Final Work Plan
Baseline, Performance, and Long-Term Monitoring at AOC 9

Former Griffiss Air Force Base
Rome, New York

June 2010

Contract No. W912DQ-09-D-3013

Prepared for:

U.S. ARMY CORPS OF ENGINEERS
KANSAS CITY DISTRICT
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Under Contract to:

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Certificate of Compliance

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Baseline, Performance, and Long-Term Monitoring at AOC 9
Former Griffiss Air Force Base, Rome, New York

June 2010

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 EEEPC's Quality Control Plan.

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List of Abbreviations and Acronyms

AOC	area of concern
BGS	below ground surface
DO	dissolved oxygen
EPA	(U.S.) Environmental Protection Agency
ERPIMS	Environmental Restoration Program Information Management System
FID	flame ionization detector
Griffiss AFB	former Griffiss Air Force Base
ID	inner diameter
MCL	maximum contaminant level
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
mL/min	milliliters per minute
mV	millivolts
NTU	nephelometric turbidity units
NYSDEC	New York State Department of Environmental Conservation
OPS	operating properly and successfully
ORP	oxidation-reduction potential
PDI	Predesign Investigation
PID	photoionization detector
ppm	parts per million
PVC	polyvinyl chloride
RAO	Remedial Action Objective
UFPO	(New York) Underground Facilities Protective Organization
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compound
WSA	Weapons Storage Area

1 Introduction

Ecology and Environment Engineering, P.C., under contract to Parsons Infrastructure & Technology Group, Inc., which is under contract to the U.S. Army Corps of Engineers (USACE) Kansas City District (Contract No. W912DQ-09-D-3013), will perform groundwater monitoring at Area of Concern 9 (AOC 9) of the former Griffiss Air Force Base (Griffiss AFB) in Rome, New York (see Figure 1-1).

1.1 Purpose of Investigation

A phased groundwater monitoring program will consist of baseline, performance, and long-term monitoring of volatile organic compound (VOC) levels in the groundwater and in Six Mile Creek. A phased approach is consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) response action process. Monitoring data will be screened against the most stringent of either the New York State Department of Environmental Conservation (NYSDEC) Class GA groundwater criteria or the U.S. Environmental Protection Agency (EPA) maximum contaminant levels (MCLs).

In phase one, groundwater sampling and analysis will establish baseline VOC concentrations in the groundwater plume and Six Mile Creek before remediation begins. Phase two, performance monitoring, will evaluate the short-term effectiveness of the remediation efforts with a total of four sampling events over two years. The long-term effectiveness of the remediation efforts will be monitored in phase three for three more years with annual sampling events.

Following the first three years of annual long-term monitoring it is anticipated that monitoring will continue on an every-other-year basis until concentrations of hazardous substances in groundwater are below Remedial Action Objectives (RAOs) (see Table 1-1). Once the RAOs have been reached the monitoring will again be performed annually until three consecutive rounds of sampling indicate that the concentrations of groundwater contaminants remain below RAOs. At that point unrestricted use of the site can be allowed. Modeling performed during evaluation of the remedial alternatives for AOC 9 indicated that the total duration of the remedial action would likely span 11 years (EEEPC 2010).

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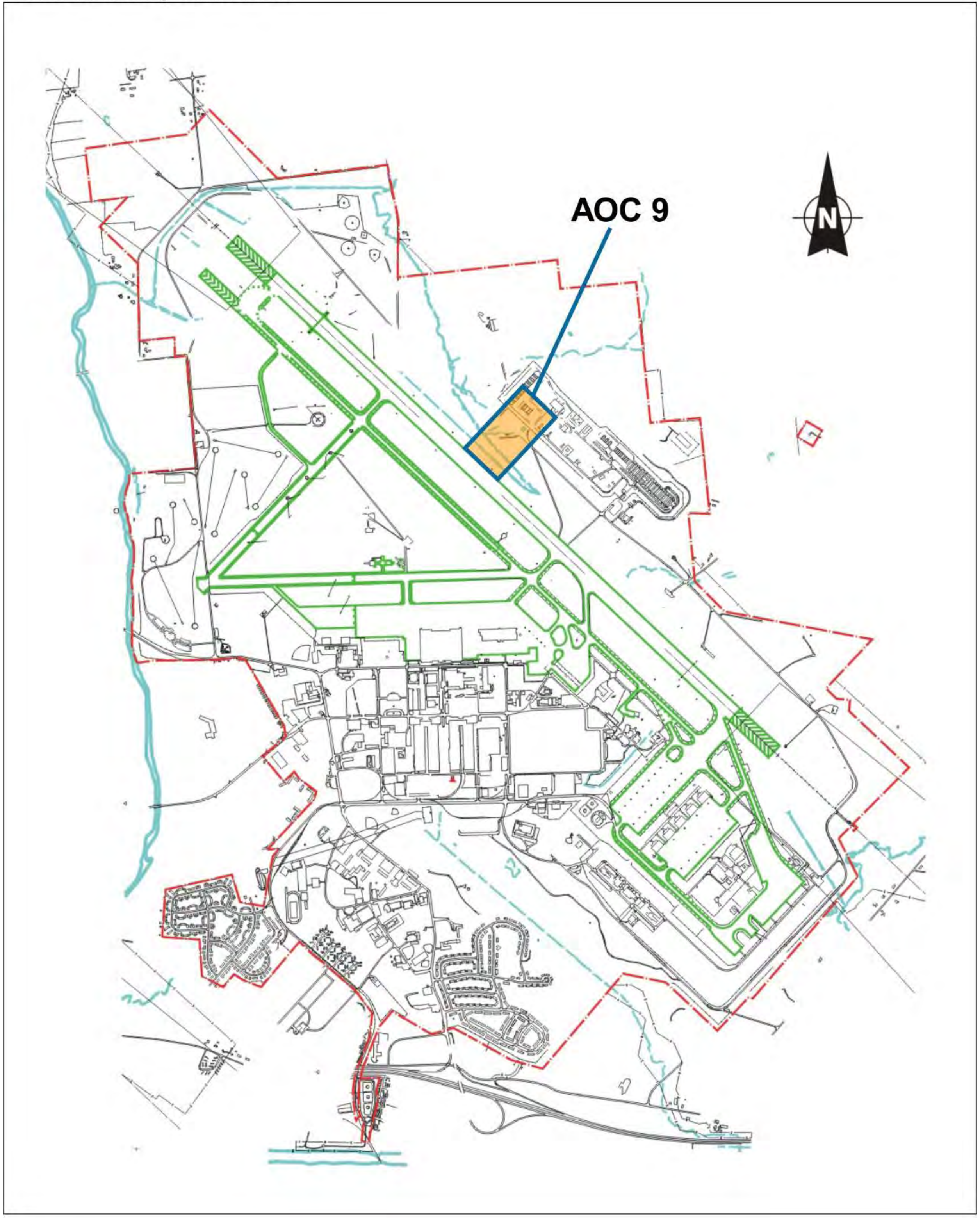

Figure 1-1 AOC 9, Former Griffiss Air Force Base, Rome, New York

Table 1-1 AOC 9 Groundwater Cleanup Goals

Contaminants of Concern[a]	Groundwater Cleanup Goal[b] (µg/L)
1,2-Dichlorobenzene	3
1,2-Dichloroethane	0.6
1,2,4-Trimethylbenzene	5
1,3,5-Trimethylbenzene	5
1,3-Dichlorobenzene	3
1,4-Dichlorobenzene	3
Acetone	50
Benzene	1
Chlorobenzene	5
cis-1,2-Dichloroethene	5
Ethylbenzene	5
Isopropylbenzene	5
Methylene Chloride	5
Naphthalene	10
n-Butylbenzene	5
n-Propylbenzene	5
o-Xylene	5
sec-Butylbenzene	5
Trichloroethene	5
tert-Butylbenzene	5
Tetrachloroethene	5
Vinyl Chloride	2
Xylene (Total)	5

Notes:

[a] From the *Final Feasibility Study Report for AOC 9* (E & E 2004a).

[b] New York State Department of Environmental Conservation (NYSDEC) Class GA groundwater standard.

1.2 Site Description and Groundwater Contamination Summary

AOC 9 is a grass-covered area approximately 1,500 feet long and 650 feet wide located in the southwest portion of the inactive Weapons Storage Area (WSA) (see Figure 1-1). The site is part of a strip of land that lies between an airplane runway to the southwest and extends into the WSA to the northeast. Perimeter Road runs through the site and Six Mile Creek borders the southwestern edge of the site.

The area comprising AOC 9 was originally farmland in the 1930s before base construction. In the 1940s and 1950s, the first landfill for the base (currently known as AOC 9) was established beneath the northern portion of the WSA extending south between Perimeter Road and Six Mile Creek. Aerial photographs show that the landfill was active between 1943 and 1957 but no later than 1960. The type of material buried at this site is unknown; however, it is reported that large quantities of the landfill material were removed during construction of the WSA.

Two munitions storage bunkers were erected between Perimeter Road and Six Mile Creek in the early 1950s. One of the bunkers (also referred to as igloos) was removed in the late 1970s or early 1980s (before 1981), and the other bunker was removed in 1992. Although the bunkers were initially used for munitions storage, they were later used to store hazardous materials.

The site's status was changed from "Area of Interest" to "Area of Concern" in 1998 when groundwater samples collected during the Expanded Site Investigation were found to contain chlorinated solvents at concentrations exceeding NYSDEC Class GA standards and EPA MCLs.

AOC 9 is currently inactive and access is somewhat restricted by Perimeter Road Gates 4 and 11. The southern portion of this area is expected to remain vacant in the future, acting as a buffer zone between the runway and future development in adjacent areas. The northern portion of the site extends into the former WSA boundary and is expected to be zoned as a nonresidential, industrial area.

The ground surface at AOC 9 slopes gently downward toward Six Mile Creek. Groundwater flows southwest toward the creek (see Figure 1-2). Depth to groundwater is approximately 10 to 12 feet but is closer to the ground surface between Perimeter Road and Six Mile Creek. Hydraulic conductivity and groundwater flow velocity were initially determined by performing slug tests. To confirm the hydraulic conductivities (K values) obtained from the slug tests, a pump test was performed on G009-MW02 in July 2003. A submersible pump was installed in MW02 and the water level was allowed to return to static conditions. The well was pumped at 0.5 gallon per minute (gpm) until the water level stabilized. Data collection was initiated at the time pumping began with an In-Situ, Inc., Hermit 2000 data logger and pressure transducer system as was done during the slug tests. Data transfer software by In-Situ, Inc., was used to download the slug test data to a computer. The raw data were then processed and interpreted using AQTESOLVE software (Duffield 1998). A K value of 1.8×10^{-3} cm/s was obtained using the interpretation methods of Cooper-Jacob, which corresponds to a groundwater velocity of 0.93 ft/day. This value correlates well with typical K values for the silty sands observed on site during drilling activities. Shallow groundwater discharges to the surface at several locations in this area. Three intermittent drainageways that discharge to Six Mile Creek are on the southern portion of the site.

F:\Griffiss\AOC9_TW_Surveyed_7-5-07\Baseline_monitoring_plan\New Figure 5-12-10_1-2.dwg

LEGEND

—X—	FENCE
—525—	TOPOGRAPHIC CONTOUR LINE (CONTOUR INTERVAL = 5 FT)
—UE—	UNDERGROUND ELECTRIC
—W—	WATER LINE
—S—	SANITARY SEWER
—OE—	OVERHEAD ELECTRIC
—/—/—/—	ABANDONED UNDERGROUND ELECTRIC
AMSL	ABOVE MEAN SEA LEVEL
CB	CHLOROBENZENE
NA	NOT AVAILABLE
ND	NOT DETECTED
476 ▬▬	GROUNDWATER CONTOUR (DASHED WHERE INFERRED)
←	DIRECTION OF GROUNDWATER FLOW
🟩	AOC9 LAND USE BOUNDARY
AOC9-GP43D ND/ND ⊙	YEAR 2000 GEOPROBE GROUNDWATER SAMPLING LOCATIONS.
G009-MW01 ⊕	PERMANENT MONITORING WELL LOCATION
TW44 ⊠	TEMPORARY MONITORING WELL LOCATION
PZ-1 ●	PIEZOMETER LOCATION
(517.35)	JUNE 27, 2007 GROUNDWATER ELEVATION (FEET AMSL) (NOT AVAILABLE FOR TW98 THROUGH TW103 OR PZ-1).

NOTES:
1. ALL CONCENTRATIONS PRESENTED IN ug/L.

60 0 60 120
SCALE: 1"=60'

GRIFFISS AFB OBGW SITES
AOC 9 SITE
ROME, NEW YORK

NOTES:
1. ALL CONCENTRATIONS PRESENTED IN ug/L.
2. THE GROUNDWATER ELEVATIONS PRESENTED ARE FROM THE ADDITIONAL AOC 9 PREDESIGN INVESTIGATION DATA SUMMARY REPORT (EEEPC 2007).
3. THE INSET PRESENTS GROUNDWATER ELEVATIONS FROM THE AOC 9 WEAPONS STORAGE AREA (WSA) LANDFILL FINAL 2002 REMEDIAL INVESTIGATION REPORT (E & E 2004).

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DRAWING TITLE:
AOC 9: GROUNDWATER CONTOUR MAP

FIGURE 1–2

Debris (including glass, slag, bricks, ceramics, cinderblocks, asphalt, concrete, wire, and metal) encountered during test pit excavations in the southern portion of the former landfill (south of the WSA) accounted for less than 1% by volume of excavated material. The lack of waste materials observed from the test pit excavations support reports that the former WSA landfill had been removed before the WSA was built.

Two Supplemental Investigations (SIs) and three Predesign Investigations (PDIs) were performed at AOC 9 to define the extent of the groundwater contaminant plume and locate the source of the groundwater contamination. The results of the SIs are provided in the *AOC 9: Weapons Storage Area (WSA) Landfill, Final 2002 Remedial Investigation Report* (E & E Inc. 2004).

The first SI was conducted from March to May 2000. The purpose of the SI was to delineate the extent of groundwater contamination that was identified in previous investigations, determine whether wastes from the WSA landfill were present, verify the WSA landfill boundary in the vicinity of the site, and provide information for evaluation of the risks to human health and the environment. The concentrations of trichloroethene (TCE) and its breakdown products (cis-1,2 dichloroethene (DCE); and vinyl chloride) ranged up to 66.9 µg/L, 227.2 µg/L, and 63.7 µg/L, respectively. The concentrations of 1, 2-dichlorobenzene, 1, 4-dichlorobenzene, chlorobenzene, and benzene ranged up to 414.2 µg/L, 214.9 µg/L, 2,352 µg/L, and 12.6 µg/L, respectively.

The second SI was conducted in July 2002, included a Geoprobe groundwater screening survey to further delineate the extent of the groundwater contamination that was previously identified and to identify potential source areas. The concentrations of TCE and its breakdown products total 1,2-DCE and vinyl chloride ranged up to 10.3 µg/L, 71.2 µg/L, and 13.1 µg/L, respectively. The concentrations of 1, 2-dichlorobenzene, 1, 4-dichlorobenzene, chlorobenzene, and benzene ranged up to 513 µg/L, 151 µg/L, 2,150 µg/L, and 12.6 µg/L, respectively.

During the first PDI, conducted from September through November 2006, four additional groundwater monitoring wells (AOC9-MW14 through AOC9-MW17) were installed at the site. The concentrations of TCE and its breakdown product Cis-1,2-DCE ranged up to 19 µg/L, and 12 µg/L, respectively. Vinyl chloride was not detected at concentrations above screening criteria. The highest concentrations of total VOCs were detected in presumed upgradient wells AOC9-MW14 and AOC9-MW15 at 1,989 micrograms per liter (µg/L) and 2,082 µg/L, respectively. These concentrations prompted further investigation to find the source of groundwater contamination upgradient of Six Mile Creek and Perimeter Road in the WSA. Two more PDIs were conducted to determine the extent and nature of this source.

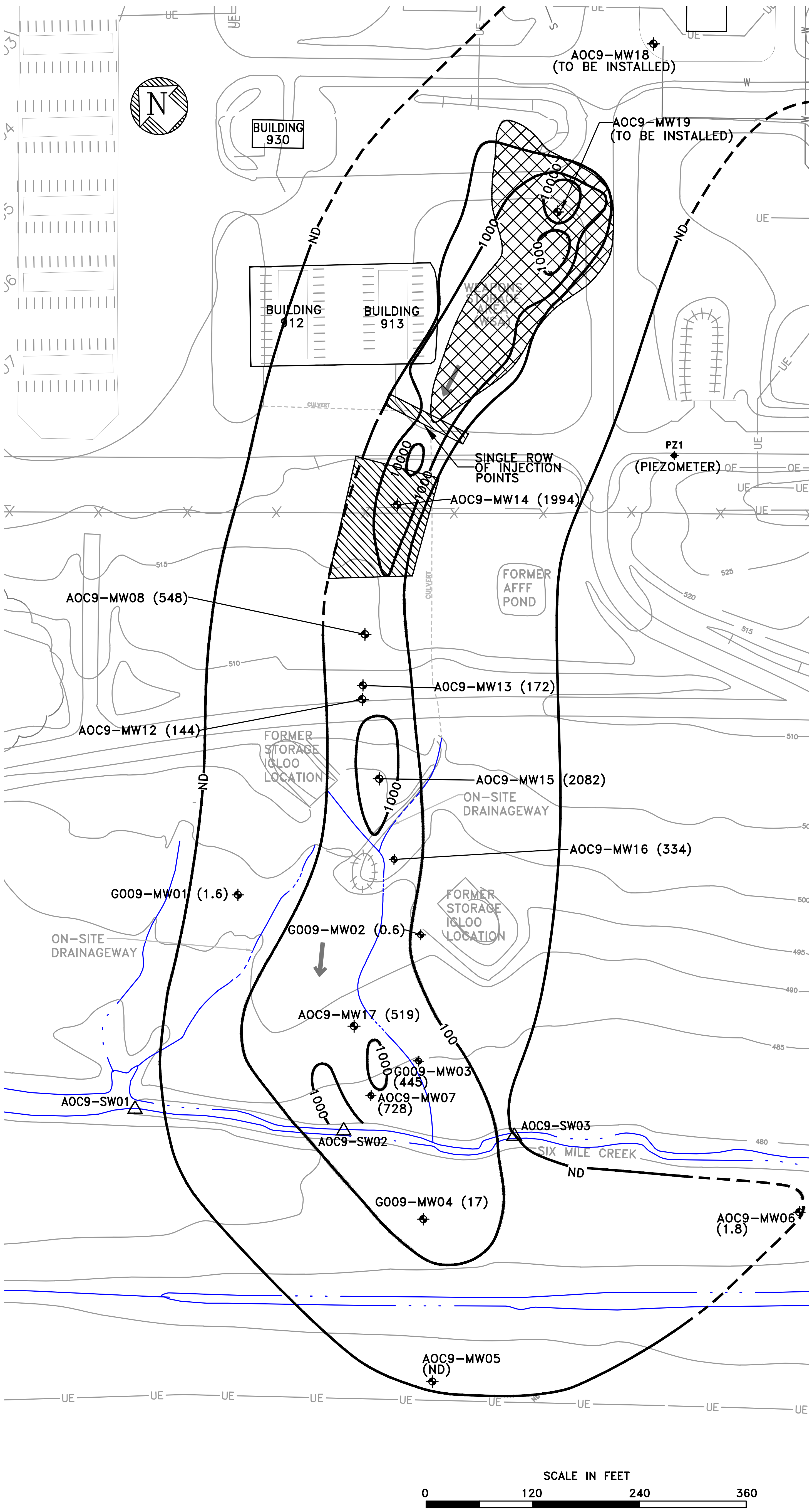
The second PDI, conducted from February through April 2007, included the installation of 25 temporary monitoring wells and identified areas approximately 200 feet east of Building 913 that contained significantly higher levels of chlorobenzene and related compounds. The concentrations of 1, 2-dichlorobenzene, 1, 4-dichlorobenzene, and chlorobenzene, ranged up to 4,930 µg/L, 1,380 µg/L, and 14,400 µg/L, respectively. The concentrations of TCE and its breakdown product Cis-1,2-DCE ranged up to 127 µg/L, and 79.5 µg/L, respectively. Vinyl chloride was not detected at concentrations above screening criteria.

The third PDI was performed in June through October 2007 to better define the plume and further identify the potential source area. During this investigation 56 new temporary monitoring wells and 42 boreholes were installed around the site. The concentrations of 1, 2-dichlorobenzene, 1, 4-dichlorobenzene, chlorobenzene, and benzene detected in the groundwater ranged up to 230 µg/L, 523 µg/L, 2,400 µg/L, and 120 µg/L, respectively. The concentrations detected in the groundwater of Tetrachloroethene (PCE), TCE, Cis-1,2-DCE, and vinyl chloride ranged up to 12 µg/L, 14 µg/L, 26 µg/L, and 3.5 µg/L, respectively. The highest levels of total VOCs detected in the soil were 1,100 milligrams per kilogram (mg/kg) and 1,600 mg/kg, with chlorobenzenes representing the largest fraction of VOCs. The contaminated soil was from a 6-foot zone near the top of the saturated zone at depths ranging between 8 to 17 feet below grade. Figure 1-3 shows the contours summarizing the groundwater results of the three PDIs. A detailed summary of the groundwater and soil data obtained from the three PDIs is provided in the *Final Additional AOC 9 Predesign Investigation Data Summary Report* (EEEPC 2007).

On the basis of the PDIs and the SIs, the soil east of Building 913 is identified as the source area for the AOC 9 groundwater contamination. An 8-acre contaminated groundwater plume extends downgradient from the source area for approximately 1,500 feet. The lateral extent of the plume is approximately 650 feet and the vertical extent ranges from ground surface (south of Perimeter Road) to 20 feet below ground surface (BGS), which is the top of bedrock.

The potential presence of non-aqueous phase liquid (NAPL) is not a concern at AOC 9. During previous investigations onsite, NAPL has not been encountered in any soil boring or groundwater samples. All soil contaminated with a Total VOC concentration greater than 1 mg/kg will be excavated and properly disposed of prior to either application of persulfate beneath the excavation area, or injection of persulfate into the dissolved phase plume downgradient of the excavation area. Source area excavation will continue until any NAPL observed is removed and no soils that provide a reading of 50 ppm or higher with a photoionization detector (PID) remain in the excavation.

F:\GRIFFISS\AOC9 TW Surveyed 7-5-07\Baseline Monitoring Plan\Figure 1-3_5-7-10.dwg



LEGEND

—×—	FENCE
— 525 —	TOPOGRAPHIC CONTOUR LINE (CONTOUR INTERVAL = 5 FT)
ND	NOT DETECTED
10000—	TOTAL VOC CONTOUR IN ug/L (DASHED WHERE INFERRED)
AOC9-MW14	EXISTING PERMANENT MONITORING WELLS
(136.4)	2004/2006 TOTAL VOC CONCENTRATION IN GROUNDWATER (ug/L)
→	GROUNDWATER FLOW DIRECTION
△	PROPOSED SURFACE WATER SAMPLING LOCATIONS
▨	PROPOSED AREA OF PERSULFATE INJECTION
▦	PROPOSED AREA OF SOIL EXCAVATION (1mg/kg TOTAL VOC CONTOUR IN SOIL) AND PERSULFATE APPLICATION

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AOC 9 SITE
ROME, NEW YORK

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parsons

DRAWING TITLE:
AOC 9
PROPOSED REMEDIAL ACTION AREAS

FIGURE 1-3

The preferred remedial alternative for AOC 9 includes removal of the source area through excavation of contaminated soil, treatment of contaminated groundwater using chemical oxidation, and land use controls. The groundwater contaminant source area is identified as the area within the 1 mg/kg total VOCs in soil contour shown on Figure 1-3. The horizontal and vertical limits of this excavation have been defined based on the selected cleanup objectives, and groundwater and soil boring analytical results. Approximately 99% of the total VOCs contaminant mass will be removed during the source area excavation (see Figure 1-3). After the soil is excavated from the 6-foot smear zone, the bottom of the excavation will be screened with the PID to ensure that the contamination has not migrated deeper into the soil. If contamination is found above 50 parts per million (ppm) with the PID, that soil will be excavated and the process repeated. In addition, as a polishing step, a sodium persulfate oxidant with an iron chelate activator (persulfate oxidant) will be applied to the bottom of the excavation to oxidize any low-level residual contamination. Application of the oxidant is expected to reduce the number of years required to meet RAOs.

After the source is removed, the concentrations of contaminants in the groundwater plume are expected to decrease due to natural processes including advection, dilution, and biodegradation. In addition, to further reduce the number of years required to meet RAOs, the groundwater will be treated with persulfate oxidant, which will be injected into the center of the plume through temporary wells approximately 15 to 25 feet deep immediately downgradient of the excavation area. The persulfate oxidant will be used because it is very stable in the subsurface, performs better in a neutral pH environment, and can destroy the major COCs at AOC 9, including CB, DCB, dichloroethane, trichloroethene, and tetrachloroethene. Oxidant injection will be performed in an area of 50 feet by 200 feet immediately downgradient of the excavation area, which will treat groundwater in an in situ plume area of 16,000 square feet (see Figure 1-3). This portion of the plume has an average saturated thickness of 10 feet and an estimated porosity of 0.35, which provides a water treatment volume of approximately 420,000 gallons. These quantities are estimated values which will be better defined during the remedial design stage. Modeling has indicated that removal of the source by excavation of the soil, application of persulfate oxidant to the soil at the bottom of the excavation, and one injection of persulfate oxidant in the center of the plume immediately downgradient of the excavation area, will result in a reduction of groundwater contaminant concentration levels and achievement of RAOs in 11 years.

During source excavation, uncontaminated overburden soil will be removed to access the contaminated soil. The overburden soil will be excavated, stockpiled, and used for backfilling following excavation of the contaminated soil. Steel sheeting will be installed around the contaminated soil area to support the excavation below the water table. An area of approximately 32,000 square feet of soil, 4 feet thick, is planned to be removed, which provides a contaminated soil removal volume of 4,500 cubic yards. These quantities are estimated values which will be better defined during the remedial design stage.

Dewatering will be performed during the excavation of the contaminated soil located below the groundwater table. The collected groundwater will be pumped into tanks, treated (if necessary), sampled, and shipped to the City of Rome Publicly Owned Treatment Works (POTW). Following excavation of the contaminated soil and application of the persulfate oxidant to the excavation floor, the steel sheeting will be removed and the area will be backfilled with the stockpiled overburden soil. Presently, the elevation of the excavation area is higher than the surrounding roadways. After completion of construction, it is expected that the final grade will be lower, but still higher than the surrounding roadway. Swales and culverts will be restored to their preconstruction elevations to match existing drainage features.

Monitoring of the groundwater plume and treatment performance will be performed by the Air Force as described in this monitoring work plan.

Institutional controls in the form of deed restrictions for affected groundwater will be implemented at the site to prevent future owners or occupants from exposing or contacting contaminated subsurface soil and groundwater. The restrictions will be maintained until the concentrations of hazardous substances in the groundwater are at such levels to allow for unrestricted use.

Based on modeling, groundwater at this site is expected to reach Remediation Goals in 11 years. Until Remediation Goals are achieved, data will be collected as part of remedy performance monitoring. Following each monitoring event, concentrations of COCs and trends in concentrations of COCs will be evaluated. If any increasing trend in COC concentration is identified in any monitoring well (e.g. three consecutive monitoring events showing a statistically increasing trend), the Air Force will propose to EPA and NYSDEC that additional action be performed. Additional oxidant injections or additional excavations may be executed without requiring either an Explanation of Significant Differences or ROD amendment. The Air Force will initiate additional oxidant injection or excavations within six months of completion of the trend analysis if these actions will be effective in achieving cleanup standards as shown in Table 1-1. If other actions will be required, the Air Force will propose development and implementation of a ROD amendment or Explanation of Significant Differences.

2

AOC-Specific Activities

This section of the work plan discusses the field activities to be performed under this investigation. The scope of work at AOC 9 described in this plan was derived from the March 2009 *Environmental Remediation at the former Griffiss Air Force Base – AOC 9 Remediation Proposal* (Parsons 2009). The Health and Safety Plan for the work is located in Appendix A, and the Quality Assurance Project Plan is located in Appendix B.

2.1 Scope of Work

The scope of work includes three monitoring sampling events; baseline sampling, performance monitoring, and long-term monitoring. Baseline sampling will be conducted to provide a snapshot of the current groundwater contaminant levels prior to implementation of the remedial action for comparison to the groundwater monitoring which will be performed after the remedial action. The purpose of performance monitoring will evaluate the short-term effectiveness of the remediation efforts. The purpose of the long-term monitoring will be to monitor the long-term effectiveness of the remedial efforts.

AOC 9 contains a mixed plume of chlorobenzenes and trichloroethane and its breakdown products in the overburden groundwater. Activities at this site will include installation and development of two new permanent monitoring wells; and multiple rounds of sampling of six existing monitoring wells, the two new, permanent monitoring wells, and three surface water locations.

Prior to well installation, 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 will be notified UFPO has been contacted.

Well AOC9-MW18 will be installed east of the treatment area (see Figure 2-1 for well locations). This well will serve as an upgradient well and will be installed during spring 2010. Installation will be completed prior to implementation of the remedial action at AOC 9 (source excavation with limited chemical oxidation of the contaminant plume). AOC9-MW18 will be constructed with a 10-foot (0.01-inch slot) polyvinyl chloride (PVC) screen in accordance with USACE protocols. The screened interval will be approximately 9.0 to 19.0 feet BGS, which will cover the top 8 to 9 feet of the aquifer in this area.

Well AOC9-MW19 will be installed in spring 2011 following the remedial excavation in the eastern portion of the groundwater contaminant source area at the current location of temporary well TW39 (see Figure 2-2 for well locations). The screened interval in AOC9-MW19 will target the interval currently screened by temporary well TW39 (9.3 to 19.3 feet BGS), which contained a total VOC concentration of 21,610 µg/L. AOC9-MW19 will be constructed with a 10-foot (0.01-inch slot) PVC screen in accordance with USACE protocols.

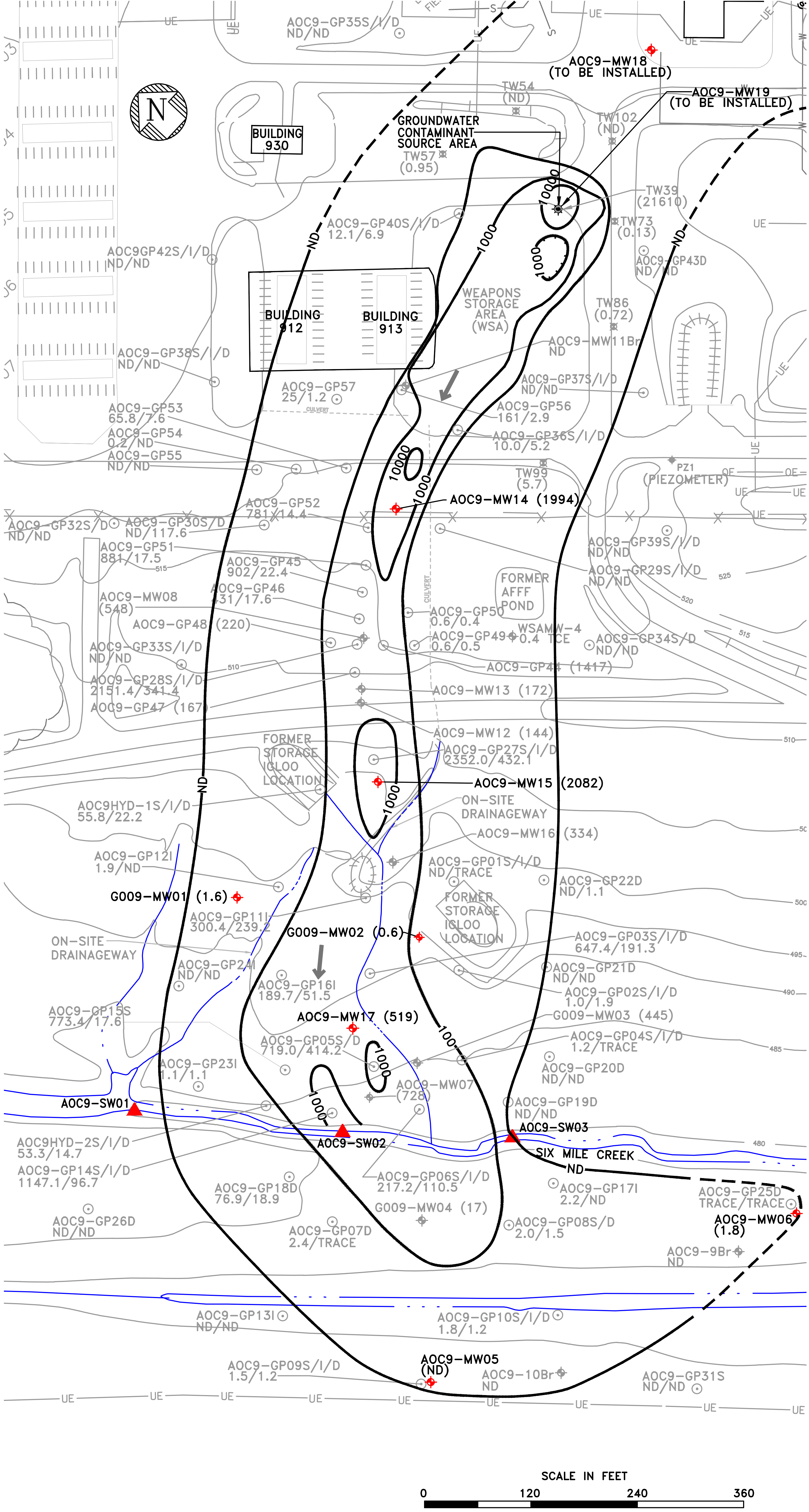
A total of eight sampling events are currently planned: one baseline sampling, four performance monitoring, and three long-term monitoring. However, following the first three years of annual long-term monitoring it is anticipated that monitoring will continue on an every-other-year basis until concentrations of hazardous substances in groundwater are below RAOs. After reaching the RAOs the monitoring will again be performed annually until three consecutive rounds of sampling indicate that the concentrations of groundwater contaminants remain below the RAOs, allowing for unrestricted use of the site.

All groundwater and surface water samples will be analyzed for VOCs using EPA Method SW8260. Analyses will be performed by a laboratory approved for this analytical method by the New York State Environmental Laboratory Accreditation Program, the U.S. Department of Defense Environmental Laboratory Accreditation Program, and the National Environmental Laboratory Accreditation Program. Reporting limits will be 1 part per billion for all VOC compounds.

Baseline sampling will be conducted before remedial action begins. Baseline sampling is to establish baseline VOC concentrations in the groundwater plume and Six Mile Creek before remediation begins. Baseline sampling will comprise the first sampling event and will consist of sampling eight monitoring wells (G009-MW01, G009-MW02, AOC9-MW05, AOC9-MW06, AOC9-MW14, AOC9-MW15, AOC9-MW-17, and AOC9-MW18) and three surface water locations (AOC9-SW01, AOC9-SW02, AOC9-SW03) (see Figure 2-1):

- Wells G009-MW01 and G009-MW02 will be sampled to establish baseline contaminant concentrations in the lateral portions of the plume and confirm the current width of the contaminant plume.
- Wells AOC9-MW05 and AOC9-MW06 will function as sentinel wells and will be sampled to establish baseline contaminant concentrations of the leading edge of the contaminant plume down gradient of the remedial action treatment area.

F:\GRIFFISS\AOC9 TW Surveyed 7-5-07\Baseline Monitoring Plan\Figure 2-1.dwg



LEGEND

— 525 —	TOPOGRAPHIC CONTOUR LINE (CONTOUR INTERVAL = 5 FT)
ND	NOT DETECTED
10000—	TOTAL VOC CONTOUR IN ug/L (DASHED WHERE INFERRED)
⌖ AOC9-MW14	PROPOSED BASELINE MONITORING WELL SAMPLE LOCATION
⊙	YEAR 2000 AND 2002 GEOPROBE GROUNDWATER SAMPLING LOCATIONS
⌖	EXISTING WELL
(136.4)	2004/2006 TOTAL VOC CONCENTRATION IN GROUNDWATER (ug/L)
➡	GROUNDWATER FLOW DIRECTION
▲	PROPOSED SURFACE WATER SAMPLING LOCATIONS
TW73 ⌧	TEMPORARY MONITORING WELL

NOTES:

1. CONCENTRATIONS OF TOTAL VOCs OF LESS THAN 1.5 ug/L WERE OBSERVED UPGRADIENT OF AOC9 AREA DISPLAYED ON THIS FIGURE. NO CHLOROBENZENES WERE DETECTED UPGRADIENT OF AOC9.
2. MONITORING WELL AOC9-MW18 IS A NEW UPGRADIENT WELL TO BE INSTALLED PRIOR TO BASELINE MONITORING.
3. MONITORING WELL AOC9-MW19 IS A NEW WELL TO BE INSTALLED IN THE PLUME SOURCE AREA AFTER THE AOC9 GROUNDWATER REMEDY IS COMPLETED, AND PRIOR TO PERFORMANCE MONITORING. AOC9-MW19 WILL BE INSTALLED AT THE LOCATION OF TEMPORARY WELL TW-39, WHICH CONTAINED 21,610 ug/L OF TOTAL VOC's IN GROUNDWATER.

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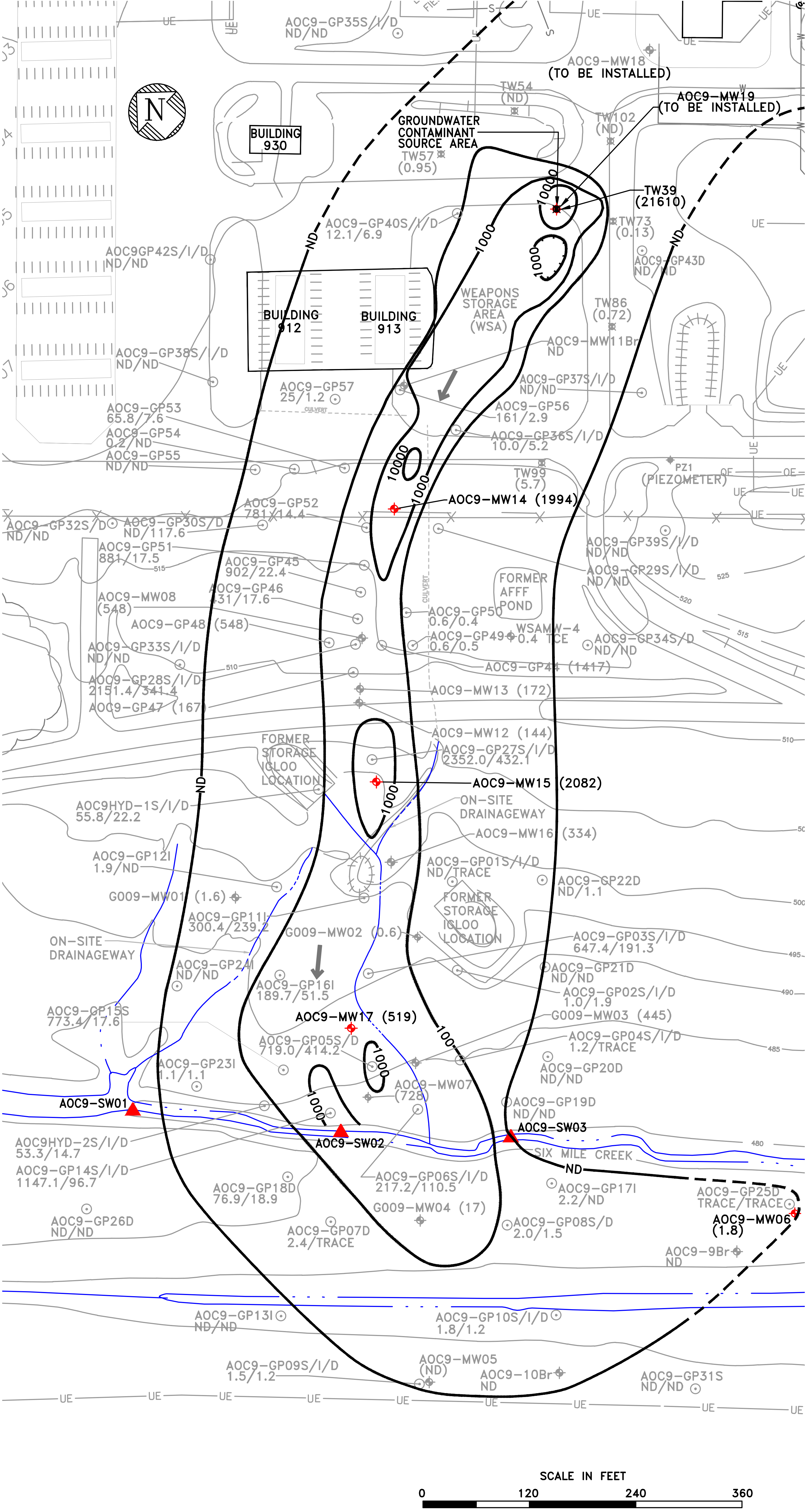
AOC 9
BASELINE MONITORING SAMPLE LOCATION MAP

FIGURE 2-1

F:\GRIFFISS\AOC9 TW Surveyed 7-5-07\Baseline Monitoring Plan\Figure 2-2.dwg



LEGEND

525	TOPOGRAPHIC CONTOUR LINE (CONTOUR INTERVAL = 5 FT)
ND	NOT DETECTED
10000	TOTAL VOC CONTOUR IN ug/L (DASHED WHERE INFERRED)
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NOTES:

1. CONCENTRATIONS OF TOTAL VOCs OF LESS THAN 1.5 ug/L WERE OBSERVED UPGRADIENT OF AOC9 AREA DISPLAYED ON THIS FIGURE. NO CHLOROBENZENES WERE DETECTED UPGRADIENT OF AOC9.
2. MONITORING WELL AOC9-MW19 IS A NEW WELL TO BE INSTALLED IN THE PLUME SOURCE AREA AFTER THE AOC9 GROUNDWATER REMEDY IS COMPLETED, AND PRIOR TO PERFORMANCE MONITORING. AOC9-MW19 WILL BE INSTALLED AT THE LOCATION OF TEMPORARY WELL TW-39, WHICH CONTAINED 21,610 ug/L OF TOTAL VOC's IN GROUNDWATER.

FORMER GRIFFISS AFB
AOC 9 SITE
ROME, NEW YORK

Prepared by:
ecology and environment engineering p.c.
In association with:
parsons

DRAWING TITLE:
AOC 9
PERFORMANCE MONITORING SAMPLE LOCATION MAP

FIGURE 2-2

- Wells AOC9-MW14, AOC9-MW15 and AOC9-MW17 will be sampled to establish baseline contaminant concentrations within the center of the plume in the area being treated during the remedial action (AOC9-MW14) and downgradient of the treatment area (AOC9-MW15 and AOC9-MW17).

- Upgradient well AOC9-MW18 will be sampled to establish baseline contaminant concentrations upgradient of the groundwater plume.

- Surface water sample locations AOC9-SW01 through AOC9-SW03 will be sampled to establish baseline contaminant concentrations within Six Mile Creek.

Baseline sampling results will establish a baseline for comparison and evaluation of the remaining performance and long-term monitoring sampling events. Sampling is anticipated to be conducted in June 2010, which is approximately one month before the remedial action is scheduled to begin at AOC 9.

Performance monitoring is anticipated to begin in October 2011, approximately four months after the remedial action at AOC 9 is scheduled to be complete, following the installation of AOC9-MW19. This well will be installed in the excavation area at the location of temporary well TW39, which was found during the Predesign Investigations to contain 21,610 µg/L of total VOCs during the Predesign Investigations, the highest level of total VOCs detected in groundwater at AOC 9.

Performance monitoring will evaluate the short-term effectiveness of the remediation efforts for two years with a total of four semiannual sampling events. Samples will be collected from five monitoring wells (AOC9-MW06, AOC9-MW14, AOC9-MW15, AOC9-MW17, and AOC9-MW19) and three surface water locations (AOC9-SW01, AOC9-SW02, and AOC9-SW03; see Figure 2-2):

- Well AOC9-MW06 will function as a sentinel well and will be sampled to determine the stability of the leading edge of the contaminant plume and to monitor the effectiveness of the remedial action in the area downgradient of the remedial action treatment area.

- Wells AOC9-MW14, AOC9-MW15, and AOC9-MW17 will be sampled to monitor the effectiveness of the remedial action in the center of the plume in the area being treated during the remedial action (AOC9-MW14) and downgradient of the treatment area (AOC9-MW15 and AOC9-MW17).

- Well AOC9-MW19 will be sampled to monitor the effectiveness of the remedial action in the center of the source area, following completion of the source area excavation. Analytical results from performance monitoring programs will be trend-evaluated against the pre-construction analytical results from temporary well TW39.

- Surface water sample locations AOC9-SW01 through AOC9-SW03 will be sampled to monitor contaminant concentrations within Six Mile Creek throughout the performance monitoring program.

Well AOC9-MW05 is not warranted to be part of the performance monitoring because based on the remedial construction activities and rate of groundwater flow (0.93 ft/day), the effects of the remedy will not be observable downgradient of Six Mile Creek until the long-term monitoring period. In addition, the most contaminated groundwater in the center of the plume flowing toward MW05 will be monitored as part of the performance monitoring and evaluated.

Long-term monitoring will consist of three sampling events—one each year for three years—to monitor the long-term effectiveness of the remediation efforts. Following the first three years of annual long-term monitoring it is anticipated that monitoring will continue on an every-other-year basis until concentrations of hazardous substances in groundwater are below RAOs. After reaching the RAOs the monitoring will again be performed annually until three consecutive rounds of sampling indicate that the concentrations of groundwater contaminants remain below the RAOs, allowing for unrestricted use of the site.

Long-term monitoring will consist of sampling nine monitoring wells [seven existing and two proposed] (G009-MW01, G009-MW02, AOC9-MW05, AOC9-MW06, AOC9-MW14, AOC9-MW15, AOC9-MW-17, AOC9-MW18, and AOC9-MW19) and three surface water locations (AOC9-SW01, AOC9-SW02, and AOC9-SW03) (see Figure 2-3):

- Wells G009-MW01 and G009-MW02 will be sampled to monitor the width of the contaminant plume and the effectiveness of the remedial action in the lateral portions of the plume.

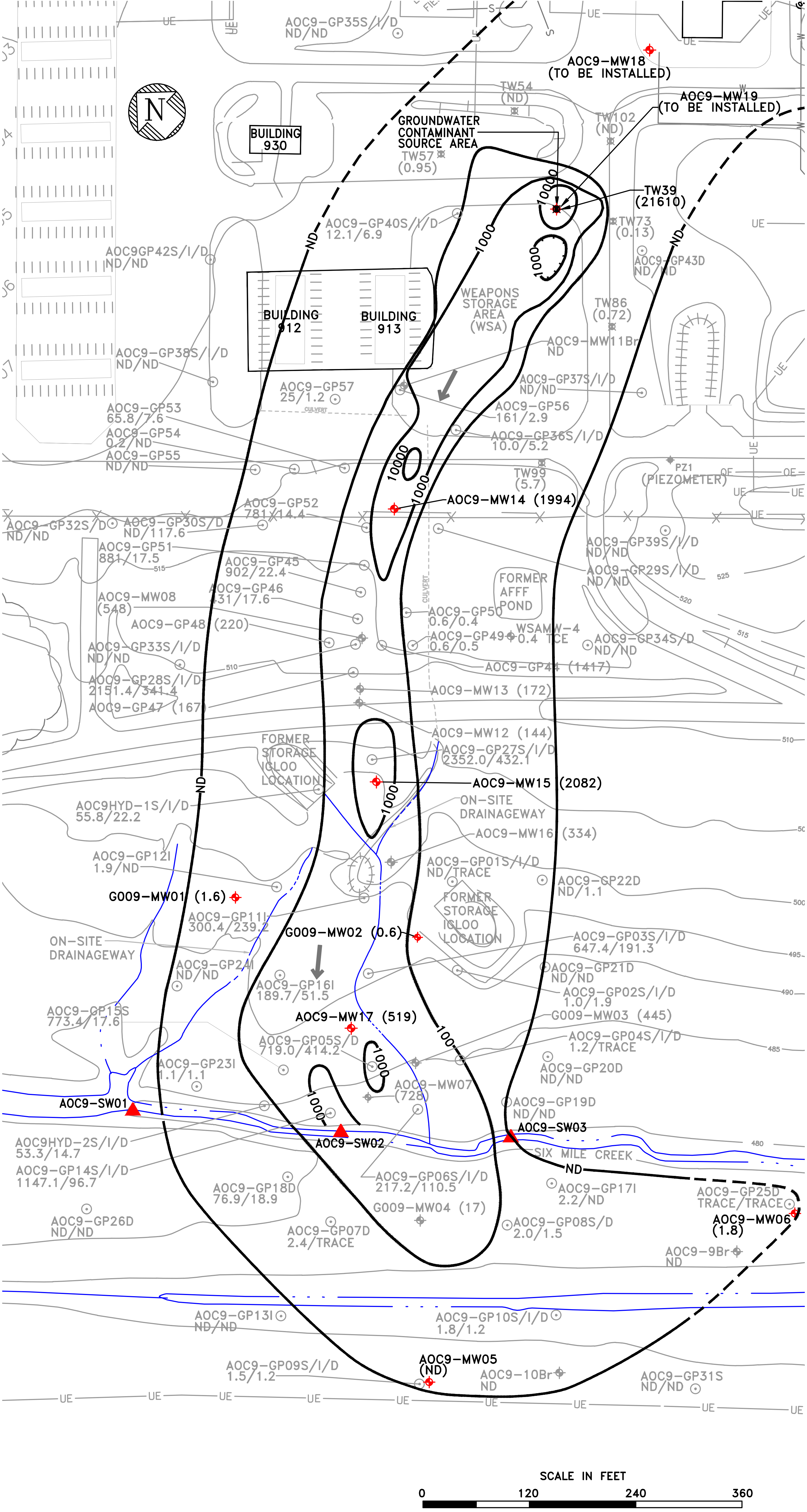
- Wells AOC9-MW05 and AOC9-MW06 will function as sentinel wells and will be sampled to monitor the stability of the leading edge of the contaminant plume and the effectiveness of the remedial action in the area downgradient of the remedial action treatment area.

- Wells AOC9-MW14, AOC9-MW15, and AOC9-MW17 will be sampled to monitor the effectiveness of the remedial action in the center of the plume in the area being treated during the remedial action (AOC9-MW14) and downgradient of the treatment area (AOC9-MW15 and AOC9-MW17).

- Well AOC9-MW18 will be sampled to monitor contaminant concentrations upgradient of the groundwater plume.

- Well AOC9-MW19 will be sampled to monitor the effectiveness of the remedial action in the center of the source area.

F:\GRIFFISS\AOC9 TW Surveyed 7-5-07\Baseline Monitoring Plan\Figure 2-3.dwg



LEGEND

— 525 — TOPOGRAPHIC CONTOUR LINE (CONTOUR INTERVAL = 5 FT)

ND NOT DETECTED

10000— TOTAL VOC CONTOUR IN ug/L (DASHED WHERE INFERRED)

AOC9-MW14 PROPOSED LONG-TERM MONITORING WELL SAMPLE LOCATION

⊙ YEAR 2000 AND 2002 GEOPROBE GROUNDWATER SAMPLING LOCATIONS

⌖ EXISTING WELL

(136.4) 2004/2006 TOTAL VOC CONCENTRATION IN GROUNDWATER (ug/L)

→ GROUNDWATER FLOW DIRECTION

▲ PROPOSED SURFACE WATER SAMPLING LOCATIONS

TW73 ⊠ TEMPORARY MONITORING WELL

NOTE:

1. CONCENTRATIONS OF TOTAL VOCs OF LESS THAN 1.5 ug/L WERE OBSERVED UPGRADIENT OF AOC9 AREA DISPLAYED ON THIS FIGURE. NO CHLOROBENZENES WERE DETECTED UPGRADIENT OF AOC9.

FORMER GRIFFISS AFB AOC 9 SITE ROME, NEW YORK	*Prepared by:* ecology and environment engineering p.c. *In association with:* parsons	DRAWING TITLE: AOC 9 LONG-TERM MONITORING SAMPLE LOCATION MAP FIGURE 2-3

- Surface water sample locations AOC9-SW01 through AOC9-SW03 will be sampled to monitor contaminant concentrations within Six Mile Creek throughout the long-term monitoring program.

To determine if the site remedy has achieved the Remedial Action Objectives per the Record of Decision, a trend analysis will be performed utilizing data gathered from the baseline, performance, and long-term monitoring programs and data from previous site investigations conducted in 1997, 2000, 2002, 2006, and 2007. AFCEE's Monitoring and Remediation Optimization System Software (MAROS Version 2.2) will be used to perform the statistical analysis as needed. The proposed monitoring well networks for the baseline, performance, and long-term programs meet the requirements of MAROS.

2.2 Sampling, Data Interpretation, and Reporting

Seven existing monitoring wells, two proposed monitoring wells, and three surface water locations will be sampled for VOCs during eight separate sampling events. Field methodology is described in Section 3. Table 2-1 lists the sampling parameters for all samples to be collected.

Sampling activities and findings of the sampling events will be documented in brief data summary reports following each sampling event for submittal to USACE and the Air Force Real Property Agency. The reports will provide the following information, as appropriate:

- Updated plume contour maps;

- Comparison of surface water sample results to historic data including the 1997 ESI (E & E 1998), the 2000 SI (E & E 2001), and the 2006 Baseline Sampling at on-base groundwater AOCs (FPM 2007) and evaluation of potential impacts of the contaminated groundwater at AOC 9 on Six Mile Creek. During the SI conducted in 2000, four surface water samples were collected from Six Mile Creek. Two VOCs were detected in the samples. Chlorobenzene was detected in all four samples, ranging from 0.236 µ/L to 0.85 µ/L. 1,2-Dicholorobenzene was detected in one sample (0.406 µ/L);

- Updated water-level contour maps;

- Summary tables of analytical results (complete data packages will be provided as appendices);

- Trend charts and/or statistical analysis (as needed) for groundwater and surface water data; and

- A brief discussion of monitoring efforts toward operating properly and successfully (OPS).

Table 2-1 AOC 9 Groundwater and Surface Water Sampling Parameters for Baseline, Performance, and Long-Term Monitoring Locations, Former Griffiss Air Force Base, Rome, New York

					Analyses[b]	
Location	Sample Number	Screen Interval Depth (ft BGS[a])	Rationale	Type	TCL VOCs - SW8260B	TCLP VOCs
Monitoring Well	G009-MW01BM/LTM(Date)	4.0-9.0	Lateral portion of plume	N	X	
	G009-MW02 BM/LTM(Date)	4.0-9.0	Lateral portion of plume	N	X	
	G009-MW02/D BM/LTM(Date)	4.0-9.0	Field Duplicate	FD	X	
	AOC9-MW05 BM/LTM(Date)	4.0-14.0	Downgradient edge of plume	N	X	
	AOC9-MW06 BM/PM/LTM(Date)	4.2-14.2	Downgradient edge of plume	N	X	
	AOC9-MW14 BM/PM/LTM(Date)	14.0-24.0	Downgradient of excavation, within 1,000 ppb contour	N	X	
	AOC9-MW14 BM/PM/LTM(Date)	14.0-24.0	MS/MSD	FR	X	
	AOC9-MW15 BM/PM/LTM(Date)	9.0-14.0	Downgradient of excavation, within 1,000 ppb contour	N	X	
	AOC9-MW17 BM/PM/LTM(Date)	9.0-14.0	Downgradient of excavation, within 100 ppb contour	N	X	
	AOC9-MW17/D BM/PM/LTM(Date)	9.0-14.0	Field Duplicate	FD	X	
	AOC9-MW18 BM/LTM(Date)	9.0-19.0	Upgradient well to be installed	N	X	
	AOC9-MW19 PM/LTM(Date)	9.3-19.3[c]	Source area well to be installed after excavation	N	X	
Surface Water	AOC9-SW01BM/PM/LTM(Date)	--	Upgradient of plume in SMC	N	X	
	AOC9-SW02BM/PM/LTM(Date)	--	At the location where plume meets SMC	N	X	
	AOC9-SW03BM/PM/LTM(Date)	--	Downgradient of plume in SMC	N	X	
Trip Blanks	AOC9-TB1(Date)	--	Water/QC Matrix	TB	X	
IDW	IDW-Water(Date)	--	IDW	N		X
IDW	IDW-Soil(Date)	--	IDW	N		X

Notes:

[a] Depth in feet below ground surface (BGS) unless otherwise stated. These screened interval depths have been chosen based on previously identified limits of contamination from the following previous investigation reports (E & E 1998, E & E 2004, and E & E 2007).

[b] At least one MS/MSD and one field duplicate will be collected per sample delivery group; one trip blank per cooler containing VOCs. Equipment and ambient blanks are not required. Well locations of the QC samples will be changed each sampling round. A second field duplicate will be collected during long-term monitoring, to maintain at least 10% coverage.

[c] Well screen for AOC9-MW19 will be placed at approximately the same depth as temporary well TW39, provided that ground surface of excavation area is restored to original elevation. Bladder pumps were installed in wells at the time of well installation. Pump intakes were positioned at the center of the well screen interval.

Key:

AOC9 = Area of Concern 9.
BGS = Below ground surface.
BM = Baseline Monitoring Location.
/D = Duplicate.
FD = Field duplicate.
FR = Field split/replicate.
ft = Feet.
IDW = Investigation derived waste.
LTM = Long-Term Monitoring Location.
MW = Monitoring well.
MS/MSD = Matrix spike/matrix spike duplicate.
N = Original sample.
PM = Performance Monitoring Location.
ppb = Parts per billion.
QC = Quality control.
SMC = Six Mile Creek.
SW = Surface Water.
TB = Trip blank.
TBD = To be determined.
TCL = Target compound list.
TCLP = toxicity characteristic leachate procedure.
VOCs = Volatile organic compounds.

Annual monitoring reports will also be prepared for submittal to the regulators, which will be more detailed to include:

- A summary of field sampling activities (including field documentation logs);
- Updated plume contour maps;
- Updated water-level contour maps;
- Summary tables of analytical results (complete data packages and data validation reports will be provided as appendices);
- Trend charts and/or statistical analysis (as needed) for groundwater and surface water data;
- Comparison of surface water sample results to historic data and evaluation of potential impacts of the contaminated groundwater at AOC 9 on Six Mile Creek;
- Updates to the site conceptual model;
- A discussion of efforts toward OPS; and
- Recommendations for a modification of the monitoring programs based on the updates to the site conceptual model (i.e., adding wells if a statistically increasing trend in Contaminants of Concern concentrations are observed over three consecutive monitoring events, or removing wells if Contaminants of Concern concentrations are below the Remedial Action Objectives for three consecutive monitoring events).

Water-level contour maps will be prepared using data collected from the 14 existing, two new permanent monitoring wells, six temporary wells, and one piezometer listed in Table 2-2. Nearby wells will be substituted in the event that the specified wells are found to have been damaged or removed.

Preliminary reports will be submitted three months after each sampling event is completed. Data will be provided in Environmental Restoration Program Information Management System (ERPIMS)-compatible format and added to the database.

Table 2-2 Water Level Data Collection Points

Permanent Monitoring Wells		
G009-MW01	AOC9-MW07	AOC9-MW16
G009-MW02	AOC9-MW08	AOC9-MW17
G009-MW03	AOC9-MW12	AOC9-MW18 (new)
G009-MW04	AOC9-MW13	AOC9-MW19 (new)
AOC9-MW5	AOC9-MW14	
AOC9-MW6	AOC9-MW15	
Temporary Monitoring Wells		
TW54	TW73	TW99
TW57	TW86	TW102
Piezometer		
PZ1		

3

Field Methods

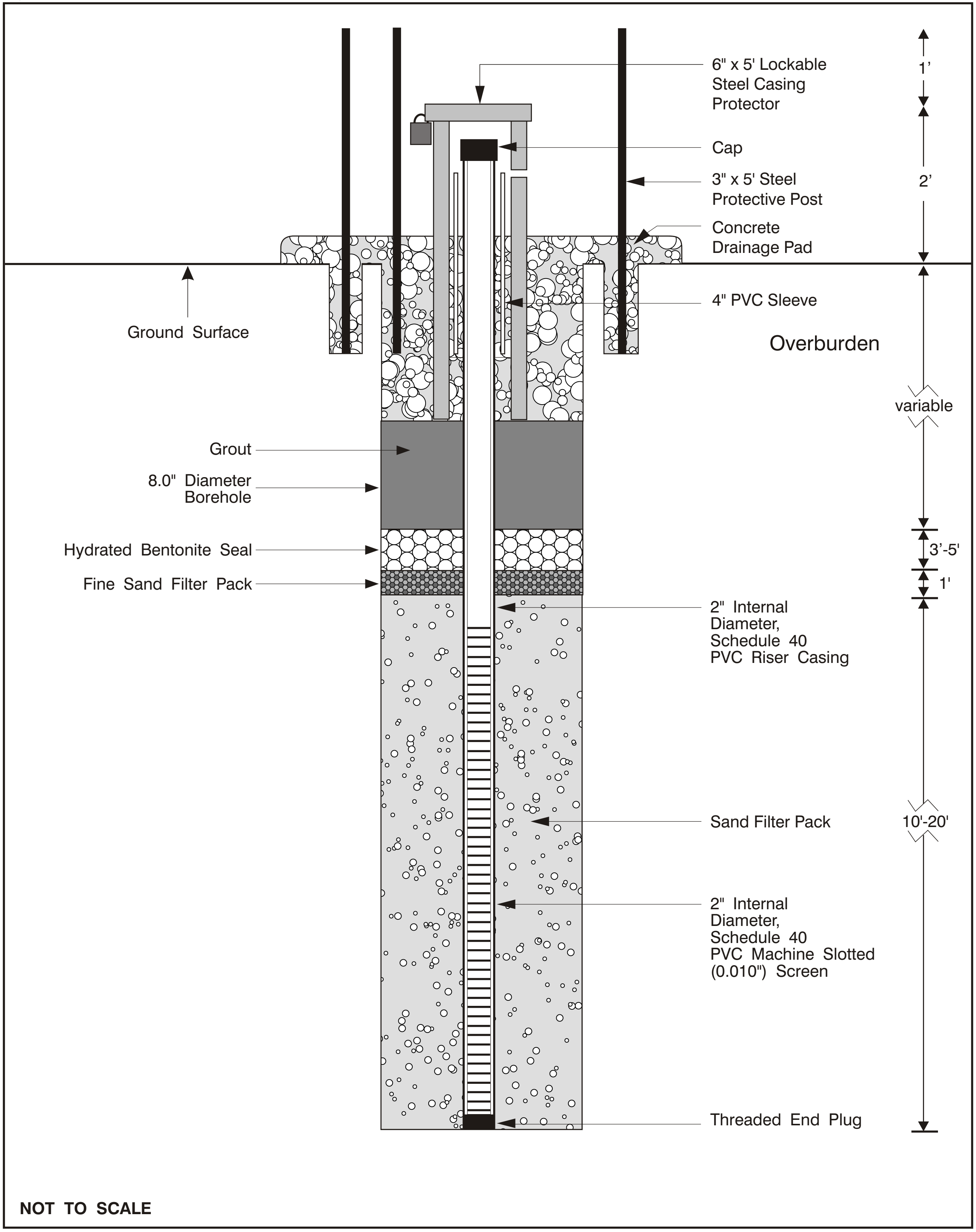
This section describes the fieldwork methods associated with the sampling events identified in Section 2. The fieldwork will include monitoring well installation, well development, and groundwater and surface water sampling. Maps showing the proposed sampling locations and a table listing the samples to be collected are provided in Section 2.

3.1 Monitoring Well Installation Methodology

A total of two new, permanent monitoring wells will be installed at AOC 9, 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. Figure 3-1 illustrates typical monitoring well construction and the construction details are recorded on the HTRW Drill Log (see Figure 3-2). 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 D1785 standards for Schedule 40 pipe. Riser will extend to a height of 2 feet above grade. Well screens will consist of 10 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.

- **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, noncarbonated, 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.



SOURCE: Ecology and Environment Engineering, P.C. 2010

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 %**
22. 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

SCREENED WELL

Stick-up ________ft

Top of Grout
____________ft

Top of
Seal at______ft

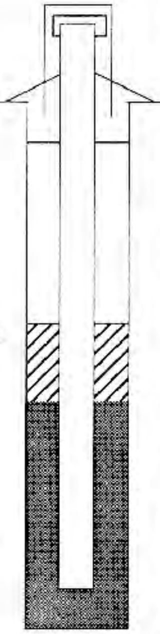
Top of Sand Pack ______ft

Top of
Screen at _____ft

Bottom of
Screen at _________ ft

Bottom of
Hole at ____________ ft

Bottom of Sandpack at _______



Lock Number________

Inner Casing
Material___________

Inner Casing Inside
Diameter____ inches

GROUND SURFACE

Quantity of Material Used:
Bentonite
Pellets____________

Cement____________

Borehole ______ inches
Diameter

Cement/
Bentonite___________

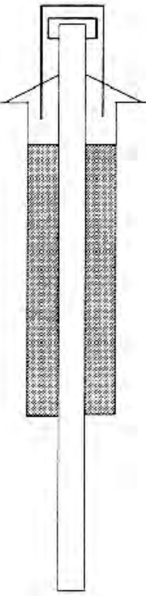
Grout_____________

Screen Slot Size _______

Screen Type ________
☐ PVC__________
☐ Stainless Steel ____

Pack Type/Size:
☐ Sand __________
☐ Gravel _________
☐ Natural _________

OPEN-HOLE WELL



Stick-up ________ft

Inner Casing
Material __________

Inner Casing Inside
Diameter _______inches

Outer Casing
Diameter _______inches

Borehole
Diameter ______ft

Bedrock _______ft

Bottom of Rock Socket/
Outer Casing _____ft

Bottom of Inner
Casing ________ft

Corehole
Diameter_________

Bottom of
Corehole ________ft

Depth (Feet)	NARRATIVE LITHOLOGIC DESCRIPTION	Moisture Content		
		Dry	Moist	Wet
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○

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

HTRW DRILLING LOG (Continuation Sheet)

Hole Number

Project

Inspector

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

Depth (Feet)	NARRATIVE LITHOLOGIC DESCRIPTION	Moisture Content		
		Dry	Moist	Wet
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○

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

- **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 3 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 if it is more than 20 feet deep. 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.** Monitoring wells will be completed 2 feet above ground surface, except for AOC9-MW19, which is adjacent to a roadway. The aboveground completion for monitoring wells will consist of a painted, 6-inch-diameter, locking, protective steel casing painted brown, and three protective posts painted yellow. Before the steel casing is installed, 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 and 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 padlock will be used to secure the well. The well adjacent to the roadway will be installed as flush-mount without protective posts.

- **Well Identification.** Wells will be identified by brass survey marker 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 identifier;
  - 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 submitted on the Hazardous, Toxic, and Radioactive Waste Drill Log Form, included as Figure 3-2, and signed by the preparer.

3.2 Well Development

Each new monitoring well will be developed no sooner than 48 hours after final grouting of the well 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. Monitoring wells will be developed using a submersible development pump according to the procedure described below.

3.2.1 Equipment and Supplies

Equipment and supplies are as follows:

- 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 ORP standard solution);
- Pump controller (QED Model 3013 or equivalent);
- Air compressor (QED Model 41000 or equivalent); and
- 55-gallon drums (if deemed necessary; see Section 3.7).

3.2.2 Development Procedures

Wells will be developed using the following 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:

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

  Where:

  H_1 = total height of the water column in the well and
  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 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 two of the three well volumes. Then discontinue surging, and continue pumping until pH, temperature, conductivity, ORP, and DO 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 EPA low-flow purging methodology (see Appendix C):
  - ± 0.1 for pH;
  - ± 10 mV for ORP;
  - ± 10% for DO and turbidity; and
  - ± 3% for conductivity and temperature.

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; and
  - A digital photograph of the final development water in a clear glass jar;

- Manage development water as described in Section 3.7 in this work plan; and

- If dedicated pumps are not used for development, decontaminate development pump and hose according to procedures outlined in Section 3.6 in this work plan.

3.3 Groundwater Sampling

Groundwater samples will be collected from existing monitoring wells G009-MW01, G009-MW02, AOC9-MW05, AOC9-MW06, AOC9-MW14, AOC9-MW17, and proposed monitoring wells AOC9-MW18 and AOC9-MW19. The types of samples proposed for analytical testing are included on Table 2-1. All groundwater samples collected from the wells will be sent to Katahdin Analytical Services for the analyses listed in Table 2-1. One trip blank will accompany each shipment containing samples for VOC analysis.

A low-flow purging/sampling procedure using dedicated bladder pumps will be used to obtain groundwater samples from the monitoring wells. The objectives and methods for this procedure are included in the EPA Region II Guidance document titled *Groundwater Sampling Procedure, Low Stress (Low Flow) Purging and Sampling* (see Appendix C). 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 provided below. Well development should be completed at least 14 days before sampling.

3.3.1 Equipment and Supplies

Equipment and supplies are as follows:

- Water level indicator;
- Flame Ionization detector (FID) or photo ionization detector (PID);
- Dedicated stainless-steel and Teflon submersible bladder pump (QED Model T1200 or equivalent) and polyethylene tubing (QED Model PT5100 or equivalent);
- QED Model MP20 (or equivalent) water quality probe, meter, and flow-through cell;
- Turbidity meter (HACH Model 2100P or equivalent);
- Pump controller/air compressor (Geocontrol Pro Pack Sampling System or equivalent);

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 r^2h 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 x10^{-3}
11/2	0.092	0.0123	1.142	1.142 x10^{-3}
2	0.163	0.0218	2.024	2.024 x10^{-3}
21/2	0.255	0.0341	3.167	3.167 x10^{-3}
3	0.367	0.0491	4.558	4.558 x10^{-3}
31/2	0.500	0.0668	6.209	6.209 x10^{-3}
4	0.653	0.0873	8.110	8.110 x10^{-3}
41/2	0.826	0.1104	10.260	10.260 x10^{-3}
5	1.020	0.1364	12.670	12.670 x10^{-3}
51/2	1.234	0.1650	15.330	15.330 x10^{-3}
6	1.469	0.1963	18.240	18.240 x10^{-3}
7	2.000	0.2673	24.840	24.840 x10^{-3}
8	2.611	0.3491	32.430	32.430 x10^{-3}
9	3.305	0.4418	41.040	41.040 x10^{-3}
10	4.080	0.5454	50.670	50.670 x10^{-3}
11	4.937	0.6600	61.310	61.310 x10^{-3}
12	5.875	0.7854	72.960	72.960 x10^{-3}
14	8.000	1.0690	99.350	99.350 x10^{-3}
16	10.440	1.3960	129.650	129.650 x10^{-3}
18	13.220	1.7670	164.180	164.180 x10^{-3}
20	16.320	2.1820	202.680	202.680 x10^{-3}
22	19.750	2.6400	245.280	245.280 x10^{-3}
24	23.500	3.1420	291.850	291.850 x10^{-3}
26	27.580	3.6870	342.520	342.520 x10^{-3}
28	32.000	4.2760	397.410	397.410 x10^{-3}
30	36.720	4.9090	456.020	456.020 x10^{-3}
32	41.780	5.5850	518.870	518.870 x 10^{-3}
34	47.160	6.3050	585.680	585.680 x10^{-3}
36	52.880	7.0690	656.720	656.720 x10^{-3}

1 Gallon = 3.785 liters
1 Meter = 3.281 feet
1 Gallon water weighs 8.33 lbs. = 3.779 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 x 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/°F)	TURB. (NTU)	COMMENTS
	GALS.	BORE VOL.					

DEVELOPED BY: ______________________________ DATE: ____________

Figure 3-3 (Cont.) Well Development Record

- Sample bottles (see Table 3-1);
- Nitrile gloves;
- Plastic 5-gallon buckets;
- Paper towels;
- Equipment calibration solutions;
- Plastic sheeting; and
- Cooler with ice.

3.3.2 Sample Collection Procedures

Samples are collected using the following procedures:

- Measure depth to water table with a water level indicator and record initial water level, pH, temperature, specific conductance (conductivity), DO, ORP, and turbidity.
- 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 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 midpoint 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.
- Calculate the volume of water in well casing/screen and filter pack using the following equation:

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

  Where:

  H_1 = total height of the water column in the well and
  H_2 = height of the saturated sand pack.

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

EPA Method	Parameter	Sample Container [a]	Amount	Preservation[b]	Holding Time	
					Extraction	Analysis[c]
Groundwater and Surface Water Samples						
SW 8260B	Volatile organics	Three 40-mL glass VOA vials with Teflon septa	Full; no headspace	HCl Cool to 4°C	NA	7 days

Notes: Holding times are from verified time of sample receipt as required by New York State Department of Environmental Conservation, Analytical Services Protocol.

[a] Samples chosen from quality assurance analysis require double the number of containers indicated.

[b] All VOA sample bottles will be pre-preserved.

[c] Number of days is from date of collection.

Key:

HCl = Hydrochloric acid.
mL = Milliliter.
NA = Not applicable.
SW = *Test Methods for Evaluating Solid Wastes* (U.S. Environmental Protection Agency, 1986, through Update III.
VOA = Volatile organic analysis.

This equation is based on the following assumptions:

- 2-inch well diameter;
- 30% sand filter pack porosity; and
- 8.5-inch borehole diameter.

- Purge a minimum of three well volumes 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 variance:

  - If water level or water quality parameters (i.e., pH, temperature, conductivity, turbidity, DO, and ORP) do not stabilize, USACE will be informed and a field adjustment form will be completed if necessary prior to sample collection.

- Collect purge water in the 5-gallon buckets and field screen with either an FID or PID. Readings will be taken directly from the surface of the purge water (NYSDEC 2009). If readings higher than 5 ppm are obtained, containerize purge water in 55-gallon drums. Label drums with contents and date generated. Drums will be stored in a location approved by the Air Force Real Property Agency and properly disposed. If readings of less than 5 ppm are obtained the purge water will be discharged to the ground.

- Record pH, temperature, conductivity, DO, ORP, and turbidity on the Groundwater Sampling 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 EPA guidelines (see Appendix C):

  - ± 0.1 for pH;
  - ± 10 mV for ORP;
  - ± 10% for DO and turbidity; and
  - ± 3% for conductivity and temperature.

  Once parameters are stabilized the groundwater sample will be collected. The sampling team will wear disposable gloves during sampling and discard the gloves once sampling is complete at each well.

- Collect groundwater sample following well purging (or sufficient recharge if purged dry). The sample will be collected using the dedicated bladder pumps. Pumping will be performed at a very slow rate to minimize volatilization and turbidity;

- Visually confirm that the sample bottles have been properly pre-preserved with the preservatives listed on Table 3-1.

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

3.3.3 Field Measurement Procedures – pH, Temperature, Specific Conductance, Dissolved Oxygen, Redox Potential, and Turbidity

pH, temperature, conductivity, DO, and ORP are 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 contains separate pH, temperature, conductivity, DO, and ORP probes in one unit. A separate meter is used to measure turbidity.

Before use, the pH, conductivity, ORP, and DO probes are calibrated or tested for responsiveness. The pH probe is calibrated first, by placing the probe in standard solutions (pH 7 and then pH 4) and adjusting the pH calibration 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 are rinsed with deionized water between each calibration solution and following calibration. Used calibration solution is discarded. Finally, the conductivity probe is checked with a solution of known conductivity.

After being calibrated the probe is fitted into the flow-through cell provided with the instrument, using the mounting hardware provided. 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 is purged at 100 to 500 mL/min so that drawdown does not exceed 0.3 foot. The water level, pH, temperature, conductivity, 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 Form (see Figure 3-4). The probes and flow-through chamber are thoroughly rinsed with deionized water after use.

The FID/PID used to field screen the purge water is calibrated each morning before field activities begin in accordance with the manufacturer’s specifications.

Groundwater Sampling Form

Project: AOC 9 Baseline, Performance, Long-Term Monitoring
Site: AOC 9-Former Griffiss Air Force Base
Well No.: __________
Sample Date: __________
Sampling Device: QED T1200 bladder pump
Well Depth (feet TOIC): __________
Screen Interval (feet BGS): __________
Casing Inner Diameter (inches): __________
Initial PID Reading (ppm): __________

Sample ID: __________
Sample Time: __________
Sample Tubing: QED Teflon-lined polyethylene
Sample Turbidity (NTUs): __________
Initial Water Level (Feet TOIC): __________
Final Water Level (feet TOIC): __________
Casing Type: PVC

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

Key:
°C = Degrees centigrade.
BGS = Below ground surface.
DO = Dissolved oxygen.
LPM = Liters per minute.
mg/L = Milligrams per liter.
mS/cm = microSiemens per centimeter.
NTU = Nephelometric turbidity unit.
NTU = Nephelometric turbidity unit.
ORP = Redox potential.
ppm = Parts per million.
PVC = Polyvinyl chloride.
TOIC = Top of inner (PVC) casing.

Figure 3-4 Groundwater Sampling Form

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Groundwater Sampling Form

Well No.: **Date:**

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

Key:

°C = Degrees centigrade.
BGS = Below ground surface.
DO = Dissolved Oxygen
LPM = Liters per minute

mg/L = Milligrams per liter
mS/cm = microSiemens per centimeter
NTU = Nephelometric turbidity unit.
NTU = Nephelometric turbidity unit.

ORP = Redox potential
ppm = Parts per million.
PVC = Polyvinyl chloride.
TOIC = Top of inner (PVC) casing.

Figure 3-4 Groundwater Sampling Form

3.4 Surface Water Sampling

To establish baseline contaminant concentrations in Six Mile Creek and monitor contaminant concentrations in the creek throughout the performance and long-term monitoring programs, surface water samples will be collected from three locations (AOC9-SW01, AOC9-SW02, and AOC9-SW03) and the data compared with historic data (see Figures 2-1, 2-2, and 2-3). All surface water samples collected from Six Mile Creek will be sent to Katahdin Analytical Services for the analyses listed in Table 2-1. Surface water sample bottle requirements, holding times, and preservation requirements are provided on Table 3-1. One trip blank will accompany each shipment containing samples for VOC analysis.

Surface water samples will be collected upstream of the site (AOC9-SW01), at the location where the contaminant plume intersects Six Mile Creek (AOC9-SW02) and downstream of the site (AOC9-SW03) during all sampling events.

Each surface water sample will be collected by first filling a dedicated sample jar directly from Six Mile Creek, then transferring creek water to pre-preserved approved sample containers, leaving no headspace. Samples will be collected in order from downstream locations to upstream locations to minimize the potential of disturbance to unsampled locations. Readings of pH, temperature, conductivity, and turbidity will be obtained at the time of sample collection.

Sample locations will be marked and labeled in the field with semi-permanent markers (e.g., wooden stakes for later location). Locations will also be measured in the field for approximate distances from permanent structures or site features and documented in the field logbook.

3.5 Sample Labeling, Packaging and Shipping, and Custody

3.5.1 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.

3.5.2 Sample Packaging and Shipping

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 ("1 of

1,” “1 of 2,” 2 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 U.S. Department of Transportation regulations. The samples will be shipped to Katahdin Analytical Services by an overnight service. Arrangements will be made with Katahdin for samples that are to be delivered to the laboratory on a weekend so that holding times are not compromised.

- Katahdin POC:
  Attn: Kate Zaleski/Sample Custody
  Katahdin Analytical Services
  600 Technology Way
  Scarborough, ME 04074
  Phone: 207-874-2400
  Fax: 207-775-4029

3.5.3 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.

3.6 Equipment Decontamination

The drill rig and all appurtenances must be decontaminated with high-pressure steam prior to their arrival to the site. All equipment will be decontaminated again upon arrival to the site to remove road dirt only. 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 sampling of 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 sawhorses 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. Once clean, no equipment may touch the ground prior to use. The equipment must be stored on the drill rig or 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 3.7, the decontamination water will be placed in 55-gallon drums and labeled accordingly.

To decontaminate groundwater field testing instruments:

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

Decontaminate well development pump and discharge hose using the 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.
- Drain pump and hose and place in a clean plastic bag.

3.7 Investigation-Derived Waste

Drill cuttings from well installation will be disposed of in accordance with New York State Technical and Administrative Guidance Memorandum HWR-89-4032 issued by NYSDEC on November 21, 1989. A registry of all drums, a description of their sources and contents, and documentation of the analytical results from tests on the contents will be provided to the client.

Investigation-derived soils and water will be field screened with a FID or PID to determine initially whether these waste are contaminated. Readings will be taken directly from the surface of the collected soils and water (NYSDEC 2009). If no contamination or contamination less than 5 ppm on an 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 wells that are determined to be contaminated, based on field screening, will be sampled and analyzed as shown on Table 2-1, and additional analyses will be performed if required by the off-site disposal company. Off-site disposal of contaminated materials involves hauling drummed water to a commercial disposal facility.

3.8 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. The information will include a record of all personnel on site associated with this project, daily objectives, work accomplished, difficulties encountered, and correspondences with the USACE and regulators. In addition, a Daily Activity Summary Form (see Figure 3-5) will be completed for each day of fieldwork by the Field Team Leader and stored in the project records.

Daily Activity Summary					
Date:			**Report No.:**		
Project Name: AOC 9 Baseline, Performance, and Long-Term Monitoring, Former Griffiss AFB			**Weather:**		
Personnel	**Hrs.**	**Affiliation**	**Personnel**	**Hrs.**	**Affiliation**

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

Figure 3-5 Daily Activity Summary Form

Page 1 of 2

Daily Activity Summary	
Date:	**Report No.:**
Project Name: AOC 9 Baseline, Performance, and Long-Term Monitoring, Former Griffiss AFB	**Weather:**
Field Tests Performed (Sampling, 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 3-5 Daily Activity Summary Form

Page 2 of 2

The task logs 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, station number, date, time, and sample matrix;
- On-site measurement data for groundwater, such as pH, temperature, conductivity, DO, and ORP;
- Any sample preservatives used;
- 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.

If any adjustments are needed in the field, a Field Adjustment Form must be filled out and submitted to the USACE for approval (see Figure 3-6).

3.9 Site Survey

A ground survey will be performed by a subcontractor to obtain horizontal locations and vertical elevations of all new monitoring wells installed. 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.

Field Adjustment Form No. ____ **Former Griffiss AFB**	
To: Mr. Douglas M. Pocze USEPA - Region 2 Federal Facilities Section 290 Broadway New York, NY 10007 Fax: (212) 637-3256 Office: (212 637-4432	Ms. Heather Bishop NYSDEC Division of Environmental Remediation Remedial Bureau A 625 Broadway, 11th floor Albany, NY 12233-7015 Fax: (518) 402-9022 Office: (518) 402-9692
From: Ms. Catherine Jerrard Air Force Real Property Agency 153 Brooks Road Rome, NY 13441-4105 Fax: (315) 356-0816 Office: (315) 356-0810	**Date:** **Time:**
Site:	**Work Plan Section:** **Page:**
Need for Field Adjustment	

Prepared by:	**Organization** Ecology and Environment Engineering, P.C.	**Date:**
Approved by:	**Org:** USACE	**Date:**

Figure 3-6 Field Adjustment Form

Page 1 of 1

4 References

Ecology and Environment Engineering, P.C. (EEEPC). February 2010. Final Feasibility Study Addendum for AOC 9, Former Griffiss Air Force Base, Rome, New York.

Ecology and Environment Engineering, P.C. (EEEPC). November 2007. Final Additional AOC 9 Predesign Investigation Data Summary Report, Former Griffiss Air Force Base, Rome, New York.

Ecology and Environment, Inc. (E & E). May 2004. AOC 9: Weapons Storage Area (WSA) Landfill, Final 2002 Remedial Investigation Report, Former Griffiss Air Force Base, Rome, New York.

Ecology and Environment, Inc. (E & E). August 2001. AOC 9: Weapons Storage Area (WSA) Landfill Supplemental Investigation, Final Data Summary Report, Former Griffiss Air Force Base, Rome, New York.

Ecology and Environment, Inc. (E & E). July 1998. Draft Report for Expanded Site Investigation and Confirmatory Sampling of Areas of Interest and Drywell/Wastewater-Related Systems, Former Griffiss Air Force Base, Rome, New York.

FPM Group (FPM). August 2007. Baseline and PDI2 Sampling On-Base Groundwater Areas of Concern, Former Griffiss Air Force Base, Rome, New York.

New York State Department of Environmental Conservation (NYSDEC). November 2009. Draft DER-10 Technical Guidance for Site Investigation and Remediation.

Parsons Infrastructure & Technology Group, Inc. March 2009. Environmental Remediation at the Former Griffiss Air Force Base – AOC 9 Remediation Proposal. Solicitation No. W912DK-09-R-3002.

A

Site-Specific Health and Safety Plan

Ecology and Environment Engineering, P.C.

SITE-SPECIFIC HEALTH AND SAFETY PLAN

Project: Griffiss AOC 9 Baseline, Performance and Long-Term Monitoring

Project No.: 002888.PI02.09

TDD/PAN No.: ______________________

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

Proposed Date of Field Activities: Spring 2010 thru Fall 2015

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

Project Manager: Robert A. Meyers P.G. Phone: (716) 684-8060

Prepared by: Megan Horanburg/Robert Meyers Date Prepared: 02/10/10

Approved by: ______________________ Date Approved: 2-15-10

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Section Page

ATTACHMENTS

List of Tables

1. INTRODUCTION

1.1 POLICY

It is E & E'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 E & E employees for the above-named project. E & E's overall safety and health program is described in *Corporate Health and Safety Program* (CHSP). After reading this plan, applicable E & E employees shall read and sign E & E's Site-Specific Health and Safety Plan Acceptance form.

This SHASP has been developed for the sole use of E & E employees and is not intended for use by firms not participating in E & E's training and health and safety programs. Subcontractors are responsible for developing and providing their own safety plans.

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 January 2010
Other: Ecology and Environment Engineering, P.C. Quality Control Plan

1.2 SCOPE OF WORK

Description of Work: As part of the baseline sampling, performance monitoring, and long term monitoring programs, monitoring well installation, and groundwater and surface water sampling will be conducted at AOC 9 at the Former Griffiss Air Force Base in Rome, NY from spring 2010 through fall 2015.

Equipment/Supplies: Attachment 1 contains a checklist of equipment and supplies that will be needed for this work.

The following is a description of each numbered task:

Task Number	Task Description
1	Groundwater sampling
2	Surface water sampling
3	Monitoring well installation

1.3 SITE DESCRIPTION

Site Map: Site maps are provided in the Final Work Plan for Baseline, Performance, and Long-Term Monitoring at AOC 9 of which this HASP is an attachment.

Site History/Description (see project work plan for detailed description): The Former Griffiss Air Force Base is located in Rome, New York. The base has been realigned under the Base Realignment and Closure (BRAC). During the Baseline, Performance and Long-Term Monitoring Program, 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 and in soil. Please see the work plan for further site-specific information.

Types and Characteristics of Contaminants/Wastes:

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

Other: ______________________________

2. ORGANIZATION AND RESPONSIBILITIES

E & E team personnel shall have on-site responsibilities as described in E & E'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
Jim Mays/Larry Roedle	Site Safety Officer(1)
Ben Cole/Megan Horanburg	Field Team Leader

(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.

3. TRAINING

Prior to work, E & E 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.

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	

Training	Required
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

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

E & E's health and safety record (HSR) form will be maintained on site by each E & E employee for the duration of his or her work. E & E 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 E & E field personnel on certain required sites; however they are not required for AOC 9.

Pocket Dosimeters: ______________________________

____

Other: ______________________________

____

4.2.2 Internal Dosimetry

☐ Whole body count ☐ Bioassay ☐ Other

Requirements: ______________________________

____

4.2.3 Radiation Dose

Dose Limits: E & E'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:

ALARA Policy: Radiation doses to E & E 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 map for the location of the site. The field work at AOC 9 will be implemented throughout the site, as described in 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.

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

Illumination Requirements: Daylight work only.

Sanitary Facilities (e.g., toilet, shower, potable water): Toilet facilities are located adjacent to AFRPA offices and the storage areas sample packaging areas used by EEEPC personnel. Other facilities are TBD.

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

Other Site-Control Requirements: Access to monitoring wells within the fenced southern portion of AOC 9 will require obtaining permission and badging from Chad Lawrence (Superintendent of Airport Maintenance) prior to arrival on site for the sampling event.

5.2 SAFE WORK PRACTICES

Daily Safety Meeting: A daily safety meeting will be conducted for all E & E personnel and documented on the Daily Safety Meeting Record form or 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 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 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 cannot correct the violation, it will communicated to the Regional Safety Coordinator (RSC) or to the Corporate Safety department for review and recommendations. Work will not resume until the violation has been corrected.

EEEPC's RSC will conduct inspections at the site during the completion of field activities. Theses inspections will include an audit briefing with the field teams, as well as a written audit report. If the SSO 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.

Other Safe Work Practices: TBD

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	■ Potential hazard: Poison Ivy/Oak ■ Establish site-specific procedures for working around identified hazards. ■ Other: Ticks
Cold Stress	1, 2, 3	■ Provide warm break area and adequate breaks. ■ Provide warm noncaffeinated beverages. ■ Promote cold stress awareness. ■ See *Cold Stress Prevention and Treatment* (attached at the end of this plan if cold stress is a potential hazard).
Compressed Gas Cylinders	1, 3	■ 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	NA	■ Ensure compliance with 29 CFR 1910.146. ■ See SOP for Confined Space Entry. Additional documentation is required. ■ Other:
Drilling	3	■ See SOP for Health and Safety on Drilling Rig Operations, which is attachment 5 of this HASP. Additional documentation may be required. ■ Landfill caps will not be penetrated without prior discussions with corporate health and safety staff. ■ Other:

Hazard	Task Number	Hazard Control Measures
Drums and Containers	1,3	■ 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	3	■ 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	NA	■ 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. ■ 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, 3	■ 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 (if applicable)	■ Provide cool break area and adequate breaks.

Hazard	Task Number	Hazard Control Measures
		■ Provide cool noncaffeinated beverages. ■ Promote heat stress awareness. ■ Use active cooling devices (e.g., cooling vests) where specified. ■ See *Heat Stress Prevention and Treatment* (attached at the end of this plan if heat stress is a potential hazard).
Heavy Equipment Operation	3	■ 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.)	NA	■ Ensure compliance with applicable subparts of 29 CFR 1910. ■ Identify special PPE needs (e.g., lanyards, safety nets, etc.) ■ Other:
Noise	3	■ 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	3	■ Wear hard hat. ■ Other:
Power Tools	3	■ Ensure compliance with 29 CFR 1910 Subpart P. ■ Other:
Sunburn	1, 2	■ Apply sunscreen. ■ Wear hats/caps and long sleeves. ■ Other:
Utility Lines	3	■ 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	■ Potential hazards: Electrical storms, snow storms, extreme heat or cold temperatures. ■ 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.

Hazard	Task Number	Hazard Control Measures
		- Discontinue work during severe weather. - Other:
Other:		- -
Other:		- -

6.2 CHEMICAL HAZARD EVALUATION AND CONTROL

6.2.1 Chemical Hazard Evaluation

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

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: NA

PPE: See Section 7.

TABLE 6-1

CHEMICAL HAZARD EVALUATION

Task Number	Compound	Exposure Limits (TWA)			Dermal Hazard (Y/N)	Route(s) of Exposure	Acute Symptoms	Odor Threshold/ Description	FID/PID	
		PEL	REL	TLV					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

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		(X)	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. E & E'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/LOP					
	1	2	3			
Full-face APR	(X)		(X)			
PAPR						
Cartridges:						
P100						
GMC-P100	(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)						

PPE	Task Number/LOP					
	1	2	3			
Manifold system						
5-Minute escape mask						
Safety glasses	X	X	X			
Monogoggles						
Coveralls/clothing	X	X	X			
Protective clothing:						
Tyvek	(X)	(X)	(X)			
Saranex or coated tyvek	(X)	(X)	(X)			
Other:						
Splash apron						
Inner gloves:						
Cotton						
Nitrile	X	X	X			
Latex						
Other:						
Outer gloves:						
Viton						
Rubber						
Neoprene	(X)	(X)	(X)			
Nitrile	(X)	(X)	(X)			
Other:						
Work gloves						
Safety boots (as per ANSI Z41)	X	X	X			
Neoprene safety boots (as per ANSI Z41)						
Boot covers (type: Disposable booties)	(X)	(X)	(X)			
Hearing protection (type:)			X			
Hard hat			X			
Face shield						
Other:						
Other:						

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

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.

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. Sampling devices (non-dedicated) will be decontaminated before the first use and after each well using an alconox solution. Decontamination water and groundwater will be field screened and handled in accordance with the work plan .

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 for disposal.

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

Disposition of Decontamination Wastes (e.g., dry wastes, decontamination fluids, etc.): All disposable equipment will be placed in a plastic bag and labeled for disposal. All water (groundwater, decon water) can be disposed of to the ground surface if PID readings are less than 5 ppm.

TABLE 8-1

HEALTH AND SAFETY MONITORING

Instrument	Task Number	Contaminant(s)	Monitoring Location	Monitoring Frequency	Action Levels[a]	
☒ PID (e.g., RAE mini RAE) ☐ FID (e.g., OVA 128-) ☐ TVA 1000	1, 2, 3	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 above background: 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	3				**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: 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:					
Other:					

TABLE 8-1

HEALTH AND SAFETY MONITORING

Instrument	Task Number	Contaminant(s)	Monitoring Location	Monitoring Frequency	Action Levels[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.

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 EEEPC 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/she 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 Corp 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 (map attached at the end of this plan): (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, NY 1-800-252-5655

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

Fire Department: 911 or City of Rome, Emergency phone number: 315/339-7784

Client Contact:

Site Contact: AFRPA Griffiss, Environmental Section, Building 301, (315) 356-0810 ext.204

Cellular Telephone Number: TBD

Radios Available: None

Other: N/A

10.3 E & E EMERGENCY CONTACTS

E & E Emergency 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	716/684/8060 (office)
b. Tom Siener	716/684/8060 (office) 716/662-4740(home)

Other:

a. E & E Emergency Response Center:	716/684-8060
b. Corporate Health and Safety Director, Dr. Paul Jonmaire:	716/684-8060 (office) 716/655-1260 (home)
c. Assistant Corporate Safety Director, Tom Siener, CIH:	716/684-8060 (office) 716/662-4740 (home) 716/597-5868 (Cell)

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 301- Sample packaging area

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

Off-Site Assembly Area: N/A

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.

Spill Control Procedures: 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.

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 1. 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.

ecology and environment, inc.

SITE-SPECIFIC HEALTH AND SAFETY PLAN ACCEPTANCE

Project:

Project No.: TDD/PAN No.:

Project Location:

Project Manager: Project Director:

The undersigned acknowledge that they have read and understood and agree to abide by the health and safety plan.

Name (Printed)	Name (Signature)	Date

ATTACHMENT 1

EQUIPMENT/SUPPLIES CHECKLIST

	No.
INSTRUMENTATION	
FID	
Thermal desorber	
O_2/explosimeter w/cal. Kit	X
Photovac tip	
PID (probe: 10.2 eV)	X
Magnetometer	
Pipe locator	
Weather station	
Draeger tube kit (tubes: ____________________)	
Brunton compass	
Real-time cyanide monitor	
Real-time H_2S monitor	
Heat stress monitor	
Noise equipment	
Personal sampling pumps and supplies	
MiniRam dust monitor	
Mercury monitor	
Spare batteries (type: 9V)	X
RADIATION EQUIPMENT/SUPPLIES	
Documentation forms	
Portable ratemeter	
Scaler/ratemeter	
1" NaI gamma probe	
2" NaI gamma probe	
ZnS alpha probe	
GM pancake probe	
Tungsten-shielded GM probe	
Micro R meter	
Ion chamber	
Alert monitor	
Pocket dosimeter	
Dosimeter charger	

	No.
Radiation warning tape	
Radiation decon supplies	
Spare batteries (type: ____________________)	
SAMPLING EQUIPMENT	
8-oz. bottles	X
Half-gallon bottles	
VOA bottles	X
String	
Hand bailers	
Thieving rods with bulbs	
Spoons	
Knives	
Filter paper	
Bottle labels	X
MISCELLANEOUS	
Pump	X
Surveyor's tape	
100' Fiberglass tape	X
300' Nylon rope	
Nylon string	
Surveying flags	
Digital Camera	X
Film	
Bung wrench	
Soil auger	
Pick	
Shovel	
Catalytic heater	
Propane gas	
Banner tape	
Surveying meter stick	

	No.
Chaining pins and ring	
Logbooks (X large, X small)	X
Required MSDSs	X
Intrinsically safe flashlight	
Potable water	X
Gatorade or equivalent	X
Tables	
Chairs	
Weather radio	
Two-way radios	
Binoculars	
Megaphone	
Cooling vest	
EMERGENCY EQUIPMENT	
First aid kit	X
Stretcher	
Portable eye wash	X
Blood pressure monitor	
Fire blanket	
Fire extinguisher	X
Thermometer (medical)	
Spill kit	
DECONTAMINATION EQUIPMENT	
Wash tubs	X
Buckets	X
Scrub brushes	X
Pressurized sprayer	
Spray bottle	X
Detergent (type: alconox)	X
Solvent (type: ______________________)	
Plastic sheeting	X
Tarps and poles	
Trash bags	X
Trash cans	

	No.
Masking tape	
Duct tape	X
Paper towels	X
Face mask	
Face mask sanitizer	
Step ladders	
Distilled water	X
Deionized water	
SHIPPING EQUIPMENT	
Coolers	X
Paint cans with lids, 7 clips each	
Vermiculite	
Shipping labels	X
DOT labels:	
"Up"	
"Danger"	
"Inside Container Complies ..."	
Hazard Group	
Strapping tape	X
Baggies	X
Custody seals	X
Chain-of-custody forms	X
Express shipment forms	X
Clear packing tape	X
Permanent markers	X

Attachment 2

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 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.

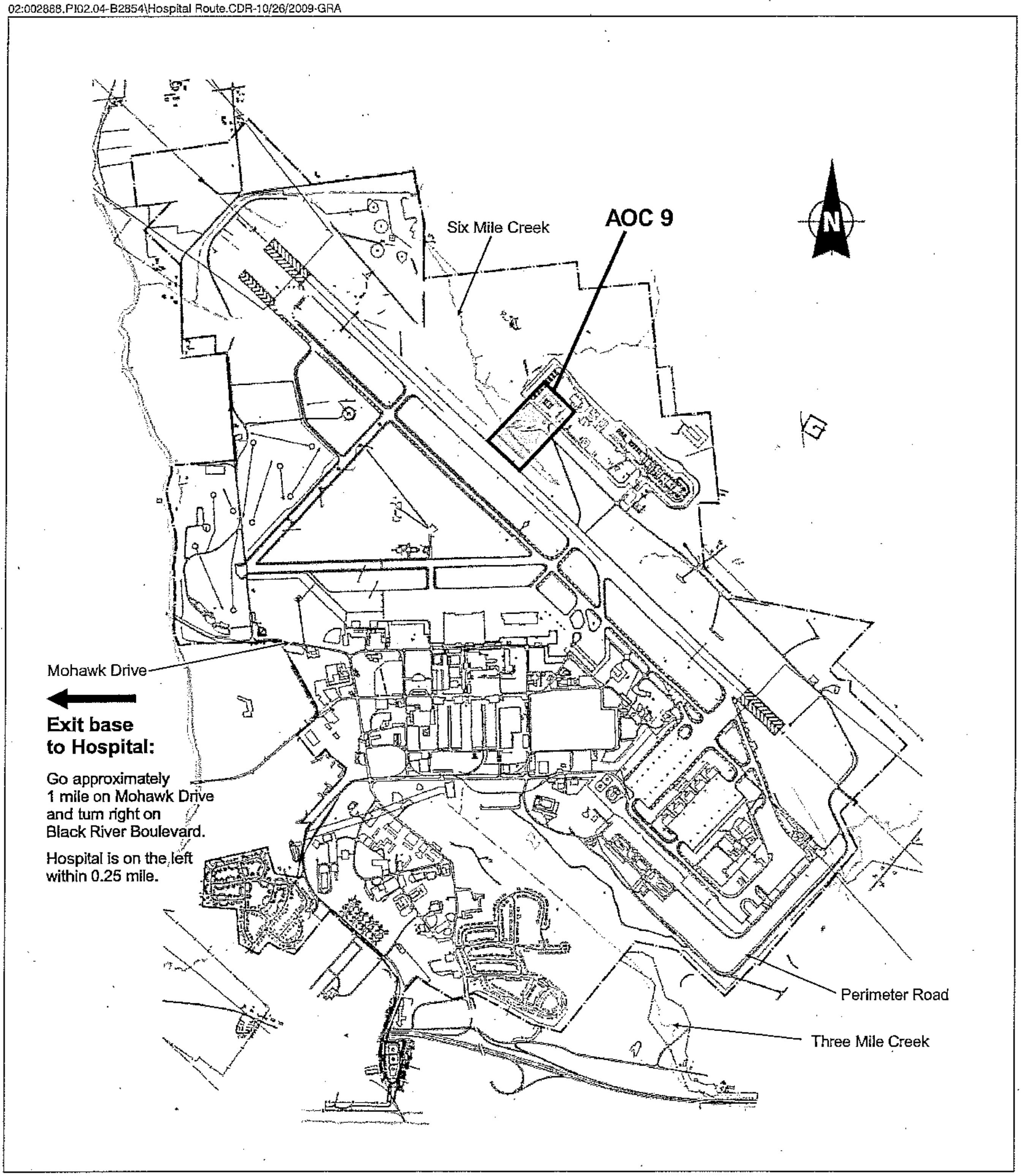
Heat Stroke. Heat stroke is a profound disturbance of the heat-regulating mechanism and is associated with high fever and collapse. It is a serious threat to life and carries a 20% mortality rate. Sometimes this condition results in convulsions, unconsciousness, and even death. Direct exposure to sun, 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



Exit base to Hospital:

Go approximately 1 mile on Mohawk Drive and turn right on Black River Boulevard.

Hospital is on the left within 0.25 mile.

Hospital Route, Former Griffiss Air Force Base, Rome, NY

Attachment 5

Health and Safety on Drilling Rig Operations
(SOP No. H&S 5.3)

Title: HEALTH AND SAFETY ON DRILLING RIG OPERATIONS

Category: H&S 5.3

Revised: September 2008

STANDARD OPERATING PROCEDURE

HEALTH AND SAFETY ON DRILLING RIG OPERATIONS

ecology and environment, inc.
368 Pleasant View Drive / Lancaster, New York 14086 / (716) 684-8060

TITLE: HEALTH AND SAFETY ON DRILLING RIG OPERATIONS

CATEGORY: H&S 5.3 **REVISED:** September 2008

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Section Page

LIST OF FIGURES

TITLE: HEALTH AND SAFETY ON DRILLING RIG OPERATIONS

CATEGORY: H&S 5.3 **REVISED:** September 2008

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.

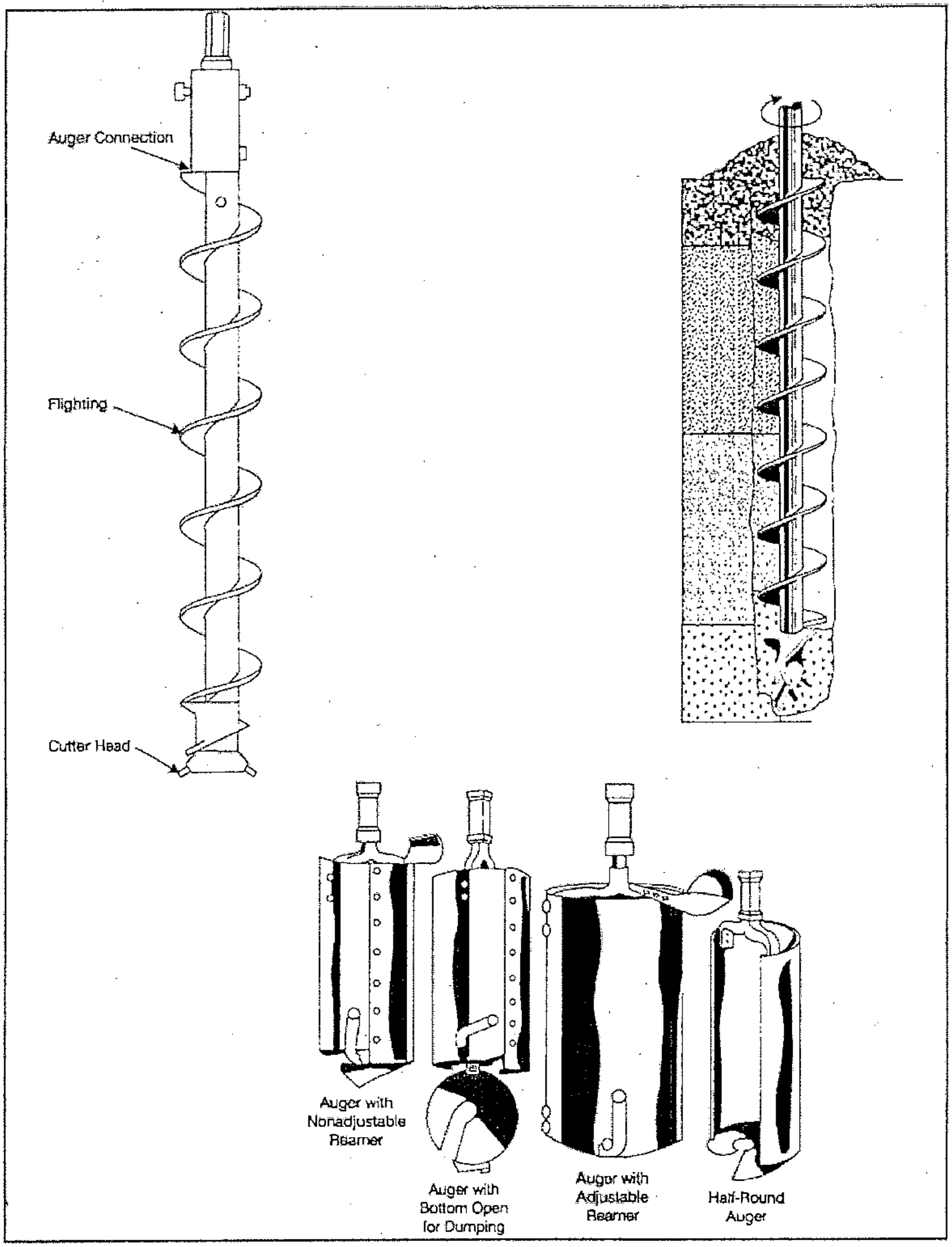

Figure 1 Solid Flight and Bucket Augers

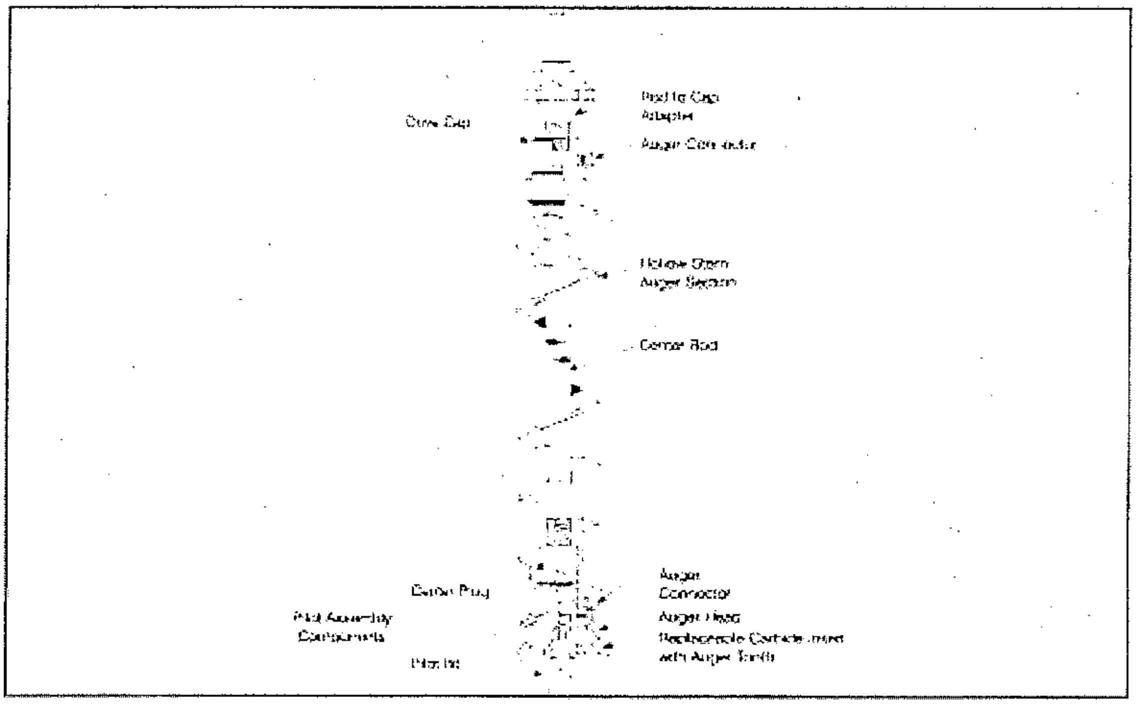

Figure 2 Hollow-Stem Auger

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.

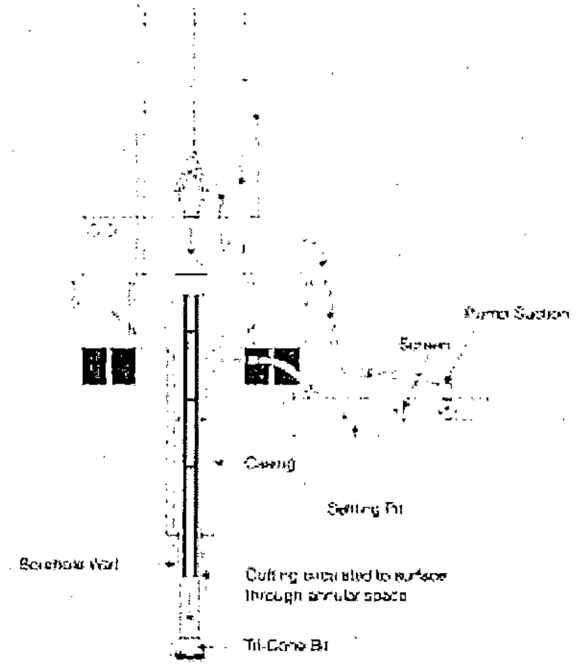

Figure 3 Open-Hole Rotary Method

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.

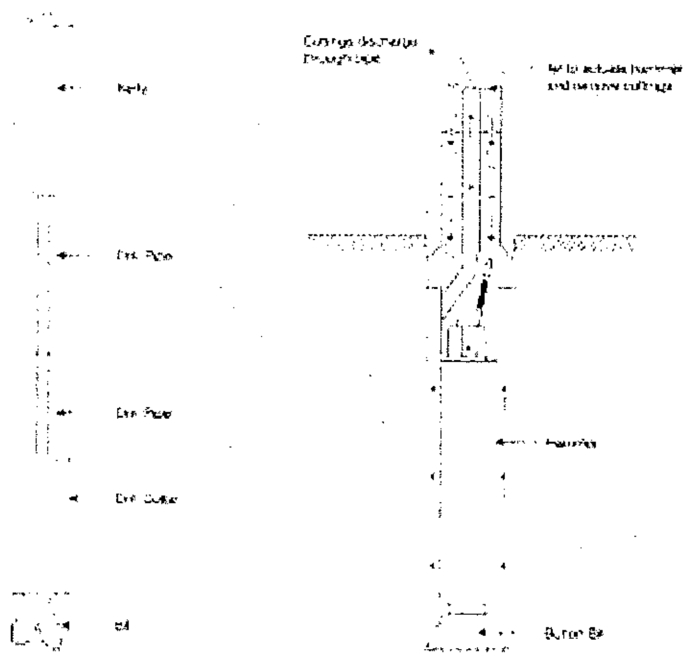

Figure 4 Direct Air Rotary

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.

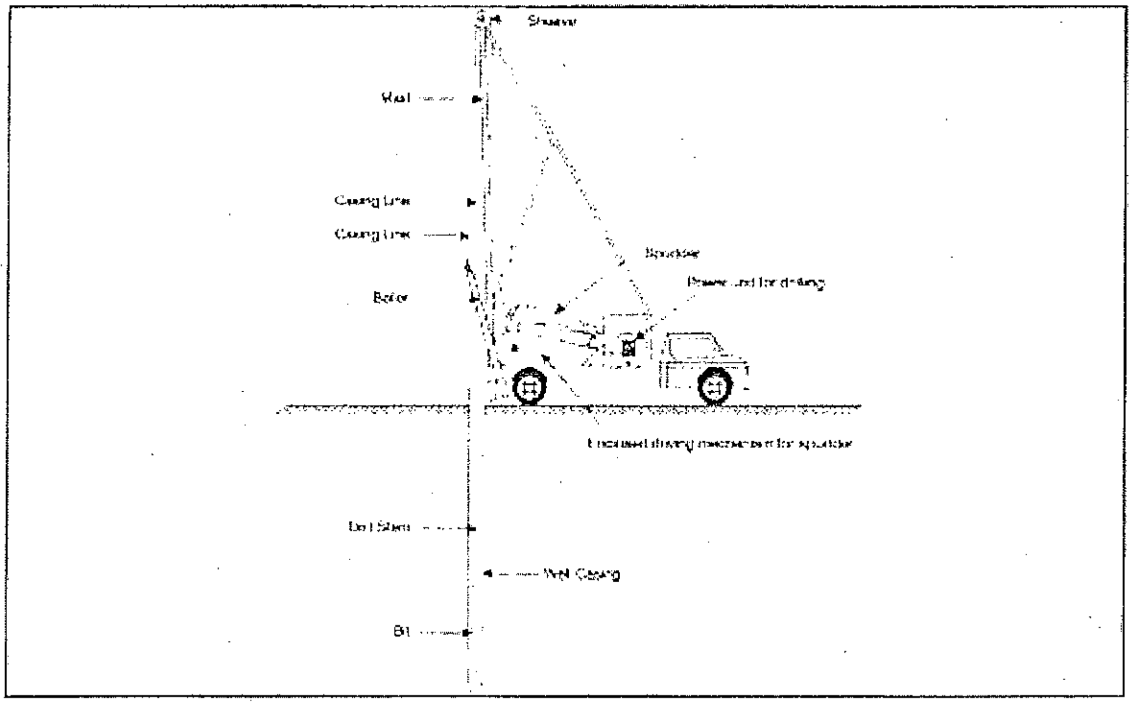

Figure 5 Cable Tool Drill Rig

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).

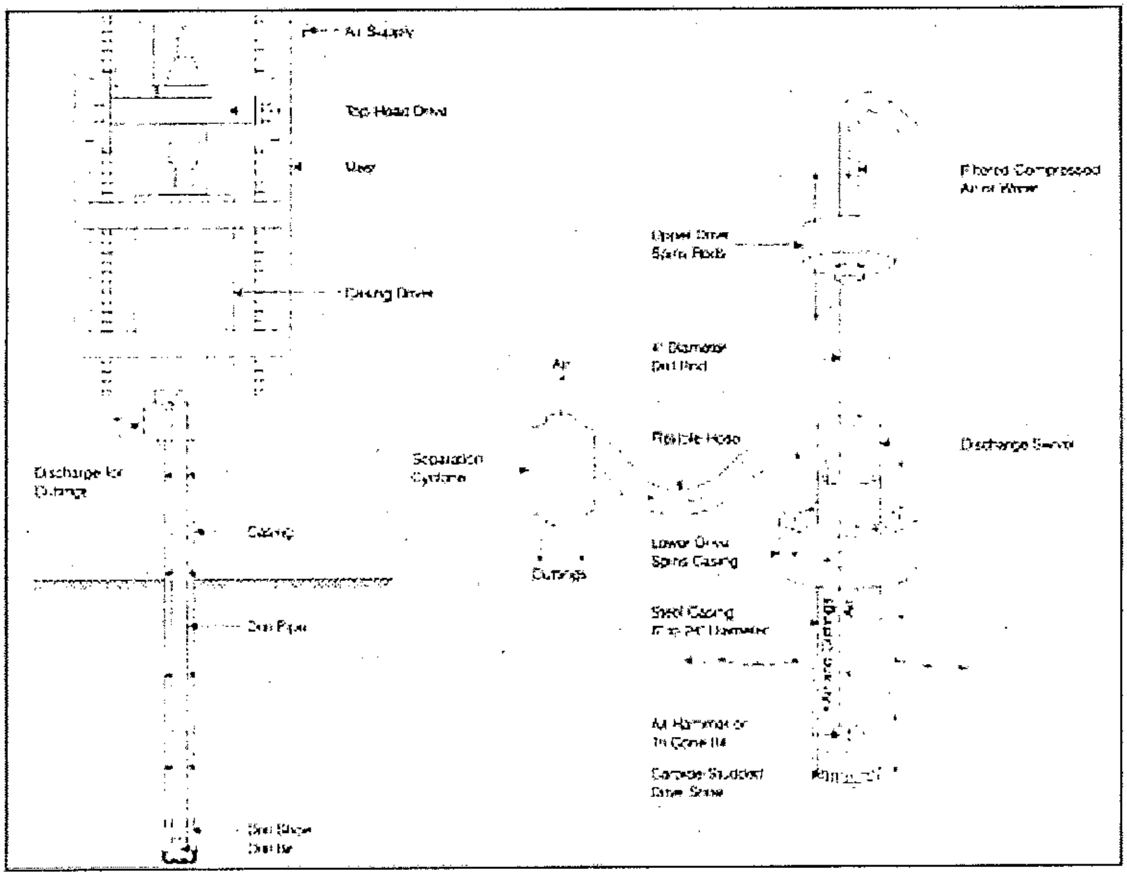

Figure 6 Casings

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.

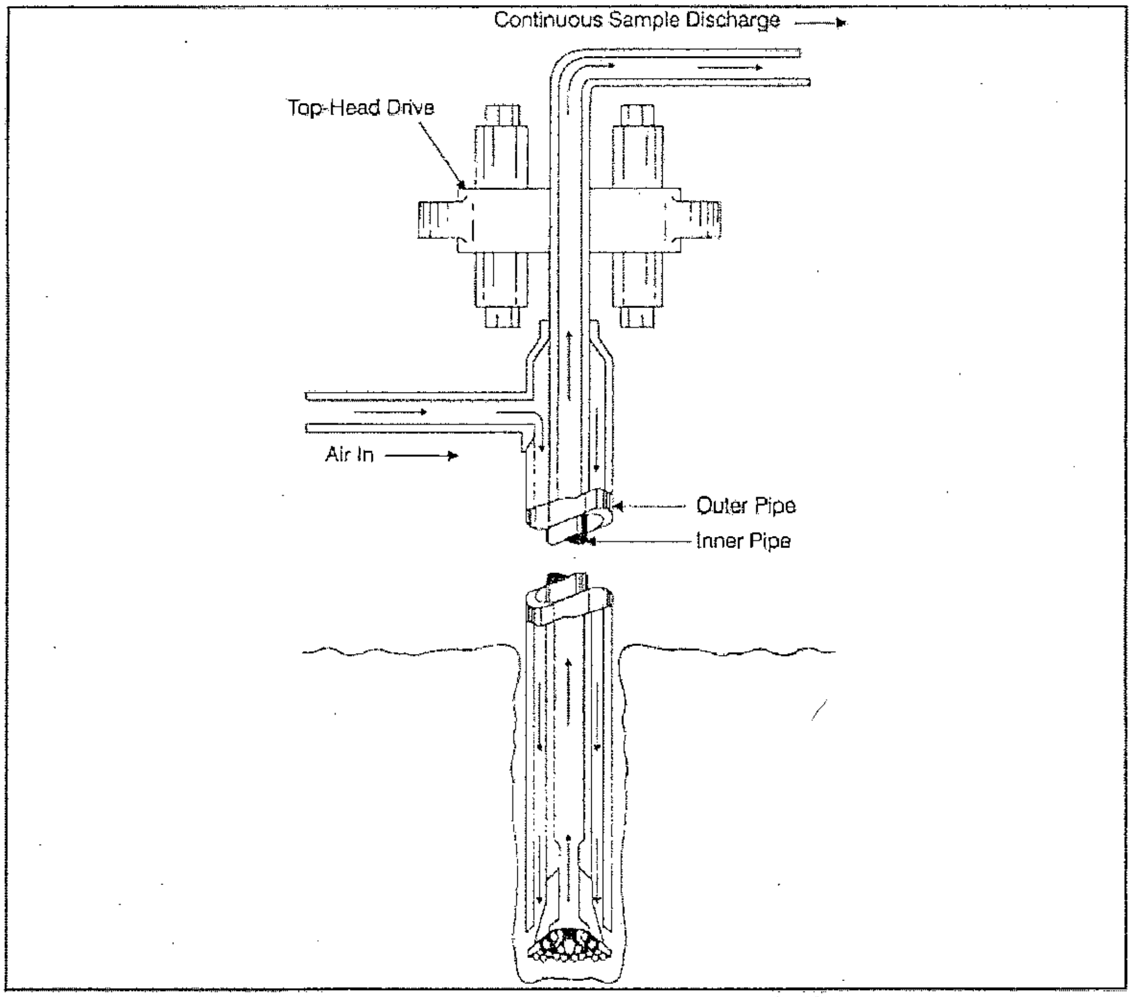

Figure 7 Reverse Circulation Rotary Method

6.7 Sonic Drilling

The sonic drill rig is similar to other drilling rigs in that it is a machine attached to a frame mounted on some type of vehicle. Sonic drilling is the use of high frequency vibration used in conjunction with down pressure and rotation to advance drilling tools through subsurface formations (see Figure 8). The use of high frequency vibration through the drilling tools causes the formation materials to vibrate at their natural frequencies allowing the drilling tool (casing) to advance by fracturing, shearing or displacing formation material. Most sonic drilling is utilized for drilling in unconsolidated material. However, sonic drilling can also be used for drilling and sampling of rock formations.

During drilling, unconsolidated samples are collected using a sample (or core) barrel. Core barrels are either solid tubes or split barrels of various diameters and lengths generally sized to match the inside diameter of the drill casing being utilized. Typical core barrels are 10 to 20 feet in length and casing sizes range from 0.5 inches to 12 inches, although 4 to 6 inch casing is typical. The core barrel is fitted with a drill bit/cutting shoe, and the sampler is placed within the outer casing material and attached to the rig by drilling rods. As the borehole is advanced, formation material is collected within the core barrel.

Following the sampling run (typically 10 to 20 feet), the core barrel is extracted from the well casing. Formation material is then extracted from the core barrel. Typically, sample material is extracted into a plastic sleeve, which is separated into convenient lengths for logging. The process of sonic drilling and sample collection will cause the sample to be distorted due to vibration, but generally will be intact. In the case of rock drilling, the vibration may create mechanical fractures that can affect the structural analysis for permeability and thereby not reflect the true *in-situ* condition.

The advantages to using sonic drilling technology includes reducing the amount of drill cutting generated, providing rapid formation penetration, and the recovery of a continuous core sample.

Physical Hazards

Noise. Excessive noise is generated from the use of oscillating drill head. Site personnel are required to wear hearing protection during drilling operations.

Overhead Equipment. During drilling operations steel casing (up to 20 foot lengths), core barrels, and drill rods may be hoisted in the air. 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.

Slips/Falls. Site personnel can slip on wet ground around the drill rig or trip over drilling equipment (e.g. wrenches, etc.). Site personnel must keep the drilling location clear of debris and contain spillage prior to and during drilling operation.

Drill Rig Lurching. The drill rig may have a tendency to lurch and shake when the drill casing comes into contact with harder materials. Site personnel should be aware of possible drill rig movement and move away from the rig if lurching or shaking occurs.

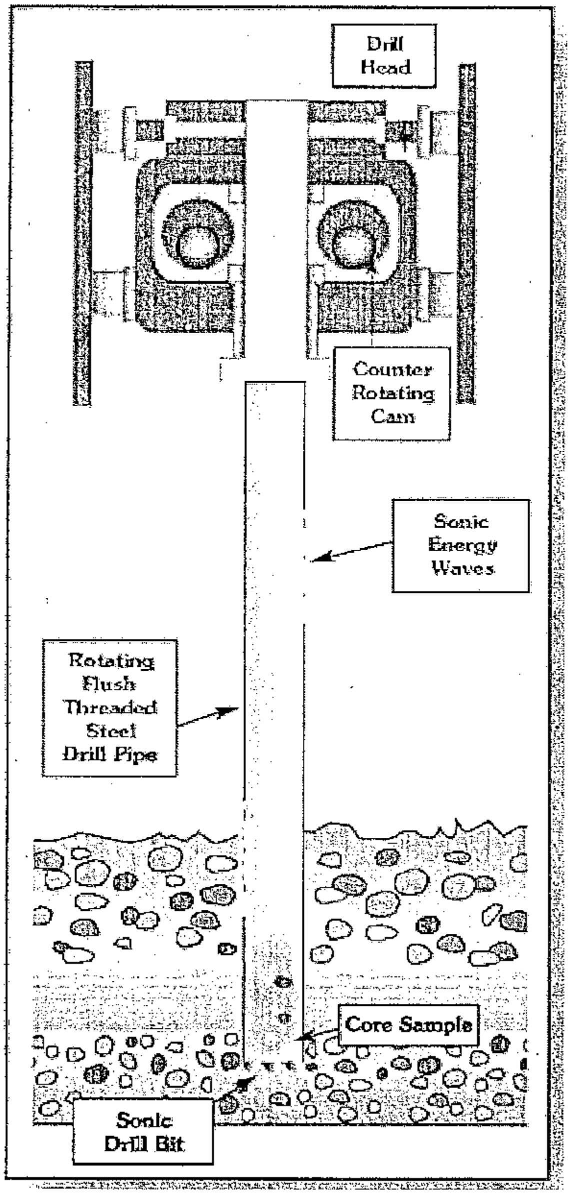

Figure 8 Sonic Drilling Method

Attachment 6

Hazard Evaluation of Chemicals

ecology and environment, inc.

Job No: 1 HAZARD EVALUATION OF CHEMICALS PREPARATION DATE: 4/11/1995

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 FLASH POINT: 84F (28.9C)
FLAMMABLE LIMITS: UPPER - 9.6 %; LOWER - 1.3 %.
VAPOR PRESSURE: 8.8 mm Hg at 68F (20C) FREEZING POINT: -50F BOILING POINT: 132 C (270 F)
ODOR CHARACTERISTIC: Mild almond Incompatabilities: 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:

ecology and environment, inc.

Job No: 1

HAZARD EVALUATION OF CHEMICALS

PREPARATION DATE: 4/11/1995

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:

ecology and environment, inc.

Job No: 1

HAZARD EVALUATION OF CHEMICALS

PREPARATION DATE: 4/11/1995

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:

ecology and environment, inc.

Job No: 1

HAZARD EVALUATION OF CHEMICALS

PREPARATION DATE: 4/11/1995

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:

ecology and environment, inc.

Job No: 1 HAZARD EVALUATION OF CHEMICALS PREPARATION DATE: 4/11/1995

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

Job No: 1

HAZARD EVALUATION OF CHEMICALS

PREPARATION DATE: 4/11/1995

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:

ecology and environment, inc.

Job No: 1

HAZARD EVALUATION OF CHEMICALS

PREPARATION DATE: 4/11/1995

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:

ecology and environment, inc.

Job No: 1 HAZARD EVALUATION OF CHEMICALS PREPARATION DATE: 4/11/1995

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

B

Project-Specific Quality Assurance Project Plan

Project-Specific Quality Assurance Project Plan for Baseline, Performance and Long-Term Monitoring at AOC 9 Former Griffiss Air Force Base Rome, New York

Contract No. W912DQ-09-D-3013

June 2010

Prepared for:

U.S. ARMY CORPS OF ENGINEERS

Prepared by:

ECOLOGY AND ENVIRONMENT ENGINEERING, P.C.
368 Pleasant View Drive
Lancaster, New York 14086

Under Contract to:

PARSONS INFRASTRUCTURE & TECHNOLOGY GROUP, INC.
301 Plainfield Road, Suite 350
Syracuse, NY 13212

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Appendix **Page**

List of Tables

Table **Page**

INTRODUCTION

This QAPP is in addition to the Draft Work Plan issued by Ecology and Environment Engineering, P.C. (EEEPC), under contract to the United States Army Corps of Engineers (USACE), Kansas City District, Contract No. W912DQ-09-R-3013, that will consist of performing baseline, performance, and long-term groundwater monitoring at Area of Concern (AOC) 9 at the former Griffiss Air Force Base (Griffiss AFB) in Rome, New York in order to monitor volatile organic contaminant levels within the groundwater and Six Mile Creek (SMC). It is to be used to address quality control and corrective action procedures in accordance with the above-referenced work.

QAPP Worksheet #1 – Title and Approval Page

Quality Assurance Project Plan (QAPP) for Baseline, Performance, and Long-term Monitoring at AOC 9, Former Griffiss Air Force Base

Document Title

United States Army Corps of Engineers, Kansas City District (USACE)

Lead Organization

Bryan Kroon and Robert Meyers, Ecology and Environment Engineering, P.C. (EEEPC)

Preparer's Name and Organizational Affiliation

368 Pleasant View Drive, Lancaster, NY 14086, 716-684-8060

bkroon@ene.com, rmeyers@ene.com

Preparer's Address, Telephone Number, and E-mail Address

02/18/2010

Preparation Date (Day/Month/Year)

Investigative Organization's Project Manager:

Signature and Date

Robert Meyers/Ecology and Environment

Printed Name/Organization/Date

Investigative Organization's Project QA Officer:

Signature and Date

Marcia Galloway/Ecology and Environment

Printed Name/Organization/Date

Lead Organization's Project Manager:

Signature and Date

Nanci Higginbotham/USACE

Printed Name/Organization/Date

Approval Signatures:

Signature and Date

Approval Authority

Signature
Printed Name/Title/Date

Approval Authority

Other Approval Signatures:

Signature

Printed Name/Title/Organization/Date

QAPP Worksheet #2 – QAPP Identifying Information

Site Number/Code:	Former Griffiss Air Force Base – AOC 9
Contractor Name:	Ecology and Environment Engineering P.C.
Contract Title:	USACE HTRW
Work Assignment Number:	W912DQ-09-D-3013

1. Identify guidance used to prepare QAPP:
   Uniform Federal Policy for Quality Assurance Project Plans (EPA-505-B-04-900B)

2. Identify regulatory program: USACE AOC

3. Identify approval entity: USACE

4. Indicate whether the QAPP is a generic or [✓ a project-specific] QAPP. (Circle one)

5. List dates of scoping sessions that were held:
   General scoping sessions: Daily Feb. 25 through March 2, 2009
   Kick-off Meetings August 11 and 12, 2009
   Regulator Briefing/Kickoff Meeting September 2, 2009

6. List dates and titles of QAPP documents written for previous site work, if applicable:

Title	**Received Date**
Site-Specific Quality Assurance Project Plan (QAPP) Predesign Investigations at landfill 6, Building 817/ WSA, Building 775, and AOC 9	July 2006
Draft - Griffiss OBGW Quality Assurance and Surveillance Plan (QASP)	June 2006

7. List organizational partners (stakeholders) and connection with lead organization:
   - United States Army Corps of Engineers, Kansas City District – Lead Organization
   - Air Force Real Property Agency (AFRPA) – Client
   - United States Environmental Protection Agency (USEPA) Region 2 – Federal Regulators
   - New York State Department of Environmental Conservation (NYSDEC) – State Regulators
   - Parsons Infrastructure & Technology Group Inc. (Parsons)

8. List data users:
   AFRPA, USACE, USEPA, NYSDEC, EEEPC, and Parsons.

9. If any required QAPP elements and required information are not applicable to the project, then circle the omitted QAPP elements and required information on the attached table. Provide an explanation for their exclusion below:

2 QAPP Cross Reference Table

Required QAPP Element(s) and Corresponding QAPP Section(s)	Crosswalk to Required Documents	Optional QAPP Worksheet # in QAPP Workbook	Required Information
Project Management and Objectives			
2.1 Title and Approval Page		1	- Title and Approval Page
2.2 Document Format and Table of Contents 2.2.1 Document Control Format 2.2.2 Document Control Numbering System 2.2.3 Table of Contents 2.2.4 QAPP Identifying Information		2 Table of Contents and List of Table	- Table of Contents - QAPP Identifying Information
2.3 Distribution List and Project Personnel Sign-Off Sheet 2.3.1 Distribution List 2.3.2 Project Personnel Sign-Off Sheet		3 4	- Distribution List - Project Personnel Sign-Off Sheet
2.4 Project Organization 2.4.1 Project Organizational Chart 2.4.2 Communication Pathways 2.4.3 Personnel Responsibilities and Qualifications 2.4.4 Special Training Requirements and Certification		5, 6, 7 8	- Project Organizational Chart - Communication Pathways - Personnel Responsibilities and Qualifications Table - Special Personnel Training Requirements Table
2.5 Project Planning/Problem Definition 2.5.1 Project Planning (Scoping) 2.5.2 Problem Definition, Site History, and Background		9 10	- Project Planning Session Documentation (including Data Needs tables) - Project Scoping Session Participants Sheet - Problem Definition, Site History, and Background - Site Maps (historical and present)
2.6 Project Quality Objectives and Measurement Performance Criteria 2.6.1 Development of Project Quality Objectives Using the Systematic Planning Process 2.6.2 Measurement Performance Criteria		11 12, 15	- Site-Specific PQOs - Measurement Performance Criteria Table Reference Limits and Evaluation Table
2.7 Secondary Data Evaluation		13	- Sources of Secondary Data and Information - Secondary Data Criteria and Limitations
2.8 Project Overview and Schedule 2.8.1 Project Overview 2.8.2 Project Schedule		14 16	- Summary of Project Tasks - Project Schedule/Timeline Table

2 QAPP Cross Reference Table

Required QAPP Element(s) and Corresponding QAPP Section(s)	Crosswalk to Required Documents	Optional QAPP Worksheet # in QAPP Workbook	Required Information
Measurement/Data Acquisition			
3.1 Sampling Tasks			
3.1.1 Sampling Process Design and Rationale		17	- Sampling Design and Rationale
3.1.2 Sampling Procedures and Requirements			- Sample Location Map
3.1.2.1 Sampling Collection Procedures		18	
3.1.2.2 Sample Containers, Volume, and Preservation			- Sampling Locations and Methods/ SOP Requirements Table
3.1.2.3 Equipment/Sample Containers Cleaning and Decontamination Procedures		19	- Analytical Methods/SOP Requirements Table
3.1.2.4 Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures		20	- Field Quality Control Sample Summary Table
3.1.2.5 Supply Inspection and Acceptance Procedures		21	- Project Sampling SOP References Table - Field Equipment Calibration, Maintenance, Testing, and Inspection Table
3.1.2.6 Field Documentation Procedures		22	
3.2 Analytical Tasks			
3.2.1 Analytical SOPs			
3.2.2 Analytical Instrument Calibration Procedures		23	- Analytical SOP References Table
3.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures		24	- Analytical Instrument Calibration Table - Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table
3.2.4 Analytical Supply Inspection and Acceptance Procedures		25	
3.3 Sample Collection Documentation, Handling, Tracking, and Custody Procedures		26	- Sample Collection Documentation Handling, Tracking, and Custody SOPs
3.3.1 Sample Collection Documentation			- Sample Container Identification
3.3.2 Sample Handling and Tracking System			- Sample Handling Flow Diagram
3.3.3 Sample Custody		27	- Sample Custody Requirements
		Lab Specific	- Example Chain-of-Custody Form and Seal
3.4 Quality Control Samples			
3.4.1 Sampling Quality Control Samples			- QC Samples Table
3.4.2 Analytical Quality Control Samples		28	- Screening/Confirmatory Analysis Decision Tree

2 QAPP Cross Reference Table

Required QAPP Element(s) and Corresponding QAPP Section(s)	Crosswalk to Required Documents	Optional QAPP Worksheet # in QAPP Workbook	Required Information
3.5 Data Management Tasks 3.5.1 Project Documentation and Records 3.5.2 Data Package Deliverables 3.5.3 Data Reporting Formats 3.5.4 Data Handling and Management 3.5.5 Data Tracking and Control		29 30	- Project Documents and Records Table - Analytical Services Table - Data Management SOPs
Assessment/Oversight			
4.1 Assessments and Response Actions 4.1.1 Planned Assessments 4.1.2 Assessment Findings and Corrective Action Responses		31 QCP 32	- Assessments and Response Actions - Planned Project Assessments Table - Audit Checklists - Assessment Findings and Corrective Action Responses Table
4.2 QA Management Reports		33	- QA Management Reports Table
4.3 Final Project Report		Work plan	
Data Review			
5.1 Overview			
5.2 Data Review Steps 5.2.1 Step I: Verification 5.2.2 Step II: Validation 5.2.2.1 Step IIa Validation Activities 5.2.2.2 Step IIb Validation Activities 5.2.3 Step III: Usability Assessment 5.2.3.1 Data Limitations and Actions from Usability Assessment 5.2.3.2 Activities		34 35, 36 37	- Verification (Step I) Process Table - Validation (Steps IIa and IIb) Process Table - Validation (Steps IIa and IIb) Summary Table - Usability Assessment
5.3 Streamlining Data Review 5.3.1 Data Review Steps To Be Streamlined 5.3.2 Criteria for Streamlining Data Review 5.3.3 Amounts and Types of Data Appropriate for Streamlining		Not Included/ Not applicable	

QAPP Worksheet #3 – Distribution List

The following personnel will receive the QAPP.

3 Distribution List

QAPP Recipients	Title	Organization	Telephone Number	Fax Number	E-mail Address	Document Control Number
Nanci Higginbotham	Project Manager	USACE	816-389-3359	816-426-5949	Nanci.E.Higginbotham@usace.army.mil	
Douglas Pocze	Project Manager	USEPA Region II	212-637-4432	212-637-3256	pocze.doug@epa.gov	
Heather L. Bishop	Project Manager	NYSDEC	518-402-9692	518-402-9022	hlbishop@gw.dec.state.ny.us	
Catherine Jerrard	Project Manager	AFRPA – Griffiss	315-356-0810	315-356-0816	catherine.jerrard@lackland.af.mil	
John Lanier	Project Manager	Parson Infrastructure and Technology Group	315-451-9560	315-451-9570	john.lanier@parsons.com	
Marcia Galloway	QA Officer	Ecology and Environment	716-684-8060	716-684-0844	mgalloway@ene.com	
Robert Meyers	Project Manager	Ecology and Environment	716-684-8060	716-684-0844	rmeyers@ene.com	
Kate Zaleski	Project Manager	Katahdin Analytical Services	207-874-2400 ext. 17	207-775-4029	kzaleski@katahdinlab.com	
Leslie Dimond	Data Quality Officer	Katahdin Analytical Services	207-874-2400 ext. 20		ldimond@katahdinlab.com	

QAPP Worksheet #4 – Project Personnel Sign-Off Sheet

Organization: USACE

4a Project Personnel Sign-Off USACE

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read Email Receipt
Nanci Higginbotham	Project Manager	816-389-3359		

QAPP Worksheet #4 – Project Personnel Sign-Off Sheet

Organization: Ecology and Environment Engineering, P.C.

4b Project Personnel Sign-Off EEEPC/Parsons

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read Email Receipt
Marcia Galloway	QA Officer	716-684-8060		
Robert Meyers	Project Manager	716-684-8060		
John Lanier	Project Manager	315-451-9560		

QAPP Worksheet #4 – Project Personnel Sign-Off Sheet

Have copies of this form signed by key project personnel from each organization list to indicate that they have read the applicable QAPP sections and will perform the tasks as described. Each organization should forward the signed sheets to the central project file maintained by EEEPC's QA Director. Any new personnel to the project should review and sign the sheet.

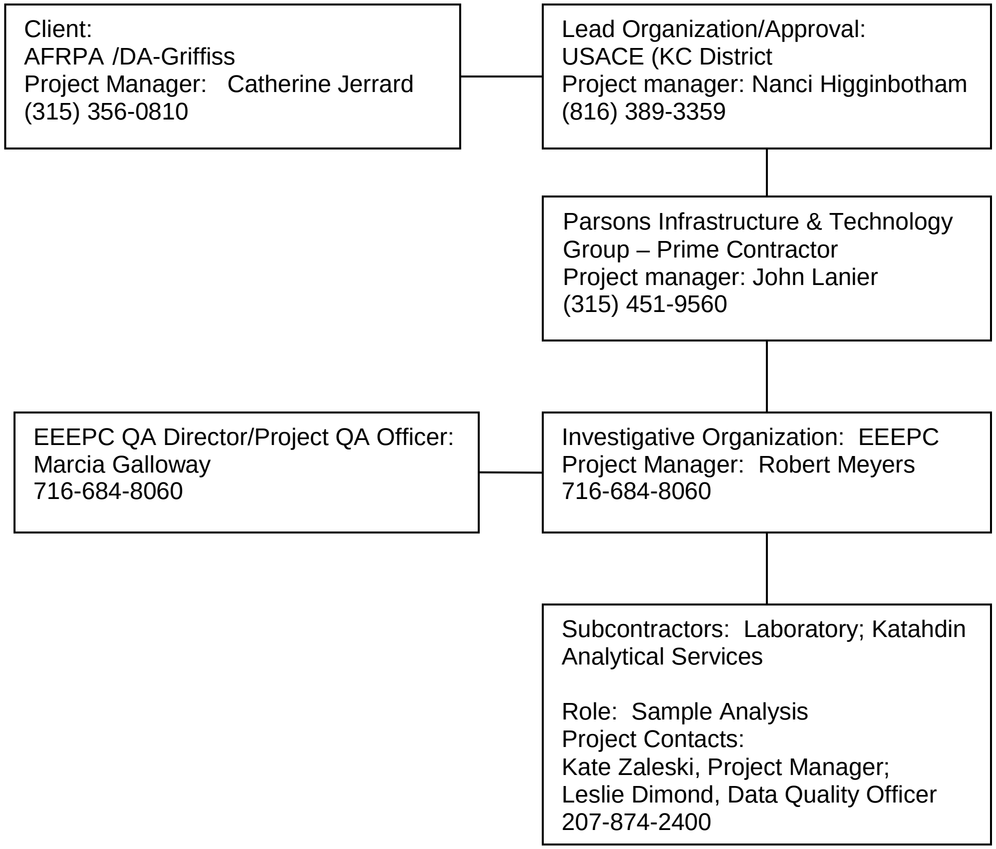
Organization: Katahdin Analytical Services - Laboratory for Groundwater and Surface water Analysis

4c Project Personnel Sign-Off Analytical Laboratory

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read Email Receipt
Kate Zaleski	Project Manager	207-874-2400 ext. 17		
Leslie Dimond	Data Quality Officer	207-874-2400 ext. 20		

QAPP Worksheet #5 – Project Organizational Chart

The following organization chart Identifies reporting relationships between all organizations involved in the project, including the lead organization and all contractors and subcontractor organizations.



Client:
AFRPA /DA-Griffiss
Project Manager: Catherine Jerrard
(315) 356-0810

Lead Organization/Approval:
USACE (KC District
Project manager: Nanci Higginbotham
(816) 389-3359

Parsons Infrastructure & Technology
Group – Prime Contractor
Project manager: John Lanier
(315) 451-9560

EEEPC QA Director/Project QA Officer:
Marcia Galloway
716-684-8060

Investigative Organization: EEEPC
Project Manager: Robert Meyers
716-684-8060

Subcontractors: Laboratory; Katahdin
Analytical Services

Role: Sample Analysis
Project Contacts:
Kate Zaleski, Project Manager;
Leslie Dimond, Data Quality Officer
207-874-2400

QAPP Worksheet #6 – Communication Pathways

The communication pathways and modes of communication that will be used during the project, after the QAPP has been approved, are listed below.

6 Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (timing, pathways, etc.)
Point of Contact with AFRPA and Regulatory Agencies	USACE PM	Nanci Higginbotham	(816) 389-3359	Nanci Higginbotham will keep other stakeholders and regulatory agencies appraised of the project status.
Point of contact with USACE	Prime contractor PM	John Lanier	(315) 451-9560	John Lanier will be facilitator for weekly conference calls with project team and quarterly meetings, and will review a deliverables prior to submittal to USACE.
Manage All Project Milestones	Contractor PM	Robert Meyers	716-684-8060	Robert Meyers will coordinate with Nanci Higginbotham (USACE PM), Catherine Jerrard (AFRPA PM) and John Lanier (Parsons PM), and the EEEPC project team (including subs) on the planning, execution and delivery of all components of the project.
Daily Field Reports	Field Team Leader (FTL)	Julie Rupp or alternate	716-684-8060	FTL will email formal daily reports to Robert Meyers.
Field Quality Issues	FTL	Julie Rupp or alternate	716-684-8060	FTL will call Robert Meyers and EEEPC's QA Officer (Marcia Galloway) to discuss issues.
Field Adjustment Form	FTL	Julie Rupp or alternate	716-684-8060	Changes to the field sampling plan based on field conditions will be documented by the FTL and sent to Robert Meyers; John Lanier and Nanci Higginbotham for real-time approval.
Lab Data Quality Issues – EEEPC subcontract laboratory	Laboratory QA Officer	See Worksheet 4	See Worksheet 4	QA/QC issues will be reported by the Laboratory Subcontractor QA Officer to Marcia Galloway within 2 business days. EEEPC will report any unresolved issues and corrective actions to USACE Project Chemist.
Communication with Sample Analysis Laboratory	Project Manager	See Worksheet 4	See Worksheet 4	General communication will be through Project manager designated as Laboratory's point-of-contact for this program.
Field and Analytical Corrective Actions	Contractor QA Officer	Marcia Galloway	716-684-8060	Marcia Galloway will determine Corrective Actions consulting with Robert Meyers and the FTL or Laboratory subcontractor. QA Officer has stop work authority pending resolution of quality issues.
Release of Analytical Data from EEEPC subcontractor laboratory	Contractor QA Officer	Marcia Galloway	716-684-8060	Marcia Galloway will release data after the appropriate validation has been successfully completed.
QAPP Amendments	Lead Organization PM	Nanci Higginbotham	(816) 389-3359	Major changes (e.g., changes in SOPs included in this document) require approval by USACE before they can be implemented.

QAPP Worksheet #7 – Personnel Responsibilities and Qualifications Table

Project personnel associated with each organization, contractor, and subcontractor and their responsible roles are listed below.

7 Personnel Responsibilities and Qualifications

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Catherine Jerrard	Project Manager	AFRPA	Management of USACE	B.S. Engineering 28 years experience
Nanci Higginbotham	Project Manager	USACE (KC District)	Management of Parsons/ EEEPC	B.S. Civil Engineering, M.S. Engineering 20 years experience
Amy Darpinian	Project Chemist	USACE (KC District)	Oversight of chemistry and laboratory data.	Ph.D. Environmental Chemistry 20 years experience
John Lanier	Project Manager	Parsons	Management of EEEPC	B.S. Chemistry/Math 35 years experience
Timothy Grady, PE	Contract Manager	EEEPC	Oversees project and program requirements	B.S. Civil Engineering, 31 years experience
Robert Meyers, PG	Project Manager	EEEPC	Manages project and field work and coordinates with USACE	B.S. Geology, 21 years experience
Thomas Heins, PE	Project Engineer	EEEPC	Task Manager for all engineering related tasks	M.E. Civil Engineering, B.S. Civil Engineering, 25 years experience
Marcia Galloway	Corporate QA Director	EEEPC	QA oversight – sampling and analytical data, general project deliverables	M.S. Analytical Chemistry, BS Chemistry, 20 years experience
Thomas Siener, CIH	Corporate RCS	EEEPC	Reviews SHASP; Conducts field safety audits	B.S. Biology, 33 years experience
Leslie Dimond	Laboratory QA Officer	Katahdin Analytical Services	Provides Laboratory QA	B.A. Chemistry 15 years experience
Kate Zaleski	Project Manager	Katahdin Analytical Services	Coordination between EEEPC and Laboratory	B.S. in Geosciences and B.A. in Chemistry, 10 years experience
Leslie Dimond	Analytical Data Quality Officer	Katahdin Analytical Services	Provides Analytical QA	B.A. in Chemistry, 15 years experience

QAPP Worksheet #8 – Special Personnel Training Requirements Table

The following information is a list of specialized training requirements for the project for personnel implementing the work performed by EEEPC as documented in the work plan.

8 Special Personnel Training Requirements

Project Function	Specialized Training By Title or Description of Course	Training Provider	Training Date	Personnel/ Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/ Certificates[1]
Sample Shipment	United States Department of Transportation (DOT) hazardous materials transportation	EEEPC	Annual Refresher	EEEPC Field Staff	EEEPC Certified DOT Lead Regional Hazmat Transportation Coordinator	EEEPC , HQ
Sample Collection	40-hour HAZWOPER training program and the cardiopulmonary resuscitation (CPR)/ first aid certification	EEEPC	Annual Refresher	EEEPC Field Samplers	American Red Cross for CPR and First Aide/EEEPC Regional Safety Coordinator for 8 hour refresher training	EEEPC , HQ
Laboratory Analysis	NYSDOH and DoD ELAP Laboratory Certification is required for all analyses subcontracted by EEEPC.	NYSDOH and DOD certify laboratories.	Annual Renewal	Subcontract Laboratory	See Worksheet 4	Original with laboratory and copy with EEEPC QA Director

[1] If training records and/or certificates are on file elsewhere, document their location in this column. If training records and/or certificates do not exist or are not available, then this should be noted.

QAPP Worksheet #9 – Project Scoping Session Participants Sheet

Weekly conference calls have been implemented to discuss all aspects of project scope and progress. A list of the meetings and scoping sessions completed to date is provided below:

9 Project Scoping Session Summary

Date of Session	Scoping Session Purpose	Key Decisions	Minute Locations
Daily Feb. 25 through March 2, 2009	Preparation of Proposal to USACE	Perform source removal with groundwater treatment via chemical oxidation.	Summarized in Proposal to USACE Dated March 2009.
Kick-off Meetings August 11 and 12, 2009	Discuss scope of project with USACE and AFRPA.	Perform source removal with groundwater treatment via chemical oxidation.	Parsons Shared Portal
Regulator Briefing/ Kickoff Meeting September 2, 2009	Discuss scope of project with USEPA and NYSDEC.	Perform source removal with groundwater treatment via chemical oxidation.	Parsons Shared Portal
Weekly conference calls with AFRPA, USACE, Parsons and EEEPC.	Discuss project issues.	Varies by week.	Agenda and document submittal schedule are stored on the Parsons Shared Portal

QAPP Worksheet #10 – Problem Definition

The problem to be addressed by the project:
AOC 9 at the Former Griffiss Air Force Base is a grass-covered area located in the southwest side of the former Weapons Storage Area. This area was formerly a landfill from which the contents were removed prior to development of the Weapons Storage Area (WSA). A mixed plume of chlorobenzenes and trichloroethene (TCE) and its degradation products present in the overburden have been identified as the site contaminants of concern from data gathered during previous Preliminary Design Investigations (PDIs) investigations. The planned remedy for the site includes source excavation and limited in situ groundwater treatment with a persulfate oxidant. Groundwater and surface water monitoring will be performed in three phases (baseline, performance, and long-term).

The objectives of the baseline, performance, and long-term groundwater and surface water monitoring are:

- Baseline groundwater and surface water sampling and analysis will establish baseline volatile organic compound (VOC) concentrations in the groundwater plume and Six Mile Creek (SMC) before remediation begins at AOC 9. Baseline sampling will be conducted in June 2010;

- Performance monitoring will evaluate the short-term effectiveness of the remediation efforts with a total of four semiannual sampling events beginning in October 2011;

- Long-term monitoring will be conducted to monitor the long-term effectiveness of the remediation efforts through annual sampling events for a three-year period;

- Following the first three years of annual long-term monitoring. it is anticipated that monitoring will continue on an every-other-year basis until concentrations of hazardous substances in groundwater are below Remedial Action Objectives (RAOs). Once the RAOs are achieved, the monitoring will again be performed annually until three consecutive rounds of sampling indicate that the concentrations of groundwater contaminants remain below RAOs. At that point, the site should be available for unrestricted use.

The environmental questions being asked:
Have remedial actions met long-term clean-up objectives for the site?

Observations from any site reconnaissance reports:
AOC 9 is a grass-covered area located in the southwest side of the former WSA and lies between an airplane runway to the southwest and extends into the WSA to the northeast. The site was originally farmland in the 1930s and was subsequently converted into a landfill in the 1940s and 1950s after base construction. In addition to the WSA, two munitions storage bunkers were erected in the early 1950s: both have since been removed but were used to house hazardous materials after their use as munitions storage.

A synopsis of secondary data or information from site reports:
Previous site investigations have yielded data that have defined the extent of contamination at the site. These investigations are summarized in Section 1.2.1 of the Work Plan.

The possible classes of contaminants and the affected matrices:
Previous investigations have identified chlorobenzenes and TCE and related compounds as the primary site contaminants in the groundwater plume and soil within the source area. The contaminated soil will be excavated during the remedial action.

Information concerning various environmental indicators:

- Groundwater flow is generally shallow and flows southwest toward SMC.
- Several locations exist where shallow groundwater discharges to the surface.
- Three intermittent drainageways that discharge to SMC exist on the southern portion of the site.
- Based on the PDI, the soil east of Building 913 has been identified as the source of the AOC 9 groundwater contamination.
- A contaminated groundwater plume extends downgradient from the source area for approximately 1,500 feet and covers 8 acres.

Project decision conditions:
Sampling of monitoring wells and surface water locations will evaluate the baseline and the performance of the remedial action (source excavation with 99% soil contamination removal and limited chemical oxidation of the dissolved phase groundwater [GW] plume) after completion. The data collected during each of the proposed sampling events will be used to evaluate the performance of the remedial action by comparing results against both historic data and the baseline sampling results. The surface water/groundwater samples will be screened against the most stringent of either the New York State Department of Environmental Conservation (NYSDEC) Class GA groundwater criteria, or the USEPA maximum contaminant levels (MCLs). The data will then be used to perform trend analysis to determine how contaminant levels change in response to the remedial actions performed.

- Three surface water sample locations will be sampled during the baseline, performance, and long-term monitoring programs. The three surface water (SW) sample locations are positioned in SMC as follows:
  - One SW sample location is positioned upgradient of the groundwater contaminant plume to monitor SW conditions entering the site.
  - The second SW sample location is positioned at the center of where the GW contaminant plume intersects SMC, and
  - The third SW location is positioned downgradient of the site to monitor SW conditions leaving the site.

- Seven existing wells, one proposed upgradient monitoring well, and three surface water locations will be sampled during the baseline sampling event to establish baseline VOC concentrations in the groundwater plume and SMC before remediation begins at AOC 9. The wells are located as follows:

  - Wells G009-MW01 and G009-MW02 will be sampled to establish baseline contaminant concentrations in the lateral portions of the plume and confirm the current width of the contaminant plume.
  - Wells AOC9-MW05 and AOC9-MW06 will function as sentinel wells and will be sampled to establish baseline contaminant concentrations at the leading edge of the contaminant plume downgradient of the remedial action treatment area.
  - Wells AOC9-MW14, AOC9-MW15, and AOC9-MW17 will be sampled to establish baseline contaminant concentrations within the center of the plume in the area being treated during the remedial action (AOC9-MW14) and downgradient of the treatment area (AOC9-MW15 and AOC9-MW17).

  - Upgradient well AOC9-MW18 will be sampled to establish baseline contaminant concentrations upgradient of the groundwater plume.

- Performance monitoring will evaluate the short-term effectiveness of the remediation efforts for two years with a total of four semiannual sampling events. Four existing monitoring wells will be sampled during performance monitoring The wells are located as follows:

  - Well AOC9-MW06 will function as a sentinel well and will be sampled to determine the stability of the leading edge of the contaminant plume and to monitor the effectiveness of the remedial action in the area downgradient of the remedial action treatment area.
  - Wells AOC9-MW14, AOC9-MW15, and AOC9-MW17 will be sampled to monitor the effectiveness of the remedial action in the center of the plume in the area being treated during the remedial action (AOC9-MW14) and downgradient of the treatment area (AOC 9-MW15 and AOC9-MW17).
  - Well AOC9-MW19, a source area well to be installed following excavation, will be sampled to monitor the effectiveness of the remedial action in the center of the source area.

- Seven existing, one proposed upgradient, and one proposed source area monitoring well will be sampled during the long-term monitoring to monitor the long-term effectiveness of the remediation efforts. The wells are located as follows:

  - Wells G009-MW01 and G009-MW02 will be sampled to monitor the width of the contaminant plume and the effectiveness of the remedial action in the lateral portions of the plume.
  - Wells AOC9-MW05 and AOC9-MW06 will function as sentinel wells and will be sampled to monitor the stability of the leading edge of the contaminant plume and the effectiveness of the remedial action in the area downgradient of the remedial action treatment area.
  - Wells AOC9-MW14, AOC9-MW15, and AOC9-MW17 will be sampled to monitor the effectiveness of the remedial action (AOC9-MW14) and downgradient of the treatment area (AOC0-MW15 and AOC9-MW17).
  - Well AOC9-MW18 will be sampled to monitor contaminant concentrations upgradient of the groundwater plume.
  - Well AOC9-MW19 will be sampled to monitor the effectiveness of the remedial action in the center of the source area.

QAPP Worksheet #11 – Project Quality Objectives/Systematic Planning Process Statements

Who will use the data?

- The data will be used by AFRPA in conjunction with the USACE.

What will the data be used for?

- Establish baseline VOC concentrations in the groundwater plume and SMC before remediation begins at AOC 9.
- Performance monitoring will evaluate the short-term effectiveness of the remediation efforts.
- Long-term monitoring will evaluate the long-term effectiveness of the remediation efforts.

What type of data is needed (matrix, target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques)?

- Off-site laboratory techniques to be utilized for VOC analysis of groundwater and surface water samples.
- Groundwater samples will be collected using USEPA low-flow methodology.
- Surface water samples will be collected as described in Section 3.4 of the Work Plan.
- Purge water collected from monitoring wells during well development and prior to sampling will be field-screened with either a photoionization detector (PID) or a flame ionization detector (FID).
- Laboratory data will be compared with historical site data and with NYSDEC Class GA groundwater standards/USEPA MCLs.
- Soil and groundwater (investigation-derived waste [IDW]) generated during the monitoring well drilling, development, and sampling will be field-screened as described in Section 3.7 of the work plan. It is not anticipated that off-site disposal of the IDW will be required because the wells are being installed into either clean fill material or upgradient of the groundwater plume or have previously been sampled several times and have not required off-site disposal. If any IDW that is generated does require off-site disposal based on field screening, the appropriate samples will be collected and analyzed for toxicity characteristic leaching procedure (TCLP) VOCs, and this QAPP will be updated accordingly.

How “good” do the data need to be in order to support the environmental decision?

- All contaminants need to be detected below site cleanup goals (NYSDEC Class GA groundwater standards/USEPA MCLs). Reporting limits will be below these values.

How much data are needed (number of samples for each analytical group, matrix, and concentration)?

- The Work Plan for AOC 9 includes a comprehensive discussion of data quantity. See Section 2.1 and Table 2-1 in the Work Plan for the planned samples for the three phases of this investigation.

Where, when, and how should the data be collected/generated?

- Groundwater and surface water monitoring will be performed in three phases (baseline, performance and long-term). The groundwater samples will be collected using USEPA low-flow sampling techniques. The surface water samples will be collected as described in Section 3.4 of the Work Plan.

The objectives for the baseline, performance, and long-term groundwater and surface water monitoring are:

- Establish baseline VOC concentrations in the groundwater plume and SMC before remediation begins at AOC 9, through a sampling event in June 2010;

- Performance monitoring will evaluate the short-term effectiveness of the remediation efforts through four semiannual sampling events beginning in October 2011; and

- Long-term monitoring will evaluate the long-term effectiveness of the remediation efforts through annual sampling events for a three-year period beginning in October 2013.

- All samples collected will be analyzed by Katahdin Analytical Services and the data produced in accordance with the DoD and NYS Environmental Laboratory Approval Program (ELAP) certification programs.

Who will collect and generate the data?

- Groundwater and surface water data will be generated by Katahdin Analytical Services.
- Field sampling, and water quality measurements will be performed by an EEEPC field team.

How will the data be reported?

- Analytical data from off-site analysis will be reported via electronic and hard copy data deliverables.
- Field data will be recorded in field logs and forms.
- All data will be presented in the sampling summary reports after sampling events have occurred.
- Electronic data will be provided in accordance with 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)

How will the data be archived?

- Hard copies will be stored at EEEPC's headquarters building in Lancaster, NY for five years.
- Electronic copies of all reports and appendices will be submitted to AFRPA and the USACE and uploaded to the Air Force Center for Environmental Excellence (AFCEE) ERPIMS.

QAPP Worksheet #12 – Measurement Performance Criteria Table

The data quality indicators (DQIs) for parameters for remedial investigation were assigned based on professional judgment to be used as a goal for determination of data usability. There are no specific guidelines or standards for establishment of these values. Each data set will be evaluated for any non-conformance issues and final determination of rejected data will be made by the project team. Laboratory QC criteria for methods are provided in laboratory SOPs in Appendix B.

12 Measurement Performance Criteria for VOCs

Sampling Procedure[2]	Analytical Method/ SOP[3]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S & A)
Matrix:	Groundwater and Surface water	**Analytical Group[1]:**	VOCs	**Concentration Level:**	Low
See Work Plan Section 3. USEPA Region II Low-flow purging and sampling.	SW-846 5030B, 8260B / CA-202	Contaminants groundwater cleanup levels (parts per billion) are compared with site cleanup goals.	Accuracy near the clean-up level should be within 20%. Accuracy at high concentrations can be within 40%. False negatives are critical.	Laboratory blanks, laboratory control sample (LCS), matrix spike/matrix spike duplicates (MS/MSD) and calibration standards.	Sampling 20% Analytical 20% Sampling and Analytical 40%

[1] If information varies within an analytical group, separate by individual analyte.

QAPP Worksheet #13 – Secondary Data Criteria and Limitations Table

13 Secondary Data Criteria and Limitations

Secondary Data	**Data Source** (originating organization, report title and date)	**Data Generator(s)** (originating organization, data types, data generation / collection dates)	How Data Will Be Used	Limitations on Data Use
Historical Data	Ecology and Environment AOC 9 RI, May 2004. Ecology and Environment and Parsons previous predesign investigation results.	EEEPC and Parsons, analytical data collected during the RI (EEEPC 2004) and predesign investigation (EEEPC/Parsons 2006 through 2007).	Evaluation of baseline and performance of the remedial action	No limitations on data use. All data have been collected under previously approved sampling and analysis programs.

QAPP Worksheet #14 – Summary of Project Tasks

The specific project tasks addressed in this project include:

- Site Planning Tasks
  - Scope of Work Development
  - Preparation of Feasibility Study (FS) Addendum
  - Preparation of Proposed Plan (PP)
  - Preparation of Record of Decision (ROD)
  - Baseline, Performance, Long-term Monitoring Work Plan Development
  - Health and Safety Plan Preparation
  - Quality Assurance Project Plan Preparation
  - Remedial Design Preparation
- Perform Remedial Action
- Monitoring Well Installation
  - Mobilization
  - Decontamination
  - Well Development
  - Field Documentation
  - Investigation-Derived Waste Management
- Baseline, Performance, and Long-term Monitoring
  - Mobilization
  - Decontamination
  - Groundwater Sampling
  - Surface water Sampling
  - Documentation and Sample Handling
  - Collection of Field QC Samples
  - Investigation-Derived Waste Management
- Laboratory Analysis
- Data Review and Assessment
  - Data Validation
  - Loading Data to AFCEE ERPIMS
- Sampling event reports to USACE and AFRPA

QAPP Worksheet #15 – Reference Limits and Evaluation Table

The following worksheet identifies the target analytes/contaminants of concern (COCs). The quantitation limits (QLs) that must be met to achieve the project quality objectives and quantitation limits from reference methods also are listed.

15 Reference Limits for Low Level Volatile Organic Compounds in Groundwater and Surface water

CLP No.	COC	Analyte	CAS Number	Project Action Limit	Project QL Goal[1]	Analytical Method QLs[1]	Achievable Laboratory Limits[2]		NYSDEC Class GA Groundwater Standards[3] (µg/L)	USEPA MCL[3] (µg/L)
				µg/L	µg/L	µg/L	MDLs	QLs		
1		Dichlorodifluoromethane	75-71-8	—	1	0.5	0.24	2.0	—	—
2		Chloromethane	74-87-3	5	1	0.5	0.36	2.0	5	—
3		Vinyl chloride	75-01-4	2	1	0.5	0.25	2.0	2	2
4		Bromomethane	74-83-9	5	1	0.5	0.49	2.0	5	—
5		Chloroethane	75-00-3	5	1	0.5	0.55	2.0	5	—
6		Trichlorofluoromethane	75-69-4	—	1	0.5	0.24	2.0	—	—
7		1,1-Dichloroethene	75-35-4	5	1	0.5	0.35	1.0	5	—
8		1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	—	1	0.5	0.31	1.0	—	—
9		Acetone	67-64-1	50	5	5	2.21	5.0	50	—
10		Carbon disulfide	75-15-0	60	1	0.5	0.25	1.0	60	—
11		Methyl acetate	79-20-9	—	1	0.5	0.53	1.0	—	—
12		Methylene chloride	75-09-2	5	1	0.5	1.13	5.0	5	—
13		trans-1,2-Dichloroethene	156-60-5	5	1	0.5	0.25	1.0	5	100
14		Methyl tert-butyl ether	1634-04-4	10	1	0.5	0.60	1.0	10	—
15		1,1-Dichloroethane	75-34-3	5	1	0.5	0.21	1.0	5	—
16		cis-1,2-Dichloroethene	156-59-2	5	1	0.5	0.21	1.0	5	70
17		2-Butanone	78-93-3	50	5	5	1.31	5	50	—
18		Bromochloromethane	74-97-5	—	1	0.5	0.21	1.0	—	—
19		Chloroform	67-66-3	7	1	0.5	0.32	1.0	7	—
20		1,1,1-Trichloroethane	71-55-6	5	1	0.5	0.20	1.0	5	200
21		Cyclohexane	110-82-7	—	1	0.5	0.31	1.0	—	—
22		Carbon tetrachloride	56-23-5	5	1	0.5	0.22	1.0	5	5
23		Benzene	71-43-2	1	1	0.5	0.26	1.0	1	5
24		1,2-Dichloroethane	107-06-2	0.6	1	0.5	0.20	1.0	0.6	5
25		1,4-Dioxane	123-91-1	—	2	2	8.8	100	—	—

15 Reference Limits for Low Level Volatile Organic Compounds in Groundwater and Surface water

CLP No.	COC	Analyte	CAS Number	Project Action Limit	Project QL Goal[1]	Analytical Method QLs[1]	Achievable Laboratory Limits[2]		NYSDEC Class GA Groundwater Standards[3] (µg/L)	USEPA MCL[3] (µg/L)
				µg/L	µg/L	µg/L	MDLs	QLs		
26		Trichloroethene	79-01-6	5	0.5	0.5	0.28	1.0	5	5
27		Methylcyclohexane	108-87-2	—	1	0.5	0.30	1.0	—	—
28		1,2-Dichloropropane	78-87-5	1	1	0.5	0.25	1.0	1	5
29		Bromodichloromethane	75-27-4	50	1	0.5	0.33	1.0	50	—
30		cis-1,3-Dichloropropene	10061-01-5	0.4	1	0.5	0.19	1.0	0.4	—
31		4-Methyl-2-pentanone	108-10-1	—	5	5	1.32	5.0	—	—
32		Toluene	108-88-3	5	1	0.5	0.27	1.0	5	1,000
33		trans-1,3-Dichloropropene	10061-02-6	0.4	1	0.5	0.20	1.0	0.4	—
34		1,1,2-Trichloroethane	79-00-5	1	0.5	0.5	0.33	1.0	1	5
35		Tetrachloroethene	127-18-4	5	5	5	0.90	1.0	5	5
36		2-Hexanone	591-78-6	50	1	0.5	1.70	5	50	—
37		Dibromochloromethane	124-48-1	50	1	0.05	0.30	1.0	50	—
38		1,2-Dibromoethane	106-93-4	—	1	0.5	0.22	1.0	—	—
39		Chlorobenzene	108-90-7	5	1	0.5	0.22	1.0	5	100
40		Ethylbenzene	100-41-4	5	1	0.5	0.21	1.0	5	700
41		o-Xylene	95-47-6	5	1	0.5	0.25	1.0	5	10,000[4]
42		m,p-Xylene	179601-23-1	5	1	0.5	0.59	2.0	5	10,000[4]
43		Styrene	100-42-5	5	1	0.5	0.23	1.0	5	100
44		Bromoform	75-25-2	50	1	0.5	0.23	1.0	50	—
45		Isopropylbenzene	98-82-8	—	1	0.5	0.23	1.0	—	—
46		1,1,2,2-Tetrachloroethane	79-34-5	5	1	0.5	0.38	1.0	5	—
47		1,3-Dichlorobenzene	541-73-1	3	1	0.5	0.26	1.0	3	—
48		1,4-Dichlorobenzene	106-46-7	3	1	0.5	0.24	1.0	3	—
49		1,2-Dichlorobenzene	95-50-1	3	1	0.5	0.15	1.0	3	—
50		1,2-Dibromo-3-chloropropane	96-12-8	0.2	1	0.05	0.50	1.0	—	0.2
51		1,2,4-Trichlorobenzene	120-82-1	5	1	0.5	0.37	1.0	5	70
52		1,2,3-Trichlorobenzene	87-61-6	—	1	0.5	0.20	1.0	—	—

[1] Analytical MDLs and QLs are those documented in validated methods.

[2] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method.

[3] Achievable laboratory limits should be below these criteria. Project QL goals are set to achieve this objective.

[4] Listed value is for total xylenes.

QAPP Worksheet #16 – Project Schedule / Timeline Table

The project activities that will be performed during the course of the project are listed below. A master schedule will be maintained by Parsons and updated as needed. The major tasks related to the QAPP are summarized below.

16 Project Schedule/Timeline

Activities	Organization	Anticipated Date(s) of Initiation	Anticipated Date of Completion	Deliverable	Deliverable Due Date
Develop Draft QAPP	EEEPC	October 2009	February 2010	Draft QAPP	Feb. 24, 2010
Draft Work Plan	EEEPC	October 2009	February 2010	Draft Work Plan	Feb. 24, 2010
Final Work Plan/ QAPP	EEEPC	March 2010	March 2010	Final Work Plan/QAPP	June 1, 2010
Baseline, Performance, and Long-term Field Monitoring	EEEPC	April 2010	2016	Data Summary Reports including, Field Logbooks and Daily Reports	Three months after completion of sampling events.
Sample Analysis from Field Investigations	Katahdin Analytical Services	April 2010	2016	CLP-like Data Package and EDD in ADR Format	28 days from sample receipt
Field Investigation Sample Analysis Review	EEEPC	May 2010	2016	Validated Data and supporting memos	14 days from receipt of last data package

QAPP Worksheet #17 – Sampling Design and Rationale

Section 2 of the Work Plan provides a complete discussion of sampling design and rationale.

QAPP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table

Groundwater and surface water sampling locations are listed in Table 2-1 and on Figures 1-2, 1-3, and 1-4 of the Work Plan. Sampling methods are described in Section 3 and documented in Appendix A of the Work Plan.

QAPP Worksheet #19 – Analytical SOP Requirements Table

For each matrix, analytical group, and concentration level, analytical and preparation method/SOP and associated sample volume, container specifications, preservation requirements, and maximum holding time are listed below.

19 Sampling Container and Preservative Summary

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference[1]	Sample Size	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Groundwater	TCL VOCs	Low	SW-846 5030B, 8260B / CA-202	40 mL	(3) 40 mL VOA Vials	pH<2 with HCl, Cool 4°C	14 days
Surface Water	TCL VOCs	Low	SW-846 5030B, 8260B / CA-202	40 mL	(3) 40 mL VOA Vials	pH<2 with HCl, Cool 4°C	14 days

[1] Specify the appropriate reference letter or number from the Analytical SOP References (Worksheet #23).

Key:
HCL = Hydrochloric Acid.
mL = Milliliter.
TCL = Target Compound List.
VOCs = Volatile Organic Compounds.

QAPP Worksheet #20 – Field Quality Control Sample Summary Table

Table 2-1 of the Baseline, Performance and Long-term Monitoring Work Plan summarizes, by matrix and analytical group, the number of field QC samples to be collected and sent to the laboratory.

Matrix	Analytical Group	Conc Level	Analytical and Preparation SOP Reference[1]	No. of Sampling Locations	No. of Field Duplicate Pairs	No. of MS/MSD	No. of Equip. Blanks[2]	Total No. Trip Blank of Samples
Groundwater and Surface water	TCL VOCs	Low	SW-846 5030B, 8260B / CA-202	See WP Table 2-1	11 - 1 per 10 samples or 10%	8 - 1 per 20 samples or 5%.	0	8 - One per sampling event
IDW (purge water)	TCL VOCs	Low	SW-846 5030B, 8260B / CA-202	TBD	0	0	0	0

QAPP Worksheet #21 – Project Sampling SOP References Table

The SOPs associated with project sampling are listed below. Routine sampling SOPs for EEEPC field personnel are stored on EEEPC's intranet site.

21 Project Sampling SOP References

Reference Number	Title, Revision Date and / or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
See Work Plan Appendix	USEPA Region II Low-Flow Sampling SOP	USEPA Region II	See SOP	N	
Env 3.7	Groundwater Well Sampling	EEEPC		N	
Env 3.15	Sampling Equipment Decontamination	EEEPC		N	
Work Plan Sec. 3.4	Surface Water Sampling Method	EEEPC		N	

QAPP Worksheet #22 – Field Equipment Calibration, Maintenance, Testing, and Inspection Table

The field equipment and instruments (other than analytical instrumentation) that require calibration, maintenance, testing, or inspection are summarized below.

22 General Field Equipment and Calibration Procedures

Instrument or Equipment	Description[a]	Field Calibration Procedure	Acceptability/ Performance Criteria	Responsible Personnel
Organic Vapor Meter (photo-ionization detector)	The PID is a portable, non-destructive trace gas analyzer. Units for site characterization must have a range of 0 to >2,000 ppm and a 10.6 or 11.7 eV lamp (e.g., MiniRAE 2000). Calibration check gas (e.g., isobutylene) must be provided with unit if field calibration is required.	In the field, PIDs will be calibrated at the start of each day if a significant change in weather occurs during the day (i.e., change in humidity or temperature) or if the unit is turned off for an extended period. When a PID is used to screen samples in the field, periodic ambient readings will also be recorded in the logbook. The calibration procedure is described in the instrument operations manual that must be supplied with each unit. Initial calibration must be verified by a certificate of calibration from the rental company or field calibration is required.	Meter must give consistent background readings.	Site Safety Officer, Project Geologist, Sampler
pH, Conductivity, Dissolved Oxygen, Redox potential, Temperature Meter	QED Model MP20 meter or equivalent designed for field use with battery operation. The unit contains separate pH, temperature, and conductivity probes in one unit.	Before use, the pH, conductivity, dissolved oxygen (DO), and redox potential (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 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.	pH ± 0.01 pH Conductivity at ± 2% FSD The instrument will be checked with a pH standard every 4 hours and at the end of the sampling day. If the response is greater than 0.2 units more or less than the standard, complete calibration will be conducted.	Project Geologist, Sampler

22 General Field Equipment and Calibration Procedures

Instrument or Equipment	Description[a]	Field Calibration Procedure	Acceptability/ Performance Criteria	Responsible Personnel
Turbidity Meter	HACH 2100P Turbidity Meter or equivalent designed for field use with battery operation. Range 0.01 to 1,000 NTU.	The unit is factory-calibrated. Field procedures involve checking the unit's responsiveness at least once a day using factory-supplied standards. The responsiveness should be checked on the 0 to 10 range, 0 to 100 range, and 0 to 1,000 range.	Turbidity ± 10%	Sampler

[a] Description is for typical equipment; equivalent units may be used.

QAPP Worksheet #23 – Analytical SOP References Table

This worksheet is completed for each laboratory that is performing analysis. A copy of the SOPs for analysis is provided in the Appendix B. Analytical SOPs are not provided.

23 Analytical SOP Reference: Katahdin Analytical Services

Reference Number	**Title, Revision Date, and / or Number**	**Definitive or Screening Data**	**Analytical Group**	**Instrument**	**Organization Performing Analysis**	**Modified for Project Work?** (Y/N)
CA-101	Equipment Maintenance, 08/09, Revision 8.	Definitive	VARIOUS	Various	Katahdin Analytical Services, Inc.	N
CA-202	Analysis of VOAs by Purge and Trap GC/MS: SW-846 Method 8260, 08/09, Revision 10.	Definitive	GW, AQ / VOC	GC/MS	Katahdin Analytical Services, Inc.	N
SD-902	Sample Receipt and Internal Control, 08/09, Revision 8.	N/A	VARIOUS	N/A	Katahdin Analytical Services, Inc.	N
SD-903	Sample Disposal, 05/09, Revision 4.	N/A	VARIOUS	N/A	Katahdin Analytical Services, Inc.	N

QAPP Worksheet #24 – Analytical Instrument Calibration Table

24 Analytical Instrument Calibration: Katahdin Analytical Services

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
Gas Chromatograph/ Mass Spectrometer Volatiles	Initial Calibration - A minimum 5-point calibration is required.	Calibrate the instrument when it is received and after a major change or if the daily calibration fails.	System Performance Check Compound (SPCCs) average Response Factors (RFs) ≥ 0.30, except chloromethane, 1,1-Dichloroethane and bromoform ≥ 0.10; Percent Relative Standard Deviation (%RSD) for RFs ≤ 30% for Calibration Check Compound CCCs. RSD < 15% for all compounds. If not met: Option 1) Linear least squares regression: r ≥ 0.995 Option 2) Non-linear regression: coefficient of determination (COD) r^2 ≥ 0.99 (6 points for second order)	Repeat calibration if criterion is not met	Analyst, Department Manager	Katahdin Analytical Services SOP CA-202
	Initial Calibration Verification (ICV)	Once after each initial calibration.	Recovery within 75-125%	Correct problem and verify second source standard. Reanalyze initial calibration.	Analyst, Department Manager	
	Continuing Calibration (CV)	Analyze a standard at the beginning of each 12-hour shift after a bromofluorobenzene (BFB) tune.	CCCs < 20%D (D = Difference or Drift); SPCCs RF >0.10 & 0.30 D = Difference or drift	Repeat initial calibration and reanalyze all samples analyzed since the last successful calibration verification.	Analyst, Department Manager	
	BFB Tune	Every 12 hours.	Criteria listed in section 7.3 current revision of SOP CA-202.	Retune and/or clean source.	Analyst, Department Manager	

QAPP Worksheet #25 – Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

25 Analytical Instrument and Equipment Maintenance, Testing, and Inspection – Katahdin Analytical Services

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
Gas Chromatograph / Mass Spectrometer	Check pressure and gas supply daily. Bake out trap and column, manual tune if BFB not in criteria, change septa as needed, cut column as needed, change trap as needed. Other maintenance specified in Laboratory Equipment Maintenance SOP.	Volatiles	Ion source, injector liner, column, column flow, purge lines, purge flow, trap.	Prior to initial calibration and/or as necessary.	Acceptable Calibration or Calibration Verification	Correct the problem and repeat Calibration or Calibration Verification	Analyst, Department Manager	Katahdin Analytical Services SOP CA-202

[1] Specify the appropriate reference letter or number from the Analytical SOP References (Worksheet #23).

QAPP Worksheet #26 – Sample Handling System

This section identifies components of the project-specific sample handling system used by EEEPC and the subcontract laboratories. All field samples will be disposed by the subcontract laboratory according to their internal procedures. Samples must be stored at the laboratory for a minimum of 30 days after the final report is submitted.

Sample Collection

EEEPC will conduct nondestructive sampling on this project. Site-specific investigation methodologies; sample types, numbers, and locations; and chemical constituents are identified in the Work Plan. Sample types and numbers and chemical constituents are also summarized in Table 2-1 of the Work Plan.

In general, sampling at a site will progress from clean areas to contaminated areas. This minimizes the potential for cross-contamination of samples and, subsequently, eliminates data anomalies or misinterpretation of the extent of contamination.

The remainder of this section describes typical procedures for handling IDW and sample containers, preservatives, holding times, packing, and shipping. Overall, the field Team Leader will be responsible for ensuring correct methods are employed, documenting any problem and verifying required corrective actions. The Project Manager will approve corrective actions, in consultation with client personnel, if appropriate. The USACE must approve any changes to the sampling program, including sample locations.

Sample Containers

The volumes and containers required for sampling activities are indicated in Worksheet 19. Prewashed sample containers will be provided by the laboratory and will be wide-mouth jars with Teflon-lined caps unless otherwise indicated. The laboratory must use an approved specialty container supplier, which prepares containers in accordance with USEPA bottle-washing procedures. The laboratory must maintain a record of all sample bottle lot numbers shipped in the event of a contamination problem. Trip blanks will be transported to the site inside the same box as volatile organic analysis (VOA) vials. Any containers purchased by EEEPC for field analysis also will be from an approved supplier.

Samples Preservation and Holding Times

All samples requiring preservation will be either collected in containers shipped from the laboratory pre-preserved or will be preserved in the field immediately after collection and transported to the site office. A clean, disposable pipette or a premeasured, single-use, glass ampule will be used to transfer liquid preservatives to the sample container. Care will be taken to avoid contact between the pipette or ampule and the sample or sample container. Solid preservatives will be transferred to the sample container using a clean, stainless-steel spoon. If the laboratory supplies pre-preserved bottles, the samples will be carefully transferred to the container to avoid any loss of preservative.

After preservation, the sample will be gently shaken to mix the preservative and a small amount of the sample will be poured into a clean cup and tested with pH paper to determine if a sufficient amount of preservative has been used. The amount of preservative necessary to adjust the sample pH will be recorded. Field blanks, which require preservation, will be preserved with a volume of reagent equal to the volume of reagent used in the samples that the blanks represent. A list of preservatives and holding times for each type of analysis are indicated in Worksheet 19. Additional preservation requirements and holding times for non-target analyses are listed in 40 Code of Federal Regulations (CFR), Part 136, July 5, 1987.

Reagents used for preservation are reagent-grade and are supplied by the laboratory. The laboratory must maintain traceability records on preservatives in the event of potential field contamination of samples. Each bottle is received from the laboratory and must be clearly labeled with laboratory name, type of chemical, lot number, and expiration date. Field personnel should record the date used in the field, site name, and EEEPC project number on the label or in the site logbook. Fresh sample preservatives will be obtained from laboratory stocks prior to mobilization for each sampling event. Preservatives stored on-site will be disposed of after use as noted above unless containers are sealed and stored under chain-of-custody in a secure area. No preservatives will be used past the expiration date.

Sample preservation will be verified at the laboratory at receipt or prior to analysis for VOCs. The preservation or pH will be recorded in the logbook. If samples are improperly preserved, a corrective action form will be submitted to the laboratory project manager for follow-up action. The laboratory will notify the Field Team Leader or Project Manager to implement corrective action in the field.

Sample Handling

The transportation and handling of samples must be accomplished in a manner that not only protects the integrity of samples but also prevents any detrimental effects due to the possible hazardous nature of the samples. Regulations for packaging, marking, labeling, and shipping of hazardous materials are promulgated by the DOT in 49 CFR 171 through 177. EEEPC trains all staff responsible for the shipment of samples in these regulations. Procedures for sample packing and shipping are documented in an EEEPC SOP.

Sample Packaging

Samples must be packaged carefully to avoid breakage or contamination and must be shipped to the laboratory at proper temperatures. The following sample packaging requirements will be followed:

- Sample bottle lids must never be mixed. All sample lids must stay with their original containers;
- Shipping coolers must be partially filled with packing materials and ice (when required) to prevent bottles from moving and breaking during shipping;
- Environmental samples are to be cooled. Wet ice packaged in sealable, plastic bags will be used to cool samples during shipping. Ice is not to be used as a substitute for packing materials;
- Any remaining space in the cooler should be filled with inert packing material such as bubble wrap. Under no circumstances should material such as sawdust or sand be used;
- A duplicate custody record must be placed in a plastic bag and taped to the inside of the cooler lid. Custody seals are affixed to the sample cooler; and
- All containers for a given sample will be shipped in the same cooler when possible. In cases where samples for volatile analysis would be shipped in several coolers on a single day, VOA vials will be consolidated into a single cooler to minimize the number of required trip blanks.

Shipping Containers

Environmental samples will be properly packaged and labeled for transport and dispatched to the laboratory facility. The SOP procedure will be followed to mark and label sample shipments. A separate chain-of-custody record must be prepared for each shipping container. The following requirements for shipping containers will be followed.

Sample shipping containers will generally be commercially purchased coolers (e.g., Coleman coolers). Each container will be custody-sealed for shipment as appropriate. The container custody seal will consist of filament tape wrapped around the package at least twice and custody seals affixed in such a way that access to the container can be gained only by cutting the filament tape and breaking a seal.

Field personnel will make arrangements for transportation of samples to the laboratory. In most cases, samples will be shipped using an overnight express carrier (e.g., Federal Express). Field personnel will provide the laboratory with a shipment schedule and notify them of deviations from planned activities. The field personnel will notify the laboratory of all of samples intended for Saturday delivery, no later than 3 p.m. (Eastern Standard Time) on Thursday.

QAPP Worksheet #27 – Sample Custody Requirements

The procedures that will be used to maintain sample custody and integrity are described below.

Sample Custody

Formal sample custody procedures begin when the precleaned sample containers leave the laboratory or upon receipt from the container vendor. The laboratory must follow written and approved SOPs for shipping, receiving, logging, and internally transferring samples. Sample identification documents must be carefully prepared so that sample identification and the chain-of-custody can be maintained and sample disposition controlled. Sample identification documents include field notebooks; sample labels; custody seals; and chain-of-custody records.

The primary objective of chain-of-custody procedures is to provide an accurate written or computerized record that can be used to trace the possession and handling of a sample from sampling through completion of all required analyses. A sample is in custody if it is:

- In a team member's physical possession;
- In a team member's view;
- Locked up; or
- Kept in a secured area that is restricted to authorized personnel.

Field Custody Procedures

Precleaned sample containers will be provided by the laboratory to the Field Team Leader. The Field Team Leader will record receipt of the sample containers in the project logbook. The following field custody procedure will be used for collection of samples:

- As few persons as possible should handle samples;
- Coolers or boxes containing cleaned bottles should be sealed with a custody tape seal during transport to the field or while in storage prior to use;
- The sample collector is personally responsible for the care and custody of samples collected until they are transferred to another person or dispatched properly under chain-of-custody rules;
- The sample collector will record sample data in the field logbook; and
- The Field Team Leader will determine whether proper custody procedures were followed during the field work and decide if additional samples are required.

Sample Labels

Sample labels or tags attached to or affixed around the sample container must be used to properly identify all samples collected in the field. The sample labels are to be placed on bottles so as not to obscure any lot numbers, and sample information must be printed in a legible manner using waterproof ink. Field identification must be sufficient to enable cross-referencing with the logbook. For chain-of-custody purposes, all QC samples are subject to exactly the same custodial procedures and documentation as "real" samples.

Chain-of-Custody Record

The laboratory’s internal chain-of-custody form will be used. Chain-of-custody forms must then be fully completed manually. The custody record also should indicate any special preservation techniques necessary or whether samples need to be filtered. Copies of chain-of-custody records are to be maintained with the project file.

Custody Seals

Custody seals are preprinted, adhesive-backed seals with security slots designed to break if the seals are disturbed. Custody seals are placed over the lid of individual coolers by the sampling technician. DOT-approved sample shipping containers are sealed in as many places as necessary to ensure security. Seals must be signed and dated before use. Upon receipt at the laboratory, the custodian must check and document on a cooler receipt form that seals on coolers are intact.

Laboratory Custody Procedures

All laboratory custody procedures must maintain a system that provides for sample log-in, signing samples out to and back from individual analysts, data storage and reporting, and sample disposal. These procedures must ensure continuous documentation of sample custody from receipt to disposal. Procedures used by the laboratory must meet all USEPA requirements. Laboratories must complete a cooler receipt form documenting the temperature and condition of samples on receipt. The form must be provided in the laboratory data package. EEEPC requires subcontract laboratories to post sample receipt information to the laboratory extranet site within 48 hours of sample receipt. The receipt information is verified prior to sample reporting.

QAPP Worksheet #28 – QC Samples Table

The QC sample criteria that will be used to perform off-site analysis are listed below. QAPP Worksheet #20 - Field Quality Control Sample Summary provides an overview of the field QC sample frequency. General project data quality indicators are highlighted below:

- Precision – Field duplicates will be collected to assess overall precision. The precision of the data is not critical for data usability. General criteria of 40% RPD for waters will be applied.
- Accuracy – Laboratory matrix spike/ matrix spike duplicates (MS/MSDs) will be used to assess accuracy. The primary data concern is to ensure analytical bias will not produce false negatives and that all potential contamination is accounted for in the baseline, performance, and long-term monitoring. Specific site contaminants need to be in the MS and should be within laboratory control limits.
- Representativeness – Data need to be representative of the areas of potential contamination at the site. Trip and laboratory blanks will be used to assess field and laboratory background. No project contaminants should be present.
- Completeness – A completeness objective of 90% is set for all samples except the site contaminants. The site contaminants have a completeness objective of 95%.
- Comparability – The ability to effectively compare data with historical results and clean-up criteria is important. Data need to be generated from the same analytical methods and have the same reporting limits. The ability to compare data with specific guidance values is critical for evaluating baseline, performance, and long-term monitoring data.

All subcontract laboratories must comply with the QC limits and requirements in the Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 3. Tables in Appendix B of the QSM provide method-specific QC limits and corrective action. The following table is a general overview of the QC acceptance criteria.

28 Laboratory QC Samples Table

Matrix	Water/Soil
Analytical Group	Volatiles
Analytical Method/ SOP Reference	SW-846 8260B/ Katahdin SOP CA-202

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per batch of 20 or less.	No target compounds should be > ½ the QL except common lab contaminants, which should be, no target compounds should be > the QL.	Investigate source of contamination. Rerun method blank prior to analysis of samples if possible. Evaluate the samples and associated QC: if blank results are above QL, report sample results which are < QL or > 10X the blank concentration. Reanalyze blank and samples >QL and < 10X the blank.	Analyst, Laboratory Department Manager, and Data Validator	Bias/Contamination	No target compounds should be > ½ the QL except common lab contaminants, which should be, no target compounds should be > the QL
Surrogate	Four per sample	Percent recoveries: Dibromofluoromethane 78-116 1,2-dichloroethane-d4 70-124 Toluene-d8 70-123 Bromofluorobenzene 69-119	If sample volume available, and within hold time reanalyze.	Analyst, Laboratory Department Manager and Data Validator	Accuracy/Bias	Percent recoveries: Dibromofluoromethane 78-116 1,2-dichloroethane-d4 70-124 Toluene-d8 70-123 Bromofluorobenzene 69-119
Laboratory Control Sample (LCS)	One per batch of 20 or less.	Recovery must be within Katahdin Analytical Services statistically derived limits.	Evaluate and reanalyze if possible. If an MS/MSD was performed in the same 12-hour clock and is acceptable, narrate. If the LCS recoveries are high but the sample results are <QL, narrate; otherwise, re-prepare and reanalyze	Analyst, Laboratory Department Manager, and Data Validator	Precision/Accuracy/ Bias	Recovery must be within Katahdin Analytical Services statistically derived limits.

28 Laboratory QC Samples Table

Matrix	Water/Soil
Analytical Group	Volatiles
Analytical Method/ SOP Reference	SW-846 8260B/ Katahdin SOP CA-202

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Internal Standard	Three per sample- Pentafluorobenzene Chlorobenzene-d5 1,4-dichlorobezene-d4	Retention times for internal standards must be ± 30 seconds and the responses within -50% to +100% of last calibration verification (12 hours) for each internal standard.	Inspect mass spectrometer or gas chromatograph for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning.	Analyst, Laboratory Department Manager, and Data Validator	Precision/Accuracy/ Bias	Retention times for internal standards must be ± 30 seconds and the responses within -50% to +100% of last calibration verification (12 hours) for each internal standard.
Matrix Spike/ Matrix Spike Duplicate (MS/ MSD)	One per sample delivery group (SDG) or every 20 samples.	Recovery should be within Katahdin Analytical Services statistically derived limits. Water Precision RPD ≤ 20%	Corrective actions will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. If both the LCS and MS/MSD are unacceptable, re-prepare the samples and QC.	Analyst, Laboratory Department Manager, and Data Validator	Precision/Accuracy/ Bias	Recovery should be within Katahdin Analytical Services statistically derived limits. Water Precision RPD ≤ 20%

QAPP Worksheet #29 – Project Documents and Records Table

29 Project Documents and Records

Sample Collection Documents and Records	On-Site Analysis Documents and Records	Off-Site Analysis Documents and Records	Data Assessment Documents and Records	Other
Field Logbooks	NA	Laboratory Reports[1]	Data Review Checklists	
Daily Field Reports		Sample Receipt Report	Data Review Summary Reports	
Field Adjustment Forms		Completed Chain-of-Custody	Audit Checklists	
Photographs		Electronic data[2]	Audit Reports	
Groundwater Sampling Forms		Raw Instrument Data	Data usability summary	
Sample Summary Reports		Laboratory Data Review Checklists		
Chain-of-Custody		Corrective Action Records		
Airbill and Shipping Documents		Internal Audit Reports		

[1] Laboratory reports will be formatted consistent with the contract requirements. For subcontract data, reports will be consistent with NYSDEC ASP Category B data deliverables.

[2] Laboratory electronic data reports will be formatted consistent with the standard laboratory electronic data deliverable (EDD) format for the ERPIMS as outlined in the ERPIMS Data Loading Handbook and the ERPIMS Quality Control Tool/Personal Computer (ERTOOLS/PC) standard format.

QAPP Worksheet #30 – Analytical Services Table

30 Analytical Services Table

Matrix	Analytical Group	Concentration Level	Analytical SOP	Sample Locations/ID Number	Data Package Turnaround Time	Laboratory / Organization (name and address, contact person and telephone number)	Backup Laboratory / Organization (name and address, contact person and telephone number)
Groundwater and Surface Water	TCL VOCs	Low	8260	See Work plan Table 2-1 and Figure 1-2	28 days	Katahdin Analytical Services 600 Technology Way Scarborough, ME 04074 207-874-2400 Kate Zaleski Leslie Dimond	

QAPP Worksheet #31 – Planned Project Assessments Table

The type, frequency, and responsible parties of planned assessment activities that will be performed for the project are identified below

31 Planned Project Assessments

Assessment Type	**Frequency**	**Internal or External**	**Organization Performing Assessment**	**Person(s) Responsible for Performing Assessment** (title and organizational affiliation)	**Person(s) Responsible for Responding to Assessment Findings** (title and organizational affiliation)	**Person(s) Responsible for Identifying and Implementing Corrective Actions (CA)** (title and organizational affiliation)	**Person(s) Responsible for Monitoring Effectiveness of CA** (title and organizational affiliation)
Field Inspection and Audit	1	Internal	EEEPC	Marcia Galloway Project Chemist/QA Officer EEEPC	Robert Meyers PM and Marcia Galloway, QA Officer EEEPC	Robert Meyers PM and Marcia Galloway, QA Officer EEEPC	Marcia Galloway, QA Officer (EEEPC) and Amy Darpinian USACE Project Chemist
Field Inspection and Audit	1	Internal	Parsons	TBD	Robert Meyers PM and Marcia Galloway, QA Officer EEEPC	Robert Meyers PM and Marcia Galloway, QA Officer EEEPC	Marcia Galloway, QA Officer (EEEPC) and Amy Darpinian USACE Project Chemist
Field Inspection and Audit	1	External	USACE	TBD USACE	Robert Meyers PM and Marcia Galloway, QA Officer EEEPC	Robert Meyers PM and Marcia Galloway, QA Officer EEEPC	Marcia Galloway, QA Officer (EEEPC) and Amy Darpinian USACE Project Chemist
Laboratory Audits	1	External	EEEPC	Marcia Galloway Project Chemist/QA Officer EEEPC	Robert Meyers PM and Marcia Galloway, QA Officer EEEPC	Robert Meyers PM and Marcia Galloway, QA Officer EEEPC	Marcia Galloway, QA Officer (EEEPC) and Amy Darpinian USACE Project Chemist
Document Peer Review	Every version of all documents	Internal and External	EEEPC, Parson, USACE, and AFRPA	Varies by document	Robert Meyers PM and Marcia Galloway, QA Officer EEEPC	Robert Meyers PM and Marcia Galloway, QA Officer EEEPC	Marcia Galloway, QA Officer (EEEPC) and USACE team members TBD

QAPP Worksheet #32 – Assessment Findings and Corrective Action Responses

32 Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (name, title, organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (name, title, organization)	Time frame for Response
Field Inspections	QC Inspection Checklist	Subcontractor	Immediate or at close of audit day	Change in subcontract SOW or Letter of Response	Robert Meyers, PM (EEEPC) and Marcia Galloway, QA Director (EEEPC) and USACE	Immediate or 7 days on approval of USACE
Field Audits	Audit Memo	Field Team Leader	Immediate or at close of audit day	Field logbooks or field adjustment forms	Marcia Galloway, QA Director (EEEPC) and USACE Project Chemist	Immediate or on approval of USACE
Laboratory Audits	Letter of findings	Laboratory PM	At close of audit day	TBD based on deficiency	Marcia Galloway, QA Director (EEEPC) and USACE Project Chemist	7 days
Data Validation Findings	Memo	Laboratory PM	As needed	TBD based on deficiency	Bryan Kroon, Data validation chemists (EEEPC)	7 days for re-submittals and 48 hours for response
Peer Review	Hard copy or electronic mark-up of deliverable	EEEPC Author and PM	Prior to report submittal	Update report	Robert Meyers, PM (EEEPC)	48 hours for response

QAPP Worksheet #33 – QA Management Reports Table

33 QA Management Reports

Type of Report	**Frequency** (Daily, weekly monthly, quarterly, annually, etc.)	**Projected Delivery Date(s)**	**Person(s) Responsible for Report Preparation** (title and organizational affiliation)	**Report Recipient(s)** (title and organizational affiliation)
Field Report	Daily	Emailed the following morning	TBD, FTL (EEEPC)	Robert Meyers EEEPC PM, and Nanci Higginbotham (USACE)
Updated Field Schedule	Once per sampling event.	2 weeks prior to each sampling event	Robert Meyers, PM (EEEPC)	Nanci Higginbotham (USACE)
Data Review Reports	Per sample delivery group	14 days from receipt of data	Bryan Kroon, Data validation chemist (EEEPC)	Marcia Galloway, QA Director (EEEPC) and USACE Project Chemist

QAPP Worksheet #34 – Verification (Step I) Process Table

The data verification scheme for analytical results is described below. The laboratory is responsible for performing internal data review consistent with NYSDEC ASP and USACE requirements. Laboratory data review must include 100 percent analyst review, 100 percent peer review, and 100 percent review by the laboratory project manager to verify that all project-specific requirements are met. The laboratory QA officer must perform review on 10 percent of the data packages. All levels of laboratory review must be fully documented and available for review if requested or if a laboratory audit is performed.

For any data generated by the EEEPC subcontract laboratory, the Project Chemist verifies that the laboratory information matches the field information and that the following items are included in the data package:

- Chain-of-custody forms;
- Case narrative describing any out-of-control events and summarizing analytical procedures;
- Corrective actions;
- Data report forms (i.e., Form I);
- Electronic data in required format and valid values (i.e., AFCEE ERPIMS);
- QA/QC summary forms;
- Calibration summary forms; and
- Chromatograms and raw documenting any QC problems as defined in the case narrative.

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

QAPP Worksheet #35 – Validation (Steps IIa and IIb) Process Table

The processes that will be followed to validate project data for EEEPC subcontract laboratory data are described below. Data validation SOPs are provided in Appendix C to this QAPP.

35 Validation (Steps IIa and IIb) Process

Data Source	**Validation Input**	**Description**	**Responsible for Validation** (name, organization)
Groundwater and Surface Water	TCL VOCs	Process EDD data and assign data review qualifiers, validate 40% of raw data	EEEPC Project Chemist Bryan Kroon

QAPP Worksheet #36 – Validation (Steps IIa and IIb) Summary Table

The criteria used to validate the data are based on the laboratory QC limits provided in Appendix B and the laboratory limits in the QSM. Worksheet 35 provides an overview of the planned validation criteria for each matrix and analytical group. Appendix C of this QAPP includes the data validation SOP that will be followed for review.

36 Validation (Steps IIa and IIb) Summary Table

Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator
Groundwater and Surface Water	VOCs	Low/Med	DoD QSM	EEEPC

QAPP Worksheet #37 – Usability Assessment

The EEEPC Project Chemist will work with the final users of the data in performing data quality assessments. The data quality assessment may include some or all the following steps:

- Data that are determined to be incomplete or not usable for the project will be discussed with the project team. If critical data points are involved that impact the ability to complete the project objectives, the data users will report immediately to the Project Manager. The Project Manager will discuss the resolution of the issue with USACE technical staff and implement the necessary corrective actions (for example, re-sampling);

- Data that are non-detect but have reporting limits elevated due to blank contamination or matrix interference will be compared with screening values. If reporting limits exceed the screening values, then the results will be handled as incomplete data as described above;

- Data that are qualified as estimated will be used for all project decision-making. If an estimated result is close to a screening value, then there is uncertainty in any conclusions as to whether the result exceeds the screening value. The data user must evaluate the potential uncertainty in developing recommendations for the site. If estimated results become critical data points in making final decisions on the site, the Project Manager and USACE technical staff should evaluate the use of the results and may consider the data point incomplete.

The assessment process involves comparing analytical results with screening values and background concentrations to determine whether the contamination present is site-related (i.e., above background levels) or significant (i.e., above screening values).

QAPP Appendix A – Scoping Meeting and Planning Minutes

MEETING MINUTES

August 19, 2009

To: Griffiss AOC 9 Project Team

From: Parsons

Subject: August 12, 2009 Project Kickoff Meeting

On Wednesday, August 12, 2009 at 9:00 AM, a meeting was held to discuss the Griffiss Air Force Base Area of Concern 9 (AOC 9) Remediation Project. Attendees included: Michael McDermott (AFRPA), Cathy Jerrard (AFRPA), Joe Wojnas (USACE-NY), Nanci Higginbotham (USACE-KC), Phil Rosewicz (USACE-KC), Andrew Gosnell (USACE-KC), David Nelson (USACE-KC), Amy Darpinian (USACE-KC), John Lanier (Parsons), Ross Miller (Parsons), Rebecca Absolom (Parsons), Daniel Hoffner (Parsons), and Tom Heins (EEEPC).

A power point presentation on the AOC 9 Site was reviewed. Handouts were distributed. Refer to Attachment 1 for the presentation.

INTRODUCTIONS

Project team members made introductions prior to the beginning of the presentation and additional introductions were not necessary. A sign in sheet has been included as Attachment 2.

SAFETY MOMENT

- The safety moment was on lightning safety.
- Lightning seldom causes burns.
- The primary cause of death from lightning is cardiac arrest.
- Storage sheds, patios, pavilions are not a safe location to remain when lightning approaches.
- If there are no enclosed buildings, it is recommended to get inside a hard-topped, all metal vehicle.
- The recommendation is to remain 2 times as far away from a tree as it is tall. When lightning strikes a tree, it will explode causing debris to fly in all directions. Standing to close to the tree increases the chances of getting hit by the debris.

REMEDIATION PROJECT TEAM

The AOC 9 Project Team is set up similar to the On-Base Groundwater (OBGW) Project Team. The Team has proven success in work together and maintaining good communication among all members. Mr. John Lanier remains as the Project Manager, Mr. Ross Miller as the Corporate Sponsor/ Technical Director, and Mr. Tim Grady is the Subcontractor Corporate Lead.

A few new members have been included as part of the AOC 9 Project Team:

- Mr. Ed Heyse, Technical Manager;
- Mr. Keith Aleckson, Quality Control Coordinator;
- Mr. James Schuetz, Hydrogeologist, and
- Marcia Galloway as the Chemical Quality Control Coordinator.

The USACE-KC District identified that the OBGW Project Team will remain involved with the AOC 9 Project. The only change will be that Mr. Dave Nelson will have a limited role due to new responsibilities.

LONG TERM OBJECTIVES

- To obtain regulatory site closure.
- To complete property transfer.

SHORT TERM OBJECTIVES

The short term objectives were discussed. The Team will review the alternate Feasibility Study (FS). It is believed that the AOC 9 Site remedy can reach Operating Properly and Successfully (OPS) within the contract term. The Project Team does not believe that Response Complete (RC) can be reached within the contract term; however the AOC 9 Site shall be progressing towards RC determination at that time.

SITE BACKGROUND

Figures from the presentation were reviewed. The Project Team discussed the site remedy as presented in the proposal:

- Excavation of the source soil in the contaminated area; and,
- Oxidation of the groundwater plume area.

AOC 9 REMEDIAL APPROACH

Pilot studies, test pits, monitoring wells and temporary wells have all contributed to a large amount of sample data available for the AOC 9 Site. The Project Teams believes that enough data has been collected to allow for the start of the FS Report. Baseline sampling will be performed in December 2009.

The FS Report, Proposed Plan, Record of Decision (ROD), and Remedial Design will be prepared. The Remedial Action Work Plan will be prepared following the design. The documents shall identify, discuss, design and implement the proposed remedy.

The remedy consists of excavation of soil, oxidation of the groundwater, and performance/long term monitoring.

In an effort to reach RC shortly after the end of the contract, 99% of the source soil will have to be removed. The excavation will be completed in two phases. The first phase will require the removal of the overburden soils, prior to the removal of the contaminated source soil. The overburden soils, which are considered non-source or “clean” will be excavated and staged in a nearby location. An H-NU meter and visual observation will assist in determining the extent of the overburden soil for excavation and staging. Any soil that is determined as contaminated, will be further sampled and removed off site, pending positive results.

Following the excavation of the overburden soil to within a foot of groundwater, sheet piling will be installed for the remaining excavation activities. The soil will be sampled as the excavation progress. Positive sample results will warrant soil removal offsite.

The excavation area will be dewatered as appropriate. Frac tanks (or similar) will be used to store the water. Sampling will be conducted to ensure that the excavation water is acceptable for discharge to the City of Rome Water Pollution Control Facility (WPCF). Based on the sampling results, carbon filtration will be applied as necessary prior to discharge.

After completing the excavation, persulfate (or similar) will be applied to the groundwater, and directly onto the base of the excavation. The success of this application will be monitored as part of the performance and long term monitoring requirements.

Existing wells downgradient the AOC 9 Site will remain unchanged and 1-2 wells will be replaced within the excavation area. Temporary wells previously installed will be closed and removed.

Following remedy implementation, the Project Team will use the overburden soils to return to the excavation to ground level. Any disturbed roadways will be restored using asphalt rather than concrete, and site drainage will be restored to previous site conditions. A final gradient plan will be developed as part of the design activities. The Project Team will ensure that the proper individuals (i.e., Griffiss Local Development Corporation (GLDC)) will remain updated on all site activities.

The Project Team will coordinate with Mr. Joe Wojnas (USACE-NY) to locate drawings and background information on Building 913 and utilities located at the AOC 9 Site.

PROJECT EXECUTION

This is a Firm Fixed Price Performance Based Contract with 21 milestone payments issued over two (2) 5-year Task Orders. The period of performance is from 2009 through 2016. The base contract has been awarded and the first Task Order is in progress.

Parsons will be managing the AOC 9 Project from the Syracuse NY office and be responsible for project plans, project oversight, remedial construction, and the persulfate (or similar) application. Parsons anticipates using Peak Environmental, a small business located in Owego NY, during the remedial construction activities. Teaming partner, Ecology and Environment is located in Lancaster, NY and will be responsible for the regulatory documents, remedial design, the baseline monitoring, and the performance and long term monitoring activities at the site.

TARGET SCHEDULE

To meet the target schedule, remedial construction activities must start in 2010. This date can be reached if the Regulators (i.e., NYSDEC and USEPA) can review and provide comments on the regulatory documents with a one month cycle. The Project Team identified that many of the issues at the AOC 9 Site have been previous discussed.

Options to expedite the document review process were discussed. This included:

- Submitting the Proposed Plan and the Feasibility Study Report to the Regulators at the same time.
- Having regular phone calls to review comments and review status.
- Including AFRPA Headquarters early on in the review process.
- Maintain project communication among NYSDEC, USEPA, AFRPA, USACE, Parsons and EEEPC.

REGULATOR BRIEFING

In an effort to progress the project forward, it was agreed upon that a regulator briefing was necessary to update the NYSDEC and USEPA on the AOC 9 Project. It is necessary to get early approval for the fast paced document review schedule.

A power point presentation will be prepared and coordination for an early September meeting will begin. The Project Team identified that the following points must clearly be expressed as part of the Regulator Briefing.

- The AOC 9 Project is groundwater remediation, not soil clean up.
- Soil sampling will be conducted for evaluation of excavating mass, not meeting clean up criteria.
- The AOC 9 Feasibility Study that will be prepared is an addendum to the original FS.
- A detailed schedule will be developed to identify the path forward.

CONCLUSION

The AFRPA, USACE, Parsons, and EEEPC agreed that this will be a fast paced project and that everyone must cooperate for it to succeed. To ensure that the project moves forward, a weekly call will be set up. This call will be scheduled on Wednesdays at 11:00 EST. The following items will also begin.

1. Master Schedule to be developed
2. Technical data and previous AOC 9 meeting minutes to be reviewed.

3. The date, location, and time for the Regulator Briefing will be coordinated.
4. A document schedule identifying review times will be issued.
5. The Project Team will begin the document preparation.

ATTACHMENT 1- Griffiss AFB AOC 9 Remediation Project Kick off Meeting Presentation

ATTACHMENT 2- Project Kickoff Meeting Sign-in Sheet

END OF MEETING

PARSONS

Griffiss AFB AOC 9 Remediation

Kickoff Meeting

August 12, 2009

Kickoff Meeting Agenda

- Safety Moment
- Remediation Project Team
- Project Objectives
- Site Background
- Remedial Approach
- Project Execution
- Target Schedule
- Questions / Discussion

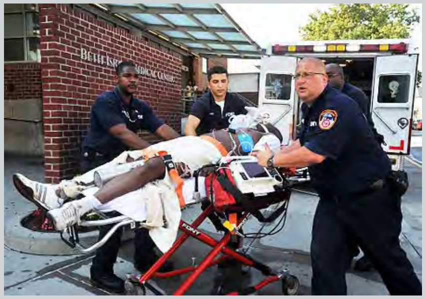
Safety Moment - Lightning Safety

At any moment, there are as many as 1800 thunderstorms in progress somewhere on the Earth, and each is producing deadly lightning

An average of 87 lightning fatalities is reported each year in the U.S.

Unlike high voltage electrical injuries, lightning seldom causes substantial burns

About 10% of the people struck by lightning are killed … the other 90% have other injuries… mostly to the nervous system



The primary cause of death from lighting is cardiac arrest

Lightning Safety

- Being outdoors is the most dangerous place to be during a lightning storm.

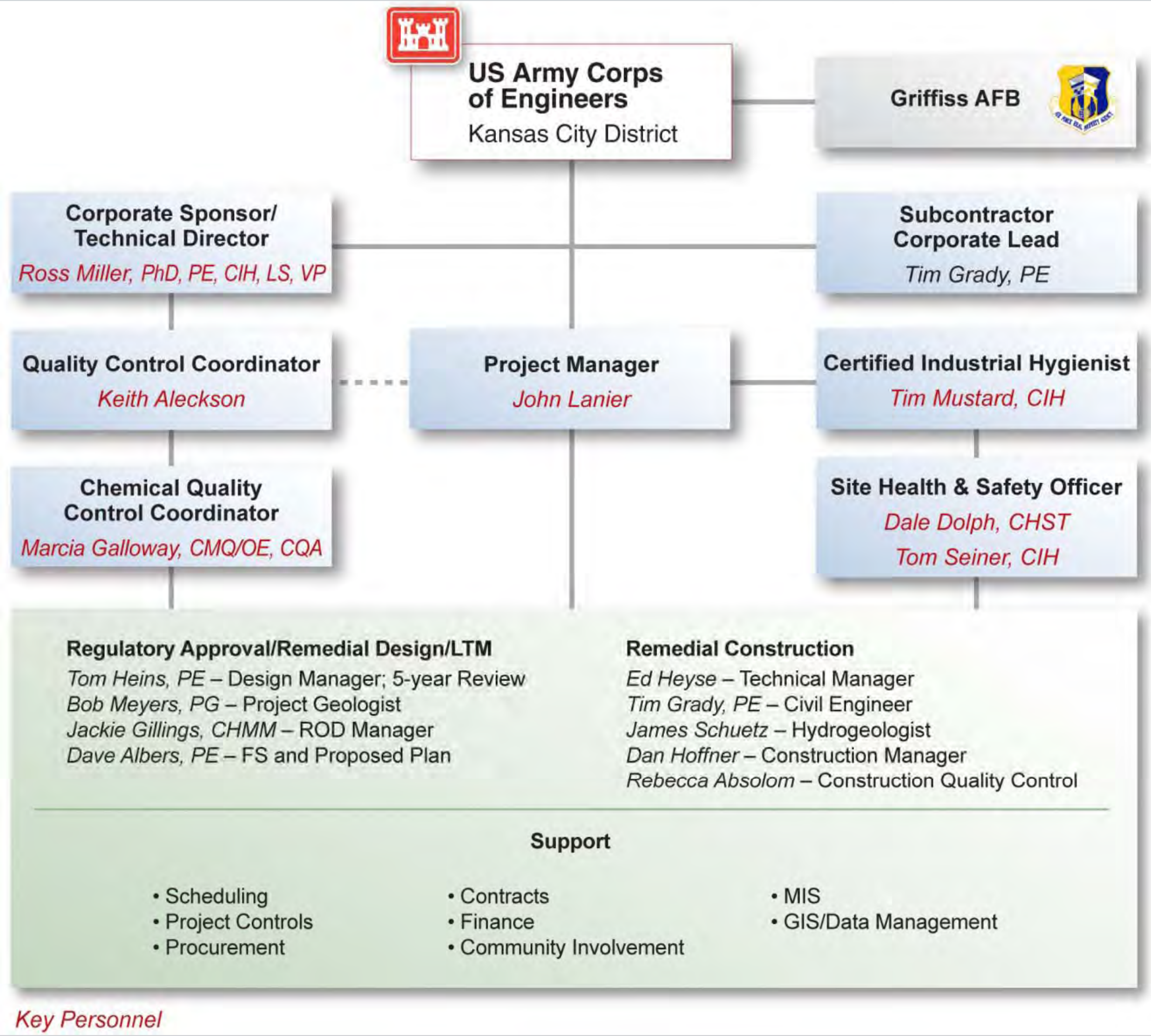
  Isolated tall trees pose the greatest danger!

- When lightning approaches, get inside

  a completely enclosed building.
- If no enclosed building is available, get inside a **hard-topped, all metal** vehicle.

- Get out of the water!
- If you cannot reach shelter, avoid being the tallest object in the area.

Remediation Project Team



US Army Corps of Engineers
Kansas City District

Griffiss AFB

Corporate Sponsor/ Technical Director
Ross Miller, PhD, PE, CIH, LS, VP

Subcontractor Corporate Lead
Tim Grady, PE

Quality Control Coordinator
Keith Aleckson

Project Manager
John Lanier

Certified Industrial Hygienist
Tim Mustard, CIH

Chemical Quality Control Coordinator
Marcia Galloway, CMQ/OE, CQA

Site Health & Safety Officer
Dale Dolph, CHST
Tom Seiner, CIH

Regulatory Approval/Remedial Design/LTM
Tom Heins, PE – Design Manager; 5-year Review
Bob Meyers, PG – Project Geologist
Jackie Gillings, CHMM – ROD Manager
Dave Albers, PE – FS and Proposed Plan

Remedial Construction
Ed Heyse – Technical Manager
Tim Grady, PE – Civil Engineer
James Schuetz – Hydrogeologist
Dan Hoffner – Construction Manager
Rebecca Absolom – Construction Quality Control

Support

- Scheduling
- Project Controls
- Procurement
- Contracts
- Finance
- Community Involvement
- MIS
- GIS/Data Management

Key Personnel

Project Objectives

Long-term Objectives

- To obtain regulatory site closure
- To complete property transfer

Project Objectives

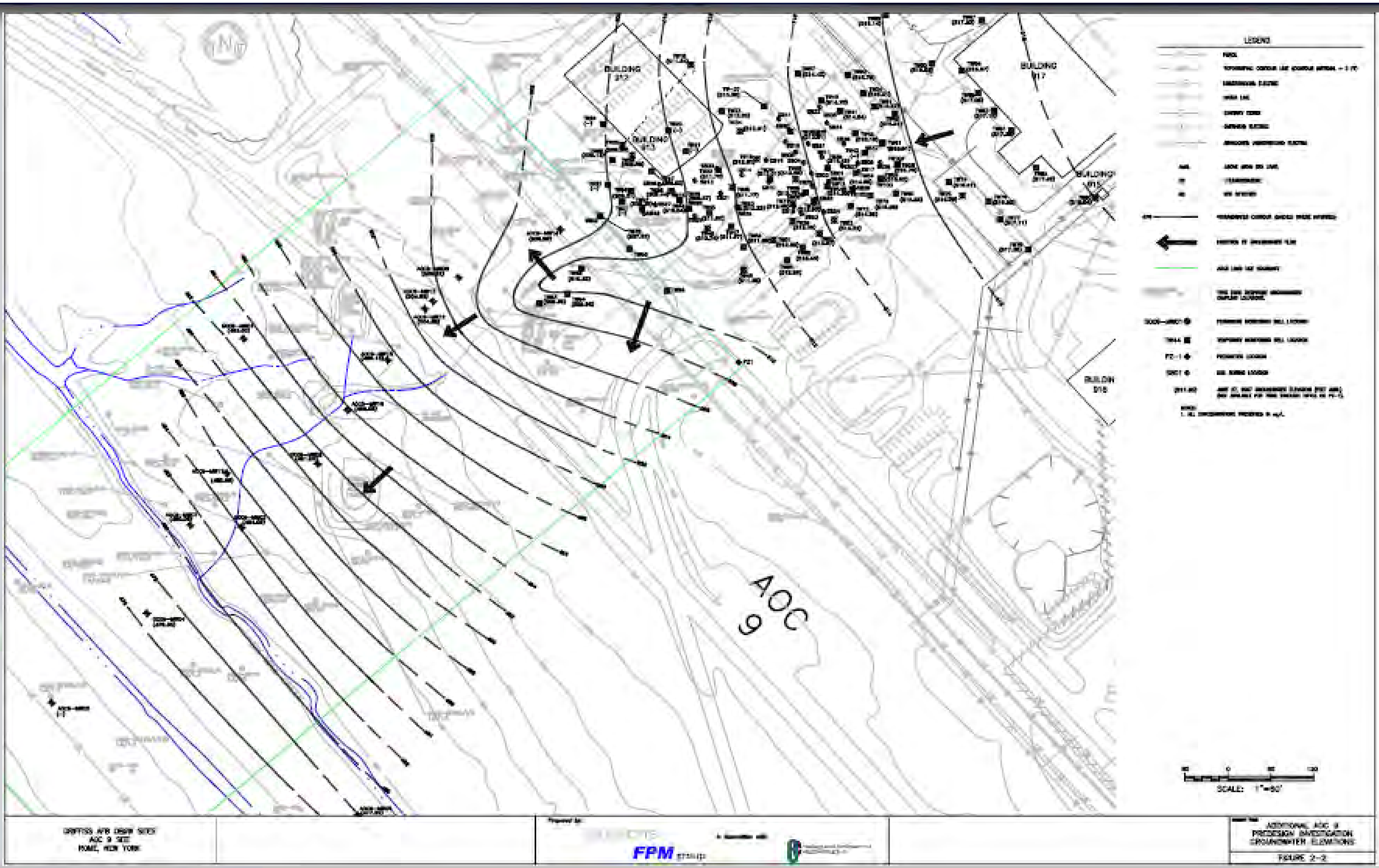
Short-term Objectives

- Reduce or eliminate the potential for human and environmental risk
- Eliminate or reduce further on-site migration of contaminated groundwater
- Achieve cleanup goals for contaminants of concern
- Identify remedial technologies, provide alternatives, and screen against the nine criteria of the National Contingency Plan (NCP)

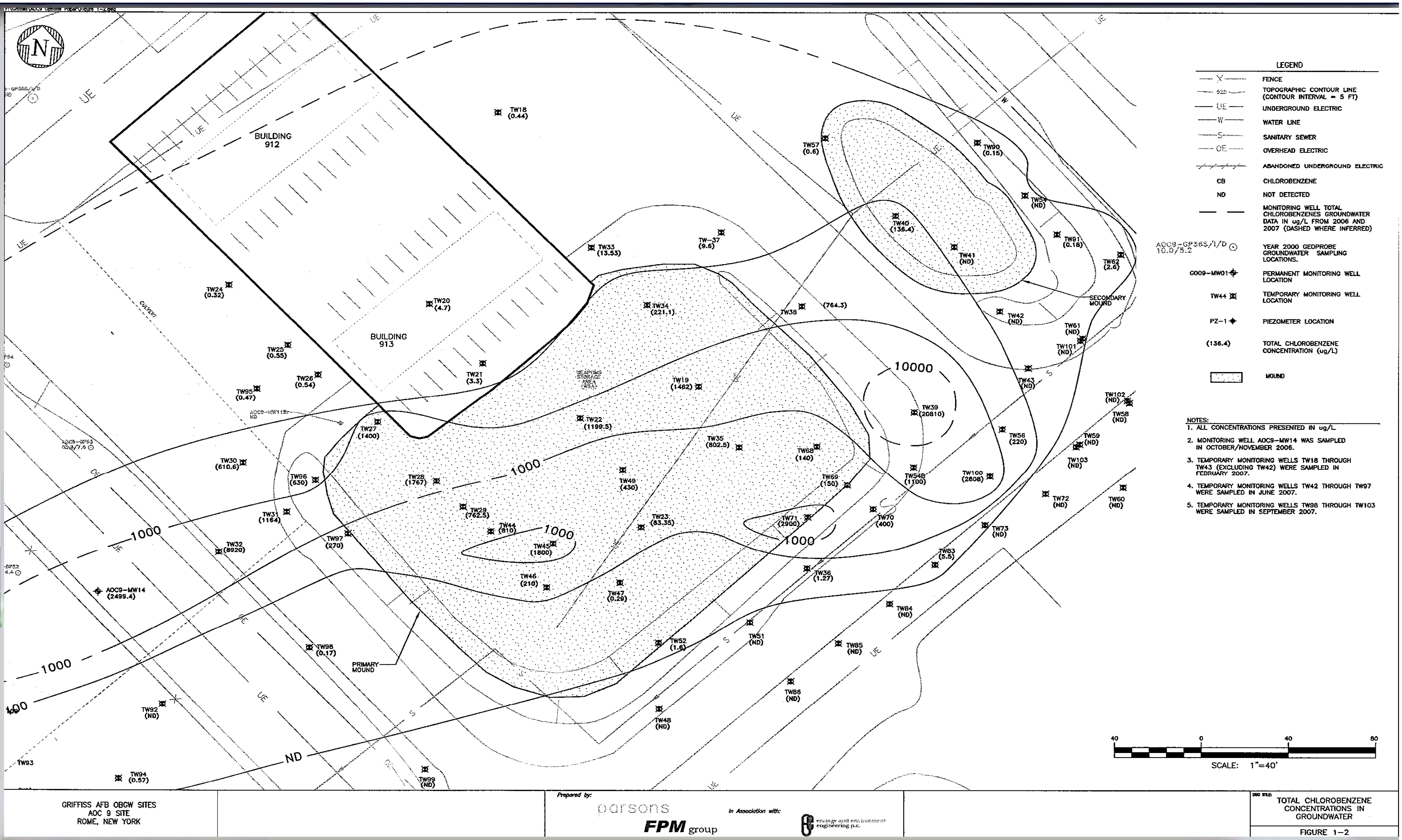
Short Term Objectives (cont'd)

- Summarize remedial alternatives proposed for AOC 9 and specify preferred alternative
- Complete design to implement selected remedy
- Achieve Response Complete (RC) or Remedy in Place (RIP) and the remedy is Operating Properly and Successfully (OPS)

Site Background – Flow Gradient AOC 9



Site Background – Total CB in Groundwater AOC 9



LEGEND

X	FENCE
525	TOPOGRAPHIC CONTOUR LINE (CONTOUR INTERVAL = 5 FT)
UE	UNDERGROUND ELECTRIC
W	WATER LINE
S	SANITARY SEWER
OE	OVERHEAD ELECTRIC
	ABANDONED UNDERGROUND ELECTRIC
CB	CHLOROBENZENE
ND	NOT DETECTED
— —	MONITORING WELL TOTAL CHLOROBENZENES GROUNDWATER DATA IN ug/L FROM 2006 AND 2007 (DASHED WHERE INFERRED)
AOC9-GP36S/I/D 10.0/5.2 ⊙	YEAR 2000 GEOPROBE GROUNDWATER SAMPLING LOCATIONS.
G009-MW01	PERMANENT MONITORING WELL LOCATION
TW44 ☒	TEMPORARY MONITORING WELL LOCATION
PZ-1	PIEZOMETER LOCATION
(136.4)	TOTAL CHLOROBENZENE CONCENTRATION (ug/L)
▨	MOUND

NOTES:

1. ALL CONCENTRATIONS PRESENTED IN ug/L.
2. MONITORING WELL AOC9-MW14 WAS SAMPLED IN OCTOBER/NOVEMBER 2006.
3. TEMPORARY MONITORING WELLS TW18 THROUGH TW43 (EXCLUDING TW42) WERE SAMPLED IN FEBRUARY 2007.
4. TEMPORARY MONITORING WELLS TW42 THROUGH TW97 WERE SAMPLED IN JUNE 2007.
5. TEMPORARY MONITORING WELLS TW98 THROUGH TW103 WERE SAMPLED IN SEPTEMBER 2007.

GRIFFISS AFB OBGW SITES
AOC 9 SITE
ROME, NEW YORK

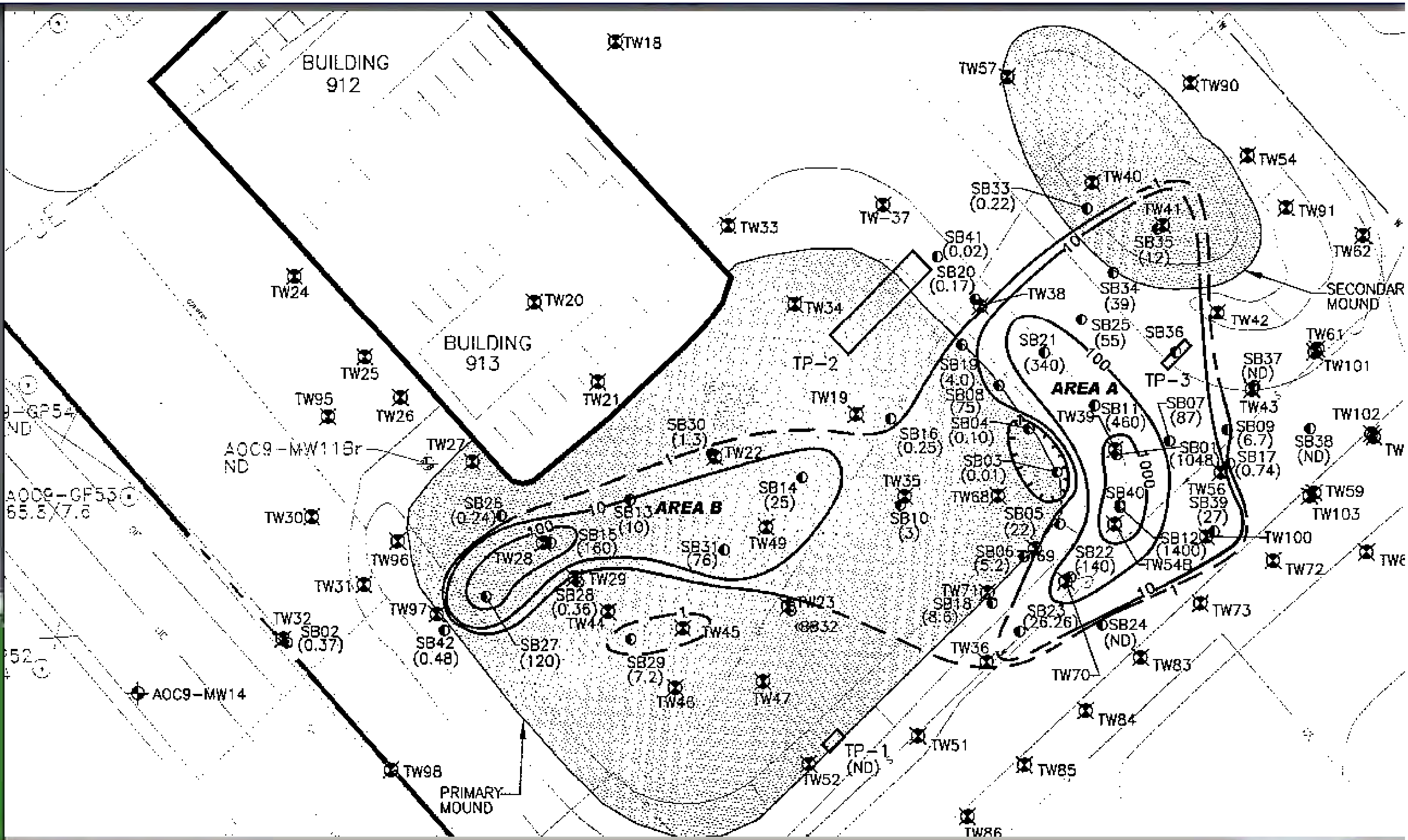
Prepared by:
parsons
FPM group
In Association with:
ecology and environment engineering p.c.

TOTAL CHLOROBENZENE CONCENTRATIONS IN GROUNDWATER

FIGURE 1–2

PARSONS

Site Background – Total CB in Soils AOC 9

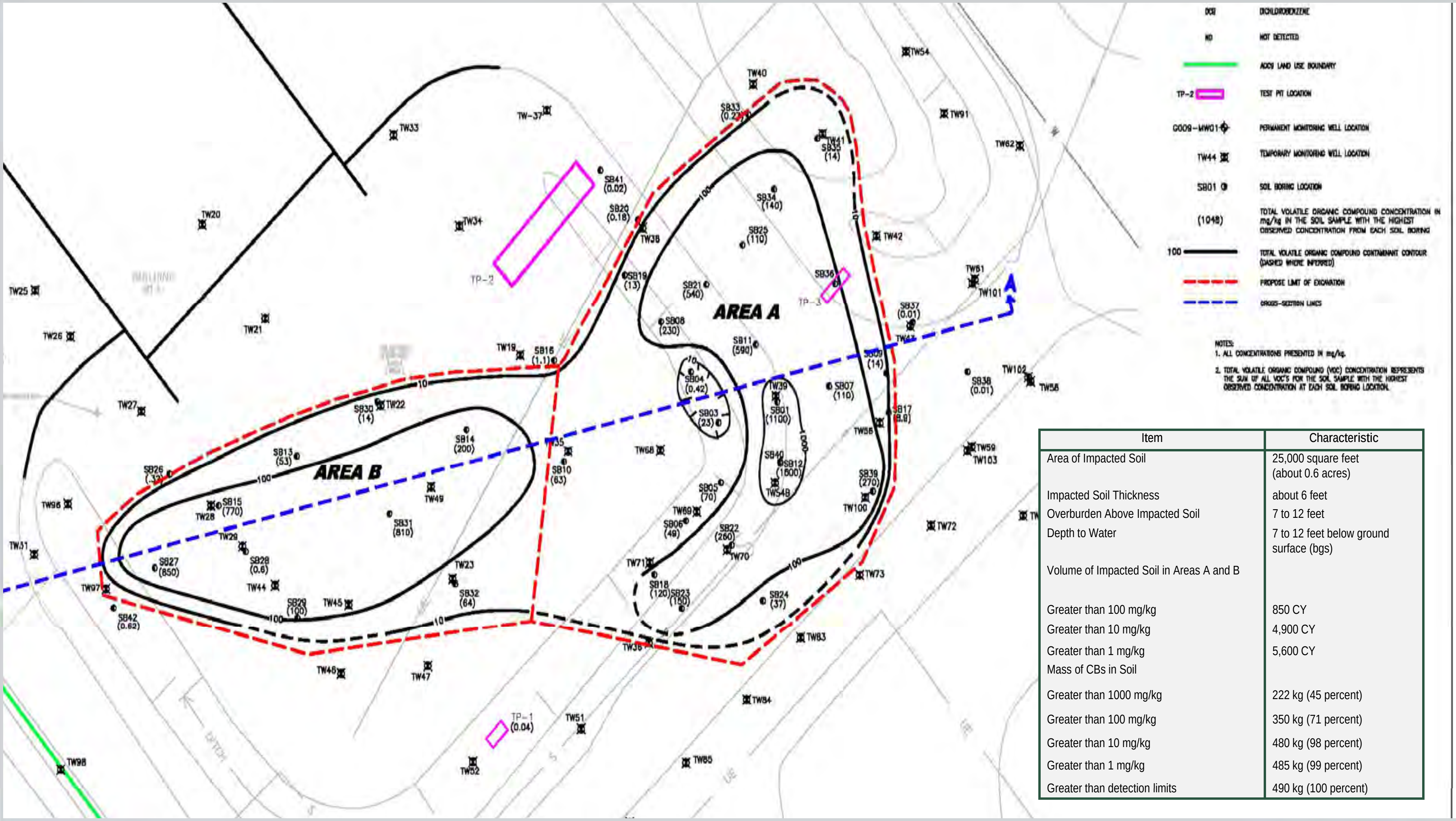


PARSONS

AOC 9 Remedial Approach

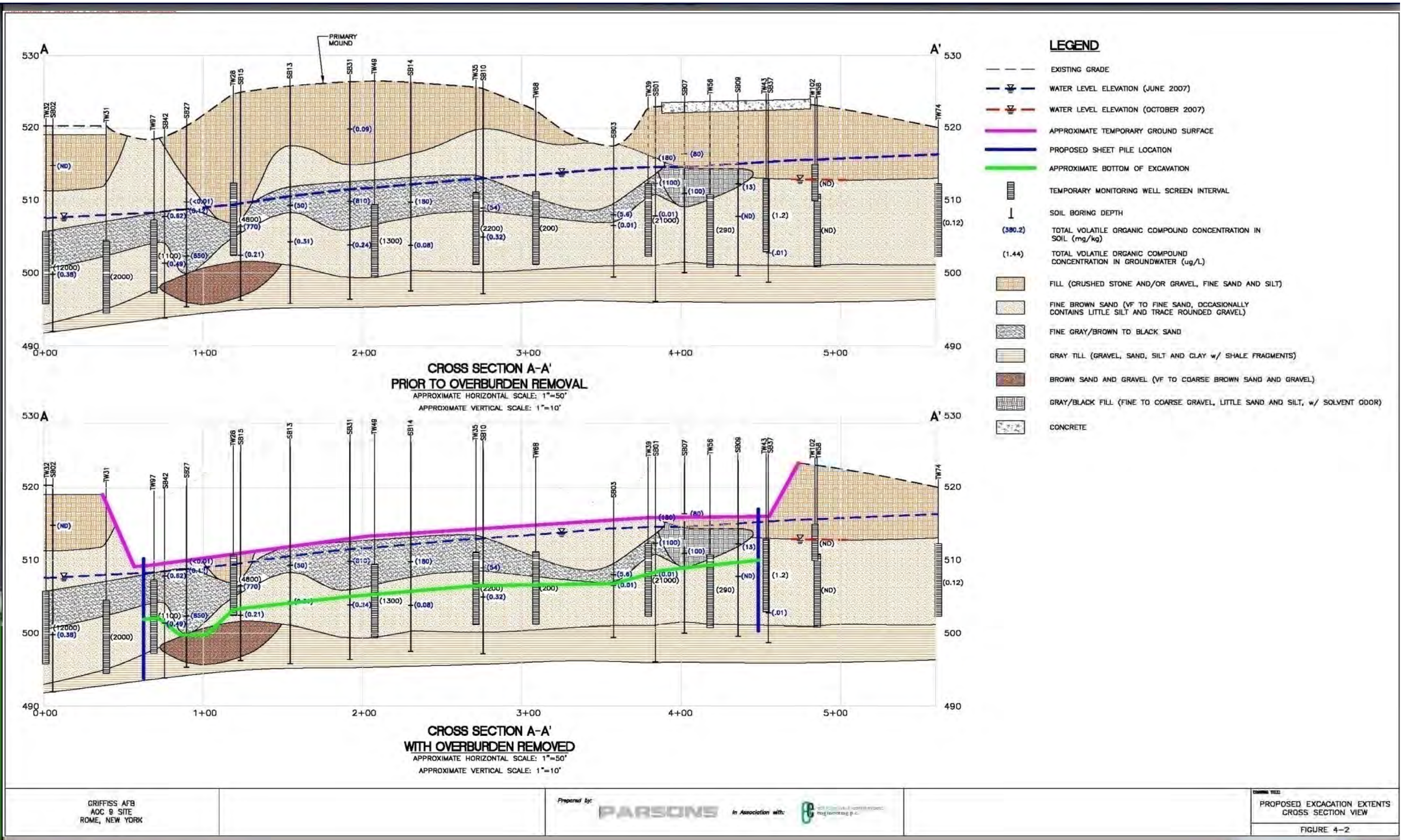
Key Proposed Strategy Elements	Key Remediation Methods	End of Contract Goal	After Contract Goal	RIP Construction Complete	OPS Regulatory Concurrence
Excavation of source area soil contamination	Sheet pile installation around the 1 milligram per kilogram (mg/kg) soil concentration area. Off-site disposal of 5600 cubic yards (CY) of contaminated soil.	Removal of 99% of contaminant mass.	No further remedial action.	11/29/2010	01/08/2014
Oxidation of groundwater plume area.	Persulfate injection in the 1000 ppb zone downgradient of the source excavation.	Reduction of GW concentrations to 100 ppb.	No actively operating remedial action systems.	05/3/2011	01/08/2014
Performance/Long Term Monitoring	Semi-annual sampling of a subset of existing wells downgradient of the source area.	Annual sampling of a subset of existing wells downgradient of the source area. Acceptance of biennial sampling post-contract.	Reduction of post contract activities to 4 sampling events over 7 years. RC in 2022.	05/03/2011	01/08/2014

AOC 9 Excavation Plan



Item	Characteristic
Area of Impacted Soil	25,000 square feet (about 0.6 acres)
Impacted Soil Thickness	about 6 feet
Overburden Above Impacted Soil	7 to 12 feet
Depth to Water	7 to 12 feet below ground surface (bgs)
Volume of Impacted Soil in Areas A and B	
Greater than 100 mg/kg	850 CY
Greater than 10 mg/kg	4,900 CY
Greater than 1 mg/kg	5,600 CY
Mass of CBs in Soil	
Greater than 1000 mg/kg	222 kg (45 percent)
Greater than 100 mg/kg	350 kg (71 percent)
Greater than 10 mg/kg	480 kg (98 percent)
Greater than 1 mg/kg	485 kg (99 percent)
Greater than detection limits	490 kg (100 percent)

AOC 9 Excavation Plan



CROSS SECTION A-A'
PRIOR TO OVERBURDEN REMOVAL
APPROXIMATE HORIZONTAL SCALE: 1"=50'
APPROXIMATE VERTICAL SCALE: 1"=10'

CROSS SECTION A-A'
WITH OVERBURDEN REMOVED
APPROXIMATE HORIZONTAL SCALE: 1"=50'
APPROXIMATE VERTICAL SCALE: 1"=10'

GRIFFISS AFB
AOC 9 SITE
ROME, NEW YORK

PROPOSED EXCACATION EXTENTS
CROSS SECTION VIEW

FIGURE 4-2

Project Execution

- ID/IQ - Firm Fixed Price Performance Based Contract
- 21 Milestone Payments
- Two 5-year Task Orders
- 2009 – 2016 Period of Performance

Project Execution

- Parsons – Syracuse, NY
  - Project Plans
  - Project Oversight
  - Remedial Construction - Peak Environmental Owego, NY (small business)
  - Persulfate Application
- Ecology & Environment – Buffalo, NY
  - Baseline Monitoring
  - Regulatory Documents / Remedial Design
  - Performance and Long Term Monitoring

Target Schedule

- AOC 9 remedial construction in 2010
- Requires timely approvals from regulators. Can meet goal with one month approval cycle.
- OBGW issues causing regulator approval delays
  - Land use control language – should be agreement
  - SVI requirements – separate operable unit
- Possible to perform remedial construction with agreement on ROD technical issues

Near Term Schedule Goals

- September 2009 – Regulator briefing
- October 2009 – Draft FS to regulators
- March 2010 – Proposed Plan public meeting
- May 2010 – ROD Approval
- June 2010 – RD Approval
- July 2010 – Construction mobilization

September Regulator Briefing – Draft Agenda

- Regulatory document schedule
  - Review times for documents (30 days)
  - Remedial design review in advance of ROD
- ROD issues
  - Land use control language – should be in agreement
  - SVI requirements – separate operable unit
- Proposed remedy – Excavation & Oxidation
- 2010 CERCLA 5-Year Review (Basewide)
- Summer 2009 OBGW (prelim. Results)

PROJECT KICKOFF MEETING

SIGN- IN SHEET

FORMER GRIFFISS AIR FORCE BASE
153 BROOKS ROAD
ROME, NY 13441

AREA OF CONCERN 9 (AOC 9) REMEDIATION

AUGUST 12, 2009

NAME (Print)	SIGNATURE	COMPANY	EMAIL	PHONE NUMBER
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DANIEL HOFFNER	Daniel Hoffner	PARSONS	dan.hoffner@parsons.com	716-541-0748
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JOE WOJNAS	Joe Wojnas	USACE	joseph.wojnar@usace.army.mil	315-356-0810 EXT 206
MICHAEL MCDERMOTT		AFRPA	MICHAEL.MCDERMOTT@LACKLAND.AF.MIL	315-356-0810 Ex 202.
TOM HEINS		E&E	THeins@ENE.com	716 684 8060
Ross Miller		Parsons	ross.miller@Parsons.com	801 523 6415
Nanci Higginbotham	Nanci E Higginbotham	USACE	nanci.e.higginbotham@usace.army.mil	816-389-3359
DAVID NELSON		USACE	david.c.nelson@usace.army.mil	816-389-3572
CATHY JERRARD	Cathy Jerrard	AFRPA	catherine.jerrard@lackland.af.mil	315 3560810 x204
JOHN LANIER		PARSONS	John.Lanier@parsons.com	(315)552-9704

MEETING MINUTES

September 2, 2009

To: Griffiss AOC 9 Project Team

From: Parsons

Subject: September 2, 2009 Regulator Briefing Meeting

On Wednesday, September 2, 2009 at 10:00 AM, a meeting was held at the New York State Department of Environmental Conservation (NYSDEC) Building, in Albany, NY to discuss the Griffiss Air Force Base Area of Concern 9 (AOC 9) Remediation Project. Attendees included: Michael McDermott (AFRPA), Cathy Jerrard (AFRPA), Nanci Higginbotham (USACE-KC), Doug Pocze (USEPA), Heather Bishop (NYSDEC), John Lanier (Parsons), Ross Miller (Parsons- via telephone), Rebecca Absolom (Parsons), Daniel Hoffner (Parsons), Tom Heins (EEEPC) and Bob Meyers (EEEPC).

A power point presentation on the AOC 9 Site was presented. Handouts were distributed. Refer to Attachment 1 for the presentation.

INTRODUCTIONS

Project team members made introductions at the beginning of the meeting. A sign in sheet has been included as Attachment 2.

SAFETY MOMENT

- The safety moment was on influenza awareness for the Fall of 2009.
- The H1N1 flu may affect ½ of the US population this year.
- The H1N1 flu is most common in the 5-24 years of age bracket, since older adults may have been exposed to the strain or a similar strain at some point in their past.
- It is predicted that the vaccine will be ready in October without any trials. The H1N1 vaccine will require two (2) shots in addition to the standard flu shot.
- Recommendations to prevent the spread of the H1N1 virus are to wash your hands often, cover your mouth and nose when sneezing or coughing, and stay home or away from work/school for 24 hours after the last fever symptom.

REMEDIATION PROJECT TEAM

The AOC 9 Project Team is set up similar to the On-Base Groundwater (OBGW) Project Team. The Team has proven success in working together and maintaining good communication among all members. The current period of performance for the AOC 9 Project coincides with the OBGW Project period of performance ending in 2016. The USAF retains environmental responsibility and will provide the formal communication. The United States Army Corps of

Engineers, Kansas City District (USACE-KC) will support the U.S. Air Force. Parsons will have the overall project responsibility; develop the project plans, work plans, construction management, and persulfate application. EEEPC will be performing the baseline monitoring, preparation of the regulatory documents and the remedial design, and the performance and long term monitoring. Peak Environmental Inc. from Owego, NY is a small business firm that will be performing the remedial construction activities.

LONG TERM OBJECTIVES

- To obtain regulatory site closure.
- To complete property transfer.

SHORT TERM OBJECTIVES

The short term objectives were discussed. The AOC 9 project will proceed through the CERCLA process that includes the Feasibility Study (FS), Proposed Plan (PP), Record of Decision (ROD), remedial design and remedial construction to achieve Remedy in Place (RIP) and Operating Properly and Successfully (OPS).

The remedial approach to the AOC 9 Remediation Project is to excavate the contamination source area and apply an oxidant to the groundwater.

SITE BACKGROUND

Previous investigation work included 2004 FS (E&E 2004) and a 2007 Additional AOC 9 PDI Data Summary Report (EEEPC 2007a). The 2007 PDI work resulted in approximately 56 new temporary monitoring wells and 42 soil borings. The temporary 1 inch wells were installed moving up gradient in an effort to located the boundaries of the source. Following the location of the source area, soil borings were taken to identity the boundary and depth of the contaminated soil. The PDI also identified the chemicals of concerns as volatile organic compounds (VOCs), specifically chlorobenzene (CB).

While developing the proposed remedial approach, approximately 25 remediation options were evaluated which included excavation, air sparging, containment, in-situ chemical oxidation (ISCO), and no action. Data obtained shows that the contaminated groundwater plume has slowly been decreasing in size.

To evaluate the available options BIOCHLOR, REMChlor & SourceDK, computer models were used to evaluate the relative remedial duration.

- Air sparging was eliminated because of a higher risk of failure due to unpredictable air distribution and strong anaerobic conditions.

- Containment was eliminated because the source would remain resulting in long time frames to meet RAOs and associated high life cycle costs.

- Excavations with lower contaminant mass removal were eliminated due to excessive schedule and excessive life cycle costs.

- ISCO only was eliminated because of a potential higher failure risk due to the difficulty in getting contact between the oxidant and the source contamination.

AOC 9 PROPOSED REMEDY

The remedy proposed includes the excavation and removal of contaminated source in areas A & B to the 1 mg/kg total VOC contour in soil. The excavation will be followed by the oxidation of the groundwater plume down gradient of the excavation. This proposed remedy allows for the shortest time to meet the remedial action objectives, removes 99% of the source mass, and has the most cost effective lifecycle cost.

The proposed ROD provisions include the proposed remedy for AOC 9 Remediation and obtaining the chemicals of concern groundwater clean-up goals. The monitoring is currently assumed to be required for eleven (11) years and the final number and locations of the monitoring wells will be finalized during the design stage.

It was discussed that the Air Force needs to determine acceptable contingency language. EPA stated that if the general statement does not clearly define the process, then a contingency with specific steps and trigger points would be required to define exactly when the Air Force would be required to implement the contingency.

Prior to the start of the proposed remedy, baseline monitoring will be conducted to provide a starting point for the remediation efforts. The excavation will include the removal of approximately 7-12 feet of clean overburden. This will be approximately 1 foot above groundwater. Field screening of the soil will occur as the material is stockpiled.

After the overburden excavation, sheet piling will be installed down to a depth of approximately 25 feet. Approximately 5,600 cubic yards of source area soils will be excavated and disposed off site. Samples will be collect from the excavated material for waste characterization and disposal offsite.

Discussion indicated that there is a clear delineated line between the clean soil and the “dirty” soil. The iron sulfide in the soil resulted in anaerobic respiration which caused the color of the soil to change to an identifiable darker appearance. Additional samples will be identified in the remedial design and remedial action work plan. The focus of the ROD will be on what the contributing source of the groundwater contamination is and how to remediate the plume.

The excavation will be dewatered and following proper testing and treating the water will be discharged to the City of Rome POTW. Prior to backfilling, an oxidant will be applied to the bottom of the excavation and temporary injections wells will be installed down gradient to assist with remediating residual areas. The details regarding the oxidation of the groundwater plume will be discussed in the detail design phase of the project.

Following remedial construction performance and long-term monitoring will continue for approximately 11 years. It is estimated that the remedy proposed for the source area will be meeting the MCL in groundwater within 11 years. A contingency will be developed to ensure that the creek and other receptors will be protected. The performance and the long term monitoring will be included in the detail design.

SCHEDULE

The current schedule proposes starting field construction activities in the summer of 2010. This is an accelerated schedule which will require that the FS and the PP be reviewed at the same time. It was identified that the PP must go through review by both the EPA and AF attorneys. The ROD for AOC 9 will require review from EPA headquarters. Based on the number of these reviews and the anticipated issues such as contingency, and other documents issued previously for review there may be schedule concerns.

The AOC 9 Project Team will have to proceed forward at an accelerated rate in order to meet the desired schedule deadlines.

ON-BASE GROUNDWATER (OBGW) REMEDIATION PROJECT

Since the last update on the OBGW Project on June 18, 2009, the vegetable oil has appeared persistent at the enhanced dechlorination sites; there is a downward trend for TCE at all the sites; and the plumes are stable with no impact to the streams.

The Annual Performance Monitoring Report will be sent in October 2009 and will include four quarters of data, trend analysis, conclusions, and recommendations. The Year 2 Performance Monitoring will begin the last week of September; however, no changes will be made to the sampling at that time.

CONCLUSION

The USEPA, NYSDEC, AFRPA, USACE, Parsons and EEEPC identified that this will be a fast paced project and that everyone must be in cooperation for it to succeed. The Regulators identified that there are a number of factors that must be considered in order to meet the presented time frame. These items include:

1. Concurrence on the contingency language between USEPA\NYSDEC and AFRPA.
2. Submittal of the FS\PP to AFRPA and Regulators early to allow proper review and comment time.
3. Prioritization of the various documents submitted by the AFRPA.

ATTACHMENT 1- Griffiss AFB AOC 9 Remediation Project Regulator Briefing Presentation

ATTACHMENT 2- Regulator Briefing Sign-in Sheet

END OF MEETING

PARSONS

Former Griffiss AFB – AOC 9 Remediation

Regulator Briefing Meeting

September 2, 2009

Meeting Agenda

- Safety Moment
- Remediation Project Team
- Project Objectives
- Remedial Approach Summary
- Site Background
- Remedial Approach Selection Process
- Remedial Action Work Details
- Schedule
- OBGW Update

Safety Moment – Influenza Awareness Fall 2009

USA TODAY

8/24/09

“U.S. report predicts 30,000 to 90,000 H1N1 deaths”

Prepared by President's Council of Advisors on Science and Technology.

May infect as much as half the U.S. population.

The science advisers urge the government to press vaccine makers to speed production

Flu Shot Facts

- 45% reduction in risk of illness
- 60% reduction in number of days ill, missed work days, working while ill, and days in bed.

H1N1 vaccine will be available early 2010

Influenza Awareness - Back to School

CDC's *Guidance for Responses to Influenza for the 2009-2010 Academic Year.*

Wash your hands often with soap and water, especially after coughing or sneezing. Alcohol-based hand cleaners are also effective.

Cover your mouth and nose with a tissue when you cough or sneeze.

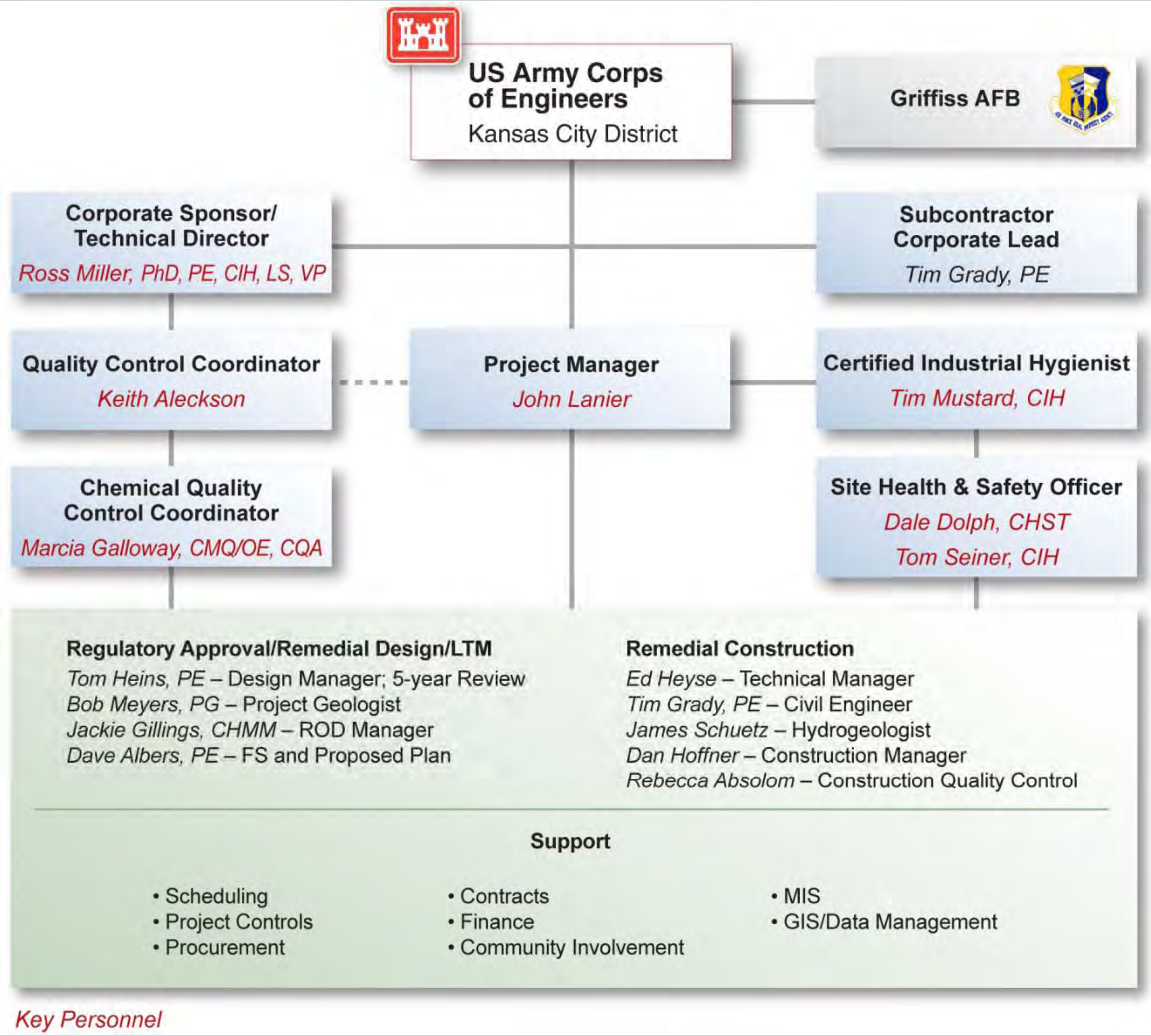
Stay home or in dorm room for 24 hours after the last fever symptoms (100 F).

Normal seasonal flu vaccine for children 6 months through 18 years of age and everyone age 50 and older.

H1N1 flu most prevalent in age group 5-24 years of age

Hand-washing 101
1. **Warm water and soap**
2. **Scrub for 20 seconds**

Remediation Project Team



US Army Corps of Engineers
Kansas City District

Griffiss AFB

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Rebecca Absolom – Construction Quality Control

Support

- Scheduling
- Project Controls
- Procurement
- Contracts
- Finance
- Community Involvement
- MIS
- GIS/Data Management

Key Personnel

Project Execution

- ID/IQ - Firm Fixed Price Performance Based Contract
- Two 5-year Task Orders
- 2009 – 2016 Period of Performance
- Contract awarded to Parsons on July 31, 2009

Project Team – Responsibilities

- Parsons – Syracuse, NY
  - Overall Project Responsibility
  - Project Plans
  - Work Plans / Construction Management
  - Persulfate Application
  - Peak Environmental – Owego, NY
    - Remedial Construction
- Ecology & Environment – Buffalo, NY
  - Baseline Monitoring
  - Regulatory Documents / Remedial Design
  - Performance and Long Term Monitoring

Project Objectives

Long Term Objectives

- Obtain regulatory site closure
- To complete property transfer

Project Objectives

Short Term Objectives

- Reduce or eliminate the potential for human and environmental risk
- Eliminate or reduce further off-site migration of contaminated groundwater
- Achieve cleanup goals for contaminants of concern
- Provide a remediation approach based on the PDI work and amend the 2004 FS to include this alternative

Project Objectives

Short Term Objectives

- Summarize remedial alternatives proposed for AOC 9 in the PP and describe the preferred alternative
- Obtain an executed ROD
- Complete remedial design & implement selected remedy
- Achieve Remedy in Place (RIP) and Operating Properly and Successfully (OPS)

AOC 9 Remedial Approach Summary

Key Proposed Strategy Elements	Key Remediation Methods	End of Contract Goal	After Contract Goal	RIP Construction Complete	OPS Regulatory Concurrence
Excavation of source area soil contamination	Sheet pile installation around the 1 milligram per kilogram (mg/kg) soil concentration area. Off-site disposal of 5600 cubic yards (CY) of contaminated soil.	Removal of 99% of contaminant mass.	No further remedial action.	11/29/2010	01/08/2014
Oxidation of groundwater plume area.	Persulfate injection downgradient of the source excavation.	Reduction of GW concentrations to 100 ppb.	No actively operating remedial action systems.	05/3/2011	01/08/2014
Performance/Long Term Monitoring	Semi-annual sampling of a subset of existing wells downgradient of the source area.	Annual sampling of a subset of existing wells downgradient of the source area. Acceptance of biennial sampling post-contract.	Reduction of post contract activities to 4 sampling events over 7 years. RC in 2022.	05/03/2011	01/08/2014

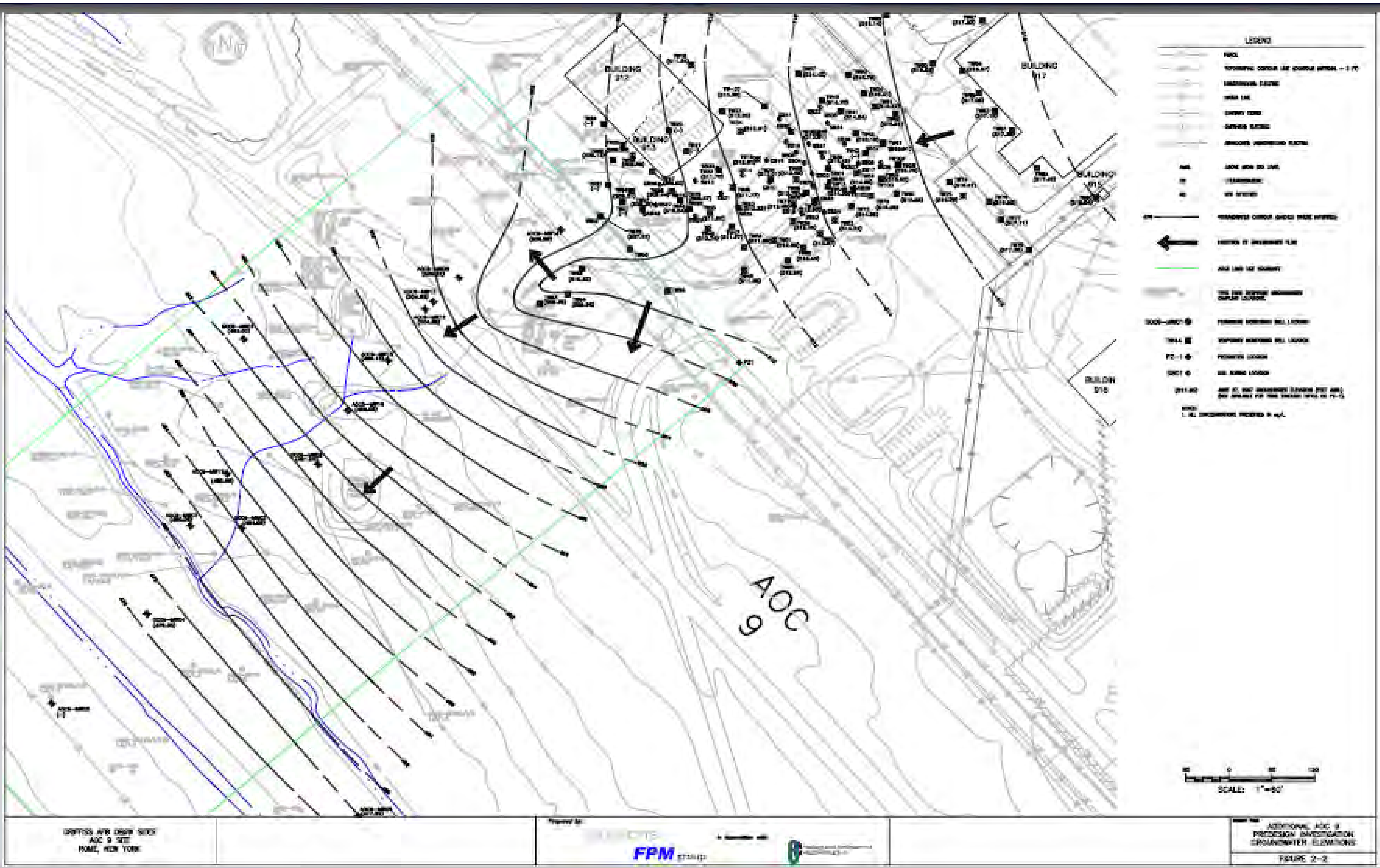
Site Background – Previous Investigations

- Previous investigation work yielded the following:
  - 2004 Feasibility Study (FS) (E & E 2004)
  - 2007 Additional AOC 9 PDI Data Summary Report (EEEPC 2007a)

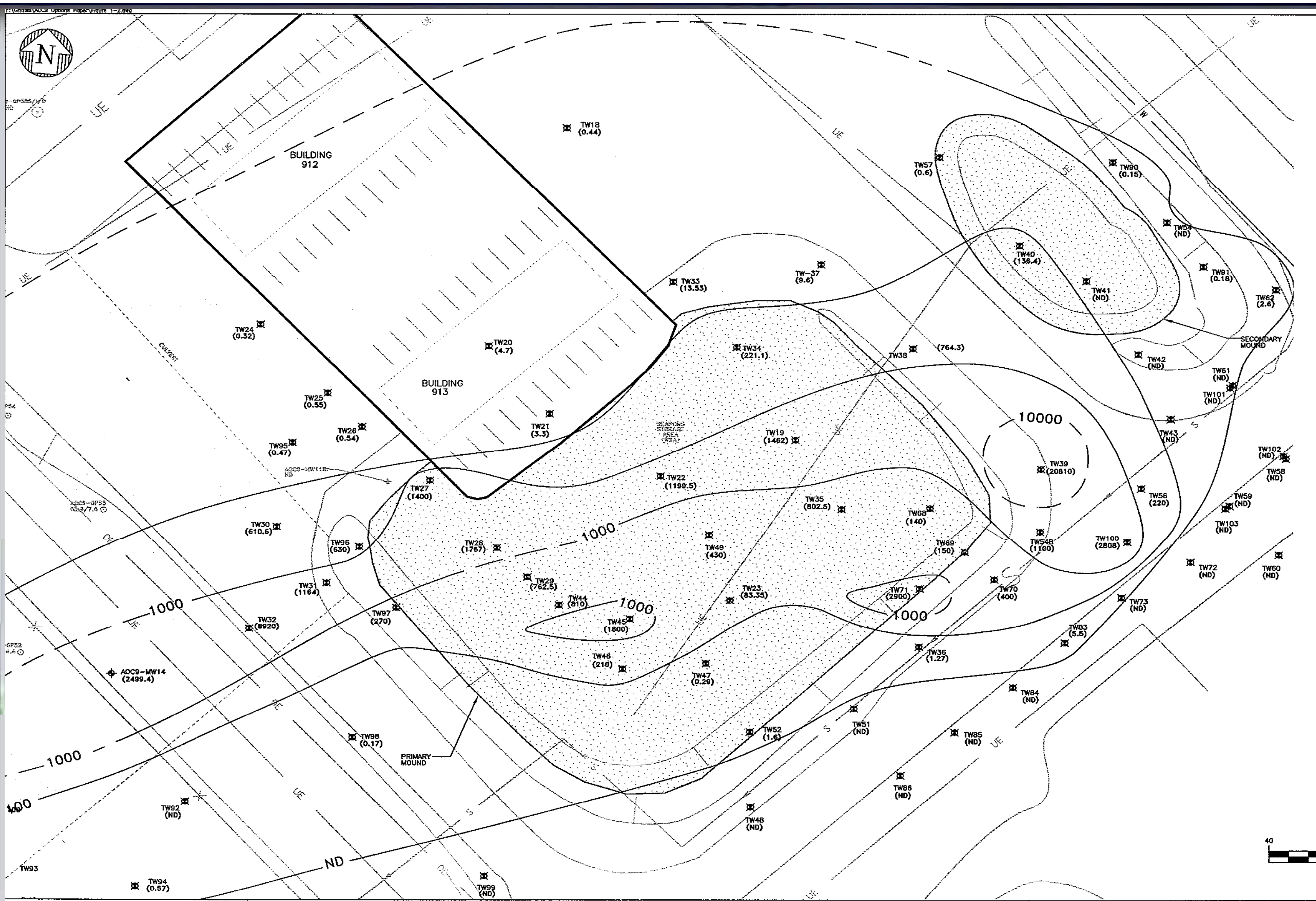
Site Background – 2007 PDI Work

- 56 new temporary monitoring wells
- 42 soil boring locations
- Results of investigations include:
  - Source areas found
  - CoC’s primarily consists of VOCs, mainly CB

Site Background – Flow Gradient AOC 9



Site Background – Total CB in Groundwater AOC 9



LEGEND

—X—	FENCE
—525—	TOPOGRAPHIC CONTOUR LINE (CONTOUR INTERVAL = 5 FT)
—UE—	UNDERGROUND ELECTRIC
—W—	WATER LINE
—S—	SANITARY SEWER
—OE—	OVERHEAD ELECTRIC
	ABANDONED UNDERGROUND ELECTRIC
CB	CHLOROBENZENE
ND	NOT DETECTED
— —	MONITORING WELL TOTAL CHLOROBENZENES GROUNDWATER DATA IN ug/L FROM 2006 AND 2007 (DASHED WHERE INFERRED)
AOC9-GP36S/I/D 10.0/5.2 ⊙	YEAR 2000 GEOPROBE GROUNDWATER SAMPLING LOCATIONS.
G009-MW01	PERMANENT MONITORING WELL LOCATION
TW44 ☒	TEMPORARY MONITORING WELL LOCATION
PZ-1	PIEZOMETER LOCATION
(136.4)	TOTAL CHLOROBENZENE CONCENTRATION (ug/L)
▨	MOUND

NOTES:

1. ALL CONCENTRATIONS PRESENTED IN ug/L.
2. MONITORING WELL AOC9-MW14 WAS SAMPLED IN OCTOBER/NOVEMBER 2006.
3. TEMPORARY MONITORING WELLS TW18 THROUGH TW43 (EXCLUDING TW42) WERE SAMPLED IN FEBRUARY 2007.
4. TEMPORARY MONITORING WELLS TW42 THROUGH TW97 WERE SAMPLED IN JUNE 2007.
5. TEMPORARY MONITORING WELLS TW98 THROUGH TW103 WERE SAMPLED IN SEPTEMBER 2007.

40 0 40 80

SCALE: 1"=40'

GRIFFISS AFB OBGW SITES
AOC 9 SITE
ROME, NEW YORK

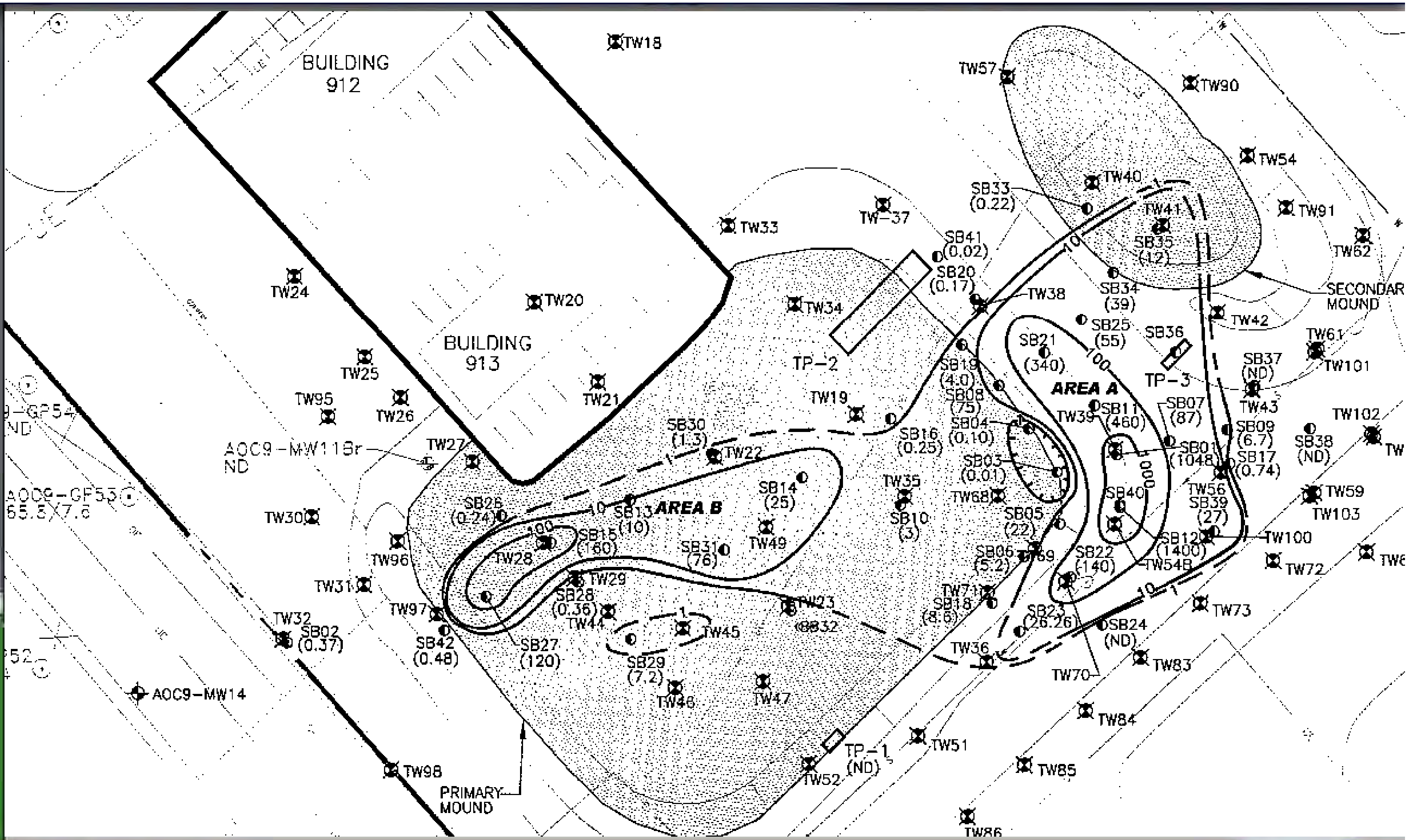
Prepared by:
parsons
FPM group

In Association with:
ecology and environment engineering p.c.

TOTAL CHLOROBENZENE CONCENTRATIONS IN GROUNDWATER

FIGURE 1–2

Site Background – Total CB in Soils AOC 9



PARSONS

Proposal Submission Process

- 25 Remediation Options Evaluated
    - Excavations
    - Air Sparging
    - Containment
    - In-Situ Chemical Oxidation (ISCO)
    - No Action

Remediation Systems Combinations Evaluated Prior to Proposal

- Modeled Remediation Systems
  - Modeled the groundwater plume using BIOCHLOR, REMChlor & SourceDK to establish relative remedial durations
- Estimated Remediation Metrics
  - Estimated Capital & Lifecycle costs using experience based Engineering Estimates
  - Estimated Remedy Effectiveness by mass removal (residual risk from remaining contamination after remediation is complete)

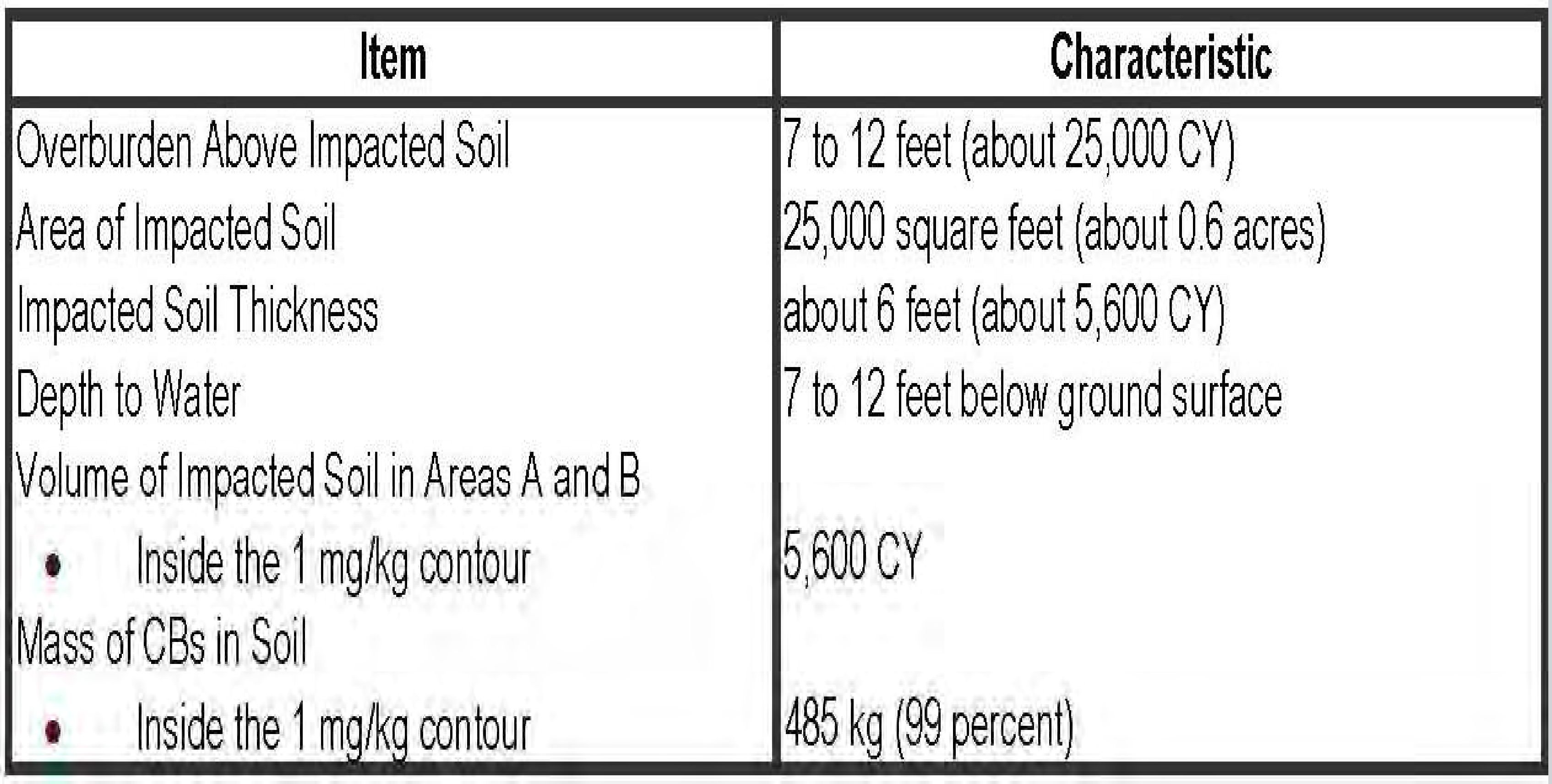
Options Eliminated

- Air Sparging
  - Higher risk of failure due to unpredictable air distribution & strongly anaerobic conditions
- Containment
  - Source remains resulting in long timeframes to meet RAO’s and associated high life-cycle costs
- Excavations with lower contaminant mass removal
  - Excessive Schedule
  - Excessive Life Cycle Costs
- ISCO Only
  - Potential higher failure risk due to the difficulty in getting contact between the oxidant and the source contaminant
- No Action

Remedy Proposed

- Excavation & removal of contaminated source in Areas A&B to the 1 mg/kg total VOC contour in soil
- Oxidation of groundwater plume downgradient of the excavation
- Remedy proposed because it allows for:
  - Shortest time to achieve RAO’s
  - Removes 99% of source mass
  - Most cost effective lifecycle cost

Excavation Metrics



Item	Characteristic
Overburden Above Impacted Soil	7 to 12 feet (about 25,000 CY)
Area of Impacted Soil	25,000 square feet (about 0.6 acres)
Impacted Soil Thickness	about 6 feet (about 5,600 CY)
Depth to Water	7 to 12 feet below ground surface
Volume of Impacted Soil in Areas A and B	
• Inside the 1 mg/kg contour	5,600 CY
Mass of CBs in Soil	
• Inside the 1 mg/kg contour	485 kg (99 percent)

Preliminary/Proposed ROD Provisions (1 of 2)

- The proposed remedy for AOC 9 OBGW includes:
  - Excavation of identified source areas
  - Oxidation downgradient of the source removal
  - Performance/Long Term Monitoring

- Achieving CoC cleanup goals: NYSDEC Class GA Groundwater Quality Standards

- Appropriate land use controls

Preliminary/Proposed ROD Provisions (2 of 2)

- Appropriate monitoring wells
  - The number and location of the wells in the network will be finalized during the design stage
  - Monitoring is currently assumed to be required for 11 years

- The selected remedies are protective of human health and the environment, comply with federal and New York State standards that are applicable or relevant and appropriate to the remedial action, are cost effective, and utilize permanent solutions to the extent possible

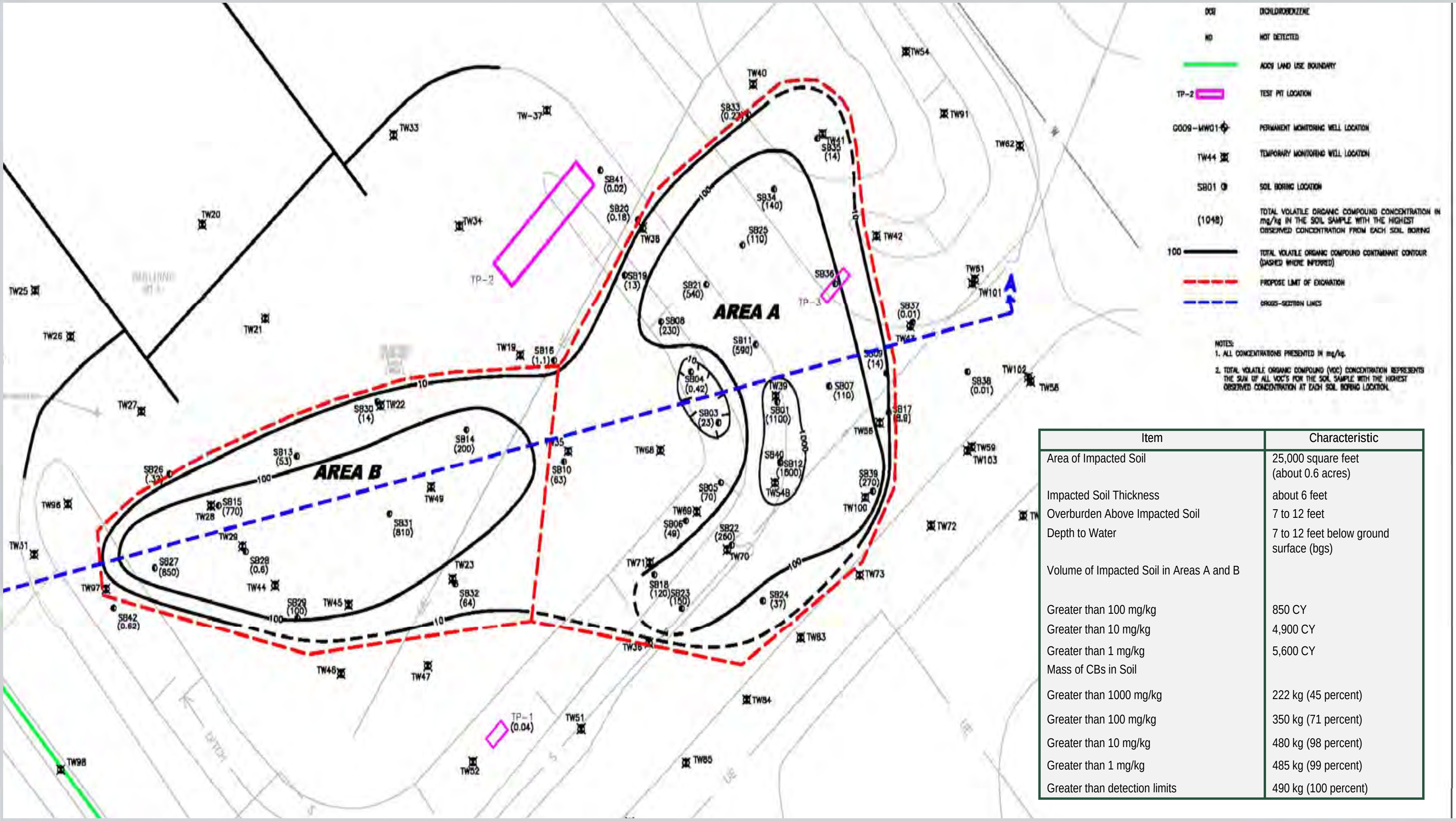
Remedial Action Work Details

- Excavation of Source Area Soil Contamination
- Oxidation of Groundwater Plume Downgradient of the Source Area
- Performance/Long Term Monitoring

Excavation of Source Soils

- Remove and stockpile ~ 25,000 cy of clean overburden (top 7-12 feet bgs to ~ 1 foot above groundwater)
  - Field screen for VOC's
- Install sheet pile around the 1 mg/kg soil concentration line identified in the PDI
  - 25-foot steel sheets to be installed in two cells
- Confirmation samples will not be needed
  - Excavation for contaminant mass removal, not to soil cleanup goals
- Excavate and dispose off-site ~ 5,600 cy of source area soil (~6 feet into the groundwater)
  - Soils will be pre-characterized for disposal prior to excavation

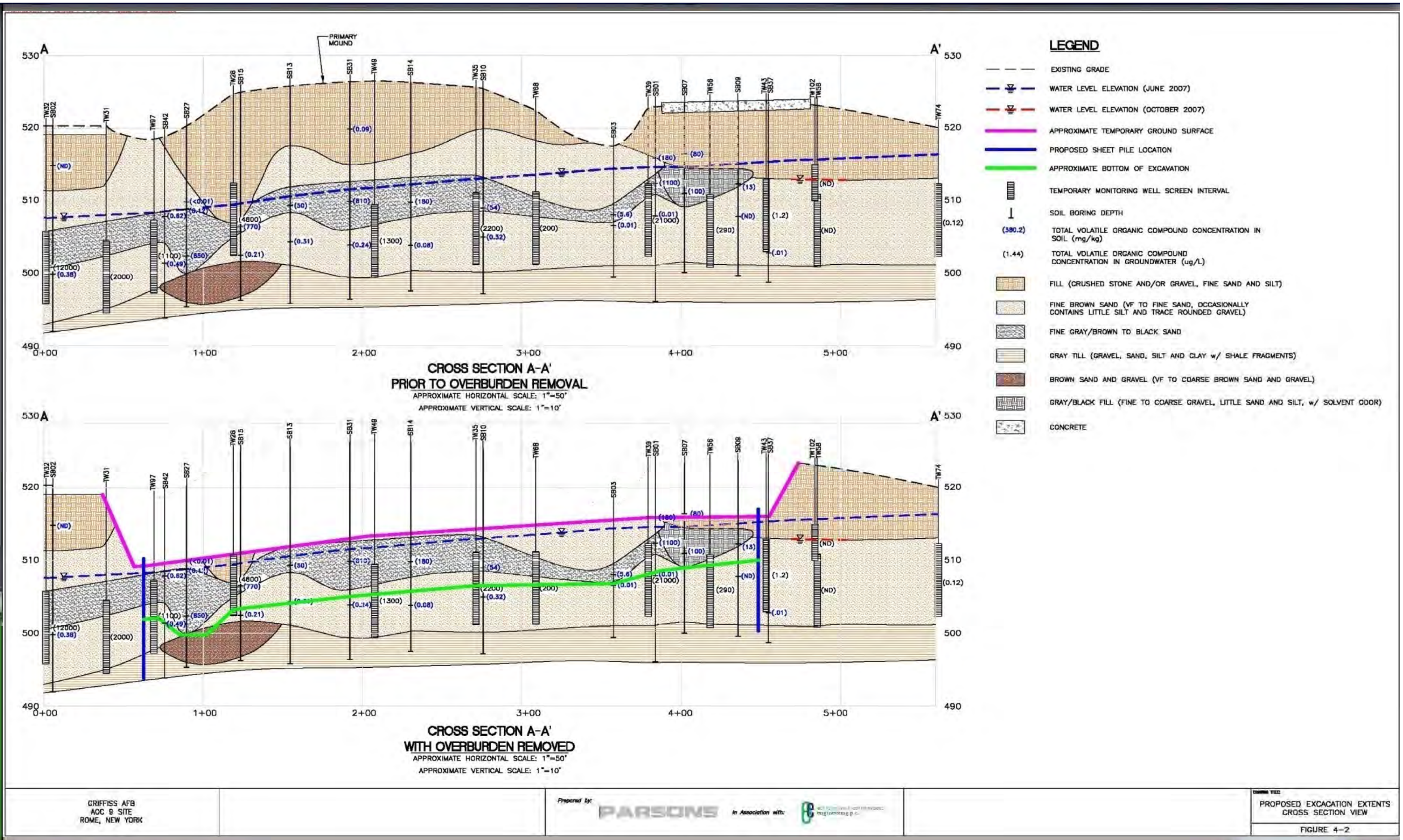
Excavation Plan



NOTES:
1. ALL CONCENTRATIONS PRESENTED IN mg/kg.
2. TOTAL VOLATILE ORGANIC COMPOUND (VOC) CONCENTRATION REPRESENTS THE SUM OF ALL VOC'S FOR THE SOIL SAMPLE WITH THE HIGHEST OBSERVED CONCENTRATION AT EACH SOIL BORING LOCATION.

Item	Characteristic
Area of Impacted Soil	25,000 square feet (about 0.6 acres)
Impacted Soil Thickness	about 6 feet
Overburden Above Impacted Soil	7 to 12 feet
Depth to Water	7 to 12 feet below ground surface (bgs)
Volume of Impacted Soil in Areas A and B	
Greater than 100 mg/kg	850 CY
Greater than 10 mg/kg	4,900 CY
Greater than 1 mg/kg	5,600 CY
Mass of CBs in Soil	
Greater than 1000 mg/kg	222 kg (45 percent)
Greater than 100 mg/kg	350 kg (71 percent)
Greater than 10 mg/kg	480 kg (98 percent)
Greater than 1 mg/kg	485 kg (99 percent)
Greater than detection limits	490 kg (100 percent)

Excavation Plan



CROSS SECTION A-A'
PRIOR TO OVERBURDEN REMOVAL
APPROXIMATE HORIZONTAL SCALE: 1"=50'
APPROXIMATE VERTICAL SCALE: 1"=10'

CROSS SECTION A-A'
WITH OVERBURDEN REMOVED
APPROXIMATE HORIZONTAL SCALE: 1"=50'
APPROXIMATE VERTICAL SCALE: 1"=10'

LEGEND

— — —	EXISTING GRADE
— ▽ —	WATER LEVEL ELEVATION (JUNE 2007)
— ▽ —	WATER LEVEL ELEVATION (OCTOBER 2007)
—	APPROXIMATE TEMPORARY GROUND SURFACE
—	PROPOSED SHEET PILE LOCATION
—	APPROXIMATE BOTTOM OF EXCAVATION
▥	TEMPORARY MONITORING WELL SCREEN INTERVAL
⊥	SOIL BORING DEPTH
(380.2)	TOTAL VOLATILE ORGANIC COMPOUND CONCENTRATION IN SOIL (mg/kg)
(1.44)	TOTAL VOLATILE ORGANIC COMPOUND CONCENTRATION IN GROUNDWATER (ug/L)
▨	FILL (CRUSHED STONE AND/OR GRAVEL, FINE SAND AND SILT)
▨	FINE BROWN SAND (VF TO FINE SAND, OCCASIONALLY CONTAINS LITTLE SILT AND TRACE ROUNDED GRAVEL)
▨	FINE GRAY/BROWN TO BLACK SAND
▤	GRAY TILL (GRAVEL, SAND, SILT AND CLAY w/ SHALE FRAGMENTS)
▨	BROWN SAND AND GRAVEL (VF TO COARSE BROWN SAND AND GRAVEL)
▦	GRAY/BLACK FILL (FINE TO COARSE GRAVEL, LITTLE SAND AND SILT, w/ SOLVENT ODOR)
▨	CONCRETE

GRIFFISS AFB
AOC 9 SITE
ROME, NEW YORK

Prepared by:
PARSONS
In Association with:

PROPOSED EXCACATION EXTENTS
CROSS SECTION VIEW

FIGURE 4-2

Excavation Dewatering

- Saturated soils will be dewatered prior to excavation and/or off-site disposal
- Excavation water will be collected in sumps and pumped to holding tanks
- Collected water will be treated (if necessary), tested and discharged to the City of Rome POTW

Excavation Backfill

- Backfill the saturated zone with clean soils
- Replace/regrade the overburden
- Restore site
  - Seeding
  - Roadways

Oxidation of Groundwater Plume

- Excavation Area (prior to backfilling)
  - Persulfate (oxidant) applied to bottom of excavation

- Persulfate oxidation application in residual areas
  - Enhances source removal
  - Reduces source mass
  - Reduces time to achieve RAO’s
  - Install temporary injection wells
  - Persulfate injected within the dissolved phase plume

Performance/Long Term Monitoring

- Performance Monitoring
  - Semi-Annual from existing downgradient wells (2 years)
- Long Term Monitoring
  - Annual from existing downgradient wells (2 years)
  - Biennial from existing downgradient wells (7 years)

Regulatory Review Schedule

Document	**Draft to Regulators**	**Regulator Comments**
Amended FS	Oct 9, 2009	Nov 9, 2009
Proposed Plan & Public Meeting	Oct 9, 2009	Nov 9, 2009 Dec 10, 2009
Draft ROD Final ROD	Dec 10, 2009 Feb 12, 2010	Feb 9, 2010 Apr 12, 2010
RD	Apr 10, 2010	May 10, 2010
RAWP	Apr 10, 2010	May 10, 2010

Construction Schedule

- Begin AOC 9 remedial construction - July 2010
- Finish excavations - December 2010
- Complete persulfate injections - May 2011
- Complete site restoration - July 2011

OBGW Update (Four TCE Sites)

- Last update on 6/18/09
  - Vegetable oil appeared persistent at enhanced dechlorination sites
  - Downward trend for TCE at all sites
  - Plumes are stable and no impact to streams
- Summer Performance Monitoring sampling (4th qtr.) June 2009
  - Preliminary 4th qtr. results consistent with 6/18 update
  - Reported with Year 1 (2008-09) Annual PM Report
  - Annual report will be sent Oct 2009 and will include
    - Four quarters of data
    - Trending analysis
    - Conclusions, recommendations
- Year 2 (2009-10) Performance Monitoring
  - Semi-annual sampling
  - First round samples week of Sep. 28, 2009

REGULATOR MEETING
FORMER GRIFFISS AIR FORCE BASE
SIGN- IN SHEET

NYSDEC
625 BROADWAY
ALBANY, NY 12233

AREA OF CONCERN 9 (AOC 9) REMEDIATION
SEPTEMBER 2, 2009

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QAPP Appendix B –
Laboratory SOPs and Quality Control Limits and Personnel Qualifications

KATAHDIN ANALYTICAL SERVICES, INC.
STANDARD OPERATING PROCEDURE

SOP Number: CA-202
Revision History
Cover Page
Page 1

TITLE: ANALYSIS OF VOAs BY PURGE AND TRAP GC/MS: SW-846 METHOD 8260

Prepared By: GC/MS Group Date: 2/97

Approved By:

Group Supervisor: J Galay Date: 011201

Operations Manager: John C. Burton Date: 1/15/01

QA Officer: Deborah J. Nadeau Date: 1·23·01

General Manager: Deneau F. Lafeau Date: 1/16/01

Revision History:

SOP Revision	Changes	Approval Initials	Approval Date	Effective Date
03 8260B	Format changes, added pollution prevention, changes to calibration section, new limits, added instrument other minor changes throughout.	DN	1·23·01	1·23·01
04 8260B	Revised sections 7.5.3.1, 7.5.5, 7.7.1, 7.8.2 + Table 2 to comply with South Carolina. Added NH oxygenates to calibration.	DN	5·23·01	5·23·01
05 8260B	Updated VOA calibration standard mixes. Added statistical limits for LCS/MS/MSD recoveries and the updated corrective actions	DN	5·21·02	5·21·02
06 8260B	Reorganization of sections 4, 5, 6 and 7, and Tables and Figures. Added definitions and information for the new data processing system.	MRC	05.03.04	05.03.04
07 8260B	minor changes rewording of sec. 7.6.3 preservation of calcareous soils	LAD	020305	020305

TITLE: ANALYSIS OF VOAs BY PURGE AND TRAP GC/MS: SW-846 METHOD 8260

SOP Revision	Changes	Approval Initials	Approval Date	Effective Date
08 8260 B	Added references, setup and operation for the Encon / Centurion autosampler / Purge and trap. Added ref. to instrument "T" and removed instrument "Q". Edited Std. conc. to reflect new instrumentation. Minor changes throughout to reflect current practice and correct typos.	LAD	04/06	04/06
09 8260 B	Sect. 4H - added list of waste streams generated and location of [illegible]. Clarified RT window studies. Added reference to MI Sop. Removed Grand Mean Calibration model. Added wording for project specific acceptance criteria. Added LCS marginal outlier criteria. Added wording clarifying Calibration verification std. Criteria and corrective action. Reworded Correlation coefficient criteria	LAD	LAD 7-25-07 ~~03/07~~ 07/07	~~03/07~~ 07/07
10	Updated Sections 7.4.5, 7.4.6, 7.4.7, 7.5.2, 8.1, 10.0 and Table 1 with DoD QSM version 4.1 criteria	LAD	08/09	08/09

TITLE: **ANALYSIS OF VOAs BY PURGE AND TRAP GC/MS: SW-846 METHOD 8260**

Please acknowledge receipt of this standard operating procedure by signing and dating both of the spaces provided. Return the bottom half of this sheet to the QA Department.

I acknowledge receipt of copy ___ of document **SOP CA-202-10**, titled **ANALYSIS OF VOAs BY PURGE AND TRAP GC/MS: SW-846 METHOD 8260**.

Recipient: ______________________________ Date: ________________

KATAHDIN ANALYTICAL SERVICES, INC.
STANDARD OPERATING PROCEDURE

I acknowledge receipt of copy ___ of document **SOP CA-202-10**, titled **ANALYSIS OF VOAs BY PURGE AND TRAP GC/MS: SW-846 METHOD 8260**.

Recipient: ______________________________ Date: ________________

1.0 SCOPE AND APPLICATION

The purpose of this SOP is to describe the procedures utilized by Katahdin Analytical Services, Inc. laboratory personnel to prepare and analyze aqueous and solid matrix samples for purgeable organics by GC/MS in accordance with SW-846 Method 8260, current revision.

This SOP will consolidate all aspects of the analyses in one working document, to be revised as necessary, for the purposes of consistency in data quality.

1.1 Definitions

VOC: Volatile Organic Compounds

VOA: Volatile Organic Analysis

ANALYTICAL BATCH: 20 or fewer samples that are analyzed together with the same method sequence and the same lots of reagents and with the handling practices common to each sample within the same time period or in continuous sequential time periods.

METHOD BLANK (laboratory reagent blank): A quality control sample designed to determine if method analytes or other interferences are present in the laboratory environment, the reagents, or the apparatus. Laboratory reagent grade water is used as a blank matrix. The blank is taken through the appropriate steps of the process.

CALIBRATION CHECK: Verification of the ratio of instrument response to analyte amount, a calibration check is done by analyzing a mid point standard. The calibration check verifies that instrument conditions are sufficiently similar to those at initial calibration.

CALIBRATION STANDARD (WORKING STANDARD): A solution prepared from the stock standard solution that is used to calibrate the instrument response with respect to analyte concentration.

INDEPENDANT CALIBRATION STANDARD: A solution prepared from a stock standard solution independent of the standard that is used to calibrate the instrument. This is prepared as an LCS and analyzed after the calibration before any sample analysis.

LABORATORY CONTROL SAMPLE (LCS): A blank that has been spiked with the analyte(s) from an independent source and is analyzed exactly like a sample. Its purpose is to determine whether the methodology is in control and to measure the degree of accuracy of the determination.

MATRIX SPIKE/MATRIX SPIKE DUPLICATE (MS/MSD): Predetermined quantities of stock solutions containing target analytes are added to a sample matrix prior to sample extraction, in the case of soils, and/or analysis. Samples are split into duplicates, spiked and analyzed. Percent recoveries are calculated for each of the spiked analytes. The relative percent difference between the samples is calculated and used to assess analytical precision.

STANDARD CURVE (CALIBRATION CURVE): A curve that plots concentration of known analyte standard versus the instrument response to the analyte.

STOCK STANDARD SOLUTION: A concentrated solution containing a single analyte or mix of certified standards, or a concentrated solution of a single analyte prepared in the laboratory with an assay reference compound. Stock standard solutions are used to prepare calibration standards.

SURROGATES: Organic compounds which are similar to analytes of interest in chemical composition as well as extraction and chromatography characteristics, but which are not normally found in environmental samples. These compounds are spiked into all blanks, standards, samples and spiked samples prior to analysis. Percent recoveries are calculated for each surrogate. Surrogates provide an indication of the accuracy for the analytical determination in a discrete sample matrix.

TARGET: A software system that combines full processing, reporting and comprehensive review capabilities, regardless of chromatographic vendor and data type.

TARGET DB: An oracle database used to store and organize all Target data files.

QUICKFORMS: A laboratory reporting software for Target and Target DB. The QuickForms report module for Target is preconfigured with generalized forms and US EPA CLP report forms and disk deliverables, which can be customized.

1.2 Responsibilities

This method is restricted to use by, or under the supervision of analysts experienced in the analysis of volatile organics by the current revision of EPA Method 8260. Each analyst must demonstrate and document their ability to generate acceptable results with this method. Refer to Katahdin SOP QA-805, current revision, "Personnel Training and Demonstration of Capability".

It is the responsibility of all Katahdin technical personnel involved in analysis of volatile organics by Method 8260 to read and understand this SOP, to adhere to the procedures outlined, and to properly document their data in the appropriate logbook. Any deviations from the test or irregularities with the samples should also be recorded in the lab logbook and reported to the Department Manager or designated qualified data reviewer responsible for this data.

It is the responsibility of the Department Manager to oversee that members of their group follow this SOP, to ensure that their work is properly documented and to initiate periodic review of the associated logbooks.

1.3 Safety

Users of this procedure must be cognizant of inherent laboratory hazards, proper disposal procedures for contaminated materials and appropriate segregation of hazardous wastes. The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined; however, each chemical should be treated as a potential health hazard. A reference file of material safety data sheets is available to all personnel involved in the chemical analysis. Everyone involved with the procedure must be familiar with the MSDSs (material safety data sheets) for all the materials used in this procedure.

Each qualified analyst or technician must be familiar with Katahdin Analytical Health and Safety Manual including the Katahdin Hazardous Waste Management Plan and must follow appropriate procedures. These include the use of appropriate personal protective equipment (PPE) such as safety glasses, gloves and lab coats when working with chemicals or near an instrument and not taking food or drink into the laboratory. Each analyst should know the location of all safety equipment. Each analyst shall receive a safety orientation from their Department Manager, or designee, appropriate for the job functions they will perform.

1.4 Pollution Prevention/Waste Disposal

Whenever possible, laboratory personnel should use pollution prevention techniques to address their waste generation. Refer to the current revision of the Katahdin Hazardous Waste Management Program for further details on pollution prevention techniques.

After analysis, partially-filled VOA vials and sample jars are returned to the appropriate refrigerators to be disposed of in adherence with the Katahdin Hazardous Waste Management Plan and Safety Manual and SOP SD-903, Sample Disposal, current revision. Expired standards are lab packed, placed in the Katahdin hazardous waste storage area, and disposed of in accordance with this SOP SD-903.

Sample aliquots used for analysis are disposed of in accordance with SOP SD-903 and the Katahdin Hazardous Waste Management Plan and Safety Manual. The soil samples must be decanted and the soil fraction disposed of separately in compliance with Katahdin's disposal policies.

There are three general types of waste generated while performing the 8260 method. The “K” waste is a combination of water, sample aliquot (post analysis), as well as internal and surrogate standards. “K” waste is generated when preparing QC, during sample analysis, and procedural cleanup. There are “K” satellites attached to each GC/MS instrument as well as an additional satellite located adjacent to the VOA sample preparation bench. “O” waste consists of methanol (as well as trace amounts of volatile analytes) and is generated when standard preparation syringes are rinsed three times with methanol. The “O” waste stream satellite is located inside the fume hood. Organic soil waste stream “I” consists of any solid left over from sample preparation and/or analysis and is located inside the fume hood. All satellites listed above are stored in a secondary container and are located in the Volatile Organics Laboratory room 111.

2.0 SUMMARY OF METHOD

The general methodology involves purging aqueous and soil samples with helium, an inert gas, for a set period of time to efficiently transfer purgeable organics to the gaseous phase. Soil samples with higher contaminant levels are extracted with methanol prior to the helium purge. These volatile organics are then retained on a cooled trap (commercially available trap suitable for the methodology) before heating causes desorption into a gas chromatograph for compound separation. Detection occurs with an electron impact ionization mass spectrometer.

3.0 INTERFERENCES

Interfering contamination may occur when a sample containing low concentrations of VOCs is analyzed immediately after a sample containing high concentrations of VOCs. During initial data review, all analyses are evaluated for potential carryover. Any samples that have suspected carryover are reanalyzed. GC/MS policy is to reanalyze a sample with positive detects greater than the Practical Quantitation Limit (PQL) that has been run immediately after a sample with the same positive detects over the upper limit of the calibration. Typically 2 or 3 rinsing blanks are analyzed at the end of a sequence. Samples are not analyzed on the instrument until a blank with no detects above PQL can be obtained. If the lines are determined to be contaminated, then the entire Tekmar or Archon must be backflushed with warm methanol and water.

4.0 APPARATUS AND MATERIALS

4.1 GC: Hewlett Packard 6890 & 5890

4.2 Mass Spectrometers (MS): HP5973, HP5972 and HP5970

4.3 Helium: Carrier gas for routine applications. All carrier gas lines must be constructed from stainless steel or copper tubing; non-polytetrafluoroethylene (non-PTFE) thread sealant or flow controllers with rubber component are not to be used.

4.4 Columns: RTX-VMS, 40 meter, 0.18 mm ID or equivalent.

4.5 Purge and Traps: Archon 5100, Tekmar 2016 and Centurion auto samplers, and Tekmar 2000, 3000 and Encon concentrators.

4.6 Purge tubes: 5 mL fritted and 25 mL fritted purge vessels and 40 mL VOA vials for soil analysis.

4.7 Hamilton Gastight syringes: 2.00 uL to 25.00 mL.

4.8 Acquisition System: The acquisition system must be interfaced to the MS and allow continuous acquisition of data throughout the duration of the chromatographic program. It must permit, at a minimum, the output of time vs. intensity (peak height or peak area). Hewlett Packard Chemstation or equivalent.

4.9 Data System: The Target software is used for processing data and generating forms.

5.0 REAGENTS

5.1 Purge and trap grade methanol

5.2 Organic-free Laboratory reagent grade water: Siemens, Poland Spring, or equivalent. This water may need to be purged with nitrogen to eliminate organic contaminants such as Methylene chloride and Chloroform, which are commonly found at ambient levels in the laboratory.

5.3 Standards: Stock standards and working standards are received and recorded in accordance with SOP CA-106 “Standard Preparation and Documentation”.

5.3.1 The expiration date for all standards is six months from date of opening the ampule with the following exceptions:

Volatile gases expire within 2 weeks of opening ampule (gases are dichlorodifluoromethane, chloromethane, bromomethane, vinyl chloride, chloroethane, and trichlorofluoromethane).

New standards must be opened if degradation is observed.

5.3.2 Secondary dilution standards

5.3.2.1 Calibration Mix – Prepare a standard in purge and trap methanol containing the compounds listed below. The final concentration of each compound is 200 ug/mL (some individual analyte concentrations may vary, i.e. Ketones). The standard should be prepared in a 1.0 mL conical vial with a mini-inert valve cap. The standard must be prepared every 7 days and stored in the VOA standards freezer between uses.

Acetone
Benzene
Bromobenzene
Bromochloromethane
Bromodichloromethane
Bromoform
Bromomethane
2-Butanone
n-Butylbenzene
sec-Butylbenzene
tert-Butylbenzene
Carbon Disulfide
Carbon Tetrachloride
Chlorobenzene
Chloroethane
2-Chloroethylvinyl Ether
Chloroform
Chloromethane
2-Chlorotoluene
4-Chlorotoluene
Cyclohexane
1,2-Dibromo-3-Chloropropane
Isopropylbenzene

Dibromochloromethane
1,2-Dibromoethane
Dibromomethane
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Dichlorodifluoromethane
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethene
cis-1,2-Dichloroethene
Trans-1,2-Dichloroethene
1,2-Dichloropropane
1,3-Dichloropropane
2,2-Dichloropropane
1,1-Dichloropropene
Cis-1,3-Dichloropropene
Trans-1,3-Dichloropropene
Ethylbezene
Hexachlorobutadiene
2-Hexanone
Idomethane
Methyl Tert-Butyl Ether

P-Isopropyltoluene
Methylene Chloride
4-Methyl-2-Pentanone
Naphthalene
N-Propylbenzene
Styrene
1,1,1,2-Tetrachloroethane
1,1,2,2-Tetrachloroethane
Tetrachloroethene
Tetrahydrofuran
Toluene
1,2,3-Trichlorobenzene
1,2,4-Trichlorobenzene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethene
Trichlorofluoromethane
1,2,3-Trichloropropane
1,2,4-Trimethylbenzene
Vinyl Acetate
Vinyl Chloride
1,3,5-Trimethylbenzene
1-Chlorohexane

5.3.2.2 Extras mix – Prepare a standard as above containing the compounds listed below. The final concentration of each compound is 200 ug/mL. The standard should be prepared in a 1.0 mL conical vial with a mini-inert valve cap. The standard must be prepared every 30 days and stored in the VOA standards freezer between uses.

Acetonitrile
Acrolein
Acrylonitrile
Allyl Chloride
Chloroprene
Diethyl Ether
Cis-1,4-Dichloro-2-Butene
Trans-1,4-Dichloro-2-Butene
1,4-Dioxane
Di-Isopropyl Ether
Ethyl Methacrylate
Ethyl Tertiary-Butyl Ether
Freon-113

Isobutyl Alcohol
Methacrylonitrile
Methylcyclohexane
Methyl Acetate
Methyl Methacrylate
Methyl Tert-Butyl Ether
Pentachloroethane
Propionitrile
Tertiary-Amyl Methyl Ether
Tertiary-Butyl Alcohol
1,3,5-Trichlorobenzene
1,2,3-Trimethylbenzene

5.3.2.3 Independent Calibration Verification Standard, Laboratory Control Spike and MS/MSD Mixture - Prepare a standard as above containing the compounds listed in Table 3. The final concentration of each compound is 200 ug/mL (some individual analyte concentrations may vary, i.e. Ketones). The standard should be prepared in a 1.0 mL conical vial with a mini-inert valve cap. The standard must be prepared every 7 days and stored in the VOA standards freezer between uses.

5.3.2.4 Surrogate Spiking Solution - Prepare a standard as above containing the compounds listed below. The final concentration of each compound is 250 ug/mL or 50 ug/mL depending on which autosampler you will be using. The standard must be prepared every 14 days and stored on the Archon and/or the Centurion autosampler in a pressurized vial or in the VOA standards freezer between uses.

4-Bromofluorobenzene
1,2-Dichloroethane-D_4
Toluene-D_8
Dibromofluoromethane

5.3.2.5 Internal Standard Solution - Prepare a standard as above containing the compounds listed below. The final concentration of each compound is 250 ug/mL or 50 ug/mL depending on which autosampler you will be using. The standard must be prepared every 14 days and stored on the Archon and/or the Centurion autosampler in a pressurized vial or in the VOA standards freezer between uses.

Pentafluorobenzene
1,4-Difluorobenzene
Chlorobenzene-D_5
1,4-Dichlorobenzene-D_4

5.3.2.6 BFB Solution - Prepare a standard as above containing 4-BFB. The final concentration is 25 ug/mL. The standard must be prepared every 30 days and stored in the VOA standards freezer between uses.

5.3.2.7 See Table 4 for a complete list of standards, concentration, and vendors.

NOTE: The concentrations of standards may vary depending on the type of autosampler being used.

6.0 SAMPLE COLLECTION, PRESERVATION AND HANDLING

All aqueous samples must be analyzed within 14 days from sample collection if preserved (by addition of HCl to pH <2) or within 7 days from sample collection if unpreserved. All soil/sediments must be analyzed within 14 days from sample collection. For specific projects, soil may be received in pre-weighed vials containing methanol, with an aliquot of the methanol used for analysis. For these projects, the methanol aliquot must be analyzed within 14 days from sample collection. Samples must be stored at 4°C ± 2°C from the time of receipt at the lab until analysis.

7.0 PROCEDURES

7.1 NAMING AND CODING CONVENTIONS FOR ANALYTICAL STANDARDS – Used in accordance with SOP CA-106 "Standard Preparation and Documentation".

7.2 COMPUTER (DATA SYSTEM) CONVENTIONS -

Conventions for all instruments are as follows:

Sub-Directory for data acquisition: C:\HPCHEM\1\DATA

Tune file: BFB.U

Method files: I826AXX.M (all samples and standards)
Where:
XX = the calibration number in chronological order
I = instrument ID (F,M,S,T,or Z)
A = matrix (A for water, S for soil and SB for sodium bisulfate soils)

BFB288AQ.M (waters) or BFB288SL.M (soils) (BFB tuning acquisition)

Data files for BFB: IB_ _ _.D where _ _ _ is a number in chronological order from 000 to 999, and I is the instrument ID (F,M,S,T,or Z).

All other data files: I_ _ _ _.D where _ _ _ _ is a number in chronological order from 0000 to 9999, and I is the instrument ID (F,M,S,T,or Z). This file also contains the Quantitation output file.

7.3 INSTRUMENT TUNING - Prior to the analysis of any calibration standards, blanks, or samples, the GC/MS system must be shown to meet the mass spectral ion abundance criteria for a 50 ng injection of p-Bromofluorobenzene (p-BFB), tabulated below:

Mass	Criteria
50	15.0-40.0% of mass 95
75	30.0-60% of mass 95
95	base peak, 100% relative abundance
96	5.0-9.0% of mass 95
173	less than 2.0% of mass 174
174	greater than 50.0% of mass 95
175	5.0-9.0% of mass 174
176	greater than 95.0%, but less than 101.0% of mass 174
177	5.0-9.0% of mass 176

7.3.1 The following are the GC/MS operating conditions for injection of BFB.

GC/MS type: 5970

Column:	RTX-VMS, 40 meter, 0.18 mm ID
Temperatures: Injection port:	170°
Transfer line:	150°
Source:	170°
Analyzer:	170°
Isothermal temperature:	150°
Run time:	10 minutes
Scan start time:	4 minutes
Scan parameters:	not to exceed 2 sec per scan
Mass range:	35-300
Number of A/D samples:	8
GC peak threshold:	1000 counts
Threshold:	10 counts

GC/MS type: 5972 and 5973

Column:	RTX-624, 40 meter, 0.18 mm I.D or RTX-VMS, 40 meter, 0.18 mm ID.
Temperatures: Injection port:	200°
Transfer line:	150°
Detector:	240°
Isothermal temperature:	150°
Run time:	8 minutes
Scan start time:	3 minutes
Scan parameters:	not to exceed 2 sec per scan
Mass range:	35-300
Number of A/D samples:	8
GC peak threshold:	1000 counts
Threshold:	10 counts

The BFB solution must be analyzed once at the beginning of each 12-hour period, the time stamp of the injection of the BFB is the beginning of the 12-hour clock. All calibrations and samples must be run within the 12-hour clock as the method specifies.

When the BFB run has concluded, the run must be evaluated to determine if sample analysis can proceed. The chromatography and the ion ratios must be examined. The BFB run is processed using the current algorithms in the Target software.

If the results indicate the system does not meet acceptance criteria, the GC/MS must be manually tuned. Once the manual tune procedure is completed, BFB must be re-injected and reevaluated. If the instrument still does not meet criteria, notify your Department Manager. Under no circumstances should calibration proceed if the instrument BFB tune is not in criteria.

7.4 INSTRUMENT CONFIGURATION / CALIBRATION

7.4.1 Tekmar LSC 3000/Archon 5100/ Tekmar 2016, Setup/Operation: Please refer to the Tekmar or Archon Manuals for more detailed operations for these instruments.

To begin, set the Tekmar LSC 2000/3000 to the specification listed in section 2-12 of the Archon manual. Edit method 14 as follows:

Method 14 should include:

Standby:	35°
Prepurge:	0 min
Preheat Temp:	0°
Sample Temp:	0°
Purge:	11 min
Dry purge:	2-4 min
Desorb preheat:	245°
Desorb Temp:	250°
Desorb time:	2-5 min
Dry purge:	2-4 min
Bake Time:	10 min
Bake Temp:	260°
Auto drain:	On
Bake gas by pass:	Off
Valve Temp:	120°
Line Temp:	120°
Runs per sample:	1

The above temperature settings are for a Vocarb 3000 trap, these temperatures may vary with the use of alternative traps. Temperature settings may also vary to optimize system performance.

The Archon autosampler should be set up according to the specifications in the manual. The setting of particular concern, with regards to keeping the Tekmar and Archon in coordination with each other, is the desorb time. There are several other programmable features on the Archon; the settings for this feature will depend on the sample matrix and method of analysis. Please refer to the Archon manual for more specifics on its programming features.

7.4.2 Encon/Centurion, Setup/Operation

Please refer to the Encon or Centurion manuals for more detailed operations for the instruments.

To begin, the Encon operation method should contain:

Purge Conditions:
Purge Gas: Helium
Purge Time: 11.0 ±0.1 minute
Purge Flow Rate: approx. 24-40 mL/min
Purge Temperature: Ambient (water)

Desorb Conditions:
DesorbTemp: 250°C
Desorb Flow rate: 15 mL/min
Desorb Time: 2.0 ± 0.1 min
Bake Time: 10 min
Bake Temperature: 260°C

The above temperature settings are for a Vocarb 3000 trap, these temperatures may vary with the use of alternative traps. Temperature settings may also vary to optimize system performance.

The Centurion autosampler should be set up according to the specifications in the manual.

7.4.3 Initial Calibration for Method 8260

Once the instrument has achieved BFB tuning criteria, calibration of the instrument can begin.

To determine the linearity of response, the GC/MS must be initially calibrated at six different levels.

For aqueous calibration, target analytes and surrogate are prepared at the following concentrations; 1.0, 5.0, 20, 50, 100 and 200 ug/L. The curve is analyzed at ambient temperature.

For a soil calibration target analytes and surrogates are prepped at the following concentrations: 5.0, 10, 20, 50, 100 and 200 ug/L. The calibration standards are stirred and heated to 40°C.

The following amounts standards should be added to 100 mL of organic-free laboratory reagent grade water in order to generate a 6-point initial calibration curve:

	STD. ID	**CAL. Mix 200 ug/mL**	**Extras Mix 200 ug/mL**	**Surr. Mix 250 ug/mL Archon**	**Surr. Mix 50 ug/mL Centurion**
AQ curve only	VSTD001	0.5 uL	0.5 uL	0.4 uL	2.0 uL
	VSTD005	2.5 uL	2.5 uL	2.0 uL	10 uL
SL curve only	VSTD010	5.0 uL	5.0 uL	4.0 uL	20 uL
	VSTD020	10 uL	10 uL	8.0 uL	40 uL
CC	VSTD050	25 uL	25 uL	20 uL	100 uL
	VSTD100	50 uL	50 uL	40 uL	200 uL
	VSTD200	100 uL	100 uL	80 uL	400 uL

The internal standard is spiked by the autosampler. Due to different spike amounts separate standards are used depending on which autosampler is being used.

After analysis of the six points, the standard analyses must be quantitated and evaluated for adherence to QC criteria, as follows. Minimum requirements for method files are use of specific quantitation ions and quantitating a specific set of target compound and surrogates with a specified internal standard. These requirements are found in Tables 3 and 5.

7.4.4 Initial Calibration Criteria

The percent (%) RSD for six calibration check compounds (CCC) must be less than or equal to 30%. CCCs are 1,1-Dichloroethene, Chloroform, 1,2-Dichloropropane, Toluene, Ethylbenzene, and Vinyl Chloride.

A system performance check must be performed as part of initial calibration. The five system performance check compounds (SPCC) and the minimum acceptable average relative response factors (RRF) for these compounds are as follows (taken from 8260B):

SPCC	RRF
Chloromethane	0.10
1,1-Dichloroethane	0.10
Bromoform	0.10
Chlorobenzene	0.30
1,1,2,2-Tetrachloroethane	0.30

The SPCCs are used to check both the standard and instrument stability.

7.4.4.1 Linearity of Target Analytes

If the RSD of any target analyte is 15% or less using the average response factor, then the response factor is presumed to be constant over the calibration range, and the average response factor may be used for quantitation.

If the RSD of any target analyte exceeds 15% using the average response factor, then a calibration option outlined in section 7.0 of method 8000 will need to be employed. Please note that some options may not be allowable for certain states, federal programs, or clients.

Option 1 (Section 7.5.2 of method 8000 - Rev. 2, 12/96), is a linear regression of instrument response versus the standard concentration. The correlation coefficient (r) for each target analyte and surrogate must be greater than or equal to 0.995. For linear models, Target calculates the correlation coefficient and then squares it (r^2). This is what is reported on all Target forms. The value for r^2 must be greater than or equal to 0.990.

Option 2 (Section 7.5.3 of method 8000 - Rev. 2, 12/96), is a non-linear calibration model not to exceed a third order (seven calibration points required) polynomial. The lab would use a quadratic model or second order polynomial. The use of a quadratic model requires six calibration points. In order for the quadratic model to be acceptable, the coefficient of determination must be greater than or equal to 0.99.

7.4.5 Independent Calibration Verification

Immediately following an initial calibration, an independent calibration standard must be analyzed. This standard contains all target compounds, internal standards and surrogates at a concentration of 50 ug/L and is obtained from a source independent of the initial calibration source. Please refer to section 8.1 and Table 1 for acceptance criteria and corrective action for this standard.

For projects or clients requiring DoD QSM 4.1 all project analytes must fall between 80-120% of the true value. No samples may be run until the ICV criteria are met.

7.4.6 Calibration Verification

Once a valid initial calibration curve has been achieved, a continuing calibration standard containing all the target compounds, internal standards and surrogates at a concentration of 50 ppb must be analyzed every 12-hour clock for Method 8260, timed from the injection of BFB. The relative response factor from the 50 ppb continuing calibration check standard must be compared to the average response factor data from the initial calibration.

The EICP (extracted ion current profile) area for any of the internal standards in the calibration verification must not change by more than a factor of two (-50% to +100%) from the same level standard in the last initial calibration. The retention time for any internal standard cannot shift by more than 30 seconds from the same level standard in the last initial calibration.

For Method 8260, if the percent difference for each CCC is less than or equal to 20%, and all of the SPCCs have a relative response factor greater than or equal to those listed in Section 7.4.3, the continuing calibration is considered valid.

For projects or clients requiring DoD QSM 4.1 all project analytes must have ± 20%D.

Continuing calibration check criteria must be met before sample analysis can proceed.

7.4.7 Retention Time Windows

Retention time windows are set at the midpoint standard of the calibration curve, following every ICAL. When a CV is analyzed (and not an ICAL), the retention time windows of the daily CV must be within 30 seconds of the midpoint calibration standard of the most recent ICAL. The samples analyzed following the daily CV must have retention times within 30 seconds of those for the daily CV. Each successive daily CV must be compared to the most recent ICAL midpoint standard.

For projects or clients requiring DoD QSM 4.1, IS responses and retention time windows for QC and samples are compared to the midpoint of the most recent ICAL.

7.5 QUALITY CONTROL SAMPLE ANALYSIS

When preparing standards in water or spiking samples with internal standards/surrogates or matrix spike solution, be sure to rinse all syringes a minimum of three times with purge and trap grade methanol between uses. Failure to do this will result in cross-contamination of samples and standards.

7.5.1 Laboratory Control Sample (LCS)

The LCS mix is prepared from a secondary source vendor (i.e. different vendor from the calibration standards). The LCS is analyzed immediately after the initial calibration curve or calibration check and prior to the method blank to minimize any analyte carryover possibilities in samples. Acceptance criteria for the LCS are outlined in Section 8.0.

To prepare the water and medium-level soil LCS, 25 uL of the LCS standard mix at 200 ug/mL are spiked into 100 mL of analyte-free laboratory reagent grade water for a final concentration of 50 ug/L. The Archon autosampler adds 1 uL of internal and 1 uL of surrogate standard to a 5 mL aliquot of this preparation for analysis. The Centurion autosampler adds 5 uL of both surrogates and internal standards to a 5 mL aliquot. To prepare the low-level soil LCS, a stir bar is added to 5 mL of the above solution in a VOA vial. The Archon unit adds an additional 10 mL of water to which the internal and surrogate standards have been added; this preparation is then heated, stirred and purged.

To prepare the water and medium-level soil LCS for analysis on the LSC 2000 / 2016 autosampler, 1.25 uL of the LCS standard mix at 200 ug/mL are spiked into 5 mL of analyte-free laboratory reagent grade water for a final concentration of 50 ug/L.

7.5.2 Method Blank Analysis

After calibration criteria have been met, a method blank must be analyzed before sample analysis can proceed. A method blank analysis must be performed once for each 12-hour calibration immediately after analysis of the calibration standard(s) and prior to sample analysis.

The aqueous method blank is a volume of analyte free laboratory reagent grade water spiked with internal and surrogate standards.

The low-level soil method blank is a volume of analyte free laboratory reagent grade water spiked with internal and surrogate standards. This method blank is analyzed using the low soil specification.

The method blank must contain less than the Practical Quantitation Level (PQL) for all analytes of interest for the samples associated with the blank.

For projects requiring DoD QSM 4.1 no analytes may be detected >1/2 the PQL and > than the 1/10th the measured amount in any sample or 1/10th the regulatory limit, whichever is larger. Except for common laboratory contaminants which may not be detected > than the PQL.

7.5.3 Surrogate Recovery Limits

Laboratory established limits are derived for each of the surrogates. Please refer to the current revision of Katahdin Analytical Services SOP # QA-808 for further information on statistical limits. All samples including blanks, laboratory control samples, matrix spikes and client samples, must meet the statistical limits for the analysis to be considered valid. If surrogate recoveries do not meet these limits, reanalysis must occur to confirm matrix interference.

7.5.4 Internal Standard Area Recoveries / Retention Times.

The internal standard responses and retention times in the method blank must be evaluated immediately after or during data acquisition. If the EICP (extracted ion current profile) area for any of the internal standard changes by a factor of two (-50% to +100%), from the last daily calibration standard, the GC/MS must by inspected, and corrective action taken. If the retention time for any internal standard has shifted by more than 30 seconds from the mid-point standard level of the most recent calibration sequence, the GC/MS must be inspected, and corrective action taken. All samples and QC must also meet the EICP area and retention time criteria or must be reanalyzed.

7.5.5 Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analysis

An MS/MSD must be analyzed every twenty samples of a similar matrix. The MS/MSD is prepared in a manner similar to the LCS, except that 40 mL aliquots (aqueous) or 5 g aliquots (soil), of environmental samples are used in place of the analyte-free laboratory reagent grade water. Note that trip blanks and field/equipment blanks should not be used for MS/MSD analyses. The spike solution (section 7.5.1) is added to the sample at a concentration of 50 ppb. Acceptance criteria for the MS/MSD are outlined in Section 8.0.

7.6 SAMPLE ANALYSIS

When new samples are received, they should be checked for past sample history. If sample history cannot be located or the sites are different than past sites, the project manager should be consulted. He/she may be able to provide more information about the sample. Sample history is used to determine what order in which to run the samples and at what dilution. Refer to Katahdin Analytical Services SOPCA-106, "Basic Laboratory Technique", current revision for information on subsampling.

Samples are removed from the VOA refrigerator and appropriate chain of custody form is completed. Remove only the vials that have not been opened yet (opened vials will be upside down). Note in sample run log any bubbles, and significant discoloration or sediment in the sample vials.

7.6.1 SAMPLE ANALYSIS FOR 8260B WATER

7.6.1.1 Tekmar LSC 2000 / 2016 units

Rinse a 5.0 mL gas-tight syringe a minimum of three times with analyte-free laboratory reagent grade water (e.g., Poland Spring or equivalent). Pour sample at ambient temperature into the syringe until nearly overflowing. Carefully insert and adjust plunger to sample volume of 5.0 mL. While adjusting plunger to final volume, expel extra volume of sample onto pH paper for sample pH verification. Add 1.0 uL of the internal and surrogate mixtures (250 ug/mL). Immediately inject contents of the syringe into the ALS sparger.

Record the sample pH in the injection logbook. Continue as above for each sample, ensuring that the 5.0 mL gas-tight syringe is rinsed a minimum of three times with laboratory reagent grade water between each sample.

7.6.1.2 Tekmar LSC 3000 / Archon 5100 units

Place the sample vials into the Archon sample tray and program the Archon for the appropriate sample volume and or dilution for the sample. The Archon unit will automatically transfer the sample to the sparge vessel while adding the internal and surrogate standard. The Archon can be programmed to run as many samples as will fit in the twelve-hour window. The auto sampler hot water rinses the sparge vessel, transfer lines, purge needle, and syringe between samples to minimize possible carryover.

Record the sample pH in the injection logbook after sample analysis is complete (usually the day after the analysis is done) and return the sample vial to the sample refrigerator.

7.6.1.3 Centurion/Encon unit

Place the sample vials into the Centurion sample tray and program the Centurion for the proper sequence. The Centurion will automatically transfer the sample to the sparge vessel while adding the internal and surrogate standards. Using the Centurion software, the analyst can program the Centurion to run as many samples that will fit into a 12 hour clock. The autosampler uses hot water to rinse the sparge vessel, transfer lines, purge needle and sample needle to minimize carryover.

Record the sample pH in the injection logbook after sample analysis is complete (usually the day after the analysis is done) and return the sample vial to the sample refrigerator.

Make sure that all entries in the injection log have been made in a complete, neat, and legible manner. Corrections in any logbook must be crossed through with a single line, dated, initialed and have a written explanation or the applicable error code.

If for any reason a sample needs to be rerun, diluted or duplicated, a note in the comments field of the injection logbook must be entered, addressing the reason why in the logbook to facilitate answering any questions that may arise during the review process.

To minimize carryover from samples that contain a target compound at a level exceeding the upper limit of the calibration curve, the following must be done: monitor both the samples immediately after the contaminated sample as well as the next run of the contaminated sample in the same purge inlet for the target(s) in question; both must have levels <PQL.

7.6.2 ANALYSIS OF LOW-LEVEL SOIL SAMPLES

Method 5035 Closed System Purge & Trap procedure for low level soils (5 ug/Kg -200 ug/Kg)

Selecting the appropriate technique may depend on cleanup goals, confidence levels, and anticipated levels of contamination. Field sampling activities typically result in Encore or Encore-like devices being submitted to the lab. These devices must be extruded within 48 hours. It is the laboratory's standard policy to extrude soil samples into 5 mL of Laboratory reagent free laboratory reagent grade water that contains a magnetic stir bar. The sample is subsequently frozen until analysis within 14 days. Note that the sample must be extruded and frozen within 48 hours of sampling, until analysis can begin. This approach is preferred over extrusion into sodium bisulfate because it is believed that the sodium bisulfate reacts with calcium carbonate in highly calcareous soils causing effervescence and driving the volatile analytes out of solution. There is also anecdotal information to suggest that acetone may be generated when bisulfate preservation occurs. The Katahdin sample ID, extrusion date, and time are recorded in the GC/MS extrusion logbook. Please refer to the Katahdin method 5035 SOP, CA-214 for more detail.

In lieu of the use of Encore samplers, the lab may pre-weigh 40 mL VOA vials containing 5 mL of laboratory reagent grade water or a 20% sodium bisulfate solution and a magnetic stir bar and ship these to the field. The vial is assigned a vial specific number prior to shipment to the field. The vial and weight will be recorded with its vial specific number in the methanol soil logbook. If possible the field sampler should weigh the sealed vial to ensure that 5 +/- 0.5 grams of sample were added in the field. When the lab receives the vials back from the field, the vials will be weighed and the weight recorded. The samples must be frozen within 48 hours of sampling, until analysis can begin.

The subsequent analysis is performed on a specially developed autosampler that heats, stirs, and purges the sample simultaneously without exposing the contents of the vial to the atmosphere. This procedure will help to minimize the loss of VOC's due to transport, handling, and analysis and may help minimize ambient lab contribution. The expected detection limits are consistent with the traditional low soil technique from method 5030. The Archon is programmed to heat each vial to 40°C during the purge time. Initiate purging for 11.0 minutes; the sample must be heated to 40°C ± 1°C before purging can begin. If you have questions concerning setting up the Tekmar or initiating a GC/MS batch run, consult the Organic Department Manager, or senior chemist within the group.

If the client does not require method 5035, method 5030 for analysis of low-level soils may be followed. This means that the Tekmar ALS 2016 unit may be used for the preparative step, as well as the Archon units.

7.6.3 ANALYSIS OF MEDIUM-LEVEL SOIL SAMPLES

Method 5030 Procedure for higher concentration soils (> 200 ug/Kg)

Higher concentration soils may be sampled as either a bulk sample or field preserved with a water miscible solvent such as methanol. If sampled in an Encore unit, the soil is extruded into methanol upon receipt at the lab.

Bulk Sample- A sample is placed in a glass jar or vial and returned to the lab for extraction and analysis. In this approach the lab takes an aliquot of soil and extracts with purge & trap grade methanol, a portion of the methanol is then analyzed for volatile analytes.

Extraction

Calibrate the balance properly (See SOP CA-102) and note it in the appropriate logbook. Place 5.0 grams of thoroughly mixed, undecanted soil sample in a 40.0 mL vial. Add 5.0 mL reagent grade methanol. Shake for 2 minutes. Let stand for 3 minutes. Record extraction in soil prep logbook.

Methanol Field Preservation - A 5 gram sample is added to a VOA vial that has been previously charged with purge and trap grade methanol (the volume of methanol is dependent upon client request). The vial with methanol has been previously weighed in the lab and assigned a vial specific number prior to shipment to the field. The vial and methanol weight will be recorded with its vial specific number in the VOA vial prep logbook. If possible the field sampler should weigh the sealed vial to ensure that 5 +/- 0.5 grams of sample were added in the field. When the lab receives the vials back from the field, the vials will be weighed and the weight recorded. A portion of the methanol is then analyzed for volatile analytes.

For analysis on Archon or Centurion autosamplers, add 400 uL of the extract into 20 mL of organic-free laboratory reagent grade water (e.g., Poland Spring or equivalent). IS and SS is added by the Archon and/or Centurion autosampler for analysis. This will give an estimated calibration range between 500-10000 ug/Kg.

7.7 FINAL DATA PACKAGE

7.7.1 Initial Data Review (IDR)

The initial data review is performed by the analyst who ran the samples. This review is of sufficient quality and detail to provide a list of samples that need to be reanalyzed or diluted and reanalyzed. The initial data review is performed on the detailed quantitation reports of the analyzed sample. This data review examines criteria that directly impact whether or not the sample needs to be reanalyzed.

- Surrogate recoveries
- stability of internal standard responses
- LCS spike recoveries
- method blank acceptance
- chromatography
- target compound detection/quantitation / review for false positives

The analyst must evaluate all data using the QA Acceptance Criteria table found within this SOP (Table 1). This table gives acceptance criteria and corrective actions for criteria that are not met. In addition to evaluating QC elements, the chromatography and quantitation of target analytes must be reviewed.

7.7.1.1 Chromatography

The chromatography should be examined for the presence or absence of any "ghost" peaks and can also be used as an indication of whether or not matrix interferences might be influencing surrogate recoveries and/or ISTD area recoveries. Whether or not the chromatography is acceptable is a judgment call on the part of the analyst and should be used in conjunction with other monitored QC (e.g., Surrogate recoveries) to determine the necessity of reanalyses.

Manual integrations are to be performed when chromatographic conditions preclude the computer algorithm from correctly integrating the peak of concern. In no instance shall a manual integration be performed solely to bring a peak within criteria.

Each peak of concern is examined by the primary analyst to ensure that the peak was integrated properly by the computer algorithm. An “M” qualifier will automatically be printed on the quantitation report summary.
This manual integration package must then be submitted to the Organic Department Manager or his/her designee, who will review each manual integration.

For specific procedures on how to manually integrate, refer to Katahdin SOP QA-812, “Manual Integration”, current revision.

7.7.1.2 Target Compound Detection/Quantitation

The method files have been set up to error on the side of false positives, that is to identify and quantitate peaks as target compounds that may not necessarily be valid hits.

The requirements for qualitative verification by comparison of mass spectra are as follows:

- all ions present in the standard mass spectra at a relative intensity > 25% must be present in the sample spectrum.
- the relative intensities of primary and secondary ions must agree within ±20% between the standard and sample spectra.
- ions greater than 25% in the sample spectrum but not present in the standard spectrum must be considered and accounted for by the analyst.

If a compound cannot be verified by all three criteria above, but, in the technical judgment of the mass spectral interpretation specialist, the identification is correct, then the laboratory shall report that compound on the Form 1 as a valid hit.

If any target concentration exceeds the upper limit, a dilution must be made and analyzed. The dilution chosen should keep the response of the largest target compound hit in the upper half of the initial calibration range.

The GC/MS laboratory initial data review must be completed within twelve hours of batch completion; in the majority of instances, the initial data review should be accomplished at the beginning of a work shift for the previous set of analyses. After the analyst has completed his or her initial data review, the data should immediately be forwarded to the Organic Department Manager, or his/her designee.

7.7.1.3 Tentatively Identified Compounds (TIC)

TIC's may be requested by certain clients for samples. Refer to SOP CA-207 "GC/MS Library Search and Quantitation".

7.7.2 Reporting

After the chromatograms have been reviewed and any target analytes have been quantitated using Target, the necessary files are brought into QuickForms. Depending on the QC level requested by the client, a Report of Analysis (ROA) and additional reports, such as LCS forms and chronology forms, are generated. The package is assembled to include the necessary forms and raw data. The data package is reviewed by the primary analyst and then forwarded to the secondary reviewer. The secondary reviewer validates the data and checks the package for any errors. When completed, the package is sent to the department manager for final review. A completed review checklist is provided with each package. The final data package from the Organics department is then processed by the Data Management department.

8.0 QUALITY CONTROL AND ACCEPTANCE CRITERIA

Refer to Table 1 and to details in this section for a summary of QC requirements, acceptance criteria, and corrective actions. These criteria are intended to be guidelines for analysts. The criteria does not cover all possible situations. If any of the QC requirements are outside the recovery ranges listed in this section or in Table 1, all associated samples must be evaluated against all the QC. In some cases data may be reported, but may be reanalyzed in other cases. Making new reagents and standards may be necessary if the standardization is suspect. The corrective actions listed in this section and in Table 1 may rely on analyst experience to make sound scientific judgments. These decisions are based on holding time considerations, client and project specific Data Quality Objectives and on review of chromatograms. The Department Manager, Operations Manager, and/or Quality Assurance Officer may be consulted to evaluate data. Some samples may not be able to be reanalyzed within hold time. In these cases "qualified" data with narration may be advisable after consultation with the client.

In some cases the standard QC requirements listed in this section and in Table 1 may not be sufficient to meet the Data Quality Objectives of the specific project. Much of the work performed at the lab is analyzed in accordance with specific QC requirements spelled out in a project specific Quality Assurance Project Plan (QAPP) or in a program specific Quality Systems Manual (QSM). The reporting limits, acceptance criteria and/or corrective actions may be different than those specified in this SOP. In these cases the appropriate information will be communicated to the Department Manager and/or senior chemists before initiation of the analyses so that specific product codes can be produced for the project. In addition, the work order notes for each project will describe the specific QAPP or QSM to be followed.

8.1 Independent Calibration Verification, LCS and MS/MSD Criteria

Statistical limits are compiled annually for LCS recoveries (archived in QA office). Statistical limits are only calculated when at least 30 usable data points are obtained for any given compound. If insufficient data points are available, nominal limits are set by the Organic Department Manager, Laboratory Operations Manager and Quality Assurance Officer. Refer to Katahdin SOP QA-808, "Generation and Implementation of Statistical QC Limits and/or Control Charts," current revision.

The use of statistical limits versus nominal limits is dependent on the client and project. This information is communicated to the Organic Department Manager through the Katahdin project manager. It is standard practice to use statistical limits for reporting purposes and to evaluate any QC criteria exceedances. However, nominal limits of 60-140% or 70-130% may be used for some projects or states.

The LCS recoveries for all analytes are evaluated. All of the compounds of interest must fall within the established statistical limits with the following sporadic exceedance allowances.

Number of Analytes	Number of Allowable Exceedances
> 90	5
71 – 90	4
51 – 70	3
31 – 50	2
11 – 30	1
<11	0

If less than the number of allowable exceedances fail the statistical limits, no corrective action is needed. If greater than the number of allowable exceedances fail the statistical limits, corrective action may be taken. Corrective actions may vary with each situation. However, in the case where the failures are high and the samples are non-detect for those compounds, then no corrective action is required. Otherwise, corrective action may involve reanalysis or recalibration. The specific corrective actions taken will rely on analyst experience to make sound scientific judgments while considering client objectives, other quality control indicators and/or the ability to reanalyze a sample within holding time.

The MS/MSD recoveries for all analytes are evaluated. If the LCS results are acceptable but the MS/MSD is not, narrate. If both the LCS and MS/MSD are unacceptable reprep the samples and QC.

Please note that for compounds with only nominal limits (i.e. insufficient data points were available to generate statistical limits), no corrective action is required for out-of-criteria recoveries until enough data points are established to generate statistical limits.

For projects or clients requiring DoD QSM 4.1 all project analytes in the ICV must fall between 80-120% of the true value. No samples may be run until the ICV criteria is met. Laboratory established recovery limits for LCS and MS/MSDs must be within 3 standard deviations of the mean LCS recovery. MS/MSD pairs must be run once per analytical/preparatory batch. RPDs must be less than or equal to 30% between MS and MSDs.

For analytes with no available DoD acceptance criteria, laboratory established limits shall be used.

8.2 Surrogate Recovery Criteria

Statistical limits are compiled annually for surrogate recoveries (archived in QA office). Statistical limits are only calculated when at least 30 usable data points are obtained for any given compound. If insufficient data points are available, nominal limits are set by the Organic Department Manager, Laboratory Operations Manager and Quality Assurance Officer. The use of statistical limits versus nominal limits is dependent on the client and project. This information is communicated to the Organic Department Manager through the Katahdin project manager. It is standard practice to use statistical limits for reporting purposes and to evaluate any QC criteria exceedances. However, nominal limits of 60-140% or 70-130% may be used for some projects or states.

8.3 QC Requirements

Refer to Table 1 for a summary of QC requirements, acceptance criteria, and corrective actions. Table 1 criteria are intended to be guidelines for analysts. The table does not cover all possible situations. If any of the QC requirements are outside the recovery ranges listed in Table 1, all associated samples must be evaluated against all the QC. In some cases data may be reported, but may be reanalyzed in other cases. Making new reagents and standards may be necessary if the standardization is suspect. The corrective actions listed in Table 1 may rely on analyst experience to make sound scientific judgments. These decisions are based on holding time considerations, client and project specific Data Quality Objectives and on review of chromatograms. The Department Manager, Operations Manager, and/or Quality Assurance Officer may be consulted to evaluate data. Due to the 14-day hold time associated with this method, samples may not be able to be reanalyzed within hold time. In these cases "qualified" data with narration may be advisable after consultation with the client.

9.0 METHOD PERFORMANCE

The method detection limit (MDL) is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the value is above zero. The MDLs are determined annually per type of instrument and filed with the Organic Department Manager and with the QAO. Refer to the current revision of Katahdin SOP QA-806, Method Detection Limit, Instrument Detection Limit and Reporting Limit Studies and Verifications, for procedures on determining the MDL.

Refer to the current revision of Method 8260 for other method performance parameters and requirements.

10.0 APPLICABLE DOCUMENTS/REFERENCES

"Test Methods for the Evaluation of Solid Waste: Physical/Chemical Methods", SW-846, third Edition, Final Update III, December 1996, Method 8260B, current revision.

"Department of Defense Quality Systems Manual for Environmental Laboratories" (DoD QSM), Version 4.1, 04/22/09.

"The National Environmental Laboratory Accreditation Conference (NELAC) Standards," June 2003.

Katahdin SOP CA-101, Equipment Maintenance, current revision.

LIST OF TABLES AND FIGURES

TABLE 1

QC REQUIREMENTS - VOLATILE ORGANICS, METHOD 8260

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Check of mass spectral ion intensities using BFB	Prior to initial calibration and calibration verification	Refer to the criteria listed in Section 7.3 of this SOP	Retune instrument, and verify
Six-point calibration for all analytes	Initial calibration prior to sample analysis	SPCCs average RF ≥0.30, except chloromethane, 1,1-DCA and bromoform ≥0.10; RSD for RFs ≤ 30% for CCCs. Refer to section 7.4.3 also.	Repeat initial calibration
Independent Calibration Verification	Once, immediately following calibration	Statistically derived from lab data or nominal limits depending on the project. Refer to QA records for statistical limits. Nominal limits are used as default limits. See also section 8.1 of this SOP for more information on allowable exceedances For projects requiring DoD QSM 4.1, all target analytes must have ± 20% recovery of true value.	Evaluate the samples and associated QC: i.e. If an MS/MSD was performed and acceptable, narrate. If an LCS/LCSD was performed and only one of the set was unacceptable, narrate. If the surrogate recoveries in the LCS are also low but are acceptable in the blank and samples, narrate. If the LCS recovery is high but the sample results are <PQL, narrate. Otherwise, reprep a blank and the remaining samples. For projects requiring DoD QSM 4.1, no samples may be run until a passing ICV is run.
Calibration verification	Once per each 12 hours, prior to sample analysis in absence of initial cal	SPCCs minimum RF ≥ 0.30, except chloromethane, 1,1-DCA and bromoform ≥ 0.10; RF for CCC analytes ≤ 20% (%D) of average initial multipoint RF For projects requiring DoD QSM 4.1, the %Difference/Drift for all target analytes must be less than or equal to 20%	Repeat initial calibration and reanalyze all samples analyzed since the last successful calibration verification
IS	During data acquisition of calibration check standard	Retention time ± 30 seconds; EICP area within -50% to +100% of last calibration verification (12 hours) for each IS For projects requiring DoD QSM 4.1, IS responses and retention times are compared to the midpoint of the most recent ICAL for all samples and QC.	Inspect mass spectrometer or GC for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning

TABLE 1 (cont.)

QC REQUIREMENTS - VOLATILE ORGANICS, METHOD 8260

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Method Blank	One per batch of 20 or fewer samples. For projects requiring DoD QSM 4.1, one per preparatory batch.	No analytes of interest detected > PQL with the exception of Methylene Chloride See section 7.5.2 of this SOP for additional DoD acceptance requirements.	(1) Investigate source of contamination (2) Evaluate the samples and associated QC: i.e. If the blank results are above the PQL, report sample results which are <PQL or > 10X the blank concentration. Otherwise, reprep a blank and the remaining samples.
LCS	One per batch of 20 or fewer samples.	Statistically derived from lab data or nominal limits depending on the project. Refer to QA records for statistical limits. Nominal limits are used as default limits. See also section 8.4 of this SOP for more information on allowable exceedances. For projects requiring DoD QSM 4.1, DoD limits shall be used, unless otherwise specified by the project QAPP.	Evaluate the samples and associated QC: i.e. If an MS/MSD was performed and acceptable, narrate. If an LCS/LCSD was performed and only one of the set was unacceptable, narrate. If the surrogate recoveries in the LCS are also low but are acceptable in the blank and samples, narrate. If the LCS recovery is high but the sample results are <PQL, narrate. Otherwise, reprep a blank and the remaining samples.
Surrogate spike	Every sample, control, standard and method blank	Statistically derived limits. For projects requiring DoD QSM 4.1, DoD limits shall be used, if available. Otherwise lab limits.	Reprep and reanalyze for confirmation of matrix interference when appropriate.
MS/MSD	One MS/MSD per every 20 samples. For projects requiring DoD QSM 4.1, one MS/MSD pair will be analyzed per preparatory batch per matrix if supplied with sufficient sample.	Statistically derived from lab data or nominal limits depending on the project. Statistical limits are used as default limits. For projects requiring DoD QSM 4.1, DoD limits shall be used, unless otherwise specified by the project QAPP.	(1) Evaluate the samples and associated QC: i.e. If the LCS results are acceptable, narrate. (2) If both the LCS and MS/MSD are unacceptable reprep the samples and QC.
MDL Study	Refer to KAS SOP QA-806, “Method Detection Limit, Instrument Detection Limit and Reporting Limit Studies and Verifications”, current revision.		
Demonstrate ability to generate acceptable P & A using 4 replicate analyses of a QC check standard	Once per year for each analyst; 4 reps	All recoveries within method QC acceptance limits	Recalculate results; locate and fix problem; rerun P & A study for those analytes that did not meet criteria prior to sample analysis

TABLE 2

SUMMARY OF METHOD MODIFICATIONS

TOPIC	KATAHDIN SOP CA-202-10	METHOD 8260, current revision
Apparatus/Materials	None	
Reagents	None	
Sample preservation/ handling	Preserved samples analyzed within 14 days. Unpreserved samples analyzed within 7 days.	Preserved samples analyzed within 14 days. No criteria for unpreserved samples.
Procedures	(1) Use laboratory reagent grade water for low level soil calibration, method blanks, and laboratory control samples to minimize clogging of archon soil needles with sand. (2) Internal Standards- pentafluorobenzene, 1,4-difluorobenzene, chlorobenzene-d5, 1,4-dichlorobenzene-d4	(1) Use an aliquot of a clean (control) matrix similar to the sample matrix. (2) Recommended internal standards – fluorobenzene, chlorobenzene-d5, 1,4-dichlorobenzene-d4
QC - Spikes	None	
QC - LCS	None	
QC - Accuracy/Precision	PQL – Practical Quantitation Level – three to ten times the MDL.	EQL – Estimated Quantitation Level – five to ten times the MDL
QC - MDL	None	

TABLE 3

VOA COMPOUNDS AND CHARACTERISTIC IONS

COMPOUND	**1° ION**	**2° ION**
Acetone	43	58
Acetonitrile	41	40, 39
Acrolein	56	55, 58
Acrylonitrile	53	52, 51
Allyl Chloride	76	41, 39
Benzene	78	-
Bromobenzene	156	77, 158
Bromochloromethane	128	49, 130
Bromodichloromethane	83	85, 127
Bromoform	173	175, 254
Bromomethane	94	96
2-Butanone	43	72
n-Butylbenzene	91	92, 134
Sec-Butylbenzene	105	134
Tert-Butylbenzene	119	91, 134
Carbon Disulfide	76	78
Carbon Tetrachloride	117	119
Chlorobenzene	112	77, 114
Chloroethane	64	66
2-Chloroethylvinyl Ether	63	65, 106
Chloroform	83	85
Chloromethane	50	52
Chloroprene	53	88, 90
2-Chlorotoluene	91	126
4-Chlorotoluene	91	126
Cyclohexane	56	84, 60
1,2-Dibromo-3-Chloropropane	75	155, 157
Dibromochloromethane	129	127
1,2-Dibromoethane	107	109, 188
Dibromomethane	93	95, 174
Diethyl Ether	74	45, 59
1,2-Dichlorobenzene	146	111, 148
1,3-Dichlorobenzene	146	111, 148
1,4-Dichlorobenzene	146	111, 148
Dichlorodifluoromethane	85	87
1,1-Dichloroethane	63	65, 83
1,2-Dichloroethane	62	98
1,1-Dichloroethene	96	61, 63
Cis-1,2-Dichloroethene	96	61, 98
Trans-1,2-Dichloroethene	96	61, 98
1,2-Dichloropropane	63	112

TABLE 3 (cont.)

VOA COMPOUNDS AND CHARACTERISTIC IONS

COMPOUND	**1° ION**	**2° ION**
1,3-Dichloropropane	76	78
2,2-Dichloropropane	77	97
1,1-Dichloropropene	75	110, 77
Cis-1,3-Dichloropropene	75	77, 39
Trans-1,3-Dichloropropene	75	77, 39
Cis-1,4-Dichloro-2-butene	75	53, 77
Trans-1,4-Dichloro-2-butene	53	88, 75
1,4-Dioxane	88	58, 43
Di-Isopropyl Ether	45	43, 87
Ethylbezene	91	106
Ethyl Methacrylate	69	41, 99
Ethyl Tertiary-Butyl Ether	59	87, 57
Freon-113	151	101
Hexachlorobutadiene	225	223, 227
2-Hexanone	43	58, 57, 100
Idomethane	142	127, 141
Isobutyl Alcohol	43	41, 42
Isopropylbezene	105	120
P-ISOPROPYLTOLUENE	119	134, 91
Methacrylonitrile	41	67, 39
Methylcyclohexane	83	55, 98
Methylene Chloride	84	86, 49
Methyl Acetate	43	74
Methyl Methacrylate	69	41, 100
4-Methyl-2-Pentanone	43	58, 85, 100
Methyl Tert-Butyl Ether	73	57, 41
Naphthalene	128	-
Pentachloroethane	167	130, 132
Propionitrile	54	52, 55
N-PROPYLBENZENE	91	120
Styrene	104	78
Tertiary-Amyl Methyl Ether	73	55, 87, 71
Tertiary-Butyl Alcohol	59	41, 43
1,1,1,2-Tetrachloroethane	131	133, 119
1,1,2,2-Tetrachloroethane	83	131, 85
Tetrachloroethene	164	129, 131, 166
Tetrahydrofuran	42	72, 71
Toluene	92	91
1,2,3-Trichlorobenzene	180	182, 145
1,2,4-Trichlorobenzene	180	182, 145
1,3,5-Trichlorobenzene	180	182, 145
1,1,1-Trichloroethane	97	99, 61
1,1,2-Trichloroethane	83	97, 85
Trichloroethene	95	97, 130, 132

TABLE 3 (cont.)

VOA COMPOUNDS AND CHARACTERISTIC IONS

COMPOUND	**1° ION**	**2° ION**
Trichlorofluoromethane	151	101, 153
1,2,3-Trichloropropane	75	77
1,2,3-Trimethylbenzene	105	120
1,2,4-Trimethylbenzene	105	120
1,3,5-Trimethylbenzene	105	120
Vinyl Acetate	43	86
Vinyl Chloride	62	64
Xylenes (Total)	106	91
1-Chlorohexane	91	55,43

TITLE: **ANALYSIS OF VOAs BY PURGE AND TRAP GC/MS: SW-846 METHOD 8260**

TABLE 4

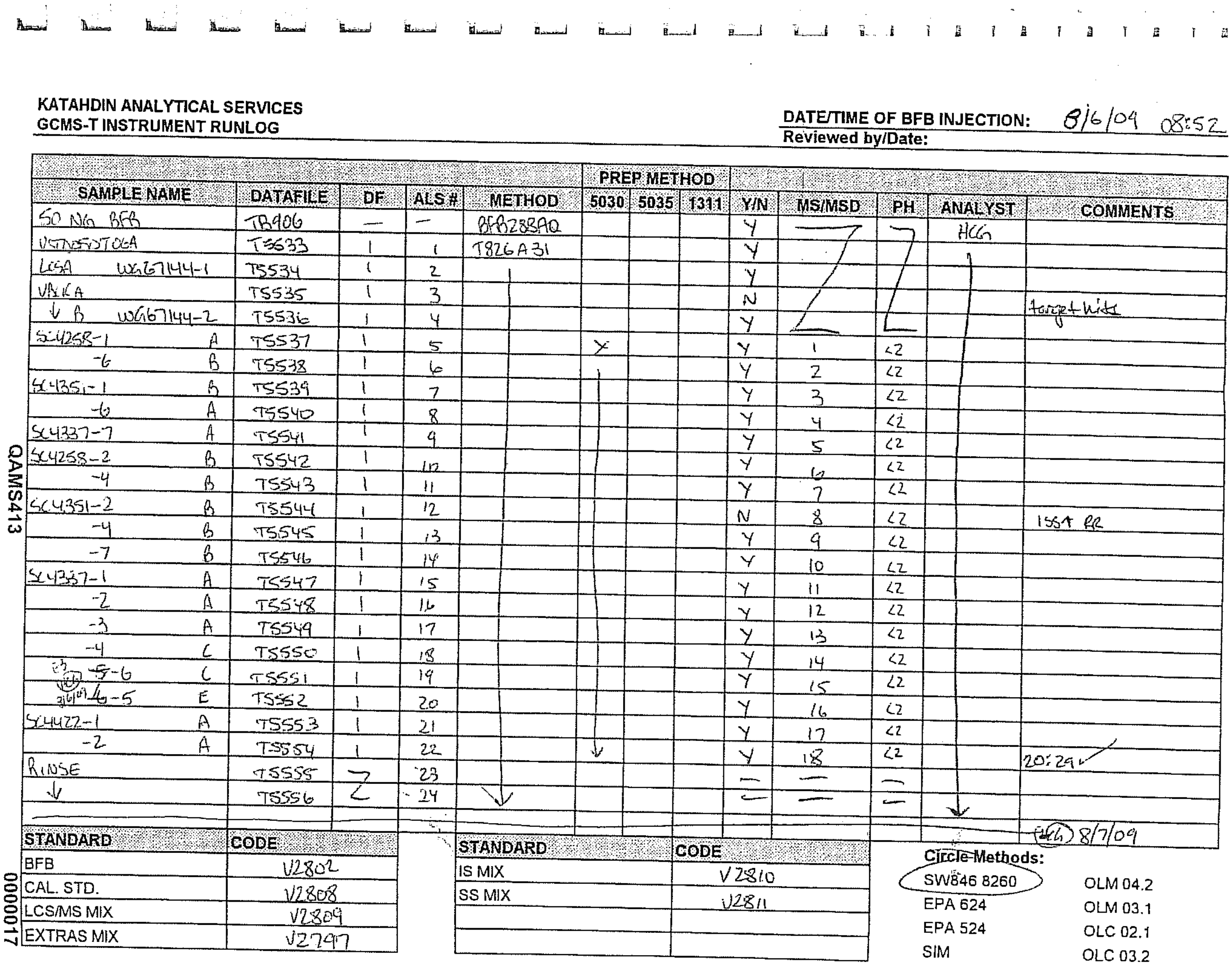
ANALYTE QUANTITATION AND INTERNAL STANDARDS

Pentafluorobenze	1,4-Difluorobenzene	Chlorobenzene - d5	1,4-Dichlorobenzene - d4
Dichlorodifluoromethane	1,2-Dichloroethane	1,3-Dichloropropane	1,1,2,2-Tetrachloroethane
Chloromethane	1,1-Dichloropropene	Tetrachloroethene	1,2,3-Trichloropropane
Bromomethane	Carbon tetrachloride	Dibromochloromethane	Isopropylbenzene
Vinyl chloride	Benzene	Chlorobenzene	Bromobenzene
Chloroethane	1,2-Dichloropropane	1,1,1,2-Tetrachloroethane	2-Chlorotoluene
Trichlorofluoromethane	Trichloroethene	Ethylbenzene	4-Chlorotoluene
Methylene Chloride	Dibromomethane	Xylenes (total)	1,3,5-Trimethylbenzene
Acetone	Bromodichloromethane	Bromoform	Tert-Butylbenzene
1,1-Dichloroethene	cis -1,3-Dichloropropene	Styrene	1,2,4-Trimethylbenzene
1,1-Dichloroethane	4-Methyl-2-pentanone	2-Hexanone	Sec-Butylbenzene
cis-1,2-Dichloroethene	Toluene-d8 (surr.)	Bromoform	1,3-Dichlorobenzene
trans-1,2-Dichloroethene	Toluene		P-Isopropyltoluene
Chloroform	trans-1,3-Dichloropropene		1,4-Dichlorobenzene
2,2-Dichloropropane	1,1,2-Trichloroethane		1,2-Dichlorobenzene
2-Butanone	1,2-Dibromoethane		N-Propylbenzene
Methyl-tert-butylether (MTBE)	Vinyl Acetate		1,2-Dibromo-3-chloropropane
Tetrahydrofuran	Methyl Methacrylate		1,2,4-Trichlorobenzene
Bromochloromethane	Ethyl Methacrylate		Naphthalene
1,1,1-Trichloroethane	1,4-Dioxane		Hexachlorobutadiene
Tertiary-butyl alcohol (TBA)	2-Chloroethylvinyl ether		1,2,3-Trichlorobenzene
Di-isopropyl ether (DIPE)	Bromofluorobenzene (surr.)		cis-1,4-Dichloro-2-butene
Ethyl-tert-butylether (ETBE)			trans-1,4-Dichloro-2-butene
Tertiary-amyl methyl ether			Pentachloroethane
Diethyl Ether			n-Butylbenzene
Carbon Disulfide			1,3,5-Trichlorobenzene
Freon-113			1,2,3-Trimethylbenzene
Iodomethane			
Acrolein			
Isobutyl Alcohol			
Allyl Chloride			
Chloroprene			
Propionitrile			
Methacrylonitrile			
Acrylonitrile			
Cyclohexane			
Methyl Acetate			
Methylcyclohexane			
1-Chlorohexane			
Dibromofluoromethane (surr.)			
1,2-Dichloroethane-d4 (surr.)			

TITLE: **ANALYSIS OF VOAs BY PURGE AND TRAP GC/MS: SW-846 METHOD 8260**

FIGURE 1

EXAMPLE OF VOA RUNLOG PAGE



KATAHDIN ANALYTICAL SERVICES
GCMS-T INSTRUMENT RUNLOG

DATE/TIME OF BFB INJECTION: 8/6/09 08:52
Reviewed by/Date:

SAMPLE NAME		DATAFILE	DF	ALS #	METHOD	PREP METHOD 5030	5035	1311	Y/N	MS/MSD	PH	ANALYST	COMMENTS
50 NG BFB		TB906	—	—	BFB288AQ				Y			HCG	
VSTD050T06A		T5533	1	1	T826A31				Y				
LCSA WG67144-1		T5534	1	2					Y				
VBLKA		T5535	1	3					N				target hits
B WG67144-2		T5536	1	4					Y				
SC4258-1	A	T5537	1	5		X			Y	1	<2		
-6	B	T5538	1	6					Y	2	<2		
SC4351-1	B	T5539	1	7					Y	3	<2		
-6	A	T5540	1	8					Y	4	<2		
SC4337-7	A	T5541	1	9					Y	5	<2		
SC4258-2	B	T5542	1	10					Y	6	<2		
-4	B	T5543	1	11					Y	7	<2		
SC4351-2	B	T5544	1	12					N	8	<2		1551 RR
-4	B	T5545	1	13					Y	9	<2		
-7	B	T5546	1	14					Y	10	<2		
SC4337-1	A	T5547	1	15					Y	11	<2		
-2	A	T5548	1	16					Y	12	<2		
-3	A	T5549	1	17					Y	13	<2		
-4	C	T5550	1	18					Y	14	<2		
~~-5~~-6	C	T5551	1	19					Y	15	<2		
~~-6~~-5	E	T5552	1	20					Y	16	<2		
SC4422-1	A	T5553	1	21					Y	17	<2		
-2	A	T5554	1	22					Y	18	<2		20:29
RINSE		T5555	2	23					—	—	—		
		T5556	2	24					—	—	—		
													HCG 8/7/09

STANDARD	CODE
BFB	V2802
CAL. STD.	V2808
LCS/MS MIX	V2809
EXTRAS MIX	V2797

STANDARD	CODE
IS MIX	V2810
SS MIX	V2811

Circle Methods:

[✓ SW846 8260]	OLM 04.2
EPA 624	OLM 03.1
EPA 524	OLC 02.1
SIM	OLC 03.2

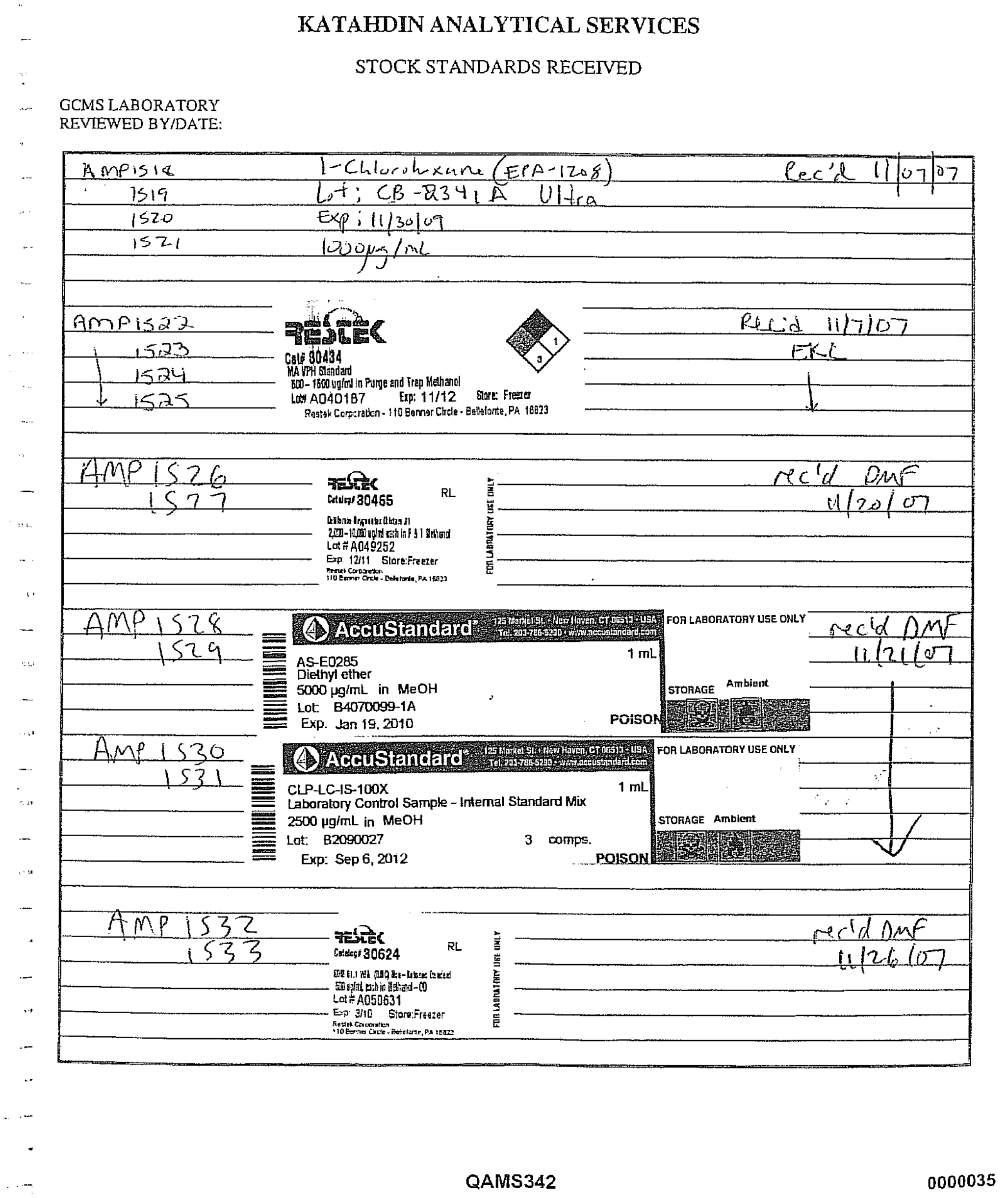
QAMS413

0000017

TITLE: **ANALYSIS OF VOAs BY PURGE AND TRAP GC/MS: SW-846 METHOD 8260**

FIGURE 2

EXAMPLE OF GC/MS STANDARDS RECEIPT LOGBOOK PAGE



KATAHDIN ANALYTICAL SERVICES

STOCK STANDARDS RECEIVED

GCMS LABORATORY
REVIEWED BY/DATE:

AMP1518 1-Chlorohexane (EPA-1208) Rec'd 11/07/07
1519 Lot; CB-834 1A Ultra
1520 Exp; 11/30/09
1521 1000µg/mL

AMP1522 Rec'd 11/7/07
1523 EKC
1524
1525

Cat# 30434
MA VPH Standard
500 – 1500 ug/ml in Purge and Trap Methanol
Lot# A040187 Exp: 11/12 Store: Freezer
Restek Corporation - 110 Benner Circle - Bellefonte, PA 16823

AMP 1526 rec'd DMF
1527 11/20/07

Catalog# 30465 RL
Lot # A049252
Exp: 12/11 Store:Freezer
Restek Corporation
110 Benner Circle - Bellefonte, PA 16823
FOR LABORATORY USE ONLY

AMP 1528 rec'd DMF
1529 11/21/07

AccuStandard® 125 Market St. • New Haven, CT 06513 • USA Tel. 203-786-5290 • www.accustandard.com
AS-E0285 1 mL
Diethyl ether
5000 µg/mL in MeOH
Lot: B4070099-1A
Exp. Jan 19, 2010
POISON
FOR LABORATORY USE ONLY
STORAGE Ambient

Amp 1530
1531

AccuStandard® 125 Market St. • New Haven, CT 06513 • USA Tel. 203-786-5290 • www.accustandard.com
CLP-LC-IS-100X 1 mL
Laboratory Control Sample – Internal Standard Mix
2500 µg/mL in MeOH
Lot: B2090027 3 comps.
Exp: Sep 6, 2012
POISON
FOR LABORATORY USE ONLY
STORAGE Ambient

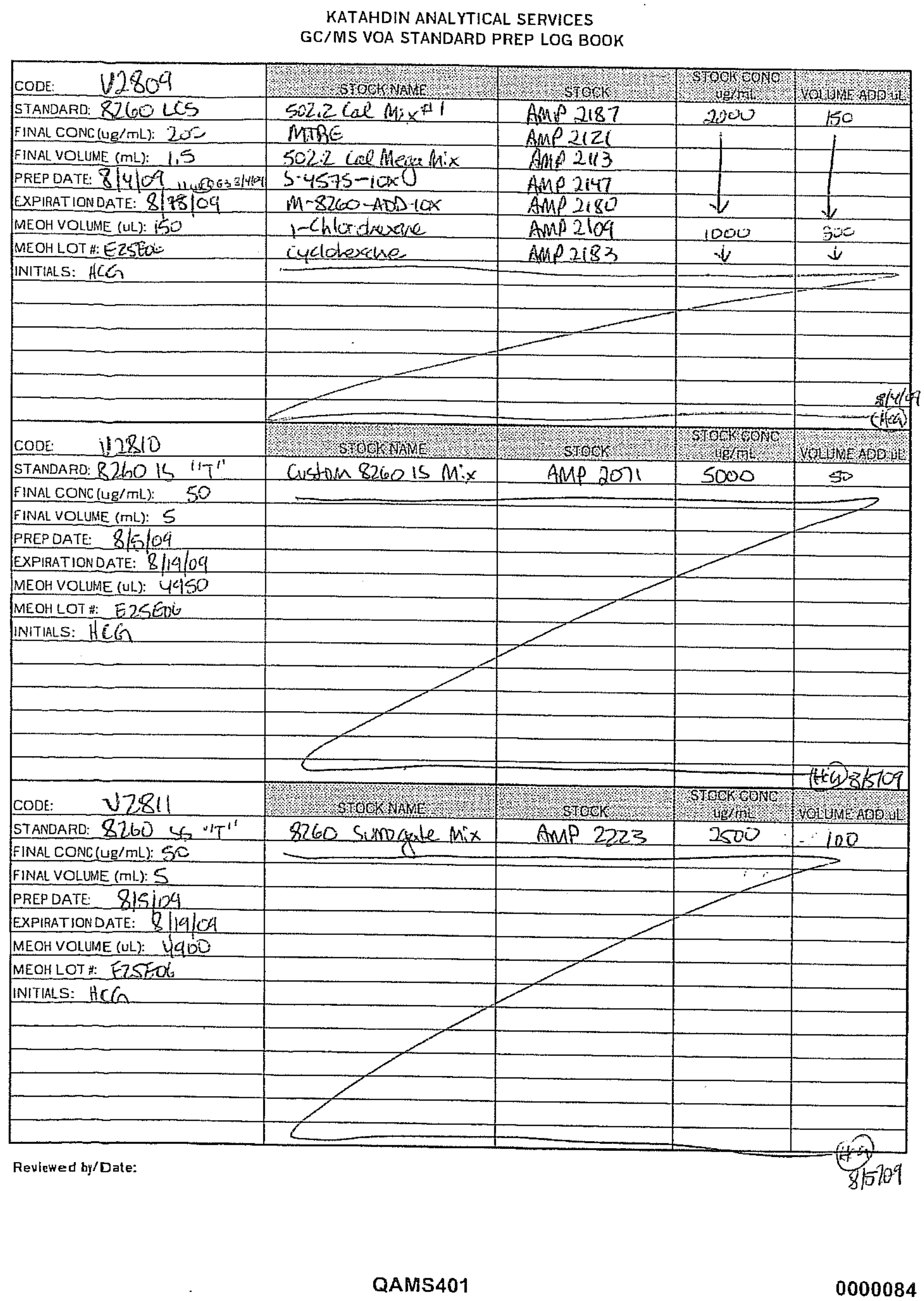
AMP 1532 rec'd DMF
1533 11/26/07

Catalog# 30624 RL
Lot # A050631
Exp: 3/10 Store:Freezer
Restek Corporation
110 Benner Circle - Bellefonte, PA 16823
FOR LABORATORY USE ONLY

QAMS342

FIGURE 3

EXAMPLE OF VOA STANDARDS PREPARATION LOGBOOK PAGE



KATAHDIN ANALYTICAL SERVICES
GC/MS VOA STANDARD PREP LOG BOOK

CODE: V2809	STOCK NAME	STOCK	STOCK CONC ug/mL	VOLUME ADD uL
STANDARD: 8260 LCS	502.2 Cal Mix#1	AMP 2187	2000	150
FINAL CONC (ug/mL): 200	MTBE	AMP 2121		
FINAL VOLUME (mL): 1.5	502.2 Cal Mega Mix	AMP 2113		
PREP DATE: 8/4/09 [illegible] 8/4/09	S-4575-10X	AMP 2147		
EXPIRATION DATE: 8/18/09	M-8260-ADD-10X	AMP 2180	↓	↓
MEOH VOLUME (uL): 150	1-Chlorohexane	AMP 2109	1000	500
MEOH LOT #: E25E06	cyclohexane	AMP 2183	↓	↓
INITIALS: HCG				

8/4/09 HCG

CODE: V2810	STOCK NAME	STOCK	STOCK CONC ug/mL	VOLUME ADD uL
STANDARD: 8260 IS "T"	Custom 8260 IS Mix	AMP 2071	5000	50
FINAL CONC (ug/mL): 50				
FINAL VOLUME (mL): 5				
PREP DATE: 8/5/09				
EXPIRATION DATE: 8/19/09				
MEOH VOLUME (uL): 4950				
MEOH LOT #: E25E06				
INITIALS: HCG				

HCG 8/5/09

CODE: V2811	STOCK NAME	STOCK	STOCK CONC ug/mL	VOLUME ADD uL
STANDARD: 8260 SS "T"	8260 Surrogate Mix	AMP 2223	2500	100
FINAL CONC (ug/mL): 50				
FINAL VOLUME (mL): 5				
PREP DATE: 8/5/09				
EXPIRATION DATE: 8/19/09				
MEOH VOLUME (uL): 4900				
MEOH LOT #: E25E06				
INITIALS: HCG				

HCG 8/5/09

Reviewed by/Date:

QAMS401

0000084

FIGURE 4

STANDARD INFORMATION

VOA Standards

Standard	Concentration	Manufacturer	Catalog Number
1,2,3 Trimethylbenzene	2000 ug/mL	Restek	58733
1,2,3 Trichlorobenzene	2000 ug/mL	Accustandard	M-502-47-10X
1,2,4 Trimethylbenzene	2000 ug/mL	Accustandard	M-502-54-10X
1,3,5 Trichlorobenzene	neat	Supelco	44-2235
1,3,5 Trimethylbenzene	2000 ug/mL	Accustandard	M502-55-10X
2-CEVE	2000 ug/mL	Accustandard	M-601C-10X
502.2 Cal Mix #1 (gases)	2000 ug/mL	Restek	30042
502.2 Cal2000 Mega Mix	2000 ug/mL	Restek	30431
504.1 Cal Mix	200 ug/mL	Accustandard	M-504.1-CSS
Acrolein & Acrylonitrile	5000 ug/mL	Accustandard	M-603-M-5X
Appendix IX Volatiles Mix	various	Accustandard	M-8240C-R3-10X
Bromochloromethane	2000 ug/mL	Accustandard	M-502-03-10X
California Oxygenates Mix #1	2000 - 10,000 ug/mL	Restek	30465
Carbon Disulfide	2000 ug/mL	Restek	30258
Chloroprene	2000 ug/mL	Accustandard	APPX9-048-R1
Custom GC Std	2000 ug/mL	Accustandard	S-11160
Custom VOC mix	various	Accustandard	S-7920-R1
Custom Volatile GC/MS Std	2000 ug/mL	Accustandard	S-3432B
Custom Volatiles GC/MS	2000 ug/mL	Accustandard	S-3432A
Dietheyl Ether	5000 ug/mL	Accustandard	AS E0285
Freon 113	2000 ug/mL	Supelco	4-7944
Method 8260 Additions	2000 ug/mL	Accustandard	M-8260-ADD-10X
Method 8260B-Revision	2000 ug/mL	Accustandard	M-8240B-R-10X
MTBE	2000 ug/mL	Supelco	4-8483
Napthalene	2000 ug/mL	Accustandard	M-502-40-10X
THF	2000 ug/mL	Accustandard	S-4575-10X
Vinyl Acetate	2000 ug/mL	Restek	30216
Vinyl Acetate	2000 ug/mL	Accustandard	APPX9-211-20X
VOA Calibration Mix #1 (Ketones)	5000 ug/mL	Restek	30006
TCL Ketone Mix	5000 ug/mL	Accustandard	CLP-022-25X
VOC Liquid Mix	2000 ug/mL	Accustandard	M-502A-R2-10X
Volatile Organic Compounds (gases)	2000 ug/mL	Accustandard	M-502B-10X
IS/SS/Tune			
Custom 8260 IS	5000 ug/mL	Restek	54577
Custom 8260 SS	5000 ug/mL	Restek	54578
4-BFB	2000 ug/mL	Supelco	48083
VOA Tuning Compound (BFB)	5000 ug/mL	Restek	30003
1,2 Dichlorobenzene-D4	2000 ug/mL	Supelco	48952-U
Fluorobenzene	2000 ug/mL	Supelco	
VOA IS (CLP)	2500 ug/mL	Restek	30004
VOA SS (CLP)	2000 ug/mL	Supelco	48943
624 IS	1500 ug/mL	Restek	30023
4-BFB/Fluorobenzene/Pentafl. (EPA 624)	20000 ug/mL	Accustandard	M-624-SS-M
8260A SS	2500 ug/mL	Restek	30240
CLP Only			
04.1 CLP VOA Cal 2000	2000 ug/mL	Restek	30456
LCS-IS	2500 ug/mL	Accustandard	CLP-LCS-IS-100X
LCS-Volatiles	200 ug/mL	Accustandard	CLP-LCS-V
CLP Volatiles DMC Stock Solution	deutrated compds	Cambridge Isotope	ES 5038
3.2 OLC mix	1000 - 2000 ug/mL	Restek	30492

QAPP Appendix C –
Data Validation SOP

STANDARD OPERATING PROCEDURE **ENV 3.26**

Title: **Verification and Validation of Chemical Analytical Data**
Date: 10/19/2006

1.0 PURPOSE

This procedure establishes the methods to be used for verifying and validating chemical analytical data and developing a preliminary assessment of data quality and usability. The specific requirements for a project will be included in the work planning documents.

2.0 SCOPE

This procedure defines the methods and requirements for:

* Uniform data review

* Verifying and validating chemical analytical data.

* Developing a preliminary assessment of data quality and usability.

* Application of personal judgment.

3.0 EQUIPMENT AND SUPPLIES

Analytical data in hard-copy data package and electronic format
Data Usability Report/Data Validation Memo template
Method Specific Checklists (Attachment 1)
Calculator

4.0 DEFINITIONS

4.1 Data Qualifiers — Letter codes attached to the analytical result to indicate the outcome of the verification and validation process. The follower qualifiers are used for chemical analytical data:

J	This qualifier indicates an estimated value because the associated QC data indicated a potential laboratory or matrix problem or interference. A "+" sign indicates a positive bias and a "-"indicates a negative bias. In addition, J flags assigned by the laboratory indicate the results are below the PQL but above the instrument detection limit (IDL) or method detection limit (MDL).
R	The result is rejected due to significant QC sample results outside of control limits. The results are not usable and represent a data gap.
U	The analyte was analyzed for but not detected above the associated numerical value. The value is the practical quantitation limit (PQL) or lower limit of detection (LOD) reported by the laboratory. The validator assigns this flag when an analyte was considered non-detect due to blank contamination.

UJ	The analyte was analyzed for but not detected above the associated numerical value. This value is considered estimated because the associated QC data indicated a potential problem.

4.2 Data Quality Assessment — the scientific and statistical evaluation of data sets to determine if data are of the right type, quality, and quantity to support their intended use. Also known as a determination of data usability. Results of data verification and validation, field information, assessment reports, and historical project data are combined to determine data usability for the intended decisions.

4.3 Data Validation — the process that evaluates data to determine the presence or absence of an analyte and establishes the uncertainty of the measurement process for contaminants of concern. Data validation qualifies the usability of each datum by comparing the data produced with the measurement quality objectives and any other analytical process requirements established for a project.

4.4 Data Verification — the process that evaluates whether laboratory conditions and operations were compliant with the analytical scope of work (SOW), work plan, sampling and analysis plan (SAP), and/or quality assurance project plan (QAPP). Data verification compares the data package with those requirements (compliance), checks for consistency and comparability of the data throughout the package, and checks for completeness of the results by ensuring that all necessary documentation is available.

5.0 HEALTH AND SAFETY

No specific health and safety requirements apply to verifying and validating chemical analytical data.

6.0 QUALITY REQUIREMENTS

The key quality requirements applicable to the verification, validation, and preliminary quality/ usability assessment of chemical analytical data are described below.

6.1 Data verification, validation, and preliminary assessment of data quality and usability shall be conducted in accordance with the guidance applicable for the project. The following documents may be applicable or other guidance may be specified in the work plans:

- The guidance in EPA QA/G-8, Guidance on Environmental Data Verification and Data Validation, and EPA QA/R-5, EPA Requirements for Quality Assurance Project Plans.
- Standard operating procedures (SOPs) and guidance for data validation from the EPA Contract Laboratory Program (CLP) and EPA Region 2.
- Applicable analytical and sampling methods identified in EPA water and wastewater methods, SW-846 and the EPA CLP.
- Guidance in the Department of Defense, Quality Systems Manual for Environmental Laboratories, Final Version 3, January 2006.

6.2 At a minimum, manual manipulation, handling, and validation of data will be double-checked by the person handling the data. For example, calculations made for particular analytical performance indicators will be double-checked to ensure that they were performed accurately; assigned data qualifiers will be checked to be sure they were assigned correctly; and so on.

7.0 PROCEDURE

7.1 Chemical Analytical Data Verification and Validation

7.1.1 Assemble the hard-copy data package and original electronic data deliverable (EDD) from the laboratory for the chemical analytical data set.

7.1.2 Assemble the technical scope of work for the laboratory, laboratory SOPs, work plan, SAP, and/or QAPP for the project, data quality objectives (DQOs), and numeric data quality indicators for the work.

7.1.3 Review the sample results following the method checklist. If checklist items are reviewed and qualified electronically, then note this in the data validation memorandum. In general, the method checklist does not need to be completed if not required for the project or if items are processed electronically.

7.1.4 If data are processed electronically, then follow the appropriate procedures for data processing. All processed electronic data should be checked against the laboratory hard copy report to verify that hard copy results match the electronic copy. It is best to check samples that are re-analyzed or run at dilution.

7.1.5 All final results should have one reported result. If multiple analytical results are reported that indicate either on hard copy or electronic what results should be reported.

7.1.6 Summarize the QC deficiencies using the Data Usability Report/Data Validation Memo template.

7.1.7 Assign data validation qualifiers if necessary. Enter the data qualifiers in the electronic copy of the analytical data.

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7.2 Preliminary Chemical Analytical Data Quality Assessment

7.2.1 Following initial data verification and validation, assemble the completed DUSR and method-specific checklists, field information (such as data sheets, field logbooks), and historical project data. If available, also assemble the results of other data assessments such as statistical assessments and comparisons to regulatory standards.

7.2.2 Review the information to determine whether the chemical analytical data satisfy the original project objectives, DQOs, and data quality indicators established for the work. At a minimum, determine whether and how the data satisfy (or do not satisfy) the precision, accuracy (bias), representativeness, comparability, and completeness (PARCC) objectives for the project. In many cases, historical data, trends, and expected data ranges can be used to evaluate the representativeness and comparability of the results. Evaluate the sensitivity of the results to verify that the PQLs or LODs are consistent with historical results and project DQOs.

7.2.3 Preliminarily determine whether the data are usable for their intended purpose for the project and whether the data can be used to make decisions. Further investigate data points that are not usable in order to determine whether additional analysis or other examination of the data can improve its usability. (However, note that the process of data verification and validation provides the best opportunity for improving data quality in the time period immediately following data collection and analysis.)

7.3 Reporting on Chemical Analytical Data Verification, Validation, and Quality/Usability

7.3.1 Summarize the results of chemical analytical data verification, validation, and quality/usability assessment in the final data report. Ensure that data qualifiers are defined and that qualified data are described and addressed.

7.3.2 Any sample results that are rejected should be reported immediately to the project manager and/or client representative.

7.3.3 Assemble the final verified and validated data into electronic and hard-copy tables.

7.3.4 Once the final tables are completed, checked data for completeness and processing errors. Verify that all sample results are reported and results can be traced to the hard copy laboratory report.

8.0 RECORD KEEPING

Maintain in the project folder area electronic files and data package files submitted by the laboratory, copies of the completed DUSR and checklist, and data validation comments or any other documentation of discussions with the laboratory regarding the data.

Any data qualifiers added by the data validator should be entered in a separate field in the data base, along with a reason for the qualification. Laboratory and validation qualifiers should be combined for final reporting.

9.0 REFERENCES

Department of Defense, 2006, Quality *Systems Manual for Environmental Laboratories, Final Version 3*.

U.S. Environmental Protection Agency (EPA), 2004, *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, EPA 540-R-04-004, Washington, DC.

______ 2002, *Guidance on Environmental Data Verification and Data Validation*, EPA QA/G-8, Washington, DC.

______, 2001, *EPA Requirements for Quality Assurance Project Plans*, EPA QA/R-5, Washington, DC .

______, 1999, *Contract Laboratory Program National Functional Guidelines for Organic Data Review*, EPA-540/R-99-008 (PB99-963506), Washington ,DC.

U.S. EPA Region 2, various dates, SOPs for Data Validation (http://www.epa.gov/region2/qa/documents.htm)

Attachment 1

Data Usability Summary Report (DUSR) Template and Method-Specific Checklists

E & E

Volatile Organic Compounds
DATA REVIEW CHECKLIST

Test:
Method No.:
Ref.:
Laboratory:
SDG No.:

	Data Review			Qualifier Code	Comment
	Yes	No	NA		
1. Are quantitation reports, chromatograms, and calibration summaries present?					
2. Did dates of analysis match summary report? Did reported data match summary report?					
3. Did holding times meet method requirements? *If method holding times were exceeded, then J flag positive results and UJ flag non-detect results. If holding times were grossly exceeded (twice holding time), then J flag positive results and R flag non-detect values.*					
4. Any compounds present in method, trip, or field blanks at > 1/2 RL or >RL for common contaminants? *If yes, then the laboratory is not compliant with method requirements: For samples, if results are <5 times the blank or < 10 times blank for common laboratory contaminants then U flag the data. Qualification also applies to TICs. If sample results are below the PQL then report the data as non-detect at the PQL. If the results are above the PQL, then report the results with that numeric value as a non-detect. The data effectively has an elevated PQL. If non-common laboratory contaminant are present in method blank and no corrective action is submitted, use judgment to qualify data.*					
5. Surrogate recoveries for method blanks and LCS within method or DoD QSM limits? Surrogate recoveries for samples and MS/MSD within method or DoD QSM limits? *If no, then samples should be reanalyzed to establish matrix effects. If samples were not re-analyzed or method blank or LCS samples had poor surrogate recoveries, then the laboratory is not compliant with method requirements.* *Positive results are flagged J as estimated. Non-detect results are flagged UJ as estimated if surrogate recoveries were between 10 and 70%. Non-detect results are rejected if recoveries were less than 10%. If more than one recovery is low, all non-detect values may be rejected. Consult guidance documents and use judgment to qualify.*					

Test:			**Method No.:**		**Ref.:**
Laboratory:			**SDG No.:**		

	Data Review			**Qualifier Code**	**Comment**
	Yes	**No**	**NA**		
6. Laboratory QC frequency one blank and LCS with each batch and one set of MS/MSD per 20 samples? *If samples were not analyzed at the required frequency, then the laboratory is not compliant with method requirements. The data reviewer should use professional judgment to determine if associated data should be qualified.*					
7. MS/MSD recoveries within method or DoD QSM limits? *If MS/MSD recoveries are out and LCS is compliant, then only qualify the data for the original sample due to matrix. Positive results are flagged J as estimated. Non-detect results are flagged UJ as estimated if MS/MSD recoveries were between 10 and 70%. Non-detect results are rejected if recoveries were less than 10%.*					
8. MS/MSD relative percent difference (RPD) within 30%? *If MS/MSD RPDs are out and LCS is compliant, then only qualify the data for the original sample due to matrix. Positive results are flagged J as estimated.*					
9. LCS recoveries within method or DoD QSM limits? Does LCS contain all analytes required for reporting? *If LCS recoveries are out and the compounds were detected in the samples, the laboratory is not compliant with method requirements. If LCS recoveries were high and associated results are non-detect, then laboratory is considered compliant and no data qualification is required. If LCS recoveries were low and more than sporadic, marginal failures, the laboratory should take corrective action or notify the project chemist in advance,* *Positive results are flagged J as estimated. Non-detect results are flagged UJ as estimated if LCS recoveries were between 10 and 70%. Non-detect results are rejected if recoveries were less than 10%. If more than a few recoveries are low, all non-detect values may be rejected. Consult guidance documents and use judgment to qualify.*					

Most DoD clients required immediate notification that the laboratory intends to submit non-compliant data as defined above. The laboratory must document these deviations and provide justification in writing. Additional data may be rejected if prior approval is not submitted.

The following items are reviewed only if determined to be required for the project.

Source: Ecology and Environment, Inc. 2006

Test:			**Method No.:**		**Ref.:**
Laboratory:			**SDG No.:**		

	Data Review			**Qualifier Code**	**Comment**
	Yes	**No**	**NA**		
10. Do internal standards (IS) areas and retention times meet criteria? IS areas should be within 50% of the area in the ICAL midpoint. *If no, samples should be reanalyzed to establish matrix effects. If samples were not reanalyzed or IS areas were out, then the laboratory is not compliant with method requirements. Positive results are flagged J as estimated. Non-detect results are flagged UJ as estimated if recoveries were between 10 and 50%. Non-detect results are rejected if recoveries were less than 10%.*					
11. Is initial calibration for continuing calibration check (CCCs) compounds <30 percent relative standard deviation (%RSD) and <15% for each analyte or curve fit? *If calibration criteria were not met, then J flag positive compounds in all associated samples.*					
12. Is a second source calibration verification analyzed after each initial calibration and are values for each analyte within 25% of expected value? *If criteria were not met, then J flag positive compounds in all associated samples.*					
13. Is continuing calibration for target compounds < 20 percent difference (%D) and were minimum response factors achieved? *If calibration criteria were not met, J flag positive compounds in all samples. If minimum response factors were not achieved, then R flag non-detect results and J flag positive results.*					
14. Were any samples reanalyzed or diluted? *For any sample reanalyzed or diluted, only one result should be reported. If the laboratory reported multiple results, then indicate the best result to include in the database and final report.*					
15. Were 100% of manual calculations or manual integrations checked by laboratory? *Cross-check 10% of the calculations if full validation is required for this project.*					
16. Were deviations documented and comments added to case narrative? *If the laboratory failed to document potential QC failures, request formal corrective action from the laboratory to ensure method requirements will be met in the future.*					

Source: Ecology and Environment, Inc. 2006

Test:			**Method No.:**		**Ref.:**
Laboratory:			**SDG No.:**		

	Data Review			**Qualifier Code**	**Comment**
	Yes	**No**	**NA**		
17. Are results reasonable for methods and matrix? *If results do not compare to historical data or expected results, perform full validation of the raw data.*					
18. Are the MDLs and/or PQLs elevated above the project required reporting limits? *Determine if matrix effects resulted in higher reported limits, and whether sample clean-up procedures can be used for samples in the future.*					
19. Are field duplicates within +/- 40% RPD for waters and 70% RPD for soils for positive values greater than PQL? *If RPD criteria were not met, J flag positive results. If RPD values were grossly exceeded, investigate potential corrective actions in sampling or analytical procedures.*					

Major Concerns:

Minor Concerns:

I attest that I have evaluated all data in accordance with this checklist:____
(Reviewer/Date)

Source: Ecology and Environment, Inc. 2006

E & E

ICP Metals
DATA REVIEW CHECKLIST

Test:			**Method No.:**		**Ref.:**
Laboratory:			**SDG No.:**		

	Data Review			**Qualifier Code**	**Comment**
	Yes	**No**	**NA**		
1. Are test logbooks and/or spreadsheet present?					
2. Did dates of preparation and analysis match summary report? Did reported data match summary report?					
3. Did holding times meet method requirements? (Holding times for applicable methods are included at the end of this checklist.) *If method holding times were exceeded, then J flag positive results and UJ flag non-detect results. If holding times were grossly exceeded (twice holding time), then J flag positive results and R flag non-detect values.*					
4. Laboratory QC frequency of one method blank, one LCS, one MS and one MSD or sample duplicate perr 20 samples? *If samples were not analyzed at the required frequency, then the laboratory is not compliant with method requirements. The data reviewer should use professional judgment to determine if associated data should be qualified.*					
5. Were all method blanks values less than ½ RL? *If no: If sample results are below the PQL but above the MDL, then report the data as non-detect at the PQL. For samples, if results are greater than the PQL but less than the blank level, use professional judgment to determine if the results should be rejected or U flagged at the blank level. If the results are above the blank level but less than 10 times blank level, then report the results flagged J as estimated.*					

Source: Ecology and Environment, Inc. 2006

Test: | **Method No.:** | **Ref.:**

Laboratory: | **SDG No.:**

	Data Review			**Qualifier Code**	**Comment**
	Yes	**No**	**NA**		
6. MS/MSD recoveries within +/-20% for waters and soils? (Exception Ag soil: 75% - 120%) *If sample concentration greater than 4X the spike concentration, then no data qualification is required. If MS recoveries are out and LCS is compliant, then only qualify the data for the **parent** sample due to matrix. Positive results are flagged J as estimated. Non-detect results are flagged UJ as estimated if recoveries were between 30 and 80%. Non-detect results are rejected if recoveries were less than 30%. If recoveries were very high, then potential method interferences should be investigated and professional judgment used to determine whether to reject positive results.*					
7. Sample duplicate or MSD relative percent difference (RPD) <20%? *If not, qualify the data for the **parent** sample due to matrix. Positive results are flagged J as estimated.*					
8. Were LCS recoveries within +/-20% for waters and soils? (Exception Ag soil: 75% - 120%) *If recovery goals were not met, then qualify the associated samples the same as MS/MSD.*					
9. Were any samples reanalyzed or diluted? *For any sample reanalyzed or diluted, only one result should be reported. If the laboratory reported multiple results, then indicate the best result to include in the database and final report.*					
10. Does serial dilution agree within +/- 10% of original? Was post-digestion spike analyzed for all serial dilution outliers? *If no, qualify all associated sample results as J.*					

Most DoD clients required immediate notification that the laboratory intends to submit non-compliant data as defined above. The laboratory must document these deviations and provide justification in writing. Additional data may be rejected if prior approval is not submitted.

The following items are reviewed only if determined to be required for the project.

Test:				**Method No.:**	**Ref.:**
Laboratory:				**SDG No.:**	
	Data Review			**Qualifier Code**	**Comment**
	Yes	**No**	**NA**		
11. Was the instrument calibrated daily? At a minimum, was a high standard and calibration blank used for the calibration? *If samples were not analyzed under acceptable calibration, then the laboratory is not compliant with method requirements. The data reviewer should use professional judgment to determine if associated data should be qualified.*					
12. Initial Calibration Verification (ICV) (second source) recoveries within +/-10% of expected values? *If recoveries are out and the compounds were detected in the samples, the laboratory is not compliant with method requirements. The data reviewer should use professional judgment to determine if associated data should be qualified.*					
13. Is a continuing calibration verification (CCV) analyzed every 10 samples and at the end of the sequence? Is the CCV value within 10% of the expected? *If recoveries are out and the compounds were detected in the samples, the laboratory is not compliant with method requirements. The data reviewer should use professional judgment to determine if associated data should be qualified.*					
14. Was the low level calibration check standard (at or below the reporting limit) analyzed daily, after the one-point initial calibration? Is the CRI within 20% of the expected value? *If recoveries are out and the compounds were detected in the samples, the laboratory is not compliant with method requirements. The data reviewer should use professional judgment to determine if associated data should be qualified.*					

Source: Ecology and Environment, Inc. 2006

Test:					**Method No.:**	**Ref.:**
Laboratory:					**SDG No.:**	
	Data Review			**Qualifier Code**	**Comment**	
	Yes	**No**	**NA**			
15. Was a calibration blank analyzed before beginning a sample run, after every 10 samples and at the end of the sequence? Were all analytes detected <2X MDL? *If no: then laboratory is not compliant with method requirements. If sample results are below the PQL but above the MDL, then report the data as non-detect at the PQL. For samples, if results are greater than the PQL but less than the blank level, use professional judgment to determine if the results should be rejected or U flagged at the blank level. If the results are above the blank level but less than 5 times blank level, then report the results flagged J as estimated.*						
16. Were the ICS solutions analyzed at the beginning of the analytical run? For ICS-A, was the absolute value for all non-spiked analytes <2x MDL? For ICS-B, within +/- 20% of expected values? *If no, then the laboratory is not compliant with method requirements. The data reviewer should use professional judgment to determine if associated data should be qualified.*						
17. Were 100% of manual calculations or manual integrations checked by laboratory? *Cross-check 10% of the calculations if full validation is required for this project.*						
18. Were deviations documented and comments added to case narrative? *If the laboratory failed to document potential QC failures, request formal corrective action from the laboratory to ensure method requirements will be met in the future.*						
19. Are results reasonable for methods and matrix? *If results do not compare to historical data or expected results, perform full validation of the raw data.*						
20. Are the MDLs and/or PQLs elevated above the project required reporting limits? *Determine if matrix effects resulted in higher reported limits, and whether sample clean-up procedures can be used for samples in the future.*						

Source: Ecology and Environment, Inc. 2006

Test:			**Method No.:**		**Ref.:**
Laboratory:			**SDG No.:**		

	Data Review			**Qualifier Code**	**Comment**
	Yes	**No**	**NA**		
21. Are field duplicates within +/- 40% RPD for waters and 70% RPD for soils for positive values greater than PQL? *If RPD criteria were not met, J flag positive results. If RPD values were grossly exceeded, investigate potential corrective actions in sampling or analytical procedures.*					

Major Concerns:

Minor Concerns:

I attest that I have evaluated all data in accordance with this checklist:____

(Reviewer/Date)

Source: Ecology and Environment, Inc. 2006

E & E

General Analytical Chemistry
DATA REVIEW CHECKLIST

Test:	**Method No.:**	**Ref.:**
Laboratory:	**SDG No.:**	

	Data Review			**Qualifier Code**	**Comment**
	Yes	**No**	**NA**		
1. Are test logbooks and/or spreadsheet present?					
2. Did dates of preparation and analysis match summary report? Did reported data match summary report?					
3. Did holding times meet method requirements? (Holding times for applicable methods are included at the end of this checklist.) *If method holding times were exceeded, then J flag positive results and UJ flag non-detect results. If holding times were grossly exceeded (twice holding time), then J flag positive results and R flag non-detect values.*					
4. Laboratory QC frequency one blank and LCS with each batch and one set of MS/MSD or MS/sample duplicate per 20 samples? For methods will not MS requirement, one sample duplicate per every 10 samples? *If samples were not analyzed at the required frequency, then the laboratory is not compliant with method requirements. The data reviewer should use professional judgment to determine if associated data should be qualified.*					
5. Were all method blanks values less than ½ RL? *If no: If sample results are below the PQL but above the MDL, then report the data as non-detect at the PQL. For samples, if results are greater than the PQL but less than the blank level, use professional judgment to determine if the results should be rejected or U flagged at the blank level. If the results are above the blank level but less than 10 times blank level, then report the results flagged J as estimated.*					

Source: Ecology and Environment, Inc. 2006

Test:	**Method No.:**	**Ref.:**
Laboratory:	**SDG No.:**	

	Data Review			Qualifier Code	Comment
	Yes	**No**	**NA**		
6. MS recoveries within +/-20% or control limits set by the method? *If sample concentration greater than 4X the spike concentration, then no data qualification is required. If MS recoveries are out and LCS is compliant, then only qualify the data for the original sample due to matrix. Positive results are flagged J as estimated. Non-detect results are flagged UJ as estimated if recoveries were between 30 and 80%. Non-detect results are rejected if recoveries were less than 30%. If recoveries were very high, then potential method interferences should be investigated and professional judgment used to determine whether to reject positive results.*					
7. Sample duplicate percent difference (%D) <20% or MSD relative percent difference (RPD) <20% or within control limits set by the method? *If results are less than 5 times the PQL, then the difference in the results should be less than the PQL. If not, qualify the data for the original sample due to matrix. Positive results are flagged J as estimated.*					
8. Initial Calibration Verification (ICV) and/or Laboratory Control Sample (LCS) recoveries within +/-10% or control limits set by the method? *If recoveries are out and the compounds were detected in the samples, the laboratory is not compliant with method requirements. Positive results are flagged J as estimated if recoveries were out. Non-detect results are flagged UJ as estimated if recoveries were between about 50 and 90%. Results are rejected if recoveries were significantly low or significantly high (i.e., more than +/- 50%). If recoveries were high and associated results were non-detect, then laboratory is considered compliant and no data qualification is required.*					
9. Were any samples reanalyzed or diluted? *For any sample reanalyzed or diluted, only one result should be reported. If the laboratory reported multiple results, then indicate the best result to include in the database and final report.*					

Most DoD clients required immediate notification that the laboratory intends to submit non-compliant data as defined above. The laboratory must document these deviations and provide justification in writing. Additional data may be rejected if prior approval is not submitted.

The following items are reviewed only if determined to be required for the project.

Source: Ecology and Environment, Inc. 2006

Test:	**Method No.:**	**Ref.:**
Laboratory:	**SDG No.:**	

	Data Review			**Qualifier Code**	**Comment**
	Yes	**No**	**NA**		
10. Was the calibration curve correlation coefficient ≥ 0.995? Were at least three points and calibration blank used for the curve? *For gravimetric and microbiological GAC tests, ensure the instruments and/or reagents were calibrated per the method. No curves are run for these tests.* *If samples were not analyzed under acceptable calibration, then the laboratory is not compliant with method requirements. The data reviewer should use professional judgment to determine if associated data should be qualified.*					
11. Continuing Calibration Verification (CCV) standards or additional LCS analyzed every 10 samples and at end? CCV/LCS recoveries within +/-10% or control limits set by the method? *If recovery goals were not met, then qualify the samples after the last acceptable CCV the same as noted above for the ICV.*					
12. Were 100% of manual calculations or manual integrations checked by laboratory? *Cross-check 10% of the calculations if full validation is required for this project.*					
13. Were deviations documented and comments added to case narrative? *If the laboratory failed to document potential QC failures, request formal corrective action from the laboratory to ensure method requirements will be met in the future.*					
14. Are results reasonable for methods and matrix? *If results do not compare to historical data or expected results, perform full validation of the raw data.*					
15. Are the MDLs and/or PQLs elevated above the project required reporting limits? *Determine if matrix effects resulted in higher reported limits, and whether sample clean-up procedures can be used for samples in the future.*					

Source: Ecology and Environment, Inc. 2006

Test:			**Method No.:**		**Ref.:**
Laboratory:			**SDG No.:**		

	Data Review			**Qualifier Code**	**Comment**
	Yes	**No**	**NA**		
16. Are field duplicates within +/- 40% RPD for waters and 70% RPD for soils for positive values greater than PQL? *If RPD criteria were not met, J flag positive results. If RPD values were grossly exceeded, investigate potential corrective actions in sampling or analytical procedures.*					
17. Time of analysis documented on spreadsheet or logbook and imported into LIMS for each sample? *Applicable methods: hexavalent chromium, BOD, color, pH, orthophosphate, turbidity, odor, residual chlorine, and ferrous iron.*					

Major Concerns:

Minor Concerns:

I attest that I have evaluated all data in accordance with this checklist:____
(Reviewer/Date)

Holding Times - (from date of sampling)

Holding Time – Method	Method
48 hours	Biological Oxygen Demand, 5 Days (BOD_5) – Method 405.1
	Hexavalent chromium – Method 7196
	Nitrate, Nitrite, Sulfate, Chloride, Orthophosphate – SW9056
7 days	Total Suspended Solids – Method 160.2
	Total Dissolved Solids – Method 160.1
14 days	Alkalinity – Method 310.1
28 days for H_2SO_4 preserved samples	Chemical Oxygen Demand – Method 410.4
	Total Organic Carbon – Method 415.2
	Ammonia – Method 350.1
	TKN – Method 351.2

Source: Ecology and Environment, Inc. 2006

E & E

Gas Chromatography Methods
DATA REVIEW CHECKLIST

Test:	**Method No.:**	**Ref.:**
Laboratory:	**SDG No.:**	

	Data Review			Qualifier Code	Comment
	Yes	No	NA		
1. Did holding times meet method requirements? *If method holding times were exceeded, then J flag positive results and UJ flag non-detect results. If holding times were grossly exceeded (twice holding time), then J flag positive results and R flag non-detect values.*					
2. Any compounds present in method, trip, or field blanks at > 1/2 RL or >RL for common contaminants? *If yes, then the laboratory is not compliant with method requirements: For samples, if results are <5 times the blank or < 10 times blank for common laboratory contaminants then U flag the data. If sample results are below the PQL then report the data as non-detect at the PQL. If the results are above the PQL, then report the results with that numeric value as a non-detect. The data effectively has an elevated PQL. If non-common laboratory contaminant are present in method blank and no corrective action is submitted, use judgment to qualify data.*					
3. Surrogate recoveries for method blanks and LCS within method or DoD QSM limits? Surrogate recoveries for samples and MS/MSD within method or DoD QSM limits? *If no, then samples should be reanalyzed to establish matrix effects. If samples were not re-analyzed or method blank or LCS samples had poor surrogate recoveries, then the laboratory is not compliant with method requirements.* *Positive results are flagged J as estimated. Non-detect results are flagged UJ as estimated if surrogate recoveries were between 10 and 70%. Non-detect results are rejected if recoveries were less than 10%. If more than one recovery is low, all non-detect values may be rejected. Consult guidance documents and use judgment to qualify.*					

Source: Ecology and Environment, Inc. 2006

Test:	**Method No.:**	**Ref.:**
Laboratory:	**SDG No.:**	

	Data Review			**Qualifier Code**	**Comment**
	Yes	**No**	**NA**		
4. Laboratory QC frequency one blank and LCS with each batch and one set of MS/MSD per 20 samples? *If samples were not analyzed at the required frequency, then the laboratory is not compliant with method requirements. The data reviewer should use professional judgment to determine if associated data should be qualified.*					
5. MS/MSD recoveries within method or DoD QSM limits? *If MS/MSD recoveries are out and LCS is compliant, then only qualify the data for the original sample due to matrix. Positive results are flagged J as estimated. Non-detect results are flagged UJ as estimated if MS/MSD recoveries were between 10 and 70%. Non-detect results are rejected if recoveries were less than 10%.*					
6. MS/MSD relative percent difference (RPD) within 30%? *If MS/MSD RPDs are out and LCS is compliant, then only qualify the data for the original sample due to matrix. Positive results are flagged J as estimated.*					
7. LCS recoveries within method or DoD QSM limits? Does LCS contain all analytes required for reporting? *If LCS recoveries are out and the compounds were detected in the samples, the laboratory is not compliant with method requirements. If LCS recoveries were high and associated results are non-detect, then laboratory is considered compliant and no data qualification is required. If LCS recoveries were low and more than sporadic, marginal failures, the laboratory should take corrective action or notify the project chemist in advance,* *Positive results are flagged J as estimated. Non-detect results are flagged UJ as estimated if LCS recoveries were between 10 and 70%. Non-detect results are rejected if recoveries were less than 10%. If more than a few recoveries are low, all non-detect values may be rejected. Consult guidance documents and use judgment to qualify.*					
8. Were any samples reanalyzed or diluted? *For any sample reanalyzed or diluted, only one result should be reported. If the laboratory reported multiple results, then indicate the best result to include in the database and final report.*					

Test:	**Method No.:**	**Ref.:**
Laboratory:	**SDG No.:**	

Most DoD clients required immediate notification that the laboratory intends to submit non-compliant data as defined above. The laboratory must document these deviations and provide justification in writing. Additional data may be rejected if prior approval is not submitted.

The following items are reviewed only if determined to be required for the project.

	Data Review			**Qualifier Code**	**Comment**
	Yes	**No**	**NA**		
9. Is the retention time window calculated for each analyte and surrogate and at +/- three times standard deviation from 72 hour study? *If criteria were not met, then J flag positive compounds in all samples.*					
10. Is minimum 5 point initial calibration <20 percent relative standard deviation (%RSD) or curve fit? *If calibration criteria were not met, then J flag positive compounds in all samples.*					
11. Is a second source calibration verification analyzed after each initial calibration and are values for each analyte within 20% of expected value? *If criteria were not met, then J flag positive compounds in all samples.*					
12. Is continuing calibration analyzed after every 10 samples and at end of sequence with all analytes within 20% of expected value? *If calibration criteria were not met, J flag positive compounds in all samples. If minimum response factors were not achieved, then R flag non-detect results and J flag positive results.*					
13. Were all positive results confirmed by second column? *If results between primary and secondary columns RPD >40% qualify results "J".*					
14. Were 100% of manual calculations or manual integrations checked by laboratory? *Cross-check 10% of the calculations if full validation is required for this project.*					
15. Were deviations documented and comments added to case narrative? *If the laboratory failed to document potential QC failures, request formal corrective action from the laboratory to ensure method requirements will be met in the future.*					

Source: Ecology and Environment, Inc. 2006

Test:				**Method No.:**	**Ref.:**
Laboratory:				**SDG No.:**	
	Data Review			**Qualifier Code**	**Comment**
	Yes	**No**	**NA**		
16. Are results reasonable for methods and matrix? *If results do not compare to historical data or expected results, perform full validation of the raw data.*					
17. Are the MDLs and/or PQLs elevated above the project required reporting limits? *Determine if matrix effects resulted in higher reported limits, and whether sample clean-up procedures can be used for samples in the future.*					
18. Are field duplicates within +/- 40% RPD for waters and 70% RPD for soils for positive values greater than PQL? *If RPD criteria were not met, J flag positive results. If RPD values were grossly exceeded, investigate potential corrective actions in sampling or analytical procedures.*					

Major Concerns:

Minor Concerns:

I attest that I have evaluated all data in accordance with this checklist:____

(Reviewer/Date)

Source: Ecology and Environment, Inc. 2006

QAPP Appendix D –
ENV 3.7 Groundwater Well Sampling
and
ENV 3.15 Sampling Equipment Decontamination

Title:	GROUNDWATER WELL SAMPLING
Category:	ENV 3.7
Revised:	March 1998

STANDARD OPERATING PROCEDURE

GROUNDWATER WELL SAMPLING

ecology and environment, inc.
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TITLE: GROUNDWATER WELL SAMPLING

CATEGORY: ENV 3.7 **REVISED:** March 1998

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TITLE: GROUNDWATER WELL SAMPLING

CATEGORY: ENV 3.7 **REVISED:** March 1998

1. Introduction

The objective of this Standard Operating Procedures (SOP) document is to provide recommended procedures for the sampling of groundwater wells, and is primarily concerned with the collection of water samples from the saturated zone of the subsurface. Every effort must be made to ensure that the sample is representative of the particular zone of water being sampled. Groundwater sampling procedures appropriate to the project objectives and site conditions will define a sampling event.

Analysis of groundwater samples may determine pollutant concentrations and its risk to public health, welfare, or the environment; extent of contaminants; and confirmation of remedial standards.

2. Scope

This document describes procedures for obtaining representative groundwater samples, quality assurance/quality control (QA/QC) measures to be followed, proper documentation of sampling activities, and recommendations for personnel safety.

3. Method Summary

Before sampling a monitoring well, the well must be purged. This may be done with a number of portable devices, including bailers, submersible pumps, bladder pumps, gas-driven pumps, gas-lift pumps, suction-lift pumps, and inertial-lift pumps. Refer to E & E Standard Operating Procedure for *Groundwater Sampling Devices* (ENV 3.6) for information on different groundwater purging and sampling devices.

A minimum of three well volumes should be removed during well purging to ensure that a representative sample of the groundwater will be sampled. Once the purging is completed and the properly prepared sample containers have been selected, sampling may proceed. Numerous types of sampling devices may be selected for the collection of the groundwater sample, but care should be taken when selecting the sampling device, as some will affect the integrity of the sample.

Sampling should occur in a progression from the least to most contaminated well, if known. Ideally, a dedicated sampling device should be used for each well. However, dedicated sampling devices may not be practical if there are a large number of groundwater samples to be collected. In this case, sampling devices should be cleaned between sampling events using the decontamination procedures outlined in E & E Standard Operating Procedure for *Equipment Decontamination* (ENV 3.15).

4. Sample Preservation, Containers, Handling, and Storage

The type of analysis for which a sample is being collected determines the type of bottle, preservative, holding time, and filtering requirements (see Table 1). Chemical preservation and cooling of samples to 4 degrees Celsius only retards biological and chemical degradation of contaminants in the sample. Therefore, it is prudent to have the samples delivered to the laboratory as soon as possible following collection.

Sample containers should be precleaned in accordance with U.S. Environmental Protection Agency (EPA) standards and prelabeled, and preservatives should be placed in the containers prior to sample collection. When filling containers, never overfill or prerinse with the water sample, since oil or other substances may remain in the container. For analyses that may require filtered samples (e.g., metals and TOC), the samples should be filtered in the field using one 0.45-micrometer (µm) membrane filter per sample container prior to being preserved.

When all samples have been collected, a field data sheet and a chain-of-custody (C-O-C) form should be completed, and all pertinent data entered in the field logbook. Samples will be placed in a cooler to be maintained on ice at 4 degrees Celsius. Samples must be shipped to arrive at the designated laboratory well before their holding times are reached. It is preferable that these samples be shipped or delivered daily to the laboratory as outlined in the E & E Standard Operating Procedure for *Sample Packaging and Shipping* (ENV 3.16).

5. Potential Problems

5.1 General

The primary goal is to obtain a representative analysis of the groundwater body. The analysis can be compromised by field personnel in two primary ways: by collecting an unrepresentative sample, and by incorrect handling of the sample. There are numerous ways that foreign contaminants can be introduced into the sample, and these must be avoided by following strict sampling procedures and utilization of trained personnel.

Table 1 SW-846 Sample Holding Times, Preservation Methods, and Volume Requirements for Water Samples

Protocol Parameter	Holding Time	Minimum Volume	Container Type	Preservation
VOA	14 days from date sampled	One 40-ml vial; no air space	Two 40-ml vials	Add HC1 until pH <2 and ice to 4°C
Semi-VOA (BNAs)	7 days to extract from date sampled	One 1-L jar	1/2-gallon amber glass bottle	Ice to 4°C
PCBs	7 days to extract from date sampled	One 1-L jar	1/2-gallon amber glass bottle	Ice to 4°C
Pesticides and PCBs	7 days to extract from date sampled	One 1-L jar	1/2-gallon amber glass bottle	Ice to 4°C
Metals	6 months from date sampled	One 300-ml bottle	1-L poly bottle	Add $HN0_3$ until pH <2 and ice to 4°C
Cyanide	14 days from date sampled	One 100-ml bottle	1-L poly bottle	Add NaOH until pH >12 and ice to 4°C
Hexavalent chromium	24 hours from time sampled	One 50-ml bottle	125-ml poly bottle	Ice to 4°C
TOC	28 days from date sampled	One 10-ml bottle	125-ml poly bottle	Add H_2SO_4 until pH <2 and ice to 4°C
TOX	7 days from date sampled	One 200-ml bottle	1-L amber glass bottle	Add H_2SO_4 until pH <2 and ice to 4°C
TRPHs	28 days from date sampled	One 1-L bottle	1-L amber glass bottle	Add H_2SO_4 until pH <2 and ice to 4°C

5.2 Purging

In a nonpumping well, there will be little or no vertical mixing of the water, and stratification will occur. The well water in the screened interval will mix with the groundwater due to normal flow patterns, but the water above the screened interval will remain isolated and become stagnant. Sampling team members should realize that stagnant water may contain foreign material inadvertently or deliberately introduced from the surface. To safeguard against collecting nonrepresentative stagnant water in a sample, the following guidelines and techniques should be adhered to during well purging and sampling:

- As a general rule, all monitoring wells should be pumped or bailed prior to the collection of the sample. Evacuation of a minimum of one volume of water in the well casing, and preferably three to five volumes, is recommended for a representative sample. In a high-yielding groundwater formation and where there is no stagnant water in the well above the screened section, evacuation prior to sample collection is not as critical. However, in all cases where the monitoring data are to be used for enforcement actions, evacuation is recommended.

- For wells that can be pumped or bailed dry, the well should be evacuated and allowed to recover prior to sample withdrawal. If the recovery rate is fairly rapid and time allows, evacuation of more than one volume of water is preferred.

- A nonrepresentative sample can also result from excessive pumping of the monitoring well. Stratification of the leachate concentrations in the groundwater formation may occur or compounds that are heavier than water may sink to the lower portions of the aquifer. Excessive pumping can dilute or increase the contaminant concentrations from what is representative of the sampling point of interest.

5.3 Materials

The material used to construct groundwater purging and sampling devices can have a significant impact on the analytical results. If practical, equipment that contacts the groundwater should be constructed from stainless steel, teflon, or glass. The use of plastic should be avoided when analyzing for organics. Table 2 discusses the advantages and disadvantages of groundwater sampling devices, and Table 3 provides a ranking of sample material compatibility under various aqueous environments.

Table 2 Advantages and Disadvantages of Various Groundwater Sampling Devices

Device	Advantages	Disadvantages
Bailer	■ The only practical limitations are size and materials ■ No power source needed ■ Portable ■ Inexpensive; it can be dedicated and hung in a well, reducing the chances of cross-contamination ■ Minimal outgassing of volatile organics while sample is in bailer ■ Readily available ■ Removes stagnant water first ■ Rapid, simple method for removing small volumes of purge water	■ Time consuming, especially for large wells ■ Transfer of sample may cause aeration
Submersible Pump	■ Portable; can be used on an unlimited number of wells ■ Relatively high pumping rate (dependent on depth and size of pump) ■ Generally very reliable; does not require priming	■ Potential for effects on analysis of trace organics ■ Heavy and cumbersome, particularly in deeper wells ■ Expensive ■ Power source needed ■ Susceptible to damage from silt or sediment ■ Impractical in low-yielding or shallow wells
Non-Gas Contact Bladder Pump	■ Maintains integrity of sample ■ Easy to use	■ Difficult to clean, although dedicated tubing and bladder may be used ■ Only useful at depths down to approximately 100 feet ■ Supply of gas for operation (bottled gas and/or compressor) is difficult to obtain and is cumbersome
Suction Pump	■ Portable, inexpensive, and readily available	■ Only useful at depths down to approximately 25 feet ■ Vacuum can cause loss of dissolved gases and volatile organics ■ Pump must be primed and vacuum is often difficult to maintain ■ May cause pH modification
Inertia Pump	■ Portable, inexpensive, and readily available ■ Rapid method for purging relatively shallow wells	■ Only useful at depths down to approximately 70 feet ■ May be time consuming to use ■ Labor-intensive ■ WaTerra pump is only effective in 2-inch diameter wells

Table 3 Relative Compatibility of Rigid Groundwater Sampling Materials

	PVC I	Galvanized Steel	Carbon Steel	Low-carbon Steel	Stainless Steel 304	Stainless Steel 316	Teflon
Buffered Weak Acid	100	56	51	59	97	100	100
Weak Acid	98	59	43	47	96	100	100
Mineral Acid/High Solids	100	48	57	60	80	82	100
Aqueous/Organic Mixtures	64	69	73	73	98	100	100
Percent Overall Rating	91	58	56	59	93	96	100

Preliminary Ranking of Rigid Materials:

Teflon
Stainless Steel 316
Stainless Steel 304
PVC I
Low-Carbon Steel
Galvanized Steel
Carbon Steel

6. Equipment Checklist

6.1 General

- Water level indicator (e.g., electric sounder, steel tape, transducer, reflection sounder, air line, etc.);
- Depth sounder;
- Appropriate keys for well cap locks;
- Steel brush;
- Organic vapor analyzer (OVA) or photo-ionization meter (HNu);
- Oil/water interface indicator (if necessary);
- Timepiece (preferably a stopwatch);
- Logbook;
- Calculator;

- Field data sheets;
- Bottle labels;
- Chain-of-custody forms;
- Custody seals;
- Sample containers;
- Engineer's rule;
- Sharp knife (locking blade);
- Tool box (screwdrivers, pliers, hacksaw, hammer, flashlight, adjustable wrench, bolt cutters, etc.);
- Leather work gloves;
- Appropriate personnel protection equipment;
- 5-gallon pails;
- Plastic sheeting;
- Sealable plastic bags;
- Shipping containers;
- Packing material;
- U.S. Department of Transportation (DOT) shipping labels;
- 55-gallon 1A2 (17-H) drums (if necessary);
- Decontamination solutions;
- Tap water;
- Non-phosphate soap;
- Aluminum foil;
- Garden sprayers;

- Brushes;
- Preservatives; and
- Distilled or deionized water, as necessary.

6.2 Groundwater Sampling Devices

Bailers

- Clean decontaminated bailers of appropriate size and construction material;
- Nylon line (enough to dedicate to each well);
- Sharp knife;
- Aluminum foil (to wrap clean bailers);
- Submersible Pumps
- Pump(s);
- Adequate power supply, generator, or battery;
- 1-inch black poly vinyl chloride (PVC) coil pipe (enough to dedicate to each well);
- Hose clamps;
- Safety cable (i.e., heavy-grade nylon line);
- Tool box supplement (pipe wrenches, wire strippers, electric tape, heat shrink, hose connectors, teflon tape);
- Winch or pulley (if desired);
- Gasoline for generator;
- Flow meter with gate valve; and
- 1-inch nipples and various pipe connectors.

Bladder Pumps

- Non-gas contact bladder pump;

- Compressor or nitrogen gas bottles;
- Batteries and charger;
- Teflon tubing (enough to dedicate to each well);
- Swagelock fitting; and
- Toolbox supplement (same as submersible pump).

Suction Pump

- Pump;
- Black coil pipe tubing (enough to dedicate to each well);
- Gasoline (if required);
- Toolbox supplement (same as submersible pump);
- Various hose connectors and nipples; and
- Flow meter with gate valve.

7. Preparation

7.1 Office Preparation

- The preparation of a Site-Specific Safety Plan (SSSP) is required prior to any sampling. The SSSP must be approved and signed by the Corporate Health and Safety Officer or designee (i.e., the Regional Safety Coordinator [RSC]);

- Prepare a Site-Specific Work Plan (SSWP) to meet the data quality objectives of the project in accordance with contract requirements. Review available background information (e.g., topographic maps, hydrogeologic maps, geologic maps, other site reports, etc.) to determine the extent of the sampling effort, the sampling method to be employed, and the type and amounts of equipment and supplies required;

    - Obtain necessary sampling and monitoring equipment (see Section 6), preclean the sampling equipment, and ensure that it is in proper working order;

    - Ensure that batteries are charged, including the OVA, HNu, pump control box, and large storage batteries;

- Locate local sources for preservatives and decontamination solutions. Review this matter with the RSC or site safety coordinator;

- Contact delivery service to confirm ability to ship all equipment and samples. Determine if shipping restrictions exist; and

- Prepare schedules and coordinate with staff, clients, and regulatory agencies, if appropriate.

7.2 Field Preparation

- Identify local suppliers of expendable sampling equipment such as ice and baggies, and overnight delivery services;

- Inspect all sampling equipment and reclean, if necessary, prior to groundwater sampling (see Table 4);

Table 4 Decontamination Solutions

Type of Hazard	Name of Solution	Remarks
Amphoteric-acids and bases	Sodium bicarbonate	5-15% aqueous solution
Inorganic acids, metal processing wastes, heavy metals	Sodium carbonate	Good water softener, 10-20% aqueous solution
Solvents and organic compounds, oily, greasy unspecified wastes	Trisodium phosphate	Good rinsing solution of detergent, 10% aqueous solution
Pesticides, fungicides, cyanides, ammonia, and other non-acidic inorganic wastes	Calcium hypochlorite	Excellent disinfectant, bleaching and oxidizing agent, 10% aqueous solution
Other Types of Decontamination Solutions		
Other Detergents and Aqueous Surfactants		
Phosphate-free laboratory detergent (Alconox, Liquinox), Pennsalt 91, Oakite, Gunk, Clorox		
Solvents		
1,1,2-Trichloroethane, H2-ethyl-hexyl acetate, pesticide-grade isopropanol/acetone/methanol/hexane, heptane (nonhydrogen bonding), alcohol, diesel fuel, naphtha, beta-propiolactone, carbon tetrachloride, 8% formalinethylene, 8% hexachloromelamine, 1,2-dichloroethane (in solution), Quadcoat		
Other Solutions		
10% nitric acid, 0.1 N/10%/20% hydrochloric acid		
Water		
Potable/tap water (demonstrated to be analyte-free), distilled water, deionized water, reagent-grade distilled and deionized water		

Source: Adapted from Devinny *et al.* 1990; Mickam *et al.* 1989.

- A general site survey should be performed prior to site entry in accordance with the SSSP followed by a site safety meeting; and

- Identify all well locations.

8. Reagents

Except for decontamination solutions and sample preservatives, there are no reagents required for these procedures. Refer to E & E Standard Operating Procedure for *Equipment Decontamination* (ENV 3.15), the SSSP, or the SSWP for proper decontamination procedures and appropriate solvents.

9. Field Sampling Procedures

9.1 Sampling Preparation

- Start at the least-contaminated well, if known;

- Remove locking well cap. Note the location of the well, time of day, and date in the field logbook or sample log;

- Remove the well cap covering the well riser;

- Test the well for volatile organic compounds (VOCs) and methane by conducting a headspace analysis with a combustible gas indicator, an OVA (for VOCs and methane), or an HNu (for VOCs). Record all readings in the field logbook;

- Lower water level measuring device into well until the surface of the water table is encountered;

- Measure the distance from the top of the water table to a reference point on the well riser or casing (e.g., top of inside casing [TOIC]) and record the distance in the field logbook;

- Lower the water level measuring device to the bottom of the well, and measure the total depth of the well using the same reference point on the well riser or casing. Record the distance in the field logbook.

- Measure the diameter of the well, and calculate the volume of water in the well by multiplying the number of feet of water by the number of gallons per foot (see Section 10);

- Determine the required volume of groundwater to be removed from the well (e.g., three well volumes or as indicated in the SSWP);

- Place plastic sheeting on the ground around the well to minimize the likelihood of contamination of sampling equipment from soil adjacent to the well; and

- Prepare the purging and sampling equipment.

9.2 Purging

The amount of flushing that a well receives prior to sample collection depends on the intent of the monitoring program, as well as the hydrogeologic conditions. Programs in which overall quality determinations of water resources are involved may require long pumping periods to obtain a sample that is representative of the groundwater. The pumped volume can be determined prior to sampling, or the well can be pumped until selected parameters (e.g., temperature, electrical conductance, pH, turbidity, etc.) have stabilized. Care must be taken not to exceed the recommended purging rate for monitoring well screens (see Table 5).

Monitoring for defining a contaminant plume requires a representative sample of a small volume of the aquifer. These circumstances require that the well be pumped enough to remove the stagnant water, but not enough to induce flow from other areas.

During purging, water level measurements may be taken regularly at 15- and 30-second intervals. The data may be used to compute water table or aquifer transmissivity and other hydraulic characteristics.

Information on the most commonly used groundwater purging and sampling devices can be found in E & E’s SOP for Groundwater Sampling Devices (ENV 3.6).

9.2.1 Bailers

Equipment needed will include a clean decontaminated bailer, nylon line, a sharp knife, and plastic sheeting. Place the plastic sheeting around the well to prevent contact of the bailer or line with the ground. Attach the line to the bailer, and then lower the bailer until it is completely submerged. Pull the bailer out of the well; ensure that the line either falls onto the plastic sheeting or never touches the ground. Empty the bailer into a 5-gallon pail. Repeat the procedure until the required purge volume has been removed. When the 5-gallon pail is full, pour the water into a 55-gallon drum or handle as indicated in the SSWP.

Table 5 Maximum Recommended Purging Rate for Monitoring Well Screens

Screen Type	Diameter (in)	Slot (in)	Open Area (ft^2/ft)	Open Area (%)	Recommended Pumping Rate		
					gpm/ft at 0.1 ft/s	gpm/ft at 0.07 ft/s	gpm/ft at 0.03 ft/s
PVC (machine slot)	2	0.01	0.018	3.4	0.804	0.563	0.241
	2	0.02	0.033	6.4	1.496	1.047	0.449
	2	0.025	0.042	8.0	1.870	1.309	0.561
	2	0.04	0.060	11.5	2.693	1.885	0.808
	2	0.051	0.075	14.4	3.385	2.369	1.015
	4	0.01	0.036	3.4	1.608	1.126	0.482
	4	0.02	0.067	6.4	2.992	2.094	0.898
	4	0.025	0.083	8.0	3.740	2.618	1.122
	4	0.04	0.120	11.5	5.386	3.770	1.616
	4	0.051	0.151	14.4	6.773	4.741	2.032
PVC (wound)	2	0.01	0.047	9.0	2.119	1.484	0.636
	2	0.02	0.089	17.0	3.989	2.793	1.197
	2	0.03	0.124	23.7	5.579	3.905	1.674
	2	0.04	0.156	29.7	6.981	4.887	2.094
	2	0.05	0.183	34.9	8.197	5.738	2.459
	4	0.01	0.078	7.5	3.522	2.465	1.057
	4	0.02	0.147	14.1	6.607	4.625	1.982
	4	0.03	0.208	19.9	9.350	6.545	2.805
	4	0.04	0.262	25.0	11.750	8.225	3.525
	4	0.05	0.309	29.5	13.869	9.708	4.161
Stainless Steel (wire-wound)	2	0.01	0.090	17.1	4.021	2.814	1.206
	2	0.02	0.157	30.0	7.044	4.931	2.113
	2	0.03	0.210	40.2	9.444	6.610	2.833
	2	0.04	0.253	48.4	11.376	7.963	3.413
	2	0.05	0.287	54.8	12.872	9.010	3.862
	4	0.01	0.177	16.9	7.948	5.563	2.384
	4	0.02	0.307	29.3	13.776	9.643	4.133
	4	0.03	0.410	39.1	18.388	12.872	5.517
	4	0.04	0.492	47.0	22.097	15.468	6.629
	4	0.05	0.560	53.4	25.120	17.584	7.536

9.2.2 Submersible Pumps

- Assemble the pump, hose, and safety cable;
- Lower the pump and assembly into the monitoring well to a point a few feet below the water level;
- Attach to a power source and commence purging operations;
- Using a flow meter or pail and a stopwatch, determine the flow rate and calculate the time required to remove the required volume of water from the well;
- Place the purge water in 55-gallon drums or handle as indicated in the SSWP; and
- Lower the pump by stages until it is just above the screen, and continue to purge until the required volume of water has been removed from the well. In cases where the well will not yield water at a sufficient recharge rate, pump the well dry and allow it to recover.

9.2.3 Non-Gas Contact Bladder Pumps

- Assemble the teflon tubing, pump, and charged control box;
- Procedures for purging with a bladder pump are the same as for a submersible pump (Section 9.2.2); and
- Be sure to adjust the flow rate to prevent violent jolting of the hose.

9.2.4 Suction Pumps

- Assemble the pump, tubing, and power source; and
- Procedures for purging with a suction pump are the same as for a submersible pump (Section 9.2.2).

9.3 Sampling

Groundwater samples can be obtained through the use of a number of groundwater sampling devices. Each groundwater sampling device has its advantages (and disadvantages) over other devices. Ideally, groundwater sampling devices should be completely inert, economical to manufacturer, easily cleaned for reuse, able to operate at remote sites in the absence of power sources, and capable of delivering variable rates for both well purging and sample collection. There are several other factors to consider when choosing a groundwater sampling device and care should be taken when selecting the device. Refer to E & E Standard Operating Procedure for Groundwater Sampling Devices (ENV 3.6) for additional information.

9.3.1 Bailers

- Make sure that clean plastic sheeting has been placed around the well;
- Attach a line to the bailer. If a bailer was used for purging, the same bailer and line may be used for sampling;
- Lower the bailer slowly and gently into the well, taking care not to shake the well casing or splash the bailer into the water. Lower the bailer to different points adjacent to the well screen to ensure that a representative water sample is collected;
- Slowly and gently retrieve the bailer from the well, avoiding contact with the well riser;
- Remove the cap from a sample container and place the cap on plastic sheeting or in a location where it will not be contaminated. Refer to Section 9.6 for special considerations for volatile organic analysis (VOA) samples;
- Slowly pour the water into the container;
- Filter and preserve samples as required by the SSWP. Mark the water level on the container with a pen;
- Prepare the necessary QA samples as outlined in the SSWP;
- Record sample information in the field logbook or on field data sheets, and complete the C-O-C form;
- Package samples in accordance with the SSWP; and
- Repeat this process until all groundwater samples have been collected.

9.3.2 Submersible Pumps

- Allow the monitoring well to recharge after purging, keeping the pump just above the screened interval;
- Attach a gate valve to the discharge hose, and reduce the flow rate to a manageable sampling rate;
- Prepare the sample containers;

- If no gate valve is available, discharge the sample into a clean jar and fill the sample containers from the jar;

- Complete the sampling and documentation procedures as outlined in Section 9.3.1; and

- Upon completion, remove the pump and assembly and properly decontaminate the pump prior to use in the next well. Do not reuse the discharge tubing.

9.3.3 Bladder Pump

- Allow the well to recharge after purging;

- Prepare the sample containers;

- Turn the pump on. Increase the cycle time and reduce the pressure to the minimum that will allow groundwater to come to the surface;

- Complete the sampling and documentation procedures as outlined in Section 9.3.1;

- Upon completion, remove the tubing from the well and either replace the teflon tubing and bladder with new dedicated tubing and bladder, or properly decontaminate the existing material;

- Nonfiltered groundwater samples should be collected directly from the outlet tubing into the sample containers; and

- Filtered groundwater samples should be obtained by connecting the pump outlet tubing directly to the filter unit. The pump pressure should be reduced to prevent a pressure buildup on the filter, which could damage the pump bladder.

9.3.4 Suction Pumps

- Allow the well to recharge;

- Attach a gate valve to the discharge line if the suction pump discharge rate cannot be controlled, or discharge the sample into a clean glass jar and fill the sample containers from the jar;

- Sample as outlined in Section 9.3.1; and

- Upon completion, remove the tubing and properly decontaminate the pump prior to use in the next well. Do not reuse the tubing.

9.4 Filtering

Samples being analyzed for total dissolved metals and total organic carbons (TOC) may require filtering. Two types of filters are commonly used: barrel filters and vacuum filters. A barrel filter works with a bicycle pump, which is used to build up positive pressure in the chamber containing the sample. Water is then forced through 0.45-µm filter paper into a jar. The barrel itself is filled manually.

A vacuum filter involves two chambers: the upper chamber contains the sample, and a 0.45-µm filter divides the two chambers. Using a portable vacuum pump, air is withdrawn from the lower chamber, creating a vacuum, which causes the sample to move through the filter into the lower chamber. Repeated pumping may be required to drain all of the sample into the lower chamber. If preservation of the samples is necessary, this should be done after filtering.

9.5 Post-Operation

After all samples have been collected and preserved, the sampling equipment should be properly decontaminated to prevent cross-contamination of samples.

- Decontaminate all equipment according to the SSWP;
- Replace sampling equipment in storage containers;
- Prepare groundwater samples for shipment. Check sample documentation and make sure samples are properly packed for shipment; and
- Organize field notes into a report format and transfer logging information to appropriate forms.

9.6 Special Consideration for VOA Sampling

The proper collection of a sample for dissolved VOCs requires minimal disturbance of the sample to limit volatilization and subsequent loss of volatiles from the sample.

Sample retrieval systems suitable for the valid collection of volatile organic samples include: positive-displacement bladder pumps, gear-driven submersible pumps, and syringe samplers and bailers. Field conditions and other constraints will limit the choice of appropriate systems. The principal objective is to provide a valid sample for analysis that has been subjected to the least amount of turbulence possible.

The following procedures should be followed when collecting VOA samples:

- Open the vial, set the cap in a clean place, and place the proper amount of preservatives (HCl) in the vial;
- Fill the vial to the top until a convex meniscus forms on the top of the vial. Do not overfill the vial;

- Check that the cap has not been contaminated, and carefully cap the vial. Place the cap directly over the top and screw down firmly. Do not overtighten and break the cap;

- Invert the vial and tap gently. If an air bubble appears, discard the sample and begin again. It is imperative that no entrapped air remains in the sample vial;

- Place the VOA vial in a cooler, oriented so that it is lying on its side, not straight up; and

- The holding time, under most protocol parameters, for VOAs is 14 days (see Table 1). It is recommended that samples be shipped or delivered to the laboratory daily. Ensure that the samples remain at 4°C, but do not allow them to freeze.

10. Calculations

Table 6 presents the volume of water in different size casings and holes. To determine the volume of water in a well, the calculations are as follows:

$$V = Tr2(0.163)$$

where:

V = Static volume of well in gallons

T = Depth of water in well, measured in feet (determined by subtracting the static water level from the total depth of the well)

r = Inside radius of well casing, measured in inches

0.163 = A constant conversion factor for the conversion of the casing radius from inches to feet and cubic feet to gallons

Table 6 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 x 10^{-3}
1.5	0.092	0.0123	1.142	1.142 x 10^{-3}
2	0.163	0.0218	2.024	2.024 x 10^{-3}
2.5	0.255	0.0341	3.167	3.167 x 10^{-3}
3	0.367	0.0491	4.558	4.558 x 10^{-3}
3.5	0.500	0.0668	6.209	6.209 x 10^{-3}
4	0.653	0.0873	8.110	8.110 x 10^{-3}
4.5	0.826	0.1104	10.260	10.260 x 10^{-3}
5	1.020	0.1364	12.670	12.670 x 10^{-3}
5.5	1.234	0.1650	15.330	15.330 x 10^{-3}
6	1.469	0.1963	18.240	18.240 x 10^{-3}
7	2.000	0.2673	24.840	24.840 x 10^{-3}
8	2.611	0.3491	32.430	32.430 x 10^{-3}
9	3.305	0.4418	41.040	41.040 x 10^{-3}
10	4.080	0.5454	50.670	50.670 x 10^{-3}
11	4.937	0.6600	61.310	61.310 x 10^{-3}
12	5.875	0.7854	72.960	72.960 x 10^{-3}
14	8.000	1.0690	99.350	99.350 x 10^{-3}
16	10.440	1.3960	129.650	129.650 x 10^{-3}
18	13.220	1.7670	164.180	164.180 x 10^{-3}
20	16.320	2.1820	202.680	202.680 x 10^{-3}
22	19.750	2.6400	245.280	245.280 x 10^{-3}
24	23.500	3.1420	291.850	291.850 x 10^{-3}
26	27.580	3.6870	342.520	342.520 x 10^{-3}
28	32.000	4.2760	397.410	397.410 x 10^{-3}
30	36.720	4.9090	456.020	456.020 x 10^{-3}
32	41.780	5.5850	518.870	518.870 x 10^{-3}
34	47.160	6.3050	585.680	585.680 x 10^{-3}
36	52.880	7.0690	656.720	656.720 x 10^{-3}

1 Gallon = 3.785 liters
1 Meter = 3.281 feet
1 Gallon water weighs 8.33 lbs = 3.785 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 = 12.319 x 10^{3} cubic meters per meter of depth

11. Quality Assurance/Quality Control

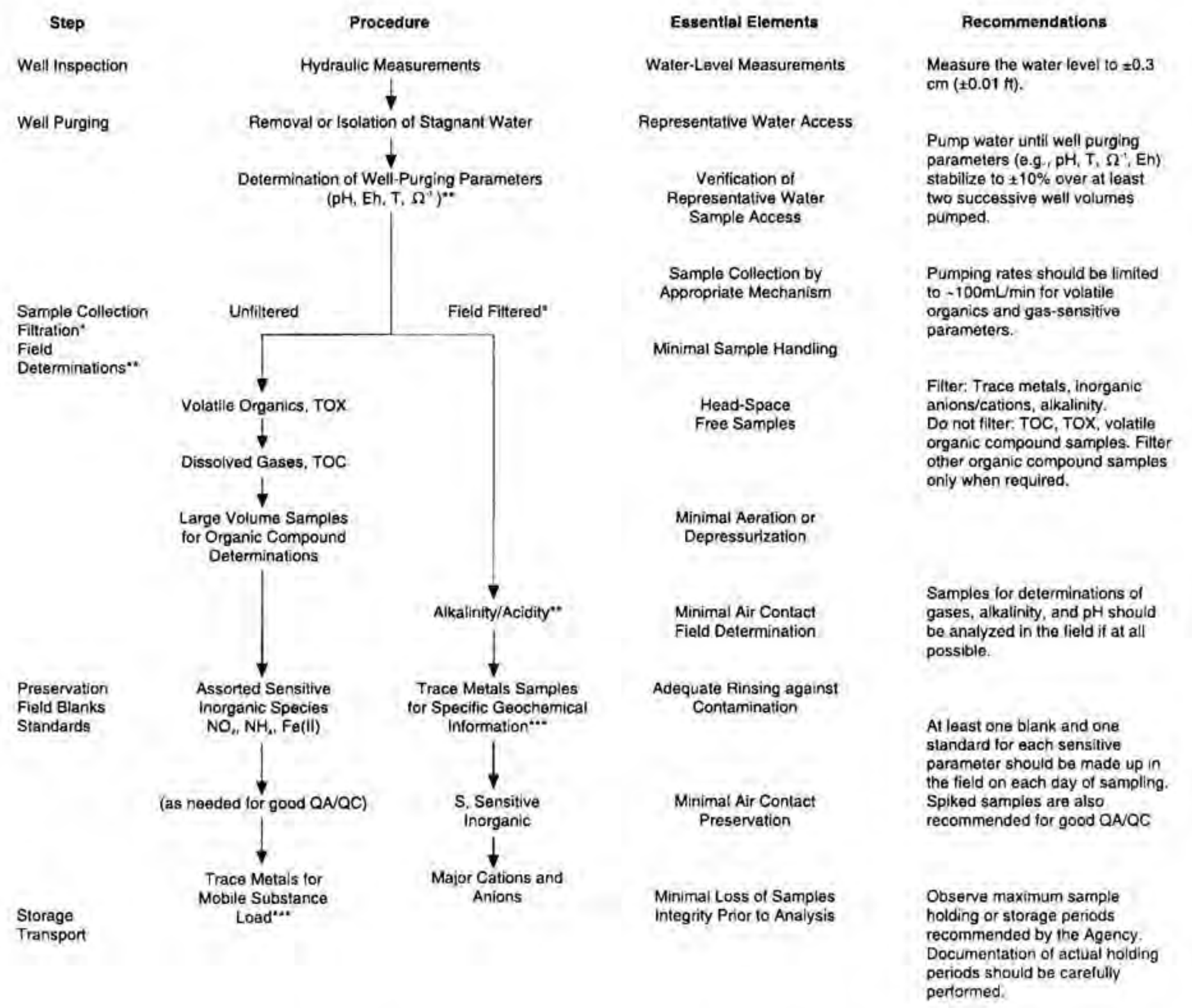
The objective of QA/QC is to identify and implement methodologies that limit the introduction of error into sampling and analytical procedures. Groundwater sampling protocols appropriate to the data quality objectives and site conditions will define the specific procedures that will be followed for sampling events (see Figure 1).

There are seven primary areas of concern for QA in the collection of representative groundwater samples:

- The SSWP should be reviewed by all team personnel involved in the collection of the groundwater samples before any sampling is attempted, with attention to contaminant type and potential concentration variations;
- Log documentation should be reviewed to determine whether the required volume of purge water was removed from the well and that the temperature, electrical conductance, and pH had been stabilized to ensure that a representative water sample of the aquifer was obtained;
- The purging and sampling devices should be made of materials and utilized in a manner that will not interact with or alter the analysis;
- The results generated by these procedures are reproducible as demonstrated through the use of duplicate samples;
- The possibility of cross-contamination is reduced by collecting samples from the least contaminated well first. Rinsate blanks should be incorporated where dedicated sampling and purging equipment is not utilized and decontamination of the equipment between sampling events is required;
- Samples are properly labeled, documented (C-O-C), preserved, and shipped; and
- A record of daily field activities, such as sample collection and tracking information, is kept in a bound book.

12. Data Validation

The data generated will be reviewed according to the QA/QC considerations presented in Section 11.



Measure the water level to ±0.3 cm (±0.01 ft).

Pump water until well purging parameters (e.g., pH, T, Ω^{-1}, Eh) stabilize to ±10% over at least two successive well volumes pumped.

Pumping rates should be limited to ~100mL/min for volatile organics and gas-sensitive parameters.

Filter: Trace metals, inorganic anions/cations, alkalinity.
Do not filter: TOC, TOX, volatile organic compound samples. Filter other organic compound samples only when required.

Samples for determinations of gases, alkalinity, and pH should be analyzed in the field if at all possible.

At least one blank and one standard for each sensitive parameter should be made up in the field on each day of sampling. Spiked samples are also recommended for good QA/QC

Observe maximum sample holding or storage periods recommended by the Agency. Documentation of actual holding periods should be carefully performed.

* Denotes samples that should be filtered to determine dissolved constituents. Filtration should be accomplished preferably with in-line filters and pump pressure or by N$_2$ pressure methods. Samples for dissolved gases or volatile organics should not be filtered. In instances where well development procedures do not allow for turbidity-free samples and may bias analytical results, split samples should be spiked with standards before filtration. Both spiked samples and regular samples should be analyzed to determine recoveries from both types of handling.

** Denotes analytical determinations that should be made in the field.

See Puls and Barcelona (1989).

Figure 1 Generalized Flow Diagram of Groundwater Sampling Protocol

13. Health and Safety

Depending on the site-specific contaminants, the type of personnel protective equipment (PPE) used during the purging and sampling of the wells is outlined in the SSSP. The SSSP should be reviewed with specific emphasis placed on the safety procedures to be followed for the well sampling tasks. Standard safe operating practices should be followed, such as minimizing contact with potential contaminants in both the vapor phase and liquid matrix through the use of respirators and protective clothing.

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Title:	**SAMPLING EQUIPMENT DECONTAMINATION**
Category:	ENV 3.15
Revised:	March 1999

STANDARD OPERATING PROCEDURE

SAMPLING EQUIPMENT DECONTAMINATION

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TITLE: SAMPLING EQUIPMENT DECONTAMINATION

CATEGORY: ENV 3.15 **REVISED:** March 1999

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TITLE: SAMPLING EQUIPMENT DECONTAMINATION

CATEGORY: ENV 3.15 **REVISED:** March 1999

1. Scope and Application

The purpose of this procedure is to provide a description of methods for preventing or reducing cross-contamination and general guidelines for designing and selecting decontamination procedures for use at potential hazardous waste sites. The decontamination procedures chosen will prevent introduction and cross-contamination of suspected contaminants in environmental samples, and will protect the health and safety of site personnel.

2. Method Summary

Removing or neutralizing contaminants that have accumulated on personnel and equipment ensures protection of personnel from permeating substances, reduces/eliminates transfer of contaminants to clean areas, prevents the mixing of incompatible substances, and minimizes the likelihood of sample contamination.

Cross-contamination can be removed by physical decontamination procedures. The abrasive and non-abrasive methods include the use of brushes, high pressure water, air and wet blasting, and high pressure Freon cleaning. These methods should be followed by a wash/rinse process using appropriate cleaning solutions. A general protocol for cleaning with solutions is as follows:

1. Physical removal.
2. Non-phosphate detergent plus tap water.
3. Tap water.
4. 10% nitric acid.
5. Distilled/deionized water rinse.
6. Solvent rinse.
7. Total air dry.
8. Triple rinse with distilled/deionized water.

This procedure can be expanded to include additional or alternate solvent rinses that will remove specified target compounds if required by site-specific work plans (WP) or as directed by a particular client.

3. Interferences

The use of distilled/deionized water commonly available from commercial vendors may be acceptable for decontamination of sampling equipment provided that it has been verified by laboratory analysis to be analyte-free distilled/deionized water. Distilled water available from local grocery stores and pharmacies is generally not acceptable for final decontamination rinses. Contaminant-free deionized water is available from commercial vendors and may be shipped directly to the site or your hotel.

The use of an untreated potable water supply is not an acceptable substitute for tap water. Tap water may be used from any municipal water treatment system.

4. Equipment/Apparatus

The following are standard materials and equipment used as a part of the decontamination process:

- Appropriate protective clothing;
- Air purifying respirator (APR);
- Field log book;
- Non-phosphate detergent;
- Selected high purity, contaminant-free solvents;
- Long-handled brushes;
- Drop cloths (plastic sheeting);
- Trash containers;
- Paper towels;
- Galvanized tubs or equivalent (e.g., baby pools);
- Tap water;
- Contaminant-free distilled/deionized water;
- Metal/plastic container for storage and disposal of contaminated wash solutions;
- Pressurized sprayers, H_2O;
- Pressurized sprayers, solvents;
- Trash bags;
- Aluminum foil;
- Sample containers;

- Safety glasses or splash shield; and
- Emergency eyewash bottle.

5. Reagents

There are no reagents used in this procedure aside from decontamination solutions used for the equipment. The type of decontamination solution to be used shall depend upon the type and degree of contamination present and as specified in the project/site-specific Quality Assurance Project Plan (QAPP).

In general, the following solvents are utilized for decontamination purposes:

- 10% nitric acid wash (reagent grade nitric acid diluted with deionized/distilled water – 1 part acid to 10 parts water)[a];
- Acetone (pesticide grade)[b] ;
- Hexane (pesticide grade)[b];
- Methanol; and
- Methylene chloride[b].

[a] Only if sample is to be analyzed for trace metals.
[b] Only if sample is to be analyzed for organics requiring specific or specialized decontamination procedures. These solvents must be kept away from samples in order to avoid contamination by decon solvents.

6. Procedures

Decontamination is the process of removing or neutralizing contaminants that have accumulated on both personnel and equipment. Specific procedures in each case are designed accordingly and may be identified in either the Health and Safety Plan (HSP), WP, QAPP, or all three.

As part of the HSP, a personnel decontamination plan should be developed and set up before any personnel or equipment enters the areas of potential contamination. Decontamination procedures for equipment will be specified in the WP and the associated QAPP. These plans should include:

- Number and layout of decontamination stations;
- Decontamination equipment needed (see Section 4);

- Appropriate decontamination methods;
- Procedures to prevent contamination of clean areas;
- Methods and procedures to minimize worker contact with contaminants during removal of protective clothing;
- Methods and procedures to prevent cross-contamination of samples and maintain sample integrity and sample custody; and
- Methods for disposal of contaminated clothing, equipment, and solutions.

Revisions to these plans may be necessary for health and safety when the types of protective clothing, site conditions, or on-site hazards are reassessed based on new information.

Prevention of Contamination

Several procedures can be established to minimize contact with waste and the potential for contamination. For example:

- Employing work practices that minimize contact with hazardous substances (e.g., avoid areas of obvious contamination, avoid touching potentially hazardous substances);
- Use of remote sampling, handling, and container-opening techniques;
- Covering monitoring and sampling equipment with plastic or other protective material;
- Use of disposable outer garments and disposable sampling equipment with proper containment of these disposable items;
- Use of disposable towels to clean the outer surfaces of sample bottles before and after sample collection; and
- Encasing the source of contaminants with plastic sheeting or overpacks.

Proper procedures for dressing prior to entrance into contaminated areas will minimize the potential for contaminants to bypass the protective clothing. Generally, all fasteners (zippers, buttons, snaps, etc.) should be used, gloves and boots tucked under or over sleeves and pant legs, and all junctures taped (see the Health and Safety Plan for these procedures).

Decontamination Methods

All personnel, samples, and equipment leaving the contaminated area of a site must be decontaminated to remove any chemicals or infectious organisms that may have adhered to them. Various decontamination methods will either physically remove, inactivate by chemical detoxification/disinfection/sterilization, or remove contaminants by both physical and chemical means.

In many cases, gross contamination can be removed by physical means. The physical decontamination techniques can be grouped into two categories: abrasive methods and non-abrasive methods.

6.1 Abrasive Cleaning Methods

Abrasive cleaning methods work by rubbing and wearing away the top layer of the surface containing the contaminant. The following reviews the available abrasive methods.

Mechanical

Mechanical methods include using brushes with metal, nylon, or natural bristles. The amount and type of contaminants removed will vary with the hardness of bristles, length of time brushing, and degree of brush contact. Material may also be removed by using appropriate tools to scrape, pry, or otherwise remove adhered materials.

Air Blasting

Air blasting equipment uses compressed air to force abrasive material through a nozzle at high velocities. The distance between nozzle and surface cleaned, air pressure, and time of air blasting dictate cleaning efficiency. The method’s disadvantages are its inability to control the exact amount of material removed and its large amount of waste generated.

Wet Blasting

Wet blast cleaning involves the use of a suspended fine abrasive. The abrasive/water mixture is delivered by compressed air to the contaminated area. By using very fine abrasives, the amount of materials removed can be carefully controlled.

6.2 Non-abrasive Cleaning Methods

Non-abrasive cleaning methods work by either dissolution or by forcing the contaminant off a surface with pressure. In general, less of the equipment surface is removed using non-abrasive methods.

High-Pressure Water

This method consists of a high-pressure pump, an operator controlled directional nozzle, and high-pressure hose. Operating pressure usually ranges from 340 to 680 psi, which relates to flow rates of 20 to 140 lpm.

Steam Cleaning

This method uses water delivered at high pressure and high temperature in order to remove accumulated solids and/or oils.

Ultra-High-Pressure Water

This system produces a water jet from 1,000 to 4,000 atm. This ultra-high-pressure spray can remove tightly-adhered surface films. The water velocity ranges from 500 m/sec. (1,000 atm) to 900 m/sec. (4,000 atm). Additives can be used to enhance the cleaning action, if approved by the QAPP for the project.

High-Pressure Freon Cleaning

Freon cleaning is a very effective method for cleaning cloth, rubber, plastic, and external/internal metal surfaces. Freon 113 (trichlorotriflorethane) is dense, chemically stable, relatively non-toxic, and leaves no residue. The vapor is easily removed from the air by activated charcoal. A high pressure (1,000 atm) jet of liquid Freon 113 is directed onto the surface to be cleaned. The Freon can be collected in a sump, filtered, and reused.

Physical removal of gross contamination should be followed by a wash/rinse process using cleaning solutions. One or more of the following methods utilize cleaning solutions.

Dissolving

Removal of surface contaminants can be accomplished by chemically dissolving them, although the solvent must be compatible with the equipment and protective clothing. Organic solvents include alcohols, ethers, ketones, aromatics, straight-chain alkanes, and common petroleum products. Halogenated solvents are generally incompatible with protective clothing and are toxic. Table 1 provides a general guide to the solubility of contaminant categories in four types of solvents.

Surfactants

Surfactants reduce adhesion forces between contaminants and the surface being cleaned and prevents reposition of the contaminants. Non-phosphate detergents dissolved in tap water is an acceptable surfactant solution.

Rinsing

Contaminants are removed and rinsing through dilution, physical attraction, and solubilization.

Disinfection/Sterilization

Disinfectants are a practical means of inactivating infectious agents. Unfortunately, standard sterilization methods are impractical for large equipment and personal protective clothing.

6.3 Field Sampling Equipment Cleaning Procedures

The following steps for equipment cleaning should be followed for general field sampling activities.

1. Physical removal (abrasive or non-abrasive methods).
2. Scrub with non-phosphate detergent plus tap water.
3. Tap water rinse.
4. 10% nitric acid (required during sampling for inorganics only).
5. Distilled/deionized water rinse.
6. Solvent rinse (required during sampling for organics only).
7. Total air dry (required during sampling for organics only).
8. Triple rinse with distilled/deionized water.

Table 1 lists solvent rinses which may be required for elimination of particular chemicals. After each solvent rinse, the equipment should be air-dried and triple-rinsed with distilled/deionized water.

Solvent rinses are not necessarily required when organics are not a contaminant of concern. Similarly, an acid rinse is not necessarily required if analysis does not include inorganics.

NOTE: Reference the appropriate analytical procedure for specific decontamination solutions required for adequate removal of the contaminants of concern.

Sampling equipment that requires the use of plastic or teflon tubing should be disassembled, cleaned, and the tubing replaced with clean tubing, if necessary, before commencement of sampling or between sampling locations.

Table 1 Decontamination Solvents

Solvent	Soluble Contaminants
Water	Low-chain compounds Salts Some organic acids and other polar compounds
Dilute Bases For example: ■ detergent ■ soap	Acidic compounds Phenol Thiols Some nitro and sulfonic compounds
Organic Solvents: For example: ■ alcohols (methanol) ■ ethers ■ ketones ■ aromatics ■ straight-chain alkanes (e.g., hexane) ■ common petroleum products (e.g., fuel oil, kerosene)	Nonpolar compounds (e.g., some organic compounds)

WARNING: Some organic solvents can permeate and/or degrade the protective clothing.

7. Quality Assurance/Quality Control

QA/QC samples are intended to provide information concerning possible cross-contamination during collection, handling, preparation, and packing of samples from field locations for subsequent review and interpretation. A field blank (rinsate blank) provides an additional check on possible sources of contamination from ambient air and from sampling instruments used to collect and transfer samples into sample containers.

A field blank (rinsate blank) consists of a sample of analyte-free water passed through/over a precleaned/decontaminated sampling device and placed in a clean area to attempt to simulate a worst-case condition regarding ambient air contributions to sample contamination.

Field blanks should be collected at a rate of one per day per sample matrix even if samples are not shipped that day. The field blanks should return to the lab with the trip blanks originally sent to the field and be packed with their associated matrix.

The field blank places a mechanism of control on equipment decontamination, sample handling, storage, and shipment procedures. It is also indicative of ambient conditions and/or equipment conditions that may affect the quality of the samples.

Holding times for field blanks analyzed by CLP methods begin when the blank is received in the laboratory (as documented on the chain of parameters and associated analytical methods).

Holding times for samples and blanks analyzed by SW-846 or the 600 and 500 series begins at the time of sample collection.

8. Health and Safety

Decontamination can pose hazards under certain circumstances even though performed to protect health and safety. Hazardous substances may be incompatible with decontamination methods (i.e., the method may react with contaminants to produce heat, explosion, or toxic products). Decontamination methods may be incompatible with clothing or equipment (e.g., some solvents can permeate and/or degrade protective clothing). Also, a direct health hazard to workers can be posed from chemical decontamination solutions that may be hazardous if inhaled or may be flammable.

The decontamination solutions must be determined to be compatible before use. Any method that permeates, degrades, or damages personal protective equipment should not be used. If decontamination methods do pose a direct health hazard, measures should be taken to protect personnel or modified to eliminate the hazard.

All site-specific safety procedures should be followed for the cleaning operation. At a minimum, the following precautions should be taken:

1. Safety glasses with splash shields or goggles, neoprene gloves, and laboratory apron should be worn.

2. All solvent rinsing operations should be conducted under a fume hood or in open air.

3. No eating, smoking, drinking, chewing, or any hand-to-mouth contact is permitted.

9. References

Field Sampling Procedures Manual, New Jersey Department of Environmental Protection, 1988.

A Compendium of Superfund Field Operations Methods, EPA 540/p-87/001.

Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual, USEPA Region IV, April 1, 1986.

Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, NIOSH/OSHA/USCG/EPA, October 1985.

C

EPA 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: DNAPL Site Evaluation (Cohen & Mercer, 1993) and the RCRA Ground-Water Monitoring: Draft Technical Guidance (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):
    ±0.1 for pH
    ±3% for specific conductance (conductivity)
    ±10 mv for redox potential
    ±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. <u>Daily Decon</u>

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

Cohen, R.M. and J.W. Mercer, 1993, DNAPL Site Evaluation, C.K. Smoley Press, Boca Raton, Florida.

Puls, R.W. and M.J. Barcelona, 1996, Low-Flow (Minimal Drawdown) Ground-water Sampling Procedures, EPA/540/S-95/504.

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