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July 28, 2006

SUBJECT: Final Work Plan Predesign Investigations at Landfill 6, Building 817/WSA, Building 775, and AOC 9

1. Enclosed please find the Final Work Plan Predesign Investigations at Landfill 6, Building 817/WSA, Building 775, and AOC 9 dated July 2006.

2. As discussed in the May kickoff meeting, this document is being provided for informational purposes. If you have any questions or concerns, please contact Cathy Jerrard at (315)330-3371.

MICHAEL F. MCDERMOTT
BRAC Environmental Coordinator

Attachment: As Noted

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Final Work Plan
Predesign Investigations at Landfill 6, Building 817/WSA, Building 775, and AOC 9

Former Griffiss Air Force Base
Rome, New York

Contract No. W912DQ-06-D-0012

July 2006

Prepared for:

U.S. ARMY CORPS OF ENGINEERS
Kansas City District
601 East 12th Street
Kansas City, Missouri 64106

Prepared by:

ECOLOGY AND ENVIRONMENT ENGINEERING P.C.
368 Pleasant View Drive
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Certificate of Compliance

Final Work Plan Predesign Investigations at Landfill 6, Building 817/WSA, Building 775, and AOC 9

July 2006

On behalf of Ecology and Environment Engineering, P.C. (EEEPC), the undersigned certify that the attached document(s) were developed in conformance with EEEPC's Scope of Work, contract requirements and further, that the work was performed in accordance with acceptable standards of engineering and scientific practice.

Marcia M. Galloway — 7/28/06

Quality Control Manager (or designee) — Date

Timothy J. Brady — 7/28/06

Program Manager (or designee) — Date

Robert A. Meyers — 7/28/06

Project Manager (or designee) — Date

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List of Abbreviations and Acronyms

AOC	area of concern
ASTM	American Society of Testing Materials
BGS	below ground surface
CB	chlorobenzene
DCE	dichloroethene
DO	dissolved oxygen
DOT	Department of Transportation
ECD	electron capture detector
EEEPC	Ecology and Environment Engineering, p.c.
ELAP	Environmental Laboratory Accreditation Program
ERDC	United States Army Engineer Research and Development Center
ERPIMS	Environmental Resources Program Information Management System
FID	flame ionization detector
ft	feet
gal	gallons
Griffiss AFB	former Griffiss Air Force Base
HTRW	hazardous, toxic, and radioactive waste
ID	inner diameter
IDW	investigation-derived waste
LF6	Landfill 6
LIMS	Laboratory Information Management System
MIP	membrane interface probe

List of Abbreviations and Acronyms (cont.)

mL/min	milliliters per minute
NELAP	National Environmental Laboratory Accreditation Program
NTU	nephelometric turbidity units
NYSDEC	New York State Department of Environmental Conservation
OBGW	On-Base Groundwater
ORP	oxidation reduction potential
PCE	perchloroethene (tetrachloroethene)
PID	photoionization detector
POC	point of contact
ppb	parts per billion
ppm	parts per million
QA	quality assurance
QC	quality control
SOP	standard operating procedure
STL	Severn-Trent Laboratories
TAGM	Technical and Administrative Guidance Memorandum
TCA	trichloroethane
TCE	trichloroethene
TCLP	toxicity characteristic leaching procedure
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
VC	vinyl chloride
VOC	volatile organic compound
WSA	Weapons Storage Area

1 Introduction

Ecology and Environment Engineering, P.C. (EEEPC), together with Parsons Infrastructure and Technology Group, Inc., under contract to the United States Army Corps of Engineers (USACE), Kansas City District, Contract No. W912DQ-06-D-0012, will perform Predesign Investigations at the following On-Base Groundwater (OBGW) Areas of Concern (AOCs) at the former Griffiss Air Force Base (Griffiss AFB) in Rome, New York: Landfill 6 (LF6), Building 817/Weapons Storage Area (WSA), AOC 9, and Building 775/Pumphouse 3.

1.1 Purpose of Investigation

Predesign investigations are being conducted at these four sites in order to better define suspected contaminant source areas for potential excavation (AOC 9 and Building 817/WSA), better define the contaminant plumes, and monitor groundwater remediation efforts (performance monitoring wells). This information will then be used in the remedial designs for each site with the ultimate objective of achieving Response Complete or Remedy in Place determinations at each site.

1.2 Site Description and Groundwater Contamination Summary

1.2.1 Landfill 6

The Landfill 6 site plume is located downgradient to the west of the former Landfill 6. The most contaminated portion of the plume is located southwest of the landfill beneath the floodplain of Three Mile Creek. There is no evidence that volatile organic compound (VOC) contaminants have migrated to the creek. The contaminants exceeding New York State Department of Environmental Conservation (NYSDEC) Class GA Groundwater Standards are trichlorothene (TCE), dichlorothene (DCE) and vinyl chloride (VC). In March 2004, the maximum TCE concentration was 2,140 parts per billion (ppb) and the maximum DCE concentration was 346 ppb. Both of these maximums were detected in wells located within a 1,600-square-foot area centered around well LF6MW-12. Figure 1-1 illustrates the total VOC concentrations exceeding 5 and 50 ppb in the LF6 plume based on historical and 2004 monitoring data.

Hot spot remediation at the site will focus on the area of the plume exceeding 500 ppb total VOCs. The goal of the hotspot treatment will be to reduce total VOC concentrations to less than 50 ppb as a result of both biodegradation and removal in the pump and treat system. Interpretation of total VOC concentrations in excess of 500 ppb is difficult at this site; therefore, this predesign investigation will include the installation of additional wells to better define the areal extent of the hot spot surrounding well LF6MW-12.

The contaminated aquifer is comprised of silty sands with an average saturated thickness extending from 19 feet below ground surface (BGS) to 80 feet BGS, where shale bedrock is encountered. Contamination is not found in the bedrock. Due to a flat gradient, groundwater velocities at this site are extremely slow and have been estimated at less than four feet per year. In general, the direction of groundwater flow at the site is southwest. Groundwater studies at the site found relatively aerobic conditions and low dissolved organic carbon within the TCE/DCE plume. The cis-1,2 DCE present in the plume may have been formed many years ago when the TCE degraded in the presence of landfill organics. There is no evidence that reductive dechlorination is occurring in the plume.

1.2.2 Building 817/Weapons Storage Area (WSA)

The Building 817/WSA site is located on the north side of the main runway between Building 817 and the culverted section of Six Mile Creek south of the former WSA. Building 817 was once used for electronics parts maintenance, and TCE and perchloroethene (PCE) were solvents used in small quantities at this location. The contaminants exceeding NYSDEC Class GA Groundwater Standards are TCE and PCE. In September 2004, the maximum TCE concentration was 90 ppb and the maximum PCE concentration was 72 ppb. Site groundwater flows south toward the culverted section of Six Mile Creek. The contaminated aquifer is composed of relatively uniform fine sands that begin 5 feet BGS and extend to shale bedrock at approximately 20 to 25 feet BGS. Contamination is not found in the bedrock. Groundwater velocities at this site have been estimated as high as 110 feet per year. In September 2004, a TCE concentration of 90 ppb was detected in downgradient well WSAVMW-17. Although there is no indication that the plume has migrated to Six Mile Creek, the level of contamination at WSAVMW-17 does indicate the potential for additional migration. Figure 1-2 illustrates the September 2004 total volatile organic levels in groundwater. The TCE/PCE plume does not contain other petroleum-based organics to stimulate reductive dechlorination. There is no significant cis-1,2-DCE in the plume, indicating that reductive dechlorination is not occurring.

1.2.3 AOC 9

AOC 9 is a grass-covered area located on the north side of the main runway between the former WSA and Six Mile Creek. From 1943 to 1957, this area was used as a base landfill. Much of the landfill material was removed from the area in the 1950s as the WSA was constructed. The primary contaminant exceeding NYSDEC Class GA Groundwater Standards at this site is chlorobenzene (CB), with 1,2-dichlorbenzene, 1,4-dichlorobenzene, PCE, TCE, DCE and VC also exceeding Class GA Groundwater Standards by at least one order of magnitude.

The presence of cis-1,2 DCE and VC at increasing concentrations in the downgradient portion of the plume indicates that some reductive dechlorination of PCE and/or TCE is occurring. In September 2004, the maximum CB concentration of 1,320 ppb was recorded in Geoprobe Well GP44S2, which is located approximately 100 feet north of Perimeter Road. The source of VOC contamination remains unknown. Contaminated groundwater at the site flows southwest from the corner of the WSA toward an open section of Six Mile Creek. Based on groundwater monitoring wells installed on either side of Six Mile Creek, some of the CB contaminated groundwater is discharging to the creek and has also migrated beneath the creek. Because CB is highly soluble and mobile in groundwater, this compound is the most widespread contaminant at the site. Figure 1-3 illustrates the September 2004 total VOC levels in groundwater.

The contaminated aquifer north of Perimeter Road is composed of silty-fine sands and coarse sands with discontinuous gravel seams. North of Perimeter Road, the aquifer is found in an interval from 10-25 feet BGS. South of Perimeter Road there is less overburden and the aquifer extends from one to 18 feet BGS. Shale bedrock underlies the aquifer, but contamination has not been detected in the bedrock. Groundwater velocities at this site have been estimated at 3,000 to 5,100 feet per year. Although the source of CB contamination at this site has never been identified, it is likely that a source exists in the unsaturated and/or saturated zone north of Perimeter Road. This would explain why CB concentrations remain above 1,000 ppb in an aquifer that is flowing so rapidly through sands and gravels.

1.2.4 Building 775/Pumphouse 3

The Building 775 plume is located downgradient to the south of former maintenance facilities in Building 774 and 776, and former fuel pump house Building 775. Although the source has not been identified, solvent use in Building 775 was thought to be a primary source of TCE contamination. Solvent use was widespread in these facilities in the 1950s, 1960s and early 1970s. Figure 1-4 illustrates the extent of VOC contamination downgradient of this maintenance area. The primary contaminant exceeding NYSDEC Class GA Groundwater Standards is TCE with minor detections of 1,1,1-trichloroethane (TCA) and PCE. Monitoring well 775VMW-5, located near the corner of Building 776, is the only well in the maintenance area that contains significant levels of TCE (99 ppb in September 2004). Most of the Building 775 plume appears to have migrated south toward Landfill 6. In September 2004, the maximum TCE concentration was 134 ppb (detected at well 775MW-20, located near the leading edge of the plume near Perimeter Road). TCE was detected at 132 ppb in well 775VMW-10, which is also located near the leading edge of the plume near Perimeter Road. TCE in both of these wells was detected in the bottom half of the sandy aquifer in screened intervals from 88 to 120 feet BGS. Nearby well LF6MW-1 is screened in the upper 10 feet of the aquifer and does not have detectable concentrations of TCE. Based on the current TCE distribution, it appears that the TCE was likely spilled in the upgradient maintenance area and has migrated southward and downward in the aquifer.

The contaminated aquifer is comprised of silty sands with an average thickness extending from 60 feet BGS to 120 feet BGS where shale bedrock is encountered. Due to a relatively flat gradient, average groundwater velocities at this site are slow and have been estimated at approximately 10 feet per year. Higher velocities may exist in discontinuous seams of coarse sand and gravel. Contamination is not found in the bedrock. Groundwater studies at nearby Landfill 6 TCE site found relatively aerobic conditions and low dissolved organic carbon concentrations. The general absence of cis-1,2 DCE in the Building 775 plume confirms that reductive dechlorination is not occurring.

1.3 Proposed Remedial Design Summary

The following subsections briefly describe the proposed remedial actions to be implemented at each of the sites. PDI tasks presented in this document will support full scale remedial actions. Designs will be finalized and described in detail in a future submittal.

1.3.1 Landfill 6

Groundwater extraction and treatment, as described in the Final FS (E & E 2005), will be combined with a hot spot reduction using an in situ bioreactor to accelerate VOC concentration reduction in the groundwater plume at this site. Groundwater will be extracted from three wells at a rate of 5 gallons per minute (gpm) each (for a total of 15 gpm) and treated at a nearby on-site treatment facility (discharges from this site may be combined with flows from the Building 775 site at a centrally located treatment building). The wells will be located near Six Mile Creek and within the estimated 50 ppb total VOC contour interval. The in situ bioreactor will be created by increasing and sustaining a high level of dissolved organic carbon in the groundwater contaminated with greater than 500 ppb of total VOCs via several injection points located upgradient of the 500 ppb hot spot and the groundwater extraction system. No DCE or VC will migrate from the site because it will be captured and treated in the downgradient extraction system. Each vegetable oil injection will dissolve over a two- to three-year period creating continuous biological reduction of VOCs downgradient of the injection points. The combination of upgradient organic injections and downgradient extraction will create an in situ bioreactor within the 500 ppb hot spot. Operation of the extraction wells and performance monitoring is estimated to occur over 10 years. Long-term monitoring will be performed during 10 years beyond the operation of the pump and treat system.

1.3.2 Building 817/WSA

During this PDI, if source area hot spots are identified (through a subsurface investigation), they will be excavated. A two-step groundwater remediation approach is proposed for this site using enhanced reductive dechlorination followed by air sparging to both volatilize and aerobically-degrade DCE and VC residuals.

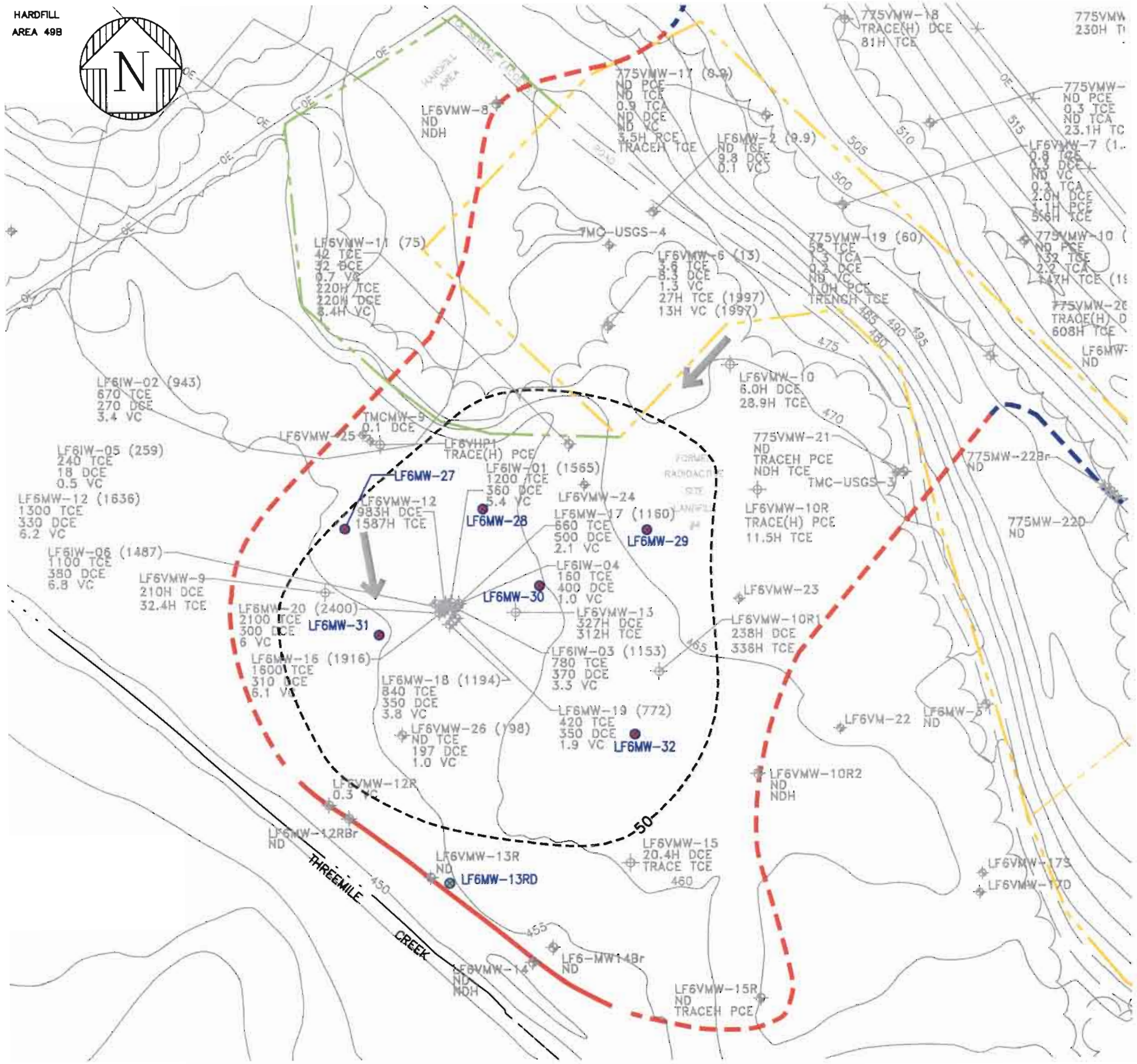
Enhanced reductive dechlorination will be accomplished with one injection of a vegetable oil/lactate emulsion in several rows/direct push injection points located in the suspected source area north of Perimeter Road as well as another row/points for the plume south of Perimeter Road. Unlike the short reaction time of oxidation injections, which only impact the contaminants within a few feet of the injection points, vegetable oil has the advantage of a delayed breakdown over a two- to three-year period creating long-term biological reduction of VOCs downgradient of the injection points. Given the relatively low concentrations of TCE and PCE in this plume, reductive dechlorination can be expected in two to three years. The second step of groundwater treatment will include a 150-foot line of air sparging wells constructed downgradient of well WSA-MW17, if needed. The purpose of this sparging wall will be to remove any residual daughter products such as cis-1,2 DCE and VC from the aquifer through volatilization and the addition of oxygen at the leading edge of the plume. This remedy will also ensure protection of Six Mile Creek. Using four existing and six new wells, performance and long-term monitoring is expected to be performed for a total of 10 to 15 years.

1.3.3 AOC 9

During this PDI, if source area hot spots are identified (through a subsurface investigation), they will be excavated. As described in the Final FS (E & E 2004), in-situ chemical oxidation using Fenton's Reageant will be used to treat the groundwater plume at this site. Approximately 350 injection points and two injections will be advanced at this site within the current 100 ppb chlorobenzene plume. The injections will be spaced appropriately to allow for refocusing of injections in remaining hot spots. Performance monitoring is expected to be performed using four new wells and seven existing wells; long-term monitoring will be performed using a total of nine wells. Monitoring is anticipated to extend for 10 years beyond the final oxidation injection.

1.3.4 Building 775/Pumphouse 3

The proposed remedy at this site will include a system of five extraction wells. Two wells will be located near Perimeter Road and screened from 80 feet bgs to bedrock to collect and treat the TCE-contaminated water in the lower portion of the aquifer. The three wells located up the centerline of the plume will be screened from approximately 60 to 100 feet bgs to collect TCE from the upper and central depths of the plume. This configuration would maximize TCE mass removal from the 50 ppb core of the plume. An extraction rate of 6 gpm per well is proposed, for a total of 30 gpm. Extracted groundwater from nearby Landfill 6 may be combined with flows from this site at a nearby centrally located treatment building. Operation of the extraction wells and performance monitoring is estimated to occur over 10 years. Long-term monitoring will be performed 10 years beyond the operation of the pump and treat system.



LEGEND

LF6MW-20	LANDFILL 6/BUILDING 775 OVERBURDEN MONITORING WELL SAMPLED IN 2004
LF6MW-12BR	LANDFILL 6/BUILDING 775 BEDROCK MONITORING WELL SAMPLED IN 2004
	EXISTING MONITORING WELL NOT SAMPLED
775MW-23 1.9H PCE	H= HIGHEST LEVEL OF HYDROPUNCH CONTAMINANTS OF CONCERN (i.e., CHLORINATED SOLVENTS) IN PARTS PER BILLION (PPB). SAMPLE RESULTS ARE FROM SPRING 2000, UNLESS INDICATED OTHERWISE.
OE	OVERHEAD ELECTRIC
505	TOPOGRAPHIC CONTOUR LINE (CONTOUR INTERVAL = 5 FT)
	HARDFILL AREA
	LANDFILL BOUNDARY
	APPROXIMATE BOUNDARY OF B775 PLUME IN 2000 (DASHED WHERE INFERRED)
	APPROXIMATE BOUNDARY OF LF6 PLUME IN 2000 (DASHED WHERE INFERRED)
	MONITORING WELL TOTAL CHLORINATED VOC GROUNDWATER DATA IN ug/L FROM 2004
	DIRECTION OF GROUNDWATER FLOW
	NEW PRE-DESIGN MONITORING WELL
	NEW PERFORMANCE MONITORING WELL
DCE	cis-DICHLOROETHENE
ND	NOT DETECTED
PCE	TETRACHLOROETHENE
TCA	1,1,1 TRICHLOROETHANE
TCE	TRICHLOROETHENE
VC	VINYL CHLORIDE

150 0 150 300

SCALE: 1"=150'

GRIFFISS AFB OBGW SITES
LANDFILL 6 TCE SITE
ROME, NEW YORK

Prepared by:

parsons

FPM group

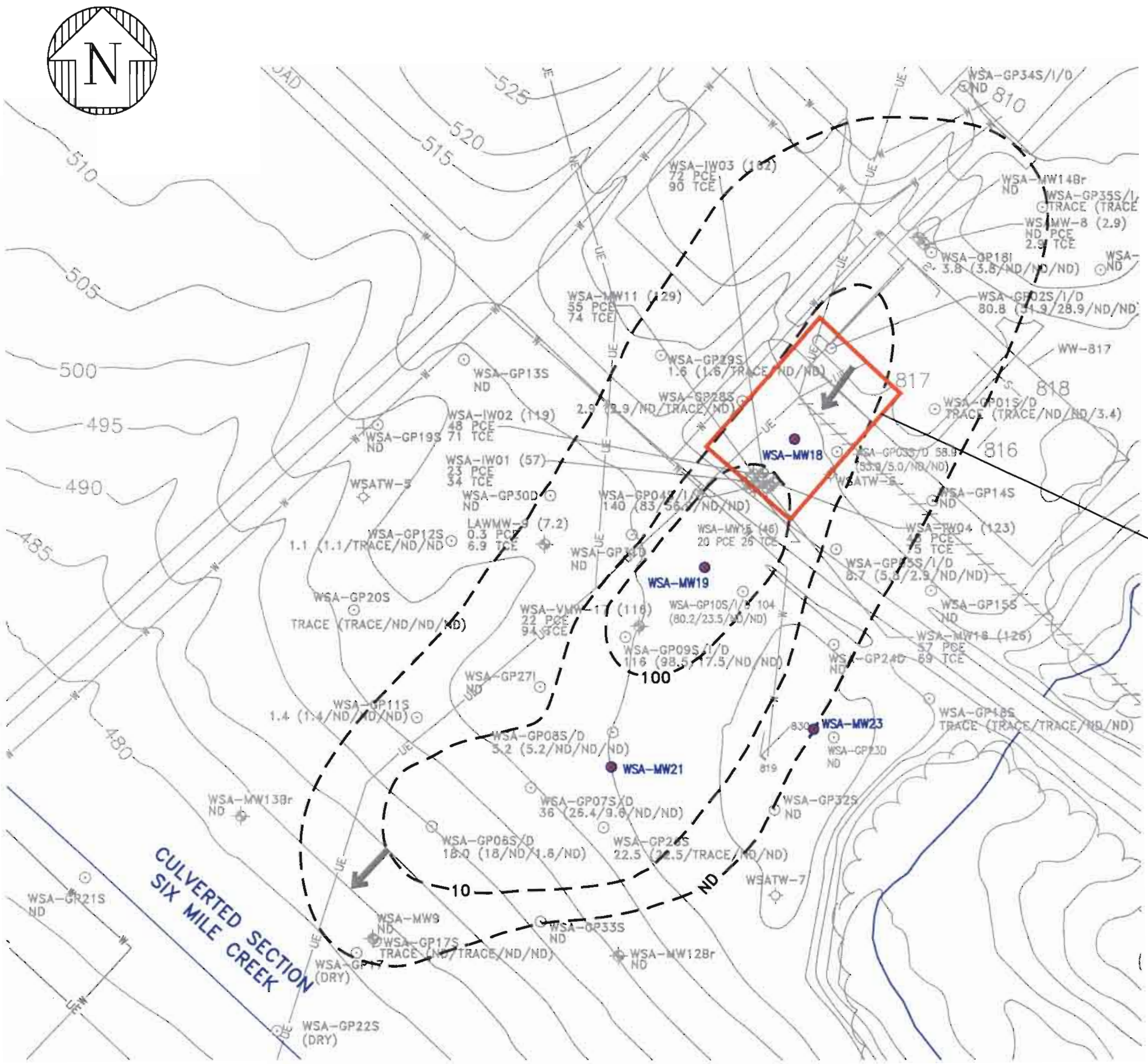
In Association with:

ecology and environment engineering p.c.

DRAWING TITLE:

LANDFILL 6
PREDESIGN INVESTIGATION MAP

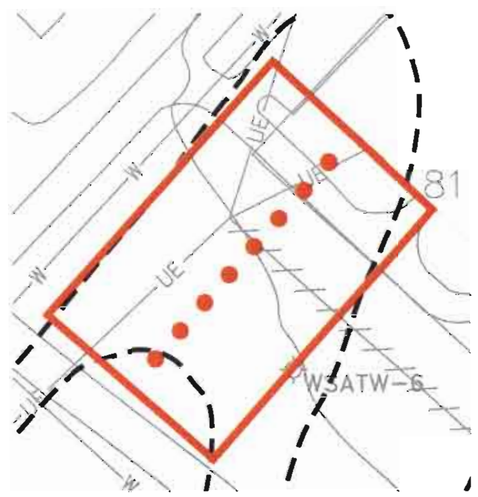
FIGURE 1-1



INVESTIGATION MAP
SCALE: 1" = 150'

150 0 150 300

SCALE: 1"=150'



INSET A
SCALE: 1" = 100'

NOTE:
INITIAL ROW OF MIP SAMPLE POINTS SHOWN. ADDITIONAL ROWS WILL BE POSITIONED PERPENDICULAR TO GROUNDWATER FLOW AND SPACING WILL BE VARIED BASED ON THE RESULTS OF THE PREVIOUS POINTS TO CLOSE IN ON POTENTIAL SOURCE AREAS.

SEE INSET A ON THIS SHEET FOR LOCATION OF INITIAL SAMPLING LOCATIONS

LEGEND

WSAMW-8	OVERBURDEN MONITORING WELL SAMPLED IN 2004
WSA-MW14Br	BEDROCK MONITORING WELL SAMPLED IN 2004
	EXISTING WELL
	SUPPLEMENTAL INVESTIGATION TEMPORARY WELL LOCATION
WSA-GP104S/I/D 140 (83/56.9/ND/ND)	YEAR 2000 GEOPROBE GROUNDWATER SAMPLING LOCATIONS WITH TOTAL OF HIGHEST CHLORINATED ETHENES IN ug/L. VALUES IN ( ) REPRESENT HIGHEST CONCENTRATION OF TCE/PCE/cis-1,2 DCE/VC, RESPECTIVELY, FROM EITHER THE SHALLOW, INTERMEDIATE, OR DEEP SAMPLE AT THE LOCATION INDICATED.
	DIRECTION OF GROUNDWATER FLOW
X	FENCE
510	TOPOGRAPHIC CONTOUR LINE (CONTOUR INTERVAL = 5 FT)
UE	UNDERGROUND ELECTRIC
W	WATER LINE
S	SANITARY SEWER
OE	OVERHEAD ELECTRIC
	ABANDONED UNDERGROUND ELECTRIC
ND	NOT DETECTED
TRACE	DETECTED BELOW PRACTICAL QUANTITATION LIMIT OF 1 ug/L
TCE	TRICHLOROETHENE
PCE	TETRACHLOROETHENE
DCE	DICHLOROETHENE
VC	VINYL CHLORIDE
- - - -	MONITORING WELL TOTAL CHLORINATED VOC GROUNDWATER DATA IN ug/L FROM 2004
	NEW PRE-DESIGN MONITORING WELL
	AREA OF MIP SURVEY SHOWING INITIAL SAMPLING LOCATIONS (SAMPLE SPACING = 20 FT)

GRIFFISS AFB OBGW SITES
WSA/BUILDING 817 SITE
ROME, NEW YORK

Prepared by:

parsons

FPM group

In Association with:

ecology and environment engineering p.c.

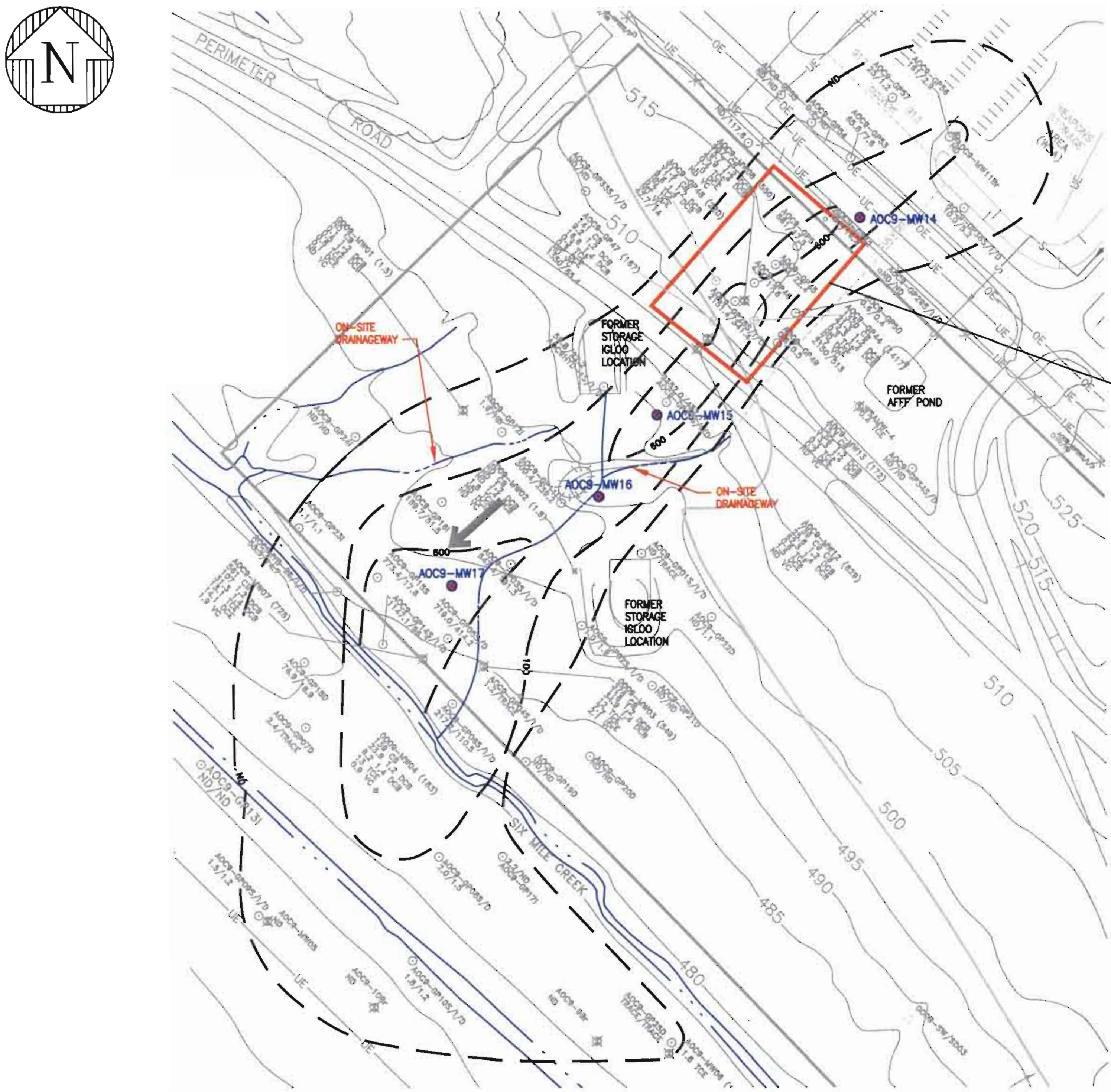
DRAWING TITLE:

BUILDING 817/WSA
PREDESIGN INVESTIGATION MAP

FIGURE 1-2

LEGEND

—UE—	UNDERGROUND ELECTRIC
—OE—	OVERHEAD ELECTRIC
—505—	TOPOGRAPHIC CONTOUR LINE (CONTOUR INTERVAL = 5 FT)
— — —	MONITORING WELL TOTAL CHLORINATED VOC GROUNDWATER DATA IN ug/L FROM 2004
←	DIRECTION OF GROUNDWATER FLOW
•	NEW PRE-DESIGN MONITORING WELL
▢ •••	AREA OF MIP SURVEY SHOWING INITIAL SAMPLING LOCATIONS (SAMPLE SPACING = 20 FT)



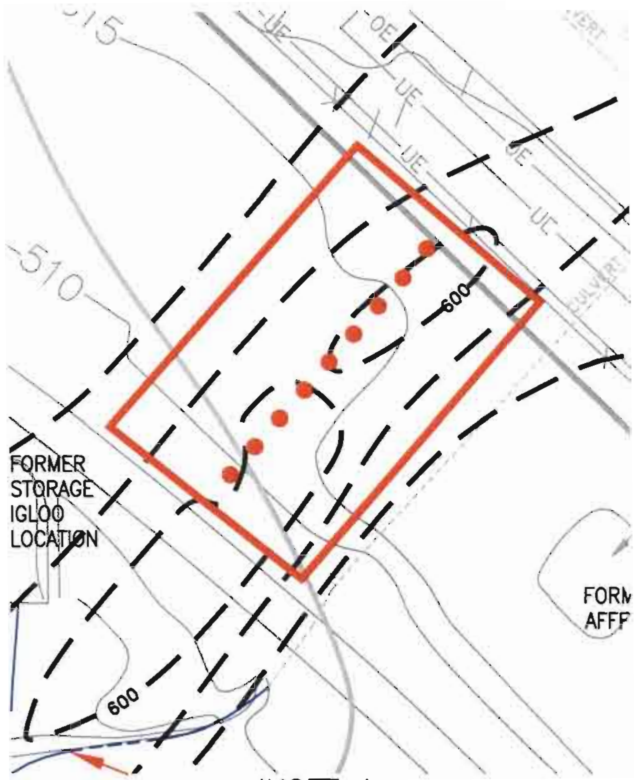
INVESTIGATION MAP

SCALE: 1" = 150'

150 0 150 300

SCALE: 1"=150'

SEE INSET A ON THIS SHEET FOR LOCATION OF INITIAL SAMPLING LOCATIONS



INSET A

SCALE: 1" = 100'

NOTE:

INITIAL ROW OF MIP SAMPLE POINTS SHOWN. ADDITIONAL ROWS WILL BE POSITIONED PERPENDICULAR TO GROUNDWATER FLOW AND SPACING WILL BE VARIED BASED ON THE RESULTS OF THE PREVIOUS POINTS TO CLOSE IN ON POTENTIAL SOURCE AREAS.

GRIFFISS AFB OBGW SITES
AOC 9 LANDFILL SITE
ROME, NEW YORK

Prepared by:

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FPM group

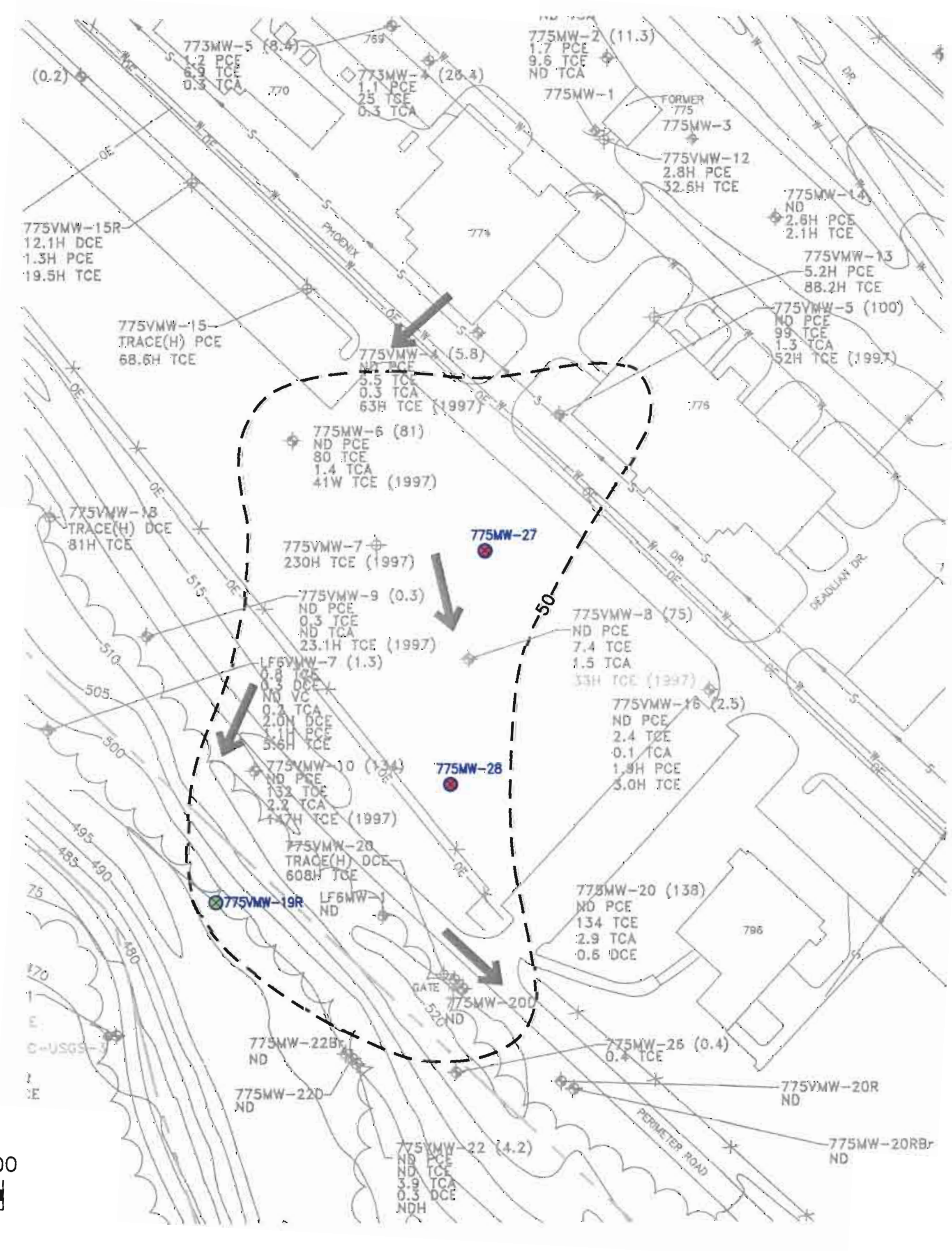
In Association with:

ecology and environment engineering p.c.

DRAWING TITLE:

AOC 9
PREDESIGN INVESTIGATION MAP

FIGURE 1-3



LEGEND

LF6MW-20	LANDFILL 6/BUILDING 775 OVERBURDEN MONITORING WELL SAMPLED IN 2004
LF6MW-12BR	LANDFILL 6/BUILDING 775 BEDROCK MONITORING WELL SAMPLED IN 2004
	EXISTING MONITORING WELL NOT SAMPLED
775MW-23 1.9H PCE	H= HIGHEST LEVEL OF HYDROPUNCH CONTAMINANTS OF CONCERN (i.e., CHLORINATED SOLVENTS) IN PARTS PER BILLION (PPB). SAMPLE RESULTS ARE FROM SPRING 2000, UNLESS INDICATED OTHERWISE.
505	TOPOGRAPHIC CONTOUR LINE (CONTOUR INTERVAL = 5 FT)
UE	UNDERGROUND ELECTRIC
W	WATER LINE
S	SANITARY SEWER
OE	OVERHEAD ELECTRIC
	DIRECTION OF GROUNDWATER FLOW
	NEW PRE-DESIGN MONITORING WELL
	NEW PERFORMANCE MONITORING WELL
	LANDFILL BOUNDARY
	MONITORING WELL TOTAL CHLORINATED VOC GROUNDWATER DATA IN ug/L FROM 2004
DCE	cis-DICHLOROETHENE
ND	NOT DETECTED
PCE	TETRACHLOROETHENE
TCA	1,1,1 TRICHLOROETHANE
TCE	TRICHLOROETHENE
VC	VINYL CHLORIDE

GRIFFISS AFB OBGW SITES
BLDG 775/PUMPHOUSE 3/TCE SITE
ROME, NEW YORK

Prepared by:

parsons

FPM group

In Association with:

ecology and environment engineering p.c.

DRAWING TITLE:

BUILDING 775
PREDESIGN INVESTIGATION MAP

FIGURE 1-4

2 AOC-Specific Activities

This section of the work plan discusses the field activities to be performed under this investigation. The work at all four sites described in this plan was derived from the February 2006 On-Base Groundwater Remediation proposal (Parsons 2006).

2.1 Scope of Work

All four of the sites being investigated contain chlorinated ethene plumes in the overburden. The contamination includes the following: TCE, PCE, and their breakdown products at LF6, Building 775, and Building 817/WSA; and a mixed plume of chlorobenzene and TCE and its breakdown products at AOC 9. Activities at each site will include drilling and installation of monitoring wells, sampling of new monitoring wells, and a Membrane Interface Probe (MIP) survey (at AOC 9 and Building 817/WSA only). Prior to field activities at each site, utilities clearance will be performed by contacting New York Underground Facilities Protective Organization (UFPO) at 1-800-962-7962. USACE and Air Force Real Property Agency (AFRPA) will be notified UFPO has been contacted. All groundwater samples will be analyzed for VOCs using USEPA Method SW8260. Analyses will be performed by a laboratory approved by both the New York State Environmental Laboratory Accreditation Program (ELAP) for this analytical method, and the National Environmental Laboratory Accreditation Program (NELAP). Reporting limits will be 1 ppb for all VOC compounds.

The following subsections describe the type and purpose of work to be performed at each site.

2.1.1 Landfill 6

There are two primary objectives of this predesign investigation. First is to better define the area and volume of the 500 ppb total VOC hotspot area near monitoring well LF6MW-12 so that the hotspot treatment can be properly located and sized. The second objective is to better define the 50 ppb total VOC contour in several areas an additional monitoring well may be valuable during full-scale remediation. The 50 ppb contour will define the primary area that the pump and treat system will capture. A MIP survey will not be conducted at the Landfill 6 site due to the deeper nature of the plume and limitations of effective direct push penetration capabilities. Six new predesign monitoring wells (LF6MW-27 through -32) will be installed to better define the 50 ppb total VOC contour (screened from approximately 35 to 55 feet BGS, the depths where the highest concentrations of TCE and DCE have been observed in the hot spot area) and one performance monitoring well (LF6MW-13RD) will be installed to monitor downgradient potential vertical migration (see Figure 1-1). The monitoring wells will be constructed with a 20-foot (0.01-inch slot) PVC screen in accordance with USACE protocols. Groundwater sampling will be performed at all newly installed monitoring wells as described in Section 2.2 below.

2.1.2 Building 817/WSA

The purpose of the Predesign Investigation at the Building 817/WSA is to better define the source area for potential source excavation and to better define the center of the plume at the Building 817/WSA site. A Geoprobe®-mounted Membrane Interface Probe (MIP) with a laboratory grade gas phase detector (photoionization detector [PID]) that is highly sensitive to TCE/PCE in soil and groundwater will be used to investigate the suspected source area near Building 817 upgradient of the proposed well WSA-MW18 (current well WSA-GP04) and the suspected utility corridor north of Perimeter Road. A detailed description of the field methodology for the MIP survey at this site is described in Section 3.5. If the MIP survey indicates that underground utilities may be the source of TCE at the site, a backhoe will be used to uncover the contaminated portion of the utility corridor to determine the condition of the underground utility and to remove and sample contaminated backfill near the utilities. In addition, four new predesign groundwater monitoring wells will be installed to better define the plume (Figure 1-2). These wells may function as multi-purpose wells (pre-design, performance monitoring, and long term monitoring). The monitoring wells will be up to 25 feet deep, and constructed with a 10-foot (0.01-inch slot) PVC screen in accordance with USACE protocols (see Table 2-1). Groundwater sampling will be performed at newly installed monitoring wells as described in Section 2.2 below.

During a previous in situ chemical oxidation pilot study at this site, a rapid loss of oxidants was noted possibly due to short circuiting of injected fluids. In order to determine whether the organic substrate injection can overcome the short circuiting issue and attain viable substrate distribution prior to the design of the full scale application, an initial injection will be performed near the proposed well WSA-MW18 (the same area where an oxidation test was completed historically). In addition, substrate injection pressure and flow rate data will be collected for planning purposes and to support the full-scale design. Groundwater wells near the injection will be monitored to determine short-term dissolved organic carbon distribution and to determine if groundwater geochemical conditions become more anaerobic and more conducive to the reductive dechlorination of TCE. A detailed description of this initial injection is described in Section 3.6.

2.1.3 AOC 9

The purpose of the Predesign Investigation at AOC 9 is to better define the contaminant plume and the source of the plume. A Geoprobe®-mounted MIP with a laboratory-grade gas-phase detector (electron capture detector [ECD]) that is highly sensitive to chlorobenzene/dichlorobenzene in soil and groundwater will be used to investigate the suspected source area between Perimeter Road and the former WSA. A detailed description of the field methodology for the MIP survey at this site is described in Section 3.5. If the MIP survey confirms elevated VOC levels in the unsaturated zone or points to a likely source area, a front-end loader or excavator will be used to scrape the surface of the soil down several feet in an attempt to located any area where solvents may have been spilled on the ground. Figure 1-3 illustrates the areas of Predesign Investigation. Four additional groundwater monitoring wells will be installed to better define the plume (one well will be installed in the potential source area and three wells in the downgradient portion of the plume south of Perimeter Road). These wells may function as multi-purpose wells (pre-design, performance monitoring, and/or long-term monitoring). Monitoring wells will be up to 24 feet deep and constructed with a 10-foot (0.01-inch slot) PVC screen in accordance with USACE protocols (see Table 2-1). Groundwater sampling will be performed at newly installed monitoring wells as described in Section 2.2 below.

2.1.4 Building 775/Pumphouse 3

The purpose of the Predesign Investigation at Building 775 is to better define the areal extent of the 50-ppb portion of the total VOC plume. A MIP survey will not be conducted at the Building 775 site due to the deeper nature of the plume and limitations of effective direct push penetration capabilities. Two new predesign monitoring wells (775MW-27 and -28) will be installed within the plume, and one performance monitoring well be installed downgradient to monitor potential contaminant migration as shown in Figure 1-4. These wells will be screened from approximately 80 to 120 feet BGS, the depths where the highest concentrations of TCE have been observed in the aquifer. Monitoring wells will be constructed with 0.01-inch slot PVC screen in accordance with USACE protocols. Groundwater sampling will be performed at all newly installed monitoring wells as described in Section 2.2 below.

2.2 Sampling, Data Interpretation, and Reporting

Newly installed monitoring wells will be developed and sampled for VOCs following drilling and completion. Table 2-1 presents a summary of all samples to be collected. EEEPC will document the Predesign Investigations performed and the findings of the investigations in a Predesign Investigation Data Summary Report. This report will include updated contaminant contour maps. Data will be provided in Environmental Resources Program Information Management System (ERPIMS) compatible format and added to the database.

Table 2-1 Groundwater Sample Listing, Predesign Investigation, Former Griffiss Air Force Base, Rome, NY

Location	Sample Number[a]	Approximate Depth Interval to be Screened (ft BGS)[b]	Rationale	Type	ANALYSES[c] TCL VOCs -SW8260B	TCLP VOCs	TCLP SVOCs	TCL PCBs	TCLP Metals/Mercury	Ignitability	pH	Reactivity	% Solids -ASTM_D2216
Landfill 6	LF6VMW-13RD	20-40	Monitor potential vertical migration	N	X								
	LF6MW-27	35-55	Within 50 ppb contour	N	X								
	LF6MW-28	25-45	Within 50 ppb contour	N	X								
	LF6MW-29	20-40	Within 50 ppb contour	N	X								
	LF6MW-30	25-45	Within 50 ppb contour	N	X								
	LF6MW-30/D	25-45	Groundwater QC	FD	X								
	LF6MW-30/S	25-45	Groundwater QA	FR	X								
	LF6MW-31	35-55	Within 50 ppb contour	N	X								
	LF6MW-32	35-55	Within 50 ppb contour	N	X								
B817/WSA	WSA-MW18	6-16	Between B817 and Perimeter Road	N	X								
	WSA-MW18 (MS/MSD)	16-Jun	Groundwater QC	MS	X								
	WSA-MW19	18-Aug	Between MW-16 and VMW-17	N	X								
	WSA-MW21	15-25	Downgradient, within plume	N	X								
	WSA-MW23	15-25	Cross-gradient, outside plume boundary	N	X								
AOC9	AOC9-MW14	14-24	Within 100 ppb contour, upgradient	N	X								
	AOC9-MW15	4-14	Within 600 ppb contour	N	X								
	AOC9-MW15/D	4-14	Groundwater QC	FD	X								
	AOC9-MW15/S	4-14	Groundwater QA	FR	X								
	AOC9-MW16	4-14	Within 100 ppb contour	N	X								
	AOC9-MW17	4-14	Within 600 ppb contour, downgradient	N	X								
B775	775VMW-19R	80-100	Downgradient, replacement well for 775VMW-19	N	X								
	775MW-27	60-80	Within 50 ppb contour	N	X								
	775MW-28	70-90	Within 50 ppb contour	N	X								

Key at the end of Table

Table 2-1 Groundwater Sample Listing, Predesign Investigation, Former Griffiss Air Force Base, Rome, NY

Location	Sample Number[a]	Approximate Depth Interval to be Screened (ft BGS)[b]	Rationale	Type	ANALYSES[c] TCL VOCs -SW8260B	TCLP VOCs	TCLP SVOCs	TCL PCBs	TCLP Metals/Mercury	Ignitability	pH	Reactivity	% Solids -ASTM_D2216
All Sites	OBGW-TB1	--	Water/QC Matrix	TB	X								
	OBGW-TB2	--	Water/QC Matrix	TB	X								
	OBGW-TB3	--	Water/QC Matrix	TB	X								
	OBGW-TB4	--	Water/QC Matrix	TB	X								
All Sites - IDW	IDW-Soil	--	IDW	N		X	X	X	X	X	X	X	X
	IDW-Water	--	IDW	N		X	X	X	X	X	X	X	

[a] Sample identification number to be consistent with historical documentation.

[b] Depth in feet below ground surface (BGS) unless otherwise stated. Screen interval depths for new wells are estimated.

[c] Sampling will be in accordance with the USACE/USEPA/NYSDEC-approved Griffiss AFB Basewide FSP (FPM 2005). One duplicate sample per every 10 samples and one trip blank per cooler will be collected.

Key:

AOC9 = Area of Concern 9
B775 = Building 775
B817 = Building 817
BGS = below ground surface
/D = duplicate
FD = field duplicate
FR = field split/replicate
ft = feet
IDW = investigation-derived waste
LF6 = Landfill 6
MW = Monitoring well
MS/MSD = matrix spike/matrix spike duplicate
MSL = mean sea level
N = original sample
PCB = polychlorinated biphenyl
ppb = parts per billion
QC = quality control sample
RD = replacement, deep
/S = split
SVOCs = semivolatile organic compounds
TB = trip blank
TBD = to be determined
TCL = target compound list
TCLP = toxicity characteristic leachate procedure
V = vertical profile
VOCs = volatile organic compounds
WSA = Weapons Storage Area

Key at the end of Table

3 Field Methodology

This section identifies the fieldwork methods to be used for the investigations described in Section 2. The fieldwork will include monitoring well installation, well development, groundwater sampling, and MIP surveys. Maps showing the proposed sample locations are provided in Section 1, and a table listing the samples to be collected is provided in Section 2.

3.1 Monitoring Well Installation Methodology

A total of 18 predesign and/or performance monitoring wells will be installed at the four sites as described in Section 2. The monitoring wells will be installed by advancing 4¼-inch inner-diameter (ID) augers to the desired depths and installing the monitoring wells through the augers. No split-spoon samples will be collected during well drilling. Monitoring wells shall be constructed as follows:

- **Monitoring Well Casing and Screen.** Riser material will consist of new, 2-inch ID, threaded, flush-joint PVC pipe. The riser pipe will conform to American Society for Testing and Materials (ASTM) D1785 standards for Schedule 40 pipe. Riser will extend to a height of 2 feet above grade. Well screens will consist of 10 to 20 feet of new, 2-inch ID, commercially fabricated, threaded, flush-joint, factory slotted (0.010 inch) PVC screen. A threaded PVC plug will be placed on the bottom of each well. All well material will be certified as "clean" by the vendor and sealed in plastic prior to installation. Figure 3-1 illustrates typical monitoring well construction.

- **Monitoring Well Filter Pack.** A sand filter pack will be installed in the annular space between the boring and well screen. The filter pack will consist of clean, chemically inert, non-carbonated, well-sorted silica sand (Morie #0 or equivalent). Care will be taken to prevent bridging by continuously probing and measuring the thickness of the filter pack as it is placed. The sand filter pack will be tremied into place. The sand filter pack will be placed from the bottom of the well screen to approximately 2 feet above the top of the well screen. One foot of fine sand (Morie #00 or equivalent will be placed above the filter pack.

- **Monitoring Well Seal.** The sand pack will be capped with a 3- to 5-foot-thick pelletized bentonite seal, depending on the amount of space between the top of the screen and the ground surface. The bentonite seal will be hydrated with clean potable water from a USACE-approved source on base. After the bentonite seal has hydrated for a minimum of 12 hours, bentonite grout will be installed between 1 and 4 feet below grade.

- **Plumbness and Alignment.** All risers and screens will be set round, plumb, and true to line. The well assembly must be hung in the borehole prior to the placement of the filter pack and not allowed to rest on the bottom of the hole so as to keep the well assembly straight and plumb. One centralizer will be installed at the bottom of the well in all wells greater than 20 feet in depth. Centralizers will be stainless steel and attached to the well casing via stainless-steel fasteners or strapping. Centralizers will not be attached to the well screen or the part of the well casing exposed to the granular filter or bentonite seal.

- **Well Completion Details.** All monitoring wells will be completed 2 feet above ground surface. The aboveground completion for monitoring wells will consist of a painted, 6-inch-diameter, locking, protective steel casing. Prior to installation of the steel casing, a 4-inch-diameter PVC sleeve will be placed around the 2-inch-ID casing from the top of the grout seal to 1 foot above ground surface to allay frost heave. Cement will be placed in the annular space between the edge of the borehole and the 4-inch PVC sleeve. The steel casing will then be placed in the cement. The casing will then be surrounded by a 2-foot by 2-foot by 4-inch-thick concrete drainage pad. A weep hole will be drilled in the base of the protective casing, just above the concrete pad, and a vented PVC slip-on well cap will be placed on the inner casing. If the above-grade well is in a location accessible to vehicular traffic, concrete-filled, 3-inch-diameter protective steel posts set 2 feet BGS in concrete and 3 feet above grade will be installed around the perimeter of the well in order to protect it. A well lock (BX-1) will be used to secure the well.

- **Well Identification.** Wells will be identified by brass survey marker. The survey marker will be embedded in the cement well pad. A metal identification tag (Brainard-Kihnan TC-350 or equivalent) will also be placed in each well casing. The tags will be labeled with an inscription pen and attached to the well caps with braided wire The tags will contain the following information:
  - Establishing company and location;
  - Well ID;
  - Date installed;
  - Well depth;
  - Casing depth and diameter;
  - Screened interval;
  - Sand interval;

- Bentonite interval;
- Grout interval; and
- Static water level.

Logs will be prepared in the field, as borings are drilled, by a qualified, experienced geologist, or geotechnical engineer. Each log will be signed by the preparer and developed on the hazardous, toxic, and radioactive waste (HTRW) drill log form included as Figure 3-2.

3.2 Well Development

Each new monitoring well will be developed no sooner than 48 hours after final grouting of the well. Development will be performed using a submersible development pump until pH, temperature, conductivity, redox potential (ORP) and dissolved oxygen (DO) have stabilized, and turbidity of the discharge is 50 nephelometric turbidity units (NTUs) or less. Development will be performed according to the procedure described below.

Equipment and Supplies

- Water level indicator;
- DO, pH, temperature, and ORP probe (or equivalent) display instrumentation, and flow-through cell (QED Model MP20 or equivalent) and associated calibration solutions (pH buffers 4 and 7, and redox standard solution);
- Pump controller (QED Model 3013 or equivalent);
- Gasoline-powered compressor (QED Model 41000 or equivalent); and
- 55-gallon drums (if deemed necessary [see Section 3.8]).

Development Procedures

- Measure static water level;
- Measure total depth of well;
- Calculate volume of water in well casing/screen and filter pack using the following equation:

  1 well volume (gal) = $[H_1 \times 0.16 \text{ gal/ft}] + \{0.30 \times [(H_2 \times 2.95 \text{ gal/ft}) - (H_2 \times .16 \text{ gal/ft})]\}$

  Where:

  H_1 = total height of the water column in the well

H_2 = height of the saturated sand pack

This equation is based on the following assumptions:
- 2-inch well diameter;
- 30% sand filter pack porosity; and
- 8.5-inch borehole diameter.

■ Lower the pump to the top of the well screen and begin pumping.

■ Develop the well until a minimum of three to five well volumes is removed plus three times the volume of water added to the well during drilling (if applicable). Surge the pump up and down and pump during removal of at least three to five well volumes. Then discontinue surging, and continue pumping until pH, temperature, conductivity, ORP, and dissolved oxygen are stable, turbidity is less than 50 NTUs, and a minimum of one additional well volume plus three to five times the volume of water added to the well during drilling is removed (if necessary). The readings are considered stable when they are within the following guidelines derived from USEPA low-flow purging (see Appendix A):
  - ± 0.1 for pH,
  - ± 3% for specific conductivity, and
  - ± 10% for turbidity and DO.

If these conditions are not achieved within a 4-hour period, USACE will be notified. If the well is purged dry during development, the well will be allowed to recharge prior to continuing development. If recharge is slow, USACE will be notified and a modification of development procedures will be discussed.

■ The development record will include the following:
  - Physical characteristics of the development water (i.e., pH, temperature, conductivity, DO, and turbidity) will be recorded on the well development record form (see Figure 3-3) at 5-minute intervals for the first 30 minutes and 10-minute intervals for the remainder of the purge cycle;
  - Total quantity of water removed;
  - Static water level before and after development;
  - A 35-mm color slide of the final development water in a clear glass jar;

■ Management of development water as described in Section 3.8 in this work plan; and

■ If dedicated pumps are not used for development, decontaminate development pump and hose according to procedures outlined in Section 3.7 in this work plan.

3.3 Groundwater Sampling

Groundwater samples will be collected from newly installed predesign and performance monitoring wells 14 days after the completion of the well development. The number of samples proposed for analytical testing is included on Table 2-1. All groundwater samples collected from the wells will be sent to Severn-Trent Laboratories (STL) for the analyses listed in Table 2-1. One trip blank will accompany each shipment containing samples for VOC analysis.

Low-flow purging/sampling using dedicated bladder pumps will be used to obtain groundwater samples from the newly installed wells. The objectives and methods for this procedure are included in the USEPA Region II Guidance document titled *Groundwater Sampling Procedure, Low Stress (Low Flow) Purging and Sampling* (see Appendix A). The primary goal of low-flow purging/sampling is to provide groundwater quality data that are representative of actual aquifer conditions with minimal alternation caused by inappropriate or variable sampling techniques. Typically, flow rates of 200 to 500 milliliters per minute (mL/min) are used for purging; however, this is dependent on site-specific hydrogeology and observed drawdown. Sampling is typically performed at flow rates of 100 to 250 mL/min. The equipment and procedure for performing low-flow groundwater sampling are identified below. Well development should be completed at least 14 days before sampling.

Equipment and Supplies

- Water level indicator;
- Dedicated stainless-steel and teflon submersible bladder pump (QED Model T1200) and polyethylene tubing;
- QED Model MP20 (or equivalent) water quality probe, meter and flow-through cell;
- Zero-DO solution;
- Pump controller (QED Model 3013 or 400 or equivalent);
- Gasoline-powered air compressor (QED Model 41000 or equivalent);
- Turbidity meter (HACH Model 2100P);
- Sample bottles (see Table 3-1);
- Sample preservation solutions (see Table 3-1);
- Cooler with ice;

- Nitrile gloves;
- Plastic sheeting;
- Paper towels;
- Equipment calibration solutions; and
- Alconox solution.

Sample Collection Procedures

- Measure depth to water table with a water level indicator and record initial water level, pH, temperature, conductivity, turbidity, ORP, and DO;
- Install the dedicated, preassembled bladder pump and associated tubing in the designated well. The bladder pump will be preassembled by the factory with well specifications provided by EEEPC once the well is complete. The pump intake will be specified to be at the midpoint of the screen interval, if sufficient water is present. This placement will help minimize entrainment of solids. Existing groundwater data was used to determine where the screen intervals will be placed. The mid-point of the screen interval was selected for the pump intake location to target contamination at each well. If sufficient groundwater is not present, the pump intake will be placed down to 6 inches above the bottom of the well;
- Purge the well using an initial flow rate of 100 to 500 mL/min; however, the flow rate should be adjusted to minimize drawdown to no more than 0.3 foot during purging and sampling. The water level should be monitored with a water level indicator at 5-minute intervals. These procedures will be followed for all well purging with the following variances:
  - If 0.3-foot drawdown is exceeded and cannot be re-established, establishment of zero drawdown (i.e., water elevation stabilization at a constant or increasing level during purging) shall be attempted. The decrease in water level greater than 0.3 foot is allowable as long as the water elevation stabilizes and remains stable or increases during the remainder of purging and sampling. If zero drawdown is not possible, stabilization of water quality parameters with drawdown should then be attempted by gradually increasing the flow rate (up to approximately 2.5 L/min) and lowering the water level in the well to a level not less than 10 feet above the top of the well screen. While increasing the flow rate, turbidity should be monitored. If a significant increase in turbidity occurs, the rate of flow adjustment should be reduced to stabilize turbidity. The rate should then be reduced to less than 500 mL/min to determine whether a stabilized water elevation can be obtained at the decreased water elevation. If a stabilized water elevation is obtained and the field parameters stabilize, samples will be collected. If a

stabilized water elevation is not obtained, the pumping rate should be increased to either run the well dry or to purge three well volumes. However, purging the well dry and thereby dewatering the well screen is not preferred and should be avoided if possible. If three well volumes are purged and the field parameters are stable, samples will be collected. If field parameters are not stable, the flow rate will be decreased as feasible to see whether field parameter stabilization can be obtained at a lower flow rate. If field parameter stabilization occurs at the lower flow rate, samples will be collected. If the field parameters do not stabilize at the lower flow rate, the well should be purged dry. Once dry, the well will be allowed to recharge, a set of field parameters will be recorded, and samples will be collected.

- Record ORP, pH, specific conductivity, temperature, turbidity, and DO on the groundwater sampling log form (see Figure 3-4) every 5 minutes until stabilization of all parameters is achieved. The purging will be considered complete after the field parameters have stabilized for three successive readings. The readings are considered stable when three successive readings are within the following USEPA guidelines (see Appendix A):
  - ± 10 mV for ORP;
  - ± 0.1 for pH;
  - ± 3% for specific conductivity and temperature; and
  - ± 10% for turbidity and DO.

  Once stabilized and turbidity is 50 NTUs or less, the groundwater sample will be collected. The sampling team must wear disposable gloves during sampling and discard the gloves once sampling is complete at each well. These procedures will be followed for all well sampling along with the following variances:
  - If turbidity is unstable (i.e., > ± 10%), but less than 50 NTUs, the groundwater sample will still be collected, the final turbidity will be recorded, and a field adjustment form (see Figure 3-5) will be completed;

- Collect groundwater sample following well purging (or sufficient recharge if purged dry). The VOC portion of the sample will be collected first, followed any remaining portions. The sample will be collected using the new dedicated bladder pumps. Pumping will be performed at a very slow rate to minimize volatilization and turbidity;

- Properly preserve the sample as indicated in Table 3-1; and

- Immediately place sample in a cooler with ice, and maintain sample temperature at 4°C.

Field Measurement Procedures

Field Analysis Procedure – pH, Temperature, Specific Conductance, Dissolved Oxygen, Redox Potential, and Turbidity. pH, temperature, specific conductance, DO, and ORP will be measured using a single unit, the QED Model MP20 or equivalent. This unit automatically corrects for salinity at low DO readings by estimating salinity from temperature and conductivity measurements, and then internally adjusting the DO reading. The probe thus contain separate pH, temperature, conductivity, DO, and ORP probes in one unit. In addition, a separate meter will be used to measure turbidity.

Before use, the pH, specific conductance, DO, and ORP probes need to be calibrated or tested for responsiveness. The pH probe will be calibrated first. This is done by placing the probe in standard solutions (pH 7 and then pH 4) and adjusting the pH calibration knobs until the correct measurement is obtained. The ORP probe is then calibrated with the ORP standard solution (Zobell), the DO probe is calibrated with water-saturated air, and the calibration is checked with a zero DO solution (solution of 20 mL of deionized water, 20 ml of sodium sulfite, and a trace of cobalt chloride). The probes should be rinsed with deionized water between each calibration solution and following calibration. Used calibration solution is to be discarded. Finally, the conductivity probe is checked with a solution of known conductivity.

After calibration, the probe is fitted into the flow-through cell provided with the instrument, using the included mounting hardware. The line from the in-well bladder pump is attached to one of the barbed hose fittings on the flow-through cell. A drainline is attached to the other fitting, with the effluent directed to a bucket. All fittings on the flow-through cell must be adjusted as necessary so that no air leaks occur in the cell. The bladder pump is then started. The well shall be purged at 100 to 500 mL/min so that drawdown does not exceed 0.3 foot. The water level, pH, temperature, specific conductance, DO, ORP, and turbidity readings will be recorded at a minimum of once every 5 minutes until the readings stabilize. All measurements will be recorded on the groundwater sampling log form (see Table 3-3). Thoroughly rinse the probes and flow-through chamber with deionized water after use.

3.4 Sample Labeling, Packaging and Shipping, and Custody

Sample Labeling

All samples will be assigned a unique sample identifier (see Table 2-1). Labels for each sample container will contain the sample identifier, date of sample collection, analytical parameters, and type of preservation used. Any change in the label information prepared prior to the sample collection will be initialed by the sampler.

Sample Packaging and Shipping

Preservation reagents will not be added to sample containers prior to the collection or immediately after collection of the sample, as indicated on Table 3-1. The samples will be placed on ice (contained in double zip-locked bags) immediately following collection and then maintained at 4°C, including during transport to the laboratory.

Sample containers will be placed inside sealed plastic bags as a precaution against cross-contamination caused by leakage or breakage. They will be placed in coolers in such a manner as to eliminate the chance of breakage during shipment. Ice in double zip-locked plastic bags will be placed in the coolers to keep the samples at 4°C throughout shipment. Each cooler will be designated with a number (i.e., 1 of 1, 1 of 2, etc.). The cooler designation will be placed on the chain-of-custody form.

Sample shipment will be performed in strict accordance with all applicable United States Department of Transportation (DOT) regulations. The samples will be shipped to Severn-Trent Laboratories (STL) by an overnight service. If USACE requests that split samples be collected, only these samples will be forwarded to the United States Army Engineer Research and Development Center Quality Control Laboratory (ERDC) by an overnight service. Arrangements will be made with both STL's and ERDC's point of contact (POC) for samples that are to be delivered to a laboratory on a weekend so that holding times are not compromised. A Laboratory Information Management System (LIMS) number (TBD), set up by the USACE Kansas City District and ERDC, must be written on all chain-of-custody forms sent to the ERDC.

- STL POC:
  Attn: Mark Nemec/Tony Bogolin
  Severn-Trent Laboratories
  10 Hazelwood Drive, Suite 106
  Amherst, NY 14228
  Phone: 716-691-2600
  Fax: 716-691-7991

- ERDC POC:
  Attn: Ms. Laura Percifield (LIMS No. TBD)
  420 South 18th Street
  Omaha, Nebraska 68102-2685
  402-444-4313 or 402-444-4314
  402-341-5448 (fax)

Sample Custody

A sample is considered to be in custody under the following situations:

- The sample is directly in your possession, or
- The sample is clearly in your view, or
- The sample is placed in a locked location, or
- The sample is in a designated secure area.

In order to demonstrate that the samples and coolers have not been tampered with during shipment, adhesive custody seals will be used. The custody seals will be placed around the cap of each sample container and across the cooler lids in such a manner that they will be visibly disturbed upon opening of the sample container or cooler. The seals will be initialed and dated by field personnel when affixed to the container and cooler.

Documentation of the chain-of-custody of the samples is necessary to demonstrate that the integrity of the samples has not been compromised between collection and delivery to the laboratory. Each sample cooler will be accompanied by a chain-of-custody record to document the transfer of custody from the field to the laboratory. All information requested in the chain-of-custody record will be completed. In addition, the airbill number assigned by the overnight courier will be listed on the chain-of-custody record. One copy of the chain-of-custody form will be retained by the samplers and will be placed in the project records file. The remaining pages will be sealed in a plastic bag and placed inside of the cooler. Upon receipt at the laboratory, the chain-of-custody forms will be completed. It is the responsibility of the laboratory to document the condition of custody seals and sample integrity upon receipt.

3.5 Membrane Interface Probe Survey

A Geoprobe®-mounted Membrane Interface Probe (MIP) with a laboratory-grade HP 5890 Series II Gas Chromatograph equipped with a PID and ECD (to detect aromatic and chlorinated compounds, respectively) will be used to conduct the MIP surveys. In addition, the probe is equipped with an electrical conductivity dipole array for measuring the electrical conductivity of the surrounding soil and the soil pore water concurrently with the MIP readings. The electrical conductivity can be used to infer the lithology of the soil in contact with the probe.

At the Building 817 site, a background push will be completed in an area with known non-detections in groundwater to first calibrate the MIP. A second calibration will be completed within a foot of WSA-GP04S to check the MIP response to known VOC contamination. The MIP instrument will first be used to delineate subsurface VOC profiles within a foot of the sewer lines exiting Building 817 to the south. An estimated 20 probe locations positioned parallel to groundwater flow will be used to delineate the source area for future excavation and/or locating remediation injection points. If elevated levels of VOCs are detected along the suspected utility corridor, the MIP survey will expand using additional rows of points parallel to the initial row to determine the extent of elevated VOC contamination. Spacing of the rows and points will vary based on the results of the previous points to close in on potential source areas. If VOCs are not detected near the suspected utility corridor, the MIP survey will be used to create several upgradient cross sections between WSA-GP04 and Building 817 to better delineate the source of VOC contamination. Continuous MIP readings will be obtained from the ground surface to bedrock or refusal.

At the AOC 9 site, a background push will be completed in an area with known non-detections in groundwater to first calibrate the MIP. A second calibration will be completed within a foot of AOC9-GP27 to check the MIP response to known VOC contamination. Beginning near existing monitoring well AOC9-MW08, an estimated 30 probe locations positioned parallel to groundwater flow will be used to delineate the source area for possible future excavation. The MIP survey will be used to create several upgradient cross sections between Perimeter Road and the former WSA to better delineate the source of VOC contamination. Continuous readings will be obtained from the ground surface to approximately 25 feet BGS.

Operation of the MIP will follow the procedures described in the *Geoprobe® Membrane Interface Probe (MIP) Standard Operating Procedure (SOP)* (included in Appendix B) (Geoprobe 2003), and the following:

- An iterative approach using rows of points starting immediately upgradient of known groundwater hot spots will be used. A predefined grid spacing will not be used. Rows of points will be positioned parallel to groundwater flow and spacing will be varied based on the results of the previous points to close in on potential source areas.

- A response test will be conducted before and after each sampling location as described in Section 4.0 of the *GeoProbe® MIP SOP*.

- A MIP log will be filled out by the driller for each location which will include, at a minimum, the following information: hole name, site location, date, detector baseline, documentation of the response tests, and documentation of any corrective actions taken during the MIP logging process.

- The probe will be advanced at the rate of 1 foot/minute to a depth of 25 feet BGS or until refusal is encountered. Refusal for the MIP survey is defined as taking longer than 1.5 minutes of continuous hammering to advance the probe one foot.

- The MIP probe and all associated tooling will be decontaminated before and after each hole according to Section 3.7 below.

3.6 Initial Injection at Building 817

The initial, organic substrate injection will be conducted in the area of highest groundwater VOC concentrations (i.e., the groundwater hot spot) at the Building 817 site, near the proposed well WSA-MW18. The groundwater hot spot is located immediately north of Perimeter Road (see Figure 1-2). The initial injection will be conducted to collect field data to support the design of a full-scale organic substrate injection program. The organic substrate will be injected to enhance biologically mediated reductive dechlorination of chlorinated ethene contamination at the site.

The initial injection will include the installation of four injection points spaced 5 to 10-feet apart on center with a direct-push drilling rig. A total of approximately 240 gallons of food-grade soybean oil, 100 gallons of fructose, and 2,000 gallons of site groundwater or potable water will be injected into the points. The organic substrate will be emulsified in the field with site groundwater or potable water and injected through points as a dilute oil-in-water emulsion. The vertical injection interval at each direct-push point is expected to be approximately 10 feet or less. Consideration will be given to selecting injection locations and depths to limit potential short-circuiting encountered during the chemical oxidation pilot study (i.e., the area of the suspected utility and potential basal gravel zone). Injection intervals will extend from approximately 2 feet below the water table to the top of bedrock. If a rapid loss of oxidant or short circuiting is found to occur, the injection depth will be reduced (above top of bedrock). The substrate will be injected at low pressure using an air operated diaphragm pump, an in-line mixer, and flexible conveyance hoses.

Prior to injection, a baseline groundwater sampling event will be conducted to define VOC concentrations and geochemical conditions in the injection area. Historic data will be used to determine pre-injection conditions to the extent practicable. The baseline sampling event is expected to entail groundwater sampling at up to four monitoring wells for VOCs, TOC, dissolved oxygen, oxidation reduction potential, pH, sulfate, nitrate, and iron.

The initial injection will begin with the extraction of approximately 2,000 gallons of site groundwater from new and existing wells and the containerization of the extracted groundwater in tanks. If groundwater cannot be extracted in sufficient quantity or at a sufficient rate to maintain schedule, potable water may be used. As the injection water is being collected, the fructose will be added to the water tank and mixed with a re-circulation pump. After approximately 2,000 gallons of water have been collected and the fructose has been thoroughly dissolved into the collected water, injection activities will commence.

Injection activities at each direct-push point will start by connecting the injection system to the top of the direct-push rod and injecting approximately 100 gallons of fructose-amended water into the point to test the functionality of the system. The functionality test will be conducted to confirm that the direct-push point screen is open and to ensure that the aquifer matrix is accepting injection fluid at pressures low enough to avoid fracturing the formation, which will be indicated by pressure gauges built into the injection system. After the system functionality test is complete, approximately 30 gallons of vegetable oil will be emulsified with approximately 300 gallons of fructose-amended water using an in-line high-sheer mixer, and the emulsion will be injected into each direct-push point. The high-sheer mixer will be installed inline between the water tanks, the vegetable oil drums, and the injection point such that the formation of the oil-in-water emulsion and the injection of the emulsion are completed in one step. If the natural soil seal around the injection point fails during injection, the direct-push rod will be pulled, the drill rig will be offset several feet, and injection activities will resume at the offset location.

After injection activities have been completed at all direct-push locations, the drilling and injection equipment will be decontaminated as described in Section 3.7, and the decontamination fluid will be disposed of in accordance with procedures outlined in Section 3.8. During the following year, monitoring wells in the area of the initial injection will be monitored for changes in VOC and TOC concentrations and geochemical impacts. Process monitoring sampling events will be conducted approximately quarterly (total of three events) and will entail groundwater sampling at up to four monitoring wells for VOCs, TOC, dissolved oxygen, oxidation reduction potential, pH, sulfate, nitrate, iron, and methane. Purge water from the monitoring wells will be handled in accordance with the procedures outlined in Section 3.8. This data, in combination with field observations collected during the initial injection, will be used to optimize the design of the full-scale Building 817 organic substrate application.

3.7 Equipment Decontamination

The drill rig or Geoprobe rig and all appurtenances must be decontaminated with high-pressure steam prior to arrival to the site. All equipment will be decontaminated again upon arrival to the site to remove road dirt only. Moreover, it is the subcontractor's responsibility to decontaminate all equipment with high-pressure steam prior to leaving the site.

Decontamination of drilling equipment will be performed prior to and after each well location. The drilling subcontractor will construct a decontamination pad, which will consist of wood and plastic sheeting, bermed on all sides, and include a high-pressure steam cleaner and a sump for water collection and pumping. Metal saw horses or pallets shall be used to keep equipment to be decontaminated off the floor of the pad. Specific attention will be given to the drilling assembly and augers. Drilling decontamination will consist of:

- High-pressure steam cleaning;
- Scrubbing with brushes if soil remains on equipment; and
- Steam rinsing.

The back end of the drill rig, and all associated drilling equipment (i.e., hollow-stem augers) will be decontaminated before and after use at each monitoring well location. Once clean, no equipment may touch the ground prior to use. The equipment must be stored on the drill rig, support truck, or on plastic sheeting.

If no contamination is detected, the decontamination water will be discharged to the ground surface. If contamination is detected as described in Section 3.8, the decontamination water will be placed in 55-gallon drums and labeled accordingly.

Decontamination of groundwater field testing instruments:

- Rinse flow-through cell and pH, temperature, conductivity, DO, and ORP probes with deionized water between each use.

Decontamination of well development pump and discharge hose by following method:

- Disassemble pump intake and use brush to clean inside of pump with alconox solution;
- Reassemble the pump and immerse the pump and discharge hose in a polyethylene drum (or equivalent) of alconox solution;
- Pump alconox solution through the pump and hose for 5 minutes;
- Remove pump and hose and immerse in a polyethylene drum (or equivalent) of clean potable water;
- Pump clean water through the pump and hose for 5 minutes; and
- Drain pump and hose and place in a clean plastic bag.

3.8 Investigation-Derived Waste (IDW)

Drill cuttings from well installations will be disposed of in accordance with New York State Technical and Administrative Guidance Memorandum (TAGM) HWR-89-4032 issued by NYSDEC on November 21, 1989. In addition, soils removed as part of backhoe investigations wall be collected in drums or metal roll-off containers, segregated, and sampled as IDW. A registry of all drums, a description of their sources and contents, and documentation of the analytical results from tests on the containerized solids will be provided to the client.

Investigation-derived soils and water will be field screened to determine initially whether these waste are contaminated. If no contamination or contamination less than 5 parts per million (ppm) on a flame ionization detector (FID) or PID is detected in the soils at a particular location, the decontamination water will be discharged to the ground surface and the soil cuttings will be spread on the ground. If contamination is detected above 5 ppm, or other visual evidence of contamination or strong odors are noted, the decontamination water and soil cuttings will be placed in 55-gallon drums and labeled accordingly. All drums will be temporarily staged in a secure area on site.

The contents of drums from sites that are suspected to be contaminated, or determined to be contaminated based on analytical results from the associated AOC, may need to be characterized by toxicity characteristic leaching procedure (TCLP). Since VOCs are the only contaminants of concern, EEEPC anticipates only TCLP VOCs will be analyzed. If required by the offsite disposal company, additional analysis such as corrosivity, ignitability, and reactivity may be needed to determine the suitability of subsequent disposal methods. Off-site disposal of contaminated materials involves hauling drummed cuttings and water to a commercial disposal facility.

3.9 Field Notebooks

Field notebooks will contain information in a daily log format, including both site and task logs. The site log is the responsibility of the Field Team Leader and will include a complete summary of the day's activity at the site (see Figure 3-6). The information will include a record of all personnel on site associated with this investigation, daily objectives, work accomplished, difficulties encountered, and correspondences with USACE, the EEEPC office, and regulators.

The task log will be the responsibility of each field team (e.g., drilling, sampling, etc.) and will include the following:

- Initials of the person making an entry and other personnel involved in the activity;
- Sampling location, depth, station number, date, time, and sample matrix;
- On-site measurement data for groundwater, such as pH, temperature, conductivity, turbidity, DO, and ORP;
- Photographic information and field observations as appropriate;
- Any unusual circumstances or difficulties;
- Conversations with USACE and regulators; and

- All recommendations by USACE.

No pages will be removed from the logbooks for any reason. If corrections are necessary, they will be made by drawing a single line through the original entry (so that the original entry can still be read) and writing the corrected entry alongside. The correction will be initialed and dated.

3.10 Site Survey

A ground survey will be performed by a subcontractor to obtain horizontal locations and vertical elevations of all monitoring wells and MIP survey points. The ground survey will utilize existing benchmarks located on the Former Griffiss AFB and be in New York Central NAD 83 State Plane coordinate system. Horizontal measurements will be performed to an accuracy of 0.001 foot and vertical measurements to 0.01 foot. Survey results will be plotted on appropriate existing base maps and will be presented in the report. Survey data in electronic format will be submitted with the report in a format compatible with the Griffiss Geographic Information System (GIS) system.

Table 3-1 Summary of Sample Containers, Amounts, Preservation, and Holding Times for Water Samples, Former Griffiss Air Force Base, Rome, NY

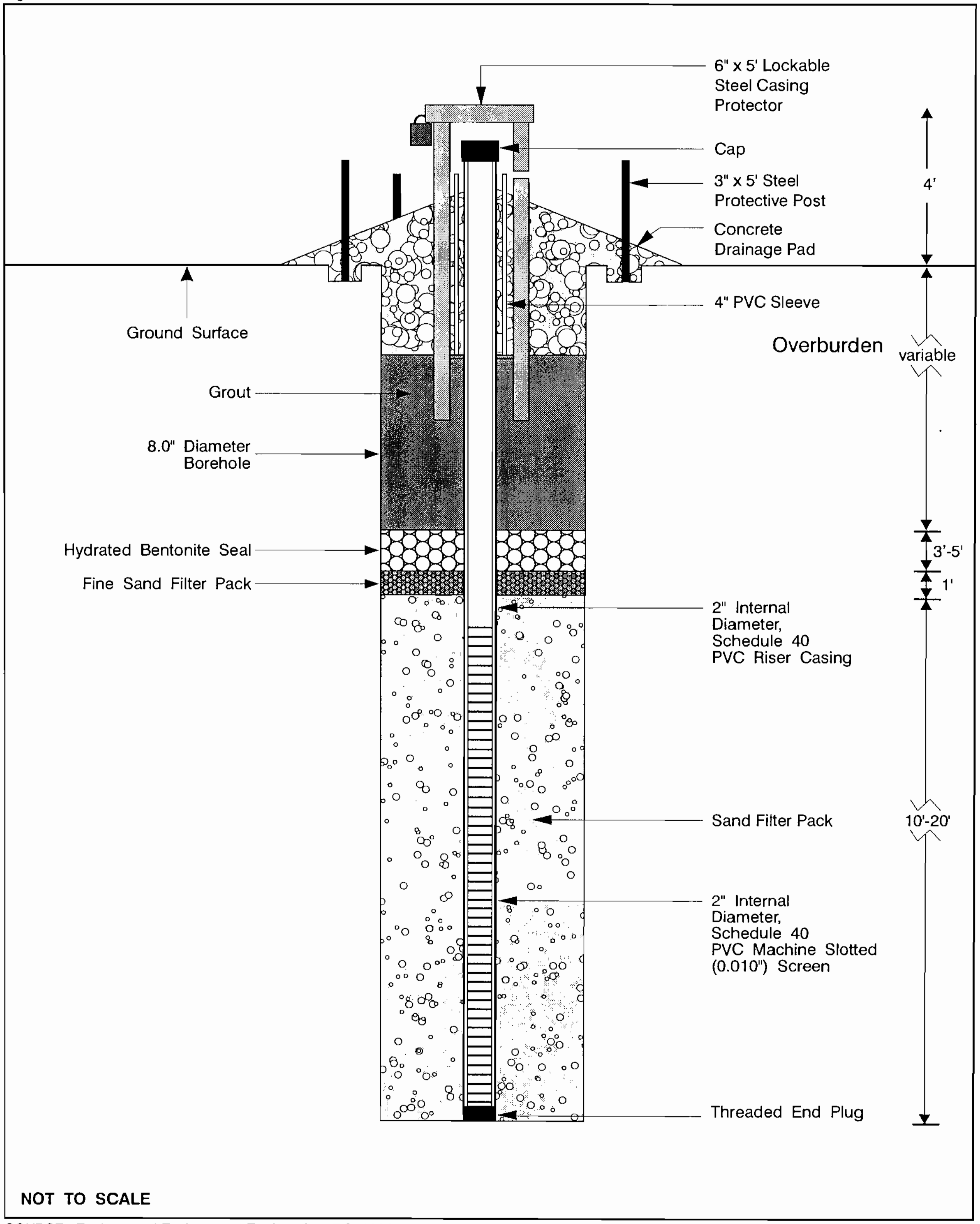
Method	Parameter	Sample Container [a]	Amount	Preservation	Holding Time [b]	
					Extraction	Analysis
Well Water Samples						
SW 8260B	Volatile organics	Three 40-ml glass VOA vials with teflon septa	Full; no headspace	HCL Cool to 4°C	NA	14 days

Note: Holding times are from verified time of sample receipt as required by New York State Department of Environmental Conservation, Analytical Services Protocol (ASP). All soil samples must be analyzed for percent solids.

[a] Samples chosen from quality assurance analysis require double the number of containers indicated.
[b] All number of days are from date of collection.

Key:
- HCL = Hydrochloric Acid
- ml = Milliliter.
- NA = Not applicable.
- SW = United States Environmental Protection Agency, "Test Methods for Evaluating Solid Wastes," SW-846, Third Edition, 1986, up to Update III.
- VOA = Volatile organic analysis.

02:002275_PT04_04-B1931
Fig3-1.CDR-7/24/2006-GRA



SOURCE: Ecology and Environment Engineering, P.C. 2006

Figure 3-1 PROPOSED CONSTRUCTION FOR PERMANENT MONITORING WELLS

HTRW DRILLING LOG	District					Hole Number
1. Company Name	2. Drill Subcontractor					Sheet of Sheets
3. Project			4. Location			
5. Name of Driller			6. Manufacturer's Designation of Drill			
7. Sizes and Types of Drilling and Sampling Equipment			8. Hole Location			
			9. Surface Elevation			
			10. Date Started		11. Date Completed	
12. Overburden Thickness			15. Depth Groundwater Encountered			
13. Depth Drilled Into Rock			16. Depth to Water and Elapsed Time After Drilling Completed			
14. Total Depth of Hole			17. Other Water Level Managements (Specify)			
18. Geological Samples	Disturbed		Undisturbed		19. Total Number of Core Boxes	
20. Samples For Chemical Analysis	VOC	Metals	Other (Specify)	Other (Specify)	Other (Specify)	21. Total Core Recovery %
21. Disposition of Hole	Backfilled	Monitoring Well	Other (Specify)	23. Signature of Inspector		

LOCATION SKETCH/COMMENTS SCALE:

PROJECT	HOLE NO.

ENG FORM 5056-R, AUG 94 (Proponent: CECW-EG)

Figure 3-2 Hazardous, Toxic, and Radioactive Waste Drill Log Form

HTRW DRILLING LOG (Continuation Sheet)

Project	Inspector	Hole Number Sheet of Sheets

Elevation (A)	Depth (B)	Description of Materials (C)	Field Screening Results (D)	Geotech Sample or Core Box No. (E)	Analytical Sample No. (F)	Blow Count (G)	Remarks (H)

PROJECT	HOLE NO.

ENG FORM 5056A-R, AUG 94 (Proponent: CECW-EG)

Figure 3-2 (Cont) Hazardous, Toxic, and Radioactive Waste Drill Log Form

WELL DEVELOPMENT RECORD

SITE ______________________ DATE ______________

LOCATION ______________________ WELL NO. ______________

____

MEASUREMENT OF WATER LEVEL AND WELL VOLUME

- Prior to sampling, the static water level and total depth of the well will be measured with a calibrated weighted line. Care will be taken to decontaminate equipment between each use to avoid cross contamination of wells.

- The number of linear feet of static water (difference between static water level and total depth of well) will be calculated.

- The static volume will be calculated using the formula:

$$V = Tr^2(0.163)$$

Where:
V = Static volume of well in gallons;
T = Depth of water in the well, measured in feet;
r = Inside radius of well casing in inches;
and 0.163 = A constant conversion factor which compensates for r²h factor for the conversion of the casing radius from inches to feet, the conversion of cubic feet to gallons, and (pi).
1 well volume (v) = ______ gallons.

Volume of Water in Casing or Hole

Diameter of Casing or Hole (in)	Gallons per Foot of Depth	Cubic Feet per Foot of Depth	Liter per Meter of Depth	Cubic Meters per Meter of Depth
1	0.041	0.0055	0.509	0.509×10^{-3}
11/2	0.092	0.0123	1.142	1.142×10^{-3}
2	0.163	0.0218	2.024	2.024×10^{-3}
21/2	0.255	0.0341	3.167	3.167×10^{-3}
3	0.367	0.0491	4.558	4.558×10^{-3}
31/2	0.500	0.0668	6.209	6.209×10^{-3}
4	0.653	0.0873	8.110	8.110×10^{-3}
41/2	0.826	0.1104	10.260	10.260×10^{-3}
5	1.020	0.1364	12.670	12.670×10^{-3}
51/2	1.234	0.1650	15.330	15.330×10^{-3}
6	1.469	0.1963	18.240	18.240×10^{-3}
7	2.000	0.2673	24.840	24.840×10^{-3}
8	2.611	0.3491	32.430	32.430×10^{-3}
9	3.305	0.4418	41.040	41.040×10^{-3}
10	4.080	0.5454	50.670	50.670×10^{-3}
11	4.937	0.6600	61.310	61.310×10^{-3}
12	5.875	0.7854	72.960	72.960×10^{-3}
14	8.000	1.0690	99.350	99.350×10^{-3}
16	10.440	1.3960	129.650	129.650×10^{-3}
18	13.220	1.7670	164.180	164.180×10^{-3}
20	16.320	2.1820	202.680	202.680×10^{-3}
22	19.750	2.6400	245.280	245.280×10^{-3}
24	23.500	3.1420	291.850	291.850×10^{-3}
26	27.580	3.6870	342.520	342.520×10^{-3}
28	32.000	4.2760	397.410	397.410×10^{-3}
30	36.720	4.9080	456.020	456.020×10^{-3}
32	41.780	5.5850	518.870	518.870×10^{-3}
34	47.160	6.3050	585.680	585.680×10^{-3}
36	52.880	7.0690	656.720	656.720×10^{-3}

1 Gallon = 3.785 liters
1 Meter = 3.281 feet
1 Gallon water weighs 8.33 lbs. = 37.785 kilograms
1 Liter water weighs 1 kilogram = 2.205 pounds
1 Gallon per foot of depth = 12.419 liters per foot of depth
1 Gallon per meter of depth = 12.419×10^{-3} cubic meters per meter of depth

INITIAL DEVELOPMENT WATER

WATER LEVEL (TOIC) ______________________
WELL DEPTH (TD) ______________________
COLOR ______________________
ODOR ______________________
CLARITY ______________________

FINAL DEVELOPMENT WATER

WATER LEVEL (TOIC) ______________________
WELL DEPTH (TD) ______________________
COLOR ______________________
ODOR ______________________
CLARITY ______________________

DESCRIPTION OF DEVELOPMENT TECHNIQUE ______________________

____

____

Figure 3-3 Well Development Record

WELL DEVELOPMENT - PARAMETER MEASUREMENTS

TIME	TOTAL VOL. WITHDRAWN		pH	COND. (umhos/cm)	TEMP. (C)	TURB. (NTU)	DO (mg/L)	COMMENTS
	GALS.	BORE VOL.						

DEVELOPED BY: ______________________________ DATE ______________

Figure 3-3 (Cont.) Well Development Record

Figure 3-4

Groundwater Sample Log

Project: Groundwater Treatability Study
Site: Former Griffiss Air Force Base
Well No.: ______
Sample Date: ______
Sampling Device: QED T1200 bladder pump
Alkalinity (mg/L as $CaCO_3$): NA
Ferrous Iron (mg/L): ______
Initial Water Level (Feet TOIC): ______
Final Water Level (feet TOIC): ______
Casing Type: PVC

Sample ID:
Sample Time: ______
Sample Tubing: QED teflon-lined polyethylene
Phenolphthalein Alkalinity (mg/L): NA
Sample Turbidity (NTUs): ______
Well Depth (feet TOIC): ______
Screen Interval (feet BGS): ______
Casing Inner Diameter (inches): ______
Initial OVA Reading (ppm): ______

Time	pH	Temperature (°C)	Conductivity (µs/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Water Level (ft TOIC)	Comments

Key:
BGS = Below ground surface.
°C = Degrees centigrade.
$CaCO_3$ = Calcium carbonate.
DO = Dissolved oxygen.
mg/L = Milligrams per liter
mV = Millivolts.
NTU = Nephelometric turbidity unit.
ORP = Redox potential.
ppm = Parts per million.
PVC = Polyvinyl chloride.
TOIC = Top of inner (PVC) casing.

Fig3-4 GW Sample Log.doc

<table>
<tr><td colspan="3">Field Adjustment Form No. __
Former Griffiss AFB</td></tr>
<tr><td colspan="2">To: Mr. Douglas M. Pocze
USEPA - Region 2
Federal Facilities Section
290 Broadway
New York, New York 10007
Fax: (212) 637-3256
Office: (212 637-4432</td><td>Ms. Heather Bishop
NYSDEC Division of Environmental Remediation
625 Broadway, 11th floor
Albany, New York 12233-7015
Fax: (518) 402-9022
Office: (518) 402-9692</td></tr>
<tr><td colspan="2">From: Mr. Michael McDermott
AFBCA
153 Brooks Road
Rome, NY 13441-4105
Fax: (315) 330-4062
Office: (315) 330-2275</td><td>Date:
Time:</td></tr>
<tr><td colspan="2">Site:</td><td>Work Plan Section: Page:</td></tr>
<tr><td colspan="3">Need for Field Adjustment</td></tr>
<tr><td>Prepared by:
R. Meyers</td><td>Organization
EEEPC</td><td>Date:</td></tr>
<tr><td>Approved by:</td><td>Org:
USACE</td><td>Date:</td></tr>
</table>

Figure 3-5 Predesign Investigation Field Adjustment Form

Daily Activity Summary	
Date:	**Report No.:**
Project Name: Groundwater Treatability Study, Performance Monitoring, Former Griffiss AFB	**Weather:**

Personnel	Hrs.	Affiliation	Personnel	Hrs.	Affiliation

Summary of Activities		
Equipment	**AOC/Task**	**Activities Performed**

Figure 3-6 Daily Activity Summary Form

Daily Activity Summary	
Date:	**Report No.:**
Project Name: Groundwater Treatability Study, Performance Monitoring, Former Griffiss AFB	**Weather:**

Field Tests Performed (Sample's, Field Screening, Chemical testing, Etc.)

Work Delays (Due To Weather, Maintenance, Breakdowns, Waiting For Decisions)

Problems Encountered And Deviations From Work Plan

Written And Verbal Instruction By The Government

Safety Issues

Planned Activities For Next Work Day

Remarks: (Visitors, Completion Of field Work At An AOC, Etc.)

Site Manager

Date

Figure 3-6 Daily Activity Summary Form (continued)

4 References

Ecology and Environment, Inc. (E & E), 2005, *Final Feasibility Study Report for Landfill 6 Groundwater, Building 775 Groundwater, and Building 817/Weapons Storage Area Groundwater, Former Griffiss Air Force Base, Rome, New York*, April 2005.

______________, 2004, *Final Feasibility Study Report for AOC 9: Weapons Storage Area (WSA) Landfill, Former Griffiss Air Force Base, Rome, New York*, October 2004.

______________, 2000, *Landfill 6 and Building 775 Areas of Concern Groundwater Study, Technical Memorandum No. 1: Field Investigation Conducted in Spring 2000, Former Griffiss Air Force Base, Rome, New York*, Vol. 1. Prepared for the U. S. Army Corps of Engineers, Kansas City District, August 2000.

Geoprobe Systems (Geoprobe), 2003, *Geoprobe® Membrane Interface Probe (MIP) Standard Operating Procedure,* Technical Bulletin No. MK3010, Prepared May 2003.

Parsons, February 2006, On-Base Groundwater Remediation Proposal, Griffiss Air Force Base, Rome, New York, Solicitation No. W912DQ-05-R-0042.

United States Environmental Protection Agency (USEPA), 1998, Ground Water Sampling Procedure Low Stress (Low Flow) Purging and Sampling, March 16, 1998.

A

USEPA Region II Groundwater Sampling Procedure, Low-Stress (Low-Flow) Purging and Sampling

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION II

GROUND WATER SAMPLING PROCEDURE
LOW STRESS (Low Flow) PURGING AND SAMPLING

I. SCOPE & APPLICATION

This Low Stress (or Low-Flow) Purging and Sampling Procedure is the EPA Region II standard method for collecting low stress (low flow) ground water samples from monitoring wells. Low stress Purging and Sampling results in collection of ground water samples from monitoring wells that are representative of ground water conditions in the geological formation. This is accomplished by minimizing stress on the geological formation and minimizing disturbance of sediment that has collected in the well. The procedure applies to monitoring wells that have an inner casing with a diameter of 2.0 inches or greater, and maximum screened intervals of ten feet unless multiple intervals are sampled. The procedure is appropriate for collection of ground water samples that will be analyzed for volatile and semi-volatile organic compounds (VOCs and SVOCs), pesticides, polychlorinated biphenyls (PCBs), metals, and microbiological and other contaminants in association with all EPA programs.

This procedure does not address the collection of light or dense non-aqueous phase liquids (LNAPL or DNAPL) samples, and should be used for aqueous samples only. For sampling NAPLs, the reader is referred to the following EPA publications: <u>DNAPL Site Evaluation</u> (Cohen & Mercer, 1993) and the <u>RCRA Ground-Water Monitoring: Draft Technical Guidance</u> (EPA/530-R-93-001), and references therein.

II. METHOD SUMMARY

The purpose of the low stress purging and sampling procedure is to collect ground water samples from monitoring wells that are representative of ground water conditions in the geological formation. This is accomplished by setting the intake velocity of the sampling pump to a flow rate that limits drawdown inside the well casing.

Sampling at the prescribed (low) flow rate has three primary benefits. First, it minimizes disturbance of sediment in the bottom of the well, thereby producing a sample with low turbidity (i.e., low concentration of suspended particles). Typically, this saves time and analytical costs by eliminating the need for collecting and analyzing an additional filtered sample from the same well. Second, this procedure minimizes aeration of the ground water during sample collection, which improves the sample quality for VOC analysis. Third, in most cases the procedure significantly reduces the volume of ground water purged from a well and the costs associated with its proper treatment and disposal.

III. ADDRESSING POTENTIAL PROBLEMS

Problems that may be encountered using this technique include a) difficulty in sampling wells with insufficient yield; b) failure of one or more key indicator parameters to stabilize; c) cascading of water and/or formation of air bubbles in the tubing; and d) cross-contamination between wells.

Insufficient Yield

Wells with insufficient yield (i.e., low recharge rate of the well) may dewater during purging. Care should be taken to avoid loss of pressure in the tubing line due to dewatering of the well below the level of the pump's intake. Purging should be interrupted before the water level in the well drops below the top of the pump, as this may induce cascading of the sand pack. Pumping the well dry should therefore be avoided to the extent possible in all cases. Sampling should commence as soon as the volume in the well has recovered sufficiently to allow collection of samples. Alternatively, ground water samples may be obtained with techniques designed for the unsaturated zone, such as lysimeters.

Failure to Stabilize Key Indicator Parameters

If one or more key indicator parameters fails to stabilize after 4 hours, one of four options should be considered: a) continue purging in an attempt to achieve stabilization; b) discontinue purging, do not collect samples, and document attempts to reach stabilization in the log book; c) discontinue purging, collect samples, and document attempts to reach stabilization in the log book; or d) Secure the well, purge and collect samples the next day (preferred). The key indicator parameter for samples to be analyzed for VOCs is dissolved oxygen. The key indicator parameter for all other samples is turbidity.

Cascading

To prevent cascading and/or air bubble formation in the tubing, care should be taken to ensure that the flow rate is sufficient to maintain pump suction. Minimize the length and diameter of tubing (i.e., 1/4 or 3/8 inch ID) to ensure that the tubing remains filled with ground water during sampling.

Cross-Contamination

To prevent cross-contamination between wells, it is strongly recommended that dedicated, in-place pumps be used. As an alternative, the potential for cross-contamination can be reduced by performing the more thorough "daily" decontamination procedures between sampling of each well in addition to the start of each sampling day (see Section VII, below).

Equipment Failure

Adequate equipment should be on-hand so that equipment failures do not adversely impact sampling activities.

IV. PLANNING DOCUMENTATION AND EQUIPMENT

- Approved site-specific Field Sampling Plan/Quality Assurance Project Plan (QAPP). This plan must specify the type of pump and other equipment to be used. The QAPP must also specify the depth to which the pump intake should be lowered in each well. Generally, the target depth will correspond to the mid-point of the most permeable zone in the screened interval. Borehole geologic and geophysical logs can be used to help select the most permeable zone. However, in some cases, other criteria may be used to select the target depth for the pump intake. In all cases, the target depth must be approved by the EPA hydrogeologist or EPA project scientist.

- Well construction data, location map, field data from last sampling event.

- Polyethylene sheeting.

- Flame Ionization Detector (FID) and Photo Ionization Detector (PID).

- Adjustable rate, positive displacement ground water sampling pump (e.g., centrifugal or bladder pumps constructed of stainless steel or Teflon). A peristaltic pump may only be used for inorganic sample collection.

- Interface probe or equivalent device for determining the presence or absence of NAPL.

- Teflon or Teflon-lined polyethylene tubing to collect samples for organic analysis. Teflon or Teflon-lined polyethylene, PVC, Tygon or polyethylene tubing to collect samples for inorganic analysis. Sufficient tubing of the appropriate material must be available so that each well has dedicated tubing.

- Water level measuring device, minimum 0.01 foot accuracy, (electronic preferred for tracking water level drawdown during all pumping operations).

- Flow measurement supplies (e.g., graduated cylinder and stop watch or in-line flow meter).
- Power source (generator, nitrogen tank, etc.).
- Monitoring instruments for indicator parameters. Eh and dissolved oxygen must be monitored in-line using an instrument with a continuous readout display. Specific conductance, pH, and temperature may be monitored either in-line or using separate probes. A nephalometer is used to measure turbidity.

- Decontamination supplies (see Section VII, below).

- Logbook (see Section VIII, below).

- Sample bottles.

- Sample preservation supplies (as required by the analytical methods).

- Sample tags or labels, chain of custody.

V. SAMPLING PROCEDURES

Pre-Sampling Activities

1. Start at the well known or believed to have the least contaminated ground water and proceed systematically to the well with the most contaminated ground water. Check the well, the lock, and the locking cap for damage or evidence of tampering. Record observations.

2. Lay out sheet of polyethylene for placement of monitoring and sampling equipment.

3. Measure VOCs at the rim of the unopened well with a PID and FID instrument and record the reading in the field log book.

4. Remove well cap.

5. Measure VOCs at the rim of the opened well with a PID and an FID instrument and record the reading in the field log book.

6. If the well casing does not have a reference point (usually a V-cut or indelible mark in the well casing), make one. Note that the reference point should be surveyed for correction of ground water elevations to the mean geodesic datum (MSL).

7. Measure and record the depth to water (to 0.01 ft) in all wells to be sampled prior to purging. Care should be taken to minimize disturbance in the water column and dislodging of any particulate matter attached to the sides or settled at the bottom of the well.

8. If desired, measure and record the depth of any NAPLs using an interface probe. Care should be taken to minimize disturbance of any sediment that has accumulated at the bottom of the well. Record the observations in the log book. If LNAPLs and/or DNAPLs are detected, install the pump at this time, as described in step 9, below. Allow the well to sit for several days between the measurement or sampling of any DNAPLs and the low-stress purging and sampling of the ground water.

Sampling Procedures

9. Install Pump: Slowly lower the pump, safety cable, tubing and electrical lines into the well to the depth specified for that well in the EPA-approved QAPP or a depth otherwise approved by the EPA hydrogeologist or EPA project scientist. The pump intake must be kept at least two (2) feet above the bottom of the well to prevent disturbance and resuspension of any sediment or NAPL present in the bottom of the well. Record the depth to which the pump is lowered.

10. Measure Water Level: Before starting the pump, measure the water level again with the pump in the well. Leave the water level measuring device in the well.

11. Purge Well: Start pumping the well at 200 to 500 milliliters per minute (ml/min). The water level should be monitored approximately every five minutes. Ideally, a steady flow

rate should be maintained that results in a stabilized water level (drawdown of 0.3 ft or less). Pumping rates should, if needed, be reduced to the minimum capabilities of the pump to ensure stabilization of the water level. As noted above, care should be taken to maintain pump suction and to avoid entrainment of air in the tubing. Record each adjustment made to the pumping rate and the water level measured immediately after each adjustment.

12. Monitor Indicator Parameters: During purging of the well, monitor and record the field indicator parameters (turbidity, temperature, specific conductance, pH, Eh, and DO) approximately every five minutes. The well is considered stabilized and ready for sample collection when the indicator parameters have stabilized for three consecutive readings as follows (Puls and Barcelona, 1996):

    $\pm$0.1 for pH
    $\pm$3% for specific conductance (conductivity)
    $\pm$10 mv for redox potential
    $\pm$10% for DO and turbidity

    Dissolved oxygen and turbidity usually require the longest time to achieve stabilization. The pump must not be removed from the well between purging and sampling.

13. Collect Samples: Collect samples at a flow rate between 100 and 250 ml/min and such that drawdown of the water level within the well does not exceed the maximum allowable drawdown of 0.3 ft. VOC samples must be collected first and directly into sample containers. All sample containers should be filled with minimal turbulence by allowing the ground water to flow from the tubing gently down the inside of the container.

    Ground water samples to be analyzed for volatile organic compounds (VOCs) require pH adjustment. The appropriate EPA Program Guidance should be consulted to determine whether pH adjustment is necessary. If pH adjustment is necessary for VOC sample preservation, the amount of acid to be added to each sample vial prior to sampling should be determined, drop by drop, on a separate and equal volume of water (e.g., 40 ml). Ground water purged from the well prior to sampling can be used for this purpose.

14. Remove Pump and Tubing: After collection of the samples, the tubing, unless permanently installed, must be properly discarded

or dedicated to the well for resampling by hanging the tubing inside the well.

15. Measure and record well depth.

16. Close and lock the well.

VI. FIELD QUALITY CONTROL SAMPLES

Quality control samples must be collected to determine if sample collection and handling procedures have adversely affected the quality of the ground water samples. The appropriate EPA Program Guidance should be consulted in preparing the field QC sample requirements of the site-specific QAPP.

All field quality control samples must be prepared exactly as regular investigation samples with regard to sample volume, containers, and preservation. The following quality control samples should be collected during the sampling event:

- Field duplicates
- Trip blanks for VOCs only
- Equipment blank (not necessary if equipment is dedicated to the well)

As noted above, ground water samples should be collected systematically from wells with the lowest level of contamination through to wells with highest level of contamination. The equipment blank should be collected after sampling from the most contaminated well.

VII. DECONTAMINATION

Non-disposable sampling equipment, including the pump and support cable and electrical wires which contact the sample, must be decontaminated thoroughly each day before use ("daily decon") and after each well is sampled ("between-well decon"). Dedicated, in-place pumps and tubing must be thoroughly decontaminated using "daily decon" procedures (see #17, below) prior to their initial use. For centrifugal pumps, it is strongly recommended that non-disposable sampling equipment, including the pump and support cable and electrical wires in contact with the sample, be decontaminated thoroughly each day before use ("daily decon").

EPA's field experience indicates that the life of centrifugal pumps may be extended by removing entrained grit. This also permits inspection and replacement of the cooling water in centrifugal pumps. All non-dedicated sampling equipment (pumps, tubing, etc.) must be decontaminated after each well is sampled ("between-well decon," see #18 below).

17. **Daily Decon**

A) Pre-rinse: Operate pump in a deep basin containing 8 to 10 gallons of potable water for 5 minutes and flush other equipment with potable water for 5 minutes.

B) Wash: Operate pump in a deep basin containing 8 to 10 gallons of a non-phosphate detergent solution, such as Alconox, for 5 minutes and flush other equipment with fresh detergent solution for 5 minutes. Use the detergent sparingly.

C) Rinse: Operate pump in a deep basin of potable water for 5 minutes and flush other equipment with potable water for 5 minutes.

D) Disassemble pump.

E) Wash pump parts: Place the disassembled parts of the pump into a deep basin containing 8 to 10 gallons of non-phosphate detergent solution. Scrub all pump parts with a test tube brush.

F) Rinse pump parts with potable water.

G) Rinse the following pump parts with distilled/ deionized water: inlet screen, the shaft, the suction interconnector, the motor lead assembly, and the stator housing.

H) Place impeller assembly in a large glass beaker and rinse with 1% nitric acid (HNO_3).

I) Rinse impeller assembly with potable water.

J) Place impeller assembly in a large glass bleaker and rinse with isopropanol.

K) Rinse impeller assembly with distilled/deionized water.

18. **Between-Well Decon**

A) Pre-rinse: Operate pump in a deep basin containing 8 to 10 gallons of potable water for 5 minutes and flush other equipment with potable water for 5 minutes.
B) Wash: Operate pump in a deep basin containing 8 to 10 gallons of a non-phosphate detergent solution, such as Alconox, for 5 minutes and flush other equipment with fresh detergent solution for 5 minutes. Use the detergent sparingly.

C) Rinse: Operate pump in a deep basin of potable water for 5 minutes and flush other equipment with potable water for 5 minutes.

D) Final Rinse: Operate pump in a deep basin of distilled/deionized water to pump out 1 to 2 gallons of this final rinse water.

VIII. FIELD LOG BOOK

A field log book must be kept each time ground water monitoring activities are conducted in the field. The field log book should document the following:

- Well identification number and physical condition.
- Well depth, and measurement technique.
- Static water level depth, date, time, and measurement technique.
- Presence and thickness of immiscible liquid layers and detection method.
- Collection method for immiscible liquid layers.
- Pumping rate, drawdown, indicator parameters values, and clock time, at three to five minute intervals; calculate or measure total volume pumped.
- Well sampling sequence and time of sample collection.
- Types of sample bottles used and sample identification numbers.
- Preservatives used.
- Parameters requested for analysis.
- Field observations of sampling event.
- Name of sample collector(s).
- Weather conditions.
- QA/QC data for field instruments.

IX. REFERENCES

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B Membrane Interface Probe (MIP) Standard Operating Procedure

STANDARD OPERATING PROCEDURE

SEI-10.12.0

USE, CALIBRATION, AND MAINTENANCE OF THE MEMBRANE INTERFACE PROBE

SOP Number: 10.12.0
Revision Number: 0

Date Issued: 08/4/04
Date of Revision: na

1.0 OBJECTIVE

The objective of this standard operating procedure (SOP) is to describe and document the procedures necessary for the use, maintenance and calibration of the Membrane Interface Probe (MIP), which includes an integral electrical conductivity (EC) system, manufactured by Geoprobe Systems. The MIP is a direct push tool used to determine the distribution of volatile organic compounds (VOCs) in saturated and unsaturated soils and to infer unconsolidated subsurface geology.

2.0 POLICIES

All SEI staff shall read and document that they have read, understand and agree to follow this SOP prior to using the MIP system. All data will be collected and handled in accordance to SOP SEI-4.5.*n*.

3.0 SAFETY ISSUES

The corporate Health and Safety Plan and the Site Health and Safety Plan specify the procedures to be followed and equipment to be used during site activities. The following is a brief and general overview of safety issues.

- Potential Safety Issues include:
    - Heavy equipment (drill rigs or direct push rigs) hazards
    - Overhead utility hazards
    - Underground utility hazards
    - Traffic/ motor vehicle hazards

- Working with hazardous chemicals, both as standards and as residual contaminants on the probe as it is withdrawn.
- Slip, trip and fall hazards
- Pinch point hazards
- Compressed gas hazards
- Fire hazards from hot work (e.g., grinding)
- Gasoline/Diesel fuel hazards (filling generator)

- In addition, the MIP system presents a potential electrical hazard due to the high voltage (120 V) heater lines that extend from the SEI truck to the tip of the MIP. Operators should unplug the MIP Controller when performing maintenance to either the controller or the connections adjacent the probe.
- During use, the heater block assembly within the probe tip is heated to over 100 °C. Care should be taken to prevent burns when handling the tip.
- MIP operators should take extra care when working with standards. When working with neat standards, make certain that there is adequate ventilation and that Nitrile or Latex gloves are worn and if necessary safety glasses.
- SEI staff and others under contract with SEI that may be present on-site will wear a hardhat whenever overhead hazards are present.
- Appropriate eye protection should be worn
- Hearing protection shall be worn whenever the direct push rig is actively advancing profiling equipment.
- Steel toed boots will be worn
- SEI staff will read and sign the site health and safety plan (HASP) where required prior to beginning a site work.
- Additional personal protective equipment shall be worn in accordance to the health and safety plan.

4.0 PROCEDURES

4.1 Introduction

The MIP provides continuous measurements of VOCs in soil and groundwater. The probe contains a permeable, Teflon membrane, which is maintained within a steel block at approximately 120 °C. As the probe is driven into the subsurface volatile compounds in the soil and/or groundwater are volatilized by the heat, diffuse through the membrane under a concentration gradient, enter the nitrogen carrier gas stream, and are delivered to the surface. The VOC content of the carrier gas stream is then measured using a HP5890 gas chromatograph (GC) equipped with a photoionization detector (PID) and/or an electron capture detector (ECD). In addition, as warranted per site, compound speciation of the contaminated gas stream can be performed using a HP5890 GC. In this step, the effluent from the detectors is trapped in a glass sample tube. The compounds are subsequently concentrated onto a solid phase microextraction (SPME) fiber, injected into the heated injection port of the GC, and separated via capillary GC and detected by a flame ionization detector (FID).

In addition to the detection of subsurface VOCs, the tool is equipped with an electrical conductivity (EC) dipole array at the leading edge of the tool for measuring the electrical conductivity of the surrounding soil and the soil pore water. The electrical conductivity is used to infer the lithology of the soil in contact with the probe. As a general rule, the electrical conductivity of the soil is inversely proportional to grain size. For example, sandy matrices will generally have lower EC values than soil rich in clays.

4.2 Equipment

4.2.1 Geoprobe Equipment

For all Geoprobe equipment see section 3.0 of Geoprobe Membrane Interface Probe Standard Operating Procedure (GMIPSOP) included as Attachment 1. A checklist of equipment used for MIP fieldwork is included in Attachment 2.

4.2.2 Detection Equipment

The MIP detection equipment has the following components:

- Gas Chromatograph: Hewlett Packard 5890 Series II system complete with all required accessories including column supplies, ultra high purity gases, syringes and data system.

- Detectors: photoionization detector (PID), electron capture detector (ECD) and flame ionization detector (FID).
- Analytical Column: SPB-624 10m x 0.20mm ID, 1.1 µm film or equivalent
- Sample introduction and preparation apparatus: 125 mL glass sample chamber with SPME fiber type 100 µm polydimethylsiloxane (PDMS) and/or type 85 μm Carboxen/PDMS.

4.3 System Assembly

A schematic of the detector system for the MIP is given in Figure 1. This schematic shows the basic setup for the MIP system, which includes a PID and ECD in series directly inline with the MIP carrier gas stream, and a FID located at the end of the capillary column on the parallel system. This configuration may be adjusted a to meet the specific needs of a given site. A detector-wiring schematic for the PID and ECD is included as Figure 2.

4.4 Field Operation

Operation of the MIP will follow the procedure described in section 5.0 of GMIPSOP (Attachment 1). In addition, signal attenuation and compound speciation will be performed with the procedures described in the following subsections.

4.4.1 Response Testing

A response test is required before and after each sampling location, as described by the procedure in section 4.0 of GMIPSOP (Attachment 1). When possible, the response test will be performed with one or more of the compounds that are the subject of the field investigation.

4.4.2 Maintaining the MIP Log

A MIP log must be filled out for each location at which the MIP is used at a given site. The MIP log, given in Attachment 2, is divided into three sections: general information, response tests, and profile information. The general information section refers to site details such as hole name, site location, date, client name, MIP operator name and SEI job number as well as MIP diagnostics such as detector baseline(s), carrier gas flow and pressure, heater temperature, and dipole voltage for each profiling location. The response test section of the MIP log is divided into initial and final response tests, and requires documentation of completed response tests before and after each profile location. The final section, referring to profile information, is for documenting actions taken during the profile as well as the corresponding depths of those actions. Potential actions include signal attenuation or sample collection for speciation tests.

4.4.3 Signal Attenuation

Signal attenuation is required when the detector signal is above the allowable range, as signified by a horizontal line in the response versus time graph on the FC4000 field instrument. Signal attenuation should be performed in the following order:

1. Adjust range on the detector
2. Adjust the attenuation on the FC4000 filed instrument by the same multiple

When the signal has decreased back towards the baseline, the range can be adjusted back to the original setting by completing the above steps in the reverse order. It is important that this sequence of steps be performed correctly so that false "peaks" are not created in the data.

An important difference in ECD and PID signal attenuation must be noted. In ECD attenuation, which is performed using the "range" button for Signal 1 located on the keypad on the front of the GC, the signal range is multiplied by values of 2 to a given exponent. Thus, entering 0 for the range gives a total attenuation of 2^0 or 1, entering 1 gives a total attenuation of 2^1 or 2, etc. PID attenuation, as performed on the front of the PID Electrometer, differs in that it can only be adjusted by orders of 10 (1, 10, 100, etc).

Once the range on a given detector has been changed, the attenuation must be adjusted on the FC4000 Field instrument by the same multiple. This is performed in either the signal versus time or signal versus depth screen by pressing the number key that corresponds to the detector in question, and adjusting the attenuation by the value that the detector signal was multiplied.

4.4.4 Compound Speciation

Compound speciation is performed by trapping the effluent from the MIP system, concentrating the volatile contaminants onto a SPME fiber and injecting the sample into a HP5890 Series II gas chromatograph equipped with a SPB-624 capillary column or equivalent and FID detector. The general procedure is described in 5 steps below.

1. Attach the 125 mL glass sample chamber, with both the inlet and outlet-valves open, to the MIP system effluent.
2. Monitor the FC4000 Field instrument for a depth where a considerable response is obtained by the MIP detectors.
3. After 1.5 minutes has elapsed from the beginning of the peak in MIP detector response, close both the inlet and outlet-valves of the glass sample chamber and remove the chamber from the MIP gas flow.
4. Insert the SPME fiber into the glass sample tube for 10 minutes.
5. Insert the SPME fiber into the GC and monitor the FID detector response using HP Chemstation on an externally attached PC.

4.5 Maintenance

4.5.1 General

The MIP system must be assembled as shown in the EC, Heater and Thermocouple Wiring Schematic given as Figure 3. Figure 3 can also be used as a trouble-shooting guide in the field. In addition, each of the diagnostic tests called for in the MIP Diagnostic Log (Attachment 2) must be successfully performed, and documented therein, prior to reporting to a site. Any maintenance that is performed on the MIP system must also be document in the MIP Diagnostic Log. Indicate whether the action performed was routine maintenance (such as replacing a membrane), or non-routine maintenance to correct a failure or malfunction of any part of the system. Note the date on which the action is taken, and describe the action taken. Be sure to sign and date each entry. The MIP Diagnostic Log should be kept with the MIP system at all times.

4.5.2 Membrane Leak Test and Replacement

Membrane leaks are considered to occur frequently and can result in an increase in tailing of detector response. Membrane leaks most often occur around the edges of the membrane and can be observed by spraying a soapy solution onto the membrane while the heater is at room temperature. Note that a small amount of gas flow (1-3 mL/min) can be observed through the center of the membrane during this procedure. Membrane leak testing should be performed at carrier gas pressures between 15 and 20 PSI. This pressure range can be achieved by disconnecting the outlet line of the MIP system and restricting flow with a finger or end cap.

Membrane replacement will be performed on an as-needed basis, either due to a reduction in response or excessive leaking. The membrane replacement procedure is described in Section 6.0 of GMIPSOP.

5.0 RESPONSIBILITIES

It is the responsibility of the individual employee to read SOPs and document training associated with the area of work they are performing.

It is the responsibility of the individual employee to follow SOPs covering activities in his/her work area and to identify and document a deviation from the written SOP.

6.0 DEFINITIONS

None

7.0 REFERENCES

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SW846. ASTM D6520.

Geoprobe Membrane Interface Probe (MIP), Standard Operating Procedure, Technical Bulletin No. MK3010, Prepared: May 2003

8.0 FIGURES

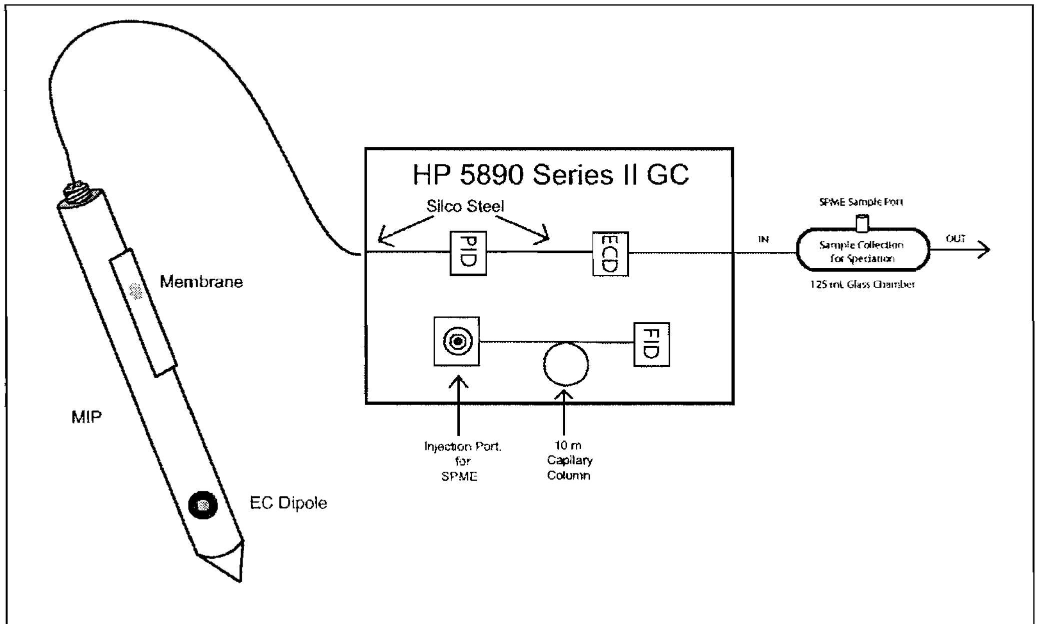

FIGURE 1: DETECTOR SYSTEMS
SEI SOP# 10.11.0 *Use, Maintenance and Calibration of the Membrane Interface Probe*

I:\GLP\SOP\SEI_SOPs\Ch10_EnvDrillcrafts\MIP\Figure 1
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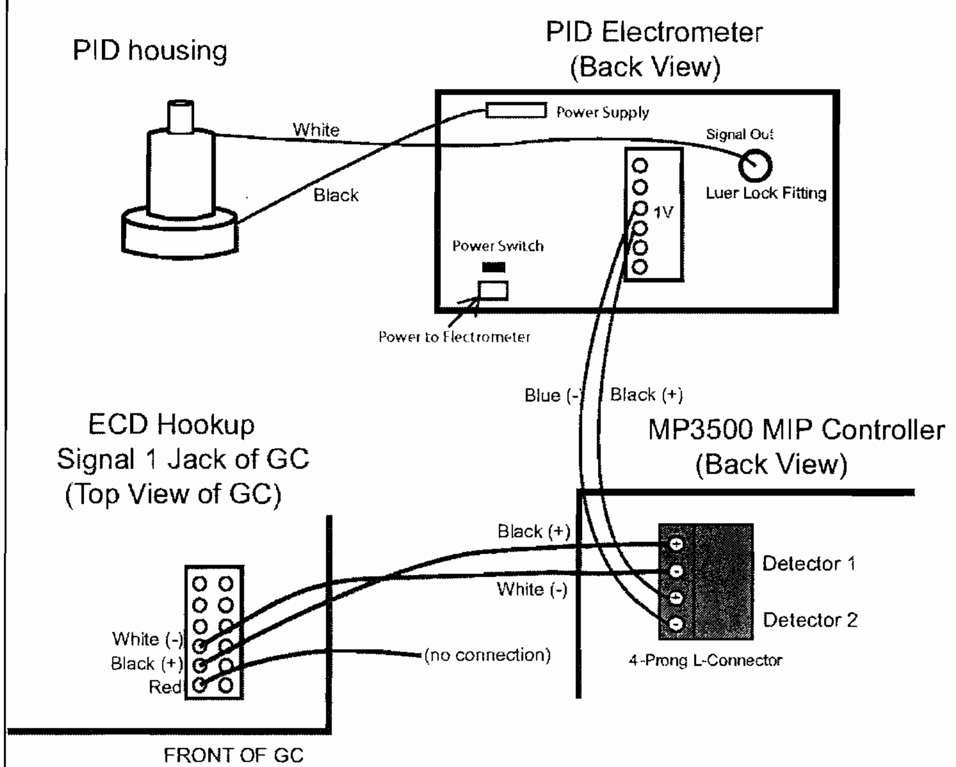

FIGURE 2: DETECTOR WIRING SCHEMATIC
SEI SOP# 10.11.0 *Use, Maintenance and Calibration of the Membrane Interface Probe*

I:\GLP\SOP\SEI_SOPs\Ch10_EnvDrill\drafts\MIP\Figure 1
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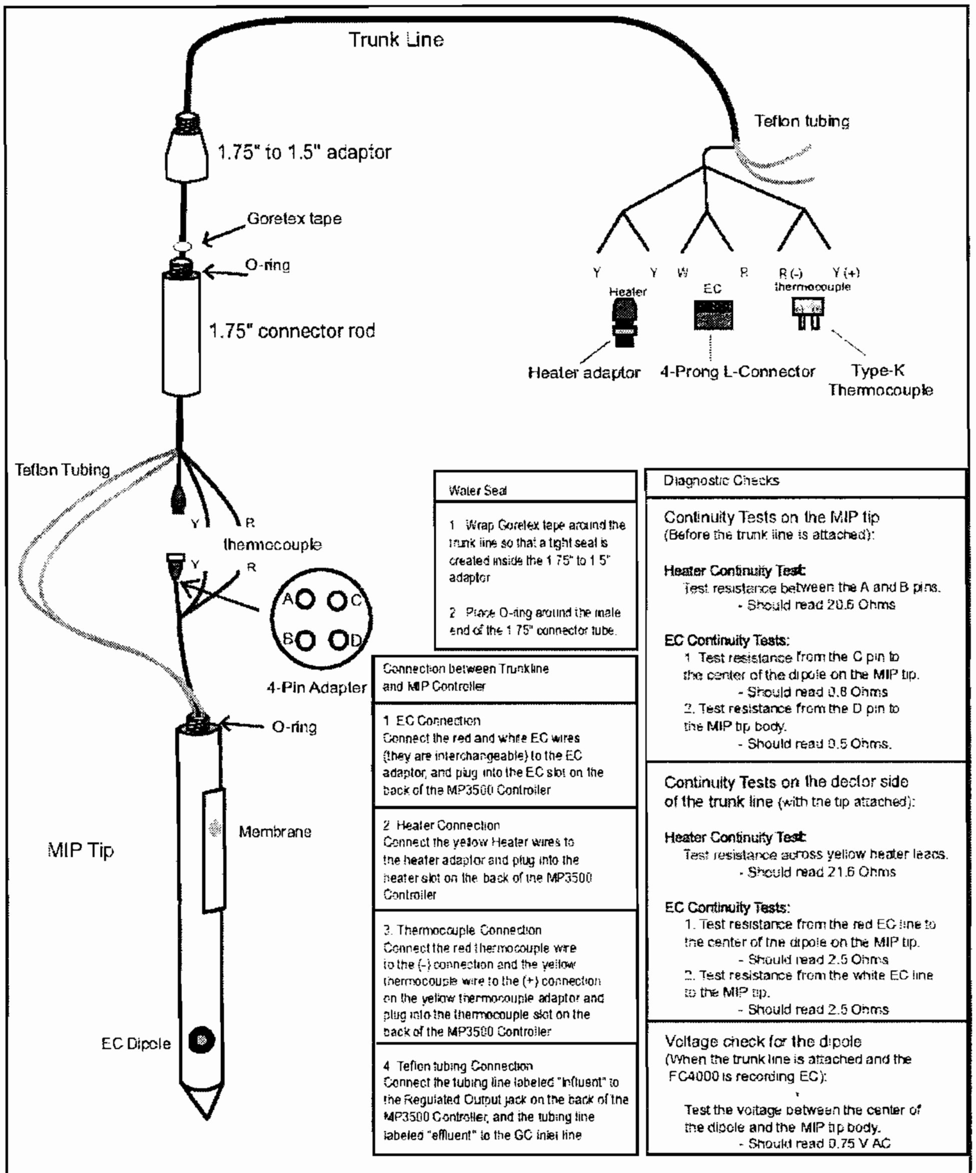

FIGURE 3: EC, Heater and Thermocouple wiring schematic
SEI SOP# 10.11.0 *Use, Maintenance and Calibration of the Membrane Interface Probe*

I:\GLP\SOP\SEI_SOPs\Ch10_EnvDrill\drafts\MIP\Figure 3
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STONE ENVIRONMENTAL INC

9.0 AUTHORIZATION

Authored by:________________________________ Date:__________

Adam Grenier, Staff Scientist

Approved by:________________________________ Date:__________

Christopher T. Stone, President

10.0 REVISION HISTORY

Not Applicable

Attachment 1

Geoprobe Membrane Interface Probe

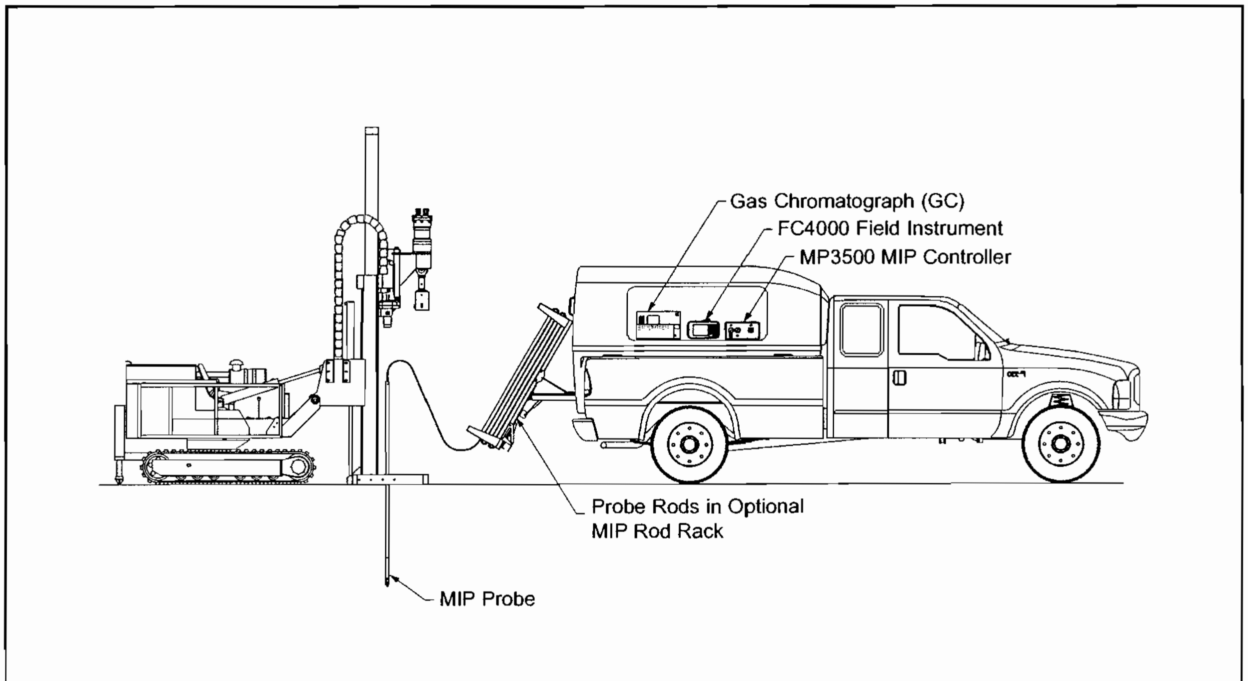
Standard Operating Procedure (GMIPSOP)

GEOPROBE® MEMBRANE INTERFACE PROBE (MIP)

STANDARD OPERATING PROCEDURE

Technical Bulletin No. MK3010

PREPARED: May, 2003



THE MIP SYSTEM MAY BE DEDICATED TO A SINGLE CARRIER VEHICLE FOR USE IN TANDEM WITH MULTIPLE GEOPROBE® DIRECT PUSH MACHINE MODELS

Geoprobe Systems®

A DIVISION OF KEJR, INC.

Geoprobe Systems®

Geoprobe® and Geoprobe Systems®, Macro-Core® and Direct Image®
are Registered Trademarks of Kejr, Inc., Salina, Kansas

Equipment and tool specifications, including weights, dimensions, materials, and operating specifications included in this brochure are subject to change without notice. Where specifications are critical to your application, please consult Geoprobe Systems®.

1.0 OBJECTIVE

This document serves as the standard operating procedure for use of the Geoprobe Systems® Membrane Interface Probe (MIP) to detect volatile organic compounds (VOCs) at depth in the subsurface.

2.0 BACKGROUND

2.1 Definitions

Geoprobe®: A brand name of high quality, hydraulically-powered machines that utilize both static force and percussion to advance sampling and logging tools into the subsurface. The Geoprobe® brand name refers to both machines and tools manufactured by Geoprobe Systems®, Salina, Kansas. Geoprobe® tools are used to perform soil core and soil gas sampling, groundwater sampling and testing, soil conductivity and contaminant logging, grouting, and materials injection.
**Geoprobe® is a registered trademark of Kejr, Inc., Salina, Kansas.*

Membrane Interface Probe (MIP): A system manufactured by Geoprobe Systems® for the detection and measurement of volatile organic compounds (VOCs) in the subsurface. A heated probe carrying a permeable membrane is advanced to depth in the soil. VOCs in the subsurface cross the membrane, enter into a carrier gas stream, and are swept to gas phase detectors at ground surface for measurement.

2.2 Discussion

The MIP is an interface between contaminates in the soil and the detectors at ground surface. It is a screening tool used to find the depth at which the contamination is located, but is not used to determine concentration of the compound. Two advantages of using the MIP are that it detects contamination in situ and can be used in all types of soil conditions.

Refer to Figure 2.1. The MIP is a logging tool used to make continuous measurements of VOCs in soil. Volatile compounds outside the probe diffuse across a membrane and are swept from the probe to a gas phase detector at ground surface. A log is made of detector response with probe depth. In order to speed diffusion, the probe membrane is heated to approximately 100° C (212° F).

Along with the detection of VOCs in the soil, the MIP also measures the electrical conductivity of the soil to give a probable lithology of the subsurface. This is accomplished by using a dipole measurement arrangement at the end of the MIP probe so that both conductivity and detector readings may be taken simultaneously. A simultaneous log of soil conductivity is recorded with the detector response.

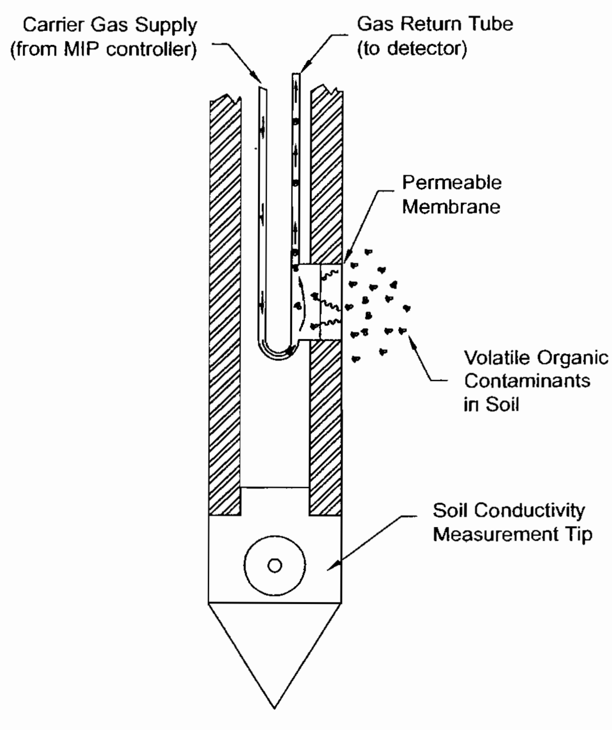


Figure 2.1
Schematic drawing of the MIP probe

3.0 Tools and Equipment

The following equipment is needed to perform and record an MIP log. Basic MIP system components are listed in this section and illustrated in Figure 3.1. Refer also to Appendix I for more required tools as determined by your specific model of Geoprobe® direct push machine.

3.1 Basic MIP System Components

Description	Quantity	Part Number
Field Instrument	(1)	FC4000
MIP Controller	(1)	MP3500
MIP/EC Acquisition Software	(1)	MP3517
MIP Probe	(1)	MP4510
Replacement Membrane	(1)	MP3512
Membrane Wrench	(1)	16172
LB Sample Tube	(1)	AT6621
Stringpot (linear position transducer)	(1)	SC160
Stringpot Cordset	(1)	SC161
MIP O-ring and Service Kit	(1)	MP2515
MIP Trunkline, 100-ft (30 m) length	(1)	MP2550
Extension Cord, 25-ft (8 m) length	(1)	SC153
Needle Valve	(1)	13700
24-in. Nafion Dryer Tube	(1)	12457

3.2 Anchoring Equipment

Description	Quantity	Part Number
Soil Anchor, 4.0-in. OD flight	(3)	10245
Anchor Foot Bridge	(1)	10824
Anchor Plate	(3)	10167
GH60 Hex Adapter (if applicable)	(1)	10809
Chain Vise	(3)	10075

3.3 Optional Accessories

Description	Quantity	Part Number
MIP Trunkline, 150-ft (46 m) length	(1)	13999
MIP Trunkline, 200-ft (61 m) length	(1)	15698
FID Compressed Air System	(1)	AT1004
Hydrogen Gas Regulator	(1)	10344
Nitrogen Gas Regulator	(1)	13940
Cable Rod Rack, for 48-in. rods	(1)	18355
Rod Cart Assembly, for 1.25-in. OD rods	(1)	SC610
Rod Cart Hitch Rack, for SC610	(1)	SC650K
Rod Cart Carrier, for SC610	(1)	SC675
Rod Wiper, for 5400 Series foot	(1)	AT1255
Rod Wiper, for 66 Series foot	(1)	18181
Rod Grip Pull Handle, for GH40 hammer	(1)	GH1255
Rod Grip Pull Handle, for GH60 hammer	(1)	9641
Water Transport System	(1)	19011

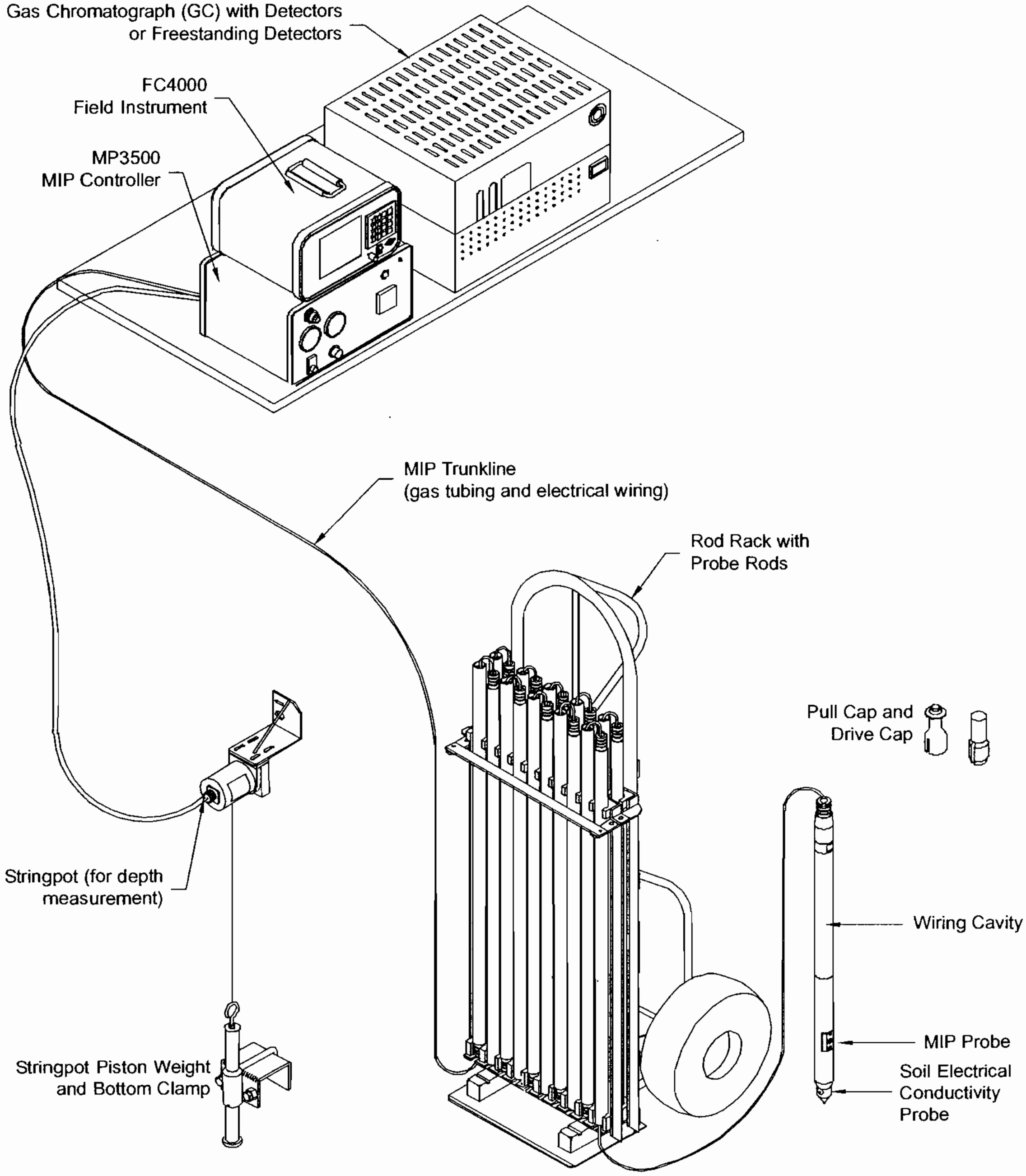


Figure 3.1
MIP system components

4.0: Quality Control - Response Testing

Response testing is an important quality control measure used to validate each log by proving that the integrity of the system is intact. Without running a response test, the operator will not know if the system is detecting the correct compounds or even if the system is working.

4.1 Preparation for Response Testing

Response testing is a necessary part of the MIP logging process because it ensures that the entire system is working correctly and also enables the operator to measure the trip time. Trip time is the time it takes for the contaminant to go from the probe, through the trunk line, and to the detectors. This time will need to be entered into the MIP software for depth calculations as described later in this document.

The following items are required to perform response testing:

- Neat sample of the analyte of interest (i.e.: benzene, TCE, PCE, etc.) purchased from chemical vendor
- Microliter syringes
- 25- or 50-mL Graduated cylinder
- Several 40-mL VOC vials with labels
- Testing cylinder made from a nominal 2-in. PVC pipe with a length of 24 in.
- 0.5 L plastic beaker or pitcher
- 25 mL Methanol
- Supply of fresh water, 0.5 L needed per test
- 5-gallon bucket filled with fine sand and water
- Stopwatch

Preparation of the stock standard is critical to the final outcome of the concentration to be placed into the testing cylinder.

1. Pour methanol into graduated cylinder to the 25 mL mark.

2. Pour 25 mL of methanol from graduated cylinder into 40-mL VOC vial.

3. Mix appropriate volume of desired neat analyte into 40-mL VOC vial containing 25 mL of methanol. The required volume of neat analyte for five common compounds is listed in Column 3 of Table 4.1. Use the equation at the then of this section to calculate the appropriate neat analyte volume for other compounds of interest.

4. Label the vial with name of standard (i.e. TCE, PCE, Benzene), concentration (50 mg/mL), date created, and created by (your name). This is the Stock Standard.

The equation used for making a stock standard is shown on the following page..

Table 4.1
Density and required volumes of neat compounds used to make a 50 mg/mL working standard into 25 ml of methanol

Compound	Density (mg/uL)	Volume of Neat Analyte Required to Prepare a Working Standard (uL)
Benzene	0.8765	1426
Toluene	0.8669	1442
Carbon Tetrachloride	1.594	784
PCE	1.6227	770
TCE	1.4642	854

25 mL (methanol) x 50 mg/mL = 1250 mg
1250 mg x 1/density of analyte = amount of neat material to be placed into 25 mL of Methanol

Example: Preparation of 50 mg/mL Benzene standard.
1250 mg x 1/0.8765 mg/uL = 1426 uL
Use 1426 uL of neat Benzene in 25 mL of Methanol to get a 50 mg/mL standard.

4.2 Response Test Procedure

With the standard prepared, the operator is ready to test the response of the probe as described below.

1. Immerse the probe into the 5-gallon bucket of fine sand and water to stabilize the baseline. This is necessary due to the sensitivity of the photoionization detector (PID) and the electron capture detector (ECD) to water.

2. Access the MIP Time software and view the detector vs. time data. The detector signals should be stable before proceeding.

3. Obtain 500 mL of water (either tap water or distilled) in a suitable measuring container.

Table 4.2
Volume of 50 mg/mL working standard and final concentration in 0.5 L test sample volume

Volume of 50 mg/mL Standard	Final Concentration of 0.5 L Sample (mg/L or ppm)
1000 uL	100
100 uL	10
10 uL	1

4. Use a standard volume specified in Table 4.2 to mix the desired test concentration. This is the Working Standard.

5. Pour the working standard into a nominal 2-inch x 24-inch PVC pipe and immediately insert the MIP into the solution (Fig. 4.1). Leave the probe in the test solution for 45 seconds. At the end of 45 seconds, place the probe back in the 5-gallon bucket of sand and water.

6. From the results on the MIP Time software the trip time and response time can both be measured (Fig. 4.2).

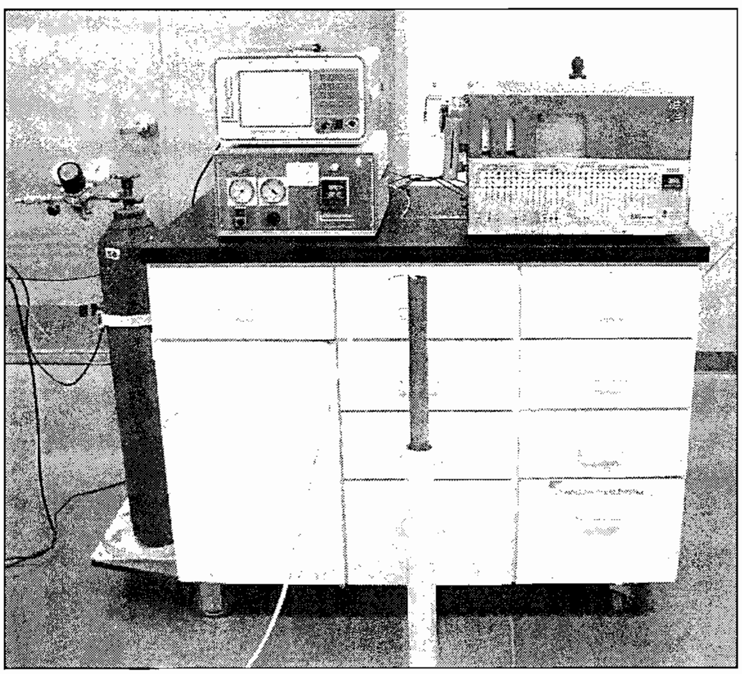


Figure 4.1
The MIP probe is placed in a PVC pipe containing the standard solution.

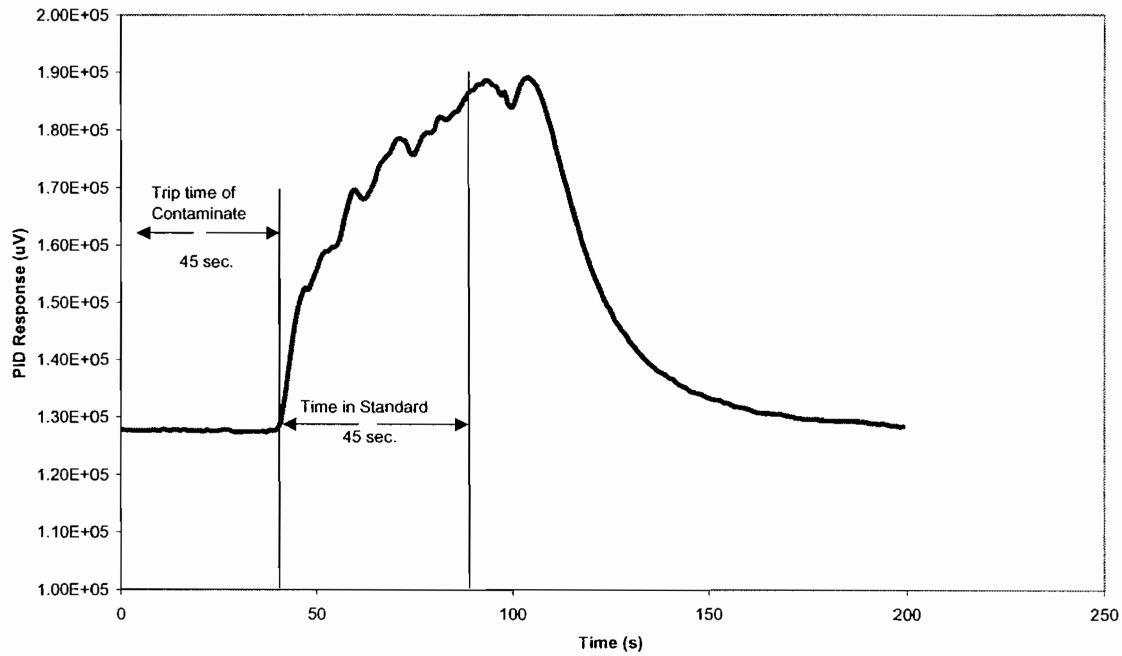


Figure 4.2
SRI PID Response Test - 10 ppm Benzene

5.0 Field Operation

1. Power on the generator.

2. Turn on any gases that will be used for the MIP system (i.e. nitrogen carrier gas, hydrogen for the FID, etc.). Check the flow rate of the system and psi on the mass flow controller. Compare these numbers to previous work.

3. Power on the detector or detectors and allow to warm up to set temperature (approximately 30 minutes).

4. Power on the MP2500 or MP3500 MIP Controller.

5. Power on the computer or the FC4000 Field Instrument.

6. Advance a pre-probe 3 to 4 feet into the subsurface at the location to be logged.

7. Remove the pre-probe and raise the probe foot of the direct push machine.

8. If advancing the MIP with percussion, raise the probe foot enough to slide the rod wiper plate underneath.

9. If pushing only, turn the desired amount of anchors into the subsurface and return the probe foot to the position from which the pre-probe was advanced. Leave the probe foot raised sufficiently to allow sliding the rod wiper underneath.

10. Place the rod wiper plate under the foot such that the opening is directly over the pre-probed hole. Lower the foot firmly onto the rod wiper.

11. If pushing only, position the anchoring bridge over the foot of the machine such that the anchors extend through the holes in the bridge (fig. 5.1). Install a chain vise at each anchor to secure the bridge.

12. With the software loaded, run a response test (Section 4.0) and record the height of the peak response and the trip time into a field notebook. Refer to Figure 4.2.

13. If the trip time is different than what was placed into the software, restart the software and enter the correct trip time.

14. Attach a slotted drive cap to the MIP drive head.

15. Insert the MIP point into rod wiper opening and drive it into the soil until the membrane of the probe is at ground level.

16. Connect the stringpot cable to the stringpot weight located on the probe foot and pull keeper pin so the weight drops to the ground.

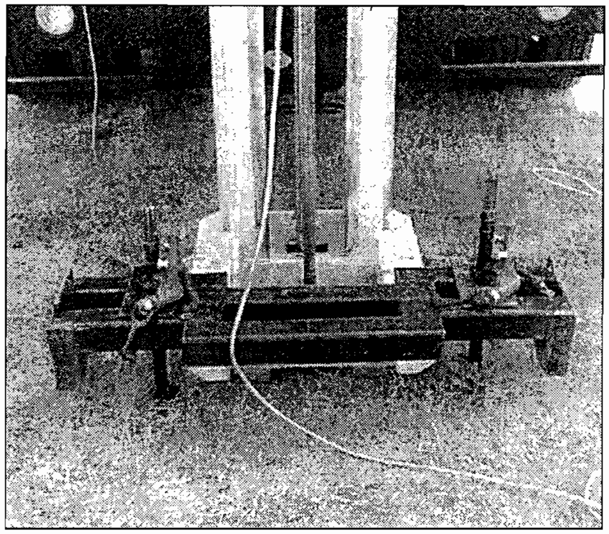


Figure 5.1
Anchor the probe foot to allow advancement of MIP probe by push only (no percussion).

NOTE: Do not allow the stringpot cable to retract into the stringpot housing at a high rate. This will ultimately damage the stringpot.

17. Record the system parameters in a field notebook at this time (i.e.. mass flow, trip time).

NOTE: If the mass flow reading drops or rises more than one psi, turn off the flow at the primary controller and remove the probe from the ground. If the temperature monitor quits heating or gives an error, remove the probe from the ground.

18. Place the trigger switch in the "ON" position.

19. Advance the probe at a rate of 1 ft/min to the predetermined log depth or until refusal is attained.

NOTE: Refusal is attained when it takes longer than 1.5 minutes of continuous hammering to advance the probe one foot. This is the maximum time to reach one foot of probe travel.

20. When the MIP log is complete, turn the trigger off and slowly return the stringpot cable into the stringpot housing.

21. Pull the probe rod string using either the Geoprobe® rod grip pull system or a slotted pull cap.

22. When the MIP reaches the surface, clean the face with water and run a response test. This response test should be written down in the field notes and compared to the initial test. This system check ensures the data for that log is valid.

23. Save the data to a 3.5-inch floppy disk and exit the MIP software.

24. Data from the MIP can now be graphed with Direct Image® MIP Display Log or imported into any spreadsheet for graphing.

6.0 Replacing a Membrane on the MIP Probe

A probe membrane is considered in good working condition as long as two requirements are met: 1) The butane sanity test result is greater than 1.0E+06 uV response, 2) Flow of the system has not varied more than 3 mL/min from the original flow of the system (a flow meter or bubble flow meter should be kept with the system at all times). If either one of these requirements are not met, a new face must be installed as follows.

1. Turn the heater off and allow the block to cool to less than 50° C on the control panel readout.

2. Clean the entire heating block with water and a clean rag to remove any debris.

3. Dry the block completely before proceeding.

4. Remove the membrane using the membrane wrench (Fig. 6.1). Keep the wrench parallel to the probe while removing the membrane to ensure proper engagement with socket head cap screw.

NOTE: Do Not leave the membrane cavity open for extended periods. Debris can become lodged in the gas openings in the plug.

5. Remove and discard the copper washer as shown in Figure 6.2. Each new membrane is accompanied by a new copper washer. **Do not reuse the copper washer.**

6. Inspect the open cavity for any foreign objects. Remove any objects present and clean the inside of cavity of any soil that was deposited on the wall of the block.

7. Insert the new copper washer around the brass plug making sure that it sits flat on the surface of the block.

8. Install the new membrane by threading it into the socket. Use the membrane wrench to tighten the membrane to a snug fit. Do not overtighten.

9. Turn the gas on and leave the heater off. Apply water to the membrane and surrounding area to check for leaks. If a leak is detected (bubbles are formed in the water), use the membrane wrench to further tighten the membrane.

10. Use a flow meter/bubble flow meter to check flow to the detectors. Record this value in a field notebook.

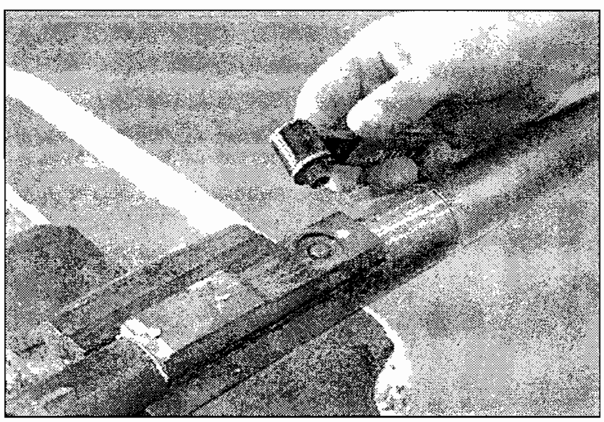


Figure 6.1
Unthread the membrane from the probe block.

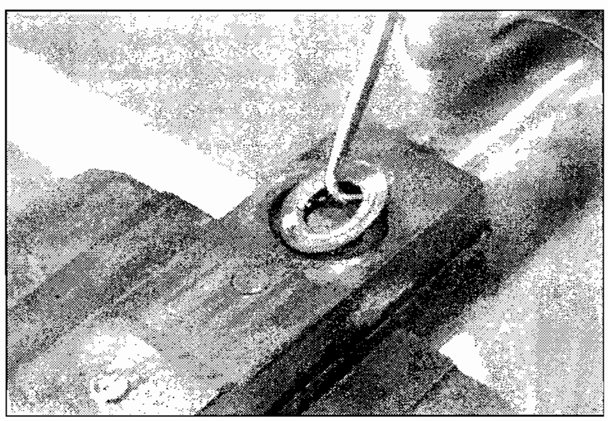


Figure 6.2
Remove and discard the copper washer.

Appendix I: Tools for Various Direct Push Machines

Model 5400 and 54DT Direct Push Machines

Description	*Part Number*
Stringpot Mounting Bracket	SC110
Stringpot Bottom Clamp	SC111
Stringpot Piston Weight	SC112
Slotted Drive Cap, for 1.25-in. rods	AT1202
Slotted Pull Cap, for 1.25-in. rods	AT1203
MIP Drive Adapter, for 1.25-in. rods	MP2512
MIP Drive Head	GW1516
Probe Rod, 1.25-in. x 48-in.	AT1248

Model 54LT Direct Push Machine

Description	*Part Number*
Stringpot Mounting Bracket	11433
Stringpot Bottom Clamp	SC111
Stringpot Piston Weight	SC112
Slotted Drive Cap, for 1.25-in. rods	AT1202
Slotted Pull Cap, for 1.25-in. rods	AT1203
MIP Drive Adapter, for 1.25-in. rods	MP2512
MIP Drive Head	GW1516
Probe Rod, 1.25-in. x 48-in.	AT1248

Model 5410 Direct Push Machine

Description	*Part Number*
Stringpot Piston Weight	SC112
Slotted Drive Cap, for 1.25-in. rods	AT1202
Slotted Pull Cap, for 1.25-in. rods	AT1203
MIP Drive Adapter, for 1.25-in. rods	MP2512
MIP Drive Head	GW1516
Probe Rod, 1.25-in. x 48-in.	AT1248

Model 6600, 66DT and 6610DT Direct Push Machines

Description	*Part Number*
Stringpot Mounting Bracket	16971
Stringpot Bottom Clamp	11751
Stringpot Piston Weight	SC112
Slotted Drive Cap, for 1.5-in. rods	15607
Slotted Pull Cap, for 1.5-in. rods	15164
Drive Cap Adapter, for GH60 and 1.25-in. rods	15498
MIP Drive Adapter, for 1.5-in. rods	18563
MIP Friction Reducer	18564
Probe Rod, 1.5-in. x 48-in.	13359

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Attachment 2

MIP Log

MIP Diagnostics Log

MIP Checklist

MIP LOG

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Page ____ of ____

Hole Name: ______________ MIP Operator(s): ______________ DET 1/Baseline ______________

Client: ______________ MIP Serial # ______________ DET 2/Baseline ______________

Date ______________ Drilling Contractor ______________ MIP Pressure/Flow Rate ______________

Site Location ______________ Probe Temp ______________

SEI # ______________ EC Voltage ______________

Initial Response Test

File Name	Concentration/ Analyte (ppm)	Response Time (s)	Detector 1: Max Response (mV)	Detector 2: Max Response (mV)	Comments:

Final Response Test

File Name	Concentration/ Analyte (ppm)	Response Time (s)	Detector 1: Max Response (mV)	Detector 2: Max Response (mV)	Comments:

Profile

File Name: Start depth: End Depth:

Depth	Action/Comment:

MIP Diagnostic Log

MIP Serial #: ____________

Date: ______________ Dates of Use: From ______ to ______

User Name(s): ____________________

SEI Project #: ____________________

Diagnostics Record

Parameter	Expected Meter Value	Actual Meter Value	Comments/Corrective Action
Heater Resistivity	22 Ohms		
Dipole Voltage	0.75 V AC		
EC Resistivity	2.5-3.6 Ohms		
Thermocouple Temp	Room Temp		
Regulator Deliviery Pres.	30 PSI		
Membrane Leak Check	No leak at 15 PSI		
Heater Max Temp	121-140 C		
MIP Pressure/Flow	8-12 PSI / 40-60 ml/min		
Dryer gas Flow Rate	2x MIP Flow		
ECD Flow Rate	30-60 ml/min		
ECD Anode Purge	1/10 of AUX Flow		

Maintenance Record

Signature(s) ____________________

____

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MIP Checklist

Geoprobe Product #	TIP ACCESSORIES	#	
MP6501	1.75" Probe	2	______
MP3512	Replacement Membranes		______
15328	Membrane Washers		______
MP2550	Trunkline	·2	______
16172	Membrane Wrench	2	______
20701	1.75" Conector tube	2	______
20712	1.75" to 1.5" tube adaptor	2	______
MP2515	MIP Service Kit	1	______
	Probe Accessories		
SC160	Stringpot Assembly	1	______
SC161	Stringpot Cord	1	______
SC112	Stringpot Piston Assembly	1	______
15607	1.5" Drive Cap	2	______
15164	1.5" Pull Cap	1	______
15498	Drive Cap adaptor	1	______
23321	Drive Cushion Assembly	1	______
18465	8" Soil Anchor	3	______
15513	Soil Anchor Extension	3	______
15340	Steel Foot Bridge	1	______
10167	Anchor Plate	3	______
10809	Hex adaptor for Anchor Assembly	1	______
10075	Chain Vise	2	______
20400	1.5" Pull Dog	1	______
	Pipe Wrench	2	______
	GC Accessories		
	Glass Sample Trap	2	______
	Fiber Holder	2	______
	Fibers	2	______
	MeOH	500mL	______
	Neat Stds		______
	Assorted Syringes		______
	UHP Gases		______
	Bubble flow meter		______
	General Accessories		
	Floppy Discs		______
	Water Vessel w/ spigot		______
	400 mL Graduated Cylinder	1	______
	Response Test Vessels	2	______
	Purge Bucket	2	______
	Printer Paper		______
	Manila Folders		______
	Data Stick		______
	Magnetic Egg Timer		______
	measuring stick		______
	Alconox Squirt Bottle	1	______

STONE ENVIRONMENTAL INC

C Quality Assurance Project Plan

Site-Specific Quality Assurance Project Plan (QAPP) Predesign Investigations at Landfill 6, Building 817/WSA, Building 775, and AOC 9

Former Griffiss Air Force Base Rome, New York

July 2006

Prepared for:

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290 Elwood Davis Road
Liverpool, New York 13088

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List of Tables

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List of Acronyms

AFCEE	Air Force Center for Environmental Excellence
AOC	Area of Concern
ASP	Analytical Services Protocol
DUSR	Data Usability Summary Report
EDD	Electronic Data Deliverable
EEEPC	Ecology and Environment Engineering, P.C.
EPA	(United States) Environmental Protection Agency
ERPIMS	Environmental Restoration Program Information Management System
FSP	Field Sampling Plan
LCS	Laboratory Control Sample
MSB	Method Spike Blank
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NYSDEC	New York State Department of Environmental Conservation
PDI	Predesign Investigation
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
SOP	Standard Operating Procedure
STL	Severn-Trent Laboratories
SOW	Scope of Work

List of Abbreviations and Acronyms (cont.)

TCE	trichloroethylene
TCL	Target Compound List
USACE	United States Army Corps of Engineers
VOCs	Volatile Organic Compounds
µg/L	micrograms per liter
WSA	Weapons Storage Area

1 Project Management

This site-specific Quality Assurance Project Plan (QAPP) has been prepared by Ecology and Environment Engineering, P.C. (EEEPC) along with Parsons Infrastructure and Technology Group, Inc., under contract to the United States Army Corps of Engineers (USACE), Kansas City District, Contract No. W912DQ-06-D-0012. EEEPC will perform Predesign Investigations (PDIs) at the following On-Base Groundwater Areas of Concern (AOCs) at the former Griffiss Air Force Base (Griffiss AFB) in Rome, New York: Landfill 6 (LF6), Building 817/Weapons Storage Area (WSA), AOC 9, and Building 775/Pumphouse 3. The performance of this study is recommended, as described in this work plan, because of existing groundwater contamination at these sites.

This QAPP has been prepared as part of the PDI work plan for the project and is an addendum to the existing QA plans for the site. The existing QA plans for the Long-term Monitoring Program and ongoing remedial actions have been reviewed and approved by the USACE, United States Air Force, New York State Department of Environmental Conservation (NYSDEC), and United States Environmental Protection Agency (EPA). EEEPC's work will maintain consistency with the historical data by implementing the same QA program for the Predesign Investigation.

This addendum documents changes, modifications, or new procedures and practices to be used that are applicable to PDI activities anticipated under this investigation. This site-specific QAPP is formatted to address the four major sections listed in the EPA Requirements for QA Project Plans (QA/R-5): Project Management, Data Generation and Acquisition, Assessment and Oversight, and Data Validation and Usability. The information provided covers only the procedures specific for implementing the Predesign Investigation.

This QAPP will incorporate by reference the QA program *Field Sampling Plan for Long-Term Monitoring Program, GAFB, Revision 3.0, March 2005* prepared by FPM Group, Ltd. The QA program implements the requirements of Air Force Center for Environmental Excellence (AFCEE) Quality Assurance Project Plan Version 3.1 with approved exceptions for the laboratory and USACE requirements. Attachment A of the QAPP includes the target compounds and reporting limits. Attachment B of the QAPP includes the list of laboratory exceptions to the AFCEE QAPP.

1.1 Project Organization

The project team for this site is listed below on Table 1-1. The laboratory to be used for the Predesign Investigation analysis is Severn-Trent Laboratories (STL)-Buffalo:

Attn: Mark Nemec/Tony Bogolin
Severn-Trent Laboratories – Buffalo
10 Hazelwood Drive, Suite 106
Amherst, NY 14228
Phone: 716-691-2600
Fax: 716-691-7991

STL-North Canton will be used as a backup laboratory.

Attn: Debbie Dunn
Severn-Trent Laboratories
4101 Shuffel Drive NW
North Canton, OH 44720
Phone: 303-497-9396
Fax: 303-497-0772

1.2 Problem Definition/Background

The problem and background for this work assignment are defined in the PDI work plan.

1.3 Project Description

The specific scope of work (SOW) for the current activities is defined in the PDI work plan.

Table 1-1 Project Organization, Predesign Investigation at the Former Griffiss AFB

Key Team Member	Contact Name and Telephone	
USACE Project Manager	Nanci Higginbotham	816 389-3359
USACE QA Officer	Amy Darpinian, Ph.D.	816-389-3897
Parsons Project Manager	John Lanier	716-633-7074
Parsons QA Officer	Norm Hilmar	303-764-8806
EEEPC Program Manager	Tim Grady	716-684-8060
EEEPC QA Officer	Marcia Meredith Galloway	716-684-8060
EEEPC Project Manager	Robert Meyers	716-684-8060
EEEPC Field Team Leader	Brian Cervi	716-684-8060
EEEPC Project Chemist	Rebecca Humphrey	716-684-8060
Laboratory	STL Buffalo	716-691-2600
Data Validator	EEEPC	716-684-8060

1.4 Quality Objectives and Criteria

The quality objectives and performance criteria for the Predesign Investigation are outlined in Attachments A and B. These general objectives can be found in the PDI work plan, Section 2.1 (Scope of Work).

1.5 Special Training/Certification

The data validator responsible for data review will meet the requirements for NYSDEC Guidance for the Development of Data Usability Summary Reports (DUSRs), June 1999.

1.6 Documents and Records

Sample identification will be used as noted below. Table 2-1 of the PDI work plan lists the samples to be collected. The sample identification scheme includes a code for the site, the matrix code, and a sequential number. A "/D" will be added for the field duplicate and a "/S" will be added for split samples..

Site Code – MM - # (/D for duplicate and /S for split)

Where MM =

- MW = Monitoring well;
- TB = Trip Blank; and
- # is the sequential monitoring well number.

The laboratory will provide a hard-copy deliverable that contains the information specified for NYSDEC Analytical Services Protocol (ASP) Category B using AFCEE type forms. Electronic data will be provided in accordance the standard laboratory electronic data deliverable (EDD) format for the Environmental Restoration Program Information Management System (ERPIMS) as outlined in the ERPIMS Data Loading Handbook and the ERPIMS Quality Control Tool/Personal Computer (ERTOOLS/PC). The data will be input to the Griffiss AFB Geographical Information System (GIS). EEEPC will use only the electronic data for evaluation and reporting. The laboratory will certify the electronic data match the hard copy reported for each package.

The following records and reports will be produced as part of this project.

- Work Plan,
- Site-specific Health and Safety Plan,
- Site-specific QAPP,

- Field Logbook (including boring logs),
- Daily Logs,
- Chain-of-custody Form,
- Laboratory Data Package – Category B using AFCEE Forms,
- Data Usability Summary Report (DUSR),
- Draft Report, and
- Draft Final Report.

Daily Logs

Daily logs and data forms are necessary to provide sufficient data to enable participants to reconstruct events that occurred during the project and to refresh the memory of field personnel should they be called upon to give testimony during legal proceedings. Daily logs also should document any deviations from the work plan, QAPP, or other applicable planning document. Procedures for recording information are specified in the Field Activities Logbook Standard Operating Procedure (SOP). All entries will be made in waterproof ink, and the time of the entry will be recorded. The top of each page of the logbook will contain the EEEPC project number, project name, and date that the entries on that page were recorded. No pages will be removed for any reason. Corrections will be made according to the procedures given later in this section. The daily logs will include a Site Log and a Task Log.

2 Data Generation and Acquisition

The samples and analytical methods planned for this site are provided on Table 2-1 of the PDI work plan. QAPP Table 2-1 lists all analyses that may be performed for this project. Laboratory target compounds, reporting limits, and current control limits are provided in Attachment A for the water methods listed on Table 2-1. All additional QC information pertaining to the methods can be found in Attachment B, Exceptions to the AFCEE QAPP.

For groundwater samples, STL-Buffalo will report the list of target VOCs that have been reported for the long-term monitoring program at the former Griffiss AFB. STL-Buffalo will report the same low-level reporting limits (see Attachment B).

Table 2-1 Required Analytical Methods for the Predesign Investigation at the Former Griffiss AFB

Parameter	Method	Containers	Preservation	Holding Time
Groundwater				
TCL VOCs	SW8260B	Three 40-ml glass VOA vials with teflon septa	Cool to 4°C HCl to pH <2	14 days

The collection of field QC samples is summarized on Table 2-2.

Table 2-2 Field Quality Control Guidelines for the Predesign Investigation at the Former Griffiss AFB

QC Sample	Description
Field Duplicate	One per matrix per 10 samples.
Field Split	One per matrix per 10 samples.
Ambient Condition Blank	Ambient blanks will not be collected for groundwater samples.
Trip Blank	One per shipment for each set of groundwater samples shipped.

The laboratory QC sample requirements follow the master QAPP and are summarized on Table 2-3.

Table 2-3 Laboratory Quality Control Sample Guidelines for the Predesign Investigation at the Former Griffiss AFB

QC Sample	Description
Method Blank	One per matrix per preparation batch for each analysis.
Matrix spike blank (MSB)/laboratory control sample (LCS)	One per matrix per preparation batch for each analysis. The MSB/LCS must contain all target analytes of concern at the site or as specified by the method.
Surrogate Spikes	Per samples as specified by the method.
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	One per matrix per preparation batch for each analysis.

3 Assessment and Oversight

EEEPC's assessment and oversight procedures for the project activities will be the same as the current QA plans and are described in the PDI work plan and summarized below.

3.1 Assessment and Response Actions

Planned assessment activities for these work assignment activities are as follows:

Field Audits

No field audits are planned.

Field Inspections

No field audits are planned.

Laboratory Audits

No project-specific audits are planned.

3.2 Reports to Management

The reports to management include a daily quality control summary report to document daily field activities and field adjustment form to document any changes in the field. The data validator will prepare a DUSR for each entire sampling round.

4 Data Validation and Usability

EEEPC will implement the general procedures for data validation and usability described in the current QA plans.

4.1 Data Review, Validation, and Verification Requirements

The laboratory is responsible for reviewing data in accordance with their approved QA manual and AFCEE QAPP requirements.

EEEPC will process all electronic data through the ERPIMS. Sample analysis results for the site characterization will undergo electronic data processing and review for usability by EEEPC. The data review reports will follow EEEPC standard report format based for DUSRs based on the NYSDEC Guidance for the Development of DUSRs, June 1999

4.2 Verification and Validation Methods

Data validation requirements will follow the current QA plans. The QC criteria are specified in Attachments A and B.

After receipt from the laboratory, project data will be validated using the steps described below.

Evaluation of Completeness

The Project Chemist will check the electronic files for compliance with ERPIMS format and the project library. If errors in loading are found, the ERPIMS files will be returned to the laboratory. The Project Chemist will also verify that the laboratory information matches the field information and that the following items are included in the hard-copy data package:

- Chain-of-Custody forms and Sample Summary forms;
- Case narrative describing any out-of-control events and summarizing analytical procedures;

- Data report forms (i.e., Form I);
- QA/QC summary forms; and
- Chromatograms documenting any QC problems.

If the data package is incomplete, the Project Chemist will contact the laboratory, which must provide all missing information within one day.

Evaluation of Compliance

The data validation procedures will process the electronic data and assign qualifiers if outliers are found. Additional compliance checks on the data are briefly outlined below.

- Review chromatograms, mass spectra, and other raw data if provided as backup information for any apparent QC anomalies;
- Review of calibration summaries or any other QC samples not provided in the EDD by the laboratory;
- Ensure that all analytical problems and corrections are reported in the case narrative and that appropriate laboratory qualifiers are added; and
- For any problems identified, review concerns with the laboratory, obtain additional information if necessary, and check all related data to determine the extent of the error.

Data Review Reporting

The Project Chemist will perform the following reporting functions:

- Alert the Project Manager to any QC problems, obvious anomalous values, or discrepancies between the field and laboratory data that may impact data usability; and
- Discuss QC problems in a DUSR for each laboratory report. The DUSR will include a short narrative and print out of qualified data;
- Prepare analytical data summary tables of qualified data that summarize those samples and analytes for which detectable concentrations were exhibited, including field QC samples; and
- At the completion of all field and laboratory efforts, summarize planned versus actual field and laboratory activities and data usability concerns in the technical report.

The USACE Project Chemist and EEEPC Project Chemist will coordinate to review the results of the QA split samples.

4.3 Reconciliation With User Requirements

Any deviations from analytical performance criteria or quality objectives for the project will be documented in the DUSR provided to the data users for the project. The QA Officer will evaluate the deviations with the Project Manager to establish usability of the data. For example, with indoor samples, many of the target compounds listed in Attachment A were not validated by EPA for the method. EEEPC anticipates that water soluble compounds such as ketones and lower volatility compounds such as the highly substituted benzenes may not meet method QC criteria. These compounds may provide qualitative information about the indoor air sample and be considered usable for the project.

The QA Officer or Project Chemist will work with the final users of the data in performing data quality assessments. Final data users will complete a peer review checklist that includes completeness review and assessment procedures for all final data tables.

A Method Target Compounds, Reporting Limits, and Quality Control Limits

A. Method Target Compounds, Reporting Limits, and Quality Control Limits Data Generation and Acquisition

Groundwater VOCs Target Compounds and Reporting Limits - Standard

Method	Parameter	Matrix	AFCEE RL	STL Buffalo PQL	STL Buffalo MDL	GW Criteria (1)	Unit of Measure
8260	1,1,1,2-Tetrachloroethane	W	0.5	0.5	0.11378		UG/L
8260	1,1,1-Trichloroethane	W	1	0.5	0.19455	5	UG/L
8260	1,1,2,2-Tetrachloroethane	W	0.5	0.5	0.10623	5	UG/L
8260	1,1,2-Trichloroethane	W	1	0.5	0.11849	1	UG/L
8260	1,1-Dichloroethane	W	1	0.5	0.15746	5	UG/L
8260	1,1-Dichloroethene	W	1	0.5	0.12446	5	UG/L
8260	1,1-Dichloropropene	W	1	0.5	0.14238		UG/L
8260	1,2,3-Trichlorobenzene	W	1	0.5	0.16061		UG/L
8260	1,2,3-Trichloropropane	W	1	0.5	0.20775		UG/L
8260	1,2,4-Trichlorobenzene	W	1	0.5	0.13641		UG/L
8260	1,2,4-Trimethylbenzene	W	1	0.5	0.22818		UG/L
8260	1,2-Dibromo-3-chloropropane	W	2	0.5	0.22284		UG/L
8260	1,2-Dibromoethane	W	1	0.5	0.14049		UG/L
8260	1,2-Dichlorobenzene	W	1	0.5	0.13546	3	UG/L
8260	1,2-Dichloroethane	W	0.5	0.5	0.12289	0.6	UG/L
8260	1,2-Dichloropropane	W	1	0.5	0.12383		UG/L
8260	1,3,5-Trimethylbenzene	W	1	0.5	0.25113		UG/L
8260	1,3-Dichlorobenzene	W	1	0.5	0.12666	3	UG/L
8260	1,3-Dichloropropane	W	0.4	0.5	0.12541	1	UG/L
8260	1,4-Dichlorobenzene	W	0.5	0.5	0.13766	3	UG/L
8260	1-Chlorohexane	W	1	0.5	0.14206		UG/L
8260	2,2-Dichloropropane	W	1	0.5	0.26936		UG/L
8260	2-Butanone	W	10	2.5	1.19497	50	UG/L
8260	4-Methyl-2-pentanone	W	10	2.5	1.43384		UG/L
8260	Acetone	W	10	2.5	1.34678	50	UG/L
8260	Benzene	W	0.4	0.5	0.14929	1	UG/L
8260	Bromobenzene	W	1	0.5	0.15778		UG/L
8260	Bromochloromethane	W	1	0.5	0.13641		UG/L
8260	Bromodichloromethane	W	0.5	0.5	0.11189	50	UG/L
8260	Bromoform	W	1	0.5	0.08329	50	UG/L
8260	Bromomethane	W	3	0.5	0.13138	5	UG/L
8260	Carbon Tetrachloride	W	1	0.5	0.18261	5	UG/L
8260	Chlorobenzene	W	0.5	0.5	0.14458	5	UG/L
8260	Chloroethane	W	1	0.5	0.13798	5	UG/L
8260	Chloroform	W	0.3	0.5	0.16029	7	UG/L
8260	Chloromethane	W	1	0.5	0.21121	5	UG/L
8260	cis-1,2-Dichloroethene	W	1	0.5	0.14238	5	UG/L
8260	cis-1,3-Dichloropropene	W	0.5	0.5	0.10309	0.4	UG/L
8260	Dibromochloromethane	W	0.5	0.5	0.09995	50	UG/L
8260	Dibromomethane	W	1	0.5	0.12226		UG/L
8260	Dichlorodifluoromethane	W	1	0.5	0.22284		UG/L
8260	Ethylbenzene	W	1	0.5	0.14552	5	UG/L

A. Method Target Compounds, Reporting Limits, and Quality Control Limits Data Generation and Acquisition

Groundwater VOCs Target Compounds and Reporting Limits - Standard

Method	Parameter	Matrix	AFCEE RL	STL Buffalo PQL	STL Buffalo MDL	GW Criteria [1]	Unit of Measure
8260	Hexachlorobutadiene	W	0.6	0.5	0.22975		UG/L
8260	Isopropylbenzene	W	1	0.5	0.24861		UG/L
8260	m/p-Xylenes	W	2	1	0.33567	5	UG/L
8260	Methyl tert butyl ether	W	5	0.5	0.09429	10	UG/L
8260	Methylene chloride	W	1	0.5	0.22378	5	UG/L
8260	Naphthalene	W	1	0.5	0.11378	10	UG/L
8260	n-Butylbenzene	W	1	0.5	0.2175		UG/L
8260	n-Propylbenzene	W	1	0.5	0.21435		UG/L
8260	o-Chlorotoluene	W	1	0.5	0.2549		UG/L
8260	o-Xylene	W	1	0.5	0.16469	5	UG/L
8260	p-Chlorotoluene	W	1	0.5	0.19801		UG/L
8260	p-Cymene	W	1	0.5	0.19392		UG/L
8260	sec-Butylbenzene	W	1	0.5	0.25458		UG/L
8260	Styrene	W	1	0.5	0.12383	5	UG/L
8260	tert-Butylbenzene	W	1	0.5	0.21467		UG/L
8260	Tetrachloroethene	W	1	0.5	0.18481	5	UG/L
8260	Toluene	W	1	0.5	0.17004	5	UG/L
8260	trans-1,2-Dichloroethene	W	1	0.5	0.12163	5	UG/L
8260	trans-1,3-Dichloropropene	W	1	0.5	0.10246	0.4	UG/L
8260	Trichloroethene	W	1	0.5	0.16186	5	UG/L
8260	Trichlorofluoromethane	W	1	0.5	0.14301		UG/L
8260	Vinyl chloride	W	1	0.5	0.19361	2	UG/L

[1]New York State Department of Environmental Conservation, Technical and Operational Guidance No. 1.1.1: Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, 1998 Table 1, Class GA, Source of Drinking Water.

B Laboratory Exceptions to the AFCEE QAPP

STL-BUFFALO VARIANCES TO AFCEE MODEL QAPP – VERSION 3.1 FOR ENVIRONMENTAL SAMPLING, FORMER GRIFFISS AIR FORCE BASE, ROME, NY METHOD 8260B

1. Section 4.4.3 Surrogates, pg. 4-8

A variance is requested from the prescribed corrective action for surrogate failures (re-preparation and re-analysis of affected samples) in the instance where clearly established matrix interferences are the cause as determined through the analysis of MS/MSD samples (i.e., the base sample, the matrix spike, and the matrix spike duplicate exhibited similar surrogate failures). In such instances the laboratory will document the event and will forward this information to the client. For any other sample in the batch, which is not a parent sample of the MS/MSD samples, surrogate failures will be subject to the corrective action prescribed in the QAPP.
Rationale: The instances described above provide objective evidence of matrix effect as determined through the analysis of sample MS/MSD. Re-analysis should not be necessary where conclusive matrix effects are demonstrated.

2. Section 4.5.3 Standard Materials, pg. 4-13

The laboratory complies with the stated requirements where available. The laboratory has not found EPA, A2LA or NIST standards for volatile gases. Two sources are used where available. NSI, Supelco, and ERA are the primary sources of standards. Wet chemistry tests utilize principally salts (from two different sources) to prepare its standards. These salts are at least 96% purity. Neat standards from at least two sources are used for herbicides, organo-phosphorus pesticides. Some appendix IX compounds are not available from NIST-, EPA- or A2LA-certified sources. Two vendors are used in these cases.
Rationale: Some analytes are not available from the sources prescribed in the QAPP.

3. Section 7, various tables – Reporting Limits and Control Limits

The laboratory reviewed the AFCEE required RLs in Section 7 of the QAPP. Several compounds in the QAPP have RLs below levels that the laboratory can reliably achieve during routine laboratory operations. The attached tables contain, in highlights, the laboratory RLs that are higher than the AFCEE limits. STL-Buffalo requests variance for all compounds in highlight.
Rationale: Instrument performance parameters do not indicate that the stated QAPP RL can be reliably achieved. The laboratory provided RL tables include historically achievable RLs.

4. Section 8.8 Hardcopy Data Reports for Screening and Definitive Data, pg. 8-9

The laboratory requests the opportunity to discuss with the prime contractor a mutually agreeable hard-copy data deliverable format. The laboratory is not currently capable of providing the exact data reporting forms contained in the QAPP. STL-Buffalo believes its current reporting format provides all the information necessary to validate a data package. STL requests a variance from specifically using the QAPP forms and to provide, instead, a format agreeable to all parties. The suggested hard-copy report shall include sufficient information in the case narrative, reporting forms and raw data, to allow prime contractors to conduct validation and flagging of the data in accordance with AFCEE QAPP guidelines.

5. Table 7.2.9-3 Summary of Calibration and QC Procedure for Method SW8260B, pg. 7-56, Calibration Verification:

The laboratory requests a modification of the CCV criteria requiring all analytes to be within +/- 20%. STL will ensure that no less than 80% of all compounds, including all compounds of known concern at Griffiss Air Force Base, will be within +/- 20%. The remaining compounds will not exceed +/- 30%. A list of compounds of known concern will be generated by the client on a quarterly basis and shared with the laboratory (Table 1.1). In the event that the laboratory is not able to meet this requirement, and all attempts of sample analysis have been exhausted (i.e., extraction/analytical holding time expired, sample volume consumed), the laboratory will document the event and contact the client to take further action. The compounds that have consistently exhibited recoveries outside of +/- 20% criteria are bromomethane, chloroethane, dichlorodifluoromethane, trichlorofluoromethane, and hexachlorobutadiene.
Rationale: Historically, the front-end gases and heavier semi-volatile compounds have shown routine recoveries at +/- 30% drift while remaining compounds stay roughly within +/- 20%. The proposed criterion eliminates the potential for low bias or false negatives.

6. Section 8.2 Data Review, Validation, and Reporting Requirements for Definitive Data, pg. 8-2

The laboratory requests a variance from the requirement to use a wet weight aliquot equivalent to the dry weight of the sample for analysis. The laboratory requests to use the method-specified wet weight aliquot and subsequently adjust the results for moisture content.
Rationale: The requested approach may lead to widely different sample weights used for samples in an analytical batch. The laboratory believes that the variability in weight may affect certain methods extraction efficiencies, thus leading to variable (not comparable) analytical results.

7. Section 7, various tables – Control Limits

The laboratory requests a variance to use a tiered approach to data evaluation and acceptability based on control limits. The laboratory shall strive to achieve the AFCEE control limits and shall use these limits as the first tier in determining data acceptability. If the surrogate or spike fall outside the AFCEE recovery or RPD specifications, the laboratory shall perform a second tier evaluation using the laboratory internal statistically derived quality control limits. If the recovery or RPD fall within the laboratory limits in the second tier review, the data shall be deemed acceptable and will not require qualification. If the data fails both the 1st and 2nd tier evaluation, corrective action shall be performed as specified in the AFCEE 3.1 Model QAPP. The current laboratory control limits are attached. As these limits are updated annually, the 2nd tier evaluation shall be performed using the most current laboratory-developed statistical limits.
Rationale: The laboratory internal control limits were evaluated by USACE and determined to be acceptable. Data which falls outside the AFCEE 3.1 limits but falls within the laboratory internal control limits would not be adversely impacted.

Method	Matrix	Parameter	Description	STL LCL LCS / SPIKES	STL UCL LCS / SPIKES	STL RPD
SW8260	Aqueous	630-20-6	1,1,1,2-Tetrachloroethane	81	129	20
SW8260	Aqueous	71-55-6	1,1,1-Trichloroethane	67	132	20
SW8260	Aqueous	79-34-5	1,1,2,2-Tetrachloroethane	63	128	20
SW8260	Aqueous	79-00-5	1,1,2-Trichloroethane	75	125	20
SW8260	Aqueous	75-34-3	1,1-Dichloroethane	69	133	20
SW8260	Aqueous	75-35-4	1,1-Dichloroethene	68	130	20
SW8260	Aqueous	563-58-6	1,1-Dichloropropene	73	132	20
SW8260	Aqueous	87-61-6	1,2,3-Trichlorobenzene	67	137	20
SW8260	Aqueous	96-18-4	1,2,3-Trichloropropane	73	124	20
SW8260	Aqueous	120-82-1	1,2,4-Trichlorobenzene	66	134	20
SW8260	Aqueous	95-63-6	1,2,4-Trimethylbenzene	74	132	20
SW8260	Aqueous	95-63-6	1,2,4-Trimethylbenzene	74	132	20
SW8260	Aqueous	107-06-2	1,2-Dichloroethane	69	132	20
SW8260	Aqueous	95-50-1	1,2-Dichlorobenzene	71	122	20
SW8260	Aqueous	96-12-8	1,2-Dibromo-3-chloropropan	50	132	20
SW8260	Aqueous	78-87-5	1,2-Dichloropropane	75	125	20
SW8260	Aqueous	106-93-4	1,2-Dibromoethane	80	121	20
SW8260	Aqueous	108-67-8	1,3,5-Trimethylbenzene	74	131	20
SW8260	Aqueous	108-67-8	1,3,5-Trimethylbenzene	74	131	20
SW8260	Aqueous	541-73-1	1,3-Dichlorobenzene	75	124	20
SW8260	Aqueous	142-28-9	1,3-Dichloropropane	73	126	20
SW8260	Aqueous	106-46-7	1,4-Dichlorobenzene	74	123	20
SW8260	Aqueous	544-10-5	1-Chlorohexane	70	125	20
SW8260	Aqueous	544-10-5	1-Chlorohexane	70	125	20
SW8260	Aqueous	594-20-7	2,2-Dichloropropane	69	137	20
SW8260	Aqueous	95-49-8	o-Chlorotoluene	73	126	20
SW8260	Aqueous	106-43-4	p-Chlorotoluene	74	128	20
SW8260	Aqueous	67-64-1	Acetone	40	135	20
SW8260	Aqueous	71-43-2	Benzene	81	122	20
SW8260	Aqueous	108-86-1	Bromobenzene	76	124	20
SW8260	Aqueous	74-97-5	Bromochloromethane	65	129	20
SW8260	Aqueous	75-27-4	Bromodichloromethane	76	121	20
SW8260	Aqueous	75-25-2	Bromoform	69	128	20
SW8260	Aqueous	74-83-9	Bromomethane	53	141	20
SW8260	Aqueous	56-23-5	Carbon Tetrachloride	66	138	20
SW8260	Aqueous	108-90-7	Chlorobenzene	81	122	20
SW8260	Aqueous	75-00-3	Chloroethane	58	133	20
SW8260	Aqueous	67-66-3	Chloroform	69	128	20
SW8260	Aqueous	74-87-3	Chloromethane	56	131	20
SW8260	Aqueous	156-59-2	cis-1,2-Dichloroethene	72	126	20
SW8260	Aqueous	10061-01-5	cis-1,3-Dichloropropene	69	131	20
SW8260	Aqueous	124-48-1	Dibromochloromethane	66	133	20
SW8260	Aqueous	74-95-3	Dibromomethane	76	125	20
SW8260	Aqueous	74-95-3	Dibromomethane	76	125	20

B. Laboratory Exceptions to the AFCEE QAPP

Method	Matrix	Parameter	Description	STL LCL LCS / SPIKES	STL UCL LCS / SPIKES	STL RPD
SW8260	Aqueous	75-71-8	Dichlorodifluoromethane	53	153	20
SW8260	Aqueous	100-41-4	Ethylbenzene	73	127	20
SW8260	Aqueous	87-68-3	Hexachlorobutadiene	67	131	20
SW8260	Aqueous	98-82-8	Isopropylbenzene	75	127	20
SW8260	Aqueous	75-09-2	Methylene chloride	63	137	20
SW8260	Aqueous	1634-04-4	Methyl-t-Butyl Ether (MTBE	65	123	20
SW8260	Aqueous	78-93-3	2-Butanone	49	136	20
SW8260	Aqueous	108-10-1	4-Methyl-2-pentanone	58	134	20
SW8260	Aqueous	104-51-8	n-Butylbenzene	69	137	20
SW8260	Aqueous	103-65-1	n-Propylbenzene	72	129	20
SW8260	Aqueous	M/P XYLENE	m/p-Xylenes	76	128	20
SW8260	Aqueous	91-20-3	Naphthalene	54	138	20
SW8260	Aqueous	95-47-6	o-Xylene	80	121	20
SW8260	Aqueous	95-47-6	o-Xylene	80	121	20
SW8260	Aqueous	99-87-6	p-Cymene	73	130	20
SW8260	Aqueous	99-87-6	p-Cymene	73	130	20
SW8260	Aqueous	135-98-8	sec-Butylbenzene	72	127	20
SW8260	Aqueous	100-42-5	Styrene	65	134	20
SW8260	Aqueous	79-01-6	Trichloroethene	70	127	20
SW8260	Aqueous	98-06-6	tert-Butylbenzene	70	129	20
SW8260	Aqueous	127-18-4	Tetrachloroethene	66	128	20
SW8260	Aqueous	108-88-3	Toluene	77	122	20
SW8260	Aqueous	156-60-5	trans-1,2-Dichloroethene	63	137	20
SW8260	Aqueous	10061-02-6	trans-1,3-Dichloropropene	59	135	20
SW8260	Aqueous	75-69-4	Trichlorofluoromethane	57	129	20
SW8260	Aqueous	75-01-4	Vinyl chloride	50	134	20
SW8260	Aqueous	3114-55-4	Chlorobenzene-D5	50	200	
SW8260	Aqueous	462-06-6	Fluorobenzene	50	200	
SW8260	Aqueous	SU106-46-7	1,4-Dichlorobenzene-D4	50	200	
SW8260	Aqueous	1868-53-7	Dibromofluoromethane	85	115	
SW8260	Aqueous	2037-26-5	Toluene-D8	81	120	
SW8260	Aqueous	460-00-4	p-Bromofluorobenzene	76	119	
SW8260	Aqueous	SU107-06-2	1,2-Dichloroethane-D4	72	119	

D Health and Safety Plan

ecology and environment engineering, p.c.

SITE-SPECIFIC HEALTH AND SAFETY PLAN

Project: 1. Predesign Investigation at Landfill 6, Building 775, 2.1.3AOC 9, & Building 775/Pumphouse 3
2. Soil Vapor Intrusion Survey At Apron 2, Building 817/WSA, Building 775, & AOC 9

Project No.: 002275.PT04

Project Location: Former Griffiss Air Force Base, Rome, NY

Proposed Date of Field Activities: Fall 2006

Program Manager: Timothy J. Grady, P.E. Phone: (716) 684-8060

Project Manager: Bob Meyers Phone: (716) 684-8060

Prepared by: Tom Siener, CIH Phone: (716) 684-8060 Date Prepared: 6/1/06

Approved by: Paul Jonmaire, Ph,D. Phone: (716) 684-8060 Date Approved: 6/5/06

1. INTRODUCTION

1.2 POLICY

It is EEEPC's policy to ensure the health and safety of its employees, the public, and the environment during the performance of work it conducts. This site-specific health and safety plan (SHASP) establishes the procedures and requirements to ensure the health and safety of EEEPC employees for the above-named project. EEEPC's overall safety and health program is described in *Corporate Health and Safety Program* (CHSP). After reading this plan, applicable EEEPC employees shall read and sign EEEPC's Site-Specific Health and Safety Plan Acceptance form.

This SHASP has been developed for the sole use of EEEPC employees and is not intended for use by firms not participating in EEEPC's training and health and safety programs. Subcontractors are responsible for developing and providing their own safety plans. Prior to the commencement of field work, EEEPC will review subcontractor Health and Safety Plans to determine if they are in compliance with applicable regulations and USACE policy. Copies of the subcontractor plans will be provided to USACE before the initiation of field activities.

This SHASP has been prepared to meet the following applicable regulatory requirements and guidance:

Applicable Regulation/Guidance
29 CFR 1910.120, Hazardous Waste Operations and Emergency Response (HAZWOPER)
USACE ER 385-1-92, Appendix C, Safety and Health Elements for HTRW Documents (SSHPs/HSDAs), 1 July 2003
USACE EM 385-1-1, Safety and Health Requirements Manual, 3 Nov 2003
Other: Ecology and Environment Engineering, P.C. Corporate Health and Safety Program, Revised September 2005
Other: Ecology and Environment Engineering, P.C. Quality Control Plan

1.2SCOPE OF WORK

Description of Work: On-site tasks associated with field investigations at the former Griffiss AFB vary with each site. Activities that may be conducted during fieldwork include:

<u>Non-Intrusive Activities</u>
Well development
Well sampling
Indoor air sampling
Outdoor air sampling
Decontamination

<u>Intrusive Activities</u>
Well drilling
Membrane interface probe survey
Soil gas sampling with GeoProbe
Subslab vapor sampling

This document will be updated in the field whenever new information is obtained. In addition, new information will be included as new tasks are assigned.

Equipment/Supplies:

The following is a description of each numbered task: (See attached summary for more detail)

Task	Predesign Investigation	Task	Soil Vapor Intrusion Survey
1	Drilling & Monitoring Well Installation	5	Indoor Air Sampling
2	Development of Wells	6	Outdoor Air Sampling
3	Sampling Wells	7	Subslab Air Sampling
4	Membrane Interface Probe Survey	8	Soil Vapor (with GeoProbe)
9	Decontamination		

1.3 SITE DESCRIPTION

Site Map: Site location maps are provided in the associated work plans for predesign investigation and soil vapor intrusion surveys at five sites.

Site History/Description (see project work plan for detailed description): The Former Griffis Air Force Base is located in Rome, New York. The base has been realined under the Base Realignment and Closure (BRAC). During the expanded site investigation, EEEPC will be conducting both intrusive and non-intrusive tasks.

Is the site currently in operation? ☐ Yes ☒ No

Locations of Contaminants/Wastes - Volatile organic chemicals (VOCs), primarily chlorinated solvents, have been detected in groundwater. Soil gas sampling has indicated the presence of numerous VOCs and methane in soil. Please see the work plan for further site-specific information.

Types and Characteristics of Contaminants/Wastes:

☒ Liquid	☐ Solid	☐ Sludge	☒ Gas/Vapor
☒ Flammable/Ignitable	☒ Volatile	☐ Corrosive	☐ Acutely Toxic
☐ Explosive	☐ Reactive	☐ Carcinogenic	☐ Radioactive
☐ Medical/Pathogenic	Other: ______		

2. ORGANIZATION AND RESPONSIBILITIES

EEEPC team personnel shall have on-site responsibilities as described in EEEPC's standard operating procedure (SOP) for Site Entry Procedures (GENTECH 2.2). The project team, including qualified alternates, is identified below.

Name	Site Role/Responsibility
Bob Meyers	Project/Task Manager
Brian Cervi	Field Team Leader

Name	Site Role/Responsibility
Stephanie Reynolds-Smith	Field Team Leader
Jim Mays	Site Safety Officer[1]
Larry Roedl	Site Safety Officer[1]
Representative from Stone Environmental, Inc.	Direct-Push Subcontractor
Representative from Parratt Wolff	Drilling Subcontractor
Representative from LaFave White & McGivern, L.S.,P.C.	Surveying Subcontractor
Tom Siener, CIH	Regional Safety Coordinator [2]

(1) EEEPC's designated Site Safety Officer (SSO) is responsible for the day to day compliance with the Site Specific Safety and Health Plan including instrument calibration, protective clothing use, conducting morning safety meeting, decontamination procedures, and coordinating emergency medical care. Documentation of these activities is entered in the Site Safety and Health Activity Log. Any designated SSO must be qualified to oversee the particular field activities by having functioned as an SSO on other similar projects.

(2) EEEPC's Regional Safety Coordinator is responsible for periodically monitoring the work site to ensure conformance with the Site Specific Safety and Health Plan. These site visits are documented on EEEPC's Field Safety Audit Form.

The direct-push subcontractor will be Stone Environmental, Inc., 535 Stone Cutter's Way, Mont Pellier, VT 05602. The Drilling Subcontractor will be Parratt Wolff, 5879 Fisher Road, East Syracuse, New York 13057. The surveying subcontractor will be LaFave White & McGivern, L.S., P.C., 133 Commercial Street, Theresa, NY 13691. See the Quality Control Plan (E&E 2005) for details on subcontractor control and coordination.

3. TRAINING

Prior to work, EEEPC team personnel shall have received training as indicated below. As applicable, personnel shall have read the project work plan, sampling and analysis plan, and/or quality assurance project plan prior to project work. The field team leader will maintain a copy of the training certificates for all field team members. Two EEEPC team members will be on site during intrusive site work.

Training	Required
40-Hour OSHA HAZWOPER Initial Training and Annual Refresher (29 CFR 1910.120)	X
Annual First Aid/CPR	X
Hazard Communication (29 CFR 1910.1200)	X
40-Hour Radiation Protection Procedures and Investigative Methods	
8-Hour General Radiation Health and Safety	
Radiation Refresher	
DOT and Biannual Refresher	X
Other:	

4. MEDICAL SURVEILLANCE

4.1 MEDICAL SURVEILLANCE PROGRAM

EEEPC field personnel shall actively participate in EEEPC's medical surveillance program as described in the CHSP and shall have received, within the past year, an appropriate physical examination and health rating.

EEEPC's health and safety record (HSR) form will be maintained on site by each EEEPC employee for the duration of his or her work. EEEPC employees should inform the site safety officer (SSO) of any allergies, medical conditions, or similar situations that are relevant to the safe conduct of the work to which this SHASP applies.

Is there a concern for radiation at the site? ☐ Yes ☒ No
If no, go to 5.1.

4.2 RADIATION EXPOSURE

4.2.1 External Dosimetry

Thermoluminescent Dosimeter (TLD) Badges: TLD badges are to be worn by all EEEPC field personnel on certain required sites.

Pocket Dosimeters: N/A

Other: N/A

4.2.2 Internal Dosimetry

☐ Whole body count ☐ Bioassay ☐ Other

Requirements: N/A

4.2.3 Radiation Dose

Dose Limits: EEEPC's radiation dose limits are stated in the CHSP. Implementation of these dose limits may be designated on a site-specific basis.

Site-Specific Dose Limits: N/A

ALARA Policy: Radiation doses to EEEPC personnel shall be maintained as low as reasonably achievable (ALARA), taking into account the work objective, state of technology available, economics of improvements in dose reduction with respect to overall health and safety, and other societal and socioeconomic considerations.

5. SITE CONTROL

5.1 SITE LAYOUT AND WORK ZONES

Site Work Zones: Refer to the work plan maps for the locations of the sites. The field work at these sites will be implemented in numerous areas, as described in the Field Sampling Plan and the Work Plan. Specific work zones will be classified as intrusive or non-intrusive, depending on the type of work to be done. Intrusive work zones will be handled as exclusion zones, as described below.

Normally, the hazardous waste site will be divided into three zones: Zone 1 – Exclusion Zone; Zone 2- Contamination Reduction Zone; and Zone 3- Support Zone. These zones will be established on the basis of contamination potential, ranging from the highest levels of contamination in the exclusion zone to no site contamination potential in the support zone. Barricades and placards will be used when necessary to control access to all three zones.

The exclusion zone, the area of active, or intrusive site investigation (i.e., the area immediately surrounding each borehole), presents the highest risk of worker exposure. These work zones will be delineated using lath stakes and flagging to exclude non-team members from entering. Personnel entering this zone will be required to wear the previously mandated level of protection. In some instances, more than one level of protection will be required within the same zone, depending on the tasks to be performed.

The contamination reduction zone will be a transition zone between the contaminated and clean zones. Decontamination of equipment and clothing will occur in this zone.

The support zone will be considered the noncontaminated or clean area. Support equipment will be located in this zone.

Site Access Requirements and Special Considerations: Site is secured by Oneida County Sherriff Patrol

Illumination Requirements: Daylight work only

Sanitary Facilities (e.g., toilet, shower, potable water): Toilet facilities are located in building 520. Other facilities are TBD.

On-Site Communications: Cellular telephones will be used for communications. Confirm cell phone operation in the site area before work begins.

Other Site-Control Requirements: TBD

5.2 SAFE WORK PRACTICES

Daily Safety Meeting: A daily safety meeting will be conducted for all EEEPC personnel and documented in the field logbook. The information and data obtained from applicable site characterization and analysis will be addressed in the safety meetings and also used to modify procedures and update this SHASP, as necessary.

Work Limitations: Work shall be limited to a maximum of 12 hours per day. If 12 consecutive days are worked, at least one day off shall be provided before work is resumed. Work will be conducted in daylight hours unless prior approval is obtained and the illumination requirements in 29 CFR 1910.120(m) are satisfied.

Weather Limitations: Work shall not be conducted during electrical storms. Work conducted in other inclement weather (e.g., rain, snow) will be approved by project management and the regional safety coordinator or designee.

Health and Safety Inspections and Corrective Action: The site safety officer (SSO) will be primarily responsible for the day-to-day field team health and safety program. The SSO has the authority to stop any onsite personnel immediately if any safety or EEEPC procedure violation is observed. If the SSO can bring the violation into compliance, work may resume. If the SSO can not correct the violation, it will be communicated to the Regional Safety Coordinator or to the Corporate Safety department for review and recommendations. Work will not resume until the violation has been corrected.

EEEPC's Regional Safety Coordinator (RSC) will conduct inspections at the site during the completion of field activities. These inspections will include an audit briefing with the field team, as well as a written audit report. If the site safety officer or RSC notes any noncompliance with the approved Health and Safety Plan on the part of the field team, corrective action will be taken. Corrective actions will be documented in the Site Safety Logbook, and may include briefings on procedures, discussion with the project and program managers, and, if necessary, replacement of field staff.

Other Work Limitations: TBD

Buddy System: Field work will be conducted in pairs of team members according to the buddy system, or individually if the buddy is in line of site.

Line of Sight: Each field team member shall remain in the line of sight and within verbal communication of at least one other team member.

Eating, Drinking, and Smoking: Eating, drinking, smoking, and the use of tobacco products shall be prohibited in the exclusion and contamination reduction areas, at a minimum, and shall only be permitted in designated areas.

Prevention of Alcohol and Drug Abuse: The use or possession of alcoholic beverages or controlled substances while on company property, or in any company vehicle, or on company time, including breaks or lunch, paid or unpaid, on any shift, is strictly prohibited. Violation of this policy will result in disciplinary action, up to and including termination of employment, and/or the requirement that the employee satisfactorily participate in a drug abuse assistance or rehabilitation program as a condition of continued employment. As part of EEEPC's drug and alcohol prevention program, EEEPC performs pre-employment drug testing.

Contamination Avoidance: Field personnel shall avoid unnecessary contamination of personnel, equipment, and materials to the extent practicable.

Sample Handling: Protective gloves of a type designated in Section 7 will be worn when containerized samples are handled for labeling, packaging, transportation, and other purposes.

Handling of Preservative Chemicals: Each preservative container will be clearly labeled using a completed HMIS label. Eye protection and gloves will be worn at all times while using the preservatives. When not in use, preservatives will be stored in an appropriate secondary container (e.g., cooler) to prevent breakage, spills, or leaks.

Other Safe Work Practices:

6. HAZARD EVALUATION AND CONTROL

6.1 PHYSICAL HAZARD EVALUATION AND CONTROL

Potential physical hazards and their applicable control measures are described in the following table for each task.

Hazard	Task Number	Hazard Control Measures
Biological (flora, fauna, etc.)	1,2,3,4,6,8,9	▪ Potential hazard: Poison Ivy/Oak; ▪ Establish site-specific procedures for working around identified hazards. ▪ Ticks.
Cold Stress	1,2,3,4,6,8,9	▪ Provide warm break area and adequate breaks. ▪ Provide warm noncaffeinated beverages. ▪ Promote cold stress awareness. ▪ See *Cold Stress Prevention and Treatment* (Attachment 1).
Compressed Gas Cylinders		▪ Use caution when moving or storing cylinders. ▪ A cylinder is a projectile hazard if it is damaged or its neck is broken. ▪ Store cylinders upright and secure them by chains or other means. ▪ Other:
Confined Space	N/A	▪ Ensure compliance with 29 CFR 1910.146. ▪ See SOP for Confined Space Entry. Additional documentation is required. ▪ Other:
Drilling	1,4,8	▪ See SOP for Health and Safety on Drilling Rig Operations (Attachment 2). Additional documentation may be required. ▪ Landfill caps will not be penetrated without prior discussions with corporate health and safety staff.
Drums and Containers		▪ Ensure compliance with 29 CFR 1910.120(j). ▪ Consider unlabeled drums or containers to contain hazardous substances and handle accordingly until the contents are identified. ▪ Inspect drums or containers and assure integrity prior to handling. ▪ Move drums or containers only as necessary; use caution and warn nearby personnel of potential hazards. ▪ Open, sample, and/or move drums or containers in accordance with established procedures; use approved drum/container-handling equipment. ▪ Other:
Electrical	1,4,8	▪ Ensure compliance with 29 CFR 1910 Subparts J and S. ▪ Locate and mark energized lines. ▪ De-energize lines as necessary. ▪ Ground all electrical circuits. ▪ Guard or isolate temporary wiring to prevent accidental contact. ▪ Evaluate potential areas of high moisture or standing water and define special electrical needs. ▪ Other:
Excavation and Trenching	N/A	▪ Ensure that excavations comply with and personnel are informed of the requirements of 29 CFR 1926 Subpart P. ▪ Ensure that any required sloping or shoring systems are approved as per 29 CFR 1926 Subpart P. ▪ Identify special personal protective equipment (PPE) (see Section 7) and monitoring (see Section 8) needs if personnel are required to enter approved excavated areas or trenches.

Hazard	Task Number	Hazard Control Measures
		▪ Maintain line of sight between equipment operators and personnel in excavations/trenches. Such personnel are prohibited from working in close proximity to operating machinery. ▪ Suspend or shut down operations at signs of cave in, excessive water, defective shoring, changing weather, or unacceptable monitoring results. ▪ Other:
Fire and Explosion	1,2,3,4,6,8,9	▪ Inform personnel of the location(s) of potential fire/explosion hazards. ▪ Establish site-specific procedures for working around flammables. ▪ Ensure that appropriate fire suppression equipment and systems are available and in good working order. ▪ Define requirements for intrinsically safe equipment. ▪ Identify special monitoring needs (see Section 8). ▪ Remove ignition sources from flammable atmospheres. ▪ Coordinate with local fire-fighting groups regarding potential fire/explosion situations. ▪ Establish contingency plans and review daily with team members. ▪ Other:
Heat Stress	1,2,3,4,6,8,9 (if applicable)	▪ Provide cool break area and adequate breaks. ▪ Provide cool noncaffeinated beverages. ▪ Promote heat stress awareness. ▪ Use active cooling devices (e.g., cooling vests) where specified. ▪ See *Heat Stress Prevention and Treatment* (Attachment 3).
Heavy Equipment Operation	1,4,8	▪ Define equipment routes, traffic patterns, and site-specific safety measures. ▪ Ensure that operators are properly trained and equipment has been properly inspected and maintained. Verify back-up alarms. ▪ Ensure that ground spotters are assigned and informed of proper hand signals and communication protocols. ▪ Identify special PPE (Section 7) and monitoring (Section 8) needs. ▪ Ensure that field personnel do not work in close proximity to operating equipment. ▪ Ensure that lifting capacities, load limits, etc., are not exceeded. ▪ Other:
Heights (Scaffolding, Ladders, etc.)	N/A	▪ Ensure compliance with applicable subparts of 29 CFR 1910. ▪ Identify special PPE needs (e.g., lanyards, safety nets, etc.) ▪ Other:
Noise	1,4,8	▪ Establish noise level standards for on-site equipment/operations. ▪ Inform personnel of hearing protection requirements (Section 7). ▪ Define site-specific requirements for noise monitoring (Section 8). ▪ Other:
Overhead Obstructions	1,4,8	▪ Wear hard hat. ▪ Other:
Power Tools	1,4,8	▪ Ensure compliance with 29 CFR 1910 Subpart P. ▪ Other:
Sunburn	1,2,3,4,6,8,9 (if applicable)	▪ Apply sunscreen. ▪ Wear hats/caps and long sleeves.

Hazard	Task Number	Hazard Control Measures
		▪ Other:
Utility Lines	1,4,8	▪ Identify/locate existing utilities prior to work. ▪ Ensure that overhead utility lines are at least 25 feet away from project activities. ▪ Contact utilities to confirm locations, as necessary. ▪ Other:
Weather Extremes	1,2,3,4,6,8,9	▪ Potential hazards: ▪ Establish site-specific contingencies for severe weather situations. ▪ Provide for frequent weather broadcasts. ▪ Weatherize safety gear, as necessary (e.g., ensure eye wash units cannot freeze, etc.). ▪ Identify special PPE (Section 7) needs. ▪ Discontinue work during severe weather. ▪ Other:
Other:		

6.2 CHEMICAL HAZARD EVALUATION AND CONTROL

6.2.1 Chemical Hazard Evaluation

Potential chemical hazards are described by task number in Tables 6-1 and 6-2. Hazard Evaluation Sheets for major known contaminants are attached at the end of this plan.

Table 6-1
CHEMICAL HAZARD EVALUATION

Task Number	Compound	Exposure Limits (TWA) PEL	REL	TLV	Dermal Hazard (Y/N)	Route(s) of Exposure	Acute Symptoms	Odor Threshold/ Description	PID Relative Response	Ioniz. Poten. (eV)
All	Trichloroethene*	100 ppm	25 ppm	50 ppm	Y	Inh, Ing, Eye, Skin	Irr. Eyes/Skin, flushed skin, confusion, dizziness, headache, weakness, drowsiness	50 ppm Sweet, Chloroform	70% 89%	9.45
All	1,2-Dichloroethene	200 ppm	200 ppm	200 ppm	Y	Inh, Ing, Eye, Skin	Dizziness, drowsiness, irritated eyes, unconsciousness	0.085 ppm Chloroform	--- ---	9.65
All	Vinyl Chloride*	1 ppm; 5 ppm C	LFC	1 ppm	Y	Inh, Eye, Skin	Dulled auditory and visual response, weakness, abdominal pain	3000 ppm Sweet, pleasant	35% 50%	9.99
All	Perchloroethene*	100 ppm	LFC	25 ppm	Y	Inh, Ing, Eye, Skin	Irr. Eyes/Nose/Throat, nausea, flush face/neck, vertigo, headache, incoordination, skin redness	5 ppm Chloroform	70% ---	9.32
All	Chlorobenzene	75 ppm	---	10 ppm	Y	Inh, Ing, Eye, Skin	Drowsiness, dizziness, coordination, unconsciousness	0.21 Mild alomond	200% ---	9.07
All	1,2 Dichlorobenzene	50 ppm	50 ppm	25 ppm sk		Inh, Ing, Eye, Skin	URT irritation, drowsiness, death	0.7 ppm Pleasant	50% ---	9.07
All	1,4-Dichlorobenzene*	75 ppm	LFC	10 ppm	Y	Inh, Ing, Eye, Skin	URT irritation, swelling eyes, headache, nausea, jaundice, death	0.12 ppm Mothballs	113% ---	8.98

Key:
* = Chemical is a known or suspected carcinogen.
--- = Information not available.
C = Ceiling Limit.
LFC = Lowest Feasible Concentration.
PEL = Permissible Exposure Limit.
ppm = parts per million.
REL = Recommended Exposure Limit.
Sk = Skin Notation.
mg/m3 = milligrams per cubic meter
TLV = Threshold Limit Value
URT = Upper Respiratory Tract

6.2.2 Chemical Hazard Control

An appropriate combination of engineering/administrative controls, work practices, and PPE shall be used to reduce and maintain employee exposures to a level at or below published exposure levels (see Section 6.2.1).

Applicable Engineering/Administrative Control Measures: TBD

PPE: See Section 7.

6.3 RADIOLOGICAL HAZARD EVALUATION AND CONTROL

6.3.1 Radiological Hazard Evaluation

Potential radiological hazards are described below by task number. Hazard Evaluation Sheets for major known contaminants are attached at the end of this plan.

Task Number	Radionuclide	DAC (μCi/ml)	Route(s) of Exposure	Major Radiation(s)	Energy(s) (MeV)	Half-Life
N/A						

6.3.2 Radiological Hazard Control

Engineering/administrative controls and work practices shall be instituted to reduce and maintain employee exposures to a level at or below the permissible exposure/dose limits (see sections 4.2.3 and 6.3.1). Whenever engineering/administrative controls and work practices are not feasible or effective, any reasonable combination of engineering/administrative controls, work practices, and PPE shall be used to reduce and maintain employee exposures to a level at or below permissible exposure/dose limits.

Applicable Engineering/Administrative Control Measures: N/A

PPE: See Section 7.

7. LEVEL OF PROTECTION AND PERSONAL PROTECTIVE EQUIPMENT

7.1 LEVEL OF PROTECTION

The following levels of protection (LOPs) have been selected for each work task based on an evaluation of the potential or known hazards, the routes of potential hazard, and the performance specifications of the PPE. On-site monitoring results and other information obtained from on-site activities will be used to modify these LOPs and the PPE, as necessary, to ensure sufficient personnel protection. The authorized LOP and PPE shall only be changed with the approval of the regional safety coordinator or designee. Level A is not included below because Level A activities, which are performed infrequently, will require special planning and addenda to this SHASP.

Task Number	B	C	D	Modifications Allowed
1, 2,3 4,7,8, 9		(X)	X	
5,6			X	

Note: Use "X" for initial levels of protection. Use "(X)" to indicate levels of protection that may be used as site conditions warrant.

7.2 PERSONAL PROTECTIVE EQUIPMENT

The PPE selected for each task is indicated below. EEEPC's PPE program complies with 29 CFR 1910.120 and 29 CFR 1910 Subpart I and is described in detail in the CHSP. Refer to 29 CFR 1910 for the minimum PPE required for each LOP.

PPE	Task Number									
	1	2	3	4	5	6	7	8	9	
Full-face APR	(X)	(X)	(X)	(X)			(X)	(X)	(X)	
PAPR										
Cartridges:										
P100										
GMC-P100	(X)	(X)	(X)	(X)			(X)	(X)	(X)	
GME-P100										
Other:										
Positive-pressure, full-face SCBA										
Spare air tanks (Grade D air)										
Positive-pressure, full-face, supplied-air system										
Cascade system (Grade D air)										
Manifold system										
5-Minute escape mask										
Safety glasses	X	X	X	X	X	X	X	X	X	
Monogoggles										
Coveralls/clothing	X	X	X	X	X	X	X	X	X	

PPE	Task Number									
	1	2	3	4	5	6	7	8	9	
Protective clothing:										
Tyvek										
Saranex or coated tyvek	(X)		(X)							
Other:										
Splash apron										
Inner gloves:										
Cotton										
Nitrile	X	X	X	X			X	X	X	
Latex										
Other:										
Outer gloves:										
Viton										
Rubber										
Neoprene	(X)	(X)	(X)	(X)			(X)	(X)	(X)	
Nitrile										
Other:										
Work gloves										
Safety boots (as per ANSI Z41)	X	X	X	X	X	X	X	X	X	
Neoprene safety boots (as per ANSI Z41)										
Boot covers (type: Disposable booties)	(X)	(X)	(X)	(X)			(X)	(X)	(X)	
Hearing protection (type: plugs)	X			X				X		
Hard hat	X			X				X		
Face shield		(X)								

8. HEALTH AND SAFETY MONITORING

Health and safety monitoring will be conducted to ensure proper selection of engineering/administrative controls, work practices, and/or PPE so that employees are not exposed to hazardous substances at levels that exceed permissible exposure/dose limits or published exposure levels. Health and safety monitoring will be conducted using the instruments, frequency, and action levels described in Table 8-1. Health and safety monitoring instruments shall have been appropriately calibrated and/or performance-checked prior to use.

Table 8-1

HEALTH AND SAFETY MONITORING

Instrument	Task Number	Contaminant(s)	Monitoring Location	Monitoring Frequency	Action Levels[a]	
☒ PID (e.g., MultiRae 2000) ☐ FID (e.g., OVA 128-GC)	1, 2,3,4,7,8,9	Volatile Organic Vapors	Breathing zone	Continuously. Reading sustained in the breathing zone for 2 minutes before taking action. Do not take the spike reading.	**Unknown Vapors** Background to 1 ppm: Level D 1 to 5 ppm above background: Level C 5 to 500 ppm above background: Level B >500 ppm above background: Level A	**Contaminant-Specific**
Oxygen Meter/Explosimeter	1,4,8	Explosive atmospheres	General area and at the borehole during drilling.	Continuously	**Oxygen** <19.5% or >22.0%: Evacuate area; eliminate ignition sources; reassess conditions. 19.5 to 22.0%: Continue work in accordance with action levels for other instruments.	**Explosivity** ≤10% LEL: Continue work in accordance with action levels for other instruments; monitor continuously for combustible atmospheres. >10% LEL: (Discontinue activity – Geoprobing, evacuate area; eliminate ignition sources; reassess conditions.
Radiation Alert Monitor (Rad-mini or RAM-4)	N/A				<0.1 mR/hr: Continue work in accordance with action levels for other instruments. ≥0.1 mR/hr: Evacuate area; reassess work plan and contact radiation safety specialist.	
Mini-Ram Particulate Monitor	N/A				**General/Unknown** Evaluate health and safety measures when dust levels exceed 2.5 milligrams per cubic meter.	**Contaminant-Specific**
HCN/H_2S (Monitox)	N/A				≥4 ppm: Leave area and consult with SSO.	
Draeger Colorimetric Tubes	N/A				**Tube** **Action Level**	**Action**

Table 8-1

HEALTH AND SAFETY MONITORING

Instrument	Task Number	Contaminant(s)	Monitoring Location	Monitoring Frequency	Action Levels[a]
Air Monitor/Sampler Type:________ Sampling medium: ________	N/A				**Action Level** **Action**
Personal Sampling Pump Type:________ Sampling medium: ________	N/A				**Action Level** **Action**
Micro R Meter	N/A				<2 mR/hr: Continue work in accordance with action levels for other instruments. 2 to 5 mR/hr: In conjunction with a radiation safety specialist, continue work and perform stay-time calculations to ensure compliance with dose limits and ALARA policy. >5 mR/hr: Evacuate area to reassess work plan and evaluate options to maintain personnel exposures ALARA and within dose limits.
Ion Chamber	N/A				See micro R meter action levels above.
Radiation Survey Ratemeter/Scaler with External Detector(s)	N/A				**Detector** **Action Level** **Action**
Noise Dosimeter (Sound Level Meter)	N/A				≤85 decibels as measured using the A-weighed network (dBa): Use hearing protection if exposure will be sustained throughout work shift. >85 dBA: Use hearing protection. >120 dBA: Leave area and consult with safety personnel.
Other:	N/A				
Other:	N/A				

[a] Unless stated otherwise, airborne contaminant concentrations are measured as a time-weighted average in the worker's breathing zone. Acceptable concentrations for known airborne contaminants will be determined based on OSHA/NIOSH/ACGIH and/or NRC exposure limits. As a guideline, 1/2 the PEL/REL/TLV, whichever is lower should be used.

9. DECONTAMINATION PROCEDURES

All equipment, materials, and personnel will be evaluated for contamination upon leaving the exclusion area. Equipment and materials will be decontaminated and/or disposed and personnel will be decontaminated, as necessary. Decontamination will be performed in the contamination reduction area or any designated area such that the exposure of uncontaminated employees, equipment, and materials will be minimized. Specific procedures are described below.

Equipment/Material Decontamination Procedures (specified by work plan): All disposable sampling equipment will be placed in a plastic bag labeled for disposal. Direct-push rod and sampling devices will be decontaminated before the first use and after each well. The decontamination water will be collected and stored in drums and left at a location approved by USACE on base.

Ventilation: All decontamination procedures will be conducted in a well-ventilated area.

Personnel Decontamination Procedures: Use dry decontamination procedures. All coveralls, gloves, and booties will be placed in a plastic bag and left at a location approved by USACE on base.

PPE Requirements for Personnel Performing Decontamination: Same as or one level of PPE lower than personnel working in the site.

Personnel Decontamination in General: Following appropriate decontamination procedures, all field personnel will wash their hands and face with soap and potable water. Personnel should shower at the end of each work shift.

Disposition of Disposable PPE: Disposable PPE must be rendered unusable and disposed of as indicated in the work plan.

Disposition of Decontamination Wastes (e.g., dry wastes, decontamination fluids, etc.): Wastes will be stored in drums and left at a location approved by USACE on base. Disposition will be determined after the results of the chemical analysis are known.

10. EMERGENCY RESPONSE

This section contains additional information pertaining to on-site emergency response and does not duplicate pertinent emergency response information contained in earlier sections of this plan (e.g., site layout, monitoring equipment, etc.). Emergency response procedures will be rehearsed regularly, as applicable, during project activities.

10.1 EMERGENCY RESPONSIBILITIES

All Personnel: All personnel shall be alert to the possibility of an on-site emergency; report potential or actual emergency situations to the team leader and SSO; and notify appropriate emergency resources, as necessary.

Team Leader: The team leader will determine the emergency actions to be performed by EEEPCE personnel and will direct these actions. The team leader also will ensure that applicable incidents are reported to appropriate EEEPC and client project personnel and government agencies.

SSO: The SSO will recommend health/safety and protective measures appropriate to the emergency.

Other: In the event of an accident, the Field Team Leader shall complete an Incident Report. He will submit a copy of the report to the Corporate Safety Officer and Project Manager for review. The completed report will be submitted to Parsons who will then forward to the United States Army Corps of Engineers (USACE), Kansas City District office within 5 days.

10.2 LOCAL AND SITE RESOURCES (including phone numbers)

Ambulance: 911 or AMCARE Ambulance Service, Inc. 315/339-5600

Hospital: Rome Hospital, Rome, NY
911 (emergency)
315/338-7000, 315/336-5600

Directions to Hospital (see Attachment 4 for map): Exit base through Mohawk Drive. Go west approximately one mile, and turn right on Black River Boulevard. Hospital is on left within 0.25 miles

Poison Control: Poison Control Center, Rome 1-800-252-5655

Police Department: 911 or Rome Police Department 315/337-3311

Fire Department: 911 or City of Rome, Emergency phone number: 315/336-1234, Ext. 7117

Client Contact:

Site Contact: AFRPA Griffiss, Environmental Section, Building 301 315/330-2275 Ext. 2275

Cellular Telephone Number: TBD

Radios Available: None

Other: N/A

10.3 EEEPC EMERGENCY CONTACTS

EEEPC Operations Center (24 Hours):	716/684-8060
Corporate Health and Safety Director, Dr. Paul Jonmaire:	716/684-8060 (office) 716/655-1260 (home)
Regional Office Contact:	
a. Timothy Grady (Program Manager)	716/684-8060 (office)
b. Tom Siener (Regional Safety Coordinator)	716/684-8060 (office) 716/662-4740 (home)
Other:	
a. Corporate Health and Safety Director, Dr. Paul Jonmaire:	716/684-8060 (office) 716/655-1260 (home)
b. Corporate Safety Officer, Tom Siener	716/684-8060 (office) 716/662-4740 (home)

10.4 OTHER EMERGENCY RESPONSE PROCEDURES

On-Site Evacuation Signal/Alarm (must be audible and perceptible above ambient noise and light levels): Three blasts of vehicle horn or air horn.

On-Site Assembly Area: Building 520.

Emergency Egress Route to Get Off Site: Nearest gate or as directed by base security (Oneida County Sheriff).

Off-Site Assembly Area: NA

Preferred Means of Reporting Emergencies: Cell Phone

Site Security and Control: In an emergency situation, personnel will attempt to secure the affected area and control site access.

Emergency Decontamination Procedures: Wash hands and remove contaminated outer wear.

PPE: Personnel will don appropriate PPE when responding to an emergency situation. The SSO and Section 7 of this plan will provide guidance regarding appropriate PPE.

Emergency Equipment: Appropriate emergency equipment is listed in Attachment 2. Adequate supplies of this equipment shall be maintained in the support area or other approved work location.

Incident Reporting Procedures: Contact EEEPC emergency contacts with cellular telephone

Spill Containment Response: The field team leader will determine each work day the possible potential for spill from equipment or any other sources that are on site. During the daily safety briefing each day, the potential for spills and specific procedures for spill containment will be established and reviewed with all team members. Appropriate spill response equipment will be kept on site at all times, consisting at a minimum of an appropriate secondary container.

Attachment 1

Cold Stress Prevention and Treatment

COLD STRESS PREVENTION AND TREATMENT

Cold temperatures are potentially hazardous, especially when work is conducted without appropriate precautions. The following sections describe cold stress prevention and the recognition and treatment of cold stress emergencies.

Preventing Emergencies Due to Cold Stress

When working in situations where the ambient temperature is low, especially if low temperatures are accompanied by windy conditions, personnel should use the following cold-stress prevention measures:

- X Wear warm, dry, loose-fitting clothing that is preferably worn in layers. Outer clothing should be waterproof and windproof. Inner clothing should be capable of retaining warmth even when it is wet (e.g., wool or polypropylene) or have wicking capabilities (to draw moisture and perspiration away from the skin).

- X Wear lined and insulated footwear and warm gloves or mittens.

- X Alternately remove and don clothing layers as necessary to regulate body temperature and reduce excess perspiration.

- X Drink warm fluids as often as desired.

- X Take frequent breaks to provide for cold stress monitoring.

Cold Stress Emergencies

Hypothermia. Exposure to cold can cause the body's internal temperature to drop to a dangerously low level. Hypothermia occurs when a person's body loses heat faster than it can be produced. The body's normal deep-body temperature is approximately 98.6 degrees Fahrenheit. If body temperature drops to 95 degrees Fahrenheit, uncontrollable shivering may occur. If cooling continues, these other symptoms may occur:

- Vague, slow, slurred speech;
- Forgetfulness, memory lapses;
- Inability to use hands;
- Frequent stumbling;
- Drowsiness;
- Exhaustion, collapse;
- Unconsciousness; and
- Death.

Hypothermia impairs the judgment of the victim. Hypothermia is possible even in temperatures above freezing and can be prevented by remaining warm and dry and avoiding overexposure to the cold.

If a person shows symptoms of hypothermia, perform the following:

- Remove the victim from exposure to wet and cold weather.
- Remove wet clothing.
- If the victim is only mildly affected, provide warm drinks and dry clothing.
- If the victim is more seriously affected (clumsy, confused, unable to shiver), begin safe-warming procedures such as hugging, wrapping in dry blankets, and the use of warm objects such as hot water bottles or heat packs, and arrange for evacuation. Do not give the victim warm drinks until he or she exhibits a clear level of consciousness and appears to be warming up.

Frostbite. Frostbite occurs when body tissue freezes. Severe frostbite can lead to reduced circulation and the possible need for amputation. To prevent frostbite, maintain good circulation and keep extremities warm and dry. In extreme cold, it is important to prevent heat loss from as many areas of the body as possible. Exposed limbs and the head are major areas of heat loss.

Tall, thin people; those in poor physical condition; people with chronic diseases; heavy smokers; children; the elderly; and those who have been drinking alcohol are more susceptible to frostbite than other people due to poor circulation, poor production of body heat, or both.

There may be no pain or numbness experienced with gradual freezing of body tissues. While in the cold, it is important to test extremities for sensation and ensure that clothing is loose-fitting and warm. Exposed parts of the body should be inspected routinely. Just before freezing, skin becomes bright red. As freezing continues, small white patches will appear and the skin will become less elastic, often remaining pitted after it is touched or squeezed.

Serious freezing is most common in the feet because people are less aware of them, circulation and sensation are poorer, and warm footwear is difficult to obtain. Hands are usually the next to freeze. Exposed parts of the head will freeze less rapidly because they are conditioned to exposure and have a better blood supply.

In very cold weather, avoid touching cold metal with bare body parts. In the event that this happens, release the skin gently using heat, warm water, or urine. Avoid handling gasoline, kerosene, or similar liquids which, when handled in cold weather, can cause immediate frostbite.

If a person shows symptoms of frostbite, consult a medical professional, if possible, and perform the following:

- Initiate rewarming only if subsequent refreezing is not a possibility (thawing and refreezing should always be avoided because this is very injurious to tissue). Rewarm body parts in water that is approximately 100 to 105 degrees Fahrenheit. Do not try to thaw the body parts using cold water, snow, or intense heat from fires or stoves. The whole body may be immersed in warm water if necessary.

- If a large portion of an extremity is frozen when rewarming is initiated, the deep body temperature may drop as cooled blood begins to circulate throughout the body. Provide warm liquids to alleviate this situation.

- Move the afflicted part gently and voluntarily during rewarming.

- Use pain medication if it is available. Rewarming can be acutely painful. After thawing is completed, a deep pain may persist for several days, depending on the severity of the frostbite. Pain may be a good sign as it indicates that nerve function is present.

- A dull purple color, swelling, or blisters indicate serious injury and the need for medical attention. Consult a medical professional.

Attachment 2

Health and Safety on Drilling Rig Operations

Title:	HEALTH AND SAFETY ON DRILLING RIG OPERATIONS
Category:	H&S 5.3
Revised:	April 1998

STANDARD OPERATING PROCEDURE

HEALTH AND SAFETY ON DRILLING RIG OPERATIONS

ecology and environment, inc.
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TITLE:	HEALTH AND SAFETY ON DRILLING RIG OPERATIONS		
CATEGORY:	H&S 5.3	REVISED:	April 1998

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1. Introduction

This document is meant to be used in conjunction with Ecology and Environment, Inc., (E & E) standard operating procedures (SOPs) for field operations and hazardous waste site operations, and incorporates by reference all safety precautions required therein. It specifically addresses the functions and responsibilities of personnel working on or around drilling operations.

E & E personnel are frequently required to oversee a subcontractor's work in the field using drill rigs to take soil and rock samples, and install piezometers and monitoring wells. This document discusses the supervision of subcontract drillers by E & E.

2. Responsibilities and Authority of Subcontract Driller

The subcontract driller has authority to direct its personnel within the area while drilling operations are in progress. Access to the hazardous area around the auger and borehole is restricted by a "super exclusion zone" delineated by a 4-foot by 8-foot sheet of plywood centered over the borehole before drilling. A large hole cut in the plywood allows penetration of the augers. No E & E personnel are allowed in this "super exclusion zone" at any time while drilling is underway.

Housekeeping around the rig is the responsibility of the driller, but all team members should, when necessary, participate in this effort.

2.1 Responsibility and Authority of E & E Personnel

E & E personnel working at a drilling site must act as support to the subcontract drilling team by providing any necessary support functions; however, it is important that E & E personnel are careful not to interfere with the drilling process. Personnel are restricted from approaching the "super exclusion zone" while drilling is underway. If an E & E crew member recognizes an unsafe condition in the work area or on the rig, he should bring it to the attention of the site safety officer (SSO) and team leader if it is not resolved in a timely manner by the subcontractor driller. If conditions are still deemed to be hazardous, team members have the option of contacting their regional safety coordinator (RSC) or Corporate Health and Safety Group in Buffalo.

It is the responsibility of all E & E personnel to have with them on site their issued non-disposable gear, including hard hat, face shield, respirator, steel-toed boots, eyepiece inserts, safety glasses, and appropriate outerwear for the expected weather. It is the E & E employee's responsibility to ensure that all of his/her equipment is in proper working order.

All personnel should be aware of emergency facilities, egress routes, and special medical conditions of their team members. As with all E & E fieldwork, the buddy system is to be enforced.

3. Training Requirements for Site Personnel

3.1 E & E Site Safety Officer

In addition to basic health and safety training, annual health and safety refresher training, first aid, cardiopulmonary resuscitation (CPR), and necessary training in field monitoring of personnel, an SSO should have previous experience as a team member on field drilling projects in order to have a working knowledge of the drill rig and the extreme hazards that can occur with its operation. Where monitoring instrumentation is to be used, the SSO must be properly trained prior to fieldwork. The SSO must have an understanding of the hazards of heat and cold stress, their associated symptoms, and proper work modifications to protect field staff from potential injury.

3.2 Other E & E Personnel

All E & E personnel present on site shall have taken the basic 40-hour health and safety course and annual 8-hour refresher training course. Field personnel also must meet medical and respiratory fitness test requirements established by E & E and Occupational Safety and Health Agency (OSHA).

3.3 Subcontract Driller and Other Subcontract Drilling Personnel

Subcontract drillers and their support personnel on site must, at a minimum, have passed basic 40-hour health and safety training as prescribed by OSHA 29 Code of Federal Regulations (CFR)1910.120. They shall be medically approved and trained to use the level(s) of respiratory protection required on site. Certification of training by the subcontractor shall be required as a deliverable included in E & E's contractual documentation. This training shall be verbally verified and logged on site by the SSO or team leader before starting work.

4. Supervision of Subcontract Drillers

4.1 Responsibilities and Authority of Site Safety Officer

The responsibilities of the SSO at a drilling site where subcontracted drillers are used include the following: rig inspections, personnel monitoring, and personnel protection.

A rig inspection should begin by verifying the following:

- The mast must be located at least 25 feet from any overhead or underground utility lines;
- The location and operation of operational and unencumbered kill switches must be reiterated to all site personnel;

- Outriggers, stabilizers, or jacks are in place, and the rig is level;
- A geophysical survey (e.g., electromagnetic or ground-penetrating radar) or a reliable site history must be obtained to verify the absence of underground utilities, buried obstacles, tanks, and drums;
- A first aid kit and filled eyewash bottle must be readily available;
- A fire extinguisher should be charged to the proper pressure and placed at the rear of the rig during drilling;
- The condition of ropes, chains, and cables must be checked;
- A lifeline or safety belt must be available if mast climbing is necessary;
- The Site Safety Plan (SSP) must be posted with emergency phone list and map of hospital route; and
- A "super exclusion zone" must be established around the borehole, using traffic cones or a 4-foot by 8-foot sheet of plywood. This defined area will be entered during active drilling only by the subcontract driller and his helper(s), except in emergency situations.

If, upon review, the SSO deems that any material item noted above requires replacement or repair, the SSO must make necessary the arrangements for that repair or replacement, and later verify that repair or replacement is sufficient before actual drilling begins. Similarly, if the conditions listed above are not met, the SSO must request that they be met to his satisfaction before allowing drilling to proceed. Working together, the SSO and the subcontract driller should verify that the rig has been checked against the operator's checklist.

The SSO's monitoring duties include calibration and setup of the appropriate monitoring devices, as specified in the SSP. At a minimum, this generally includes an O_2/explosimeter and real-time organic-vapor monitoring capabilities (e.g., HNU, organic vapor analyzer [OVA]). Noise and heat-stress monitoring are employed where appropriate. If the SSO believes additional monitoring devices beyond the directive of the SSP should be employed (e.g., Rad Mini, Mini Ram), it is his/her responsibility to obtain this equipment from the nearest E & E office through the cooperation of the RSC or the Corporate Health and Safety Group. The SSO is also responsible for ensuring that a trained operator for this additional equipment is on site.

It is the responsibility of the SSO to ensure that all safety equipment is in good working order. Day-to-day operations, as well as calibration data, must be recorded in the equipment log or SSO log. Adequate supplies such as breathing air, drinking liquids, and calibration gas must be maintained.

E & E personnel are forbidden from entering the "super exclusion zone" around the borehole while drilling is underway. The SSO must not attempt to take air readings in or around the auger while it is in use, or from cutting samples while the auger is in motion. If possible, an

O_2/explosimeter should be set up for unmanned (alarmed) operations at the rig, using an extension hose to continuously draw samples from the borehole area during drilling operations.

The SSO has ultimate authority over the subcontractor with regard to whether work practices meet the requirements of the SSP. Shutdown of work or restriction of personnel are options available to the SSO. The SSO should hold informal site safety briefings at the start of both fieldwork and daily work shifts throughout the course of the project. Although E & E contractually requires subcontractors to provide properly trained and outfitted staff, the SSO should verify verbally at the start-up meeting that the field staff has necessary respiratory approval and OSHA-mandated training, especially at hazardous waste sites. Site safety briefing topics, as well as the names of attendees, will be recorded in the site safety log.

If the SSO has reason to believe that either E & E or subcontractor personnel are under the influence of alcohol or drugs, or are otherwise ill before or during work on site, he or she should consider restricting those team members from site work. Personnel who are to perform work that requires Level C protection must be clean-shaven or they may be restricted at the discretion of the SSO.

The following is a list of basic topics to be discussed at site safety meetings:

- Personnel responsibilities;
- Planned investigation and presumed potential hazards;
- Levels of protection, monitoring plan, and equipment;
- Emergency scenario plans, including use of kill switches;
- Location and operation of kill switches, fire extinguisher, and first aid kits;
- Heat and cold stress hazards;
- "Super exclusion zone" around borehole; and
- Warnings to subcontractors about hazards of climbing the mast without proper safety equipment.

Because heat stress is a constant threat during warm weather, the SSO is responsible for determining whether conditions are unsuitable for work. If site conditions require the assistance of work modifications, cooling vests, and other cooling means, the SSO may decide that work should not continue. The need for worker monitoring through blood pressure and oral temperature checks will be determined by the SSO with assistance from the RSC and Corporate Health and Safety Group staff, if necessary.

The SSO will be responsible for shutting down the drilling operation if electrical storms occur in the site area.

No refueling operations will be performed until rig engines are shut down. Motor fuels should be stored and dispensed from spring-loaded, OSHA/Factory Mutual-approved metal or polyethylene gas cans.

The SSO should ensure and document that no boreholes are left open or unfilled after drilling equipment is moved. In instances where a hole must be left open and unattended, suitable barricades or the equivalent will be staged around the hole to prevent personnel and equipment from falling in.

4.2 Responsibilities and Authority of Other E & E Personnel

All E & E personnel on site are required to follow the terms of the SSP and the direction of the SSO. Because the SSO cannot be in all places at all times, the crew should observe the subcontractors and condition of their equipment at all times, and report immediately to the team leader and SSO any safety-related issues that are unresolved. Included are such details as dressout, site functions, and decontamination. It is important that the SSO be involved so that proper log entries can be made.

It is a policy of E & E not to provide safety equipment or monitoring instrumentation to subcontractors. Some projects, however, may be arranged in such a manner that allows E & E personnel and subcontractors to share the same expendable supplies.

E & E personnel are forbidden from approaching augers during drilling. Activities at the borehole, such as sampling, require that the operation of equipment be stopped.

5. Drilling Hazards

5.1 General Drilling Hazards

Drilling operations present numerous health and safety hazards to site personnel, subcontractor drillers, and members of the public who may approach the rigs. Drilling hazards that apply to all drilling methods and possible control methods include:

- Slip/trip/fall hazards;
- Ergonomic hazards;
- Moving objects;
- Unguarded points of operation;
- Heat/cold stress;
- Noise;
- Buried or overhead utilities;

- Radiological hazards;
- Lightning;
- Chemical hazards; and
- Biological hazards.

5.2 Physical Hazards (Slip/Trip/Fall Hazards)

Personnel may be injured if they trip over tools or objects, walk on uneven terrain, fall from heights or into holes, or slip on surfaces.

Controls

- Store all tools and supplies away from the super exclusion zone;
- Personnel should use caution when walking on uneven surfaces so that they do not lose their balance;
- Subcontractor drillers must wear a lifeline or safety belt if mast climbing is necessary;
- Boreholes should be barricaded or marked with flags when drilling has been completed to prevent personnel from stepping in the hole; and
- Soil or sand should be applied to wet or slippery surfaces.

5.3 Ergonomic Hazards

Muscle strains, sprains, and injuries can occur when personnel use improper lifting methods, lift objects that are too heavy, improperly reach for objects, or work in awkward positions.

Controls

- Lift with the back as straight as possible, bend the knees, and keep the object close to the body;
- Use two people to move heavy objects such as augers;
- Avoid excessive stretching of the arms when picking up objects; and
- Avoid sudden twisting of the back or working in awkward positions.

5.4 Moving Objects

Site personnel may be injured if they are struck by debris from the borehole or by drilling machinery or components.

Controls

- Wear the appropriate personal protective equipment such as safety boots, safety glasses, and a hard hat; and
- Adequate inspection and maintenance of the drill rig will reduce the likelihood of worn equipment or parts falling and causing accidents.

5.5 Unguarded Points of Operation

The spinning auger on a drill rig or the V-belt drive on a motor are unguarded points of operation that can pull site personnel into the machinery and cause serious injuries.

Controls

- Mechanical guards cannot be placed around the spinning auger on a drill rig. Site personnel must stay away from the spinning auger and avoid wearing loose clothing that could get caught in the auger; and
- Mechanical guards must be placed over V-belt drives.

5.6 Heat/Cold Stress

Drilling is a strenuous job, and heat stress is a major hazard in hot, humid environments, especially when personnel are wearing protective equipment such as coveralls, gloves, boots, and respirators. Cold injury can occur at low temperatures and when the wind-chill factor is low.

Heat Stress

Controls

- Recognize the signs and symptoms of heat stress;
- Monitor workers who are wearing protective clothing; and
- Provide fluid replacement and schedule rest periods in cool locations.

Cold Stress

Controls

- Recognize the signs and symptoms of cold stress;
- Personnel must wear appropriate clothing during cold weather; and
- A warm rest location and fluid replacement should be provided.

5.7 Noise

Excessive noise can cause hearing damage, distract workers, and interfere with communications.

Controls

- In excessive noise areas, wear the hearing protection recommended by the SSO.

5.8 Buried or Overhead Utilities

Contact of drilling tools with electric, gas, steam, process, or other utility lines can result in fires, explosions, electric shock hazards, burns, etc.

Controls

- The boom on the drill rig must be kept at least 25 feet from overhead and buried utilities;
- After buried utilities have been located using an appropriate geophysical survey, the line locations should be marked with flags. Maps of underground utilities should also be checked, if available, to verify locations; and
- Drilling operations should proceed slowly in areas near buried utilities, as the actual utility location may not exactly correspond to the area identified by a flag or as illustrated on a map.

5.9 Radiological Hazards

5.9.1 Nonionizing Radiation

Nonionizing radiation is radiation that emits photon energy that is not sufficient to produce ionization in biological systems. Radio frequencies (including radar and microwave), infrared, visible light, and ultraviolet regions of the electromagnetic spectrum are considered to be nonionizing. Ultraviolet radiation from the sun is usually the major nonionizing radiation hazard present during drilling operations. Ultraviolet radiation can damage the skin and eyes. Potential effects include, but are not limited to, sunburn, skin cancer, photosensitization, and cataracts.

Controls

- Wear sunscreen on all exposed skin areas; and
- Wear safety glasses that block ultraviolet radiation (or sunglasses worn over safety glasses).

5.9.2 Ionizing Radiation Hazards

Ionizing radiation is electromagnetic or particulate radiation with sufficient energy to ionize atoms. Ionizing radiation may be present on some drilling sites and includes:

- Electromagnetic radiation
  - Gamma rays
  - X-rays
- Particulate radiation
  - Alpha
  - Beta
  - Neutrons

Controls

Site personnel can minimize their exposure to external radiation hazards by:

- Limiting exposure time;
- Increasing the distance from the radiation source; and
- Shielding the radiation source.

Some radiation sources can enter the body through inhalation, ingestion, and/or skin contact. Exposure can be controlled through the wearing of personal protective equipment and thorough washing of skin surfaces with soap and water.

5.10 Lightning Hazard

The elevated mast on a drill rig is a potential target of lightning.

Controls

- The SSO will halt drilling operations when electrical storms approach the drilling location.

5.11 Chemical Hazards

Chemical contaminants may be present in the form of gases, vapors, aerosols, fumes, liquids, or solids. Site personnel may be exposed to these contaminants through one or more of the following pathways: inhalation, ingestion, skin, and/or eye contact.

Controls

- Become familiar with the specific drilling operation being used to identify and avoid chemical discharge locations;
- Wear appropriate personal protective equipment;
- Practice contamination avoidance; and
- Stay upwind during grout mixing (silica inhalation hazard).

5.12 Biological Hazards

Biological hazards that may be present during drilling operations include poisonous plants, animals, and insects, and infectious agents.

Controls

- Wear insect repellant at sites where biting insects are prevalent;
- Learn to identify poisonous plants that cause dermatitis, such as poison ivy and poison oak;
- Wear impervious personal protective clothing (e.g., saranex coveralls, latex booties, nitrile surgical gloves) if work must be conducted in areas where site personnel will contact poisonous plants; and
- Avoid potential animal nesting areas and animal carcasses.

6. Drilling Methods and Hazards

6.1 Solid Flight and Bucket Augers

Solid-flight augers (also referred to as solid-stem augers, continuous flight augers, and disk augers) use solid-stem auger sections, with the flighting (curved corkscrew-like blades) connected end-to-end to the cutting head (see Figure 1). Soil cuttings are moved upward to the ground surface by the flighting as the auger penetrates into the soil. Samples are typically collected by removing an auger section, attaching a split-spoon or thin-wall sampler to the end of a drill rod, and placing this arrangement into the borehole. Split-spoon samples are collected by using a hammer connected to the drill rod and split-spoon. The hammer is operated by wrapping sections of rope around a rotating cathead hoist (a wide metal cylinder). A disk auger is similar to a solid-flight auger except that it is larger in diameter and the flighting goes around the stem once. Bucket augers have a cutting edge on the bottom. Once the bucket auger fills with soil cuttings, it is brought to the surface to be emptied. Figure 1 shows various types of bucket augers.

Auger drill methods are used in unconsolidated material for sampling subsurface media, installing groundwater monitoring wells, and identifying depth to bedrock.

6.2 Hollow-Stem Auger

A drill rig rotates a hollow-stem auger (see Figure 2) and moves it vertically into the soil. The hollow stem allows use of continuous or intermittent soil sampling techniques. Once the required depth has been reached, screens and casing for monitoring wells can be placed in the hollow-stem gravel pack and grout is added as the auger is pulled out of the borehole. Hollow-stem auger drilling is a common method of monitoring well installation.

6.2.1 Auger Drilling Hazards

Physical Hazards

Spinning Auger. The spinning auger is not equipped with a metal guard; therefore, it is imperative that personnel use extreme caution when working near spinning auger, as contact with the auger can cause personnel to be pulled into the auger and crushed between the auger and the drill rig. Only approved drillers will remain in proximity to the borehole during drilling, and an approximate 4- by 8-foot "super exclusion area" will be established by placing a 4- by 8-foot sheet of plywood over the borehole, or by placing flagging or traffic cones around a 4- by 8-foot perimeter. No personnel, except the driller and the driller's helper, will enter this zone during drilling. The SSO will issue warnings to those personnel not authorized to enter this zone.

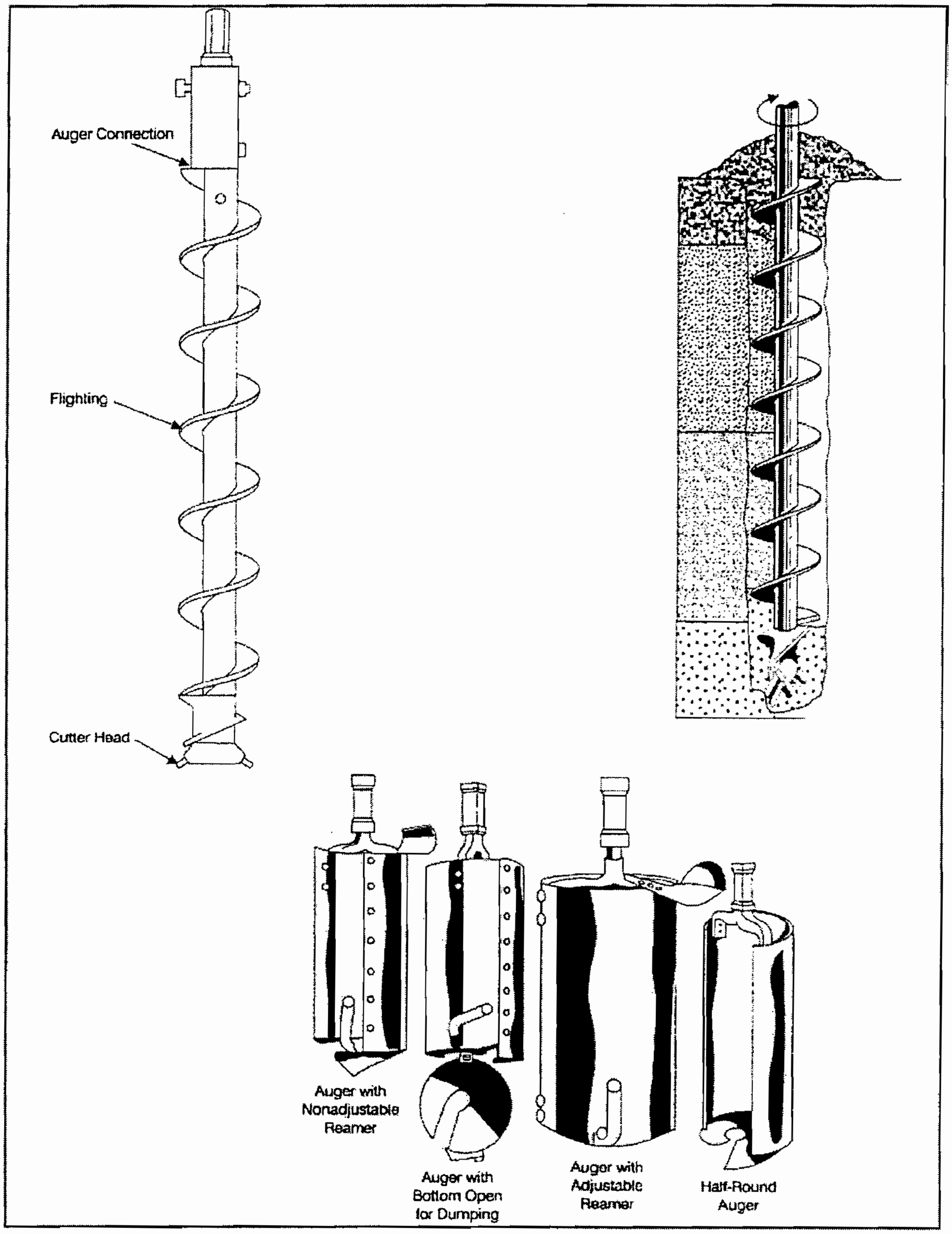

Figure 1 Solid Flight and Bucket Augers

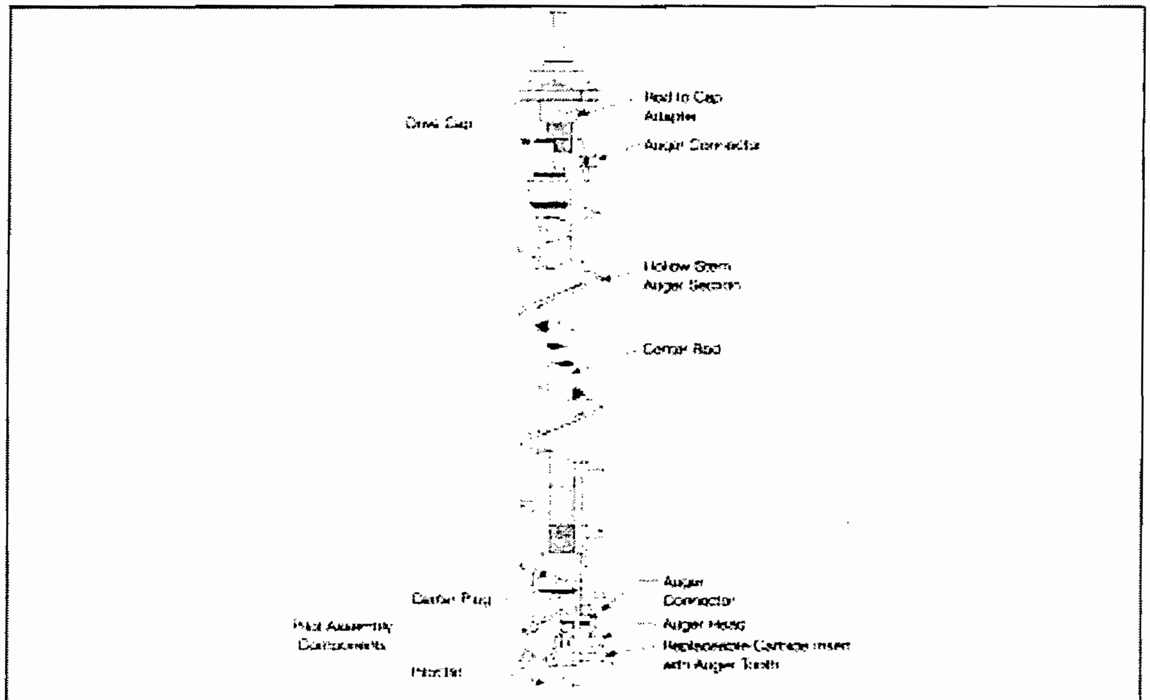

Figure 2 Hollow-Stem Auger

Overhead Equipment. If wire line core sampling is conducted, drill steel and sampling gear will be lifted overhead. Site personnel must conduct the necessary equipment inspections to ensure it is in good condition prior to the start of drilling operations. In addition, drillers must make sure that proper hoisting procedures are used to reduce the likelihood of dropping drill steel or sampling gear.

Drill Rig Lurching. The drill rig has a tendency to lurch and shake when the auger comes into contact with harder materials. This is especially true when hollow-stem auger drilling methods are utilized. The rig can also lurch seriously in hearing sands. Site personnel should be aware of possible drill rig movement and move away from the rig if lurching or shaking occurs.

Noise. If split-spoon sampling is conducted, a hammer is used to drive the spoon into the soil. The hammer generates a loud noise when it contacts a metal surface. Site personnel are required to wear appropriate hearing protection during hammering operations.

6.3 Open-Hole Rotary Methods

A direct mud rotary drilling system (also direct [liquid] rotary, hydraulic rotary, or reverse [circulation] rotary) is shown in Figure 3. Drilling fluid (mud) is pumped through drill rods to a bit. The mud flows back to the surface through the space between the drill rods and the borehole and is discharged at the surface through a pipe into a tank, tub, pond, or pit. After the cuttings settle, a pump recirculates the liquid back through the drill rods. The mud serves to:

- Cool and lubricate the bit;
- Stabilize the borehole well; and
- Prevent the inflow of fluids from formations.

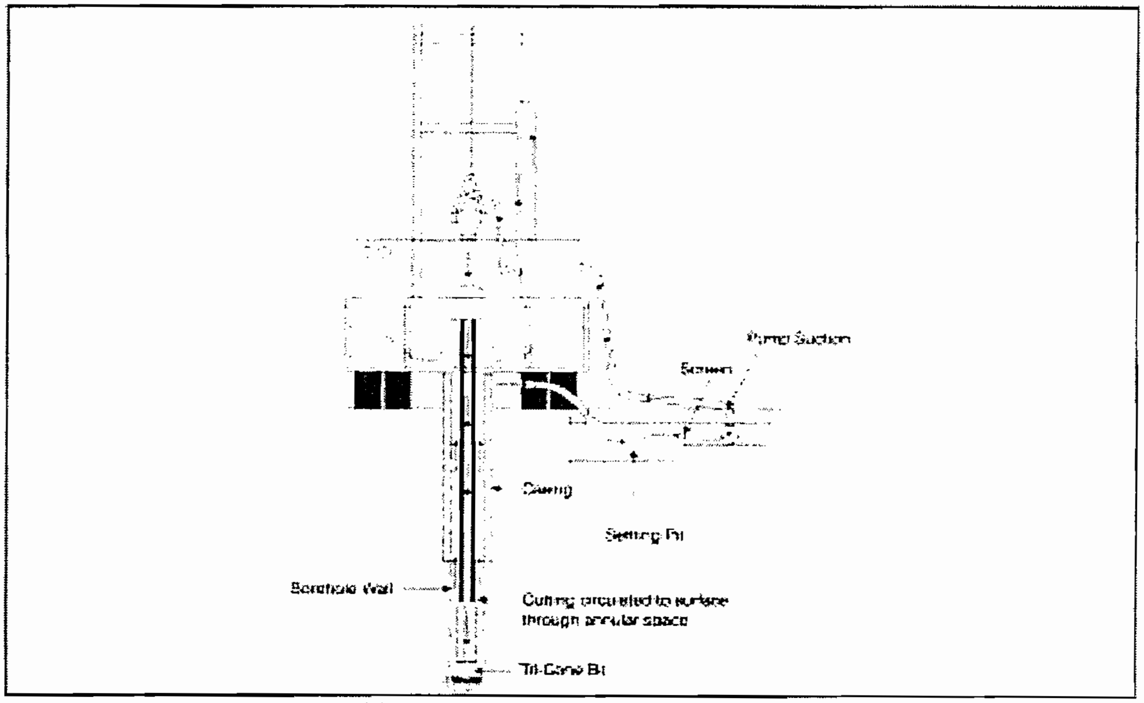

Figure 3 Open-Hole Rotary Method

A shale shaker can collect a sample from the circulated fluid by placing it in the discharge flow before the settling pit. In addition, the drilling fluid flow can be shut off and split-spoon, thing-wall, or consolidated-core samplers can be used to collect a sample by inserting a sampler through the drill rods. Reverse circulation rotary drilling is a variation of mud rotary drilling in that the mud flows from the mud pit down the borehole outside the drill rods, passes up through the bit carrying cuttings into the drill rods, and is then discharged into the mud pit. The equipment used is similar to the direct mud rotary method, except most of the equipment is larger.

Equipment Breaks. A break in support equipment for drill steel could cause equipment to fall and injure site personnel. Equipment inspection is required to ensure it is in good condition prior to the start of drilling operations.

Slippery Conditions. Because the use of drilling mud will create slippery conditions around the drill rig and support area, mud should be contained to the immediate work area. Slippery spots should be dried with sand/dirt to reduce slipping hazards. Gloves should be changed when they become coated with mud.

6.4 Direct Air Rotary with Rotary Bit/Downhole Hammer

Also called an air rotary with roller-cone (tri-cone) bit, down-the-hole hammer, or air percussion rotary, the rig setup for air rotary with a tri-cone or roller-cone bit is similar to direct mud rotary (see Figure 3), except the method uses air instead of water and drilling mud. The main components of a drill string using a tri-cone bit are illustrated in Figure 4. Compressed air is forced down through the drill rods to cool the bit, and cuttings are carried up the open hole to the surface. A cyclone slows down the air velocity, forcing the cuttings into the container. A roller-cone drill bit is used for hard-to-soft consolidated rock and unconsolidated formations. When a downhole hammer is utilized, it replaces the roller-cone bit (see Figure 4). The hammer produces a pounding action as it rotates. Other features are similar to the rotary bit, except small amounts of surfactant and water are used for dust and bit temperature control.

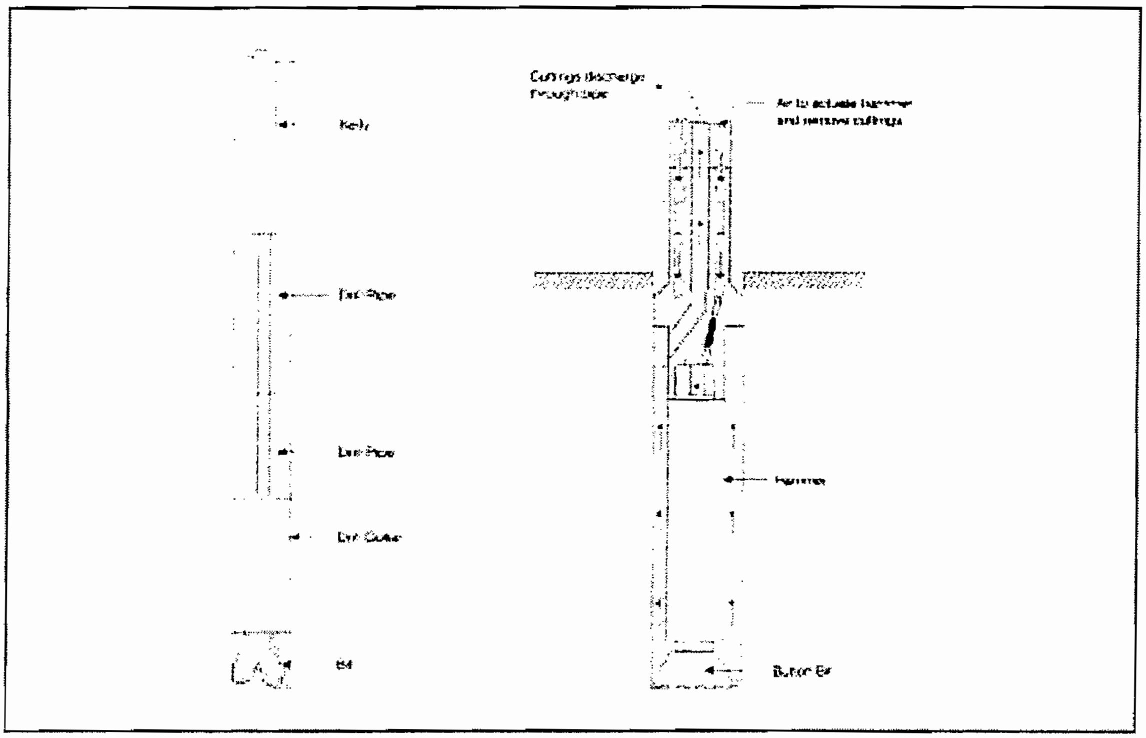

Figure 4 Direct Air Rotary

Physical Hazards

Noise. Excessive noise is generated from the use of air compressors, casing drivers, and downhole hammers. Site personnel are required to wear hearing protection during drilling operations.

Cuttings and Water. Cuttings and water blown from the hole can strike and injure site personnel. Site personnel must stay away from this discharge location and wear appropriate personal protective equipment.

Overhead Equipment. If wire line core sampling is conducted, drill steel and sampling gear will be lifted overhead. Site personnel must conduct the necessary equipment inspections to ensure it is in good condition prior to the start of drilling operations. In addition, drillers must make sure that proper hoisting procedures are followed to reduce the likelihood of falling drill steel or sampling gear.

6.5 Cable Tool

A cable tool drill rig operates by repeatedly lifting and dropping tools attached to a cable into a borehole. Figure 5 shows the components of a cable tool rig. This drilling method crushes rock and a spudding beam mixes the crushed particles with water. The water and debris is removed by a bailer or pump. In unconsolidated formations, a casing is driven into the ground. In consolidated formations, drilling is conducted with the use of a casing.

Physical Hazards

Noise. The spudding beam generates excessive noise. All personnel must wear appropriate hearing protection during drilling operations.

Rig Movement. The drill rig tends to lurch as the drill string is raised and lowered. Site personnel must maintain an adequate distance from the rig during drilling operations.

Overhead Equipment. Drill string and bailers are hoisted during drilling operations and present an overhead hazard to site personnel if a tool falls from a height.

6.6 Casing Advancement: Rotary Drill-Through Methods

6.6.1 Drill-Through Casing Driver and Dual Rotary Method

Casing drivers advancement (also referred to as air [mud] rotary drill or downhole hammer with casing drivers, air rotary casing hammer, and air drilling with casing hammer) involves a driver that moves the casing as drilling occurs (see Figure 6) during the use of conventional direct air (mud) or downhole hammer equipment. Drill cuttings move upward in the space between the drill pipe and the casing. The diameter of the casing is slightly larger than the bit so it can be easily removed.

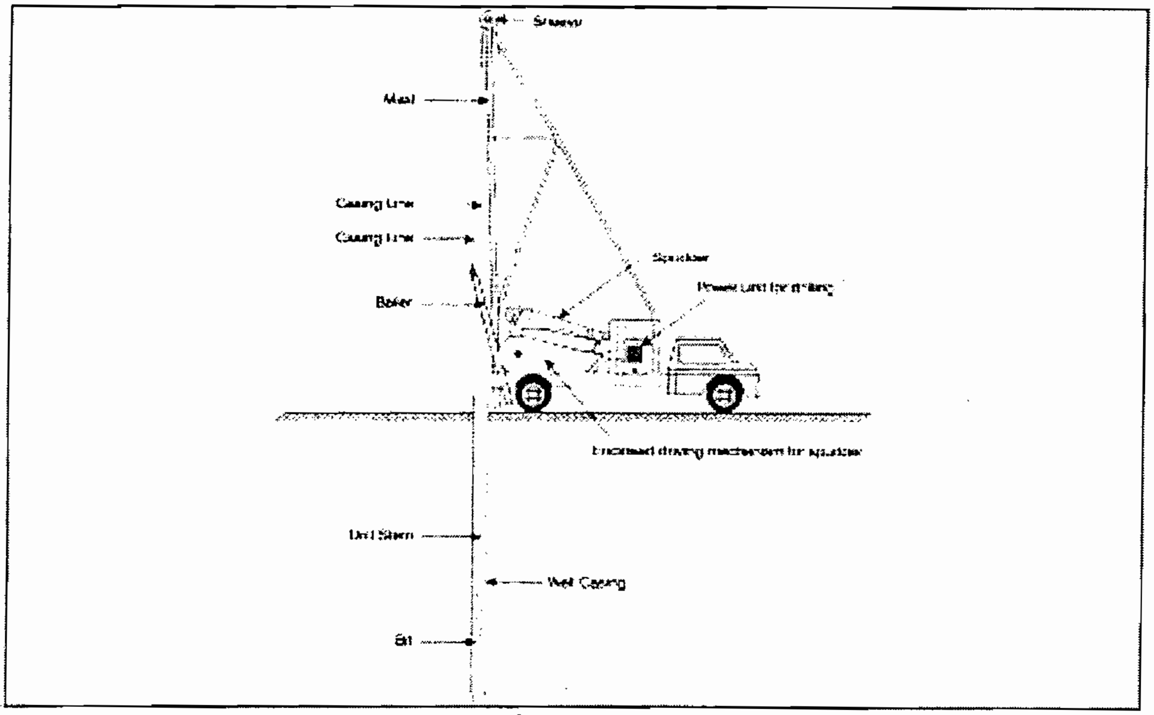

Figure 5 Cable Tool Drill Rig

In dual rotary advancement, the casing is moved by using a rotary steel casing provided with a carbide-studded drive shoe. The carbide ring cuts through the overburden material. Rotary drilling (usually air) takes place at the same time using a downhole hammer or tri-cone bit. Drilling can be conducted either inside or ahead of the casing.

The type of drilling is used to install monitoring wells in unconsolidated formations, where loss of circulation of drilling fluids is a problem, and/or where prevention of cross-contamination of aquifers is important.

6.6.2 Reverse Circulation (Rotary, Percussion Hammer, and Hydraulic Percussion)

The reverse-circulation rotary drilling method can utilize air rotary with a downhole hammer or bit or mud rotary. Two or three casings can be used.

Reverse circulation dual-wall rotary. This method is similar to downhole hammers with a casing driver or air rotary-cone bit, except air is moved down the space between the casing and the drill pipe to the bit, and soil cuttings are pushed to the surface through the drill pipe (see Figure 7).

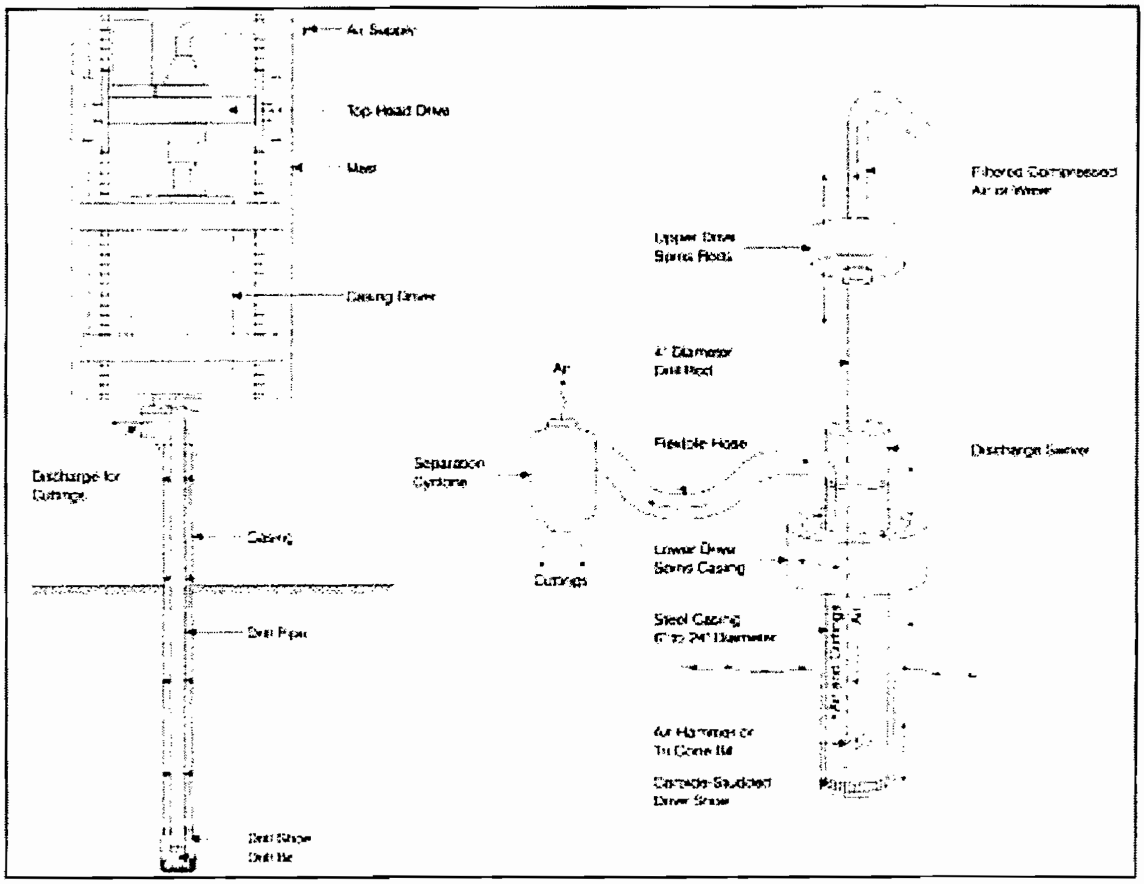

Figure 6 Casings

Reverse circulation dual-wall percussion hammer. The percussion hammer operates in a similar manner of reverse circulation as the dual-wall rotary method, except the drive method is different. Either two or three casings are used. Compressed air is moved into the space between the outer and inner pipes, and soil cuttings are discharged from the inner pipe to a cyclone. A percussion hammer on the most of the drill rig strikes an anvil on the top of the drive assembly. Two or three casings are driven, and the bit does not rotate.

Physical Hazards – Reverse Circulation Dual-Wall Rotary

Noise. Excessive noise is generated from the use of air compressors, casing drivers, and downhole hammers. Site personnel are required to wear hearing protection during drilling operations.

Cuttings. Cuttings and debris discharged from the hole can strike and injure site personnel. Site personnel must stay away from the discharge point and wear appropriate personal protective equipment.

Overhead Equipment. If wire line core sampling is conducted, drill steel and sampling gear will be lifted overhead. Site personnel must conduct the necessary equipment inspections to ensure it is in good condition prior to the start of drilling operations. In addition, drillers must make sure that proper hoisting procedures are followed to reduce the likelihood of dropping drill steel or sampling gear.

Physical Hazards – Hydraulic Percussion

Slips/Falls. Site personnel can slip on wet ground around the drill rig or fall into the water tank. Site personnel must keep the drilling location clear of debris and contain spillage prior to and during drilling operation.

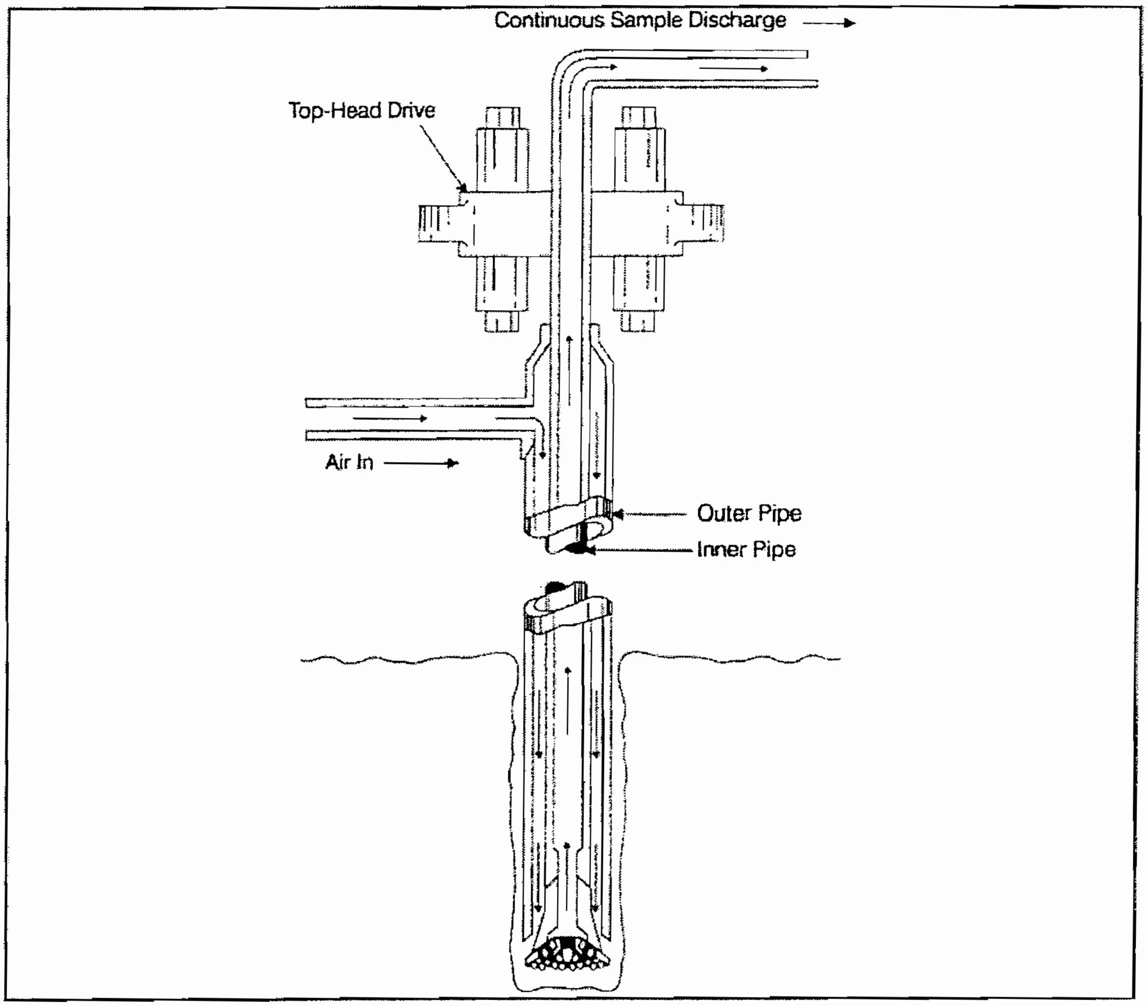

Figure 7 Reverse Circulation Rotary Method

Attachment 3

Heat Stress Prevention and Treatment

HEAT STRESS PREVENTION AND TREATMENT

Elevated temperatures are potentially hazardous, especially when work is conducted without appropriate precautions. The following sections describe heat stress prevention and the recognition and treatment of heat emergencies.

Effects of Heat

A predictable amount of heat is generated as a result of normal oxidation processes within the body. If heat is liberated rapidly, the body cools to a point at which the production of heat is accelerated, and the excess heat brings the body temperature back to normal.

Interference with the elimination of heat leads to its accumulation and to the elevation of body temperature. This condition produces a vicious cycle in which certain body processes accelerate and generate additional heat. Afterward, the body must eliminate not only the heat that is normally generated but also the additional quantities of heat.

Most body heat is brought to the surface by the bloodstream and escapes to cooler surroundings by conduction and radiation. If moving air or a breeze strikes the body, additional heat is lost by convection. When the temperature of the surrounding air becomes equal to or rises above the body temperature, all the heat must be lost by vaporization of the moisture or sweat from skin surfaces. As the air becomes more humid (contains more moisture), vaporization from the skin decreases. Weather conditions including high temperatures (90 to 100 degrees F), high humidity, and little or no breeze cause the retention of body heat. Such conditions or a succession of such days (a heat wave) increase the chances of a medical emergency due to heat.

Preventing Emergencies Due to Heat

When working in situations where the ambient temperatures and humidity are high, and especially in situations where protection levels A, B, or C are required, the site safety officer should:

- Ensure that all employees drink plenty of fluids (Gatorade or its equivalent);
- Ensure that frequent breaks are scheduled so overheating does not occur; and
- Revise work schedules, when necessary, to take advantage of the cooler parts of the day (i.e., 5:00 a.m. to 11:00 a.m. and 6:00 p.m. to nightfall).

When protective clothing is required, the suggested guidelines correlating ambient temperature and maximum wearing time per excursion are:

Ambient Temperature	Maximum Wearing Time per Excursion
Above 90 degrees F	15 minutes
85 to 90 degrees F	30 minutes
80 to 85 degrees F	60 minutes
70 to 80 degrees F	90 minutes
60 to 70 degrees F	120 minutes
50 to 60 degrees F	180 minutes

One method of measuring the effectiveness of an employee's rest-recovery regime is by monitoring the heart rate. The "Brouha guideline" is one such method and is performed as follows:

- Count the pulse rate for the **last** 30 seconds of the first minute of a 3-minute period, the **last** 30 seconds of the second minute, and the **last** 30 seconds of the third minute; and

- Double each result to yield beats per minute.

If the recovery pulse rate during the last 30 seconds of the first minute is 110 beats/minute or less, and the deceleration between the first, second, and third minutes is **at least** 10 beats/minute, then the work-recovery regime is acceptable. If the employee's rate is above the rate specified, a longer rest period will be required, accompanied by an increased intake of fluids.

Heat Emergencies

Heat Cramps. Heat cramps usually affect people who work in hot environments and perspire a great deal. Loss of salt from the body causes very painful cramps in leg and abdominal muscles. Heat cramps may also result from drinking iced water or other drinks either too quickly or in too large a quantity. The symptoms of heat cramps are:

- Painful muscle cramps in legs and abdomen;

- Faintness; and

- Profuse perspiration.

To provide emergency care for heat cramps, move the patient to a cool place. Give him or her sips of liquids such as Gatorade or its equivalent. Apply manual pressure to the cramped muscle. Move the patient to a hospital if there is any indication of a more serious problem.

Heat Exhaustion. Heat exhaustion also may occur in individuals working in hot environments and may be associated with heat cramps. Heat exhaustion is caused by the pooling of blood in the vessels of the skin. The heat is transported from the interior of the body to the surface by the blood. The skin vessels become dilated and a large amount of blood is pooled in the skin. This condition, plus the blood that is pooled in the lower extremities when in an upright position, may lead to an inadequate return of blood to the heart and eventual physical collapse. The symptoms of heat exhaustion are:

- Weak pulse;

- Rapid and usually shallow breathing;
- Generalized weakness;
- Pale, clammy skin;
- Profuse perspiration;
- Dizziness/faintness; and
- Unconsciousness.

To provide emergency care for heat exhaustion, move the patient to a cool place and remove as much clothing as possible. Have the patient drink cool water, Gatorade, or its equivalent. If possible, fan the patient continually to remove heat by convection, but do not allow chilling or overcooling. Treat the patient for shock and move him or her to a medical facility if there is any indication of a more serious problem.

Heat Stroke. Heat stroke is a profound disturbance of the heat-regulating mechanism and is associated with high fever and collapse. It is a serious threat to life and carries a 20% mortality rate. Sometimes this condition results in convulsions, unconsciousness, and even death. Direct exposure to sun, poor air circulation, poor physical condition, and advanced age (over 40) increase the chance of heat stroke. Alcoholics are extremely susceptible. The symptoms of heat stroke are:

- Sudden onset;
- Dry, hot, and flushed skin;
- Dilated pupils;
- Early loss of consciousness;
- Full and fast pulse;
- Deep breathing at first, followed by shallow or faint breathing;
- Muscle twitching, growing into convulsions; and
- Body temperature reaching 105 to 106 degrees F or higher.

When providing emergency care for heat stroke, remember that it is a life-threatening emergency. Transportation to a medical facility should not be delayed. Move the patient to a cool environment, if possible, and remove as much clothing as possible. Ensure an open airway. Reduce body temperature promptly by dousing the body with water or, preferably, by wrapping the patient in a wet sheet. If cold packs are available, place them under the arms, around the neck, at the ankles, or any place where blood vessels that lie close to the skin can be cooled. Protect the patient from injury during convulsions.

Attachment 4

Map Showing Route to Hospital from Former Griffiss AFB

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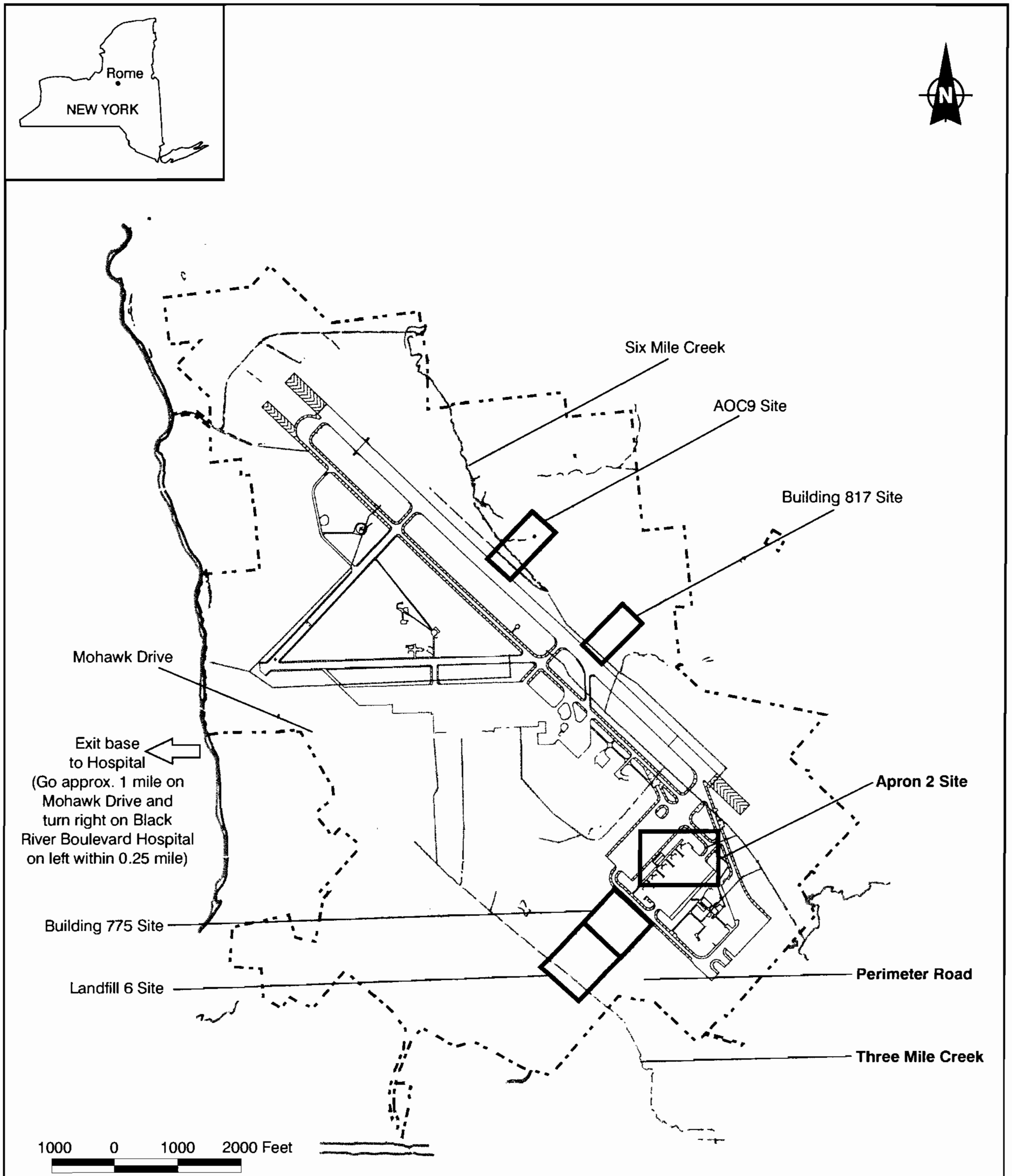

Legend

Base Boundary

Stream

Airfield/Road

Existing Building

Demolished Building

UNITED STATES AIR FORCE
GRIFFISS AIR FORCE BASE
ROME, NEW YORK

Attachment 4
Hospital Route

SOURCE: Basemap obtained from FPM Group.

Attachment 5

Hazard Evaluation of Chemicals

CHEMICAL NAME: Chlorobenzene
CAS NUMBER: 108-90-7 DOT NAME/ID NO: UN 1134
SYNONYMS: MCB, Phenyl chloride, Chlorobenzol

CHEMICAL AND PHYSICAL PROPERTIES:
CHEMICAL FORMULA: C6H5CL MOLECULAR WEIGHT: 112.56 SPG/D: 1.11 SOLUBILITY: Slightly soluble
PHYSICAL STATE: Colorless liquid with an aromatic almond-like
FLAMMABLE LIMITS: UPPER - 9.6 %; LOWER - 1.3 %. FLASH POINT: 84F (28.9C)
VAPOR PRESSURE: 8.8 mm Hg at 68F (20C) FREEZING POINT: -50F BOILING POINT: 132 C (270 F)
ODOR CHARACTERISTIC: Mild almond Incompatablilities: STRONG OXIDIZING AGENTS

BIOLOGICAL PROPERTIES:
IDLH: 2400 PPM TLV-TWA: 10 ppm PEL - TWA: 75 ppm ODOR THRESHOLD: 0.21 ppm
HUMAN (LCLO): RAT/MOUSE (LC50):
CARCINOGEN: TERATOGEN: AQUATIC:
ROUTE OF EXPOSURE: Inh, Ing, Eye, Skin

HANDLING RECOMMENDATIONS (PERSONAL PROTECTIVE MEASURES):
Personal protection: Wear solvent-resistant gloves and clothing.Wear splash-proof chemical goggles and face shield when working with liquid.Respiratory Protection.

Gloves: Polyvinyl-Alcohol-VG; Teflon-VG; Viton-VG.
E = Excellent (> 8 hours); VG = Very Good (4 - 8 hrs); G = Good (1 - 4 hours); P = Poor (< 1 hour)

MONITORING RECOMMENDATIONS:
Monitoring:

HEALTH HAZARDS:
Acute Symptoms: Drowsiness, dizziness, incoordination, unconsciousness.Irritate the skin, causing a rash or burning feeling.Irritate the eyes, nose and throat.

Chronic Symptoms: May damage the liver.skin burns.Reduced memory and concentration, personality changes (withdrawal, irritability),fatigue, sleep disturbances.

FIRST AID:
FIRST AID-INHAL: Remove the person from exposure. Begin rescue breathing if breathing has stopped and CPR if heart action has stopped.Transfer promptly to a medical facility.
FIRST AID-EYE: Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids.
FIRST AID-SKIN: Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

DISPOSAL/WASTE TREATMENT:
DISPOSAL OF WASTE:

CHEMICAL NAME: Dichlorobenzene, 1,2-
CAS NUMBER: 95-50-1 DOT NAME/ID NO: UN 1591
SYNONYMS: o-dichlorobenzene, ortho-dichlorobenzene

CHEMICAL AND PHYSICAL PROPERTIES:
CHEMICAL FORMULA: MOLECULAR WEIGHT: SPG/D: SOLUBILITY: Slightly soluble.1,2-Dichlorobenzene is slightl
PHYSICAL STATE: Colorless to pale yellow liquid with a pleasant odor.
FLAMMABLE LIMITS: FLASH POINT: 151F (66.1C)
VAPOR PRESSURE: 1.2 mm Hg at 68F (20C) FREEZING POINT: BOILING POINT:
ODOR CHARACTERISTIC: Pleasant Incompatabilities:

BIOLOGICAL PROPERTIES:
IDLH: TLV-TWA : 25 ppm Sk PEL - TWA: 50 ppm C ODOR THRESHOLD: 0.7 ppm
HUMAN (LCLO): RAT/MOUSE (LC50):
CARCINOGEN: Yes TERATOGEN: AQUATIC: Some substances increase in conce
ROUTE OF EXPOSURE: Inh, Ing, Eye, Skin

HANDLING RECOMMENDATIONS (PERSONAL PROTECTIVE MEASURES):
Personal protection: Wear solvent-resistant gloves and clothing.Protective clothing.Eye Protection.Respiratory Protection.

Gloves: Viton-E.
E = Excellent (> 8 hours); VG = Very Good (4 - 8 hrs); G = Good (1 - 4 hours); P = Poor (< 1 hour)

MONITORING RECOMMENDATIONS:
Monitoring:

HEALTH HAZARDS:
Acute Symptoms: Contact with the liquid can irritate the skin. Prolonged contact can cause skin burns.The liquid can irritate and burn the eyes.Exposure can cause headaches and nausea, and can irritate the eyes, nose, and throat.

Chronic Symptoms: There is some evidence for an association between exposure to Dichlorobenzenes and leukemia. It is unclear at this time whether this association represents an increased cancer risk.1,2-Dichlorobenzene may damage the testes (male reproductive glands).

FIRST AID:
FIRST AID-INHAL: Remove the person from exposure.Begin rescue breathing if breathing has stopped and CPR if heart action has stopped. Transfer promptly to a medical facility.
FIRST AID-EYE: Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids. Seek medical attention.
FIRST AID-SKIN: Quickly remove contaminated clothing. Immediately wash area with large amounts of soap and water. Seek medical attention.

DISPOSAL/WASTE TREATMENT:
DISPOSAL OF WASTE:

CHEMICAL NAME: Dichlorobenzene, 1,4-*
CAS NUMBER: 106-46-7 DOT NAME/ID NO: UN 1592
SYNONYMS: p-dichlorobenzene, Dichloride, PDCB

CHEMICAL AND PHYSICAL PROPERTIES:
CHEMICAL FORMULA: MOLECULAR WEIGHT: SPG/D: SOLUBILITY: Insoluble
PHYSICAL STATE: Colorless or white crystalline (sand like) material with a mothball odor.
FLAMMABLE LIMITS: FLASH POINT: 150F (65.5C)
VAPOR PRESSURE: 0.4 mm Hg at 68F (20C) FREEZING POINT: BOILING POINT:
ODOR CHARACTERISTIC: Mothballs Incompatabilities:

BIOLOGICAL PROPERTIES:
IDLH: 1000 ppm TLV-TWA : 10 ppm PEL - TWA: 75 ppm ODOR THRESHOLD: 0.12 ppm
HUMAN (LCLO): RAT/MOUSE (LC50):
CARCINOGEN: Yes TERATOGEN: AQUATIC: Some substances increase in conce
ROUTE OF EXPOSURE: Inh, Ing, Eye, Skin

HANDLING RECOMMENDATIONS (PERSONAL PROTECTIVE MEASURES):
Personal protection: Wear protective gloves and clothing.Wear dust proof goggles.Respiratory Protection.

Gloves: Nitrile Rubber-G.
E = Excellent (> 8 hours); VG = Very Good (4 - 8 hrs); G = Good (1 - 4 hours); P = Poor (< 1 hour)

MONITORING RECOMMENDATIONS:
Monitoring:

HEALTH HAZARDS:
Acute Symptoms: Headaches, dizziness, nausea, and swelling around the eyes, hands and feet. Contact with the dust can cause skin burns.Exposure to the vapor can irritate the eyes, nose, and throat.

Chronic Symptoms: There is limited evidence that 1,4-Dichlorobenzene can damage the developing animal fetus.Test evidence is inadequate to determine if 1,4-Dichlorobenzene causes cancer in animals.Damage the nervous system.

FIRST AID:
FIRST AID-INHAL: Remove the person from exposure. Begin rescue breathing if breathing has stopped and CPR if heart action has stopped. Transfer promptly to a medical facility.
FIRST AID-EYE: Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids. Seek medical attention.
FIRST AID-SKIN: Quickly remove contaminated clothing. Immediately wash area with large amounts of soap and water.

DISPOSAL/WASTE TREATMENT:
DISPOSAL OF WASTE:

CHEMICAL NAME: Dichloroethylene, 1,2
CAS NUMBER: 540-59-0 DOT NAME/ID NO: UN 1150
SYNONYMS: cis/trans 1,2 Dichloroethylene

CHEMICAL AND PHYSICAL PROPERTIES:
CHEMICAL FORMULA: ClCH=CHCl MOLECULAR WEIGHT: 97 SPG/D: 1.27 SOLUBILITY: Slightly soluble
PHYSICAL STATE: Colorless liquid with an ether like odor.
FLAMMABLE LIMITS: UPPER-12.8%; LOWER-5.6%. FLASH POINT: 36 39F
VAPOR PRESSURE: 180 265 mm Hg at 68F FREEZING POINT: -57F to -115F BOILING POINT: 118-140F
ODOR CHARACTERISTIC: Chloroform Incompatabilities: STRONG OXIDIZERS, STRONG ALKALIS, POTASSIUM HYDROXIDE, COPPER

BIOLOGICAL PROPERTIES:
IDLH: 4000 ppm TLV-TWA : 200 ppm PEL - TWA: 200 ppm ODOR THRESHOLD: 0.085 ppm
HUMAN (LCLO): RAT/MOUSE (LC50):
CARCINOGEN: Yes TERATOGEN: AQUATIC: Some substances increase in conce
ROUTE OF EXPOSURE: Inh, Ing, Eye, Skin

HANDLING RECOMMENDATIONS (PERSONAL PROTECTIVE MEASURES):
Personal protection: Wear solvent resistant gloves and clothing.Protective clothing.Eye Protection.Respiratory Protection.

Gloves: Viton-G.
E = Excellent (> 8 hours); VG = Very Good (4 - 8 hrs); G = Good (1 - 4 hours); P = Poor (< 1 hour)

MONITORING RECOMMENDATIONS:
Monitoring:

HEALTH HAZARDS:
Acute Symptoms: The liquid may irritate the skin, causing a rash or burning feeling on contact, and can irritate the eyes. The vapor can irritate the nose and throat.

Chronic Symptoms: 1,2-Dichloroethylene has not been tested for its ability to adversely affect reproduction.

FIRST AID:
FIRST AID-INHAL: Remove the person from exposure. Begin rescue breathing if breathing has stopped and CPR if heart action has stopped. Transfer promptly to a medical facility.
FIRST AID-EYE: Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids. Seek medical attention.
FIRST AID-SKIN: Quickly remove contaminated clothing. Immediately wash area with large amounts of soap and water.

DISPOSAL/WASTE TREATMENT:
DISPOSAL OF WASTE:

CHEMICAL NAME: Tetrachloroethylene*
CAS NUMBER: 127-18-4 DOT NAME/ID NO: UN 1897
SYNONYMS: PERCHLOROETHYLENE, 1,1,2,2-TETRACHLOROETHYLENE

CHEMICAL AND PHYSICAL PROPERTIES:
CHEMICAL FORMULA: CL2C:CCL2 MOLECULAR WEIGHT: 165.83 SPG/D: 1.62 SOLUBILITY: Insoluble
PHYSICAL STATE: Clear liquid with a sweet chloroform-like
FLAMMABLE LIMITS: FLASH POINT:
VAPOR PRESSURE: 14 mm Hg at 68F (20C) FREEZING POINT: -2F BOILING POINT: 121 C (250 F)
ODOR CHARACTERISTIC: --- Incompatabilities: STRONG OXIDIZING AGENTS, ALKALI METALS, ALUMINUM

BIOLOGICAL PROPERTIES:
IDLH: 150 TLV-TWA : 25 ppm PEL - TWA: 100 ppm ODOR THRESHOLD: 5 ppm
HUMAN (LCLO): RAT/MOUSE (LC50): LD50 (ORAL-RAT)(MG/KG)-8850;
CARCINOGEN: Yes TERATOGEN: AQUATIC:
ROUTE OF EXPOSURE: Inh, Ing, Eye, Skin

HANDLING RECOMMENDATIONS (PERSONAL PROTECTIVE MEASURES):
Personal protection: Avoid skin contact with Tetrachloroethylene. Wear solvent-resistant gloves and clothing.Eye Protection.Respiratory Protection.

Gloves: Nitrile Rubber-G; Polyvinyl-Alcohol-E; Teflon-E; Viton-E.
E = Excellent (> 8 hours); VG = Very Good (4 - 8 hrs); G = Good (1 - 4 hours); P = Poor (< 1 hour)

MONITORING RECOMMENDATIONS:
Monitoring:

HEALTH HAZARDS:
Acute Symptoms: IRR (E/N/T), NAU, flush face/neck, vertigo, HA, incoordination,skin redness,damage of the liver and kidneys enough to cause death,skin burns, and can cause eye burns

Chronic Symptoms: May damage the developing fetus,may damage the liver and kidneys,lung damage.

FIRST AID:
FIRST AID-INHAL: Remove the person from exposure. Begin rescue breathing if breathing has stopped and CPR if heart action has stopped.Transfer promptly to a medical facility.
FIRST AID-EYE: Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids.Seek medical attention.
FIRST AID-SKIN: Quickly remove contaminated clothing. Immediately wash area with large amounts of soap and water. Seek medical attention.

DISPOSAL/WASTE TREATMENT:
DISPOSAL OF WASTE: DISPOSE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL

CHEMICAL NAME: Trichloroethane, 1,1,1-
CAS NUMBER: 71-55-6 DOT NAME/ID NO:
SYNONYMS: METHYL CHLOROFORM, CHLOROTHANE

CHEMICAL AND PHYSICAL PROPERTIES:
CHEMICAL FORMULA: MOLECULAR WEIGHT: SPG/D: SOLUBILITY:
PHYSICAL STATE:
FLAMMABLE LIMITS: FLASH POINT:
VAPOR PRESSURE: FREEZING POINT: BOILING POINT:
ODOR CHARACTERISTIC: Sweet Incompatabilities:

BIOLOGICAL PROPERTIES:
IDLH: 1000ppm TLV-TWA : 350 ppm PEL - TWA: 350 ppm ODOR THRESHOLD: 100 ppm
HUMAN (LCLO): RAT/MOUSE (LC50):
CARCINOGEN: TERATOGEN: AQUATIC:
ROUTE OF EXPOSURE: Inh, Ing, Eye, Skin

HANDLING RECOMMENDATIONS (PERSONAL PROTECTIVE MEASURES):
Personal protection:

Gloves: Polyvinyl-Alcohol-E; Teflon-VG; Viton-E.
E = Excellent (> 8 hours); VG = Very Good (4 - 8 hrs); G = Good (1 - 4 hours); P = Poor (< 1 hour)

MONITORING RECOMMENDATIONS:
Monitoring:

HEALTH HAZARDS:
Acute Symptoms: Irritation of eyes/nose, drowsiness, Incoordination

Chronic Symptoms: 11.30

FIRST AID:
FIRST AID-INHAL:
FIRST AID-EYE:
FIRST AID-SKIN:

DISPOSAL/WASTE TREATMENT:
DISPOSAL OF WASTE:

CHEMICAL NAME: Trichloroethylene*
CAS NUMBER: 79-01-6 DOT NAME/ID NO: UN 1710
SYNONYMS: ETHYLENE TRICHLORIDE, TCE, TRICHLOROETHENE

CHEMICAL AND PHYSICAL PROPERTIES:
CHEMICAL FORMULA: C2HCL3 MOLECULAR WEIGHT: 131.4 SPG/D: 1.47 SOLUBILITY: Slightly soluble
PHYSICAL STATE: Colorless liquid with a sweet odor.
FLAMMABLE LIMITS: UPPER-(77F) 10.5%; LOWER-(77F) 8% FLASH POINT:
VAPOR PRESSURE: 58 mm Hg at 68F FREEZING POINT: -99F BOILING POINT: 87 C (189 F)
ODOR CHARACTERISTIC: Sweet Incompatabilities: CHEMICALLY ACTIVE METALS, STRONG BASES,STRONG OXIDIZING AGENTS.

BIOLOGICAL PROPERTIES:
IDLH: 1000 TLV-TWA : 50 ppm PEL - TWA: 100 ppm ODOR THRESHOLD: 50 ppm
HUMAN (LCLO): RAT/MOUSE (LC50): LD50 (ORAL-RAT)(MG/KG)-7193;
CARCINOGEN: Yes TERATOGEN: Yes AQUATIC:
ROUTE OF EXPOSURE: Inh, Ing, Eye, Skin

HANDLING RECOMMENDATIONS (PERSONAL PROTECTIVE MEASURES):
Personal protection: Avoid skin contact with Trichloroethylene. Wear protective gloves and clothing.Eye Protection.Respiratory Protection.

Gloves:

E = Excellent (> 8 hours); VG = Very Good (4 - 8 hrs); G = Good (1 - 4 hours); P = Poor (< 1 hour)

MONITORING RECOMMENDATIONS:
Monitoring:

HEALTH HAZARDS:
Acute Symptoms: Flushed skin, confusion, dizziness, headache,Irritate the eyes, nose, throat, and lungs,lightheadedness, dizziness, visual disturbances, an excited feeling, nausea and vomiting.

Chronic Symptoms: Skin allergy,liver and kidneys damage,blistering, roughening, and cracking of the exposed skin,paralysis of the fingers.

FIRST AID:
FIRST AID-INHAL: Remove the person from exposure. Begin rescue breathing if breathing has stopped and CPR if heart action has stopped.Transfer promptly to a medical facility.
FIRST AID-EYE: Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids. Seek medical attention immediately.
FIRST AID-SKIN: Quickly remove contaminated clothing. Immediately wash area with large amounts of soap and water. Seek medical attention immediately.

DISPOSAL/WASTE TREATMENT:
DISPOSAL OF WASTE: DISPOSE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL

CHEMICAL NAME: Vinyl chloride*
CAS NUMBER: 75-01-4 DOT NAME/ID NO: UN 1086
SYNONYMS: CHLOROETHYLENE, VINYL CHLORIDE MONOMER

CHEMICAL AND PHYSICAL PROPERTIES:
CHEMICAL FORMULA: $CH_2=CHCl$ MOLECULAR WEIGHT: 62.5 SPG/D: 2.21 SOLUBILITY: Slightly soluble
PHYSICAL STATE: Colorless gas usually handled as liquid with a
FLAMMABLE LIMITS: UPPER-33%; LOWER-3.6% FLASH POINT: 108F
VAPOR PRESSURE: 2580 mm Hg at 68F FREEZING POINT: -256F BOILING POINT: 7F
ODOR CHARACTERISTIC: Sweet, pleasant Incompatabilities: COPPER, OXIDIZERS, ALUMINUM, PEROXIDES, IRON, STEEL

BIOLOGICAL PROPERTIES:
IDLH: TLV-TWA : 1 ppm PEL - TWA: 1 ppm; 5 ppm C ODOR THRESHOLD: 3000 ppm
HUMAN (LCLO): RAT/MOUSE (LC50):
CARCINOGEN: Yes TERATOGEN: Yes AQUATIC:
ROUTE OF EXPOSURE: Inh, Ing, Eye, Skin

HANDLING RECOMMENDATIONS (PERSONAL PROTECTIVE MEASURES):
Personal protection: Avoid skin contact with Vinyl Chloride. Wear solvent resistant gloves and clothing.Eye Protection.Respiratory Protection.gloves and clothing.Eye Protection.Respiratory Protection.

Gloves: Nitrile Rubber-VG; Viton-VG.
E = Excellent (> 8 hours); VG = Very Good (4 - 8 hrs); G = Good (1 - 4 hours); P = Poor (< 1 hour)

MONITORING RECOMMENDATIONS:
Monitoring:

HEALTH HAZARDS:
Acute Symptoms: Dulled auditory and visual response,headaches, nausea, weakness, and can cause you to pass out and die,frostbite.

Chronic Symptoms: Liver, brain and lung cancer,reproductive damage in humans,permanently damage the liver and damage the kidneys, nervous system and blood cells,skin allergy,can cause symptoms like stomach ulcers.

FIRST AID:
FIRST AID-INHAL: Remove the person from exposure. Begin rescue breathing if breathing has stopped and CPR if heart action has stopped.Transfer promptly to a medical facility.
FIRST AID-EYE: Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids. Seek medical attention immediately.
FIRST AID-SKIN: Immerse affected part in warm water. Seek medical attention.

DISPOSAL/WASTE TREATMENT:
DISPOSAL OF WASTE: