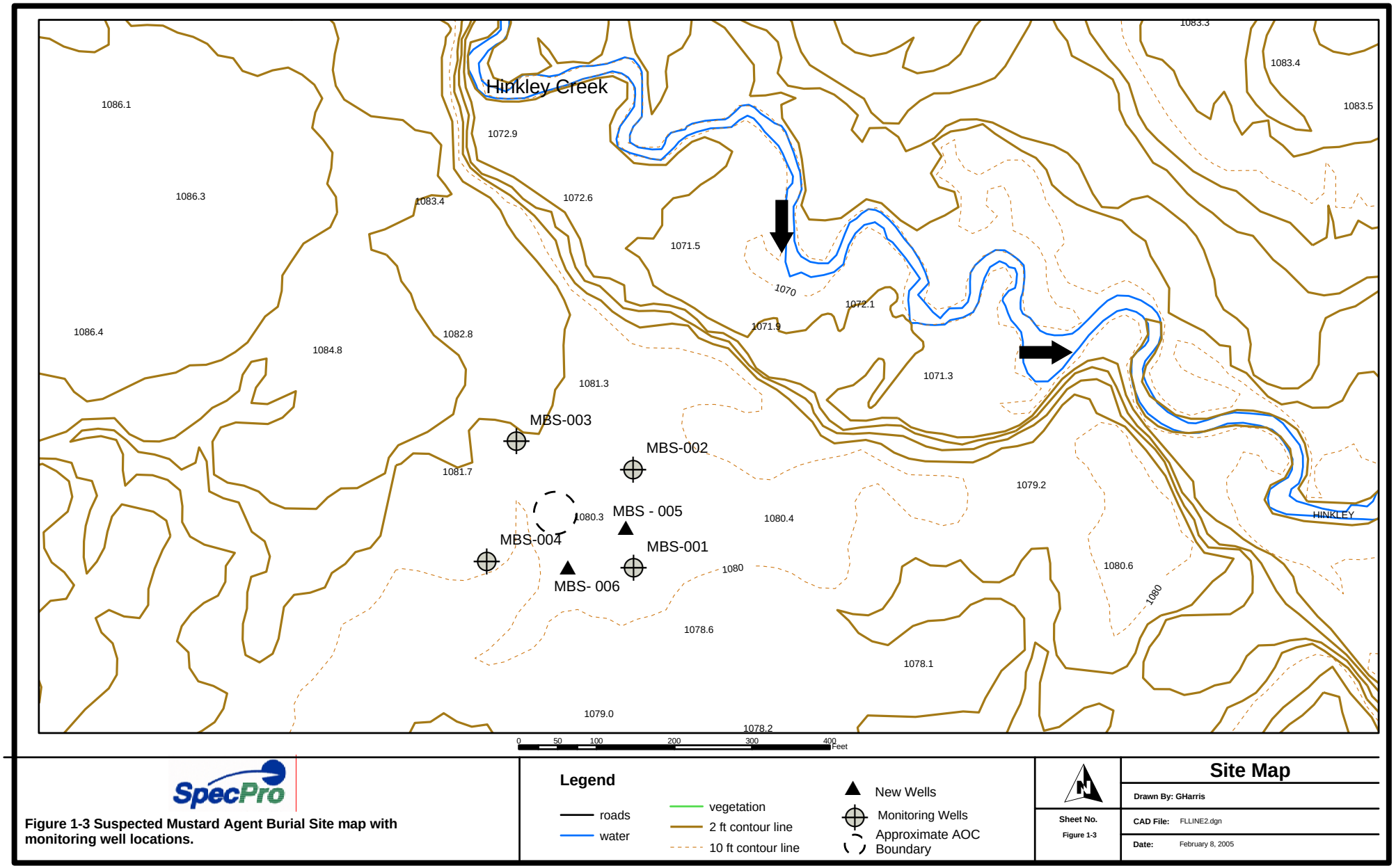


Figure 1-3 Suspected Mustard Agent Burial Site map with monitoring well locations.

1.3 SITE CHEMICAL BACKGROUND VALUES

Chemicals occur naturally in soil, sediment, surface water, and groundwater. The natural levels of chemicals - called background levels - must be known in order to determine whether the concentrations measured at the Suspected Mustard Agent Burial AOC are higher than would be expected if the site operations had not occurred. Facility-wide background values for inorganic constituents in soil, sediment, surface water, and groundwater were developed as part of a previous Phase II Remedial Investigation (RI) conducted at the Winklepeck Burning Grounds at RVAAP (USACE 2001b). Although some organic compounds also occur under ambient conditions (i.e., some polycyclic aromatic hydrocarbons (PAHs)), the organic compounds of primary concern (e.g., explosives) are man-made, and, therefore, comparison to background is not relevant.

In the facility-wide background study, a background level was calculated for each inorganic constituent detected for each environmental medium of interest. The background level is the 95 percent upper tolerance limit of the 95th percentile of the distribution of background concentrations. This means that if a sample is taken from an area with concentrations of inorganics that are not elevated above background, the measured concentration will be below the background criteria 95 percent of the time. If a measured concentration is above the background criteria, it is likely that it comes from an area with concentrations above background levels.

Background criteria were set to zero for inorganics that were not detected in the facility-wide background samples. For metals that were not detected in the background samples, any detected result from the Suspected Mustard Agent Burial AOC would be considered to be above background. RVAAP facility-wide background criteria for filtered groundwater obtained from monitoring wells screened in the unconsolidated zone is listed in Table 4-4.

1.4 DEMOGRAPHY AND LAND USE

U.S. Census Bureau population estimates for 2001 indicate that the populations of Portage and Trumbull counties are 152,743 and 223,982, respectively. Population centers closest to RVAAP are Ravenna, with a population of 12,100, and Newton Falls, with a population of 4,866.

The RVAAP facility is located in a rural area and is not close to any major industrial or developed areas. Approximately 55 percent of Portage County, in which the majority of RVAAP is located, consists of either woodland or farmland acreage. The closest major recreational area, the Michael J. Kirwan Reservoir (also known as West Branch Reservoir), is located adjacent to the western half of RVAAP south of State Route 5.

Up until 1999, the RVAAP was identified as a 21,419-acre installation. The property boundary was resurveyed by the Ohio Army National Guard (OHARNG) over a two year period (2002 and 2003) and the actual total acreage of the property was found to

be 21,683.289 acres. As of February 2006, a total of 20,403 acres of the former 21,683 acre RVAAP have been transferred to the United States Property and Fiscal Officer (USP&FO) for Ohio for use by the OHARNG as a military training site. The current RVAAP consists of 1,280 acres in several distinct parcels scattered throughout the confines of the OHARNG Ravenna Training and Logistics Site (RTLS). The RVAAP and the RTLS are collocated on contiguous parcels of property and the RTLS perimeter fence completely encloses the remaining parcels of the RVAAP. Training and related activities included field operations and bivouac training, convoy training, equipment maintenance, and storage of heavy equipment.

1.5 DATA QUALITY OBJECTIVES

The project Data Quality Objective (DQO) is to provide sufficient high-quality data to address the primary project objective identified above in Section 1.1.

1.5.1 Conceptual Site Model

The facility-wide hydrogeologic conceptual site model (CSM) for RVAAP, presented in the Facility-wide SAP, is applicable to the suspected mustard agent burial AOC. The CSM for RVAAP and other limited operational information have been used to refine the CSM specific to the project area.

Hydrogeologic and analytical data for groundwater at the Suspected Mustard Agent Burial AOC obtained during the 2004 investigation (SpecPro, Inc, 2005). This data was used to identify the downgradient locations for the additional monitoring wells.

The additional monitoring well locations were placed to be sufficiently outside the suspected burial site so that if mustard agent was present and leaking into the groundwater, only the breakdown products would be encountered in the uppermost groundwater bearing zone outside of the burial site. All monitoring well locations remained outside of a 160-ft by 160-ft square centered on the suspected mustard agent burial AOC.

1.5.2 Problem Definition

An unidentified and unsubstantiated source reported that mustard agent containers may have been buried west of the NACA Test Area. An area to the west of the NACA Test Strip was excavated in 1969 and one 50-gallon drum and several small rusted cans were discovered, with no evidence of contamination. A second area approximately 500 feet south of the excavated area was then proposed as the suspected site. This area was marked and fenced, although the fence has disintegrated over time. This area is currently marked with Seibert stakes. This second, marked area is the suspected mustard agent burial AOC to be investigated for this study. Previous investigations have not detected mustard agent or mustard agent breakdown products within or adjacent to the suspected burial area. The report of the

environmental investigation performed in 2004 recommended that additional monitoring wells be installed at the site to complete an optimal downgradient array.

1.5.3 Identify Decisions

The key decisions for all investigations at RVAAP have been identified in the Facility-wide SAP in Section 3.2.4 and in Table 3-1. The purpose of this investigation is to install additional monitoring wells in optimal downgradient locations and determine if mustard agent breakdown products are present outside the suspected burial AOC. If the breakdown products are detected in the groundwater samples outside the suspected burial AOC, it will be assumed that mustard agent is buried within the AOC and additional investigation may be necessary. Breakdown products not detected outside the suspected burial AOC can be explained by one of three different scenarios:

- Mustard agent is present at the burial AOC, but is not leaking into the subsurface.
- Mustard agent is present and leaking at the burial AOC, but the breakdown products were not detected by the sampling.
- Mustard agent is not present at the suspected burial AOC.

Decision rules used to guide remediation decisions are provided in Section 3.2.6 of the Facility-wide SAP.

1.5.4 Define the Study Boundaries

The suspected mustard agent burial AOC and the monitoring well locations are shown in Figure 1-3.

1.5.5 Identify Inputs to the Decisions

Inputs to the decision process are the analytical results and the refined site-specific conceptual model developed from field observations and environmental data.

1.5.6 Specify Limits on Decision Error

Limits on decision errors are addressed in Section 3.2.8 of the Facility-wide SAP.

1.5.7 Sample Design

The purpose of the sampling is to detect if mustard agent breakdown products are present in the uppermost groundwater bearing zone outside the suspected burial AOC. Groundwater flow direction was identified during the 2004 investigation and additional monitoring wells were installed at optimal downgradient locations for this investigation. Due to safety concerns, the wells were installed far enough outside the suspected burial AOC so that if mustard agent was leaking into the groundwater inside the burial AOC, only the breakdown products would be encountered outside the burial AOC. The downgradient well MBSmw-001 was analyzed during the 2004 investigation for the RVAAP-defined full suite of constituents. Groundwater collected from the two new monitoring wells installed for this investigation, MBSmw-005 and MBSmw-006 was analyzed for the RVAAP-defined full suite of constituents.

1.6 REPORT ORGANIZATION

This Monitoring Well Installation and Sampling Report is organized to meet Ohio EPA requirements in accordance with U.S. Environmental Protection Agency (USEPA), CERCLA Superfund process, and USACE guidance. The report consists of an Executive Summary, Chapters 1.0 through 6.0, and supporting appendices. The chapters are organized as follows:

- Chapter 1.0 describes the purpose, objectives, and organization of this report and provides a description and history of the Suspected Mustard Agent Burial AOC.
- Chapter 2.0 describes the environmental setting at RVAAP and the Suspected Mustard Agent Burial AOC, including the geology, hydrogeology, climate, population, and ecological resources.
- Chapter 3.0 describes the specific methods used for field data collection and the approach to analytical data management and laboratory programs.
- Chapter 4.0 presents the data generated during the investigation and discusses the results.
- Chapter 5.0 presents the conclusions.
- Chapter 6.0 provides a list of referenced documents used to support this report.

Appendices (A through H) to this report contain supporting data collected during the investigation and consist of the following:

- Appendix A presents the Geotechnical Laboratory Report.
- Appendix B contains monitoring well logs, and well development records.
- Appendix C contains the Slug Test results
- Appendix D presents the Data Quality Control Summary Report.
- Appendix E contains the Investigation Derived Waste information.
- Appendix F presents the Laboratory Analytical Reports.

2.0 ENVIRONMENTAL SETTING

This chapter describes the physical characteristics of the Suspected Mustard Agent Burial AOC and the surrounding environment. The geology, hydrology, climate, and ecological characteristics of RVAAP were originally presented in Chapter 3.0 of the *Phase I Remedial Investigation Report for High-Priority Areas of Concern at RVAAP* (USACE 1998a).

2.1 RVAAP PHYSIOGRAPHIC SETTING

RVAAP is located within the Southern New York Section of the Appalachian Plateaus physiographic province (USGS 1968). This province is characterized by elevated uplands underlain primarily by Mississippian and Pennsylvanian age bedrock units that are horizontal or gently dipping. The province is characterized by its rolling topography with incised streams having dendritic drainage patterns. The Southern New York Section has been modified by glaciation, which rounded ridges and filled major valleys and blanketed many areas with glacially derived unconsolidated deposits (i.e., sand, gravel, and finer grained outwash deposits). As a result of glacial activity in this section, old stream drainage patterns were disrupted in many locales, and extensive wetland areas developed.

2.2 SURFACE FEATURES AND SITE TOPOGRAPHY

The Suspected Mustard Agent Burial AOC is located in the south-central portion of the RVAAP facility, as shown in Figure 1-2. The AOC is characterized by relatively flat-lying topography. Topography of the AOC was mapped by the USACE in 1998 on a 0.6-meter (2-foot) contour interval, with an accuracy of 0.006 meter (0.02 feet), from aerial photographs taken in 1997. This survey is the basis for the topographic features presented in the figures in this report. Elevations across the AOC vary from approximately 329.7 meters on the western portion of the AOC, to 329.2 meters (1,081.7 feet to 1,080 feet) above mean sea level (amsl) on the southeastern portion.

The site is generally flat-lying and wooded. An old electrical power line right-of-way runs through the site, and the remnants of the chain-link fence that enclosed the suspected mustard agent burial site are rolled up on the ground at the south end of the site. Hinckley Creek is located approximately 500 feet northeast of the site. The site is located in a mature hardwood forest. A few small wetland areas have been identified in the AOC.

2.3 SOILS AND GEOLOGY

The geology at RVAAP consists of horizontal to gently dipping bedrock strata of Mississippian and Pennsylvanian age overlain by varying thicknesses of unconsolidated glacial deposits. The bedrock and unconsolidated geology at RVAAP

and geology specific to the Suspected Mustard Agent Burial AOC are presented in the following subsections.

2.3.1 Soils and Glacial 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 portion of the facility (Figure 2-1). Unconsolidated glacial deposits vary considerably in their character and thickness across RVAAP, from zero in some of the eastern portions of the facility to an estimated 46 meters (150 feet) in the south-central portion.

The character and distribution of the glacial material indicate that the material throughout much of RVAAP is ground moraine. These tills consist of laterally discontinuous assemblages of yellow-brown, brown, and gray silty clays to clayey silts, with sand and rock fragments. Deposits from bodies of glacial-age standing water may also have been encountered, in the form of >15-meter (50-foot) -thick deposits of uniform light gray silt (USACE 2001c). Also present are glacial outwash deposits, generally consisting of coarse-grained alluvium (sand and gravel) deposited by glacial meltwater.

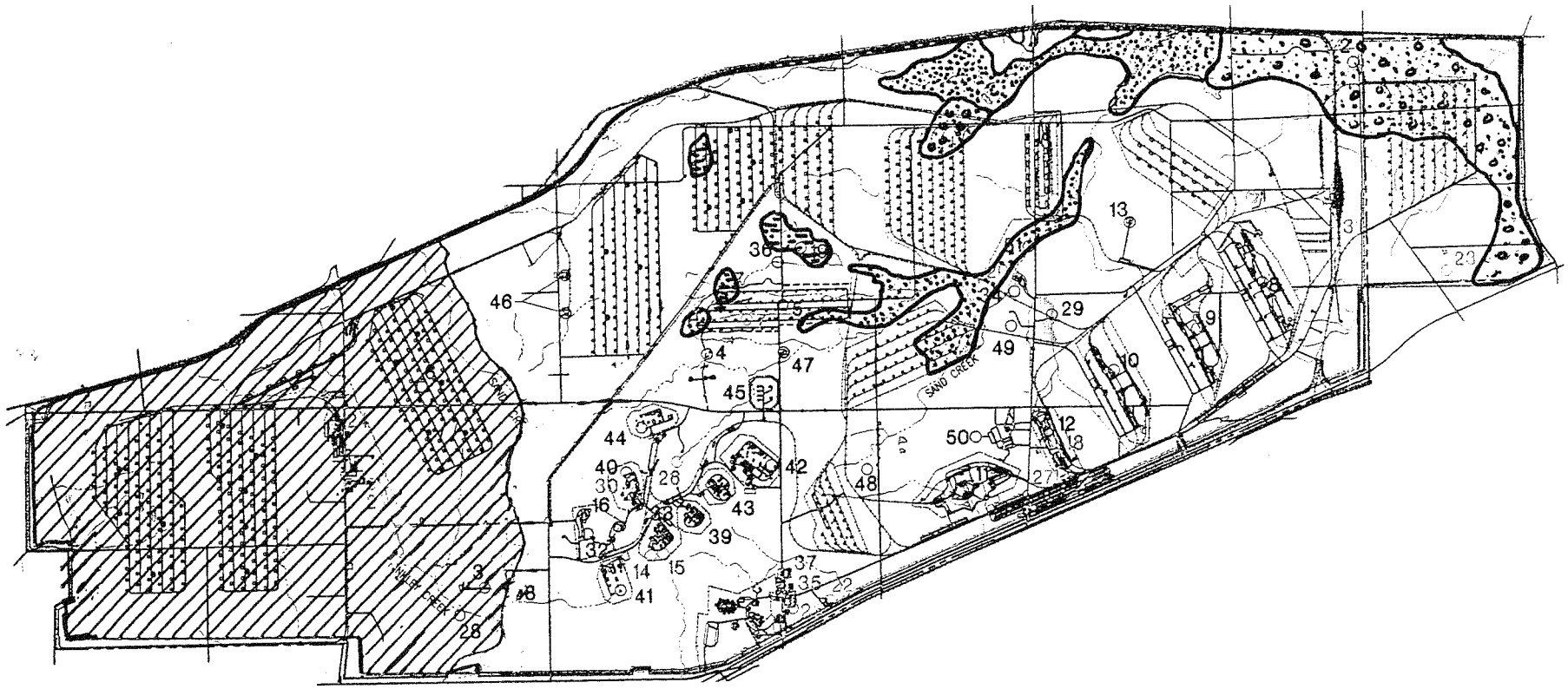
Soils at the site are generally derived from the Wisconsin-age silty clay glacial till. Distributions of soil types are discussed and mapped in the Soil Survey of Portage County, Ohio (USDA 1978). According to the Portage County soil survey, the soil present at the Suspected Mustard Agent Burial AOC is the Bogart silt loam. This soil is characterized as a deep, moderately well-drained, nearly level soil formed in sandy and gravelly glacial outwash material, with permeabilities ranging from $4.23x10^{-4}$ to $4.23x10^{-3}$ centimeters/second (USDA, 1978).

Geotechnical data collected during the investigation are presented Chapter 4.0 and in the geotechnical laboratory report provided in Appendix B of this report; geologic logs for monitoring wells are in Appendix C.

The unconsolidated sediments found in the monitoring well borings is summarized as follows:

MBSmw-005

- 1 to 10 ft below ground surface (bgs) - till consisting of brown and gray silty clay, trace to some sand.
- 10 to 23 ft bgs – gray plastic clay.
- 23 to 30 ft bgs – Brown fine to medium, some coarse sand, with gravel up to 1” diameter, trace to some silt and clay.



Ravenna Army Ammunition Plant Suspected Mustard Agent Burial Site, Ravenna, Ohio	
Glacial Geology of RVAAP	
SPECPRO, INC. ENVIRONMENTAL SERVICES	
DATE: 2/16/2005	FIGURE: 2-1

MBSmw-006

- 1 to 9 ft bgs – generally brown grading to gray silty clay with very fine sand.
- 9 to 17 ft bgs – gray plastic clay
- 17 to 28 ft bgs – brown and gray fine to medium sand.

2.3.2 Bedrock Stratigraphy

Bedrock occurrence at RVAAP consists of Mississippian and Pennsylvanian Age sedimentary rocks that lie stratigraphically beneath the glacial deposits of the Lavery and Hiram Tills (Figure 2-2). The oldest bedrock that outcrops within the facility is the Cuyahoga Group of Mississippian Age. The Cuyahoga outcrops in the far northeastern corner of the facility, and generally consists of blue-gray silty shale with interbedded sandstone (Figure 2-3). The remainder of the facility is underlain by bedrock associated with the Pottsville Formation of Pennsylvanian Age. The Sharon Member of the Pennsylvanian Pottsville Formation unconformably overlies the eroded Cuyahoga Group throughout the eastern half of RVAAP. The Sharon Member consists of two units: sandstone/conglomerate and shale. The Sharon Conglomerate unit of the Sharon Member is highly porous, permeable, cross-bedded, and frequently fractured and weathered. The Sharon Shale unit is a light to dark-gray fissile shale, which has been eroded in many locations. The Connoquenessing Sandstone Member of the Pottsville Formation unconformably overlies the Sharon Member and is a medium- to coarse-grained gray-white sandstone. The Mercer Member of the Pottsville Formation overlies the Connoquenessing and consists of silty to carbonaceous shale. The Homewood Member of the Pottsville Formation unconformably overlies the Mercer Member and consists of coarse-grained cross-bedded sandstones. The Connoquenessing, Mercer, and Homewood Members are present only in the western half of RVAAP. The regional dip of the Pottsville Formation strata is between 1.5 and 3 meters (5 to 10 feet) per mile to the south.

Bedrock was not encountered in any of the borings drilled at this AOC.

Adapted from USATHAMA, 1978.
Ravenna Army Ammunition Plant
Suspected Mustard Agent Burial
Site, Ravenna, Ohio
Bedrock Geology
of RVAAP
SPECPRO, INC.
ENVIRONMENTAL SERVICES
DATE: 2/16/2005
FIGURE: 2-2
Homewood Sandstone Member
Mercer Member
Connoquenessing Sandstone Member
Sharon Member, Shale Unit
Sharon Member, Conglomerate Unit
Cuyahoga Group
OHIO STATE PLANE (NAD83)
0
2000
4000
8000
SCALE: 1" = 4000'

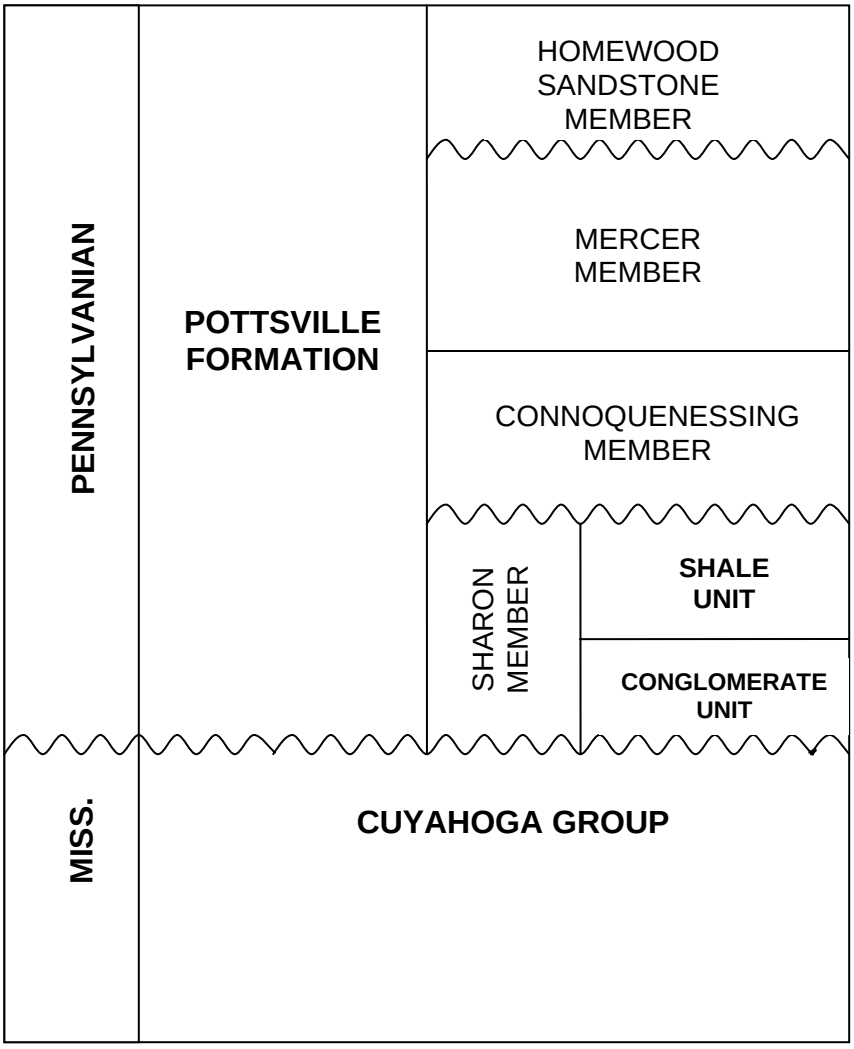


Figure 2-3. Bedrock Stratigraphy of RTLS/RVAAP (complied from USGS, 1966)

2.4 HYDROLOGY

2.4.1 Regional Hydrogeology

Sand and gravel aquifers are present in the buried-valley and outwash deposits in Portage County as described in the *Phase I Remedial Investigation Report for High-Priority Areas of Concern at RVAAP* (USACE 1998). Generally these saturated zones are too thin and localized to provide large quantities of water for industrial or public water supplies; however, yields are sufficient for residential water supplies. Lateral continuity of these aquifers is not known. Recharge of these units comes from surface water infiltration of precipitation and surface streams. Specific groundwater recharge and discharge areas at RVAAP have not been delineated.

2.4.1.1 Unconsolidated Sediment

The thickness of the unconsolidated interval at RVAAP ranges from thin to absent in the eastern and northeastern portion of RVAAP to an estimated 45 meters (150 feet) in the central portion of the installation. The groundwater table occurs within the unconsolidated zone in many areas of the installation. Because of the very heterogeneous nature of the unconsolidated glacial materials, groundwater flow patterns are difficult to determine with a high degree of accuracy. Vertical recharge from precipitation likely occurs via infiltration along root zones and desiccation cracks and partings within the soil column. Laterally, most groundwater flow likely occurs along preferential pathways (e.g., sand seams, channel deposits, or other stratigraphic discontinuities) having higher permeabilities than surrounding clay or silt-rich materials.

2.4.1.2 Bedrock Hydrogeology

The sandstone facies of the Sharon Member, and in particular the Sharon Conglomerate, were the primary sources of groundwater during RVAAP's active phase, although some wells were completed in the Sharon Shale. Past studies of the Sharon Conglomerate indicate that the highest yields come from the quartzite pebble conglomerate facies and from jointed and fractured zones. Where it is present, the overlying Sharon Shale acts as a relatively impermeable confining layer for the sandstone. Monitoring wells completed in the Sharon Sandstone at Load Line 1 in 1999 typically had hydraulic conductivities of 2.35×10^{-5} to 7.3×10^{-4} centimeters/second (USACE 2001c). Hydraulic conductivities in wells completed in the Sharon Shale generally are much lower than those in the sandstone.

2.4.1.3 Surface Water System

The entire RVAAP facility is situated within the Ohio River Basin, with the West Branch of the Mahoning River representing the major surface stream in the area. This stream flows adjacent to the western end of the facility, generally from north to south, before flowing into the M.J. Kirwan Reservoir that is located to the south of State Route 5. The West Branch flows out of the reservoir along the southern facility boundary before joining the Mahoning River east of RVAAP.

The western and northern portions of RVAAP display low hills and dendritic surface drainage. The eastern and southern portions are characterized by an undulating to moderately level surface, with less dissection by surface drainage. The facility is marked with marshy areas and flowing and intermittent streams, with headwaters located in the higher regions of the site. Three primary watercourses drain RVAAP: the South Fork of Eagle Creek, Sand Creek, and Hinkley Creek.

2.4.2 Suspected Mustard Agent Burial AOC Hydrologic/Hydrogeologic Setting

Surface water at the site drains to Hinckley Creek, located approximately 400 feet northeast of the site. Hinkley Creek, with a drainage area of 28.5 square kilometers (11.0 square miles), flows in a east-southeasterly direction by the AOC. Hinckley Creek flows into the West Branch of the Mahoning River south of the RVAAP facility.

Monitoring wells MBSmw-001 through -006 were screened within unconsolidated glacial sediments. Groundwater levels were measured in the monitoring wells on November 7, 2005 and on January 13, 2006. (Table 2-1) and used to construct groundwater contour maps of the AOC (Figures 2-4 and 2-5). Groundwater flow at the site is towards the south-southeast portion of the AOC. The downgradient monitoring wells at the site are MBSmw-001, -005, and -006.

Slug tests were performed at the two new monitoring wells in November 2005. These tests consisted of inserting a slug into the monitoring well (slug in), thus raising the water level in the well and measuring how the water level returned to equilibrium conditions, and by then removing the slug (slug out), thus lowering the water and measuring how the water level in the well returned to equilibrium. Hydraulic conductivities measured during the slug tests for the wells screened in unconsolidated sediments were 3.4×10^{-4} centimeters/second (MBSmw-005 slug in test), 1.1×10^{-3} centimeters/second (MBSmw-005 slug out test), and 3.1×10^{-4} centimeters/second (MBSmw-006 slug out test) (Table 2-2).

Table 2-1 Monitoring Well Groundwater Elevation Summary
Suspected Mustard Agent Burial AOC (RVAAP-28)
RVAAP

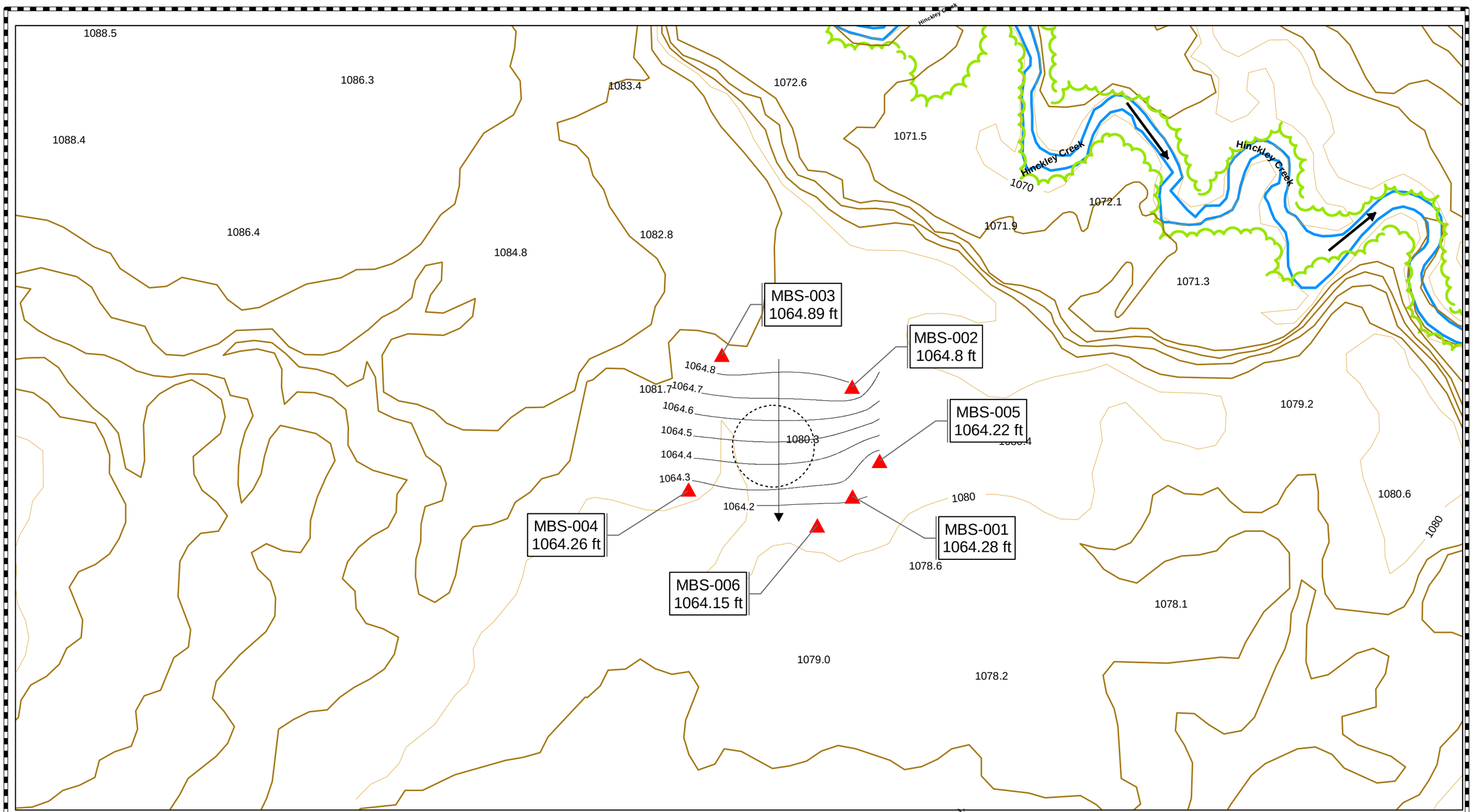
Monitoring Well ID Number	Screened Interval (ft)	Total Depth (ft)	Ground Surface Elevation ft	Top of Casing Elevation ft	Depth to Water (ft) 11/17/2005	Groundwater Elevation (ft) 11/17/2005	Depth to Water (ft) 1/13/2006	Groundwater Elevation (ft) 1/13/2006
MBS-001	19 - 29	30.0	1079.68	1082.20	17.92	1064.28	17.42	1064.78
MBS-002	18 - 28	30.0	1080.50	1083.22	18.42	1064.80	17.79	1065.43
MBS-003	18.5 - 28.5	30.0	1082.45	1084.45	19.56	1064.89	18.57	1065.88
MBS-004	14.7 - 24.7	26.0	1079.55	1081.80	17.53	1064.27	16.55	1065.25
MBS-005	20 - 30	30.0	1080.50	1082.42	18.20	1064.22	17.66	1064.76
MBS-006	18.1 - 28.1	30.0	1080.29	1081.83	17.68	1064.15	17.10	1064.73

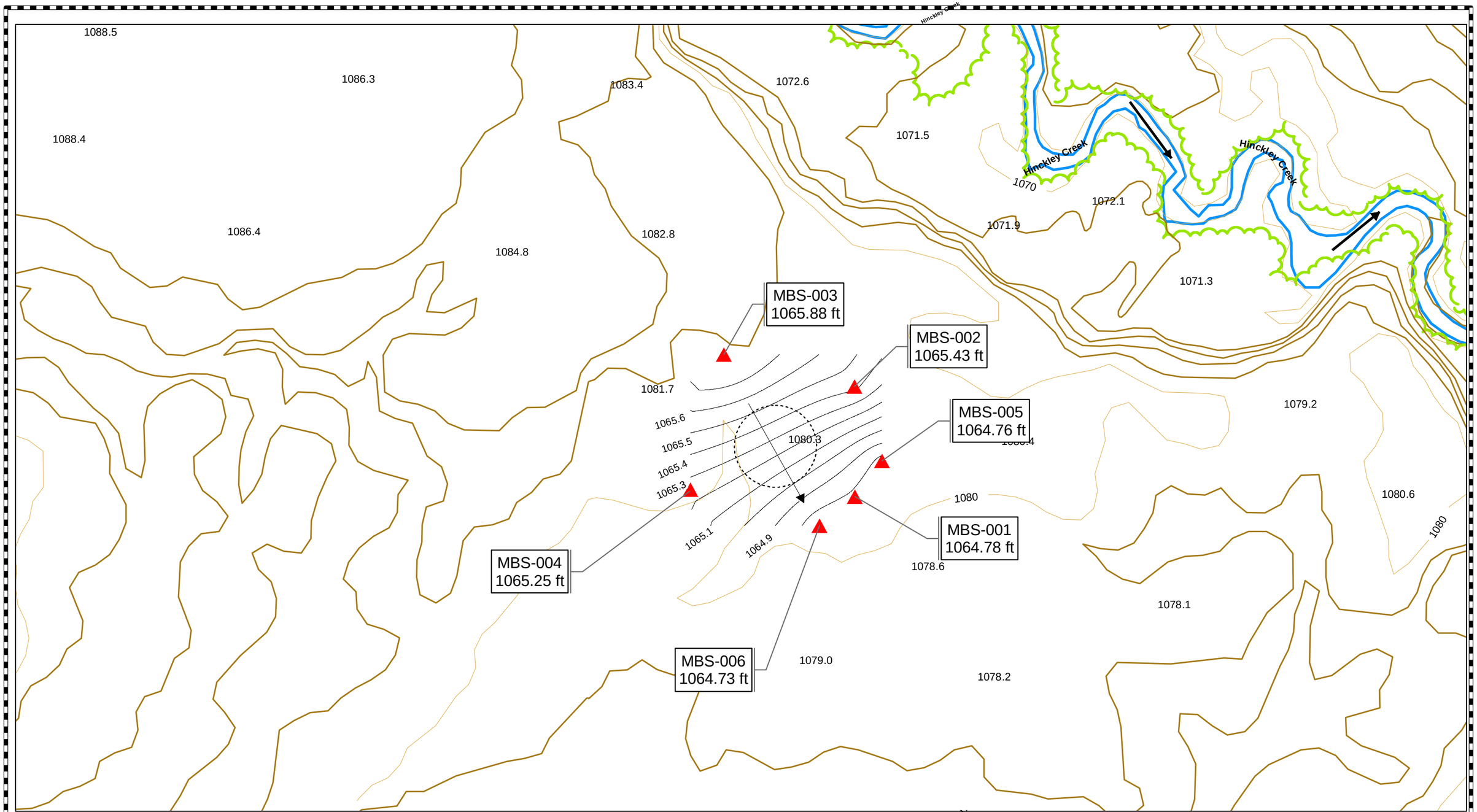
Table 2-2 Monitoring Well Summary
Suspected Mustard Burial Site (RVAAP-28)
RTLS/RVAAP

Monitoring Well ID Number	North	East	Screened Interval (ft)	Total Depth (ft)	Ground Surface Elevation ft	Top of Casing Elevation ft	Depth to Bottom from Top of Inner Casing 11/17/2005 (ft)	Slug Test K, (cm/sec)	
								Slug In	Slug Out
MBS-001	550759.5	2345323.0	19 - 29	30.0	1079.68	1082.20	30.93	$8.2x10^{-4}$	$1.8x10^{-3}$
MBS-002	550886.2	2345322.3	18 - 28	30.0	1080.50	1083.22	30.36	$4.9x10^{-4}$	$5.0x10^{-4}$
MBS-003	550922.8	2345172.4	18.5 - 28.5	30.0	1082.45	1084.45	30.67	$6.3x10^{-5}$	$7.5x10^{-5}$
MBS-004	550767.9	2345134.2	14.7 - 24.7	26.0	1079.55	1081.80	26.56	$2.1x10^{-4}$	$3.4x10^{-4}$
MBS-005	550800.7	2345354.1	20 - 30	30.0	1080.50	1082.42	30.05	$3.4x10^{-4}$	$1.1x10^{-3}$
MBS-006	550726.1	2345282.3	18.1 - 28.1	30.0	1080.29	1081.83	28.10	--	$3.1x10^{-4}$

2.5 CLIMATE

RVAAP has a humid continental climate characterized by warm, humid summers and cold winters. Precipitation varies widely through the year. The driest month is, on average, February, and the wettest month is July. Data from the National Weather Service compiled over the past 47 years indicate that the average rainfall for the area is 0.98 meter (38.72 inches) annually. The average snowfall is 1.08 meters (42.4 inches) annually. Severe weather, in the form of thunder and hail in summer and snowstorms in winter, is common.


1088.5
1086.3
1083.4
1072.6
1088.4
1071.5
Hinckley Creek
Hinckley Creek
1070
1072.1
1086.4
1071.9
1082.8
1084.8
1071.3
MBS-003
1064.89 ft
MBS-002
1064.8 ft
1064.8
1064.7
1081.7
1064.6
1064.5
1080.3
1064.4
1064.3
1064.2
MBS-005
1064.22 ft
1079.2
1080
MBS-004
1064.26 ft
MBS-001
1064.28 ft
1078.6
1080.6
1080
MBS-006
1064.15 ft
1078.1
1079.0
1078.2
Legend
Monitoring Well
Water
2 ft contour line
Suspected Mustard Agent Burial Site
Vegetation
10 ft contour line
Flow Direction
Mustard111705Elev_contour
N
W
E
S
0 45 90 180 270 360
Feet
SCALE: 1 inch equals 107 feet
SpecPro
Environmental Services
SpecPro
Environmental Services
Ravenna Army Ammunitions Plant
Ravenna, OH
RTLS/RVAAP
Figure 2-4
Groundwater Contour Map
(measured 11-17-2005)
CADD/GIS FORMAT: ArcGis 9.1
Drawn By: V Greenwade
DATE: Jan. 2006
PLAN
MAP: FLLINE2.dgn
SHEET 1 of 1


1088.5
1086.3
1083.4
1072.6
1088.4
1071.5
Hinckley Creek
Hinckley Creek
1070
1072.1
1086.4
1071.9
1082.8
1084.8
1071.3
MBS-003
1065.88 ft
MBS-002
1065.43 ft
1081.7
1065.6
1065.5
1065.4
1065.3
1080.3
1079.2
MBS-005
1064.76 ft
1080.4
1080
1065.1
1064.9
MBS-001
1064.78 ft
1078.6
1080.6
1080
MBS-004
1065.25 ft
1078.1
MBS-006
1064.73 ft
1079.0
1078.2
Legend
Monitoring Well
Water
2 ft contour line
Suspected Mustard Agent Burial Site
Vegetation
10 ft contour line
Groundwater Elevation Contour
Flow Direction
N
W
E
S
0
45
90
180
270
360
Feet
SCALE: 1 inch equals 107 feet
SpecPro
Environmental Services
SpecPro
Environmental Services
Ravenna Army Ammunitions Plant
Ravenna, OH
RTLS/RVAAP
Figure 2-5
Groundwater Contour Map
(measured 01-13-2006)
CADD/GIS FORMAT: ArcGis 9.1
Drawn By: V Greenwade
DATE: Jan. 2006
PLAN
MAP: FLLINE2.dgn
SHEET 1 of 1

3.0 STUDY AREA INVESTIGATION

The scope of the field investigation at the Suspected Mustard Agent Burial AOC included sampling of surface and subsurface soils, and groundwater. This chapter presents information on locations of and rationale for samples collected during the field effort and provides a synopsis of the sampling methods employed during the investigation. Specific notation is made where site conditions required a departure from planned activities in the Final Work Plan and SAP Addenda (USACE, 2004). Information regarding standard field decontamination procedures, sample container types, preservation techniques, sample labeling, chain-of-custody, and packaging and shipping requirements implemented during the field investigation may be found in the Facility-wide SAP (USACE 2001a) and the Final Work Plan, SAP Addendum, and Quality Assurance Project Plan (QAPP) Addendum.

3.1 SURFACE AND SUBSURFACE SOIL CHARACTERIZATION

The monitoring well borings were continuously sampled as described in Section 3.2.2 and logged by a qualified geologist. Monitoring well boring logs are presented in Appendix B.

Soil samples for geotechnical analyses were collected in the screened interval from each of the monitoring wells. Shelby tube samples were collected from depths ranging from 6.1 meters (20 feet) to 7.9 meters (26 feet) at the monitoring well locations. Two Shelby tube samples were planned for the screened interval at each of the monitoring well boring locations; however field conditions prevented the collection of one of the samples at each of the following locations:

- MBSmw-005 at 24 to 26 feet bgs due to Shelby Tube refusal.
- MBSmw-006 at 22 to 24 feet bgs due to Shelby Tube refusal.

Shelby tube samples were submitted to a J&L Laboratories of Wadsworth, Ohio for geotechnical analysis as described in Section 3.3.1. The geotechnical lab report is presented in appendix A.

3.2 GROUNDWATER CHARACTERIZATION

3.2.1 Rationale

The 2004 hydrogeologic and environmental investigation identified groundwater flow direction at the site. In the report of the 2004 investigation, it was recommended that two additional monitoring wells be installed downgradient of the suspected burial site. The locations of the two additional monitoring wells were chosen based on groundwater elevations measured in December 2004, March 2005, July 2005, and August 2005 from the four monitoring wells installed in Fall 2004. The additional monitoring well locations were approved in September 2005 by representatives from

the USACE, Ohio EPA, and SpecPro, Inc. The monitoring wells were specifically installed outside of the suspected burial site so that only breakdown products would be encountered if present, and not actual mustard agent. Based on the groundwater elevations measured at the wells in 2004 and 2005, MBSmw-003 was designated as the background (upgradient) well for this site. For this investigation, groundwater from each of the six monitoring wells was analyzed for the mustard breakdown products 1,4-dithiane; 1,4-oxathiane; and thiodiglycol. Additionally, the groundwater sampled from the newly installed wells MBSmw-005 and MBSmw-006 were also analyzed for explosives, propellants, VOCs, SVOCs, pesticides, PCBs, filtered TAL metals and cyanide.

3.2.2 Monitoring Well Installation Methods

All monitoring well installation activities were conducted according to the Facility-wide SAP and the Suspected Mustard Agent Burial Site Work Plan and SAP Addenda. Monitoring wells borings were drilled through unconsolidated soil and were installed under the direct supervision of a qualified geologist. An 11-centimeter (4.25-inch) inside-diameter, hollow-stem auger was used to advance the borehole through unconsolidated materials. Soil samples were collected continuously from the surface to the borehole termination depth using a split-spoon sampler. Shelby tube samples were collected as described in Section 3.1 during well drilling for description of soil stratigraphy and geotechnical analyses.

Organic vapors were monitored from soil cuttings at each borehole using an organic vapor analyzer (OVA); however, samples for headspace readings were not collected. In addition, the breathing zone was continuously monitored for evidence of organic chemicals. The UXO team leader checked each borehole for chemical warfare agents as described in Sections 3.4 and 4.3 of this report. All readings were recorded in the project logbooks.

Following drilling of the boreholes to the appropriate depths, monitoring wells were constructed from pre-cleaned 5-centimeter (2-inch) schedule 40 polyvinyl chloride (PVC) pipes. Well screens were commercially fabricated with slot widths of 0.025 centimeter (0.01 inch). All monitoring wells were constructed using a 3-meter (10-foot) screen. The well casing and screens were assembled and lowered into the open borehole. Following placement of the well casing and screen, a pre-washed filter pack, consisting of Global Supply No. 5 sand, was placed from the bottom of the borehole to approximately 0.6 meter (2 feet) above the top of the well screen in each well. A 0.6-meter (2-foot) or 0.9-meter (3-foot) bentonite pellet annular seal was then poured into the borehole on top of the filter pack.

For monitoring well completion, a grout mixture consisting of Type I Portland cement and 5 percent bentonite was placed from the top of the annular seal to the ground surface, followed by the placement of a protective steel surface casing with locking cover and construction of a mortar collar and cement pad. .

Four steel posts were installed around each well and painted. Monitoring well installation procedures are provided in Section 4.3.2 of the Facility-wide SAP (USACE 2001a). Well diagrams provided in Appendix C present the construction details for the monitoring wells installed during this investigation including depths, screened intervals, and groundwater elevations. This information is summarized in Table 2-2.

Once the wells were completely installed, the location and elevation of each well was surveyed by a licensed surveyor. These locations and elevations are provided in the well logs in Appendix C.

3.2.3 Well Development Methods

The two new monitoring wells (MBSmw-005 and -006) were developed on November 2, 2005 so that representative groundwater samples could be collected. Well development was accomplished by purging at least five well volumes of groundwater using a bailer until the development water was visually clear (where possible), sediment thickness in the well was less than 3.0 centimeters (0.1 foot), and certain groundwater parameters (temperature, specific conductivity, pH, and dissolved oxygen) had stabilized. Well development records were included in the project logbooks and are provided in Appendix C.

3.2.4 Groundwater Field Sampling Methods

Groundwater samples were collected at MBSmw-002, 003, 004, and 006 on 11/07/05, and at MBSmw-001 and 005 on 11/08/05. Due to a laboratory equipment malfunction, thiodiglycol was not analyzed within the sample's holding time. All six monitoring wells were resampled for thiodiglycol on January 13, 2006 and submitted to the laboratory for analyses.

The procedure for sampling groundwater is described in Sections 4.3.4 and 4.3.5 of the Facility-wide SAP. Before sampling, the monitoring wells were purged until readings of pH, conductivity, dissolved oxygen, and water temperature reached equilibrium. Groundwater samples were collected using a QED Micropurge pump and sampling system. General groundwater quality indicator parameters (pH, specific conductance, dissolved oxygen, temperature, and turbidity) were monitored during the sampling procedure and are presented in Appendix C. All monitoring wells were purged until temperature, pH, dissolved oxygen, and specific conductivity readings had stabilized. The wells installed for this project were installed in till. Wells installed in till at RVAAP have typically had turbidity readings >5NTUs when sampled. All groundwater samples were analyzed for the mustard agent breakdown products 1,4-dithiane, 1,4-oxythiane, and thiodiglycol. The groundwater sample collected from the downgradient well MBSmw-001 was analyzed for explosives, propellants, TAL metals (filtered only), cyanide, VOCs, SVOCs, and pesticides/PCBs. Groundwater samples analyzed for dissolved metals were filtered using a disposable filter with 0.45-µm pores. The results of groundwater sampling are discussed in detail in Section 4.2. The groundwater sampling logs are contained in Appendix C.

3.2.5 In Situ Permeability Testing

Slug tests were performed at the two newly installed monitoring wells to determine the hydraulic conductivity of the geologic materials surrounding each well screen. Slug tests followed the provisions of the Final Work Plan and SAP Addenda. These analyses calculate horizontal hydraulic conductivities in the screened interval of each well. Both falling-head and rising-head tests were conducted in order to obtain comparative results and validate the test results. Falling-head tests were performed by inserting a PVC cylinder into the well and monitoring the return (drop) of the potentiometric surface to the pretest static water level over time. Rising-head tests were performed by reversing the process (e.g., the slug was removed, and the rise in water level was monitored). The tests were performed after each well had fully recovered from groundwater sampling, using pressure transducers for water level measurements and automated data collection. The slug was designed to displace approximately 0.3 meter (1 foot) of water. Due to an operator mistake and/or equipment failure, faulty data was recorded for the slug-in test for MBSmw-005, and was not used to calculate permeability information.

Water level measurements were recorded using a pre-programmed logarithmic time interval. Water levels were monitored until the well re-equilibrated to 90 percent of the pretest water level. The data were evaluated using the updated Bouwer and Rice method (Bouwer 1989,). Compensation for water levels within the screened interval is included in this evaluation method. The results of the slug tests performed in December 2004 are presented in Appendix D and are discussed in Section 2.4.2, and are summarized in Table 2-2.

3.3 ANALYTICAL PROGRAM OVERVIEW

3.3.1 Geotechnical Analyses

Shelby tubes were collected from monitoring well borings as described in Section 3.1. Geotechnical analytical parameters for undisturbed samples included moisture content, grain size distribution, Unified Soil Classification System (USCS), Atterberg limits, specific gravity, bulk density, and porosity.

3.3.2 Laboratory Analyses

All analytical procedures were completed in accordance with applicable professional standards, EPA requirements, government regulations and guidelines, USACE Louisville District analytical quality assurance (QA) guidelines, and specific project goals and requirements. The sampling and analysis program conducted during this investigation involved the collection and analysis of groundwater. Field screening for organic vapors was conducted at each sampling location using an OVA. Specified

samples were analyzed by an independent quality control (QC) split analytical laboratory.

Samples collected during the investigation were analyzed by Severn-Trent Laboratories (STL), North Canton, OH, a USACE Center of Excellence certified laboratory. The specified QC split samples collected were analyzed by GPL Laboratories of Frederick, MD.

Laboratories supporting this work have statements of qualifications including organizational structures, QA manuals, and standard operating procedures, which are available upon request.

Samples were collected and analyzed according to the Facility-wide SAP, the Final Sampling and Analysis Plan addendum, and the Quality Assurance Project Plan Addendum. Prepared in accordance with USACE and EPA guidance, the Facility-wide SAP and associated addenda outline the organization, objectives, intended data uses, and QA/QC activities to achieve the desired DQOs and maintain the defensibility of the data. Project DQOs were established in accordance with EPA Region 5 guidance. Requirements for sample collection, handling, analysis criteria, target analytes, laboratory criteria, and data validation criteria for this investigation are consistent with EPA requirements for National Priorities List (NPL) sites. DQOs for this project included analytical precision, accuracy, representativeness, completeness, comparability, and sensitivity for the measurement data. Appendix E (Data Quality Control Summary Report) presents an assessment of those objectives as they apply to the analytical program.

Strict adherence to the requirements set forth in the Facility-wide SAP and project addenda was required of the analytical laboratory so that conditions adverse to quality would not arise. The laboratory was required to perform all analyses in compliance with EPA SW-846 *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Analytical Protocols* (USEPA 1990a),. SW-846 chemical analytical procedures were followed for the analyses of metals, VOCs, SVOCs, pesticides, PCBs, explosives, propellants, and cyanide. Laboratories were required to comply with all methods as written; recommendations were considered requirements.

QA/QC samples for this project included trip blanks, QA field duplicates, laboratory method blanks, laboratory control samples, laboratory duplicates, matrix spike/matrix spike duplicate (MS/MSD) samples, and QC field split samples (submitted to the independent USACE-contracted laboratory). Equipment rinsate blanks and trip blanks were submitted for analysis along with field duplicate samples to provide a means to assess the quality of the data resulting from the field sampling program. Equipment rinsate blanks were used to assess the adequacy of the equipment decontamination processes for soil sample collection. Trip blanks were used to assess the potential for contamination of samples caused by contaminant migration during sample shipment and storage. Field duplicate samples were analyzed to determine sample heterogeneity and sampling methodology reproducibility. Laboratory method blanks and laboratory control samples were employed to determine the accuracy and precision of the analytical method as implemented by the laboratory. Matrix spikes

provided information about the effect of the sample matrix on the measurement methodology. Laboratory sample duplicates and MS/MSDs assisted in determining the analytical reproducibility and precision of the analysis for the samples of interest. The QC field split samples provide independent verification of the accuracy and precision of the principal analytical laboratory. Evaluation of these QC measures and of their contribution to documenting the project data quality is provided in Appendix E, Data Quality Summary Report (DQSR). The Laboratory Analytical Reports, including chain-of-custody forms, is presented in Appendix F.

SpecPro, Inc. is the custodian of the project file and will maintain the contents of the file for this investigation, including all relevant records, reports, logs, field notebooks, pictures, subcontractor reports, correspondence, and chain-of-custody forms. These files will remain in a secure area under the custody of the SpecPro, Inc. Program Manager until they are transferred to the USACE Louisville District and RVAAP.

3.3.3 Data Review, Validation, and Quality Assessment

Samples were properly packaged for shipment and dispatched to STL Laboratories for analysis. A separate signed custody record with sample numbers and locations listed was enclosed with each shipment. When transferring the possession of samples, the individuals who relinquished and received the samples signed, dated, and noted the time on the record. All shipments were in compliance with applicable Department of Transportation regulations for environmental samples.

Data were produced, reviewed, and reported by the laboratory in accordance with specifications outlined in the Suspected Mustard Agent Burial Site QAPP Addendum, the USACE Louisville District analytical QA guidelines, and the laboratory's QA manual. Laboratory reports included documentation verifying analytical holding time compliance.

GPL Laboratories performed in-house analytical data reduction under the direction of the laboratory project manager and QA officer. These individuals were responsible for assessing data quality and informing SpecPro of any data that are considered "unacceptable" or that require caution on the part of the data user in terms of its reliability. Data were reduced, reviewed, and reported as described in the laboratory QA manual and standard operating procedures. Data reduction, review, and reporting by the laboratory were conducted as follows:

- Raw data produced by the analyst were turned over to the respective area supervisor.
- The area supervisor reviewed the data for attainment of QC criteria as outlined in the established methods and for overall reasonableness.
- Upon acceptance of the raw data by the area supervisor, a report was generated and sent to the laboratory project manager.

- The laboratory project manager completed a thorough review of all reports.

- The laboratory project manager executed the final reports.

Data were then delivered to SpecPro for data verification. STL prepared and retained full analytical and QC documentation for the project in both paper copy and electronic storage media (e.g., magnetic tape), as directed by the analytical methodologies employed. STL provided the following information to SpecPro in each analytical data package submitted:

- Cover sheets listing the samples included in the report and narrative comments describing problems encountered in analysis;

- Tabulated results of inorganic and organic compounds identified and quantified; and,

- Analytical results for QC sample spikes, sample duplicates, initial and continuing calibration verifications of standards and blanks, method blanks, and laboratory control sample information.

Data was verified by SpecPro to ensure that the precision and accuracy of the analytical data were adequate for their intended use. This verification also attempted to minimize the potential of using false positive or false negative results in the decision-making process (i.e., to ensure accurate identification of detected versus non-detected compounds). This approach was consistent with DQOs for the project and with the analytical methods. Analytical data were verified through the review process outlined in the SAP and are presented in the Data Quality Control Summary Report in Appendix E. All data packages will be forwarded to the USACE independent data validation contractor.

3.4 MUNITION AND EXPLOSIVES OF CONCERN (MEC) AVOIDANCE AND FIELD RECONNAISSANCE

A MEC avoidance subcontractor was present during all field operations. The MEC Team Leader provided an initial safety briefing on MEC to train all field personnel to recognize and stay away from propellants and MEC. Daily tailgate safety briefings included reminders regarding OE avoidance. Site visitors were briefed on MEC avoidance before they were allowed access to the AOC. Prior to beginning sampling activities, access routes into areas from which samples were to be collected were assessed by the MEC Team Leader for potential MEC using visual surveys and hand-held magnetometers. The MEC Team Leader remained with the sampling crews as work progressed. For monitoring well borings, the MEC Team Leader screened the borehole with a Schonstadt GA-72CD Magnetometer to a minimum depth of at least 3.6 meters (12 feet). Once groundwater was encountered, the drilling equipment removed from the borehole was screened for Chemical Warfare Agents (CWA) using a M256 Chemical Agent Detector Kit as described in the Final Unexploded Ordnance

(UXO) and Explosive Avoidance Plan (Appendix C of the Final Work Plan). The MEC Team Leader was onsite as drilling was performed to visually examine drill cuttings for any unusual materials indicative of potential MEC and chemical warfare agents.

4.0 ANALYTICAL RESULTS OF INVESTIGATION

This chapter presents results of the geotechnical and groundwater analyses. Section 4.1 of this chapter presents the geotechnical laboratory results. Section 4.2 presents the groundwater laboratory analysis. A summary of the results of the ordnance and explosives avoidance activities is presented in Section 4.3.

4.1 GEOTECHNICAL RESULTS

Two Shelby tubes were collected from the two monitoring well borings and submitted for geotechnical analyses as described in Sections 3.1 and 3.3.1. The soil samples were analyzed for moisture content, grain size distribution, Atterberg limits, USCS classification, specific gravity, bulk density, and porosity. Table 4-1 provides a summary of the geotechnical data for subsurface soil at the Suspected Mustard Agent Burial AOC. Appendix A contains the geotechnical laboratory report.

Sieve analyses and USCS classification identified the samples as ranging from lean clay (CL) at MBSmw-005 to sandy silty Clay with gravel (CL-ML) at MBSmw-006. Moisture content of the samples was 20.7% for MBSmw-005 and 9.8% for MBSmw-006. Porosity values were 0.419 for MBSmw-005 and 0.269 for MBSmw-006. Dry bulk density ranged from 100.4 pound/cubic foot at MBSmw-005 to 122.5 pound/cubic foot at MBSmw-006.

4.2 GROUNDWATER LABORATORY ANALYSES RESULTS

4.2.1 Mustard Breakdown Products

Based on the groundwater elevations measured at the wells in 2004 and 2005, MBSmw-003 was designated as the background (upgradient) well for this site. The groundwater was sampled on November 7, 2005 (MBSmw-002, 003, 004, and 006) and November 8, 2005 (MBSmw-001 and 005). These samples were analyzed for the mustard agent breakdown products 1,4-dithiane; 1,4-oxathine; and thiodiglycol. These compounds were not detected above the method detection limits in any of the groundwater samples. The results are summarized in Table 4-2.

Table 4-1
Suspected Mustard Agent Burial Site Geotechnical Summary
RVAAP

Sample Number (Sample Date)	Depth (ft)	Moisture Content (%)	Specific Gravity	Density (pcf)		Porosity	USCS Classification	USCS Description
				Wet	Dry			
MBSmw-005-ST (10/27/2005)	20 - 22	20.7	2.766	121.2	100.4	0.419	CL	Lean Clay
MBSmw-006-ST (10/26/2005)	24 - 26	9.8	2.685	134.6	122.5	0.269	CL-ML	Sandy Silty Clay with Gravel

Table 4-2 Mustard Agent Breakdown Products Analytical Results

Analyte Sample Number (Sample Date)	Units	1,4-dithiane	1,4-oxathiane	Thiodiglycol
MBSmw-001-0013-GW (11/8/2005)	ug/L	0.88U	1U	10U
MBSmw-002-0014-GW (11/7/2005)	ug/L	0.88U	1U	10U
MBSmw-003-0015-GW (11/7/2005)	ug/L	0.88U	1U	10U
MBSmw-004-0016-GW (11/7/2005	ug/L	0.88U	1U	10U
MBSmw-005-0017 (11/8/2005)	ug/L	0.88U	1U	10U
MBSmw-006-0019-GW (11/7/2005)	ug/L	0.88U	1U	10U

Qualifier Definitions:
U = Not detected above method detection limits
MBSmw-003 is the background (upgradient) well for this site.

4.2.2 Results of Additional Laboratory Analyses on Downgradient Wells

The groundwater sampled from downgradient wells MBSmw-005 and MBSmw-006 was analyzed for explosives, propellants, filtered TAL metals and cyanide, VOCs, SVOCs, pesticides and PCBs. Explosives and propellants, and PCBs were not detected above reporting limits in the groundwater sampled from MBSmw-005 and -006. The results for explosive and propellant analysis are presented in Table 4-3. The results for filtered TAL Metals and cyanide (Table 4-4), VOCs (Table 4-5), SVOCs (Table 4-6), and Pesticides/PCBs (Table 4-7) are discussed in the following sections.

Table 4-3 Explosive and Propellant Analytical Results for MBSmw-005 and MBSmw-006

Analyte	Region 9 Preliminary Remediation Goal (PRG)	MBSmw-005-0010-GW (11/8/2005)	MBSmw-006-0012-GW (11/7/2005)
1,3,5-Trinitrobenzene	1100	0.03U	0.03U
1,3-Dinitrobenzene	3.6	0.05U	0.05U
2,4,6-Trinitrotoluene	2.2	0.05UU	0.05UU
2,4-Dinitrotoluene	73	0.05U	0.05U
2,6-Dinitrotoluene	36	0.05U	0.05U
2-Amino-4,6-Dinitrotoluene	NS	0.1U	0.1U
4-Amino-2,6-Dinitrotoluene	NS	0.05U	0.05U
HMX	1800	0.036U	0.036U
m-Nitrotoluene	120	0.088U	0.088U
Nitrobenzene	3.4	0.05U	0.05U
Nitroguanidine	3600	20U	20U
o-Nitrotoluene	0.049	0.057U	0.057U
p-Nitrotoluene	0.66	0.088U	0.088U
RDX	0.61	0.036U	0.036U
Tetryl	360	0.05U	0.05U
Nitrocellulose	NS	0.12U	**0.14 B,J**

All results reported in ug/L
Qualifier Definitions:
B = estimated result, less than reporting limit
J = Method blank contamination.
U = Not detected above method detection limit
NS = no standard

4.2.2.1 TAL Metals and Cyanide

The results of the filtered TAL metals and unfiltered cyanide analyses for groundwater sampled from MBSmw-005 and -006 are presented in Table 4-4. The following TAL metals were detected in the groundwater sample: arsenic, barium, calcium, iron, magnesium, manganese, potassium, nickel and sodium. These compounds were screened against site background levels, and against compounds that are considered as essential nutrients to determine if they are to be considered as Site-Related Contaminants (SRCs). Calcium, magnesium, iron, potassium, and sodium were eliminated as potential SRCs because they are considered as essential nutrients. Arsenic and manganese were eliminated as potential SRCs because they were detected in the groundwater samples at a concentration less than the site background level. Barium and nickel remain as SRCs for the AOC. Barium was detected at a concentration of 84.0 and 86.1 micrograms/liter (ug/L), which is greater than the background concentration of 82.1 ug/L. The MCL for barium is 2000 ug/L, and the Region 9 PRG for barium is 2600 ug/L. Nickel was detected at MBSmw-006 at a concentration of 1.7 ug/L. Since there is no background level set for nickel, any concentration of nickel detected would lead to it being considered as an SRC. The MCL for nickel is 100 ug/L, and the Region 9 PRG for nickel is 730 ug/L.

Table 4-4 TAL Metals and Cyanide Analytical Results for MBSmw-005 and MBSmw-006

Analyte	Units	MBSmw-005-0010-GF (11/8/2005)	MBSmw-006-0012-GF (11/7/2005)	Background Groundwater Unconsolidated Zone - Filtered	SRC?	MCL	Region 9 PRG
Aluminum	ug/L	47U	47U	0	No	NS	36000
Antimony	ug/L	4.1U	4.1U	0	No	6	15
Arsenic	ug/L	**7.3B**	4.3U	11.7	No	10	0.045
Barium	ug/L	**84.0**	**86.1**	82.1	Yes	2000	2600
Beryllium	ug/L	0.3U	0.3U	0	No	4	NS
Cadmium	ug/L	0.42U	0.42U	0	No	5	NS
Calcium	ug/L	**87200**	**80800**	115000	No	NS	NS
Chromium	ug/L	1.6U	1.6U	7.3	No	100	NS
Cobalt	ug/L	1.2U	1.2U	0	No	NS	730
Copper	ug/L	1.8U	1.8U	0	No	1300	1500
Iron	ug/L	**359B**	32U	279	No	30	10000
Lead	ug/L	1.7U	1.7U	0	No	15	NS
Magnesium	ug/L	**25100**	**26000**	43300	No	NS	NS
Manganese	ug/L	**350 J**	**550 J**	1020	No	50	880
Mercury	ug/L	0.09U	0.09U	0	No	2	11
Nickel	ug/L	1.4U	**1.7 B**	0	Yes	100	730
Potassium	ug/L	**1710 B**	**5790**	2890	No	NS	NS
Selenium	ug/L	2.4U	2.4U	0	No	50	180
Silver	ug/L	2.1U	2.1U	0	No	100	180
Sodium	ug/L	**10000**	**10800**	45700	No	NS	NS
Thallium	ug/L	0.022U	0.022U	0	No	2	2.4
Vanadium	ug/L	1.9U	1.9U	0	No	NS	36
Zinc	ug/L	6.6U	6.6U	60.9	No	5000	11000
Cyanide, Total	ug/L	1.3U	1.3U	0	No	200	730

Results of detected compounds in **BOLD**
U = Not detected above method detection limits
J = Method blank contamination
B = Estimated result with result less than reporting limit but greater or equal to the IDL/Method Detection Limit (MDL).
NS = No Standard
SRC = Site-related Contaminant, MCL = Maximum Contaminant Level, PRG = Preliminary remediation Goal

4.2.2.2 VOCs

The results for VOC analysis for groundwater sampled from MBSmw-005 and-006 are presented in Table 4-5. The only compound detected above method detection limits was 2-butanone (MBSmw-005) at 0.95 ug/L however, this concentration was below the Region 9 PRG (7000 ug/L).

Table 4-5 VOCs Analytical Results for MBSmw-005 and MBSmw-006

Analyte	MCL	Region 9 PRG	MBSmw-005-0010-GW (1/13/2006)	MBSmw-006-0012-GW (1/13/2006)
1,1,1-Trichlorethane	NS	3200	0.21U	0.21U
1,1,2,2-Tetrachloroethane	NS	0.43	0.22U	0.22U
1,1,2-Trichlorethane	NS	0.2	0.22U	0.22U
1,1-Dichloroethane	NS	7	0.18U	0.18U
1,1-Dichloroethene (total)	NS	810	0.21U	0.21U
1,2,-Dibromoethane	NS	0.0056	0.21U	0.21U
1,2-Dichloroethane	NS	0.12	0.35U	0.35U
1,2-Dichloropropane	NS	120	0.15U	0.15U
2-Butanone	NS	7000	**0.95J**	0.39U
2-Hexanone	NS	NS	0.35U	0.35U
4-Methyl-2-Pentanone	NS	NS	0.32U	0.32U
Acetone	NS	5500	1.1U	0.74U
Benzene	5	0.35	0.22U	0.22U
Bromochloromethane	NS	0.18	0.24U	0.24U
Bromoform	NS	8.5	0.17U	0.17U
Bromodichloromethane	NS	0.18	0.14U	0.14U
Bromomethane	NS	8.7	0.36U	0.36U
Carbon Disulfide	NS	1000	0.28U	0.28U
Carbon Tetrachloride	5	0.17	0.19U	0.19U
Chlorobenzene	NS	110	0.2U	0.2U
Chloroethane	NS	4.6	0.24U	0.24U
Chloroform	NS	0.17	0.16U	0.16U
Chloromethane	NS	160	0.14U	0.14U
cis-1,3-Dichloropropene	NS	0.4	0.12U	0.12U
Dibromochloromethane	NS	0.13	0.19U	0.19U
Ethylbenzene	700	1300	0.19U	0.19U
Methylene Chloride	NS	4.3	0.19U	0.19U
Styrene	11	1600	0.13U	0.13U
Tetrachloroethylene	5	0.1	0.19U	0.19U
Toluene	1000	720	0.17U	0.17U
trans-1,3-dichloropropene	NS	0.4	0.17U	0.17U
Trichloroethene	5	0.028	0.28U	0.28U
Vinyl Chloride	2	0.02	0.21U	0.21U
Xylenes (total)	NS	210	0.44U	0.44U

All results in ug/L
Results of detected compounds in BOLD
Qualifier Definitions:
U = Not detected above method detection limits
J = estimated
NS = No Standard

4.2.2.3 SVOCs

Complete results for the SVOC analysis are presented in Table 4-6. All compounds were not detected above the method detection limits, except for benzoic acid at MBSmw-006 at 4.5 ug/L. The Region 9 PRG for benzoic acid is 150000 ug/L.

Table 4-6 SVOC Analytical Results for MBSmw-005 and MBSmw-006

Analyte	MCL	Region 9 PRG	MBSmw-005-0010-GW (11/8/2005)	MBSmw-006-0012-GW (11/7/2005)
1,2-Dichlorobenzene	NS	370	0.16U	0.16U
1,2,4-Trichlorobenzene	NS	7.2	0.12U	0.12U
1,3-Dichlorobenzene	NS	180	0.11U	0.11U
1,4-Dichlorobenzene	NS	0.5	0.13U	0.13U
2,2-Oxybis(1-Chloropropane)	NS	NS	1U	1U
2,4,5-Trichlorophenol	NS	3600	0.13U	0.13U
2,4,6-Trichlorophenol	NS	3.6	0.16U	0.16U
2,4-Dichlorophenol	NS	110	0.24U	0.24U
2,4-Dimethylphenol	NS	730	0.23U	0.23U
2,4-Dinitrophenol	NS	73	1.3U	1.3U
2,4-Dinitrotoluene	NS	73	0.16U	0.16U
2,6-Dinitrotoluene	NS	NS	0.17U	0.17U
2-Chloronapthalene	NS	49.	0.29U	0.29U
2-Chlorophenol	NS	30	0.14U	0.14U
2-Methylnapthalene	NS	NS	0.028U	0.028U
2-methylphenol	NS	1800	0.15U	0.15U
2-Nitroaniline	NS	3.2	0.18U	0.18U
2-Nitrophenol	NS	NS	0.14U	0.14U
3,3-Dichlorobenzene	NS	0.15	0.19U	0.19U
3-Nitroaniline	NS	3.2	0.094U	0.094U
4,6-dinitro-2-methyl phenol	NS	NS	0.29U	0.29U
4-Bromophenyl-phenylether	NS	NS	0.29U	0.29U
4-chloro-3-methylphenol	NS	NS	0.18U	0.18U
4-Chloroaniline	NS	150	0.31U	0.31U
4-Chlorophenyl Phenyl Ether	NS	NS	0.21U	0.21U
4-methylphenol	NS	180	1U	1U
4-Nitroaniline	NS	3.2	0.11U	0.11U
4-Nitrophenol	NS	NS	1U	1U
Acenaphthene	NS	NS	0.028U	0.028U
Acenaphthylene	NS	NS	0.030U	0.030U
Anthracene	NS	1800	0.030U	0.030U
Benzoic acid	NS	150000	**4.5J**	0.81U
Benzyl alcohol	NS	11000	1.1U	1.1U
Benzo(a)anthracene	NS	0.092	0.028U	0.028U
Benzo(a)pyrene	0.2	0.0092	0.022U	0.022U
Benzo(a)fluoranthene	NS	0.092	0.043U	0.043U
Benzo(k)fluoranthene	NS	0.92	0.071U	0.071U
Benzo(ghi)perylene	NS	NS	0.044U	0.044U
Benzyl Butyl Phthalate	NS	7300	0.14U	0.14U
Bis(2-Chloroethyl) ether	NS	NS	0.19U	0.19U

Analyte	MCL	Region 9 PRG	MBSmw-005-0010-GW (11/8/2005)	MBSmw-006-0012-GW (11/7/2005)
bis(2-chloroethoxy) methane	NS	NS	0.24U	0.24U
bis(2-ethylhexyl) phthalate	NS	4.8	2.3U	1.1U
Carbazole	NS	3.4	0.17U	0.17U
Chrysene	NS	9.2	0.035U	0.035U
Dibenz(a,h)Anthracene	NS	0.0093	0.054U	0.054U
Dibenzofuran	NS	12	0.025U	0.025U
Diethyl Phthalate	NS	NS	0.12U	0.12U
Dimethyl Phthalate	NS	360000	0.27U	0.27U
di-n-Butyl Phthalate	NS	NS	0.13U	0.13U
di-n-Octyl Phthalate	NS	1500	0.16U	0.16U
Fluoranthene	NS	NS	0.024U	0.024U
Fluorene	NS	NS	0.035U	0.035U
Hexachlorobenzene	1	0.042	0.075U	0.075U
Hexachlorocyclopentadiene	NS	220	1.5U	1.5U
Hexachlorobutadiene	NS	0.86	0.11U	0.11U
Hexachloroethane	NS	4.8	0.21U	0.21U
Indeno(1,2,3-c,d)Pyrene	NS	0.092	0.081U	0.081U
Isophorone	NS	71	0.16U	0.16U
Napthalene	NS	6.2	0.031U	0.031U
Nitrobenzene	NS	3.4	0.21U	0.21U
n-Nitrosodi-n-Propylamine	NS	9600	0.21U	0.21U
n-Nitrosodiphenylamine	NS	14	0.18U	0.18U
Pentachlorphenol	1	0.56	2U	2U
Phenanthrene	NS	NS	0.044U	0.044U
Phenol	NS	11000	0.14U	0.14U
Pyrene	NS	180	0.051U	0.051U

All results in ug/L
Results of detected compounds in BOLD
Qualifier Definitions:
U = Not detected above method detection limits
J = estimated
NS = No Standard

4.2.3.4 Pesticides and PCBs

Complete results for pesticide and PCB analysis are presented in Table 4-7. PCBs were not detected in the groundwater sampled from MBSmw-005 and -006, except for PCB-1260 which was estimated at MBSmw-006 at a concentration of 0.088 ug/L. The MCL for PCB-1260 is 0.5 ug/L and the Region 9 PRG is 0.034 ug/L. Pesticides were not detected in the groundwater sampled from MBSmw-005 and -006.

Table 4-7 Pesticides and PCBs Analytical Results for MBSmw-005 and MBSmw-006

Analyte	MCL	Region 9 PRG	MBSmw-005-0010-GW (11/8/2005)	MBSmw-006-0012-GW (11/7/2005)
PCB-1016	0.5	0.034	0.25U	0.25U
PCB-1221	0.5	0.034	0.49U	0.49U
PCB-1232	0.5	0.034	0.41U	0.41U
PCB-1242	0.5	0.034	0.11U	0.11U
PCB-1248	0.5	0.034	0.049U	0.049U
PCB-1254	0.5	0.034	0.087U	0.087U
PCB-1260	0.5	0.034	0.071U	**0.088J**
4,4-DDD	NS	0.28	0.0085U	0.0085U
4,4-DDE	NS	0.2	0.0076U	0.0076U
4,4-DDT	NS	0.2	0.0086U	0.0086U
Aldrin	NS	0.003	0.0061U	0.0061U
Alpha-BHC	NS	0.011	0.0062U	0.0062U
Alpha-Chlordane	NS	NS	0.0073U	0.0073U
Beta-BHC	NS	0.032	0.0068U	0.0068U
Delta-BHC	NS	NS	0.0064U	0.0064U
Dieldrin	NS	0.023	0.0067U	0.0067U
Endosulfan I	NS	0.022	0.0072U	0.0072U
Endosulfan II	NS	0.022	0.0072U	0.0072U
Endosulfan Sulfate	NS	NS	0.0083U	0.0083U
Endrin	2	11	0.0074U	0.0074U
Endrin Aldehyde	NS	11	0.0091U	0.0091U
Endrin Ketone	NS	NS	0.013U	0.013U
Gamma-BHC (Lindane)	0.2	0.052	0.0062U	0.0062U
Gamma-Chlordane	NS	NS	0.0065U	0.0065U
Heptachlor	0.4	0.015	0.0062U	0.0062U
Heptachlor Epoxide	0.2	0.0074	0.0065U	0.0065U
Methoxychlor	40	180	0.01U	0.01U
Toxaphene	3	0.061	0.33U	0.33U

All results in ug/L
Results of detected compounds in BOLD
Qualifier Definitions:
U = Not detected above method detection limits
J = estimated
NS = No Standard

4.3 MEC AVOIDANCE SURVEY SUMMARY

UXO technicians provided MEC avoidance training and support during all field operations in accordance with the UXO and Explosive Avoidance Plan (Appendix C of the Final Work Plan). The MEC avoidance crew cleared all soil, surface water/sediment, and drilling locations. No unexploded ordnance, propellants, or visible explosives were discovered during field reconnaissance and magnetometer surveys of access routes and sampling or drilling. Mustard agent or any other chemical warfare

agent was not detected on any of the drilling equipment used to install the monitoring wells.

4.4 SUMMARY OF ANALYTICAL RESULTS

Groundwater samples were collected from all six monitoring wells at the Suspected Mustard Agent Burial AOC. All of the samples were analyzed for mustard agent breakdown products. The groundwater collected from the downgradient wells MBSmw-005 and -006 was additionally analyzed for explosives and propellants, filtered TAL metals and unfiltered cyanide, VOCs, SVOCs, pesticides and PCBs. The results of the laboratory analysis are as follows:

- Mustard agent breakdown products were not detected in any of the groundwater samples collected.
- Nitrocellulose at MBSmw-006 was the only explosive and propellant detected in the samples collected from MBSmw-005 and MBSmw-006. The result (1.4 ug/L) was qualified with a “B” due to method blank contamination.
- Analytical results of groundwater samples tested for Target Analyte List (TAL) Metals were screened against facility wide background levels. Barium (84.0 ug/L at MBSmw-005 and 86.1 ug/L at MBSmw-006) and nickel (1.7 ug/L at MBSmw-006) exceeded the facility wide background levels for these TAL Metals. The facility wide background level for barium is 82.1 ug/L. The facility wide background level for nickel is 0 ug/l.
- 2-butanone at MBSmw-005 (0.95 ug/L) was the only VOC detected. The Region 9 PRG for 2-butanone is 7000 ug/L.
- Benzoic acid (4.5 ug/L at MBSmw-005) was the only SVOC detected. The Region 9 PRG for benzoic acid is 150000 ug/L.
- PCB-1260 (estimated at 0.088 ug/L at MBSmw-006) was the only PCB detected for this investigation. The MCL for PCB-1260 is 0.5 ug/L and the Region 9 PRG is 0.034 ug/L. Pesticides were not detected in the groundwater sampled for this investigation.

5.0 CONCLUSIONS

Mustard breakdown products were not detected in the groundwater sampled from the monitoring wells installed at the Suspected Mustard Agent Burial AOC. There are three possible explanations for this:

1. Mustard agent was not buried at the suspected burial site and is not present at this location.
2. Mustard agent is present at the suspected burial site, but is not leaching into the groundwater.
3. Mustard agent is present at the suspected burial site and is leaching into the groundwater, but none of the wells installed for this investigation were placed to intercept the plume.

It would take a substantial investigation to prove or disprove possibilities #'s 1 and 2 listed above. At this time, we do not recommend further investigation to determine if mustard agent is present at the site for the following reasons:

1. An unsubstantiated and undocumented source reported that mustard agent containers may have been buried at the site.
2. Thiodiglycol, a mustard agent breakdown product, was not detected at the AOC during the previous investigation.
3. Mustard agent or mustard agent breakdown products were not detected at the AOC during this investigation.
4. In summary, there has never been any evidence or documented indication that mustard agent was ever buried at the AOC to warrant further investigation.

6.0 REFERENCES

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APPENDIX A

GEOTECHNICAL LABORATORY REPORT

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Laboratory Test Summary
JL04517
1/18/2006

Sample Data ASTM D 2216

Sample Number		Depth (m)	Depth (ft)	Tare Number	Tare Weight	Wet Weight	Dry Weight	Sample Weight	Moisture Content
MBSMW	005-ST	--	20-22'	149	9.48	667.97	554.89	545.41	**20.7%**

Bulk Density ASTM D 2937

Total Weight	Tube Weight	Sample Weight	Diameter (in)	Length (in)	Volume (cm^3)	Wet Density (pcf)	Dry Density (pcf)
668.0	9.48	658.5	2.823	3.307	339.228	**121.2**	**100.4**

Specific Gravity (-10 Material) ASTM D 854

Sample Weight (Mo)	Full Pycno (Mb)	Temp (ºC)	Density Water $d(T_b)$	Correction K	Pynco/Water (M_a at T_b)	Specific Gravity (T_b)	Specific Gravity (T_{20})	Porosity (n)	V_S	V_w	V_a
39.16	370.41	20.6	0.99810	0.9999	345.41	2.766	**2.766**	**0.419**	**58.1%**	**33.3%**	**8.5%**

Particle Size Distribution ASTM D 422

Percent Passing (by weight)						Gravel (%)	Sand			Silt (%)	Clay (%)	Fines (%)
3/8"	#4	#10	#40	#100	#200		Cor. (%)	Med. (%)	Fine (%)			
100.0	100.0	100.0	99.9	99.8	99.7	0.0	0.0	0.1	0.2	19.3	80.4	99.7

Limits ASTM D 4318 **Classification** ASTM D 2487

Atterberg Limits LL	PL	PI	USCS Classification		Cu	Cc	D10	D30	D50	D60
42.9	**20.5**	**22.4**	**CL**	**LEAN CLAY**	**--**	**--**	**--**	**--**	**--**	**--**

Laboratory Test Summary
JL04517
1/18/2006

Sample Data ASTM D 2216

Boring Number	Sample Number	Depth (m)	Depth (ft)	Tare Number	Tare Weight	Wet Weight	Dry Weight	Sample Weight	Moisture Content
MBSMW	006-ST	--	24-26'	150	9.38	831.10	757.44	748.06	**9.8%**

Bulk Density ASTM D 2937

Total Weight	Tube Weight	Sample Weight	Diameter (in)	Length (in)	Volume (cm^3)	Wet Density (pcf)	Dry Density (pcf)
821.7	9.38	812.3	2.856	3.591	376.897	**134.6**	**122.5**

Specific Gravity (-10 Material) ASTM D 854

Sample Weight (Mo)	Full Pycno (Mb)	Temp (°C)	Density Water $d(T_b)$	Correction K	Pynco/Water (M_a at T_b)	Specific Gravity (T_b)	Specific Gravity (T_{20})	Porosity (n)	V_S	V_w	V_a
39.76	366.82	20.8	0.99807	0.9998	341.87	2.685	**2.685**	**0.269**	**73.1%**	**19.3%**	**7.6%**

Particle Size Distribution ASTM D 422

Percent Passing (by weight)							Sand					
3/8"	#4	#10	#40	#100	#200	Gravel (%)	Cor. (%)	Med. (%)	Fine (%)	Silt (%)	Clay (%)	Fines (%)
97.1	94.4	90.2	78.0	56.7	50.6	5.6	4.2	12.2	27.4	47.8	29.7	50.6

Limits ASTM D 4318 **Classification** ASTM D 2487

Atterberg Limits										
LL	PL	PI	USCS Classification		Cu	Cc	D10	D30	D50	D60
17.5	**11.3**	**6.2**	**CL -ML**	**SANDY SILTY CLAY WITH GRAVEL**	--	--	--	--	--	--

Note: One large gravel in sample, removed to prevent sample GSD bias. Sample classification adjusted to include gravel descriptor.

APPENDIX B

MONITORING WELL LOGS AND WELL DEVELOPMENT RECORDS

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MONITORING WELL LOGS AND WELL DEVELOPMENT RECORDS

MBS-001 11-08-05

Al Brillinger

12:45 Setup @ MBS-001

Sample # MBSmw-001-0006-gw / ~~MBSmw-001-0006-gf~~ 12-1-05 ae

Sample for: thiodiglycol
1,4-oxythiane
1,4-dithiane

12:50 begin purging

time	gal. removed/ ~~total~~	Temp	Spec Cond	pH	TURB.	DO	DTW
12:53	0.25/0.25	11.1	0.515	7.78	124	10.67	18.01
12:56	0.25/0.50	10.8	0.507	7.68	118	10.42	18.05
12:59	0.25/0.75	10.7	0.506	7.63	116	10.65	18.06
13:02	0.25/1.0	10.7	0.501	7.64	661	10.62	18.06
13:05	0.25/1.25	10.6	0.501	7.62	607	10.61	18.07

13:05 begin sampling

13:20 finish sampling

Wea = cloudy 50-55°

sign Al Brillinger QA Chantelle Carroll 12-1-05

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SUSPECTED MUSTRAD AGENT BURIAL SITE

Date (mm/dd/yy): 1-13-06 Su M Tu W Th F Sa PAGE_____ OF _____

Task Team Members:

Chantelle Carroll

Erik Pietrzak

Narrative (include time and location):

9:45 Arrive at well location MBS-01, setup

10:25 Begin to purge well (Static) D.T.o Water 17.42', Dist. to Bottom 30.92'

Flow rate on meter 140 ml per minute

10:57 Take Sample MBSmw-001-0013-gw for thiodiglycol

11:07 Finished Sample - clean up/ decon go to next well location

Daily Weather Conditions: A.M. Sunny, p. clouds, no wind, warm 50°'s (F.)

P.M.

Recorded By Chantelle Carroll QA Checked By Al Billings

WELL PURGE and DEVELOPMENT RECORD

PROJECT NAME: SUSPECTED MUSTARD AGENT BURIAL SITE

WELL NUMBER AND LOCATION: MB5-OD1 PAGE _____ OF _____

DATE	TIME	GALLONS REMOVED	TOTAL GALLONS REMOVED	pH (Standard Units)	TEMP (C)	SPECIFIC CONDUCTIVITY (µMHOS/CM)	DISSOLVED OXYGEN (mg/L)	TURBIDITY (NTU)	COMMENTS
1-13-06	10:25	initial	—	7.19	10.1	88.0	1.0	>999	Flow 140 D.T.W. 17.42
	10:34	.13	.13	7.15	10.1	87.3	0.52	762	
	10:38	.12	.25	7.18	10.1	86.6	0.45	619	17.47
	10:44	.25	.50	7.21	10.0	85.7	0.24	497	
	10:48	.25	.75	7.22	10.0	85.2	0.21	434	17.47
	10:56	.25	1	7.20	10.0	84.9	0.20	402	17.47

RECORDED BY: Chantelle Carroll 1-13-06
(Signature and Date)

QA CHECK BY: Al Brilliyn 2-14-06
(Signature and Date)

11-7-05 MON

Al Brillinger

13:55 begin purging @ MBS-002

sample #: MBSmw-002-0007-gw
~~MBSmw-002-0007-gf~~ 12-1-05 cc

sample for thiodiglycol
1,4-dithiane
1,4-oxythiane

14:15 begin sampling

14:30 finish sampling, decon move to MBS-006

Wea: = sunny 50-55°

Sign Al Brillinger QA [signature] 12-1-05

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SUSPECTED MUSTRAD AGENT BURIAL SITE

Date (mm/dd/yy): 1-13-06 Su M Tu W Th (F) Sa PAGE____ OF ____

Task Team Members:

Chantelle Carroll

Erik Pietrzak

Narrative (include time and location):

13:00 Arrive and setup on MBS-002

13:10 Begin purging - Flow rate 220 ml/min.

D.T.B 30.36 ; D.T. water 17.79

increase flow rate to 228 ml/min - D.T.W. 17.94

13:33 Take Sample - thiodiglycol

MBSmw-002-0014-gw

13:43 Finish sample, Cleanup/decon - go to next location (MBS-04)

Daily Weather Conditions: A.M. overcast to possible rain, warm 55+ °F, wind pickup

P.M. ____

Recorded By Chantelle Carroll QA Checked By Al Bullington

& DEVELOPMENT

WELL PURGE RECORD

PROJECT NAME: Suspected Mustard Agent Burial Site

WELL NUMBER AND LOCATION: MBS-002 RVAAP-28

PAGE 1 OF 1

DATE	TIME	GALLONS REMOVED	TEMP (C)	SPECIFIC CONDUCTIVITY (µMHOS/CM)	pH (Standard Units)	TURBIDITY	TOTAL GALLONS REMOVED	WELL VOLUMES REMOVED	COMMENTS
11/16/04	10:55	15	10.1	256.6	7.5	>999	15	1.66	
11/16/04	11:10	~~205~~ 5 AB 11-16	10.2	254.2	7.5	>999	20	2.22	
11/16/04	11:40	~~30~~ 10 AB 11-16	10.2	257.1	7.5	>999	30	3.33	
11/16/04	12:10	~~40~~ 10 AB 11-16	10.2	247.4	7.5	>999	40	4.44	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	DO 9.51
[illegible]	[illegible]	[illegible]	9.3	[illegible]	[illegible]	573	[illegible]	[illegible] 11-29	DO 9.49
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] 11-29	DO 9.40
[illegible]	[illegible]	[illegible]	9.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] 11-29	DO 9.47
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	137	[illegible]	[illegible] 11-29	DO 9.38 last reading
11-7-05	13:58	0.25	11.5	0.437	7.70	>999	0.25		DO=11.41 DTW=18.65
	14:01	0.25	11.0	0.431	7.65	>999	0.50		DO=11.38 DTW=18.65
	14:04	0.25	10.8	0.429	7.57	>999	0.75		DO=11.24 DTW=18.65
	14:07	0.25	10.7	0.427	7.53	975	1.0		DO=11.07 DTW=18.65
	14:10	0.25	10.6	0.426	7.53	511	1.25		DO=11.04 DTW=18.65
	14:13	0.25	10.6	0.425	7.55	350	1.50		DO=10.99 DTW=

Sample 11-7-05

RECORDED BY: Al Bullyan 11-16-04
(Signature and Date)
Chandler Carroll 11-29-04
Al Bullyan 11-7-05

QA CHECK BY: Chandler Carroll 11/16-04
(Signature and Date)
Al Bullyan 11-30-04
Chandler Carroll 12-1-05

APPENDIX B

9

WELL PURGE and DEVELOPMENT RECORD

PROJECT NAME: SUSPECTED MUSTARD AGENT BURIAL SITE

WELL NUMBER AND LOCATION: MBS-002 PAGE _____ OF _____

DATE	TIME	GALLONS REMOVED	TOTAL GALLONS REMOVED	pH (Standard Units)	TEMP (C)	SPECIFIC CONDUCTIVITY (µMHOS/CM)	DISSOLVED OXYGEN (mg/L)	TURBIDITY (NTU)	COMMENTS
1-13-06	13:10	initial	—	7.86	10.8	71.9	1.30	430	Flow 220 D.T.W 17.79
	13:18	.25	.25	7.67	10.4	69.1	0.47	353	17.93
	13:23	.25	.50	7.60	10.4	68.2	0.35	237	17.94
	13:26	.25	.75	7.53	10.6	67.9	0.28	217	Flow 228 17.97
	13:29	.25	1	7.50	10.6	67.2	0.18	157	17.97
	13:31	.25	1.25	7.50	10.6	66.9	0.16	147	17.97

RECORDED BY: [signature] 1-13-06
(Signature and Date)

QA CHECK BY: [signature] 2/13/06
(Signature and Date)

11-07-05 TMON.

Al Brillinger

09:30 - 10:30 move sampling supplies from NACA site to MBS-003

10:35 Measure water levels in all wells w/ Herron dipper-T electronic water level meter (SN 05767)

	TIME	DTW	DTB	
MBS-001	10:53	17.92	30.93 (soft)	all measure from top of inner csg.
MBS-002	10:56	18.42	30.36 (soft - silty tip)	
MBS-003	10:37	19.56	30.67 (hard)	
MBS-004	10:40	17.53	26.56 (soft)	
MBS-005	10:49	18.20	30.05 (firm) silty tip	
MBS-006	10:45	17.68	28.10 (firm)	

11:00 set up sampling @ MBS-003

Sample # MBSmw-003-0008-gw cc 12-1-05

~~MBSmw-003-0007-gf~~

Sampling for thiodiglycol, 1,4-dithiane, and 1,4-oxythiane

11:19 start purging

11:36 finish purging

11:40 start sampling

11:57 finish sampling - decon, move to MBS-004

Weather: sunny 50-55°

Sign Al Brillinger

12-1-05

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SUSPECTED MUSTRAD AGENT BURIAL SITE

Date (mm/dd/yy): 1-13-05 Su M Tu W Th (F) Sa PAGE____ OF ____

Task Team Members:

Chantelle Carroll

Erik Pietrzak

Narrative (include time and location):

14:20 Arrive & setup MBS-003

14:38 Begin Purge

flow rate 184 ml/min

D.T.W 18.57

P.T.B. 30.65

15:10 Begin sample MBSmw-003-0015-gw

for thiodiglycol

15:25 Finish sample, clean up site and return to building

Daily Weather Conditions: A.M. overcast, more rain?, 2 burst of < 3 min. each) 50-60°F

P.M. ____

Recorded By Chantelle Carroll QA Checked By Al Bruey

* Development

WELL PURGE RECORD

PROJECT NAME: Suspected Mustard Agent Burial Site

WELL NUMBER AND LOCATION: MBS-003

PAGE 1 OF 1

DATE	TIME	GALLONS REMOVED	TEMP (C)	SPECIFIC CONDUCTIVITY (µMHOS/CM)	pH (Standard Units)	TURBIDITY	TOTAL GALLONS REMOVED	WELL VOLUMES REMOVED	COMMENTS
11/7/04	0855	10	10.7	535	7.5		10	1.1	
							12	1.33	
11/8/04	12:15	4	12.1	354.6	7.59	7999	16	1.77	D.O. 3.75 ~~351.0~~ cc
	12:25	" ~~8~~ 4	11.0	585.0	7.50	7999	20	2.22	DO 3.51 ~~585~~ cc
	12:49	" ~~12~~ 4	10.9	448.9	7.55	7999	24	2.66	DO 3.41
	BOD	3	10.9	501.6	7.54	7999	27	3.00	DO 5.43 → bailer only ¼ - ⅓ full
	13:05	Final 1	11.4	448.2	7.57	7999	28	3.11	DO 3.22 → last reading before dry
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
sample 11-7-05									
11-7-05	11:25	0.25	11.6	0.465	7.42	118	0.25		D.O = 11.25 DTW = 19.87
	11:28	0.25	11.3	0.460	7.37	122	0.50		DO = 10.95 DTW - 20.02
	11:31	0.25	11.2	0.463	7.41	35	0.75		DO = 10.91 DTW - 20.20
	11:34	0.25	11.1	0.461	7.43	17	1.0		DO = 10.87 DTW =

RECORDED BY: Al Bullington 11/18/04
(Signature and Date)
Chandelle Canall 11/18/04
Al Bullington 11-7-05

QA CHECK BY: Chandelle Canall 11-17-04
(Signature and Date)
Al Bullington 11-30-04
Chandelle Canall 12-1-05

WELL PURGE and DEVELOPMENT RECORD

PROJECT NAME: SUSPECTED MUSTARD AGENT BURIAL SITE

WELL NUMBER AND LOCATION: MBS-003 PAGE _____ OF _____

DATE	TIME	GALLONS REMOVED	TOTAL GALLONS REMOVED	pH (Standard Units)	TEMP (C)	SPECIFIC CONDUCTIVITY (µMHOS/CM)	DISSOLVED OXYGEN (mg/L)	TURBIDITY (NTU)	COMMENTS	
1-13-06	14:38	initial	–	7.29	11.6	74.7	6.00	7.7.8	184 Flow	19.05 DTW
	14:48	.50	.5	7.17	11.0	73.9	3.64	64.8		19.15
	14:52	.15	.65	7.19	10.9	73.8	3.72	40.1	148 Flow	19.30
	14:55	.25	.90	7.18	10.9	73.7	375	30.1		
	14:59	.20	1.10	7.19	10.8	73.5	3.73	21.5		19.49
	15:03	.15	1.25	7.18	10.8	73.4	3.63	20.9	136 Flow	19.60
	15.09	.25	1.50	7.18	10.8	73.4	3.61	18.2		19.60

RECORDED BY: Chantelle Carroll 1-13-06
(Signature and Date)

QA CHECK BY: Al Bullock 2/13/06
(Signature and Date)

11-7-05 MON Al Brillinger

12:30 Setting up for sampling @ MBS-004

Sample # MBSmw-004-0009-gw
~~MBSmw-004-0009-gf~~ CC 12-1-05

Sampling for thiodiglycol
1,4-oxythiane
1,4-dithiane

12:41 begin purging

12:59 begin sampling

13:13 finish sampling - decon, move to MBS-001

Wea= sunny 50-55°

sign Al Brillinger QA Charlie Call 12-1-05

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SUSPECTED MUSTRAD AGENT BURIAL SITE

Date (mm/dd/yy): 1-13-06 Su M Tu W Th (F) Sa PAGE ____ OF ____

Task Team Members:

Chantelle Carnall

Erik Pietrzak

Narrative (include time and location):

13:45 Setup MBS-004

13:57 Begin Purge

Flow rate 268 ml/min D.T.W. 16.55 D.T.B 26.60

Take sample (Thiodiglycol)

14:17 MBSmw-004-0016-gw

14:23 Finish sample, clean up/decon, go to next well (Final one today - 003)

Daily Weather Conditions: A.M. overcast, lt. rain - stop (last 3 min) 55-60°F

P.M. ____

Recorded By Chantelle Carnall QA Checked By [signature]

APPENDIX B

? DEVELOPMENT

WELL PURGE RECORD

PROJECT NAME: Suspected Mustard Agent Burial Site

WELL NUMBER AND LOCATION: MBS-OC4

PAGE 1 OF 1

DATE	TIME	GALLONS REMOVED	TEMP (C)	SPECIFIC CONDUCTIVITY (µMHOS/CM)	pH (Standard Units)	TURBIDITY	TOTAL GALLONS REMOVED	WELL VOLUMES REMOVED	COMMENTS
Develop 11/17/04	10:25	15	10.5	5.19	7.5	>999	15	2.14	
	10:50	10	10.7	284.2	7.5	>999	25	3.57	
AB 11-17-04	11/17/04 11:05	5	10.7	284.1	7.5	>999	30	4.28	
AB 11-17-04	11/17/04 11:25	5	10.7	295.1	7.5	>999	35	5	
	11/29/04 16:08	in 7.0	9.3	.332	7.39	>999	—		DO. 9.03 DTW 16.31
Sample 17	16:16	.5	9.6	.331	7.28	>999	.5		DO 8.96
	16:22	.5	9.5	.329	7.30	647	1		D.O. 8.99 16.75
	16:27	.3	9.9	.329	7.25	412	1.3		DO. 9.02
	16:32	.5	9.9	.329	7.28	268	1.8		DO 9.19 16:28 = 16.75
	16:35	.2	9.9	.330	7.28	159	2.0		DO. 9.30
Sample 11-7-05	11-7-05 12:45	0.25	11.7	0.436	7.65	778	0.25		D.O = ~~11.38~~ AB reading DTW = 17.70
	12:48	0.25	11.4	0.438	7.66	401	0.50		DO = 11.37 DTW = 17.75
	12:51	0.25	11.3	0.437	7.62	230	0.75		DO = 11.17 DTW = 17.80
	12:54	0.25	11.0	0.437	7.61	221	1.0		DO = 11.12 DTW = 17.82
	12:57	0.25	11.2	0.438	7.59	188	1.25		DO = 11.10 DTW = 17.85

RECORDED BY: Al Bullinger 11-17-04
(Signature and Date)
Chandler Carroll 11-29-04
Al Bullinger 11-7-05

QA CHECK BY: Chandler Carroll 11-18-04
(Signature and Date)
Al Bullinger 11-30-04
Chandler Carroll 12-1-05

GROUNDWATER PURGE SHEET

PROJECT NAME: Suspected Mustard Agent Burial Site

DATE (mm/dd/yy): 11/29/04 TIME: 16 :08

WELL ID NUMBER: MBS-001 WELL LOCATION: RVAAP-28

DEPTH OF SCREENED INTERVAL (BTOC): 14.7 ft to _____ ft

INNER CASING: TYPE: PVC ID: 2" inches

DTW 16.31
DTB 26.72
10.41/2 = 5.21
21.51

WELL VOLUME CALCULATION Vc = 3.142 X $(di/2)^2$ x (TD-H) _____

Vf = 3.142 x $[(dH/2)^2 - (do/2)^2]$ (TD-S or H) (P) _____
NOTE: If S>H use S, if S<H use H

Vt = (Vc + Vf) (7.48) _____

WHERE:

Vc = Volume of water in well casing, cu. ft.
Vt = Total volume, ga.
Vf = Volume of water in filter pack, cu. ft.
do = outside of diameter of well casing, ft.
di = inside diameter of well casing, ft.
P = estimated porosity of filter pack
dH = diameter of borehole, ft.
TD = total depth of well from top of well casing, ft.
H = depth of water, ft., from top of well casing
S = depth to base of seal, ft., from top of well casing

.25 tube x Pi = .0136 x 21.51
.029 x 18 = .522 x 3 = .66 gal

PURGE METHOD; [ ] Bailer [ ] Bladder Pump [X] Pump Type Sample Pro

MINIMUM PURGE VOLUME = Vt x 3 PURGE VOLUME: .66 GAL.

SAMPLE METHOD: [ ] Bailer [ ] Bladder Pump [X] Other (specify) Sample Pro

SITE CONDITIONS DURING PURGING: _____

FIELD OBSERVATIONS: wet but sunny, p. cloudy, mid-40's low 30's

S&A PLAN SAMPLING PROCEDURE FOLLOWED: [ ] YES [ ] NO IF NO, WHY WAS A DEVIATION NECESSARY: _____

RECORDED BY: Charlie Carroll 11-29-04
(Signature and Date)

QA CHECK BY: QC Bullenger 11-30-04
(Signature and Date)

APPENDIX B

LL

WELL PURGE and DEVELOPMENT RECORD

PROJECT NAME: SUSPECTED MUSTARD AGENT BURIAL SITE

WELL NUMBER AND LOCATION: MBS - 004 PAGE _____ OF _____

DATE	TIME	GALLONS REMOVED	TOTAL GALLONS REMOVED	pH (Standard Units)	TEMP (C)	SPECIFIC CONDUCTIVITY (µMHOS/CM)	DISSOLVED OXYGEN (mg/L)	TURBIDITY (NTU)	COMMENTS
1-13-06	13:57	Initial	—	7.34	11.2	74.7	1.77	71.8	Flow 268 D.TW. ~~16.72~~ cc 16.55
	14:01	.25	.25	7.30	10.9	74.4	0.72	69.	16.72
	14:04	.25	.50	7.27	10.8	739	0.58	61.2	16.79
	14:07	.25	.75	7.27	10.7	73.7	0.53	53.9	16.85
	14:10	.25	1.0	7.28	10.7	73.7	0.49	52.6	16.85
	14:13	.25	1.25	7.28	10.7	73.5	0.45	60.0	16.89
	14:16	.30	1.55	7.28	10.7	73.2	0.43	60.0	16.89

RECORDED BY: Chandra McConnell 1-13-06
(Signature and Date)

QA CHECK BY: Al Bullington 2/13/06
(Signature and Date)

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SUSPECTED MUSTRAD AGENT BURIAL SITE

Date (mm/dd/yy): 10/26/05 Su M Tu (W) Th F Sa PAGE____ OF ____

Task Team Members:

Al Brillingen — Bob Fay (ISSI, Inc.)

Chris White (TTL, Inc.)

Guy Jackson (TTL, Inc)

Narrative (include time and location):

MBS-005

13:40 Frank w/ Falkenberg Exc. on site to move rig from MBS-006 to MBS-005

- using dozer to mob. pipe, augers, sand, bentonite cement to drill site

15:45 Begin drilling, sampling @ MBS-005

(Paul Zorko on site 14:00-16:00)

17:00 Drill, sample to 14', clean up site, IV for the day

Daily Weather Conditions: A.M. _____

P.M. partly cloudy 45°

Recorded By Al Brillingen QA Checked By

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SUSPECTED MUSTRAD AGENT BURIAL SITE

Date (mm/dd/yy): 10/27/05 Su M Tu W (Th) F Sa PAGE____ OF ____

Task Team Members:

Al Brillinger — Guy Jackson (TTL, Inc)

Bob Fay (ISSI, Inc)

Chris White (TTL, Inc.)

Narrative (include time and location):

7:30 H&S tailgate mtg @ office

8:40 @ MBS-005

8:45 begin augering, sampling 14' bgs

9:20 Shelby tube collected (~1.5' recovery) 20'-22' bgs

9:45 Attempt shelby tube 24'-26' bgs - no recovery

10:10 sample 26'-28' bgs, plan to set well @ 28'

- trouble setting well @ 28' - heaving sands +7' into augers
- re-auger 20-28'
- tremie set well

15:45 finish installing MBS-005

- start to demob from site, rig moved out, soil drums (4) moved out

*Bob Fay checked borehole every 2' from 0-10' w/ gradiometer. Readings indicated no UXO. Borehore equip. was checked w/ CWA paper upon contact w/ formation water. NO CWA detected. Bob Fay off site @ 11:00, Paul Zorko @ site on+off 0900-16:00

Daily Weather Conditions: A.M. Cloudy 40°

P.M. cloudy 40°

Recorded By Al Brillinger QA Checked By Randall Carnell

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SUSPECTED MUSTRAD AGENT BURIAL SITE

Date (mm/dd/yy): 10-28-05 Su M Tu W Th (F) Sa PAGE____ OF ____

Task Team Members:

Al Brillinger

Chris White (TTL, Inc) Kevin Zolgus (Falkenberg Exc.)

Guy Jackson (TTL, Inc.)

Narrative (include time and location):

07:30 H&S tailgate

08:00 move to site (Kevin on post 8:00)

moving concrete to site w/ dozer

guard posts, concrete pads

10:00 Kevin Zolgus off site

Drillers set concrete pads, outer protective casing, guard posts and cleaned site

15:30 TTL lv for weekend. will return Monday 10/31/05 to paint guard posts & outer casings, decon rig & equip, finish demobing from site

Daily Weather Conditions: A.M. partly cloudy 40°

P.M. ____

Recorded By Al Brillinger QA Checked By Chantelle Conrad

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SUSPECTED MUSTRAD AGENT BURIAL SITE

Date (mm/dd/yy): 10/31/05 Su (M) Tu W Th F Sa PAGE____ OF ____

Task Team Members:

Al Brillinger

Chris White (TTL, Inc)

Jay Leonard (TTL, Inc)

Narrative (include time and location):

9:20 TTL on site to paint outer casings & guard posts, decon ~~ea~~ AB rig, demob from site

13:40 TTL IV site

Daily Weather Conditions: A.M. sunny 50°

P.M. Sunny - partly sunny 55°

Recorded By Al Brillinger QA Checked By

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SUSPECTED MUSTRAD AGENT BURIAL SITE

Date (mm/dd/yy): 11/2/05 Su M Tu (W) Th F Sa PAGE____ OF ____
Task Team Members:

Al Brillinger

Narrative (include time and location):

13:50 Ar @ MBS-005 from MBS-006
14:00 begin development of MBS-005 by bailer
16:30 finish development of MBS-005; 45 gallons of water removed (5 well volumes). pH, Temp, Spec. Cond, D.O stabilized w/in 10% 3x during development.
16:40 off site

Daily Weather Conditions: A.M. _____
P.M. sunny 55°

Recorded By Al Brillinger QA Checked By Chantel Carroll

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SUSPECTED MUSTRAD AGENT BURIAL SITE

Date (mm/dd/yy): 11-08-05 Su M (Tu) W Th F Sa PAGE____ OF ____

Task Team Members:

Al Brillinger

Narrative (include time and location):

09:30-10:00 move gear from NACA area to MBS-005

10:00-10:17 set up for sampling @ MBS-005

Sample No: = MBSmw-005-0010-gw; MBSmw-005-0040-gf; MBSmw-005-0110-gf; MBSmw-005-0110-gw; MBSmw-005-0110-gws (Dup/split)

TAL metals, SVOCs, VOCs, cyanide, Pest., PCBs, Expl., Prop, thiodiglycol

1,4-oxythiane, 1,4-dithiane

10:17 begin purging

10:40 begin sampling

finish sampling, decon, move to MBS-001.

Daily Weather Conditions: A.M. cloudy 55°

P.M.

Recorded By (signature) QA Checked By (signature)

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SUSPECTED MUSTRAD AGENT BURIAL SITE

Date (mm/dd/yy): 11-21-05 Su (M) Tu W Th F Sa PAGE____ OF ____
Task Team Members:

Al Brillinger

Narrative (include time and location):

MBS-005 Slug test

Slug = standard . minitroll & RuggedReader

DTW = 18.05'

12:00 Slug in

12:15 Slug out

12:35 lv site

Daily Weather Conditions: A.M. Sunny 50°

P.M. ____

Recorded By Al Brillinger QA Checked By [signature]

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SUSPECTED MUSTRAD AGENT BURIAL SITE

Date (mm/dd/yy): 1-13-06 Su M Tu W Th (F) Sa PAGE____ OF ____

Task Team Members:

Chantelle Carroll

Erik Pietrzak

Narrative (include time and location):

11:07 Arrive and set up on MB5-05

11:18 Begin purging well D.T.W. 17.66, Distance to Bottom - 29.9

Flow rate on meter ~~71.65~~ 160 ml/minute

1153 Take sample for thiodiglycol and dup. sample

MB5mw-005-0017-gw

MB5mw-005-0018-gw (dup)

1202 Finish sample, clean up/decon equipment ; go to next well location (06)

Daily Weather Conditions: A.M. Sunny P. clouds, light breeze, warm 50°F.

P.M. ____

Recorded By Chantelle Carroll QA Checked By Al Bulanza

HTRW DRILLING LOG

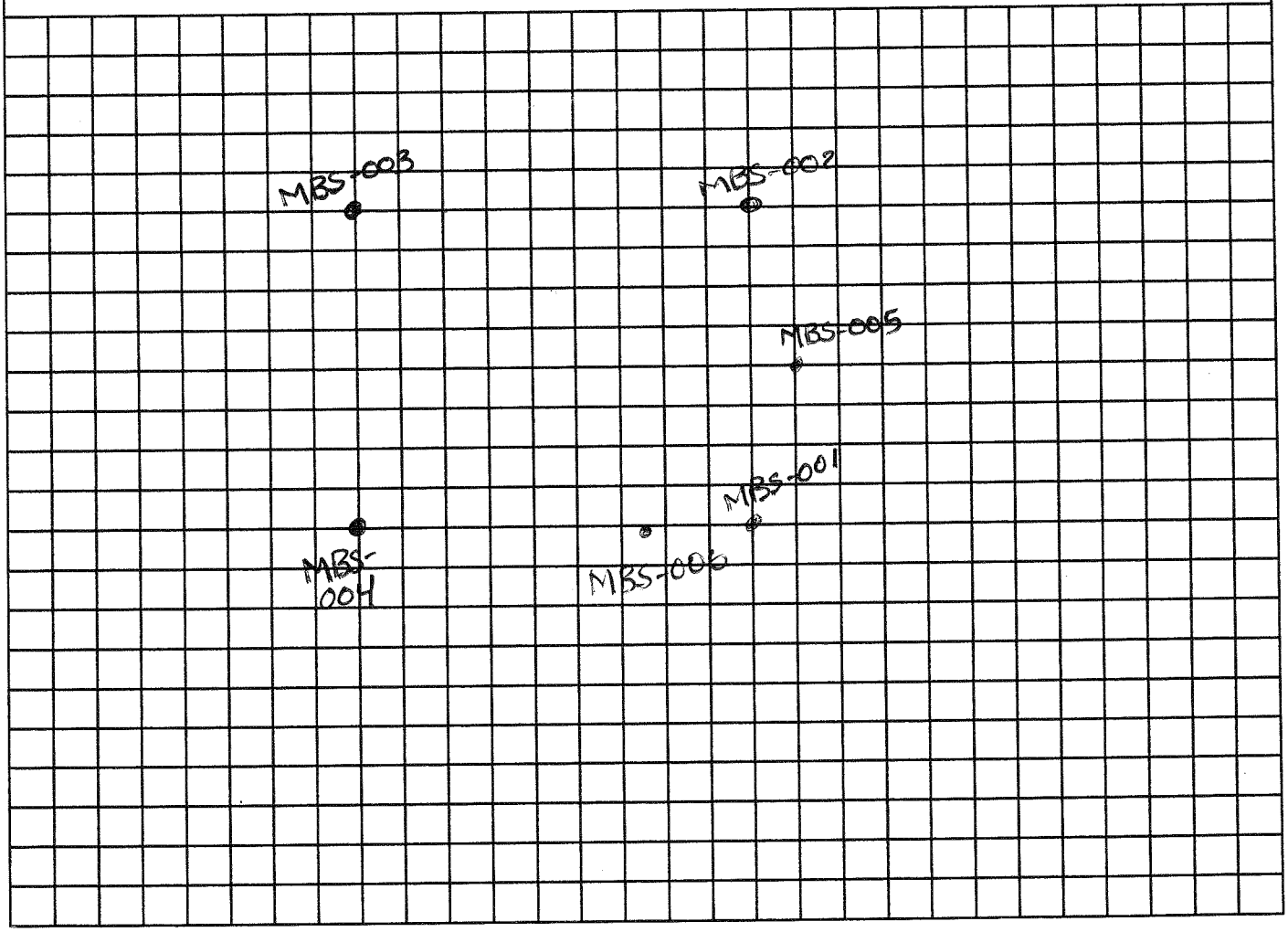
	DISTRICT: Louisville	HOLE NUMBER MBS-005
1. COMPANY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR: TTL, Inc.	SHEET 1 OF 4
3. PROJECT: Suspected MBS (RVAAP-28)	4. LOCATION: RVAAP-28	
5. NAME OF DRILLER: Chris White	6. MANUFACTURERS DESIGNATION OF DRILL: CME 45 (ATV)	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" split spoon, 4 1/4" HSA	8. HOLE LOCATION: MBS-005	
Subsurface Instruments Borehole Gradiometer (BHG-1) used for UXO readings 0 to 12'. Drilling equipment checked for CWA using M256 chemical detector kit & first groundwater. Readings for CWA-paper; neg=OK, positive = tor color change	9. SURFACE ELEVATION:	
	10. DATE STARTED: 15:45 10/26/05	11. DATE COMPLETED: 15:45 10/27/05
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED:	
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:	
14. TOTAL DEPTH OF HOLE: 28' bgs.	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):	

18. GEOTECHNICAL SAMPLES	DISTRICT	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
		Shelby tube 1	N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
All readings for UXO & CWA were negative			(See column G of boring log)			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		X		Al Bulling.

LOCATION SKETCH/COMMENTS — SCALE: N.T.S



HTRW DRILLING LOG

HOLE NUMBER MBS-005

PROJECT: RVAAP AOC-28 | INSPECTOR Al Brillinger | SHEET 2 OF 4

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	~~HEADSPACE~~ SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	0	Top 0.2- leaves, roots org. debris Next 1.6'- Brown and gray mottled silty CLAY w/ f-m SAND (TILL)	PID 0.0	SPT Blows Cts. 2-2-4-6		Gradiometer = 0.7 @ G.S 0.7 @ 2'
	2	REC= 1.8' (15:55) Brown & gray (mottled) silty CLAY w/ f-m SAND (TILL) damp	0.0	2-5-6-7		Grad. = 0.7
	4	REC= 1.6 (15:58) Brown & gray (mottled) silty CLAY w/ f-m SAND (till)	0.0	4-5-8-10		Grad = 0.7
	6	REC= 1.7 (16:03) Brown & or. brown CLAY, some SILT Brown silt layer @ 7.7 to 7.8' bgs	0.0	4-8-11-12		Grad = 0.7
	8	REC= 2.0 16:12 Brown clayey SILT, silty CLAY, some or-br silt seams	0.0	4-6-8-12		Grad = 1.3 BKG = 3.5 TIP (spoon) wet CWA paper = neg. - no color change
	10	REC= 2.0 (16:25)				

HTRW DRILLING LOG

HOLE NUMBER MBS-005

PROJECT: RVAAP AOC-28 | INSPECTOR Al Brillinger | SHEET 3 OF 4

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	PID ~~HEADSPACE~~ SCREENING RESULTS	SPT (BLOW CTS) GEOTECH ~~SAMPLE OR CORE~~ BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	11	Gray CLAY w/ SILT (plastic)	0.0	2-3-4-6		Gradiometer = 0.2 milligauss
	12	REC = 2.0 (16:35)				
		Top 1.5 - Gray CLAY w/ SILT	0.0	2-4-5-6		
	13	Bottom 0.4 - Gray wet SILT, some CLAY				
	14	REC = 1.9 (16:50)				finish for day 10-26-05 17:00 HRS
		Gray CLAY w/ Silt, wet	0.0	2-3-4-5		FIRST SAMPLE 10-27-05 depth to water in borehole = 10.2' bgs.
	15					
	16	REC = 2.0 (08:47)				
		Gray, plastic CLAY, wet	0.0	2-WOH-2-3		CWA paper = neg. read (no color change)
	17					
	18	REC = 2.0 (08:55)				
		Gray, plastic CLAY		1-2-3-2		
	19					
	20	REC = 2.0 (9:03)				

HTRW DRILLING LOG

HOLE NUMBER MBS-005

PROJECT: RVAAP AOC-28 | INSPECTOR Al Brillinger | SHEET 3 OF

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	21	Gray plastic CLAY @ tip of shelby tube	0.0	Shelby tube- 2' @ 450 psi		Shelby tube @ 20-22' Heaving ~~sand~~ mat'l AD 3' into augers while augering to 20' CWA paper = neg. read (no color change)
	22	REC=1.5'				
		TOP 1' Gray plastic CLAY, wet	0.0	WOH-7-6-5		
	23	Bottom 0.2- Gray med-cse SAND (wet)				
	24	REC=1.2' (9:35)	0.0	shelby tube 5" push		CWA paper = neg. read (no color change)
	25					
	26	NO RECOVERY (9:45)				
		TOP 1' = Gray f-cse SAND, some SILT wet	0.0	5-12-14-12		CWA paper = neg. read (no color change)
	27	Bottom 0.2' = Hard gray v. fine SAND/SILT				
	28	REC=1.2' (10:09) (9:58) AB ~~E.O.B @ 28'~~ E.O.B @ 28'				
	29					
	30					

MONITORING WELL INSTALLATION LOG

PROJECT NAME: Suspected Mustard Agent Burial Site

MONITORING WELL ID: ~~MBS-006~~ AB MBS-005

INSTALLATION START: DATE: 10/27/05 TIME: 10:10

INSTALLATION FINISH: DATE: 10/27/05 TIME: 15:45

ANNULAR SPACE MATERIALS INVENTORY:

GRANULAR FILTER PACK: TYPE: Global Filter Pack ~~NSF~~ 50-lb bag QUANTITY: 10

BENTONITE SEAL: TYPE: Bentonite chips 24-lb bag QUANTITY: 1

GROUT: TYPE: cement-bentonite (Type I portland) QUANTITY: 70 gallons

DESCRIPTION OF WELL SCREEN:

SLOT SIZE (inches): 0.01 SLOT CONFIGURATION: machine slot

OUTSIDE DIAMETER: 2.375" NOMINAL INSIDE DIAMETER: 2.067"

SCHEDULE/THICKNESS: SCH 40 COMPOSITION: PVC

MANUFACTURER: Johnson

TYPE OF MATERIAL BETWEEN BOTTOM OF BORING AND SCREEN: filter pack sand

DESCRIPTION OF WELL CASING:

OUTSIDE DIAMETER: 2.375" NOMINAL INSIDE DIAMETER: 2.067'

SCHEDULE/THICKNESS: SCH 40 COMPOSITION: PVC

MANUFACTURER: Johnson

JOINT DESIGN AND COMPOSITION: flush thread w/ "O" ring

CENTRALIZERS DESIGN AND COMPOSITION: N/A

DESCRIPTION OF PROTECTIVE CASING:

NOMINAL INSIDE DIAMETER: 6" COMPOSITION: Steel

SPECIAL PROBLEMS ENCOUNTERED DURING WELL CONSTRUCTION AND THEIR RESOLUTION:

Heaving sand inside auger @ 28' bgs. Reauger hole from 20-28'.

Was all well screen and casing material used for construction free of foreign matter (e.g. adhesive tape, labels, soil, grease, etc.)? YES [X] NO [ ]

Was all well screen and casing material used for construction free of unsecured couplings, ruptures, and other physical breakage and/or defects? YES [X] NO [ ]

Is deformation or bending of the installed well screen and casing minimized to the point of allowing the insertion and retrieval of a 1.0-inch bailer throughout the entire length of the complete well? YES [ ] NO [ ]

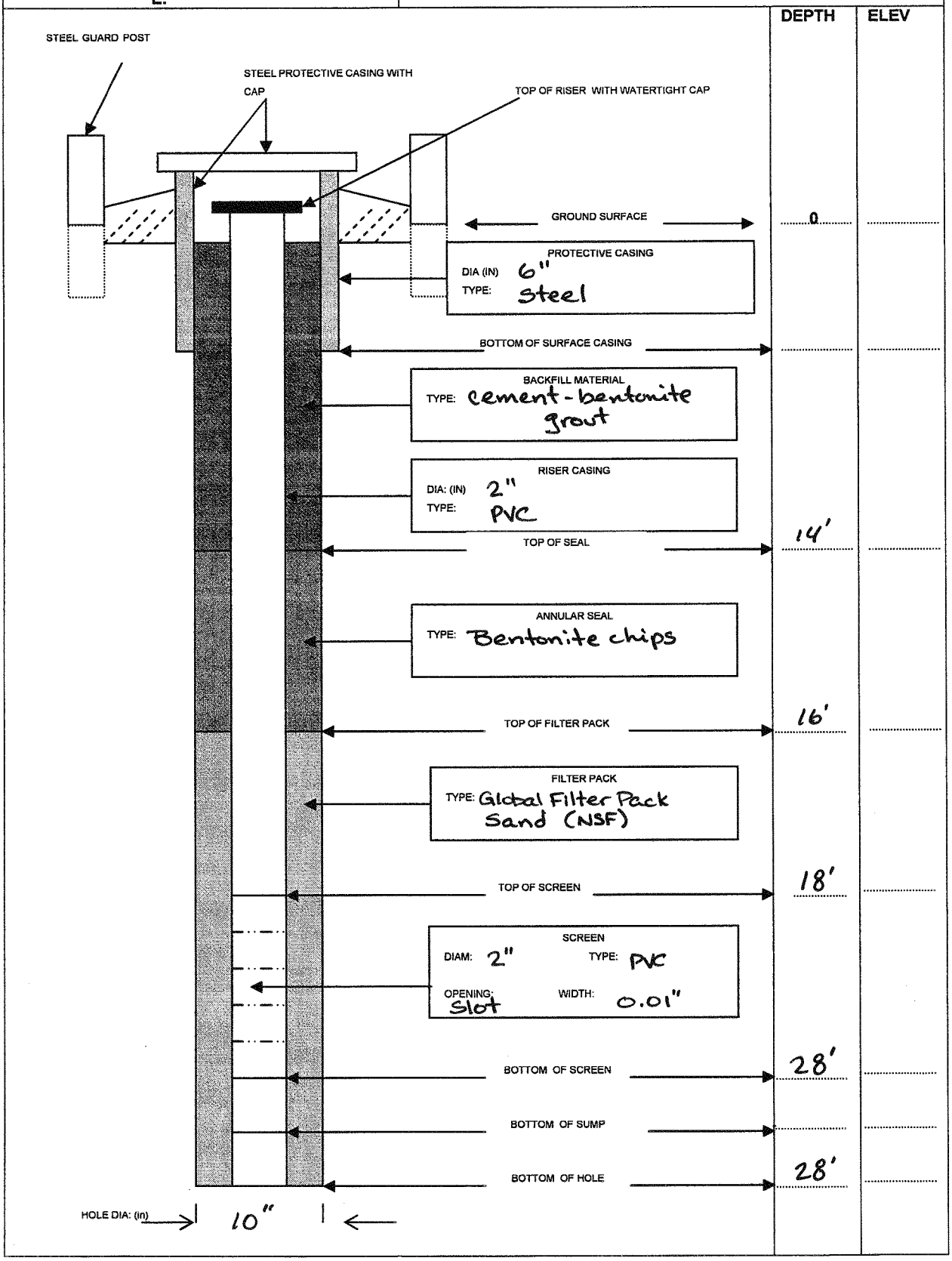
QUANTITY OF APPROVED WATER USED FOR FILTER PACK EMPLACEMENT:

RECORDED BY: Al Bulling 10-27-05 (Signature and Date) QA CHECK BY: [signature] 12-1-05 (Signature and Date)

MONITORING WELL CONSTRUCTION DIAGRAM

PROJECT NAME: Suspected Mustard Agent Burial Site

WELL NUMBER: MBS-005	**BEGIN:** 10/26/05	**END:** 10/27/05
COORDINATES: N: E:	**REFERENCE POINT:**	**ELEVATION:**



Well Volume Calculation Sheet

Date: 11/2/05 Time: 14:00

Well ID: MBS-005

Well Location: RVAAP-28

Total Depth of Well (ft BTOC) 30
Depth to Water (ft BTOC) 16.95
Height of water column (ft) (Hc) 13.05

Well Volume Calculation:

Vc = $3.142(Rc^2)*Hc$ 0.28 cu. ft.

Vf = $3.142[(Rf^2)-(Ro^2)]*$(Hc or length of screen)*(0.30)
Note use length of screen if Hc>length of screen
= 0.9 cu. ft.

Vt = (Vc+Vf)*(7.48 gal/cu. ft.)

= 9.06 gal. x 5 = 45.3

Where:

Vc = Volume of casing (ft^3)
Vf = Volume of filter pack (ft^3)
Vt = Total Volume
Ro = Outside radius of casing (0.10 ft)
Hc = Height of water column 13.05 (ft)
Rf = Radius of filter pack (0.33 ft)
Rc = Radius of inside casing (0.083 ft)

WELL DEVELOPMENT FORM

PROJECT NAME: Suspected Mustard Agent Burial Site

Date: 11 / 2 / 05

Well Number and Location: MBS-005 RVAAP-28

Development Crew: Al Brillinger

Driller (if applicable): _____

Water Levels/Time: Initial: 16.95 / 14:00 Pumping: ~~18.35 / 16:20~~ AB

Final: 18.35 / 16:20

Total Well Depth: Initial: 26.2 Ft BTOC Final: 30.00 Ft BTOC

Date and Time: Begin: 11/2/05 / 14:00 Completed: 11/2/05 / 16:20

Development Method(s): bailer

Total Quantity of Water Removed: 45 gals

FIELD MEASUREMENT	SERIAL NUMBER	DATE OF LAST CALIBRATION
Temperature	Horiba U-10 605007	10/31/05
Specific Conductivity	"	"
pH	"	"
Turbidity	"	"

APPENDIX B

WELL PURGE RECORD

PROJECT NAME: Suspected Mustard Agent Burial Site

WELL NUMBER AND LOCATION: MBS-005 PAGE _____ OF _____

DATE	TIME	GALLONS REMOVED	TEMP (C)	SPECIFIC CONDUCTIVITY (µMHOS/CM)	pH (Standard Units)	TURBIDITY	TOTAL GALLONS REMOVED	WELL VOLUMES REMOVED	COMMENTS DO
11/2/05	15:20	27	10.2	0.474	7.61	436 AB 0.474	27	3	10.55
	15:40	4.5	9.9	0.468	7.50	461	31.5	3.5	10.17
	15:55	4.5	9.9	0.461	7.48	470	36.0	4.0	10.17
	16:05	4.5	10.0	0.463	7.51	516	40.5	4.5	10.11
	16:20	4.5	10.0	0.464	7.52	497	45.0	5.0	10.12
11-8-05	10:20	0.25	10.4	0.615	7.67	>999	0.25		DO=9.70 DTW=18.25
	10:23	0.25	10.4	0.589	7.52	>999	0.50		DO=9.9 DTW=18.25
	10:26	0.25	10.4	0.569	7.57	>999	0.75		DO=9.96 DTW=18.25
	10:29	0.25	10.4	0.552	7.52	>999	1.0		DO=10.06 DTW=18.25
	10:31	0.125	10.4	0.541	7.55	>999	1.125		DO=10.10 DTW=18.25
	10:33	0.125	10.4	0.540	7.57	>999	1.25		DO=10.11 DTW=18.25
	10:35	0.125	10.4	0.539	7.57	>999	1.375		DO=10.13 DTW=18.25

Develop

sample 360 11-8-05

RECORDED BY: Al Bulley 11-8-05
(Signature and Date)

QA CHECK BY: [signature] 12-1-05
(Signature and Date)

WELL PURGE and DEVELOPMENT RECORD

PROJECT NAME: SUSPECTED MUSTARD AGENT BURIAL SITE

WELL NUMBER AND LOCATION: MBS-05 PAGE _____ OF _____

DATE	TIME	GALLONS REMOVED	TOTAL GALLONS REMOVED	pH (Standard Units)	TEMP (C)	SPECIFIC CONDUCTIVITY (µMHOS/CM)	DISSOLVED OXYGEN (mg/L)	TURBIDITY (NTU)	COMMENTS
1-13-00	11:18	initial	—	7.18	10.6	0.95	2.48	7999	Flow 160 17.65 D.T.W.
	11:24	.25	.25	7.13	10.4	99.4	.44	>999	
	11:29	.25	.50	7.15	10.4	97.0	.20	831	17.65
	11:37	.25	.75	7.15	10.4	96.4	.20	724	17.65
	11:43	.25	1.0	7.16	10.4	93.0	.12	420	
	11:48	.25	1.25	7.16	10.4	93.2	.08	320	
	11:52	.15	1.40	7.16	10.4	91.9	.07	256	17.65

RECORDED BY: Charles McCarroll 1-13-00
(Signature and Date)

QA CHECK BY: Al Bullington 2/13/00
(Signature and Date)

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SUSPECTED MUSTRAD AGENT BURIAL SITE

Date (mm/dd/yy): 10-24-05 Su (M)Tu W Th F Sa PAGE____ OF ____
Task Team Members:

Al Brillinger — Guy Jackson (TTL, Inc)
Bob Fay (ISSI, Inc)
Chris White (TTL, Inc.)

Narrative (include time and location):

10:00 Bob Fay on site
11:30 TTL on site
- take ~~1,00~~ AB 500 gallon tank (water) to NACA Test Area
12:30 Viets on site to deliver 500 gallons of water
13:05 Safety meeting @ 1038 (kickoff mtg)
14:00 Scope out access to drill sites
- drillers service truck broke down on ~~Glee~~ AB Greenleaf Rd. - bad alternator
- drillers fix truck, load rig, build decon area

17:12 Drillers off site

Daily Weather Conditions: A.M. Rain, 45°
P.M. Rain, 45°

Recorded By Al Brillinger QA Checked By Donald Carr

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SUSPECTED MUSTRAD AGENT BURIAL SITE

Date (mm/dd/yy): 10-25-05 Su M (Tu) W Th F Sa PAGE____ OF ____

Task Team Members:

Al Brillinger — Guy Jackson (TTL, Inc)

Bob Fay (ISSI, Inc.)

Chris White (TTL, Inc)

Narrative (include time and location):

07:30 Tailgate H&S meeting
- drillers to fix service truck & load drums on rig

0930 move to site

10:00 Rig stuck in mud on south access trail
- need to call dozer for rig inspection
- Falkenberg Excavating due on site w/ dozer & operator in pm. Falkenberg 330-626-4215

14:30 Falkenberg on site w/ Terex 8220 dozer

15:30 move rig to site, setup on MBS-006

Drill & sample to 16' @ MBS-006

Bob Fay check downhole w/ gradiometer - acl reading indicate no UXO

17:00 finish, move off site for the day

Daily Weather Conditions: A.M. Rain 40°

P.M. Rain 45°

Recorded By Al Brillinger QA Checked By [signature]

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SUSPECTED MUSTRAD AGENT BURIAL SITE

Date (mm/dd/yy): 10/26/05 Su M Tu (W) Th F Sa PAGE____ OF ____

Task Team Members:

Al Brillinger — Guy Jackson (TTL, Inc)

Bob Fay (ISSI, Inc.)

Chris White (TTL, Inc.)

Narrative (include time and location):

07:30 H & S tailgate mtg.

8:30 @ MBS-006 site, begin augering @ 16'

- site v. wet & muddy
- attempt shelby tube 22'-24' - no recovery
- shelby tube 24-26' - 4" recovery

10:30 finish drilling to 28' bgs - will set well to depth ≈ 28' (Paul Zorko on site)

12:00 finish grouting MBS-006

12:40 off site for lunch

Bob Fay of ISSI, Inc checked bore hole every 2' from 0 to 10' bgs w/ gradiometer. Readings @ MBS-006 indicated no UXO. He also checked drill pipe upon contact w/ formation water using Chemical Warfare Agent detector paper. All readings were negative - no CWA present.

Daily Weather Conditions: A.M. cloudy 40°

P.M. ____

Recorded By Al Brillinger QA Checked By Donald Carroll

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SUSPECTED MUSTRAD AGENT BURIAL SITE

Date (mm/dd/yy): 11/02/05 Su M Tu (W) Th F Sa PAGE____ OF ____

Task Team Members:

Al Brillinger

Narrative (include time and location):

10:30 Hauling supplies & equip. from NACA site to MBS-006 & MBS-005 for well development.
11:00 begin development of MBS-006 by bailer
13:30 finish development of MBS-006. 4/5 gallons of water removed. PH, Temp, Spec. Cond, D.O. stabilized 3x during development.
13:50 move to MBS-005

Daily Weather Conditions: A.M. Sunny 50°

P.M. ____

Recorded By Al Brillinger QA Checked By [signature]

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SUSPECTED MUSTRAD AGENT BURIAL SITE

Date (mm/dd/yy): AB 11/07/05 Su (M) Tu W Th F Sa PAGE____ OF ____

Task Team Members:

Al Brillinger

Chantelle Carroll

Narrative (include time and location):

14:50 Set up on MBS-006

Sample # MBSmw-006-012-gw MS/MSD

MBSmw-006-012gf

Pest, PCB, Expl., Prop. SVOC, VOC, CN, TAL metals

thiodiglycol, 1,4-dithiane, 1,4-oxythiane

14:55 begin purging

15:15 begin sampling

16:20 finish sampling decon - move off site for the day

Daily Weather Conditions: A.M. _____

P.M. sunny 55°

Recorded By Al Brillinger QA Checked By Chantelle Carroll

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SUSPECTED MUSTRAD AGENT BURIAL SITE

Date (mm/dd/yy): 11-21-05 Su (M) Tu W Th F Sa PAGE____ OF ____

Task Team Members:

Al Brillinger

Narrative (include time and location):

10:40 on site @ MBS-006 to perform slug test.

DTW = 17.54

11:15
AB ~~12:15~~ perform slug in test

11:20
AB ~~12:30~~ perform slug out test

Daily Weather Conditions: A.M. Sunny 50°

P.M. ____

Recorded By Al Brillinger QA Checked By [signature]

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SUSPECTED MUSTRAD AGENT BURIAL SITE

Date (mm/dd/yy): 1-13-06 Su M Tu W Th (F) Sa PAGE____ OF ____

Task Team Members:

Chantelle Carroll

Erik Pietrzak

Narrative (include time and location):

12:03 Arrive and Setup on MBS-006

12:11 Begin Pumping D.T.W - 17.10 ; D.T.B. 28.09, Flowrate 228 ml/min

12:47 take sample for thiodiglycol and MS/MSD

MBSmw-006-0019-gw / MBSmw-006-019-MS/MSD

Finish Sample, clean up/decon

13:02 go to next location (well 02)

Daily Weather Conditions: A.M. P.clouds, threatning rain, warm 50-56°F

P.M. ____

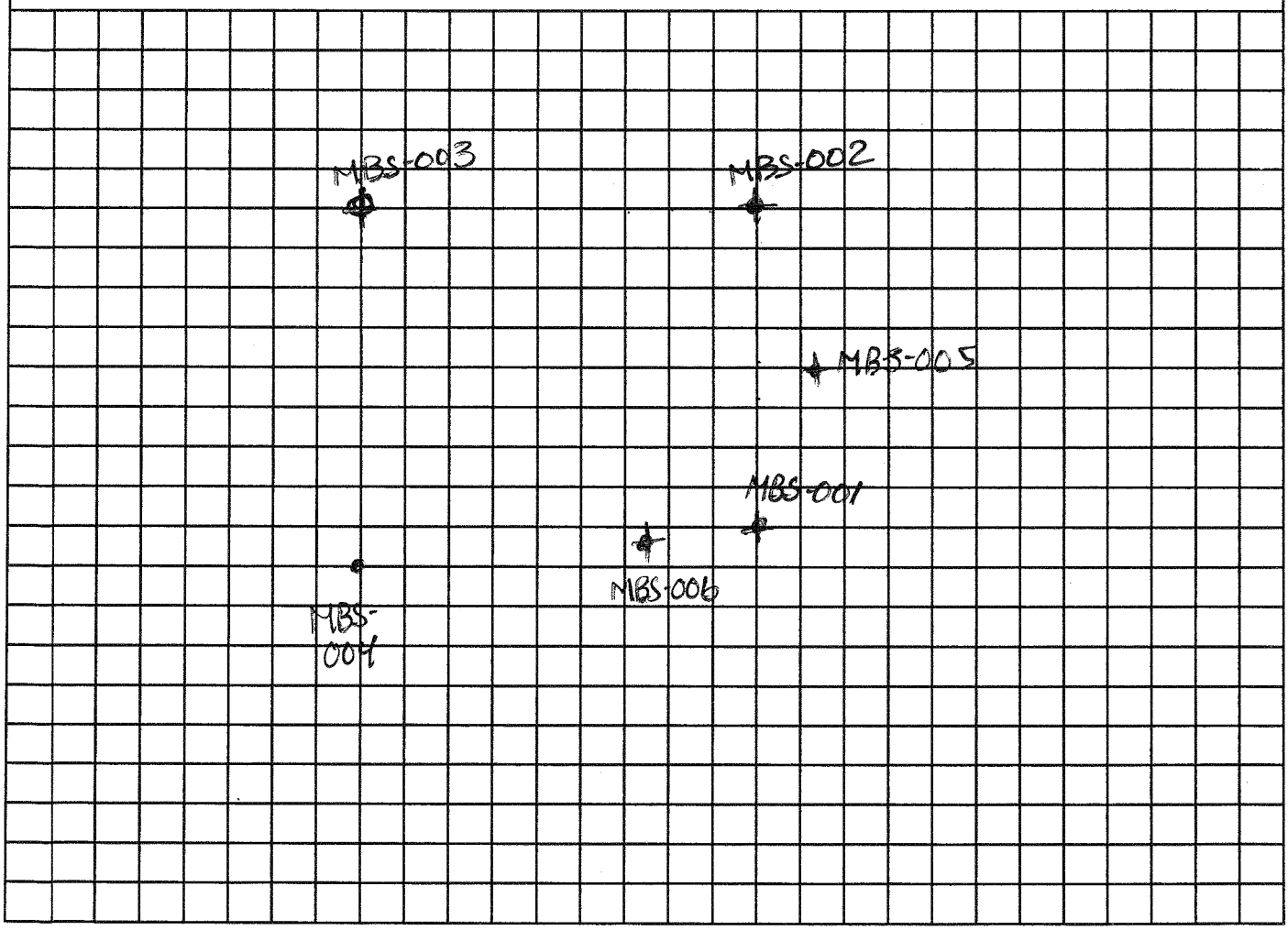
Recorded By Chantelle Carroll QA Checked By Al Briggi

HTRW DRILLING LOG

	DISTRICT: Louisville	HOLE NUMBER: MBS-006
1. COMPANY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR: TTL, Inc.	SHEET 1 OF 4
3. PROJECT: Suspected Mustard Agent Burial	4. LOCATION: RVAAP-28	
5. NAME OF DRILLER: Chris White	6. MANUFACTURERS DESIGNATION OF DRILL: CME 45 (ATV)	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4 1/4 HSA, 2" Split Spoon	8. HOLE LOCATION: MBS-006	
Subsurface Instruments Borehole Gradiometer (BHG-1) used for UXO readings 0 to 12'. Drilling equipment checked for CWA using M256 chemical detector kit @ first ground water. Readings for CWA paper; neg = OK; positive =	9. SURFACE ELEVATION:	
	10. DATE STARTED: 15:30 10-25-05	11. DATE COMPLETED: 09:44 10/26/05
12. OVERBURDEN THICKNESS: + or actual #	15. DEPTH GROUNDWATER ENCOUNTERED: 17.7'	
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 10.2' bgs (15 hrs.)	
14. TOTAL DEPTH OF HOLE: 28'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES: N/A			
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
All readings for UXO & CWA were negative (see column G of boring log)						
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR: Al Bulling.		
		X				

LOCATION SKETCH/COMMENTS — SCALE: N.T.S



HTRW DRILLING LOG

HOLE NUMBER MBS-006

PROJECT: Suspected MBS (RVAAP-28) | INSPECTOR Al Brillinger | SHEET 2 OF 4

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	~~HEADSPACE~~ PID SCREENING AB RESULTS	~~GEOTECH~~ Blow county SAMPLE (SPT) OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	1	Brown & gray (mottled) Silty fine Sand to silty sandy CLAY (TILL)	0.0	1-1-2-7		Gradiometer rdg = neg (3.2 milligauss)
	2	Rec= 2.0'				
		Brown and gray (mottled) silty CLAY, with v. fine Sand (Till)	0.0	3-4-5-9		Grad = neg (3.2)
	3					
	4					
		Brown & gray (mottled) silty CLAY with very fine Sand (till)	0.0	3-4-6-10		Grad.= 0.6 (neg.)
	5					
	6	(REC=2.0)				
		Brown & gray (mottled) CLAY, with orange-brown silty clay seams	0.0	4-8-10-15		Grad = 1.6
	7					
	8	REC = 2.0				
		TOP 1.2': Brown & gray (mottled) CLAY, with orange-brown silty clay seams	0.0	7-9-11-13		Grad. = 1.4/1.3
	9	Bottom 0.8': Gray plastic CLAY, some silt				
	10	REC= 2.0' (14:25 hrs)				

HTRW DRILLING LOG

HOLE NUMBER MBS-006

PROJECT: Suspected MBS (RVAAP-28) | INSPECTOR Al Brillinger | SHEET 3 OF 4

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	~~HEADSPACE~~ PID SCREENING RESULTS	~~GEOTECH SAMPLE OR CORE BOX~~ SPT Blow counts	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
		Gray CLAY, some Silt, trace v. fine Sand	0.0	2-4-5-6		Grad. = 1.5
	11					
	12	REC = 2.0'				
		Gray CLAY, trace Silt	0.0	2-3-5-7		
	13					
	14	(REC = 2.0')				
		Gray CLAY, plastic, trace silt	0.0	2-2-3-4		
	15	Clay becomes damp @ 16.5'				
	16	(Rec = 2.0') (17:00 hrs)				End drilling for the day (10/25) @ 17:00 hrs
		TOP 1.7': Gray CLAY, as above	0.0	WOH-WOH-13-18		- check drill pipe w/ CWA paper: neg. read, no color change - no indication of CWA
	17	Bottom 0.3': Brown, wet fine to coarse angular to subangular SAND, with gravel, some silt				Begin drilling 10/26/05
	18	(Rec = 2.0') (08:45 hrs)				
		TOP 0.8': Brown, wet fine to coarse SAND, with gravel	0.0	8-8-5-8		
	19	Bottom 0.7': Gray clayey Silt, silty CLAY with fine to medium SAND				
	20	(Rec = 1.5') (08:55 hrs)				

HTRW DRILLING LOG

HOLE NUMBER MBS-006

PROJECT: Suspected MBS (RVAAP-28) | INSPECTOR Al Brillinger | SHEET 4 OF 4

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	PID ~~HEADSPACE~~ AB SCREENING RESULTS	~~GEOTECH SAMPLE~~ AB ~~OR CORE BOX~~	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	21	Brown, wet, fine to medium SAND, fine sand content increases with depth	0.0	SPT Blow Counts 3-4-6-13		CWA paper = neg. read (no color change)
	22	(Rec = 2.0') (09:08 hrs)	0.0		Shelby tube	Shelby tube push ≈ 10" @ 900 psi
	23	No Recovery				CWA paper = neg. read (no color change)
	24	REC = NR	0.0		Shelby tube	Shelby tube push ≈ 18" @ 1,000 psi
	25					CWA paper = neg. read (no color change)
	26	Rec = 4" Gray medium to very fine SAND, fine % increases with depth	0.0	8-8-18-12		
	27					
	28	(Rec = 1.6') (09:44 hrs)				End of boring @ 28' bgs
	29					
	30					

MONITORING WELL INSTALLATION LOG

PROJECT NAME: Suspected Mustard Agent Burial Site

MONITORING WELL ID: MBS-006

INSTALLATION START: DATE: 10/26/05 TIME: 10:30

INSTALLATION FINISH: DATE: 10/26/05 TIME: 12:00

ANNULAR SPACE MATERIALS INVENTORY:

GRANULAR FILTER PACK: TYPE: Global Filter Pack NSF 50-lb bag QUANTITY: 6

BENTONITE SEAL: TYPE: Bentonite chips 94-lb bag QUANTITY: 1/2 bag

GROUT: TYPE: cement-bentonite TYPE I portland QUANTITY: 60 gallons

DESCRIPTION OF WELL SCREEN:

SLOT SIZE (inches): 0.01 SLOT CONFIGURATION: machine slot

OUTSIDE DIAMETER: 2.375" NOMINAL INSIDE DIAMETER: 2.067"

SCHEDULE/THICKNESS: 40 COMPOSITION: PVC

MANUFACTURER: Johnson

TYPE OF MATERIAL BETWEEN BOTTOM OF BORING AND SCREEN: filter pack sand

DESCRIPTION OF WELL CASING:

OUTSIDE DIAMETER: 2.375" NOMINAL INSIDE DIAMETER: 2.067'

SCHEDULE/THICKNESS: SCH 40 COMPOSITION: PVC

MANUFACTURER: Johnson

JOINT DESIGN AND COMPOSITION: flush thread w/ "O" ring

CENTRALIZERS DESIGN AND COMPOSITION: N/A

DESCRIPTION OF PROTECTIVE CASING:

NOMINAL INSIDE DIAMETER: 6" COMPOSITION: steel

SPECIAL PROBLEMS ENCOUNTERED DURING WELL CONSTRUCTION AND THEIR RESOLUTION:

NONE

Was all well screen and casing material used for construction free of foreign matter (e.g. adhesive tape, labels, soil, grease, etc.)? YES [X] NO [ ]

Was all well screen and casing material used for construction free of unsecured couplings, ruptures, and other physical breakage and/or defects? YES [X] NO [ ]

Is deformation or bending of the installed well screen and casing minimized to the point of allowing the insertion and retrieval of a 1.0-inch bailer throughout the entire length of the complete well? YES [X] NO [ ]

QUANTITY OF APPROVED WATER USED FOR FILTER PACK EMPLACEMENT: N/A

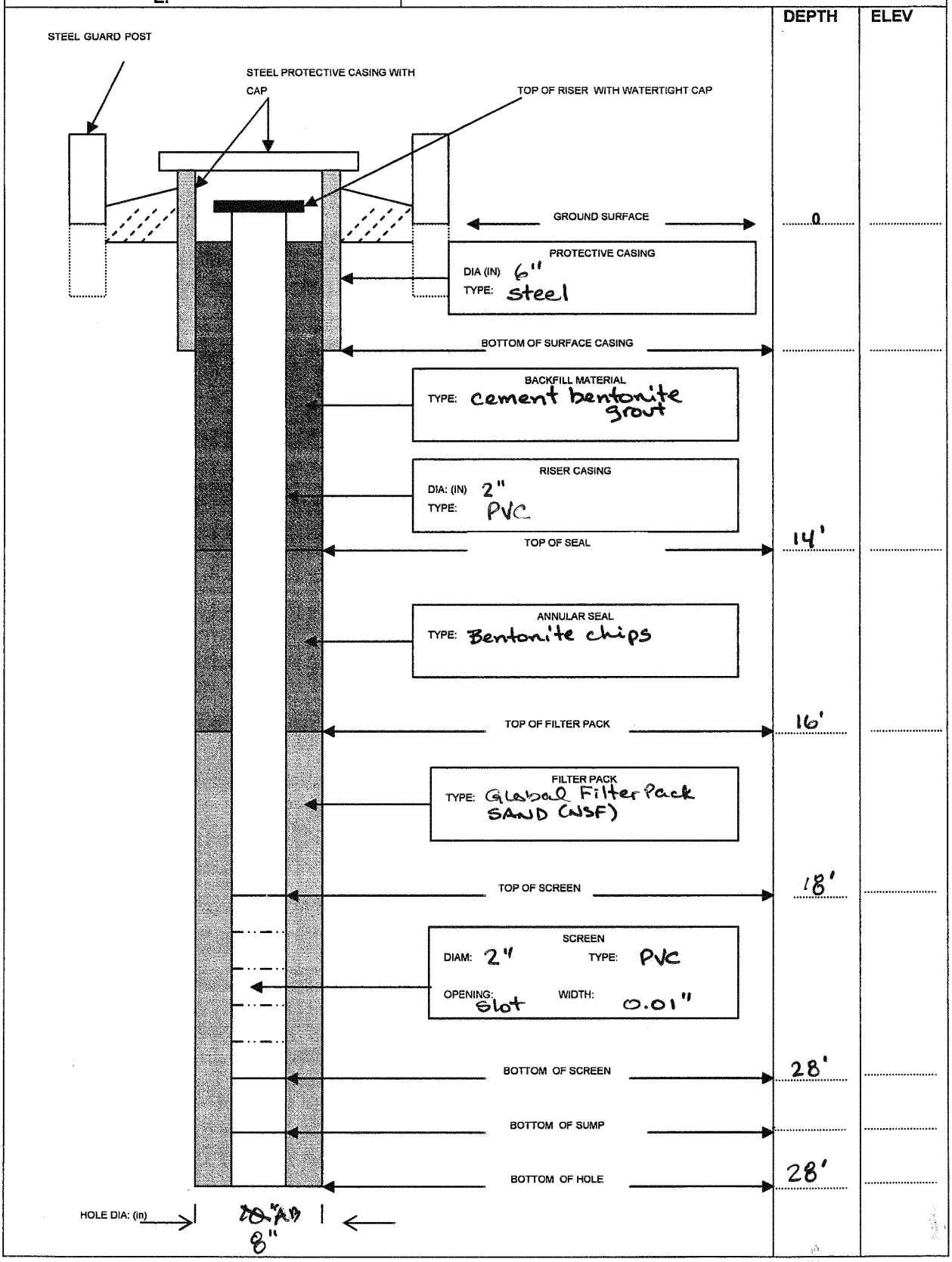
RECORDED BY: Al Bulling 10-26-05 QA CHECK BY: Mark Carroll 12-1-05

(Signature and Date) (Signature and Date)

MONITORING WELL CONSTRUCTION DIAGRAM

PROJECT NAME: Suspected Mustard Agent Burial Site

WELL NUMBER: MBS-006	**BEGIN:** 10/25/05	**END:** 10/26/05
COORDINATES: N: E:	**REFERENCE POINT:**	**ELEVATION:**



Well Volume Calculation Sheet

Date: 11/02/05 Time: 11:00

Well ID: MBS-006

Well Location: RVAAP-28

Total Depth of Well (ft BTOC) 30.00
Depth to Water (ft BTOC) 17.65
Height of water column (ft) (Hc) 12.35

Well Volume Calculation:

Vc = 3.142(Rc^2)*Hc (0.006889)(12.35) 0.267 cu. ft.

Vf = 3.142[(Rf^2)-(Ro^2)]*(Hc or length of screen)*(0.30)
Note use length of screen if Hc>length of screen
= 0.93 cu. ft. (3.142)(0.0989)(10)(.3) = 0.93

Vt = (Vc+Vf)*(7.48 gal/cu. ft.) = (0.267+0.93)(7.48)=
= 8.97 gal. x 5 = 44.85 gallons

Where:

Vc = Volume of casing (ft^3)
Vf = Volume of filter pack (ft^3)
Vt = Total Volume
Ro = Outside radius of casing (0.10 ft) Ro^2 = 0.01
Hc = Height of water column 12.35 (ft)
Rf = Radius of filter pack (0.33 ft) Rf^2 = 0.1089
Rc = Radius of inside casing (0.083 ft)

Rc^2 = 0.006889

WELL DEVELOPMENT FORM

PROJECT NAME: Suspected Mustard Agent Burial Site

Date: 11 / 02 / 05

Well Number and Location: MBS-006 @ RVAAP-28

Development Crew: Al Brillinger

Driller (if applicable): _____

Water Levels/Time: Initial: 17.65 / 11:00 Pumping: _____ / _____

Final: 17.70 / 13:30

Total Well Depth: Initial: 29.45 Ft BTOC Final: 28.1 Ft BTOC

Date and Time: Begin: 11/02/05 11:10 Completed: 11/2/05 / 13:30

Development Method(s): bailer

Total Quantity of Water Removed: 45 gals

FIELD MEASUREMENT	SERIAL NUMBER	DATE OF LAST CALIBRATION
Temperature	Horiba U-10 605007	10/31/05
Specific Conductivity	"	"
pH	"	"
Turbidity	"	"

APPENDIX B

WELL PURGE RECORD & DEVELOPMENT

PROJECT NAME: Suspected Mustard Agent Burial Site

WELL NUMBER AND LOCATION: MBS-006 PAGE _____ OF _____

DATE	TIME	GALLONS REMOVED	TEMP (C)	SPECIFIC CONDUCTIVITY (µMHOS/CM)	pH (Standard Units)	TURBIDITY	TOTAL GALLONS REMOVED	WELL VOLUMES REMOVED	COMMENTS
Develop 11/2/05	12:55	31.5	AB ~~9.7~~ 10.8	0.471 ms/cm	7.10	998	31.5	3.5	DO. 11.48 mg/L
	13:08	4.5	10.7	0.440	7.54	>999	36	4.0	10.79
	13:20	4.5	10.4	0.450	7.60	>999	40.5	4.5	10.77
	13:30	4.5	10.4	0.451	7.61	>999	45	5.0	10.67
11-7-05	14:58	0.25	11.0	0.465	7.85	109	0.25		DO=10.90 DTW= 17.8
	15:01	0.25	11.0	0.411	8.19	826	0.50		DO = 10.83 DTW = 17.75
Sample 538	15:04	0.25	10.9	0.416	8.22	563	0.75		DO=10.70 DTW-17.75
	15:07	0.25	10.6	0.429	8.01	396	1.0		DO= 10.53 DTW= 17.75
	15:10	0.25	10.8	0.438	7.84	175	1.25		DO= 10.58 DTW=17.75
	15:12	0.125	10.7	0.439	7.80	226	1.375		DO=10.56
	15:14	0.125	10.7	0.440	7.78	106	1.5		DO= 10.50 DTW=17.75

RECORDED BY: Al Bulley 11-7-05
(Signature and Date)

QA CHECK BY: Chandler Carroll 12-1-05
(Signature and Date)

APPENDIX C

SLUG TEST RESULTS

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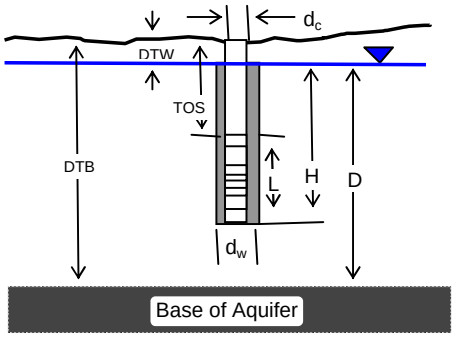
WELL ID: MBSmw-005

Local ID: MBSmw-005slugin
Date: 11/21/2005
Time: 13:00

INPUT

Construction:		
Casing dia. (d_c)	2	Inch
Annulus dia. (d_w)	8.25	Inch
Screen Length (L)	10	Feet
Depths to:		
water level (DTW)	18.2	Feet
top of screen (TOS)	20	Feet
Base of Aquifer (DTB)	30	Feet
Annular Fill:		
across screen --	Coarse Sand	
above screen --	Bentonite	
Aquifer Material --	Fine Sand	



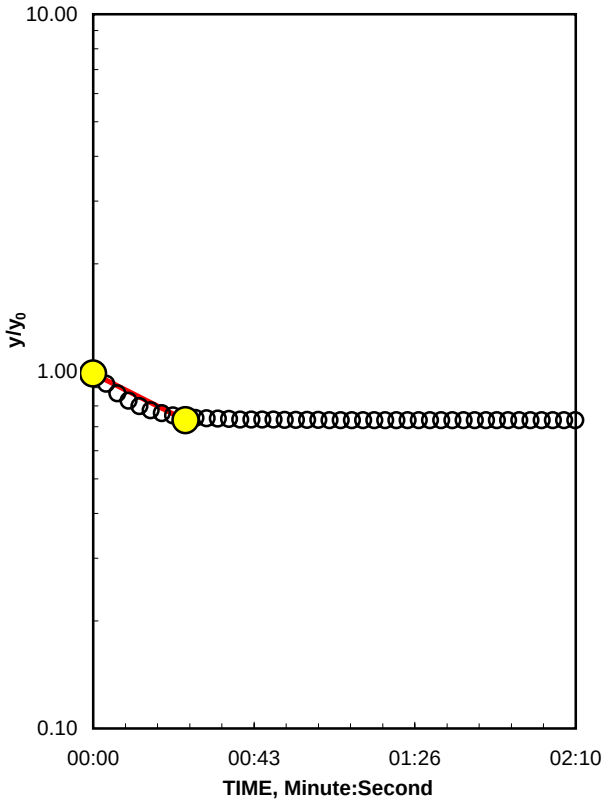
COMPUTED

L_{wetted}	10	Feet
D =	11.8	Feet
H =	11.8	Feet
L/r_w =	29.09	
$y_{0\text{-DISPLACEMENT}}$ =	35.70	cm
$y_{0\text{-SLUG}}$ =	37.48	cm
From look-up table using L/r_w		
Fully penetrate C =	2.041	
ln(Re/rw) =	2.623	
Re =	4.74	cm
Slope =	0.005283	$\log_{10}$/sec
$t_{90\%}$ recovery =	189	sec

Input is consistent.

K = 0.00034 cm/Second

Adjust slope of line to estimate K



K= 0.00034 is less than likely minimum of 0.00106 for Fine Sand

REMARKS: Bouwer and Rice analysis of slug test, WRR 1976

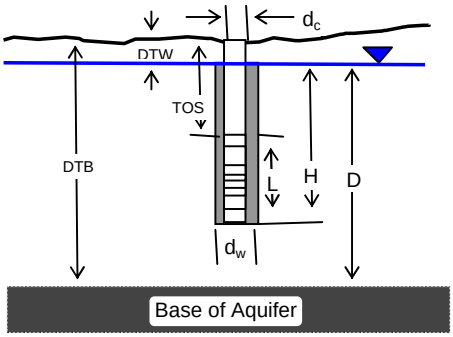
Entry	Reduced Data Time, Hr:Min:Sec	Water Level
1	0:00:00.0	9.37
2	0:00:03.0	9.28
3	0:00:06.0	9.22
4	0:00:09.0	9.17
5	0:00:12.0	9.14
6	0:00:15.0	9.11
7	0:00:18.0	9.09
8	0:00:21.0	9.08
9	0:00:24.0	9.08
10	0:00:27.0	9.07
11	0:00:30.0	9.07
12	0:00:33.0	9.06
13	0:00:36.0	9.06
14	0:00:39.0	9.06
15	0:00:42.0	9.06
16	0:00:45.0	9.06
17	0:00:48.0	9.06
18	0:00:51.0	9.06
19	0:00:54.0	9.06
20	0:00:57.0	9.06
21	0:01:00.0	9.06
22	0:01:03.0	9.06
23	0:01:06.0	9.06
24	0:01:09.0	9.06
25	0:01:12.0	9.06
26	0:01:15.0	9.06
27	0:01:18.0	9.06
28	0:01:21.0	9.05
29	0:01:24.0	9.05
30	0:01:27.0	9.06
31	0:01:30.0	9.06
32	0:01:33.0	9.06
33	0:01:36.0	9.06
34	0:01:39.0	9.06
35	0:01:42.0	9.06
36	0:01:45.0	9.06
37	0:01:48.0	9.05
38	0:01:51.0	9.05
39	0:01:54.0	9.05
40	0:01:57.0	9.06
41	0:02:00.0	9.06
42	0:02:03.0	9.05
43	0:02:06.0	9.06
44	0:02:09.0	9.06
45	0:02:12.0	9.06

WELL ID: MBSmw-005

Local ID: /-005slugout
Date: 11/21/2005
Time: 13:15

INPUT

Construction:		
Casing dia. (d_c)	2	Inch
Annulus dia. (d_w)	8.25	Inch
Screen Length (L)	10	Feet
Depths to:		
water level (DTW)	18.2	Feet
top of screen (TOS)	20	Feet
Base of Aquifer (DTB)	30	Feet
Annular Fill:		
across screen --	Coarse Sand	
above screen --	Bentonite	
Aquifer Material --	Fine Sand	



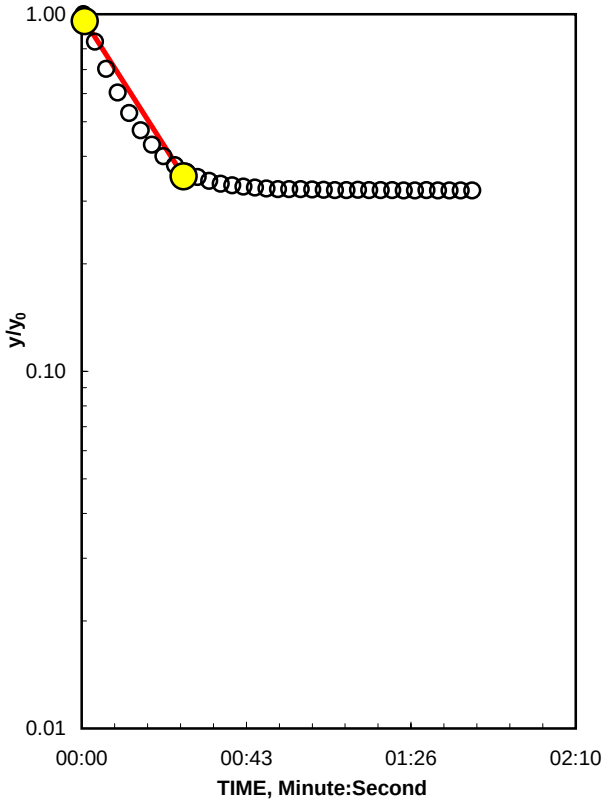
COMPUTED

L_{wetted}	10	Feet
D =	11.8	Feet
H =	11.8	Feet
L/r_w =	29.09	
$y_{0\text{-DISPLACEMENT}}$ =	41.97	cm
$y_{0\text{-SLUG}}$ =	37.48	cm
From look-up table using L/r_w		
Fully penetrate C =	2.041	
ln(Re/rw) =	2.623	
Re =	4.74	cm
Slope =	0.016744	$\log_{10}$/sec
$t_{90\%}$ recovery =	60	sec

Input is consistent.

K = 0.0011 cm/Second

Adjust slope of line to estimate K



REMARKS: Bouwer and Rice analysis of slug test, WRR 1976

Reduced Data

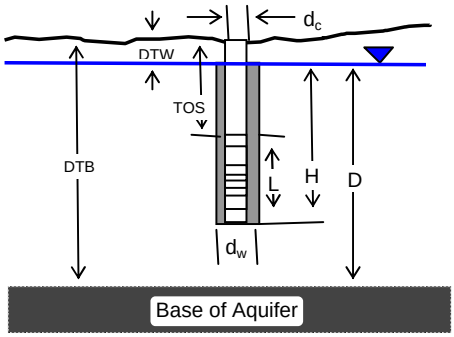
Entry	Time, Hr:Min:Sec	Water Level
1	0:00:06.0	8.12
2	0:00:09.0	8.35
3	0:00:12.0	8.53
4	0:00:15.0	8.67
5	0:00:18.0	8.77
6	0:00:21.0	8.85
7	0:00:24.0	8.91
8	0:00:27.0	8.95
9	0:00:30.0	8.98
10	0:00:33.0	9.00
11	0:00:36.0	9.02
12	0:00:39.0	9.03
13	0:00:42.0	9.04
14	0:00:45.0	9.04
15	0:00:48.0	9.05
16	0:00:51.0	9.05
17	0:00:54.0	9.05
18	0:00:57.0	9.05
19	0:01:00.0	9.05
20	0:01:03.0	9.05
21	0:01:06.0	9.06
22	0:01:09.0	9.06
23	0:01:12.0	9.06
24	0:01:15.0	9.06
25	0:01:18.0	9.06
26	0:01:21.0	9.06
27	0:01:24.0	9.06
28	0:01:27.0	9.06
29	0:01:30.0	9.06
30	0:01:33.0	9.06
31	0:01:36.0	9.06
32	0:01:39.0	9.06
33	0:01:42.0	9.06
34	0:01:45.0	9.06
35	0:01:48.0	9.06

WELL ID: MBSmw-006

Local ID: MBS-006 slug out
Date: 11/21/2005
Time: 12:30

INPUT

Construction:		
Casing dia. (d_c)	2	Inch
Annulus dia. (d_w)	10.25	Inch
Screen Length (L)	10	Feet
Depths to:		
water level (DTW)	17.7	Feet
top of screen (TOS)	18	Feet
Base of Aquifer (DTB)	28	Feet
Annular Fill:		
across screen --	Coarse Sand	
above screen --	Bentonite	
Aquifer Material --	Fine Sand	



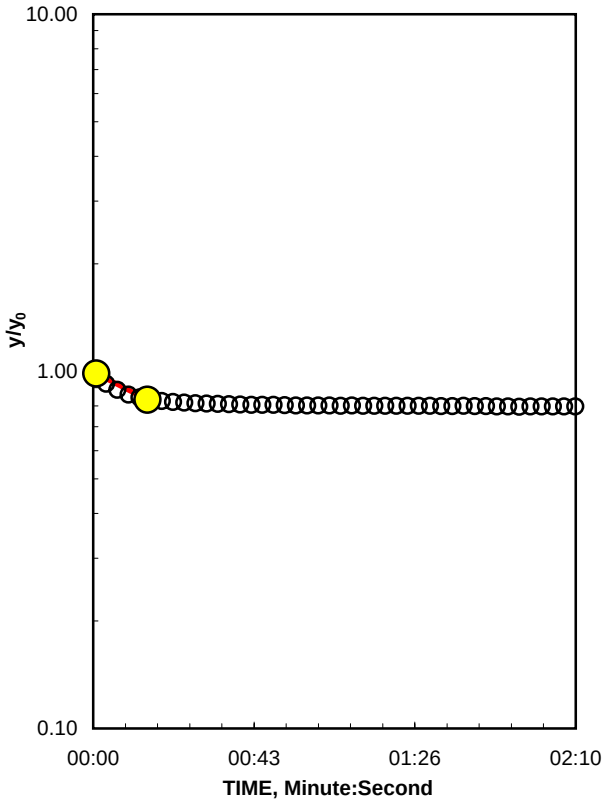
COMPUTED

L_{wetted}	10	Feet
D =	10.3	Feet
H =	10.3	Feet
L/r_w =	23.41	
$y_{0\text{-DISPLACEMENT}}$ =	32.65	cm
$y_{0\text{-SLUG}}$ =	37.48	cm
From look-up table using L/r_w		
Fully penetrate C =	1.856	
ln(Re/rw) =	2.354	
Re =	4.49	cm
Slope =	0.005387	$\log_{10}$/sec
$t_{90\%}$ recovery =	186	sec

Input is consistent.

K = 0.00031 cm/Second

Adjust slope of line to estimate K



K= 0.00031 is less than likely minimum of 0.00106 for Fine Sand

REMARKS: Bouwer and Rice analysis of slug test, WRR 1976

Entry	Reduced Data Time, Hr:Min:Sec	Water Level
1	0:00:00.0	7.13
2	0:00:03.0	7.21
3	0:00:06.0	7.25
4	0:00:09.0	7.28
5	0:00:12.0	7.30
6	0:00:15.0	7.31
7	0:00:18.0	7.32
8	0:00:21.0	7.32
9	0:00:24.0	7.33
10	0:00:27.0	7.33
11	0:00:30.0	7.33
12	0:00:33.0	7.33
13	0:00:36.0	7.33
14	0:00:39.0	7.34
15	0:00:42.0	7.34
16	0:00:45.0	7.34
17	0:00:48.0	7.34
18	0:00:51.0	7.34
19	0:00:54.0	7.34
20	0:00:57.0	7.34
21	0:01:00.0	7.34
22	0:01:03.0	7.34
23	0:01:06.0	7.34
24	0:01:09.0	7.34
25	0:01:12.0	7.34
26	0:01:15.0	7.34
27	0:01:18.0	7.34
28	0:01:21.0	7.34
29	0:01:24.0	7.34
30	0:01:27.0	7.34
31	0:01:30.0	7.34
32	0:01:33.0	7.34
33	0:01:36.0	7.34
34	0:01:39.0	7.34
35	0:01:42.0	7.34
36	0:01:45.0	7.34
37	0:01:48.0	7.35
38	0:01:51.0	7.35
39	0:01:54.0	7.35
40	0:01:57.0	7.35
41	0:02:00.0	7.35
42	0:02:03.0	7.35
43	0:02:06.0	7.35
44	0:02:09.0	7.35
45	0:02:12.0	7.35

APPENDIX D

DATA VERIFICATION/ VALIDATION REPORTS

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DATA VERIFICATION /VALIDATION REPORT
PROJECT: RVAAP Mustard Burial Site
Prepared by Valarie Mariola of Mariola's Data Validation Services

SDG: A5K090129

The following samples were received at STL North Canton on 11/08/2005 by laboratory transit in acceptable condition for the analysis specified below. Analysis of explosives, nitrocellulose, nitroguanidine, and chemical warfare degradates were performed by STL Sacramento.

Sample Date	Sample ID	QC	VOC	SVOC	EXP	Nitro cellulose	Nitro guanidine	Metals	Pest	PCB	CN	CW-degradates
11/7/05	MBSmw-006-0012-gw		X	X	X	X	X		X	X	X	X
11/7/05	MBSmw-006-0012-gf							X				
11/8/05	MBSmw-005-0011-gw	FD-1	X	X	X	X	X		X	X	X	X
11/8/05	MBSmw-005-0011-gf	FD-2						X				
11/8/05	MBSmw-005-0010-gw	OR-1	X	X	X	X	X		X	X	X	X
11/8/05	MBSmw-005-00101-gf	OR-2						X				
11/8/05	Trip Blank	TB	X									
11/8/05	MBSmw-001-0006-gw											X
11/7/05	MBSmw-002-0007-gw											X
11/7/05	MBSmw-003-0008-gw											X
11/7/05	MBSmw-004-0009-gw											X

OR – Original Aliquot of sample, FD – Field Duplicate, TB – Trip Blank , CN - Cyanide
CW degradates - 1,4-oxathiane, 1,4-dithiane, and thiodiglycol

VOLATILES (EPA 8260B)
The following was reviewed and found acceptable:

- Holding times, preservation, sample handling
- Tuning criteria
- Initial Calibration Criteria including SPCC and CCC compounds
- ICV 2nd source and MRL criteria
- CCV criteria
- Internal standard area counts and retention times
- RRT and ion abundance criteria for all quantified compounds
- Manual integration consistent with LCG guidance documents
- Surrogate recoveries
- MS/MSD RPD values
- Field Duplicate RPD values

The method blank contained methylene chloride (2.1 ug/L J). Most of the associated samples in this analytical batch had undetectable levels of methylene chloride. Methylene chloride was detected in the trip blank at a concentration of 2.0 ug/L J. This concentration is within 5x the value found in the blank and has been qualified (B) – found in blank. This concentration is most probable due to contamination affecting the method blank, and to be consistent with ADR software has been further qualified U at the standard reporting limit for methylene chloride.

The trip blank contained methylene chloride (2.0 ug/L JB) and acetone (1.5 ug/L J). All samples in this analytical batch had concentrations within 5x the value found in the trip blank and have been qualified (B) –found in blank. This concentration is most probable due to contamination affecting the trip blank, and to be consistent with ADR software, results for acetone have been further qualified U at the standard reporting limit for acetone.

LCS percent recoveries were outside of laboratory established QC limits for methylene chloride (122%), 1,1,-dichloroethane (83%), bromodichloromethane (82%), trans-1,3-dichloropropene (78%), 4-methyl-2-pentanone (70%), 1,1,2,2-tetrachloroethane (78%), ethylbenzne (85%), styrene (80%), and xylene (84%). All LCS percent recoveries fall within LCG percent recovery levels with the exception of methylene chloride. Positive results associated with this elevated percent recovery have already been qualified estimated (J).

MS/MSD analysis was performed on sample MBSmw-006-0012-GW. Percent recoveries outside of laboratory established QC limits were reported for 1,1,-dichloroethane (87% *[88-127%]*), 1,1,2-trichloroehane (85% *[86-129%]*), 4-methyl-2-pentanone (69%,72% *[82-135%]*), 2-hexanone (70%,73%), 1,1,2,2-tetrachloroethane (80%,82%), styrene (82%, 87%),

SEMI-VOLATILES (EPA 8270C, prep method 3520)
The following was reviewed and found acceptable:

- Holding times, preservation, sample handling
- Tuning criteria
- Initial Calibration criteria including SPCC and CCC compounds
- Initial Calibration verification
- Continuing calibration criteria
- Internal standard area counts and retention times
- RRT and ion abundance criteria for all quantified compounds
- Manual integration consistent with LCG guidance documents
- Surrogate recoveries

The method blank contained bis(2-ethylhexyl)phthalate (1.8 ug/L). All associated samples in this analytical batch had levels of this compounds within 5x the value found in the blank and have been qualified (B) – found in blank. This concentration is most probable due to contamination affecting the method blank, and to be consistent with ADR software results have been further qualified U at the concentration found in the samples.

LCS percent recoveries were outside of laboratory established QC limits for 2,4-dimethylphenol (25%, *[28-109%]*), and hexachlorocylclopentadiene (0% *[10-98%]*). LCS percent recoveries less than 30% and outside of lab control limits requires that all associated sample results for these compounds be qualified rejected (R).

MS/MSD analysis was performed on sample MBSmw-006-0012-GW. Percent recoveries outside of laboratory established QC limits were reported for 2,4-dimethylphenol (24% *[28-109%]*) and hexachlorocyclopentadiene (0%,0% *[10-98%]*). All results for these compounds have been previously quantified rejected due to LCS percent recoveries.

PESTICIDES (EPA 8081A, prep method 3520)
The following was reviewed and found acceptable:

- Holding times, preservation, sample handling
- Instrument performance, Breakdown criteria
- Initial Calibration Criteria
- ICV 2nd source and MRL criteria
- CCV criteria
- Surrogate recoveries
- LCS percent recoveries
- MS/MSD percent recoveries and RPD values
- The method blank was free from contamination

PCBs (EPA 8082, prep method 3520)

The following was reviewed and found acceptable:
- Holding times, preservation, sample handling
- Initial Calibration Criteria
- ICV 2nd source and MRL criteria
- CCV criteria
- Confirmation of positive values using second column
- Surrogate recoveries
- LCS percent recoveries
- MS/MSD percent recoveries and RPD values
- The method blank was free from contamination

EXPLOSIVES (EPA 8330)
The following was reviewed and found acceptable:
- Holding times, preservation, sample handling
- Initial Calibration Criteria
- ICV 2nd source and MRL criteria
- CCV criteria
- Surrogate recoveries
- LCS percent recoveries
- MS/MSD percent recoveries and RPD values
- The method blank was free from contamination

NITROGUANIDINE (UV/HPLC)
The following was reviewed and found acceptable:
- Preservation, sample handling
- Initial Calibration Criteria
- ICV 2nd source and MRL criteria
- CCV criteria
- LCS percent recoveries
- MS/MSD percent recoveries and RPD values
- The method blank was free from contamination

CHEMICAL WARFARE DEGRADENTS (EPA 8270C CWM)
1,4-oxathiane and 1,4-dithiane
The following was reviewed and found acceptable:
- Preservation, sample handling
- Initial Calibration Criteria
- ICV 2nd source and MRL criteria
- CCV criteria
- LCS percent recoveries
- MS/MSD percent recoveries and RPD values
- The method blank was free from contamination

THIODIGLYCOL (EPA 8321A)
The following was reviewed and found acceptable:
- Preservation, sample handling
- CCV criteria
- LCS percent recoveries
- MS/MSD percent recoveries
- The method blank was free from contamination

Holding time per the method is 47 days. Samples were analyzed 7 days after the holding time expired due to instrument problems. Samples results have been qualified estimated (J) due to holding time exceedence.

Initial calibration criteria for thiodiglycol did not meet method criteria. A correlation coefficient of 0.992 was reported and did not meet method criteria of 0.995. Results for all samples have been qualified rejected (R).

Second source criteria was not met for thiodiglycol. Recovery of a secondary source standard was 34.2% which did not meet the ± 30% set by the method. Results for all samples have been qualified rejected (R).

Elevated MS/MSD RPD values were reported for thiodiglycol. Although percent recoveries were within acceptable limits, RPD values were 43% for the MS/MSD. Results have been rejected based on initial calibration and second source criteria, no further flagging has been done based on RPD criteria.

METALS (EPA 6010B, 7470A)

The following was reviewed and found acceptable:

- Holding times, preservation, sample handling
- Initial Calibration Criteria
- ICV 2nd source and MRL criteria
- ICSA criteria
- CCV criteria
- LCS percent recoveries
- MS percent recoveries
- Post digestion spike criteria
- Serial Dilution criteria, method of standard addition

Method blank contamination was reported for manganese (0.31 ug/L). The reporting limit for this compound is 100 ug/L. All sample concentrations for manganese were greater than 100 times the value found in the method blank. No data was qualified based on this.

Elevated RPD values were reported for copper and nickel. These elevated values were due to estimated values less than the reporting limit being reported in one aliquot, while undetectable levels of the compounds were found in the second aliquot. The concentrations reported were less than 50 times the reporting limit. No data was qualified based on these RPD values.

GENERAL CHEMISTRY

Cyanide and Nitrocellulose

The following was reviewed and found acceptable:

- Holding times, preservation, sample handling
- Initial Calibration Criteria
- Initial Calibration Blank
- CCV, CCB criteria
- LCS percent recoveries
- MS/MSD percent recoveries and RPD values

Nitrocellulose was detected in the method blank (0.19 mg/L). All samples had undetectable levels of nitrocellulose; therefore no data was qualified based on this.

DATA VERIFICATION /VALIDATION REPORT
PROJECT: RVAAP Mustard Burial Site
Prepared By Valarie Mariola of Mariola's Data Validation Services

SDG: A6A160120

The following samples were received at STL North Canton on 1/14/2006 by laboratory transit in acceptable condition for the analysis specified below. Analysis of chemical warfare degradates were performed by STL Sacramento.

Sample Date	Sample ID	QC	CW-degradates
1/13/06	MBSmw-001-0013-gw		X
1/13/06	MBSmw-002-0014-gw		X
1/13/06	MBSmw-003-0015-gw		X
1/13/06	MBSmw-004-0016-gw		X
1/13/06	MBSmw-005-0017-gw	OR-1	X
1/13/06	MBSmw-005-0018-gw	FD-1	X
1/13/06	MBSmw-006-0019-gw		X

OR – Original Aliquot of sample, FD – Field Duplicate,
CW degradates - thiodiglycol

THIODIGLYCOL (EPA 8321A)
The following was reviewed and found acceptable:

- Preservation, sample handling
- Initial Calibration Criteria
- ICV 2nd source and MRL criteria
- CCV criteria
- LCS percent recoveries
- MS/MSD percent recoveries and RPD values

APPENDIX E

INVESTIGATION DERIVED WASTE REPORT

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INVESTIGATION-DERIVED WASTE CHARACTERIZATION AND DISPOSAL PLAN

FOR THE

ADDITIONAL GROUNDWATER MONITORING WELL INSTALLATION AND GROUNDWATER SAMPLING AT THE SUSPECTED MUSTARD AGENT BURIAL SITE (RVAAP-28) AT THE RAVENNA ARMY AMMUNITION PLANT, RAVENNA, OHIO

PREPARED FOR

US ARMY JOINT OPERATIONS COMMAND
CONTRACT NO. W912QR-04-M-0116

DECEMBER 2005

INVESTIGATION-DERIVED WASTE CHARACTERIZATION AND DISPOSAL PLAN

FOR THE
ADDITIONAL GROUNDWATER MONITORING WELL INSTALLATION AND GROUNDWATER SAMPLING AT THE SUSPECTED MUSTARD AGENT BURIAL SITE (RVAAP-28)
AT THE
RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO

DECEMBER 2005

Prepared for

U.S. Army Joint Operations Command
Contract No. W912QR-04-M-0116

Prepared by

SpecPro, Inc.
8451 State Route 5
Ravenna, OH 44266

CONTENTS

TABLES

ACRONYMS

DOD	Department of Defense
EPA	U.S. Environmental Protection Agency
IDW	investigation-derived wastes
Ohio EPA	Ohio Environmental Protection Agency
PPE	personal protective equipment
RVAAP	Ravenna Army Ammunition Plant
TCLP	Toxicity Characteristic Leaching Procedure
USACE	US Army Corps of Engineers
UXO	unexploded ordnance

1.0 INTRODUCTION

Investigative activities conducted during the Additional Groundwater Monitoring Well Installation and Groundwater Sampling at the Suspected Mustard Agent Burial Site at the Ravenna Army Ammunition Plant (RVAAP), Ravenna, Ohio, resulted in the generation of investigation-derived wastes (IDW) consisting of soil and water wastes. The IDW was generated in the course of drilling, sampling, and decontamination activities. The purpose of this report is to characterize and classify the IDW for disposal. The report includes a summary of the IDW generated and its origin; classification of the IDW and recommendations for disposal; and a review of the analytical results used for waste characterization. This document follows guidance established by the USACE and the Ohio EPA regarding IDW disposition at RVAAP.

2.0 OPERATIONAL HISTORY AND WASTE GENERATION

Information regarding the operational history and suspected contaminants at the Suspected Mustard Agent Burial Site is presented in Section 1 of the *Final Work Plan and Sampling and Analysis Plan Addenda for the Groundwater Monitoring Well Installation and Groundwater Sampling at the Suspected Mustard Agent Burial Site at the Ravenna Army Ammunition Plant, Ravenna, Ohio* (SAP Addendum). Section 7 of the SAP Addendum describes procedures used for sampling and managing IDW at RVAAP.

Soil and water (groundwater and decontamination water) IDW generated during drilling and sampling activities are listed, by container, in Table 2-1 below.

Table 2-1. IDW Inventory

Container Number	Container Type & Size	Contents	Volume	Source of Waste
MBS-005-001	55 Gal. Open Top	Soil Cuttings	Full	Monitoring Well 005
MBS-005-002	55 Gal. Open Top	Soil Cuttings	Full	Monitoring Well 005
MBS-005-003	55 Gal. Closed Top	Development/Purge water	¾ Full	Monitoring Well 005
MBS-006-004	55 Gal. Open Top	Soil Cuttings	Full	Monitoring Well 006
MBS-006-005	55 Gal. Open Top	Soil Cuttings	Full	Monitoring Well 006
MBS-006-006	55 Gal. Closed Top	Development/Purge water	¾ Full	Monitoring Well 006

3.0 MANAGEMENT OF ENVIRONMENTAL MEDIA

All environmental media were managed in a manner that minimized potential risk to human health and the environment. IDW was handled as nonhazardous material pending waste characterization and classification based on analytical results. The Facility-Wide SAP (USACE 2001) and the Final Work Plan/Sampling and Analysis Plan (2004) contain approved procedures used for containerizing and handling IDW.

Indigenous solid IDW (soil cuttings) generated during the investigation from drilling activities were collected and contained in lined 55-gallon drums. The drums were sealed and staged in a lined storage area behind Building 1036.

All liquid indigenous (groundwater) IDW generated from monitoring well installation, development, and purging was segregated by sample station and placed into closed-top 55-gallon drums. The water was then transferred by 5-gallon buckets to closed-top 55-gallon drums located behind building 1036.

4.0 DISCUSSION OF ANALYTICAL RESULTS

Per Section 7.4 of the Facility-Wide SAP (2001), the analytical results from environmental samples collected during the investigation were used to characterize IDW for groundwater. Where correlative environmental samples do not exist, waste characterization samples were collected in accordance with Section 7 of the Work Plan and Sampling and Analysis Plan Addendum. The IDW characterization results are presented in Appendix 1.

5.0 RECOMMENDATIONS FOR DISPOSAL

Table 7-1 of the Facility-Wide SAP (2001) shows the maximum concentration of contaminants for the toxicity characteristic for hazardous wastes per 40 CFR 261.24. Analytical results for the IDW are compared with these criteria to determine whether waste containers are potentially hazardous or non-hazardous.

For the characterization of IDW solid wastes (e.g., soils) as non-hazardous or hazardous, the Resource Conservation and Recovery Act (RCRA) regulatory limit will be compared to the mean contaminant level as presented in Appendix 2. Although the analysis conducted on the materials was a total analysis, the Toxicity Characteristic Leaching Procedure (TCLP) methodology will be used for waste classification by applying a twenty-fold dilution factor to total results for

comparison to TCLP. For purposes of hazardous waste determination, if a given analyte is found to exceed 20 times the regulatory limit, it is being considered a RCRA-hazardous waste due to the dilution factor inherent in the TCLP method for solid materials. Analytical results for liquids were directly compared to the regulatory limits to determine hazardous waste applicability.

5.1 Soils

As previously discussed, excess soils were generated from the monitoring well installations. All excess soils generated during the investigation were placed 55-gallon drums and staged behind Building 1036. A composite sample was collected from the four drums containing soil IDW and submitted for TCLP analysis. The results were compared to regulatory TCLP criteria and to sitewide background criteria to properly characterize the soil for disposal. Based on this comparison, it was recommended that these containers be classified as contaminated, non-hazardous and sent off-site for non-hazardous disposal to a licensed solid waste facility.

5.2 Groundwater

Excess groundwater was generated during the well installation, development, and sampling activities associated with this investigation. A comparison of analytical data generated from groundwater sampling activities and TCLP data indicated that no regulatory criteria for RCRA hazardous waste determinations were exceeded. It is recommended that the two drums containing excess groundwater be classified as contaminated, non-hazardous and that they be sent off-site for disposal to a permitted water treatment facility.

5.3 Decontamination Fluids

All of the waste samples were collected in 2 five gallon locking lid containers from decontamination fluids generated from cleaning of daily sampling equipment used during the investigation. These containers were inadvertently placed into the MBS-005 purge-water drum. The total amount of decon water was under 3 gallons. However, the drums were composite sampled and all analytes were below TCLP threshold values and therefore is classified as non-hazardous. It is recommended that these containers be classified as contaminated, non-hazardous, and that it be sent off-site for disposal to a permitted water treatment facility.

5.4 Summary of Disposal Recommendations

Table 5-1 presents a summary of the waste classification and recommended disposal options presented in Section 5.

Table 5.1 Summary of Waste Classification and Disposal Recommendations

Container Number	Media	Waste Criteria	Disposal Recommendation
MBS-005-001	Soil	Mustard Agent Breakdown Products, Explosives Detected OR Metals Above Background	Consolidated for Off-Site Non-Hazardous Disposal
MBS-005-002	Soil	Mustard Agent Breakdown Products, Explosives Detected OR Metals Above Background	Consolidated for Off-Site Non-Hazardous Disposal
MBS-005-003	Water	Mustard Agent Breakdown Products, Explosives Detected OR Metals Above Background	Consolidated for Off-Site Non-Hazardous Disposal
MBS-006-004	Soil	Mustard Agent Breakdown Products, Explosives Detected OR Metals Above Background	Consolidated for Off-Site Non-Hazardous Disposal
MBS-006-005	Soil	Mustard Agent Breakdown Products, Explosives Detected OR Metals Above Background	Consolidated for Off-Site Non-Hazardous Disposal
MBS-006-006	Water	Mustard Agent Breakdown Products, Explosives Detected OR Metals Above Background	Consolidated for Off-Site Non-Hazardous Disposal

6.0 REFERENCES

USACE 2001. *Facility-Wide Sampling and Analysis Plan for Environmental Investigations at the Ravenna Army Ammunition Plant, Ravenna, Ohio.*

APPENDIX 1

INVESTIGATION-DERIVED WASTE ANALYTICAL RESULTS SUMMARY

SEVERN TRENT LABORATORIES, INC.

PRELIMINARY DATA SUMMARY

The results shown below may still require additional laboratory review and are subject to change. Actions taken based on these results are the responsibility of the data user.

Lot #: A5K100401 MUSTARD PROJECT **Date Reported:** 12/01/05

PARAMETER		RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD	
Client Sample ID: MBS-1DW-SO(11/2005)						
Sample #: 001 Date Sampled: 11/09/05 12:10 Date Received: 11/10/05 Matrix: SOLID						
Inductively Coupled Plasma (ICP) Metals TCLP						Reviewed
Silver	TCLP	ND	0.50	mg/L	SW846 6010B	
Arsenic	TCLP	ND	0.50	mg/L	SW846 6010B	
Barium	**TCLP**	**0.59 B**	**10.0**	**mg/L**	**SW846 6010B**	
Cadmium	**TCLP**	**0.0011 B**	**0.10**	**mg/L**	**SW846 6010B**	
Chromium	**TCLP**	**0.0018 B**	**0.50**	**mg/L**	**SW846 6010B**	
Lead	**TCLP**	**0.0043 B**	**0.50**	**mg/L**	**SW846 6010B**	
Selenium	TCLP	ND	0.25	mg/L	SW846 6010B	
Mercury in Liquid Waste (Manual Cold-Vapor) TCLP						Reviewed
Mercury	TCLP	ND	0.0020	mg/L	SW846 7470A	

B Estimated result. Result is less than RL.

Volatile Organics by GC/MS TCLP					Reviewed
Benzene	ND	0.025	mg/L	SW846 8260B	
Carbon tetrachloride	ND	0.025	mg/L	SW846 8260B	
Chlorobenzene	ND	0.025	mg/L	SW846 8260B	
Chloroform	ND	0.025	mg/L	SW846 8260B	
1,2-Dichloroethane	ND	0.025	mg/L	SW846 8260B	
1,1-Dichloroethylene	ND	0.070	mg/L	SW846 8260B	
Methyl ethyl ketone	ND	0.050	mg/L	SW846 8260B	
Tetrachloroethylene	ND	0.070	mg/L	SW846 8260B	
Trichloroethylene	ND	0.050	mg/L	SW846 8260B	
Vinyl chloride	ND	0.025	mg/L	SW846 8260B	
Semivolatile Organic Compounds by GC/MS TCLP					Reviewed
o-Cresol	ND	0.0040	mg/L	SW846 8270C	
m-Cresol & p-Cresol	ND	0.040	mg/L	SW846 8270C	
1,4-Dichlorobenzene	ND	0.0040	mg/L	SW846 8270C	
2,4-Dinitrotoluene	ND	0.020	mg/L	SW846 8270C	
Hexachlorobenzene	ND	0.020	mg/L	SW846 8270C	
Hexachlorobutadiene	ND	0.020	mg/L	SW846 8270C	
Hexachloroethane	ND	0.020	mg/L	SW846 8270C	
Nitrobenzene	ND	0.0040	mg/L	SW846 8270C	
Pentachlorophenol	ND	0.040	mg/L	SW846 8270C	

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SEVERN TRENT LABORATORIES, INC.

PRELIMINARY DATA SUMMARY

The results shown below may still require additional laboratory review and are subject to change. Actions taken based on these results are the responsibility of the data user.

Lot #: A5K100401 MUSTARD PROJECT **Date Reported:** 12/01/05

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD	
Client Sample ID: MBS-1DW-SO(11/2005)					
Sample #: 001 Date Sampled: 11/09/05 12:10 Date Received: 11/10/05 Matrix: SOLID					
Semivolatile Organic Compounds by GC/MS TCLP					Reviewed
Pyridine	ND	0.020	mg/L	SW846 8270C	
2,4,5-Trichloro-phenol	ND	0.020	mg/L	SW846 8270C	
2,4,6-Trichloro-phenol	ND	0.020	mg/L	SW846 8270C	
Inorganic Analysis					Reviewed
Reactive Cyanide	ND	200	mg/kg	SW846 7.3.3	
Pensky-Martens Method for Determining Ignitability	**>180**		**deg F**	**SW846 1010**	
Soil and Waste pH	**7.2**		**No Units**	**SW846 9045C**	
Reactive Sulfide	ND	500	mg/kg	SW846 7.3.4	
Client Sample ID: MBS-1DW-PURGE/DECON					
Sample #: 002 Date Sampled: 11/09/05 10:30 Date Received: 11/10/05 Matrix: WATER					
Inductively Coupled Plasma (ICP) Metals TCLP					Reviewed
Silver TCLP	ND	0.50	mg/L	SW846 6010B	
Arsenic TCLP	ND	0.50	mg/L	SW846 6010B	
Barium TCLP	**0.061 B**	**10.0**	**mg/L**	**SW846 6010B**	
Cadmium TCLP	ND	0.10	mg/L	SW846 6010B	
Chromium TCLP	ND	0.50	mg/L	SW846 6010B	
Lead TCLP	ND	0.50	mg/L	SW846 6010B	
Selenium TCLP	ND	0.25	mg/L	SW846 6010B	
Mercury in Liquid Waste (Manual Cold-Vapor) TCLP					Reviewed
Mercury TCLP	ND	0.0020	mg/L	SW846 7470A	

B Estimated result. Result is less than RL.

Volatile Organics by GC/MS TCLP					Reviewed
Benzene	ND	0.025	mg/L	SW846 8260B	
Carbon tetrachloride	ND	0.025	mg/L	SW846 8260B	
Chlorobenzene	ND	0.025	mg/L	SW846 8260B	

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SEVERN TRENT LABORATORIES, INC.

PRELIMINARY DATA SUMMARY

The results shown below may still require additional laboratory review and are subject to change. Actions taken based on these results are the responsibility of the data user.

Lot #: A5K100401 MUSTARD PROJECT **Date Reported:** 12/01/05

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD	
Client Sample ID: MBS-1DW-PURGE/DECON					
Sample #: 002 Date Sampled: 11/09/05 10:30 Date Received: 11/10/05 Matrix: WATER					
Volatile Organics by GC/MS TCLP					Reviewed
Chloroform	ND	0.025	mg/L	SW846 8260B	
1,2-Dichloroethane	ND	0.025	mg/L	SW846 8260B	
1,1-Dichloroethylene	ND	0.070	mg/L	SW846 8260B	
Methyl ethyl ketone	ND	0.050	mg/L	SW846 8260B	
Tetrachloroethylene	ND	0.070	mg/L	SW846 8260B	
Trichloroethylene	ND	0.050	mg/L	SW846 8260B	
Vinyl chloride	ND	0.025	mg/L	SW846 8260B	
Semivolatile Organic Compounds by GC/MS TCLP					Reviewed
o-Cresol	ND	0.0040	mg/L	SW846 8270C	
m-Cresol & p-Cresol	ND	0.040	mg/L	SW846 8270C	
1,4-Dichlorobenzene	ND	0.0040	mg/L	SW846 8270C	
2,4-Dinitrotoluene	ND	0.020	mg/L	SW846 8270C	
Hexachlorobenzene	ND	0.020	mg/L	SW846 8270C	
Hexachlorobutadiene	ND	0.020	mg/L	SW846 8270C	
Hexachloroethane	ND	0.020	mg/L	SW846 8270C	
Nitrobenzene	ND	0.0040	mg/L	SW846 8270C	
Pentachlorophenol	ND	0.040	mg/L	SW846 8270C	
Pyridine	**0.0044 J**	**0.020**	**mg/L**	**SW846 8270C**	
2,4,5-Trichloro-phenol	ND	0.020	mg/L	SW846 8270C	
2,4,6-Trichloro-phenol	ND	0.020	mg/L	SW846 8270C	

J Estimated result. Result is less than RL.

Inorganic Analysis					Reviewed
Reactive Cyanide	ND	200	mg/kg	SW846 7.3.3	
Pensky-Martens Method for Determining Ignitability	**>180**		**deg F**	**SW846 1010**	
pH Aqueous	**7.8**		**No Units**	**SW846 9040B**	
Reactive Sulfide	ND	500	mg/kg	SW846 7.3.4	

APPENDIX F

LABORATORY ANALYTICAL REPORTS

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ANALYTICAL REPORT

PROJECT NO. 0000341

MUSTARD BURIAL SITE

Lot #: A5K090129

Chantelle Carrol

SpecPro Inc
8451 State Route 5
Ravenna, OH 44266

SEVERN TRENT LABORATORIES, INC.

Frank J. Calovini
Project Manager

January 11, 2006

EXECUTIVE SUMMARY - Detection Highlights

A5K090129

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
MBSmw-006-0012-gw 11/07/05 15:15 001				
Aroclor 1260	0.088 J	1.0	ug/L	SW846 8082
bis(2-Ethylhexyl) phthalate	1.1 B	1.0	ug/L	SW846 8270C
Nitrocellulose	0.14 B,J	0.50	mg/L	MCAWW 353.2
MBSmw-006-0012-gf 11/07/05 15:15 002				
Barium	86.1	10.0	ug/L	SW846 6010B
Calcium	80800	1000	ug/L	SW846 6010B
Magnesium	26000	1000	ug/L	SW846 6010B
Manganese	550 J	100	ug/L	SW846 6010B
Nickel	1.7 B	20.0	ug/L	SW846 6010B
Potassium	5790	5000	ug/L	SW846 6010B
Sodium	10800	1000	ug/L	SW846 6010B
MBSmw-005-0011-gw 11/08/05 10:40 003				
Benzoic acid	4.5 J	10	ug/L	SW846 8270C
bis(2-Ethylhexyl) phthalate	2.3 B	1.0	ug/L	SW846 8270C
Acetone	1.1 J	10	ug/L	SW846 8260B
2-Butanone	0.95 J	10	ug/L	SW846 8260B
MBSmw-005-0011-gf 11/08/05 10:40 004				
Arsenic	5.3 B	10.0	ug/L	SW846 6010B
Barium	83.2	10.0	ug/L	SW846 6010B
Calcium	86600	1000	ug/L	SW846 6010B
Iron	405 B	1000	ug/L	SW846 6010B
Magnesium	24900	1000	ug/L	SW846 6010B
Manganese	343 J	100	ug/L	SW846 6010B
Potassium	1710 B	5000	ug/L	SW846 6010B
Sodium	9650	1000	ug/L	SW846 6010B
MBSmw-005-0010-gw 11/08/05 10:40 005				
Benzoic acid	4.4 J	10	ug/L	SW846 8270C
bis(2-Ethylhexyl) phthalate	1.6 B	1.0	ug/L	SW846 8270C
Acetone	1.2 J	10	ug/L	SW846 8260B
2-Butanone	1.0 J	10	ug/L	SW846 8260B
Nitrocellulose	0.14 B,J	0.50	mg/L	MCAWW 353.2

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EXECUTIVE SUMMARY - Detection Highlights

A5K090129

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
MBSmw-005-0010-gf 11/08/05 10:40 006				
Arsenic	7.3 B	10.0	ug/L	SW846 6010B
Barium	84.0	10.0	ug/L	SW846 6010B
Calcium	87200	1000	ug/L	SW846 6010B
Iron	359 B	1000	ug/L	SW846 6010B
Magnesium	25100	1000	ug/L	SW846 6010B
Manganese	350 J	100	ug/L	SW846 6010B
Potassium	1710 B	5000	ug/L	SW846 6010B
Sodium	10000	1000	ug/L	SW846 6010B
TRIP BLANK 11/08/05 15:00 007				
Methylene chloride	2.0 B	2.0	ug/L	SW846 8260B
Acetone	1.5 J	10	ug/L	SW846 8260B

ANALYTICAL METHODS SUMMARY

A5K090129

PARAMETER	ANALYTICAL METHOD
Chemical Warfare Degradates by GC/MS	SW846 8270C CWM
Cyanide, Total	SW846 9012A
Inductively Coupled Plasma (ICP) Metals	SW846 6010B
ICP-MS (6020)	SW846 6020
LCMS by SW8321A SW8321A	SW846 SW8321A
Mercury in Liquid Waste (Manual Cold-Vapor)	SW846 7470A
Nitroaromatics and Nitramines by HPLC	SW846 8330
Nitrocellulose as N, 353.2	MCAWW 353.2
Organics by UV/HPLC	SW846 8330 (Modified)
Organochlorine Pesticides	SW846 8081A
PCBs by SW-846 8082	SW846 8082
Semivolatile Organic Compounds by GC/MS	SW846 8270C
Trace Inductively Coupled Plasma (ICP) Metals	SW846 6010B
Volatile Organics by GC/MS	SW846 8260B

References:

MCAWW "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, March 1983 and subsequent revisions.

SW846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

SAMPLE SUMMARY

A5K090129

WO #	SAMPLE#	CLIENT SAMPLE ID	SAMPLED DATE	SAMP TIME
HPNKV	001	MBSmw-006-0012-gw	11/07/05	15:15
HPNK9	002	MBSmw-006-0012-gf	11/07/05	15:15
HPNLA	003	MBSmw-005-0011-gw	11/08/05	10:40
HPNLC	004	MBSmw-005-0011-gf	11/08/05	10:40
HPNLD	005	MBSmw-005-0010-gw	11/08/05	10:40
HPNLG	006	MBSmw-005-0010-gf	11/08/05	10:40
HPNND	007	TRIP BLANK	11/08/05	15:00
HPNNE	008	MBSmw-001-0006-gw	11/08/05	13:05
HPNNG	009	MBSmw-002-0007-gw	11/07/05	14:15
HPNNH	010	MBSmw-003-0008-gw	11/07/05	11:40
HPNNJ	011	MBSmw-004-0009-gw	11/07/05	12:59

NOTE(S):

- The analytical results of the samples listed above are presented on the following pages.
- All calculations are performed before rounding to avoid round-off errors in calculated results.
- Results noted as "ND" were not detected at or above the stated limit.
- This report must not be reproduced, except in full, without the written approval of the laboratory.
- Results for the following parameters are never reported on a dry weight basis: color, corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test, pH, porosity pressure, reactivity, redox potential, specific gravity, spot tests, solids, solubility, temperature, viscosity, and weight.

SpecPro Inc

Client Sample ID: MBSmw-006-0012-gw

GC/MS Volatiles

Lot-Sample #...: A5K090129-001 Work Order #...: HPNKV1AA Matrix.....: WG
Date Sampled...: 11/07/05 15:15 Date Received..: 11/08/05
Prep Date.....: 11/21/05 Analysis Date..: 11/21/05
Prep Batch #...: 5325119
Dilution Factor: 1 Method.....: SW846 8260B

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Bromochloromethane	ND	1.0	ug/L	0.24
1,2-Dibromoethane	ND	1.0	ug/L	0.24
Chloromethane	ND	1.0	ug/L	0.14
Bromomethane	ND	1.0	ug/L	0.36
Vinyl chloride	ND	1.0	ug/L	0.21
Chloroethane	ND	1.0	ug/L	0.24
Methylene chloride	ND	2.0	ug/L	0.19
Acetone	ND	10	ug/L	0.74
Carbon disulfide	ND	1.0	ug/L	0.28
1,1-Dichloroethene	ND	1.0	ug/L	0.18
1,1-Dichloroethane	ND	1.0	ug/L	0.21
1,2-Dichloroethene (total)	ND	1.0	ug/L	0.35
Chloroform	ND	1.0	ug/L	0.16
1,2-Dichloroethane	ND	1.0	ug/L	0.16
2-Butanone	ND	10	ug/L	0.39
1,1,1-Trichloroethane	ND	1.0	ug/L	0.21
Carbon tetrachloride	ND	1.0	ug/L	0.19
Bromodichloromethane	ND	1.0	ug/L	0.14
1,2-Dichloropropane	ND	1.0	ug/L	0.15
cis-1,3-Dichloropropene	ND	1.0	ug/L	0.12
Trichloroethene	ND	1.0	ug/L	0.28
Dibromochloromethane	ND	1.0	ug/L	0.19
1,1,2-Trichloroethane	ND	1.0	ug/L	0.22
Benzene	ND	1.0	ug/L	0.22
trans-1,3-Dichloropropene	ND	1.0	ug/L	0.17
Bromoform	ND	1.0	ug/L	0.17
4-Methyl-2-pentanone	ND	10	ug/L	0.32
2-Hexanone	ND	10	ug/L	0.35
Tetrachloroethene	ND	1.0	ug/L	0.19
1,1,2,2-Tetrachloroethane	ND	1.0	ug/L	0.22
Toluene	ND	1.0	ug/L	0.17
Chlorobenzene	ND	1.0	ug/L	0.20
Ethylbenzene	ND	1.0	ug/L	0.19
Styrene	ND	1.0	ug/L	0.13
Xylenes (total)	ND	2.0	ug/L	0.44

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SpecPro Inc

Client Sample ID: MBSmw-006-0012-gw

GC/MS Volatiles

Lot-Sample #...: A5K090129-001 Work Order #...: HPNKV1AA Matrix.....: WG

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	98	(73 - 122)
1,2-Dichloroethane-d4	91	(61 - 128)
Toluene-d8	97	(76 - 110)
4-Bromofluorobenzene	86	(74 - 116)

SpecPro Inc

MBSmw-006-0012-gw

GC/MS Volatiles

Lot-Sample #: A5K090129-001 **Work Order #:** HPNKV1AA **Matrix:** WG

MASS SPECTROMETER/DATA SYSTEM (MSDS) TENTATIVELY IDENTIFIED COMPOUNDS

PARAMETER	CAS #	ESTIMATED RESULT	RETENTION TIME	UNITS
None				ug/L

SpecPro Inc

Client Sample ID: MBSmw-006-0012-gw

GC/MS Semivolatiles

Lot-Sample #...: A5K090129-001 **Work Order #...:** HPNKV1AC **Matrix.....:** WG
Date Sampled...: 11/07/05 15:15 **Date Received..:** 11/08/05
Prep Date.....: 11/14/05 **Analysis Date..:** 11/25/05
Prep Batch #...: 5318057
Dilution Factor: 1 **Method.....:** SW846 8270C

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Benzoic acid	ND	10	ug/L	0.81
Benzyl alcohol	ND	5.0	ug/L	1.1
Phenol	ND	1.0	ug/L	0.14
bis(2-Chloroethyl)-ether	ND	1.0	ug/L	0.19
2-Chlorophenol	ND	1.0	ug/L	0.14
1,3-Dichlorobenzene	ND	1.0	ug/L	0.11
1,4-Dichlorobenzene	ND	1.0	ug/L	0.13
1,2-Dichlorobenzene	ND	1.0	ug/L	0.16
2-Methylphenol	ND	1.0	ug/L	0.15
2,2'-oxybis(1-Chloro-propane)	ND	1.0	ug/L	0.21
4-Methylphenol	ND	1.0	ug/L	0.20
N-Nitrosodi-n-propyl-amine	ND	1.0	ug/L	0.21
Hexachloroethane	ND	1.0	ug/L	0.21
Nitrobenzene	ND	1.0	ug/L	0.21
Isophorone	ND	1.0	ug/L	0.16
2-Nitrophenol	ND	2.0	ug/L	0.14
2,4-Dimethylphenol	ND	2.0	ug/L	0.23
bis(2-Chloroethoxy) methane	ND	1.0	ug/L	0.24
2,4-Dichlorophenol	ND	2.0	ug/L	0.24
1,2,4-Trichloro-benzene	ND	1.0	ug/L	0.12
Naphthalene	ND	0.20	ug/L	0.031
4-Chloroaniline	ND	2.0	ug/L	0.31
Hexachlorobutadiene	ND	1.0	ug/L	0.11
4-Chloro-3-methylphenol	ND	2.0	ug/L	0.18
2-Methylnaphthalene	ND	0.20	ug/L	0.028
Hexachlorocyclopenta-diene	ND	10	ug/L	1.5
2,4,6-Trichloro-phenol	ND	5.0	ug/L	0.16
2,4,5-Trichloro-phenol	ND	5.0	ug/L	0.13
2-Chloronaphthalene	ND	1.0	ug/L	0.29
2-Nitroaniline	ND	2.0	ug/L	0.18
Dimethyl phthalate	ND	1.0	ug/L	0.27

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SpecPro Inc

Client Sample ID: MBSmw-006-0012-gw

GC/MS Semivolatiles

Lot-Sample #...: A5K090129-001 Work Order #...: HPNKV1AC Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Acenaphthylene	ND	0.20	ug/L	0.030
2,6-Dinitrotoluene	ND	5.0	ug/L	0.17
3-Nitroaniline	ND	2.0	ug/L	0.094
Acenaphthene	ND	0.20	ug/L	0.028
2,4-Dinitrophenol	ND	5.0	ug/L	1.3
4-Nitrophenol	ND	5.0	ug/L	1.0
Dibenzofuran	ND	1.0	ug/L	0.025
2,4-Dinitrotoluene	ND	5.0	ug/L	0.16
Diethyl phthalate	ND	1.0	ug/L	0.12
4-Chlorophenyl phenyl ether	ND	2.0	ug/L	0.21
Fluorene	ND	0.20	ug/L	0.035
4-Nitroaniline	ND	2.0	ug/L	0.11
4,6-Dinitro-2-methylphenol	ND	5.0	ug/L	1.8
N-Nitrosodiphenylamine	ND	1.0	ug/L	0.18
4-Bromophenyl phenyl ether	ND	2.0	ug/L	0.29
Hexachlorobenzene	ND	0.20	ug/L	0.075
Pentachlorophenol	ND	5.0	ug/L	2.0
Phenanthrene	ND	0.20	ug/L	0.044
Anthracene	ND	0.20	ug/L	0.030
Carbazole	ND	1.0	ug/L	0.17
Di-n-butyl phthalate	ND	1.0	ug/L	0.13
Fluoranthene	ND	0.20	ug/L	0.024
Pyrene	ND	0.20	ug/L	0.051
Butyl benzyl phthalate	ND	1.0	ug/L	0.14
3,3'-Dichlorobenzidine	ND	5.0	ug/L	0.19
Benzo(a)anthracene	ND	0.20	ug/L	0.028
Chrysene	ND	0.20	ug/L	0.035
bis(2-Ethylhexyl) phthalate	1.1 B	1.0	ug/L	0.36
Di-n-octyl phthalate	ND	1.0	ug/L	0.16
Benzo(b)fluoranthene	ND	0.20	ug/L	0.043
Benzo(k)fluoranthene	ND	0.20	ug/L	0.071
Benzo(a)pyrene	ND	0.20	ug/L	0.022
Indeno(1,2,3-cd)pyrene	ND	0.20	ug/L	0.081
Dibenz(a,h)anthracene	ND	0.20	ug/L	0.054
Benzo(ghi)perylene	ND	0.20	ug/L	0.044

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SpecPro Inc

Client Sample ID: MBSmw-006-0012-gw

GC/MS Semivolatiles

Lot-Sample #...: A5K090129-001 Work Order #...: HPNKV1AC Matrix.....: WG

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Nitrobenzene-d5	59	(32 - 112)
2-Fluorobiphenyl	60	(30 - 110)
Terphenyl-d14	87	(51 - 135)
Phenol-d5	58	(10 - 117)
2-Fluorophenol	42	(19 - 108)
2,4,6-Tribromophenol	64	(42 - 124)

NOTE(S):

B Method blank contamination. The associated method blank contains the target analyte at a reportable level.

SpecPro Inc

MBSmw-006-0012-gw

GC/MS Semivolatiles

Lot-Sample #: A5K090129-001 **Work Order #:** HPNKV1AC **Matrix:** WG

MASS SPECTROMETER/DATA SYSTEM (MSDS) TENTATIVELY IDENTIFIED COMPOUNDS

PARAMETER	CAS #	ESTIMATED RESULT		RETENTION TIME	UNITS
Unknown		12 J	M	2.8991	ug/L
Unknown		1.8 J	M	3.4814	ug/L
Unknown Hydrocarbon		1.3 J	M	9.4753	ug/L
Unknown Hydrocarbon		1.4 J	M	9.8332	ug/L
Unknown Hydrocarbon		1.6 J	M	10.249	ug/L
Unknown Hydrocarbon		1.1 J	M	10.741	ug/L
Unknown Hydrocarbon		1.1 J	M	11.318	ug/L

NOTE(S):

M: Result was measured against nearest internal standard assuming a response factor of 1.

SpecPro Inc

Client Sample ID: MBSmw-006-0012-gw

GC/MS Semivolatiles

Lot-Sample #...: A5K090129-001 Work Order #...: HPNKV1AK Matrix.....: WG
Date Sampled...: 11/07/05 15:15 Date Received..: 11/08/05
Prep Date.....: 11/14/05 Analysis Date..: 11/28/05
Prep Batch #...: 5318209
Dilution Factor: 1 Method.....: SW846 8270C CWM

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
1,4-Oxathiane	ND	5.0	ug/L	0.88
1,4-Dithiane	ND	5.0	ug/L	1.0

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2-Fluorobiphenyl	75	(16 - 127)
Nitrobenzene-d5	91	(43 - 121)

SpecPro Inc

Client Sample ID: MBSmw-006-0012-gw

GC Semivolatiles

Lot-Sample #...: A5K090129-001 **Work Order #...:** HPNKV1AD **Matrix.....:** WG
Date Sampled...: 11/07/05 15:15 **Date Received..:** 11/08/05
Prep Date.....: 11/14/05 **Analysis Date..:** 11/24/05
Prep Batch #...: 5318048
Dilution Factor: 1 **Method.....:** SW846 8081A

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
alpha-BHC	ND	0.030	ug/L	0.0062
beta-BHC	ND	0.030	ug/L	0.0068
delta-BHC	ND	0.030	ug/L	0.0064
gamma-BHC (Lindane)	ND	0.030	ug/L	0.0062
Heptachlor	ND	0.030	ug/L	0.0062
Aldrin	ND	0.030	ug/L	0.0061
Heptachlor epoxide	ND	0.030	ug/L	0.0065
Endosulfan I	ND	0.030	ug/L	0.0072
Dieldrin	ND	0.030	ug/L	0.0067
4,4'-DDE	ND	0.030	ug/L	0.0076
Endrin	ND	0.030	ug/L	0.0074
Endosulfan II	ND	0.030	ug/L	0.0072
4,4'-DDD	ND	0.030	ug/L	0.0085
Endosulfan sulfate	ND	0.030	ug/L	0.0083
4,4'-DDT	ND	0.030	ug/L	0.0086
Methoxychlor	ND	0.10	ug/L	0.010
Endrin ketone	ND	0.030	ug/L	0.013
Endrin aldehyde	ND	0.030	ug/L	0.0091
alpha-Chlordane	ND	0.030	ug/L	0.0073
gamma-Chlordane	ND	0.030	ug/L	0.0065
Toxaphene	ND	2.0	ug/L	0.33

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Tetrachloro-m-xylene	89	(39 - 130)
Decachlorobiphenyl	49	(10 - 147)

SpecPro Inc

Client Sample ID: MBSmw-006-0012-gw

GC Semivolatiles

Lot-Sample #...: A5K090129-001 **Work Order #...:** HPNKV1AE **Matrix.....:** WG
Date Sampled...: 11/07/05 15:15 **Date Received..:** 11/08/05
Prep Date.....: 11/14/05 **Analysis Date..:** 12/01/05
Prep Batch #...: 5318049
Dilution Factor: 1 **Method.....:** SW846 8082

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Aroclor 1016	ND	1.0	ug/L	0.25
Aroclor 1221	ND	1.0	ug/L	0.49
Aroclor 1232	ND	1.0	ug/L	0.41
Aroclor 1242	ND	1.0	ug/L	0.11
Aroclor 1248	ND	1.0	ug/L	0.049
Aroclor 1254	ND	1.0	ug/L	0.087
Aroclor 1260	**0.088 J**	**1.0**	**ug/L**	0.071

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Tetrachloro-m-xylene	106	(35 - 130)
Decachlorobiphenyl	38	(10 - 110)

NOTE(S):

J Estimated result. Result is less than RL.

SpecPro Inc

Client Sample ID: MBSmw-006-0012-gw

Trace Level Organic Compounds

Lot-Sample #...: A5K090129-001 Work Order #...: HPNKV1AL Matrix.....: WG
Date Sampled...: 11/07/05 15:15 Date Received..: 11/08/05
Prep Date.....: 11/18/05 Analysis Date..: 01/05/06
Prep Batch #...: 5322621
Dilution Factor: 1

PARAMETER	RESULT	DETECTION LIMIT	UNITS	METHOD
Thiodiglycol	ND	10	ug/L	SW846 SW8321A

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Thiodiglycol-d4	108	(50 - 120)

SpecPro Inc

Client Sample ID: MBSmw-006-0012-gw

Trace Level Organic Compounds

Lot-Sample #...: A5K090129-001 **Work Order #...:** HPNKV1AJ **Matrix.....:** WG
Date Sampled...: 11/07/05 15:15 **Date Received..:** 11/08/05
Prep Date.....: 11/18/05 **Analysis Date..:** 11/19/05
Prep Batch #...: 5322405
Dilution Factor: 1

PARAMETER	RESULT	DETECTION LIMIT	UNITS	METHOD
Nitroguanidine	ND	20	ug/L	SW846 8330 (Modif

SpecPro Inc

Client Sample ID: MBSmw-006-0012-gw

HPLC

Lot-Sample #...: A5K090129-001 Work Order #...: HPNKV1AG Matrix.....: WG
Date Sampled...: 11/07/05 15:15 Date Received..: 11/08/05
Prep Date.....: 11/14/05 Analysis Date..: 11/17/05
Prep Batch #...: 5318288
Dilution Factor: 1 Method.....: SW846 8330

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
2-Amino-4,6-dinitrotoluene	ND	0.10	ug/L	0.10
4-Amino-2,6-dinitrotoluene	ND	0.10	ug/L	0.050
1,3-Dinitrobenzene	ND	0.10	ug/L	0.050
2,4-Dinitrotoluene	ND	0.10	ug/L	0.050
2,6-Dinitrotoluene	ND	0.10	ug/L	0.050
HMX	ND	0.10	ug/L	0.036
Nitrobenzene	ND	0.10	ug/L	0.050
2-Nitrotoluene	ND	0.50	ug/L	0.088
3-Nitrotoluene	ND	0.50	ug/L	0.057
4-Nitrotoluene	ND	0.50	ug/L	0.088
RDX	ND	0.10	ug/L	0.036
Tetryl	ND	0.10	ug/L	0.050
1,3,5-Trinitrobenzene	ND	0.10	ug/L	0.030
2,4,6-Trinitrotoluene	ND	0.10	ug/L	0.050

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
3,4-Dinitrotoluene	109	(84 - 125)

SpecPro Inc

Client Sample ID: MBSmw-006-0012-gw

General Chemistry

Lot-Sample #...: A5K090129-001 **Work Order #...:** HPNKV **Matrix.....:** WG
Date Sampled...: 11/07/05 15:15 **Date Received..:** 11/08/05

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Cyanide, Total	ND	0.010	mg/L	SW846 9012A	11/16/05	5320331
	Dilution Factor: 1			MDL.....: 0.0013		
Nitrocellulose	0.14 B,J	0.50	mg/L	MCAWW 353.2	11/29-12/01/05	5333468
	Dilution Factor: 1			MDL.....: 0.12		

NOTE(S):

RL Reporting Limit

B Estimated result. Result is less than RL.

J Method blank contamination. The associated method blank contains the target analyte at a reportable level.

SpecPro Inc

Client Sample ID: MBSmw-006-0012-gf

TOTAL Metals

Lot-Sample #...: A5K090129-002 **Matrix.....:** WG
Date Sampled...: 11/07/05 15:15 **Date Received..:** 11/08/05

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 5314034						
Aluminum	ND	200	ug/L	SW846 6010B	11/10-11/17/05	HPNK91AL
		Dilution Factor: 1		MDL.....: 47.0		
Arsenic	ND	10.0	ug/L	SW846 6010B	11/10-11/17/05	HPNK91AA
		Dilution Factor: 1		MDL.....: 4.3		
Lead	ND	10.0	ug/L	SW846 6010B	11/10-11/17/05	HPNK91AE
		Dilution Factor: 1		MDL.....: 1.7		
Antimony	ND	100	ug/L	SW846 6010B	11/10-11/17/05	HPNK91AP
		Dilution Factor: 1		MDL.....: 4.1		
Barium	86.1	**10.0**	**ug/L**	**SW846 6010B**	**11/10-11/17/05**	**HPNK91AT**
		Dilution Factor: 1		MDL.....: 3.2		
Selenium	ND	10.0	ug/L	SW846 6010B	11/10-11/17/05	HPNK91AH
		Dilution Factor: 1		MDL.....: 2.4		
Beryllium	ND	10.0	ug/L	SW846 6010B	11/10-11/17/05	HPNK91AW
		Dilution Factor: 1		MDL.....: 0.30		
Cadmium	ND	10.0	ug/L	SW846 6010B	11/10-11/17/05	HPNK91A1
		Dilution Factor: 1		MDL.....: 0.42		
Calcium	80800	**1000**	**ug/L**	**SW846 6010B**	**11/10-11/17/05**	**HPNK91A4**
		Dilution Factor: 1		MDL.....: 80.0		
Chromium	ND	20.0	ug/L	SW846 6010B	11/10-11/17/05	HPNK91A7
		Dilution Factor: 1		MDL.....: 1.6		
Cobalt	ND	20.0	ug/L	SW846 6010B	11/10-11/17/05	HPNK91CA
		Dilution Factor: 1		MDL.....: 1.2		
Copper	ND	20.0	ug/L	SW846 6010B	11/10-11/17/05	HPNK91CE
		Dilution Factor: 1		MDL.....: 1.8		
Iron	ND	1000	ug/L	SW846 6010B	11/10-11/17/05	HPNK91CH
		Dilution Factor: 1		MDL.....: 32.0		
Magnesium	26000	**1000**	**ug/L**	**SW846 6010B**	**11/10-11/17/05**	**HPNK91CL**
		Dilution Factor: 1		MDL.....: 86.0		

(Continued on next page)

SpecPro Inc

Client Sample ID: MBSmw-006-0012-gf

TOTAL Metals

Lot-Sample #...: A5K090129-002 Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Manganese	550 J	100	ug/L	SW846 6010B	11/10-11/17/05	HPNK91CP
		Dilution Factor: 1		MDL.....: 0.23		
Nickel	1.7 B	20.0	ug/L	SW846 6010B	11/10-11/17/05	HPNK91CT
		Dilution Factor: 1		MDL.....: 1.4		
Potassium	5790	5000	ug/L	SW846 6010B	11/10-11/17/05	HPNK91CW
		Dilution Factor: 1		MDL.....: 54.0		
Silver	ND	20.0	ug/L	SW846 6010B	11/10-11/17/05	HPNK91C1
		Dilution Factor: 1		MDL.....: 2.1		
Sodium	10800	1000	ug/L	SW846 6010B	11/10-11/17/05	HPNK91C4
		Dilution Factor: 1		MDL.....: 410		
Vanadium	ND	20.0	ug/L	SW846 6010B	11/10-11/17/05	HPNK91C7
		Dilution Factor: 1		MDL.....: 1.9		
Zinc	ND	100	ug/L	SW846 6010B	11/10-11/17/05	HPNK91DA
		Dilution Factor: 1		MDL.....: 6.6		
Mercury	ND	0.20	ug/L	SW846 7470A	11/10/05	HPNK91DH
		Dilution Factor: 1		MDL.....: 0.090		
Thallium	ND	1.0	ug/L	SW846 6020	11/10-11/17/05	HPNK91DE
		Dilution Factor: 1		MDL.....: 0.022		

NOTE(S):

J Method blank contamination. The associated method blank contains the target analyte at a reportable level.

B Estimated result. Result is less than RL.

SpecPro Inc

Client Sample ID: MBSmw-005-0011-gw

GC/MS Volatiles

Lot-Sample #...: A5K090129-003 Work Order #...: HPNLA1AA Matrix.....: WG
Date Sampled...: 11/08/05 10:40 Date Received..: 11/08/05
Prep Date.....: 11/21/05 Analysis Date..: 11/21/05
Prep Batch #...: 5325119
Dilution Factor: 1 Method.....: SW846 8260B

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Bromochloromethane	ND	1.0	ug/L	0.24
1,2-Dibromoethane	ND	1.0	ug/L	0.24
Chloromethane	ND	1.0	ug/L	0.14
Bromomethane	ND	1.0	ug/L	0.36
Vinyl chloride	ND	1.0	ug/L	0.21
Chloroethane	ND	1.0	ug/L	0.24
Methylene chloride	ND	2.0	ug/L	0.19
Acetone	**1.1 J**	**10**	**ug/L**	**0.74**
Carbon disulfide	ND	1.0	ug/L	0.28
1,1-Dichloroethene	ND	1.0	ug/L	0.18
1,1-Dichloroethane	ND	1.0	ug/L	0.21
1,2-Dichloroethene (total)	ND	1.0	ug/L	0.35
Chloroform	ND	1.0	ug/L	0.16
1,2-Dichloroethane	ND	1.0	ug/L	0.16
2-Butanone	**0.95 J**	**10**	**ug/L**	**0.39**
1,1,1-Trichloroethane	ND	1.0	ug/L	0.21
Carbon tetrachloride	ND	1.0	ug/L	0.19
Bromodichloromethane	ND	1.0	ug/L	0.14
1,2-Dichloropropane	ND	1.0	ug/L	0.15
cis-1,3-Dichloropropene	ND	1.0	ug/L	0.12
Trichloroethene	ND	1.0	ug/L	0.28
Dibromochloromethane	ND	1.0	ug/L	0.19
1,1,2-Trichloroethane	ND	1.0	ug/L	0.22
Benzene	ND	1.0	ug/L	0.22
trans-1,3-Dichloropropene	ND	1.0	ug/L	0.17
Bromoform	ND	1.0	ug/L	0.17
4-Methyl-2-pentanone	ND	10	ug/L	0.32
2-Hexanone	ND	10	ug/L	0.35
Tetrachloroethene	ND	1.0	ug/L	0.19
1,1,2,2-Tetrachloroethane	ND	1.0	ug/L	0.22
Toluene	ND	1.0	ug/L	0.17
Chlorobenzene	ND	1.0	ug/L	0.20
Ethylbenzene	ND	1.0	ug/L	0.19
Styrene	ND	1.0	ug/L	0.13
Xylenes (total)	ND	2.0	ug/L	0.44

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SpecPro Inc

Client Sample ID: MBSmw-005-0011-gw

GC/MS Volatiles

Lot-Sample #...: A5K090129-003 Work Order #...: HPNLA1AA Matrix.....: WG

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	96	(73 - 122)
1,2-Dichloroethane-d4	91	(61 - 128)
Toluene-d8	97	(76 - 110)
4-Bromofluorobenzene	84	(74 - 116)

NOTE(S):

J Estimated result. Result is less than RL.

SpecPro Inc

MBSmw-005-0011-gw

GC/MS Volatiles

Lot-Sample #: A5K090129-003 Work Order #: HPNLA1AA Matrix: WG

MASS SPECTROMETER/DATA SYSTEM (MSDS) TENTATIVELY IDENTIFIED COMPOUNDS

PARAMETER	CAS #	ESTIMATED RESULT	RETENTION TIME	UNITS
None				ug/L

SpecPro Inc

Client Sample ID: MBSmw-005-0011-gw

GC/MS Semivolatiles

Lot-Sample #...: A5K090129-003 **Work Order #...:** HPNLA1AC **Matrix.....:** WG
Date Sampled...: 11/08/05 10:40 **Date Received..:** 11/08/05
Prep Date.....: 11/14/05 **Analysis Date..:** 11/25/05
Prep Batch #...: 5318057
Dilution Factor: 1 **Method.....:** SW846 8270C

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Benzoic acid	**4.5 J**	**10**	**ug/L**	**0.81**
Benzyl alcohol	ND	5.0	ug/L	1.1
Phenol	ND	1.0	ug/L	0.14
bis(2-Chloroethyl)-ether	ND	1.0	ug/L	0.19
2-Chlorophenol	ND	1.0	ug/L	0.14
1,3-Dichlorobenzene	ND	1.0	ug/L	0.11
1,4-Dichlorobenzene	ND	1.0	ug/L	0.13
1,2-Dichlorobenzene	ND	1.0	ug/L	0.16
2-Methylphenol	ND	1.0	ug/L	0.15
2,2'-oxybis(1-Chloro-propane)	ND	1.0	ug/L	0.21
4-Methylphenol	ND	1.0	ug/L	0.20
N-Nitrosodi-n-propyl-amine	ND	1.0	ug/L	0.21
Hexachloroethane	ND	1.0	ug/L	0.21
Nitrobenzene	ND	1.0	ug/L	0.21
Isophorone	ND	1.0	ug/L	0.16
2-Nitrophenol	ND	2.0	ug/L	0.14
2,4-Dimethylphenol	ND	2.0	ug/L	0.23
bis(2-Chloroethoxy) methane	ND	1.0	ug/L	0.24
2,4-Dichlorophenol	ND	2.0	ug/L	0.24
1,2,4-Trichloro-benzene	ND	1.0	ug/L	0.12
Naphthalene	ND	0.20	ug/L	0.031
4-Chloroaniline	ND	2.0	ug/L	0.31
Hexachlorobutadiene	ND	1.0	ug/L	0.11
4-Chloro-3-methylphenol	ND	2.0	ug/L	0.18
2-Methylnaphthalene	ND	0.20	ug/L	0.028
Hexachlorocyclopenta-diene	ND	10	ug/L	1.5
2,4,6-Trichloro-phenol	ND	5.0	ug/L	0.16
2,4,5-Trichloro-phenol	ND	5.0	ug/L	0.13
2-Chloronaphthalene	ND	1.0	ug/L	0.29
2-Nitroaniline	ND	2.0	ug/L	0.18
Dimethyl phthalate	ND	1.0	ug/L	0.27

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SpecPro Inc

Client Sample ID: MBSmw-005-0011-gw

GC/MS Semivolatiles

Lot-Sample #...: A5K090129-003 Work Order #...: HPNLA1AC Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Acenaphthylene	ND	0.20	ug/L	0.030
2,6-Dinitrotoluene	ND	5.0	ug/L	0.17
3-Nitroaniline	ND	2.0	ug/L	0.094
Acenaphthene	ND	0.20	ug/L	0.028
2,4-Dinitrophenol	ND	5.0	ug/L	1.3
4-Nitrophenol	ND	5.0	ug/L	1.0
Dibenzofuran	ND	1.0	ug/L	0.025
2,4-Dinitrotoluene	ND	5.0	ug/L	0.16
Diethyl phthalate	ND	1.0	ug/L	0.12
4-Chlorophenyl phenyl ether	ND	2.0	ug/L	0.21
Fluorene	ND	0.20	ug/L	0.035
4-Nitroaniline	ND	2.0	ug/L	0.11
4,6-Dinitro-2-methylphenol	ND	5.0	ug/L	1.8
N-Nitrosodiphenylamine	ND	1.0	ug/L	0.18
4-Bromophenyl phenyl ether	ND	2.0	ug/L	0.29
Hexachlorobenzene	ND	0.20	ug/L	0.075
Pentachlorophenol	ND	5.0	ug/L	2.0
Phenanthrene	ND	0.20	ug/L	0.044
Anthracene	ND	0.20	ug/L	0.030
Carbazole	ND	1.0	ug/L	0.17
Di-n-butyl phthalate	ND	1.0	ug/L	0.13
Fluoranthene	ND	0.20	ug/L	0.024
Pyrene	ND	0.20	ug/L	0.051
Butyl benzyl phthalate	ND	1.0	ug/L	0.14
3,3'-Dichlorobenzidine	ND	5.0	ug/L	0.19
Benzo(a)anthracene	ND	0.20	ug/L	0.028
Chrysene	ND	0.20	ug/L	0.035
bis(2-Ethylhexyl) phthalate	**2.3 B**	**1.0**	**ug/L**	**0.36**
Di-n-octyl phthalate	ND	1.0	ug/L	0.16
Benzo(b)fluoranthene	ND	0.20	ug/L	0.043
Benzo(k)fluoranthene	ND	0.20	ug/L	0.071
Benzo(a)pyrene	ND	0.20	ug/L	0.022
Indeno(1,2,3-cd)pyrene	ND	0.20	ug/L	0.081
Dibenz(a,h)anthracene	ND	0.20	ug/L	0.054
Benzo(ghi)perylene	ND	0.20	ug/L	0.044

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SpecPro Inc

Client Sample ID: MBSmw-005-0011-gw

GC/MS Semivolatiles

Lot-Sample #...: A5K090129-003 Work Order #...: HPNLA1AC Matrix.....: WG

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Nitrobenzene-d5	58	(32 - 112)
2-Fluorobiphenyl	55	(30 - 110)
Terphenyl-d14	69	(51 - 135)
Phenol-d5	56	(10 - 117)
2-Fluorophenol	44	(19 - 108)
2,4,6-Tribromophenol	68	(42 - 124)

NOTE(S):

J Estimated result. Result is less than RL.

B Method blank contamination. The associated method blank contains the target analyte at a reportable level.

SpecPro Inc

MBSmw-005-0011-gw

GC/MS Semivolatiles

Lot-Sample #: A5K090129-003 **Work Order #:** HPNLA1AC **Matrix:** WG

MASS SPECTROMETER/DATA SYSTEM (MSDS) TENTATIVELY IDENTIFIED COMPOUNDS

PARAMETER	CAS #	ESTIMATED RESULT		RETENTION TIME	UNITS
Unknown		3.3 J	M	2.8989	ug/L
Unknown		0.84 J	M	3.1927	ug/L
Unknown Organic Acid		1.5 J	M	4.6137	ug/L
Unknown Organic Acid		0.85 J	M	4.977	ug/L
Unknown		1.4 J	M	6.6544	ug/L
Unknown		0.80 J	M	6.6865	ug/L
Unknown		1.1 J	M	8.1342	ug/L

NOTE(S):

M: Result was measured against nearest internal standard assuming a response factor of 1.

SpecPro Inc

Client Sample ID: MBSmw-005-0011-gw

GC/MS Semivolatiles

Lot-Sample #...: A5K090129-003 Work Order #...: HPNLA1AK Matrix.....: WG
Date Sampled...: 11/08/05 10:40 Date Received..: 11/08/05
Prep Date.....: 11/14/05 Analysis Date..: 11/28/05
Prep Batch #...: 5318209
Dilution Factor: 1 Method.....: SW846 8270C CWM

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
1,4-Oxathiane	ND	5.0	ug/L	0.88
1,4-Dithiane	ND	5.0	ug/L	1.0

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2-Fluorobiphenyl	81	(16 - 127)
Nitrobenzene-d5	93	(43 - 121)

SpecPro Inc

Client Sample ID: MBSmw-005-0011-gw

GC Semivolatiles

Lot-Sample #...: A5K090129-003 Work Order #...: HPNLA1AD Matrix.....: WG
Date Sampled...: 11/08/05 10:40 Date Received..: 11/08/05
Prep Date.....: 11/14/05 Analysis Date..: 11/24/05
Prep Batch #...: 5318048
Dilution Factor: 1 Method.....: SW846 8081A

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
alpha-BHC	ND	0.030	ug/L	0.0062
beta-BHC	ND	0.030	ug/L	0.0068
delta-BHC	ND	0.030	ug/L	0.0064
gamma-BHC (Lindane)	ND	0.030	ug/L	0.0062
Heptachlor	ND	0.030	ug/L	0.0062
Aldrin	ND	0.030	ug/L	0.0061
Heptachlor epoxide	ND	0.030	ug/L	0.0065
Endosulfan I	ND	0.030	ug/L	0.0072
Dieldrin	ND	0.030	ug/L	0.0067
4,4'-DDE	ND	0.030	ug/L	0.0076
Endrin	ND	0.030	ug/L	0.0074
Endosulfan II	ND	0.030	ug/L	0.0072
4,4'-DDD	ND	0.030	ug/L	0.0085
Endosulfan sulfate	ND	0.030	ug/L	0.0083
4,4'-DDT	ND	0.030	ug/L	0.0086
Methoxychlor	ND	0.10	ug/L	0.010
Endrin ketone	ND	0.030	ug/L	0.013
Endrin aldehyde	ND	0.030	ug/L	0.0091
alpha-Chlordane	ND	0.030	ug/L	0.0073
gamma-Chlordane	ND	0.030	ug/L	0.0065
Toxaphene	ND	2.0	ug/L	0.33

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Tetrachloro-m-xylene	90	(39 - 130)
Decachlorobiphenyl	48	(10 - 147)

SpecPro Inc

Client Sample ID: MBSmw-005-0011-gw

GC Semivolatiles

Lot-Sample #...: A5K090129-003 Work Order #...: HPNLA1AE Matrix.....: WG
Date Sampled...: 11/08/05 10:40 Date Received..: 11/08/05
Prep Date.....: 11/14/05 Analysis Date..: 12/01/05
Prep Batch #...: 5318049
Dilution Factor: 1 Method.....: SW846 8082

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Aroclor 1016	ND	1.0	ug/L	0.25
Aroclor 1221	ND	1.0	ug/L	0.49
Aroclor 1232	ND	1.0	ug/L	0.41
Aroclor 1242	ND	1.0	ug/L	0.11
Aroclor 1248	ND	1.0	ug/L	0.049
Aroclor 1254	ND	1.0	ug/L	0.087
Aroclor 1260	ND	1.0	ug/L	0.071

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Tetrachloro-m-xylene	89	(35 - 130)
Decachlorobiphenyl	39	(10 - 110)

SpecPro Inc

Client Sample ID: MBSmw-005-0011-gw

Trace Level Organic Compounds

Lot-Sample #...: A5K090129-003 **Work Order #...:** HPNLA1AL **Matrix.....:** WG
Date Sampled...: 11/08/05 10:40 **Date Received..:** 11/08/05
Prep Date.....: 11/18/05 **Analysis Date..:** 01/05/06
Prep Batch #...: 5322621
Dilution Factor: 1

PARAMETER	RESULT	DETECTION LIMIT	UNITS	METHOD
Thiodiglycol	ND	10	ug/L	SW846 SW8321A

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Thiodiglycol-d4	97	(50 - 120)

SpecPro Inc

Client Sample ID: MBSmw-005-0011-gw

Trace Level Organic Compounds

Lot-Sample #...: A5K090129-003 Work Order #...: HPNLA1AJ Matrix.....: WG
Date Sampled...: 11/08/05 10:40 Date Received..: 11/08/05
Prep Date.....: 11/18/05 Analysis Date..: 11/19/05
Prep Batch #...: 5322405
Dilution Factor: 1

PARAMETER	RESULT	DETECTION LIMIT	UNITS	METHOD
Nitroguanidine	ND	20	ug/L	SW846 8330 (Modif

SpecPro Inc

Client Sample ID: MBSmw-005-0011-gw

HPLC

Lot-Sample #...: A5K090129-003 Work Order #...: HPNLA1AG Matrix.....: WG
Date Sampled...: 11/08/05 10:40 Date Received..: 11/08/05
Prep Date.....: 11/14/05 Analysis Date..: 11/17/05
Prep Batch #...: 5318288
Dilution Factor: 1 Method.....: SW846 8330

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
2-Amino-4,6-dinitrotoluene	ND	0.10	ug/L	0.10
4-Amino-2,6-dinitrotoluene	ND	0.10	ug/L	0.050
1,3-Dinitrobenzene	ND	0.10	ug/L	0.050
2,4-Dinitrotoluene	ND	0.10	ug/L	0.050
2,6-Dinitrotoluene	ND	0.10	ug/L	0.050
HMX	ND	0.10	ug/L	0.036
Nitrobenzene	ND	0.10	ug/L	0.050
2-Nitrotoluene	ND	0.50	ug/L	0.088
3-Nitrotoluene	ND	0.50	ug/L	0.057
4-Nitrotoluene	ND	0.50	ug/L	0.088
RDX	ND	0.10	ug/L	0.036
Tetryl	ND	0.10	ug/L	0.050
1,3,5-Trinitrobenzene	ND	0.10	ug/L	0.030
2,4,6-Trinitrotoluene	ND	0.10	ug/L	0.050

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
3,4-Dinitrotoluene	108	(84 - 125)

SpecPro Inc

Client Sample ID: MBSmw-005-0011-gw

General Chemistry

Lot-Sample #...: A5K090129-003 **Work Order #...:** HPNLA **Matrix.....:** WG
Date Sampled...: 11/08/05 10:40 **Date Received..:** 11/08/05

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Cyanide, Total	ND	0.010	mg/L	SW846 9012A	11/16/05	5320331
		Dilution Factor: 1		MDL.....: 0.0013		
Nitrocellulose	ND	0.50	mg/L	MCAWW 353.2	11/29-12/01/05	5333468
		Dilution Factor: 1		MDL.....: 0.12		

SpecPro Inc

Client Sample ID: MBSmw-005-0011-gf

TOTAL Metals

Lot-Sample #...: A5K090129-004 Matrix.....: WG
Date Sampled...: 11/08/05 10:40 Date Received..: 11/08/05

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 5314034						
Aluminum	ND	200	ug/L	SW846 6010B	11/10-11/17/05	HPNLC1AH
		Dilution Factor: 1		MDL.....: 47.0		
Arsenic	**5.3 B**	**10.0**	**ug/L**	**SW846 6010B**	**11/10-11/17/05**	**HPNLC1AE**
		Dilution Factor: 1		MDL.....: 4.3		
Lead	ND	10.0	ug/L	SW846 6010B	11/10-11/17/05	HPNLC1AF
		Dilution Factor: 1		MDL.....: 1.7		
Antimony	ND	100	ug/L	SW846 6010B	11/10-11/17/05	HPNLC1AJ
		Dilution Factor: 1		MDL.....: 4.1		
Barium	**83.2**	**10.0**	**ug/L**	**SW846 6010B**	**11/10-11/17/05**	**HPNLC1AK**
		Dilution Factor: 1		MDL.....: 3.2		
Selenium	ND	10.0	ug/L	SW846 6010B	11/10-11/17/05	HPNLC1AG
		Dilution Factor: 1		MDL.....: 2.4		
Beryllium	ND	10.0	ug/L	SW846 6010B	11/10-11/17/05	HPNLC1AL
		Dilution Factor: 1		MDL.....: 0.30		
Cadmium	ND	10.0	ug/L	SW846 6010B	11/10-11/17/05	HPNLC1AA
		Dilution Factor: 1		MDL.....: 0.42		
Calcium	**86600**	**1000**	**ug/L**	**SW846 6010B**	**11/10-11/17/05**	**HPNLC1AC**
		Dilution Factor: 1		MDL.....: 80.0		
Chromium	ND	20.0	ug/L	SW846 6010B	11/10-11/17/05	HPNLC1AD
		Dilution Factor: 1		MDL.....: 1.6		
Cobalt	ND	20.0	ug/L	SW846 6010B	11/10-11/17/05	HPNLC1AQ
		Dilution Factor: 1		MDL.....: 1.2		
Copper	ND	20.0	ug/L	SW846 6010B	11/10-11/17/05	HPNLC1AR
		Dilution Factor: 1		MDL.....: 1.8		
Iron	405 B	1000	ug/L	SW846 6010B	11/10-11/17/05	HPNLC1AT
		Dilution Factor: 1		MDL.....: 32.0		
Magnesium	24900	1000	ug/L	SW846 6010B	11/10-11/17/05	HPNLC1AU
		Dilution Factor: 1		MDL.....: 86.0		

(Continued on next page)

SpecPro Inc

Client Sample ID: MBSmw-005-0011-gf

TOTAL Metals

Lot-Sample #...: A5K090129-004 Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Manganese	343 J	100	ug/L	SW846 6010B	11/10-11/17/05	HPNLC1AV
		Dilution Factor: 1		MDL.....: 0.23		
Nickel	ND	20.0	ug/L	SW846 6010B	11/10-11/17/05	HPNLC1AW
		Dilution Factor: 1		MDL.....: 1.4		
Potassium	1710 B	5000	ug/L	SW846 6010B	11/10-11/17/05	HPNLC1AX
		Dilution Factor: 1		MDL.....: 54.0		
Silver	ND	20.0	ug/L	SW846 6010B	11/10-11/17/05	HPNLC1AM
		Dilution Factor: 1		MDL.....: 2.1		
Sodium	9650	1000	ug/L	SW846 6010B	11/10-11/17/05	HPNLC1AN
		Dilution Factor: 1		MDL.....: 410		
Vanadium	ND	20.0	ug/L	SW846 6010B	11/10-11/17/05	HPNLC1AP
		Dilution Factor: 1		MDL.....: 1.9		
Zinc	ND	100	ug/L	SW846 6010B	11/10-11/17/05	HPNLC1A0
		Dilution Factor: 1		MDL.....: 6.6		
Mercury	ND	0.20	ug/L	SW846 7470A	11/10/05	HPNLC1A2
		Dilution Factor: 1		MDL.....: 0.090		
Thallium	ND	1.0	ug/L	SW846 6020	11/10-11/17/05	HPNLC1A1
		Dilution Factor: 1		MDL.....: 0.022		

NOTE(S):

B Estimated result. Result is less than RL.

J Method blank contamination. The associated method blank contains the target analyte at a reportable level.

SpecPro Inc

Client Sample ID: MBSmw-005-0010-gw

GC/MS Volatiles

Lot-Sample #...: A5K090129-005 **Work Order #...:** HPNLD1AA **Matrix.....:** WG
Date Sampled...: 11/08/05 10:40 **Date Received..:** 11/08/05
Prep Date.....: 11/21/05 **Analysis Date..:** 11/21/05
Prep Batch #...: 5325119
Dilution Factor: 1 **Method.....:** SW846 8260B

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Bromochloromethane	ND	1.0	ug/L	0.24
1,2-Dibromoethane	ND	1.0	ug/L	0.24
Chloromethane	ND	1.0	ug/L	0.14
Bromomethane	ND	1.0	ug/L	0.36
Vinyl chloride	ND	1.0	ug/L	0.21
Chloroethane	ND	1.0	ug/L	0.24
Methylene chloride	ND	2.0	ug/L	0.19
Acetone	**1.2 J**	**10**	**ug/L**	**0.74**
Carbon disulfide	ND	1.0	ug/L	0.28
1,1-Dichloroethene	ND	1.0	ug/L	0.18
1,1-Dichloroethane	ND	1.0	ug/L	0.21
1,2-Dichloroethene (total)	ND	1.0	ug/L	0.35
Chloroform	ND	1.0	ug/L	0.16
1,2-Dichloroethane	ND	1.0	ug/L	0.16
2-Butanone	**1.0 J**	**10**	**ug/L**	**0.39**
1,1,1-Trichloroethane	ND	1.0	ug/L	0.21
Carbon tetrachloride	ND	1.0	ug/L	0.19
Bromodichloromethane	ND	1.0	ug/L	0.14
1,2-Dichloropropane	ND	1.0	ug/L	0.15
cis-1,3-Dichloropropene	ND	1.0	ug/L	0.12
Trichloroethene	ND	1.0	ug/L	0.28
Dibromochloromethane	ND	1.0	ug/L	0.19
1,1,2-Trichloroethane	ND	1.0	ug/L	0.22
Benzene	ND	1.0	ug/L	0.22
trans-1,3-Dichloropropene	ND	1.0	ug/L	0.17
Bromoform	ND	1.0	ug/L	0.17
4-Methyl-2-pentanone	ND	10	ug/L	0.32
2-Hexanone	ND	10	ug/L	0.35
Tetrachloroethene	ND	1.0	ug/L	0.19
1,1,2,2-Tetrachloroethane	ND	1.0	ug/L	0.22
Toluene	ND	1.0	ug/L	0.17
Chlorobenzene	ND	1.0	ug/L	0.20
Ethylbenzene	ND	1.0	ug/L	0.19
Styrene	ND	1.0	ug/L	0.13
Xylenes (total)	ND	2.0	ug/L	0.44

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SpecPro Inc

Client Sample ID: MBSmw-005-0010-gw

GC/MS Volatiles

Lot-Sample #...: A5K090129-005 Work Order #...: HPNLD1AA Matrix.....: WG

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	97	(73 - 122)
1,2-Dichloroethane-d4	90	(61 - 128)
Toluene-d8	98	(76 - 110)
4-Bromofluorobenzene	86	(74 - 116)

NOTE(S):

J Estimated result. Result is less than RL.

SpecPro Inc

MBSmw-005-0010-gw

GC/MS Volatiles

Lot-Sample #: A5K090129-005 Work Order #: HPNLD1AA Matrix: WG

MASS SPECTROMETER/DATA SYSTEM (MSDS) TENTATIVELY IDENTIFIED COMPOUNDS

PARAMETER	CAS #	ESTIMATED RESULT	RETENTION TIME	UNITS
None				ug/L

SpecPro Inc

Client Sample ID: MBSmw-005-0010-gw

GC/MS Semivolatiles

Lot-Sample #...: A5K090129-005 Work Order #...: HPNLD1AC Matrix.....: WG
Date Sampled...: 11/08/05 10:40 Date Received..: 11/08/05
Prep Date.....: 11/14/05 Analysis Date..: 11/25/05
Prep Batch #...: 5318057
Dilution Factor: 1 Method.....: SW846 8270C

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Benzoic acid	**4.4 J**	**10**	**ug/L**	**0.81**
Benzyl alcohol	ND	5.0	ug/L	1.1
Phenol	ND	1.0	ug/L	0.14
bis(2-Chloroethyl)-ether	ND	1.0	ug/L	0.19
2-Chlorophenol	ND	1.0	ug/L	0.14
1,3-Dichlorobenzene	ND	1.0	ug/L	0.11
1,4-Dichlorobenzene	ND	1.0	ug/L	0.13
1,2-Dichlorobenzene	ND	1.0	ug/L	0.16
2-Methylphenol	ND	1.0	ug/L	0.15
2,2'-oxybis(1-Chloro-propane)	ND	1.0	ug/L	0.21
4-Methylphenol	ND	1.0	ug/L	0.20
N-Nitrosodi-n-propyl-amine	ND	1.0	ug/L	0.21
Hexachloroethane	ND	1.0	ug/L	0.21
Nitrobenzene	ND	1.0	ug/L	0.21
Isophorone	ND	1.0	ug/L	0.16
2-Nitrophenol	ND	2.0	ug/L	0.14
2,4-Dimethylphenol	ND	2.0	ug/L	0.23
bis(2-Chloroethoxy) methane	ND	1.0	ug/L	0.24
2,4-Dichlorophenol	ND	2.0	ug/L	0.24
1,2,4-Trichloro-benzene	ND	1.0	ug/L	0.12
Naphthalene	ND	0.20	ug/L	0.031
4-Chloroaniline	ND	2.0	ug/L	0.31
Hexachlorobutadiene	ND	1.0	ug/L	0.11
4-Chloro-3-methylphenol	ND	2.0	ug/L	0.18
2-Methylnaphthalene	ND	0.20	ug/L	0.028
Hexachlorocyclopenta-diene	ND	10	ug/L	1.5
2,4,6-Trichloro-phenol	ND	5.0	ug/L	0.16
2,4,5-Trichloro-phenol	ND	5.0	ug/L	0.13
2-Chloronaphthalene	ND	1.0	ug/L	0.29
2-Nitroaniline	ND	2.0	ug/L	0.18
Dimethyl phthalate	ND	1.0	ug/L	0.27

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SpecPro Inc

Client Sample ID: MBSmw-005-0010-gw

GC/MS Semivolatiles

Lot-Sample #...: A5K090129-005 Work Order #...: HPNLD1AC Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Acenaphthylene	ND	0.20	ug/L	0.030
2,6-Dinitrotoluene	ND	5.0	ug/L	0.17
3-Nitroaniline	ND	2.0	ug/L	0.094
Acenaphthene	ND	0.20	ug/L	0.028
2,4-Dinitrophenol	ND	5.0	ug/L	1.3
4-Nitrophenol	ND	5.0	ug/L	1.0
Dibenzofuran	ND	1.0	ug/L	0.025
2,4-Dinitrotoluene	ND	5.0	ug/L	0.16
Diethyl phthalate	ND	1.0	ug/L	0.12
4-Chlorophenyl phenyl ether	ND	2.0	ug/L	0.21
Fluorene	ND	0.20	ug/L	0.035
4-Nitroaniline	ND	2.0	ug/L	0.11
4,6-Dinitro-2-methylphenol	ND	5.0	ug/L	1.8
N-Nitrosodiphenylamine	ND	1.0	ug/L	0.18
4-Bromophenyl phenyl ether	ND	2.0	ug/L	0.29
Hexachlorobenzene	ND	0.20	ug/L	0.075
Pentachlorophenol	ND	5.0	ug/L	2.0
Phenanthrene	ND	0.20	ug/L	0.044
Anthracene	ND	0.20	ug/L	0.030
Carbazole	ND	1.0	ug/L	0.17
Di-n-butyl phthalate	ND	1.0	ug/L	0.13
Fluoranthene	ND	0.20	ug/L	0.024
Pyrene	ND	0.20	ug/L	0.051
Butyl benzyl phthalate	ND	1.0	ug/L	0.14
3,3'-Dichlorobenzidine	ND	5.0	ug/L	0.19
Benzo(a)anthracene	ND	0.20	ug/L	0.028
Chrysene	ND	0.20	ug/L	0.035
bis(2-Ethylhexyl) phthalate	**1.6 B**	**1.0**	**ug/L**	**0.36**
Di-n-octyl phthalate	ND	1.0	ug/L	0.16
Benzo(b)fluoranthene	ND	0.20	ug/L	0.043
Benzo(k)fluoranthene	ND	0.20	ug/L	0.071
Benzo(a)pyrene	ND	0.20	ug/L	0.022
Indeno(1,2,3-cd)pyrene	ND	0.20	ug/L	0.081
Dibenz(a,h)anthracene	ND	0.20	ug/L	0.054
Benzo(ghi)perylene	ND	0.20	ug/L	0.044

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SpecPro Inc

Client Sample ID: MBSmw-005-0010-gw

GC/MS Semivolatiles

Lot-Sample #...: A5K090129-005 Work Order #...: HPNLD1AC Matrix.....: WG

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Nitrobenzene-d5	60	(32 - 112)
2-Fluorobiphenyl	56	(30 - 110)
Terphenyl-d14	68	(51 - 135)
Phenol-d5	58	(10 - 117)
2-Fluorophenol	45	(19 - 108)
2,4,6-Tribromophenol	70	(42 - 124)

NOTE(S):

J Estimated result. Result is less than RL.

B Method blank contamination. The associated method blank contains the target analyte at a reportable level.

SpecPro Inc

MBSmw-005-0010-gw

GC/MS Semivolatiles

Lot-Sample #: A5K090129-005 **Work Order #:** HPNLD1AC **Matrix:** WG

MASS SPECTROMETER/DATA SYSTEM (MSDS) TENTATIVELY IDENTIFIED COMPOUNDS

PARAMETER	CAS #	ESTIMATED RESULT		RETENTION TIME	UNITS
Unknown		1.4 J	M	2.8993	ug/L
Unknown		1.1 J	M	3.1878	ug/L
Unknown		0.91 J	M	4.6088	ug/L
Unknown		1.1 J	M	5.9924	ug/L
Unknown		1.1 J	M	6.6548	ug/L
Unknown		0.91 J	M	8.1292	ug/L

NOTE(S):

M: Result was measured against nearest internal standard assuming a response factor of 1.

SpecPro Inc

Client Sample ID: MBSmw-005-0010-gw

GC/MS Semivolatiles

Lot-Sample #...: A5K090129-005 Work Order #...: HPNLD1AK Matrix.....: WG
Date Sampled...: 11/08/05 10:40 Date Received..: 11/08/05
Prep Date.....: 11/14/05 Analysis Date..: 11/28/05
Prep Batch #...: 5318209
Dilution Factor: 1 Method.....: SW846 8270C CWM

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
1,4-Oxathiane	ND	5.0	ug/L	0.88
1,4-Dithiane	ND	5.0	ug/L	1.0

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2-Fluorobiphenyl	69	(16 - 127)
Nitrobenzene-d5	91	(43 - 121)

SpecPro Inc

Client Sample ID: MBSmw-005-0010-gw

GC Semivolatiles

Lot-Sample #...: A5K090129-005 **Work Order #...:** HPNLD1AD **Matrix.....:** WG
Date Sampled...: 11/08/05 10:40 **Date Received..:** 11/08/05
Prep Date.....: 11/14/05 **Analysis Date..:** 11/24/05
Prep Batch #...: 5318048
Dilution Factor: 1 **Method.....:** SW846 8081A

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
alpha-BHC	ND	0.030	ug/L	0.0062
beta-BHC	ND	0.030	ug/L	0.0068
delta-BHC	ND	0.030	ug/L	0.0064
gamma-BHC (Lindane)	ND	0.030	ug/L	0.0062
Heptachlor	ND	0.030	ug/L	0.0062
Aldrin	ND	0.030	ug/L	0.0061
Heptachlor epoxide	ND	0.030	ug/L	0.0065
Endosulfan I	ND	0.030	ug/L	0.0072
Dieldrin	ND	0.030	ug/L	0.0067
4,4'-DDE	ND	0.030	ug/L	0.0076
Endrin	ND	0.030	ug/L	0.0074
Endosulfan II	ND	0.030	ug/L	0.0072
4,4'-DDD	ND	0.030	ug/L	0.0085
Endosulfan sulfate	ND	0.030	ug/L	0.0083
4,4'-DDT	ND	0.030	ug/L	0.0086
Methoxychlor	ND	0.10	ug/L	0.010
Endrin ketone	ND	0.030	ug/L	0.013
Endrin aldehyde	ND	0.030	ug/L	0.0091
alpha-Chlordane	ND	0.030	ug/L	0.0073
gamma-Chlordane	ND	0.030	ug/L	0.0065
Toxaphene	ND	2.0	ug/L	0.33

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Tetrachloro-m-xylene	78	(39 - 130)
Decachlorobiphenyl	21	(10 - 147)

SpecPro Inc

Client Sample ID: MBSmw-005-0010-gw

GC Semivolatiles

Lot-Sample #...: A5K090129-005 Work Order #...: HPNLD1AE Matrix.....: WG
Date Sampled...: 11/08/05 10:40 Date Received..: 11/08/05
Prep Date.....: 11/14/05 Analysis Date..: 12/01/05
Prep Batch #...: 5318049
Dilution Factor: 1 Method.....: SW846 8082

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Aroclor 1016	ND	1.0	ug/L	0.25
Aroclor 1221	ND	1.0	ug/L	0.49
Aroclor 1232	ND	1.0	ug/L	0.41
Aroclor 1242	ND	1.0	ug/L	0.11
Aroclor 1248	ND	1.0	ug/L	0.049
Aroclor 1254	ND	1.0	ug/L	0.087
Aroclor 1260	ND	1.0	ug/L	0.071

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Tetrachloro-m-xylene	106	(35 - 130)
Decachlorobiphenyl	31	(10 - 110)

SpecPro Inc

Client Sample ID: MBSmw-005-0010-gw

Trace Level Organic Compounds

Lot-Sample #...: A5K090129-005 Work Order #...: HPNLD1AL Matrix.....: WG
Date Sampled...: 11/08/05 10:40 Date Received..: 11/08/05
Prep Date.....: 11/18/05 Analysis Date..: 01/05/06
Prep Batch #...: 5322621
Dilution Factor: 1

PARAMETER	RESULT	DETECTION LIMIT	UNITS	METHOD
Thiodiglycol	ND	10	ug/L	SW846 SW8321A

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Thiodiglycol-d4	87	(50 - 120)

SpecPro Inc

Client Sample ID: MBSmw-005-0010-gw

Trace Level Organic Compounds

Lot-Sample #...: A5K090129-005 Work Order #...: HPNLD1AJ Matrix.....: WG
Date Sampled...: 11/08/05 10:40 Date Received..: 11/08/05
Prep Date.....: 11/18/05 Analysis Date..: 11/19/05
Prep Batch #...: 5322405
Dilution Factor: 1

PARAMETER	RESULT	DETECTION LIMIT	UNITS	METHOD
Nitroguanidine	ND	20	ug/L	SW846 8330 (Modif

SpecPro Inc

Client Sample ID: MBSmw-005-0010-gw

HPLC

Lot-Sample #...: A5K090129-005 **Work Order #...:** HPNLD1AG **Matrix.....:** WG
Date Sampled...: 11/08/05 10:40 **Date Received..:** 11/08/05
Prep Date.....: 11/14/05 **Analysis Date..:** 11/17/05
Prep Batch #...: 5318288
Dilution Factor: 1 **Method.....:** SW846 8330

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
2-Amino-4,6-dinitrotoluene	ND	0.10	ug/L	0.10
4-Amino-2,6-dinitrotoluene	ND	0.10	ug/L	0.050
1,3-Dinitrobenzene	ND	0.10	ug/L	0.050
2,4-Dinitrotoluene	ND	0.10	ug/L	0.050
2,6-Dinitrotoluene	ND	0.10	ug/L	0.050
HMX	ND	0.10	ug/L	0.036
Nitrobenzene	ND	0.10	ug/L	0.050
2-Nitrotoluene	ND	0.50	ug/L	0.088
3-Nitrotoluene	ND	0.50	ug/L	0.057
4-Nitrotoluene	ND	0.50	ug/L	0.088
RDX	ND	0.10	ug/L	0.036
Tetryl	ND	0.10	ug/L	0.050
1,3,5-Trinitrobenzene	ND	0.10	ug/L	0.030
2,4,6-Trinitrotoluene	ND	0.10	ug/L	0.050

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
3,4-Dinitrotoluene	106	(84 - 125)

SpecPro Inc

Client Sample ID: MBSmw-005-0010-gw

General Chemistry

Lot-Sample #...: A5K090129-005 **Work Order #...:** HPNLD **Matrix.....:** WG
Date Sampled...: 11/08/05 10:40 **Date Received..:** 11/08/05

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Cyanide, Total	ND	0.010	mg/L	SW846 9012A	11/16/05	5320331
		Dilution Factor: 1		MDL.....: 0.0013		
Nitrocellulose	0.14 B,J	0.50	mg/L	MCAWW 353.2	11/29-12/01/05	5333468
		Dilution Factor: 1		MDL.....: 0.12		

NOTE(S):

RL Reporting Limit

B Estimated result. Result is less than RL.

J Method blank contamination. The associated method blank contains the target analyte at a reportable level.

SpecPro Inc

Client Sample ID: MBSmw-005-0010-gf

TOTAL Metals

Lot-Sample #...: A5K090129-006 Matrix.....: WG
Date Sampled...: 11/08/05 10:40 Date Received..: 11/08/05

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 5314034						
Aluminum	ND	200	ug/L	SW846 6010B	11/10-11/17/05	HPNLG1AH
		Dilution Factor: 1		MDL.....: 47.0		
Arsenic	7.3 B	10.0	ug/L	SW846 6010B	11/10-11/17/05	HPNLG1AE
		Dilution Factor: 1		MDL.....: 4.3		
Lead	ND	10.0	ug/L	SW846 6010B	11/10-11/17/05	HPNLG1AF
		Dilution Factor: 1		MDL.....: 1.7		
Antimony	ND	100	ug/L	SW846 6010B	11/10-11/17/05	HPNLG1AJ
		Dilution Factor: 1		MDL.....: 4.1		
Barium	84.0	10.0	ug/L	SW846 6010B	11/10-11/17/05	HPNLG1AK
		Dilution Factor: 1		MDL.....: 3.2		
Selenium	ND	10.0	ug/L	SW846 6010B	11/10-11/17/05	HPNLG1AG
		Dilution Factor: 1		MDL.....: 2.4		
Beryllium	ND	10.0	ug/L	SW846 6010B	11/10-11/17/05	HPNLG1AL
		Dilution Factor: 1		MDL.....: 0.30		
Cadmium	ND	10.0	ug/L	SW846 6010B	11/10-11/17/05	HPNLG1AA
		Dilution Factor: 1		MDL.....: 0.42		
Calcium	87200	1000	ug/L	SW846 6010B	11/10-11/17/05	HPNLG1AC
		Dilution Factor: 1		MDL.....: 80.0		
Chromium	ND	20.0	ug/L	SW846 6010B	11/10-11/17/05	HPNLG1AD
		Dilution Factor: 1		MDL.....: 1.6		
Cobalt	ND	20.0	ug/L	SW846 6010B	11/10-11/17/05	HPNLG1AQ
		Dilution Factor: 1		MDL.....: 1.2		
Copper	ND	20.0	ug/L	SW846 6010B	11/10-11/17/05	HPNLG1AR
		Dilution Factor: 1		MDL.....: 1.8		
Iron	359 B	1000	ug/L	SW846 6010B	11/10-11/17/05	HPNLG1AT
		Dilution Factor: 1		MDL.....: 32.0		
Magnesium	25100	1000	ug/L	SW846 6010B	11/10-11/17/05	HPNLG1AU
		Dilution Factor: 1		MDL.....: 86.0		

(Continued on next page)

SpecPro Inc

Client Sample ID: MBSmw-005-0010-gf

TOTAL Metals

Lot-Sample #...: A5K090129-006 Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Manganese	**350 J**	**100**	**ug/L**	**SW846 6010B**	**11/10-11/17/05**	**HPNLG1AV**
		Dilution Factor: 1		MDL.....: 0.23		
Nickel	ND	20.0	ug/L	SW846 6010B	11/10-11/17/05	HPNLG1AW
		Dilution Factor: 1		MDL.....: 1.4		
Potassium	**1710 B**	**5000**	**ug/L**	**SW846 6010B**	**11/10-11/17/05**	**HPNLG1AX**
		Dilution Factor: 1		MDL.....: 54.0		
Silver	ND	20.0	ug/L	SW846 6010B	11/10-11/17/05	HPNLG1AM
		Dilution Factor: 1		MDL.....: 2.1		
Sodium	**10000**	**1000**	**ug/L**	**SW846 6010B**	**11/10-11/17/05**	**HPNLG1AN**
		Dilution Factor: 1		MDL.....: 410		
Vanadium	ND	20.0	ug/L	SW846 6010B	11/10-11/17/05	HPNLG1AP
		Dilution Factor: 1		MDL.....: 1.9		
Zinc	ND	100	ug/L	SW846 6010B	11/10-11/17/05	HPNLG1A0
		Dilution Factor: 1		MDL.....: 6.6		
Mercury	ND	0.20	ug/L	SW846 7470A	11/10/05	HPNLG1A2
		Dilution Factor: 1		MDL.....: 0.090		
Thallium	ND	1.0	ug/L	SW846 6020	11/10-11/17/05	HPNLG1A1
		Dilution Factor: 1		MDL.....: 0.022		

NOTE(S):

B Estimated result. Result is less than RL.

J Method blank contamination. The associated method blank contains the target analyte at a reportable level.

SpecPro Inc

Client Sample ID: TRIP BLANK

GC/MS Volatiles

Lot-Sample #...: A5K090129-007 Work Order #...: HPNND1AA Matrix.....: WQ
Date Sampled...: 11/08/05 15:00 Date Received..: 11/08/05
Prep Date.....: 11/21/05 Analysis Date..: 11/21/05
Prep Batch #...: 5325119
Dilution Factor: 1 Method.....: SW846 8260B

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Bromochloromethane	ND	1.0	ug/L	0.24
1,2-Dibromoethane	ND	1.0	ug/L	0.24
Chloromethane	ND	1.0	ug/L	0.14
Bromomethane	ND	1.0	ug/L	0.36
Vinyl chloride	ND	1.0	ug/L	0.21
Chloroethane	ND	1.0	ug/L	0.24
Methylene chloride	**2.0 B**	**2.0**	**ug/L**	**0.19**
Acetone	**1.5 J**	**10**	**ug/L**	**0.74**
Carbon disulfide	ND	1.0	ug/L	0.28
1,1-Dichloroethene	ND	1.0	ug/L	0.18
1,1-Dichloroethane	ND	1.0	ug/L	0.21
1,2-Dichloroethene (total)	ND	1.0	ug/L	0.35
Chloroform	ND	1.0	ug/L	0.16
1,2-Dichloroethane	ND	1.0	ug/L	0.16
2-Butanone	ND	10	ug/L	0.39
1,1,1-Trichloroethane	ND	1.0	ug/L	0.21
Carbon tetrachloride	ND	1.0	ug/L	0.19
Bromodichloromethane	ND	1.0	ug/L	0.14
1,2-Dichloropropane	ND	1.0	ug/L	0.15
cis-1,3-Dichloropropene	ND	1.0	ug/L	0.12
Trichloroethene	ND	1.0	ug/L	0.28
Dibromochloromethane	ND	1.0	ug/L	0.19
1,1,2-Trichloroethane	ND	1.0	ug/L	0.22
Benzene	ND	1.0	ug/L	0.22
trans-1,3-Dichloropropene	ND	1.0	ug/L	0.17
Bromoform	ND	1.0	ug/L	0.17
4-Methyl-2-pentanone	ND	10	ug/L	0.32
2-Hexanone	ND	10	ug/L	0.35
Tetrachloroethene	ND	1.0	ug/L	0.19
1,1,2,2-Tetrachloroethane	ND	1.0	ug/L	0.22
Toluene	ND	1.0	ug/L	0.17
Chlorobenzene	ND	1.0	ug/L	0.20
Ethylbenzene	ND	1.0	ug/L	0.19
Styrene	ND	1.0	ug/L	0.13
Xylenes (total)	ND	2.0	ug/L	0.44

(Continued on next page)

SpecPro Inc

Client Sample ID: TRIP BLANK

GC/MS Volatiles

Lot-Sample #...: A5K090129-007 **Work Order #...:** HPNND1AA **Matrix.....:** WQ

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	99	(73 - 122)
1,2-Dichloroethane-d4	93	(61 - 128)
Toluene-d8	98	(76 - 110)
4-Bromofluorobenzene	84	(74 - 116)

NOTE(S):

B Method blank contamination. The associated method blank contains the target analyte at a reportable level.

J Estimated result. Result is less than RL.

SpecPro Inc

TRIP BLANK

GC/MS Volatiles

Lot-Sample #: A5K090129-007 **Work Order #:** HPNND1AA **Matrix:** WQ

MASS SPECTROMETER/DATA SYSTEM (MSDS) TENTATIVELY IDENTIFIED COMPOUNDS

PARAMETER	CAS #	ESTIMATED RESULT	RETENTION TIME	UNITS
None				ug/L

SpecPro Inc

Client Sample ID: MBSmw-001-0006-gw

GC/MS Semivolatiles

Lot-Sample #...: A5K090129-008 Work Order #...: HPNNE1AA Matrix.....: WG
Date Sampled...: 11/08/05 13:05 Date Received..: 11/08/05
Prep Date.....: 11/14/05 Analysis Date..: 11/28/05
Prep Batch #...: 5318209
Dilution Factor: 1 Method.....: SW846 8270C CWM

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
1,4-Oxathiane	ND	5.0	ug/L	0.88
1,4-Dithiane	ND	5.0	ug/L	1.0

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2-Fluorobiphenyl	84	(16 - 127)
Nitrobenzene-d5	93	(43 - 121)

SpecPro Inc

Client Sample ID: MBSmw-001-0006-gw

Trace Level Organic Compounds

Lot-Sample #...: A5K090129-008 **Work Order #...:** HPNNE1AC **Matrix.....:** WG
Date Sampled...: 11/08/05 13:05 **Date Received..:** 11/08/05
Prep Date.....: 11/18/05 **Analysis Date..:** 01/05/06
Prep Batch #...: 5322621
Dilution Factor: 1

PARAMETER	RESULT	DETECTION LIMIT	UNITS	METHOD
Thiodiglycol	ND	10	ug/L	SW846 SW8321A

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Thiodiglycol-d4	88	(50 - 120)

SpecPro Inc

Client Sample ID: MBSmw-002-0007-gw

GC/MS Semivolatiles

Lot-Sample #...: A5K090129-009 Work Order #...: HPNNG1AA Matrix.....: WG
Date Sampled...: 11/07/05 14:15 Date Received..: 11/08/05
Prep Date.....: 11/14/05 Analysis Date..: 11/28/05
Prep Batch #...: 5318209
Dilution Factor: 1 Method.....: SW846 8270C CWM

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
1,4-Oxathiane	ND	5.0	ug/L	0.88
1,4-Dithiane	ND	5.0	ug/L	1.0

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2-Fluorobiphenyl	75	(16 - 127)
Nitrobenzene-d5	93	(43 - 121)

SpecPro Inc

Client Sample ID: MBSmw-002-0007-gw

Trace Level Organic Compounds

Lot-Sample #...: A5K090129-009 Work Order #...: HPNNG1AC Matrix.....: WG
Date Sampled...: 11/07/05 14:15 Date Received..: 11/08/05
Prep Date.....: 11/18/05 Analysis Date..: 01/05/06
Prep Batch #...: 5322621
Dilution Factor: 1

PARAMETER	RESULT	DETECTION LIMIT	UNITS	METHOD
Thiodiglycol	ND	10	ug/L	SW846 SW8321A

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Thiodiglycol-d4	89	(50 - 120)

SpecPro Inc

Client Sample ID: MBSmw-003-0008-gw

GC/MS Semivolatiles

Lot-Sample #...: A5K090129-010 **Work Order #...:** HPNNH1AA **Matrix.....:** WG
Date Sampled...: 11/07/05 11:40 **Date Received..:** 11/08/05
Prep Date.....: 11/14/05 **Analysis Date..:** 11/28/05
Prep Batch #...: 5318209
Dilution Factor: 1 **Method.....:** SW846 8270C CWM

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
1,4-Oxathiane	ND	5.0	ug/L	0.88
1,4-Dithiane	ND	5.0	ug/L	1.0

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2-Fluorobiphenyl	78	(16 - 127)
Nitrobenzene-d5	90	(43 - 121)

SpecPro Inc

Client Sample ID: MBSmw-003-0008-gw

Trace Level Organic Compounds

Lot-Sample #...: A5K090129-010 Work Order #...: HPNNH1AC Matrix.....: WG
Date Sampled...: 11/07/05 11:40 Date Received..: 11/08/05
Prep Date.....: 11/18/05 Analysis Date..: 01/05/06
Prep Batch #...: 5322621
Dilution Factor: 1

PARAMETER	RESULT	DETECTION LIMIT	UNITS	METHOD
Thiodiglycol	ND	10	ug/L	SW846 SW8321A

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Thiodiglycol-d4	75	(50 - 120)

SpecPro Inc

Client Sample ID: MBSmw-004-0009-gw

GC/MS Semivolatiles

Lot-Sample #...: A5K090129-011 Work Order #...: HPNNJ1AA Matrix.....: WG
Date Sampled...: 11/07/05 12:59 Date Received..: 11/08/05
Prep Date.....: 11/14/05 Analysis Date..: 11/28/05
Prep Batch #...: 5318209
Dilution Factor: 1 Method.....: SW846 8270C CWM

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
1,4-Oxathiane	ND	5.0	ug/L	0.88
1,4-Dithiane	ND	5.0	ug/L	1.0

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2-Fluorobiphenyl	70	(16 - 127)
Nitrobenzene-d5	92	(43 - 121)

SpecPro Inc

Client Sample ID: MBSmw-004-0009-gw

Trace Level Organic Compounds

Lot-Sample #...: A5K090129-011 **Work Order #...:** HPNNJ1AC **Matrix.....:** WG
Date Sampled...: 11/07/05 12:59 **Date Received..:** 11/08/05
Prep Date.....: 11/18/05 **Analysis Date..:** 01/05/06
Prep Batch #...: 5322621
Dilution Factor: 1

PARAMETER	RESULT	DETECTION LIMIT	UNITS	METHOD
Thiodiglycol	ND	10	ug/L	SW846 SW8321A

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Thiodiglycol-d4	83	(50 - 120)

Chain of Custody Record

STL-4124 (0901)

SEVERN TRENT STL
Severn Trent Laboratories, Inc.

Client: Spec Pro	Project Manager: Chantelle Carroll	Date: 11-8-05	Chain of Custody Number: 248983
Address	Telephone Number (Area Code)/Fax Number	Lab Number	Page 1 of 1
City: Ravenna / State / Zip Code	Site Contact: Chantelle Carroll / Lab Contact		
Project Name and Location (State)	Carrier/Waybill Number		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis (Attach list if more space is needed): Exp	Pcp	SVOC	PCB/Pest	1,4dith/1,4ox	thiodiglycol	TAL Metal	Cyanide	Special Instructions/ Conditions of Receipt
MBSmw-005-0011-gw	11-8-05	1040		X			11				1		2	2	2	2	2	1		1	
MBSmw-005-0011-gf	11-8-05	1040		X					1										1		

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal
☐ Return To Client ☐ Disposal By Lab ☐ Archive For ______ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other______

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished By: Chantelle Carroll	11-8	1500	1. Received By: Al Haidet	11-8-05	1515
2. Relinquished By: A.H.	11-8-05	1738	2. Received By: Diana Mitew	11/8/05	1738
3. Relinquished By			3. Received By		

Comments

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

Chain of Custody Record

SEVERN TRENT STL
Severn Trent Laboratories, Inc.

STL-4124 (0901)

Client: SpecPro
Address:
City: Ravenna | State: | Zip Code:
Project Name and Location (State): Mustard Burial Site
Contract/Purchase Order/Quote No.:

Project Manager: Chantal DeCarroll
Telephone Number (Area Code)/Fax Number:
Site Contact: Chantal DeCarroll | Lab Contact:
Carrier/Waybill Number:

Date: 11-8-05
Lab Number:
Chain of Custody Number: 248978
Page 1 of 1

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Matrix: Aqueous	Matrix: Sed.	Matrix: Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis (Attach list if more space is needed): Exp	Pcp	SVoc	PCB/Pest	1,4 diox/1,4 oxy	thiodiglycol	TAL Metal	Cyanide	Special Instructions/ Conditions of Receipt
MBSmw-006-0012-gw	11-7-05	1515		X			11				1		2	2	2	2	2	1		1	
MBSmw-006-0012-gf	11-7-05	15:15		X					1										1		

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal: ☐ Return To Client ☐ Disposal By Lab ☐ Archive For ____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required: ☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other ____

QC Requirements (Specify):

	Date	Time		Date	Time
1. Relinquished By: Chantal DeCarroll	11-8	1500	1. Received By: Al Haidet	11-8-05	1515
2. Relinquished By: A. H.	11-8-05	1738	2. Received By: Ann Sanders	11/8/05	1738
3. Relinquished By			3. Received By		

Comments:

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

Chain of Custody Record

SEVERN TRENT STL
Severn Trent Laboratories, Inc.

STL-4124 (0901)

Client	Spec Pro
Address	
City	Ravenna
State	OH
Zip Code	
Project Name and Location (State)	Mustard Burial Site
Contract/Purchase Order/Quote No.	
Project Manager	Chantelle Carroll
Telephone Number (Area Code)/Fax Number	
Site Contact	Chantelle Carroll
Lab Contact	
Carrier/Waybill Number	
Date	11-8-05
Lab Number	
Chain of Custody Number	248982
Page	1 of 1

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis: Exp	Pep	SVOC	PCB/Pest	1,4 dithiane/1,4 oxathiane	thiodiglycol	TAL met	Cyanide	Special Instructions/ Conditions of Receipt
MBSmw-~~010~~ 005-0010-gw	11-8	1040		X			11		X		1		2	2	2	2	2	1		1	
MBSmw-005-0010-gf	11-8	1040		X					1										1		

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal
☐ Return To Client ☐ Disposal By Lab ☐ Archive For ______ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other______

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished By: Chantelle Carroll	11-8	1500	1. Received By: Al Haislet	11-8-05	1515
2. Relinquished By: A. H.	11-8-05	1738	2. Received By: Diana Mitler	11/9/05	1738
3. Relinquished By			3. Received By		

Comments

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

SEVERN TRENT **STL**
Severn Trent Laboratories, Inc.

Chain of Custody Record

STL-4124 (0901)

Client: Spec Pro	Project Manager: Chantelle Carroll	Date: 11-8-05	Chain of Custody Number: 248979
Address:	Telephone Number (Area Code)/Fax Number:	Lab Number:	Page 1 of 1
City: Ravenna / State: / Zip Code:	Site Contact: Chantelle Carroll	Lab Contact:	
Project Name and Location (State): Mustard Burial Site	Carrier/Waybill Number:		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis: Exp	Prop	SVOC	PCB/Pest	1,4dith/1,4ox	Thiodiglycol	TAL metals	Cyanide	VOC
MBSmw-006-0012-ms/msd	11-7-05	1515		X			11		1	3	1		2	2	2	2	2	1	1	1	3
MBSmw-005-0011-gw	11-8-05	1010		X						3									+		3
MBSmw-005-0010-gw	11-8-05	1040		X						3											3
MBSmw-006-0012-gw	11-7-05	1515		X						3											3
Trip Blank	11-8	1500		X						1											1

Special Instructions/Conditions of Receipt

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal: ☐ Return To Client ☐ Disposal By Lab ☐ Archive For ____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required: ☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other____

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished By: Chantelle Carroll	11-8	1500	1. Received By: Al Hazlett	11-8-05	1515
2. Relinquished By: A. H.	11-8-05	1738	2. Received By: Diana Mitev	11/9/05	1738
3. Relinquished By			3. Received By		

Comments

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

Chain of Custody Record

SEVERN TRENT STL
Severn Trent Laboratories, Inc.

STL-4124 (0901)

Client: Spec Pro	Project Manager: Chantelle Carroll	Date: 11-8-05	Chain of Custody Number: 248980
Address:	Telephone Number (Area Code)/Fax Number:	Lab Number:	Page 1 of 1
City: Ravenna / State: / Zip Code:	Site Contact: Chantelle Carroll	Lab Contact:	Analysis (Attach list if more space is needed)
Project Name and Location (State): Mustard Burial Site	Carrier/Waybill Number:		Special Instructions/ Conditions of Receipt
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	Analysis: 1,4 dioxane	1,4 dioxane	Hexadecane
MBSmw-001-0006-GW	11-8-05	1305		X			4						2	2	2
MBSmw-002-0007-GW	11-7-05	1415		X			4						2	2	2
MBSmw-003-0008-GW	11-7-05	1140		X			4						2	2	2
MBSmw-004-0009-GW	11-7-05	1257		X			4						2	2	2

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal
☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months
(A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other

QC Requirements (Specify)

1. Relinquished By: Chantelle Carroll	Date: 11-8	Time: 1530	1. Received By: Al Hardet	Date: 11-8-05	Time: 1515
2. Relinquished By: A. H.	Date: 11-8-05	Time: 1738	2. Received By: Diana Miller	Date: 11/9/05	Time: 1738
3. Relinquished By:	Date:	Time:	3. Received By:	Date:	Time:

Comments

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

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APPENDIX F

STL Cooler Receipt Form/Narrative **Lot Number:** A5K090129

North Canton Facility

Client: SPEC PRO Project: Mustard Burial Quote#: 67615

Cooler Received on: 11/8/05 Opened on: 11/9/05 by: Diana (Signature)

Fedx ☐ Client Drop Off ☐ UPS ☐ DHL ☐ FAS ☐ STL Courier ☒ MitW

Stetson ☐ US Cargo ☐ Other: _____

STL Cooler No# See back Foam Box ☐ Client Cooler ☐ Other _____

1. Were custody seals on the outside of the cooler? Yes ☒ No ☐ Intact? Yes ☒ No ☐ NA ☐
   If YES, Quantity 10
   Were the custody seals signed and dated? Yes ☒ No ☐ NA ☐
2. Shipper's packing slip attached to this form? Yes ☒ No ☐ NA ☐
3. Did custody papers accompany the samples? Yes ☒ No ☐ Relinquished by client? Yes ☒ No ☐
4. Did you sign the custody papers in the appropriate place? Yes ☒ No ☐
5. Packing material used: Bubble Wrap ☒ Foam ☒ None ☐ Other : _____
6. Cooler temperature upon receipt _____ °C (see back of form for multiple coolers/temp)

METHOD: Temp Vial ☐ Coolant & Sample ☐ Against Bottles ☐ IR ☒ ICE/H_2O Slurry ☐

COOLANT: Wet Ice ☒ Blue Ice ☐ Dry Ice ☐ Water ☐ None ☐

7. Did all bottles arrive in good condition (Unbroken)? Yes ☒ No ☐
8. Could all bottle labels and/or tags be reconciled with the COC? Yes ☒ No ☐
9. Were samples at the correct pH? (record below/on back) Yes ☒ No ☐ NA ☐
10. Were correct bottles used for the tests indicated? Yes ☒ No ☐
11. Were air bubbles >6 mm in any VOA vials? Yes ☐ No ☒ NA ☐
12. Sufficient quantity received to perform indicated analyses? Yes ☒ No ☐
13. Was a Trip Blank present in the cooler? Yes ☒ No ☐ Were VOAs on the COC? Yes ☒ No ☐
14. Does the trip blank number match the cooler number in which it was received? Yes ☐ No ☒ NA ☐

Contacted PM _____ Date: _____ by: _____ via Voice Mail ☐ Verbal ☐ Other ☐

Concerning: _____

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1. CHAIN OF CUSTODY

The following discrepancies occurred:

2. SAMPLE CONDITION

Sample(s) _____ were received after the recommended holding time had expired.

Sample(s) _____ were received in a broken container.

3. SAMPLE PRESERVATION

Sample(s) _____ were further preserved in sample receiving to meet recommended pH level(s). *Nitric Acid Lot # 091305-HNO3; Sulfuric Acid Lot # 041305-H2SO4; Sodium Hydroxide Lot # -041305 -NaOH; Hydrochloric Acid Lot # 100504-HCl; Sodium Hydroxide and Zinc Acetate Lot # 071604-CH3COO2ZN/NaOH*

Sample(s) _____ were received with bubble > 6 mm in diameter (cc: PM)

4. Other (see below or back)

Client ID	pH	Date	Initials
0011-gf	<2	11/9/05	DM
0012-gf	<2 <2	"	"
0010-gf	<2	"	"

SOP: NC-SC-0005, Sample Receiving
N:\QAQC\NARRATIVS\STL\Cooler Receipt STL\COOLER_STL_Rev 51 092005.doc

STL Cooler Receipt Form/Narrative
North Canton Facility

Client ID	pH	Date	Initials

Cooler	Temp	Method	Coolant
L28	1.0°C	IR	ICE
K740	3.4°C	↓	↓
L99	2.2°C		
K962	2.6°C		
L56	2.5°C		

Discrepancies Cont.

SOP: NC-SC-0005, Sample Receiving
N:\QAQC\NARRATIV\STL\Cooler Receipt STL\COOLER_STL_Rev 51 092005.doc

ANALYTICAL REPORT

PROJECT NO. 0000341

MUSTARD BURIAL SITE

Lot #: A6A160120

Chantelle Carrol

SpecPro Inc
8451 State Route 5
Ravenna, OH 44266

SEVERN TRENT LABORATORIES, INC.

Frank J. Calovini
Project Manager

February 2, 2006

EXECUTIVE SUMMARY - Detection Highlights

A6A160120

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
NO DETECTABLE PARAMETERS				

ANALYTICAL METHODS SUMMARY

A6A160120

PARAMETER	ANALYTICAL METHOD
LCMS by SW8321A SW8321A	SW846 SW8321A

References:

SW846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

SAMPLE SUMMARY

A6A160120

WO #	SAMPLE#	CLIENT SAMPLE ID	SAMPLED DATE	SAMP TIME
HVN85	001	MBSMW-001-0013-GW	01/13/06	10:57
HVN9E	002	MBSMW-002-0014-GW	01/13/06	12:33
HVN9H	003	MBSMW-003-0015-GW	01/13/06	15:10
HVN94	004	MBSMW-004-0016-GW	01/13/06	14:17
HVN96	005	MBSMW-005-0017-GW	01/13/06	11:53
HVN97	006	MBSMW-005-0018-GW	01/13/06	11:53
HVN98	007	MBSMW-006-0019-GW	01/13/06	12:47

NOTE(S):

- The analytical results of the samples listed above are presented on the following pages.
- All calculations are performed before rounding to avoid round-off errors in calculated results.
- Results noted as "ND" were not detected at or above the stated limit.
- This report must not be reproduced, except in full, without the written approval of the laboratory.
- Results for the following parameters are never reported on a dry weight basis: color, corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test, pH, porosity pressure, reactivity, redox potential, specific gravity, spot tests, solids, solubility, temperature, viscosity, and weight.

SpecPro Inc

Client Sample ID: MBSMW-001-0013-GW

Trace Level Organic Compounds

Lot-Sample #...: A6A160120-001 **Work Order #...:** HVN851AA **Matrix.....:** WG
Date Sampled...: 01/13/06 10:57 **Date Received..:** 01/14/06
Prep Date.....: 01/26/06 **Analysis Date..:** 01/27/06
Prep Batch #...: 6026357
Dilution Factor: 1

PARAMETER	RESULT	DETECTION LIMIT	UNITS	METHOD
Thiodiglycol	ND	10	ug/L	SW846 SW8321A

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Thiodiglycol-d8	85	(50 - 120)

SpecPro Inc

Client Sample ID: MBSMW-002-0014-GW

Trace Level Organic Compounds

Lot-Sample #...: A6A160120-002 Work Order #...: HVN9E1AA Matrix.....: WG
Date Sampled...: 01/13/06 12:33 Date Received..: 01/14/06
Prep Date.....: 01/26/06 Analysis Date..: 01/27/06
Prep Batch #...: 6026357
Dilution Factor: 1

PARAMETER	RESULT	DETECTION LIMIT	UNITS	METHOD
Thiodiglycol	ND	10	ug/L	SW846 SW8321A

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Thiodiglycol-d8	89	(50 - 120)

SpecPro Inc

Client Sample ID: MBSMW-003-0015-GW

Trace Level Organic Compounds

Lot-Sample #...: A6A160120-003 Work Order #...: HVN9H1AA Matrix.....: WG
Date Sampled...: 01/13/06 15:10 Date Received..: 01/14/06
Prep Date.....: 01/26/06 Analysis Date..: 01/27/06
Prep Batch #...: 6026357
Dilution Factor: 1

PARAMETER	RESULT	DETECTION LIMIT	UNITS	METHOD
Thiodiglycol	ND	10	ug/L	SW846 SW8321A

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Thiodiglycol-d8	88	(50 - 120)

SpecPro Inc

Client Sample ID: MBSMW-004-0016-GW

Trace Level Organic Compounds

Lot-Sample #...: A6A160120-004 Work Order #...: HVN941AA Matrix.....: WG
Date Sampled...: 01/13/06 14:17 Date Received..: 01/14/06
Prep Date.....: 01/26/06 Analysis Date..: 01/27/06
Prep Batch #...: 6026357
Dilution Factor: 1

PARAMETER	RESULT	DETECTION LIMIT	UNITS	METHOD
Thiodiglycol	ND	10	ug/L	SW846 SW8321A

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Thiodiglycol-d8	88	(50 - 120)

SpecPro Inc

Client Sample ID: MBSMW-005-0017-GW

Trace Level Organic Compounds

Lot-Sample #...: A6A160120-005 Work Order #...: HVN961AA Matrix.....: WG
Date Sampled...: 01/13/06 11:53 Date Received..: 01/14/06
Prep Date.....: 01/26/06 Analysis Date..: 01/27/06
Prep Batch #...: 6026357
Dilution Factor: 1

PARAMETER	RESULT	DETECTION LIMIT	UNITS	METHOD
Thiodiglycol	ND	10	ug/L	SW846 SW8321A

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Thiodiglycol-d8	88	(50 - 120)

SpecPro Inc

Client Sample ID: MBSMW-005-0018-GW

Trace Level Organic Compounds

Lot-Sample #...: A6A160120-006 Work Order #...: HVN971AA Matrix.....: WG
Date Sampled...: 01/13/06 11:53 Date Received..: 01/14/06
Prep Date.....: 01/26/06 Analysis Date..: 01/27/06
Prep Batch #...: 6026357
Dilution Factor: 1

PARAMETER	RESULT	DETECTION LIMIT	UNITS	METHOD
Thiodiglycol	ND	10	ug/L	SW846 SW8321A

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Thiodiglycol-d8	94	(50 - 120)

SpecPro Inc

Client Sample ID: MBSMW-006-0019-GW

Trace Level Organic Compounds

Lot-Sample #...: A6A160120-007 **Work Order #...:** HVN981AA **Matrix.....:** WG
Date Sampled...: 01/13/06 12:47 **Date Received..:** 01/14/06
Prep Date.....: 01/26/06 **Analysis Date..:** 01/27/06
Prep Batch #...: 6026357
Dilution Factor: 1

PARAMETER	RESULT	DETECTION LIMIT	UNITS	METHOD
Thiodiglycol	ND	10	ug/L	SW846 SW8321A

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Thiodiglycol-d8	87	(50 - 120)

Chain of Custody Record

SEVERN TRENT STL

Severn Trent Laboratories, Inc.

STL-4124 (0901)

Client	Project Manager	Date	Chain of Custody Number
Spec Pro	Chantelle Carroll	1-13-06	230993
Address	**Telephone Number (Area Code)/Fax Number**	**Lab Number**	**Page 1 of 1**
8451 St Rt 5 (RVAAP)	330-358-1753		
City / **State** / **Zip Code**	**Site Contact**	**Lab Contact**	
Ravenna / OH / 44266	Chantelle Carroll		
Project Name and Location (State)	**Carrier/Waybill Number**		
RVAAP Mustard Burial Site			
Contract/Purchase Order/Quote No.			
* Check w/Frank Calovini for any questions			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H_2SO_4	HNO_3	HCl	NaOH	ZnAc/NaOH	Analysis: Thiodiglycol 10w	Special Instructions/ Conditions of Receipt
MBSmw-001-0013-gw	1-13	1057		X			X						1	
MBSmw-002-0014-gw	1-13	1233		X			X						1	
MBSmw-003-0015-gw	1-13	1510		X			X						1	
MBSmw-004-0016-gw	1-13	1417		X			X						1	
MBSmw-005-0017-gw	1-13	1153		X			X						1	
MBSmw-005-0018-gw	1-13	1153		X			X						1	
MBSmw-006-0019-gw	1-13	1247		X			X						1	
MBSmw-006-0019-~~MS/MSD~~	1-13	1247		X			X						1	
temp blank														
IDW rinse water	1-13	1700		X			X						3	
(3-one gallon containers)														

Possible Hazard Identification

☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal

☐ Return To Client ☒ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required

☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other _____

QC Requirements (Specify)

1. Relinquished By	Date	Time	1. Received By	Date	Time
Chantelle Carroll	1-13	1715	Erik Pietrzak	1-13-06	1715
2. Relinquished By	Date	Time	2. Received By	Date	Time
Erik Pietrzak	1-13-05	1855	Rebecca L. Shutt	1-13-06	1855
3. Relinquished By	Date	Time	3. Received By	Date	Time
			Lisa Harris	1-14-06	8:00

Comments

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

APPENDIX F

STL Cooler Receipt Form/Narrative Lot Number: 160120
North Canton Facility

Client: Spec Pro Project: Ravenna Army Arsenal Quote#:
Cooler Received on: 1-13-06 Opened on: 1-14-06 by: Lisa Hnig (Signature)
Fedx ☐ Client Drop Off ☐ UPS ☐ DHL ☐ FAS ☐ STL Courier ☒
Stetson ☐ US Cargo ☐ Other:
STL Cooler No# NO # Foam Box ☐ Client Cooler ☐ Other

1. Were custody seals on the outside of the cooler? Yes ☐ No ☒ Intact? Yes ☐ No ☐ NA ☒
   If YES, Quantity
   Were the custody seals signed and dated? Yes ☐ No ☐ NA ☒
2. Shipper's packing slip attached to this form? Yes ☐ No ☐ NA ☒
3. Did custody papers accompany the samples? Yes ☒ No ☐ Relinquished by client? Yes ☒ No ☐
4. Did you sign the custody papers in the appropriate place? Yes ☒ No ☐
5. Packing material used: Bubble Wrap ☒ Foam ☐ None ☐ Other :
6. Cooler temperature upon receipt 3.9 °C (see back of form for multiple coolers/temp)

METHOD: Temp Vial ☐ Coolant & Sample ☐ Against Bottles ☐ IR ☒ ICE/H_2O Slurry ☐
COOLANT: Wet Ice ☒ Blue Ice ☐ Dry Ice ☐ Water ☐ None ☐

7. Did all bottles arrive in good condition (Unbroken)? Yes ☒ No ☐
8. Could all bottle labels and/or tags be reconciled with the COC? Yes ☒ No ☐
9. Were samples at the correct pH? (record below/on back) Yes ☐ No ☐ NA ☒
10. Were correct bottles used for the tests indicated? Yes ☒ No ☐
11. Were air bubbles >6 mm in any VOA vials? Yes ☐ No ☐ NA ☒
12. Sufficient quantity received to perform indicated analyses? Yes ☒ No ☐
13. Was a Trip Blank present in the cooler? Yes ☐ No ☒ Were VOAs on the COC? Yes ☐ No ☒
14. Does the trip blank number match the cooler number in which it was received? Yes ☐ No ☐ NA ☒

Contacted PM _____ Date: _____ by: _____ via Voice Mail ☐ Verbal ☐ Other ☐
Concerning: _____

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	1. CHAIN OF CUSTODY
	The following discrepancies occurred: IDW rinse water was disposed per client request.
	2. SAMPLE CONDITION
	Sample(s) _____ were received after the recommended holding time had expired.
	Sample(s) _____ were received in a broken container.
	3. SAMPLE PRESERVATION
	Sample(s) _____ were further preserved in sample receiving to meet recommended pH level(s). *Nitric Acid Lot # 100405-HNO3; Sulfuric Acid Lot # 100405-H2SO4; Sodium Hydroxide Lot # -100405 -NaOH; Hydrochloric Acid Lot # 100504-HCl; Sodium Hydroxide and Zinc Acetate Lot # 071604-CH3COO2ZN/NaOH*
	Sample(s) _____ were received with bubble > 6 mm in diameter (cc: PM)
	4. Other (see below or back)

Client ID	pH	Date	Initials