FINAL

REMEDIAL ACTION WORK PLAN FOR INSTALLATION RESTORATION PROGRAM SITES 4, 7 and 9

NEW YORK AIR NATIONAL GUARD
(106TH RESCUE WING)
FRANCIS GABRESKI INTERNATIONAL AIRPORT

WESTHAMPTON BEACH, NEW YORK

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Prepared for
NGB/A7CVR
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Prepared by
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contributed to the preparation of this document and should not be considered an eligible contractor for its review.

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ACRONYMS AND ABBREVIATIONS

ANG	Air National Guard
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
COC	Chain of Custody
DERP	Defense Environmental Restoration Program
DoD	Department of Defense
DPT	Direct-Push Technology
EPA	U.S. Environmental Protection Agency
FOM	Field Operations Manager
FTP	Field Technical Procedure
HASP	Health and Safety Plan
HDD	Horizontal Directional Drilling
HP	Horsepower
IDW	investigation-derived waste
IRP	Installation Restoration Program
LIPA	Long Island Power Authority
MCL	Maximum Contaminant Level
MNA	Monitored Natural Attenuation
NGB/A7CVR	National Guard Bureau Environmental Restoration Branch
NYANG	New York Air National Guard
NYSDEC	New York State Department of Conservation
ORP	Oxidation Reduction Potential
PM	Project Manager
Ppb	parts per billion
psi	pounds per square inch
PVC	polyvinyl chloride
QA/QC	Quality assurance/quality control
QAPP	Quality Assurance Project Plan
RA	Remedial Action
RQW	Rescue Wing
SAIC	Science Applications International Corporation
scfm	standard cubic feet per minute
SARA	Superfund Amendments and Reauthorization Act
µg/L	micrograms per liter
VOC	volatile organic compound

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1.0 INTRODUCTION

In 1984, the Defense Environmental Restoration Program (DERP) was established to promote and coordinate efforts for the evaluation and cleanup of contamination at U.S. Department of Defense (DoD) installations. In 1987, DERP became part of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA). The Installation Restoration Program (IRP) was established under DERP to identify, investigate, and clean up contamination at DoD installations. The IRP is focused on cleanup of contamination associated with past DoD activities to ensure that threats to public health are eliminated and to restore natural resources for future use following applicable, relevant, and appropriate federal, state, and local cleanup standards. Within the Air National Guard (ANG), the National Guard Bureau Environmental Restoration Branch (NGB/A7CVR) manages the IRP and related activities.

SAIC Engineering of New York, P.C., a wholly owned subsidiary of Science Applications International Corporation (SAIC), has been retained by the ANG to conduct a Remedial Action (RA) for three IRP Sites at the New York Air National Guard (NYANG) 106th Rescue Wing (RQW), located at Francis Gabreski International Airport, West Hamptonbeach, New York (Figure 1-1). The RA is being conducted under the National Guard Bureau Contract No. DAHA92-01-D-0008, Delivery Order 0027.

1.1 PROJECT PURPOSE AND SCOPE

The primary purpose of this RA is to install and operate a groundwater remediation system at IRP Sites 4 and 9 and to perform groundwater sampling at all sites for performance monitoring, monitored natural attenuation (MNA) and / or regulatory closure at:

- Site 4 – Aircraft Refueling Apron Ditch
- Site 7 – Former Fire Training Area
- Site 9 – Ramp Drainage Outfall.

SAIC will provide the necessary personnel, equipment, and materials required to complete the remedial action construction at Sites 4 and 9, to conduct the performance and MNA monitoring at Sites 4 and 9, to conduct the remedial action operation at Sites 4 and 9 for one year, and to conduct the regulatory closure sampling at Site 7. MNA will be employed for the low levels of dissolved phase groundwater contamination outside the source areas at Sites 4 and 9. These activities will be conducted in accordance with the provisions of New York State and Suffolk County Regulations, New York State Department of Environmental Conservation (NYSDEC), the scope of work in the National Guard Bureau Contract No. DAHA92-01-D-0008 Delivery Order 0027, and the Final Air National Guard Environmental Restoration Program Investigation Guidance (ANG 2005).

1.2 GENERAL REMEDIAL APPROACH

The primary objectives associated with the RA at IRP Sites 4, 7, and 9 are to:

- Install an air sparging system to treat petroleum related contamination in the groundwater at Sites 4 and 9,

- Perform two rounds of performance groundwater sampling at Sites 4 and 9,
- Perform closure sampling at Site 7, and
- Operate and maintain the air sparging system for a period of one year and determine the system effectiveness.

1.3 PROJECT PROCEDURES

All remedial construction and sampling activities will be conducted in accordance with:

- Quality Assurance Project Plan (QAPP) provided in Appendix A
- Health and Safety Plan (HASP) provided in Appendix B
- *Final Air National Guard Installation Restoration Program Investigation Protocol* (ANG 1998).

In addition, SAIC has developed the following Construction Procedures and Field Technical Procedures (FTPs) that will be used throughout the project (Table 1-1). The applicable procedures will be maintained on-site by the Field Operations Manager (FOM).

Table 1-1. SAIC Standard Operating Procedures for Field Activities

No	Title	Rev #	Revision Date
CONST-001	Submittal Review and Approval	0	11/15/1999
CONST-002	Control of Materials	0	11/15/1999
CONST-003	Installation, Testing, and Startup of Materials and Equipment	0	11/15/1999
CONST-004	Field Surveys	0	11/15/1999
CONST-005	Control of Project Change	0	11/15/1999
FTP-175	Field Measurement of Physical and Topographical Features	0	6/30/1993
FTP-370	Groundwater Sampling Procedures: Water Level Measurements	0	6/30/1993
FTP-400	Equipment Decontamination	1	6/8/2001
FTP-405	Cleaning and Decontaminating Sample Containers & Sampling Equip	1	8/15/2000
FTP-600	Groundwater Sampling Procedures: Using a Bailer	1	6/8/2001
FTP-625	Chain of Custody (COC)	1	6/8/2001
FTP-650	Labeling, Packaging, and Shipping of Environmental Field Samples	1	2/11/2000
FTP-651	Hazardous Materials/Dangerous Goods Shipping for Field Work	1	7/18/2003
FTP-655	Chemical Analysis	0	6/30/1993
FTP-691	Composite Procedures	0	6/30/1993
FTP-750	Field Measurement Procedures: Organic Vapor Detection	5	6/8/2001
FTP-752	Field Measurement Procedures: Combustible Gas Detection	3	9/15/2000
FTP-755	Field Gas Chromatograph Headspace Screening for VOCs	0	10/26/1993
FTP-880	Field Measurement Procedures: pH, Temperature, and Conductivity	4	8/15/2000
FTP-910	Field Measurement Procedures: Turbidity	0	12/31/1998
FTP-955	Field Measurement Procedures: Dissolved Oxygen	1	9/15/2000
FTP-1215	Use of Field Logbooks	0	4/9/1999

FTP-1220	Documenting and Controlling Field Changes to Approved Work Plans	1	7/7/1999

1.4 QUALITY MANAGEMENT

The SAIC Quality Assurance / Quality Control (QA/QC) Officer will be responsible for ensuring that all QC procedures are followed. Immediate corrective actions will be taken at any time they are deemed necessary. All QC procedures will be conducted in accordance with the QAPP, included as Appendix A of this Work Plan.

1.5 SUBCONTRACT MANAGEMENT

SAIC is responsible for the cost, schedule, and quality of all work performed under this delivery order number, including the work of subcontractors. SAIC will hire subcontractors for the drilling and electrical services. These subcontractors will support SAIC's efforts at the NYANG 106th RQW and will be selected through a fair procurement process. All potential subcontractors will be evaluated based on relevant experience, technical qualifications required to successfully complete each task, conformance to technical specifications, and best-value. SAIC's Project Manager (PM) or designee will maintain oversight of the subcontractor's completion of specified tasks with respect to technical performance, quality, and adherence to cost and schedule. All subcontractor activity will be in compliance with this Work Plan and associated HASP and QAPP.

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2.0 INSTALLATION BACKGROUND INFORMATION

Background information to include facility description and history, individual site descriptions, and previous investigations may be found in the *Draft Final Proposed Remedial Action Plan*, dated September 2006 by SAIC and the *Final Remedial Investigation Report for Sites 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, and 12* dated June 2004 by PEER Consultants, P.C..

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3.0 ENVIRONMENTAL SETTING

The current nature and extent of petroleum contamination at Sites 4, 7 and 9 with complete descriptions of environmental factors such as meteorology, geology, soil type, and hydrogeology may be found in the *Draft Final Proposed Remedial Action Plan,* dated September 2006 by SAIC and the *Final Remedial Investigation Report for Sites 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, and 12* dated June 2004 by PEER Consultants, P.C.. In brief summary, there are no soil impacts at Sites 4, 7 or 9. The groundwater at Sites 4 and 9 is impacted by VOCs and SVOCs to include: (1,1-dimethyl-ethyl)benzene, (1-methylpropyl)-benzene, 1-methyl-4-1(1-methylethyl)-benzene, 1,2,4-trimethybenzene, 1,3,5-trimethylbenzene, acetone, benzene, butylbenzene, cumene (isopropylbenzene), ethylbenzene, propylbenzene, toluene, total xylenes. BTEX represents the majority of the contamination with generally 10-fold higher concentrations than all other constituents combined. The groundwater at Site 7 historically was impacted by petroleum contaminants but the most recent sampling event conducted in 2004 indicated no groundwater contaminants and closure monitoring will be conducted to achieve regulatory closure.

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4.0 RELEVANT ACTION LEVELS

4.1 GROUNDWATER

The relevant NYSDEC action levels for groundwater are summarized in Table 4-1. The Federal drinking water maximum contaminant levels (MCLs) are provided for reference.

Table 4-1. Groundwater Action Levels for Detected Compounds

Volatile Organics (ug/L)	NYSDEC [a]	MCL [b]	Maximum Detected at Sites 4 and 9[e]
(1,1-Dimethyl-ethyl)benzene	5 [c]	N/A	2.9
(1-Methylpropyl)-benzene	N/A	N/A	2.6
1,2,4-Trimethyl-benzene	5	N/A	515
1,3,5-Trimethyl-benzene	5 [c]	N/A	230
Acetone	N/A	N/A	22.2
1-Methyl-4-(1-methylethyl)-benzene	N/A	N/A	12
Benzene	1	5	0.6
Butylbenzene	5 [c]	N/A	13.3
Chloroform	7	80	ND
Cumene (Isopropylbenzene)	5 [c]	N/A	61.2
Ethylbenzene	5 [c]	700	770
n-Propylbenzene	5 [c]	N/A	76.3
Toluene	5 [c]	1,000	670
Xylene, Total	5 [c]	10,000	2,860

Notes:

a) New York State Department of Environmental Conservation Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations, Table 1 (cf. section 703.5) Water Quality Standards Surface Waters and Groundwaters, Class GA waters, Amended August 1999

b) Federal Drinking Water Maximum Contaminant Level

c) The principal organic contaminant standard for groundwater of 5 ug/L applies to this substance

d) N/A – no regulatory criteria established shaded values - represent concentrations exceeding regulatory criteria

e) Maximum values from 2004 sampling event

4.2 SOIL

There is no impacted soil requiring remediation.

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5.0 PERMIT AND CERTIFICATION REQUIREMENTS

5.1 STATE PERMIT AND CERTIFICATION REQUIREMENTS

A licensed water well driller in the State of New York will perform all drilling activities. Well completion reports will be submitted to the Board of Water Well Contractors subsequent to completion of all field activities. A licensed electrician in the State of New York will perform final electrical connections.

5.2 FACILITY PERMIT AND CERTIFICATION REQUIREMENTS

Digging permits are required from the 106th RQW Base Civil Engineer and Gabreski Airport Civil Engineer prior to the installation of soil borings, piezometers, groundwater monitoring wells, subsurface air sparge piping and subsurface electrical distribution. Once these locations have been staked, the 106th RQW Base Civil Engineer and Gabreski Airport Civil Engineer will review historical and as-built underground utility drawings, inspect the positions, mark known utility lines in the area and issue the required digging permits. SAIC also will contact the local dig alert service (e.g. Long Island One Call Center 800-272-4480) prior to any intrusive activities prior to field activities and will clear each intrusive location with a geophysical survey.

A building permit and electrical service application also will be required from Suffolk County and Long Island Power Authority (LIPA) prior to installation of the air sparge system and the electrical transformer, respectively. SAIC will complete the applicable application forms and receive associated permits prior to installation of the air sparge system at Sites 4 and 9.

No other permits, licenses, or fees are required for RA construction activities.

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6.0 REMEDIAL ACTION

The objective of this remedial action is to accelerate the removal of petroleum contamination from the groundwater at Sites 4 and 9 utilizing air sparging and MNA. Based on the analyses presented in the *Draft Final Proposed Remedial Action Plan,* dated September 2006 by SAIC, this will be accomplished through the installation of an air sparge system, as described below. Performance sampling will be conducted at Sites 4 and 9 to monitor the effectiveness of the air sparge system. Closure sampling will be conducted at Sites 4, 9 and 7 to achieve regulatory closure.

6.1 REMEDIAL ACTION CONSTRUCTION FOR SITES 4 AND 9

Monitoring Well Installation & Baseline Sampling

2-inch Well Installation: Two nested monitoring wells will be installed at SW-6 as 2-inch, flush mount wells using hollow stem augers to match the existing nested monitoring well pair. The monitoring wells will be drilled using hollow-stem augers with an inside diameter of 6 inches. The depth of the monitoring wells will be 40 and 50 foot below ground surface (bgs). Soil samples will be collected continuously for lithologic logging. To avoid underground utilities, the first 5 feet of the monitoring well borings will be installed using hand augers.

The SW-6 wells will be constructed of nominal 2-inch diameter, flush-threaded, polyvinyl chloride (PVC) casing, and a 0.010-inch PVC screen. The monitoring well screen will be 10 feet in length. The filter pack of the monitoring well will be filled with clean silica sand, and will be placed from the bottom to approximately 1 foot above the top of the screened interval. A 3-ft bentonite seal will be placed on top of the filter pack, and then soil cuttings will be used to fill the remaining borehole to a depth of about 2 feet. The bentonite transitional seal will be composed of uncoated, 1/8-inch bentonite pellets or chips. Potable water will be added to hydrate the bentonite seal. The bentonite seal will be allowed to hydrate for a minimum of 1 hour before any further annular material is placed. The monitoring well will be completed with a 1-foot annular seal and a flush-mount vault, set in a concrete base. The annular seal will consist of a bentonite cement grout (3 to 5 percent bentonite by dry weight) installed to about 1 foot bgs. The concrete base will be at least 4 inches thick and will slope to drain away from the protective manhole. The base will extend at least 1-foot laterally in all directions from the outside of the well.

1-inch Pre-Pack Well Installation: Sixteen nested monitoring wells will be installed using direct-push technology (DPT) to match the existing nested monitoring well pairs. The depth of the monitoring wells is indicated in Table 6-1. Soil samples will not be collected continuously for lithologic logging. To avoid underground utilities, the first 5 feet of the monitoring well borings will be installed using hand augers.

The DPT wells will be constructed of as 1.4-inch outside diameter (0.75-inch inside diameter) as PVC Geoprobe® Prepacked Wells. The monitoring wells will have a 0.010-inch PVC screen, 10 feet in length. The well annulus will be backfilled with Red Flint #40 sand or equivalent from the bottom of the borehole to approximately 2 feet above the top of the well screen where allowed. A 3-ft bentonite seal will be placed on top of the pre-pack, and then clean silica sand will be used to fill the remaining borehole to a depth of about 2 feet bgs. The bentonite seal will be allowed to hydrate for a minimum of 1 hour before any further annular material is placed. The monitoring well will be completed with a 1-foot annular seal and a flush-mount vault, set in a concrete base. The annular seal will consist of a bentonite cement grout (3 to 5 percent bentonite by dry weight) installed to about 1 foot bgs. The concrete base will

be at least 4 inches thick and will slope to drain away from the protective manhole. The base will extend at least 1-foot laterally in all directions from the outside of the well.

Table 6-1. 1-inch Pre-Packed Well Installation Information

Existing MW or Historic Sample Point	Current Screen Interval (ft bgs)	Depth to GW (ft bgs)	Monitoring Location	Proposed Screen Intervals (ft bgs)
SWD-24 (Site 4)	23-33	31	Plume Centerline	35-45
SDW-023 (Site 4)	23-33	28	Down Gradient	35-45
DPT-09B (Site 4)	NA	NA	Side Gradient	25-35
4-SB-28D (Site 9)	NA	NA	Up Gradient	25-35 35-45
06MW02 (Site 9)	23-33	26	Plume Centerline	35-45 45-55 55-65
06MW03 (Site 9)	5-35	11	Plume Centerline	35-45 45-55 45-65
DPT-02 (Site 9)	NA	NA	Side Gradient	25-45
DPT-01B (Site 9)	NA	NA	Down Gradient	5-35 35-45 45-55 45-65

Well Development: Development of the monitoring wells will begin no sooner than 24 hours following installation to allow further hydration of the annular seals. The well will be developed by surging the screened interval with a decontaminated surge block to move water back and forth through the sand pack. After surging, the well will be pumped using a submersible pump. Aggressive pumping and surging of the well will be conducted to remove fines and establish good communication with the aquifer. A minimum of three well volumes will be removed from the well. The field parameters of pH, temperature, specific conductance, and turbidity will be measured and documented on a well development form. The well will continue to be developed until turbidity is clear [less than 50 nephelometric turbidity units (NTUs)], or until no visibly discernible color difference is observed over time.

Baseline Groundwater Sampling: A minimum of 72 hours following well development, the new groundwater monitoring wells will be gauged and sampled. Prior to sampling, the well will be gauged using an interface probe for water level depth relative to a reference mark on the north side of the top of the monitoring well casing. During purging, the purge water will be monitored for pH, dissolved oxygen, oxygen-reduction potential (ORP), temperature, specific conductance, and turbidity stability. Well purging measurements and observations will be documented on a well sampling form. Well purging and sampling will be conducted at described in the Remedial Action Work Plan QAAP. After purging, a baseline sample will be taken from each monitoring well for volatile organic compounds. Semivolatile organic compounds and natural attenuation parameters also will be taken from the new monitoring wells installed at SW-6 and 06MW03. All non-disposable down-hole equipment will be decontaminated.

Air Sparge System Installation

A total of 50 sparge points, 38 at Site 4 and 12 at Site 9, will be installed in the areas of the groundwater plume exceeding 1000 µg/l of total benzene, toluene, ethylbenzene, and xylene (BTEX) (see Figure 6-1).

Injection of air to increase dissolved oxygen will stimulate aerobic bioremediation of the residual contamination. This active treatment will reduce the contaminant mass in the source areas, which will in turn decrease the flux of contaminants out of the source area. This decrease will allow natural attenuation (i.e., biodegradation, dispersion, dilution, etc.) to effectively reduce the contamination in the lower concentration areas of the plume (e.g. outside the 1000 µg/l of BTEX). The sparge points will be placed 80 feet on center throughout the source areas, which is based on the findings of the supplemental investigation that was conducted in July 2006.

The air sparge points will be constructed of ¾-inch schedule 40 PVC and will be installed with DPT to an approximate depth of 50 feet bgs at Site 4 and 60 ft bgs at Site 9 (see Figure 6-2). Each well will have 5 feet of 0.010 inch slotted well screen. The points will be packed with sand to approximately 2 feet above the well screen, 1-ft of bentonite pellets, and then sand to approximately 1 foot below the bottom of the well vault. The last foot of annular space will be grouted with cement. Each sparge point will be equipped with a pressure gage and flow control valve. The sparge points will be surface flush completed with light traffic rated vaults.

A Rietschle Model DLR 400 Rotary Claw Compressor or equivalent will be used to deliver compressed air to the sparge points. The DLR 400 is a 30 horsepower (HP), 460 volt compressor that produces 245 standard cubic feet per minute (SCFM) at 25 pounds per square inch (psi). The compressor will rest on a 4 by 6 feet skid that will be placed on a 12 inch thick 12 by 8 feet gravel pad (see Figures 6-3 and 6-4). The compressor will be located at the southeastern corner of the POL yard fence southeast of Site 9 (see Figure 6-1).

All above ground piping for the sparge system will be galvanized schedule 40 steel pipe, while all below pipe will be schedule 40 PVC (see Figure 6-3). A 3-inch Schedule 40 PVC supply line will deliver air from the compressor to 1-inch schedule 40 PVC lines connected to the sparge wells. All supply lines will be placed at a minimum of 24 inches bgs with a ride on trencher. All underground assets will be located prior to trenching and assets potentially impacted by the trencher will be hand cleared first. After placement of the PVC pipe, the pipe will be bedded with trench spoils to approximately 12 inches bgs and an underground magnetic marking tape will be placed. The trench will then be backfilled completely and compacted with the ride-on trencher.

The 3 inch PVC pipe for compressed air to Site 4 will be placed under the abandoned portion of Runway 6 using horizontal directional drilling (HDD). The horizontal boring will be placed at a depth to ensure no impacts to the runway pavement and base layers. A 10” X 17” vault will be installed on each side of the runway (see Figure 6-5) to provide access to the connection points of the PVC line under the abandoned runway.

An electrical connection for the air sparging system currently is unavailable at Sites 4 and 9. Therefore the LIPA will install a new transformer to the southeast of Site 9 at Gabreski Airport to provide 3 phase, 480 volt electrical service. From the splice box provided by LIPA, a #4 AWG electric cable will be extended to the electrical service panel on the air sparging system (see Figure 6-6). The electric cable will be placed in a 2 inch schedule 80 PVC conduit approximately 24 inches bgs. The same procedures used for trenching and bedding of the air sparge piping will be used to trench the approximately 1200 feet from the electrical supply to the sparge system. All electrical connections will be performed by a New York licensed electrician and will conform to LIPA specifications.

After installation of the air sparging system, a chain-link fence will be installed around the sparge pad in order to permit access to authorized personnel only. The sparge pad fence details are presented in Figure 6-7.

At the completion all RA construction activities, the disturbed portions of the site will be restored to its preexisting condition and will be seeded with the appropriate vegetation. The record drawings for the RA construction will be documented in a completion report.

Operation and Maintenance (O&M)

The air sparge system must be properly maintained to provide pressurized air to the injection wells for remediation of the dissolved phase contamination. SAIC has been contracted to operate and maintain this treatment system for a period of one year.

The primary components of the system requiring inspection and maintenance include the following:

- Rotary Screw Compressor (Rietschle Thomas-DLR 400)
- Piping, fittings, and valves
- Well head vaults
- Pressure gages
- Electrical (electrical panel, transformer, connections, wiring).

The location and layout of equipment, piping, valves, connections, gages, and air sparge wells are shown on the system design drawings.

SAIC will develop site specific inspection, operation and maintenance forms for any weekly, monthly and non-routine repairs. The air compressor will require routine maintenance for proper operation. Table C1 in Appendix C summarizes the routine maintenance requirements (lubrication, cleaning, etc.) and Table C2 includes a trouble shooting guide. When conducting maintenance on the compressor, lock-out-tag-out procedures will be followed, and before conducting repairs, the temperature of the unit and associated piping will be checked to ensure the equipment has cooled sufficiently.

Each well will include a well head with pressure gage, flow control valve and other piping. The condition of the well head will be noted on a periodic inspection form, cleaned periodically, and faulty gauges replaced as needed.

Any other exposed piping, valves, etc. will be inspected for general condition and any repairs performed must be noted.

The general condition of the transformer, panel, wiring at the equipment pad and other exposed equipment will be noted on the periodic inspection form. In addition, the following will be recorded on a site-specific O&M Field Log Sheet during each inspection:

- Compressor discharge and individual sparge well pressure
- Sparge system flowrate
- Compressor runtime hours
- Oil level of the compressor
- Completed maintenance

Site 4 & 9 Performance Sampling

Eight monitoring wells (SW-5, SW-6, SW-7, SW-8, SW-9, SW-10, SDW-23, and SDW-24) will be sampled semi-annually for one year to evaluate the performance of the air sparge system. The samples will be analyzed for BTEX by U.S. Environmental Protection Agency (EPA) Method 8021 at an offsite fixed base laboratory in accordance to Section 4.0 of the QAAP. Field parameters also will be measured at the time of sampling using a flow-through cell and will include dissolved oxygen, temperature, ORP, conductivity, turbidity, and pH. The purpose of the monitoring will be to establish contaminant-concentration trends and evaluate the effectiveness and impacts of the treatment system. Additionally, monitoring wells outside the treatment areas (SW-7, SW-10, SW-8, and SDW-023) will be analyzed annually for natural attenuation parameters. The sampling results will be used to ascertain the effectiveness of MNA at reducing the contamination outside the active treatment zones.

Reporting

SAIC will prepare a Remedial Action Completion Report and Semi-Annual Monitoring Reports. The Completion Report will describe all construction activities completed, deviations from this work plan, and record drawings. The Completion Report also will include all manufacturer supplied specifications, literature and drawings for installed equipment.

The Semi-Annual Monitoring Reports will be prepared and submitted within 90 days of completion of each sampling event. The report will document all field activities carried out at the site and include field and laboratory data from the sampling events and O&M tasks. The report will also provide interpretation of the analytical results and present the associated findings and recommendations.

6.2 FIELD ACTIVITIES FOR SITE 7

Closure Sampling

The most recent 2004 groundwater sampling results from Site 7 indicate that the groundwater plume has degraded to a point where it no longer requires active remediation. Therefore, quarterly groundwater sampling will commence to demonstrate compliance for progression towards site closure in accordance with NYSDEC regulations. Six monitoring wells (MW-23, MW-24, MW-103, MW-104, MW-105, and MW-106) will be sampled quarterly for one year and analyzed for VOCs, SVOCs, and TAL Metals by EPA Methods 8260B, 8270B, and 6010B/7000, respectively, at an offsite fixed base laboratory in accordance to Section 4.0 of the QAAP. MW-24 and MW-103 could not be located during the last round of groundwater sampling at Site 7. Another attempt to locate the wells will be made and if they can not be found they will be replaced with MW-11 and MW-14. Field parameters will also be measured at the time of sampling using a flow-through cell and will include dissolved oxygen, temperature, ORP, conductivity, turbidity, and pH.

Reporting

The results of the Site 7 sampling will be included in the Semi-Annual Monitoring Reports described above for Sites 4 and 9, and will include the field and analytical data from both quarterly monitoring events.

6.3 ANALYTICAL METHODS

A full discussion of analytical methods for all groundwater samples collected is presented in the QAPP, which is located in Appendix A.

6.4 DEVIATIONS FROM THE WORK PLAN

If during the execution of the this work plan, it is identified that changes to the Work Plan are necessary to meet the objective of the project, the SAIC Project Manager will verbally contact the ANG Project Manager with the recommended changes. The recommendations will be followed up with written documentation of the required changes on an SAIC Field Change Order Form (see Figure 2 of the QAPP).

7.0 SAMPLE COLLECTION PROCEDURES

7.1 GROUNDWATER SAMPLES

Prior to sampling, water and free product (if present) levels will be gaged using an interface probe. Groundwater samples collected from monitoring wells will be accomplished by using low flow purging techniques in order to increase the degree of confidence in sample representativeness and groundwater quality results. Each monitoring well will be purged immediately prior to sample collection using either a bladder or peristaltic pump. The pump or bottom of the tubing will be positioned near the middle of the screened interval of the well to ensure that standing water is removed and fresh formation water is drawn into the well. Low flow purging techniques (flow rate of <100 ml/min) will be used in conjunction with a flow-through cell to measure the following water quality parameters: pH, specific conductivity, turbidity, dissolved oxygen, ORP, and temperature. Purging will be considered complete when the indicator parameters of pH, temperature, conductivity, and turbidity have stabilized to within the following limits:

- pH ± 0.1 pH units
- Temperature ± 1°C
- Conductivity ± 10%
- Turbidity < 10 NTUs

In the event that wells recharge extremely slowly and are unable to be micropurged, the well will be purged dry, allowed to recharge, and sampled for VOCs when a sufficient volume of water has entered the well. Groundwater for the remaining analytical parameters will be collected as sufficient water fills the well.

All groundwater samples collected from the permanent monitoring wells will be submitted to a fixed-base laboratory for the analyses specified in section 6.

A full discussion of the appropriate sample containers and preservative requirements are provided in the QAPP, which can be found in Appendix A.

7.2 FIELD QUALITY CONTROL SAMPLING

All field QC sampling procedures and methods are fully discussed in the QAPP, which is located in Appendix A.

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8.0 EQUIPMENT DECONTAMINATION PROCEDURES

To prevent contamination of samples by materials originating from on-site sampling equipment, applicable equipment will be decontaminated before sampling activities begin, between sample locations, and after sampling activities have been completed. American Society for Testing and Materials (ASTM) Type II reagent water will be used for decontamination. Sampling equipment that comes in direct contact with samples will receive additional cleaning. Decontamination procedures will consist of:

- Washing and scrubbing with laboratory-grade, nonphosphate detergent
- Rinsing with tap water; and
- Rinsing with ASTM Type II reagent-grade water

Decontamination of drilling equipment (DPT rods) will be performed prior to use and at the end of each day. Equipment will be moved to a site-specific decontamination area where the equipment will be thoroughly steam-cleaned or hand washed. A decontamination pad will be constructed to catch the water from any steam-cleaning operations. The pad will consist of a plastic liner approximately 40 by 40 feet and sloped to the center so that the water will accumulate to be pumped into the proper containers for disposal. Water from decontamination activities will be handled as investigation-derived waste (IDW) as outlined in Chapter 9.0.

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9.0 INVESTIGATION-DERIVED WASTES

During the RA, a certain amount of waste material (decontamination fluids and purge water) will be produced as a result of decontamination and sampling activities. SAIC will be responsible for sampling, characterizing, containing, and labeling all liquid wastes generated during this project. Soil wastes will be spread at the site of generation without sampling. Decontamination and purge waters will be contained in U.S. Department of Transportation-approved 55-gal steel drums. The fluids will be sampled and analyzed for VOCs, SVOCs, and metals. All liquid remediation waste generated will be containerized and staged at a central location on Base designated by the Environmental Manager (EM). All such wastes will be handled and disposed of by SAIC (manifests for offsite disposal will be signed by Base EM) in accordance with local, state, and federal regulations.

All IDW containers will be properly marked to indicate their contents, collection date, contractor's name and phone number, and container identification number at the time of initial use. The Base EM will be responsible for signing all manifests and ensuring proper disposal of contaminated wastes.

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10.0 REFERENCES

ANG (Air National Guard) 2005. Final Air National Guard Environmental Restoration Program Investigation Guidance, July.

PEER (PEER Consultants, P.C.) 2004. *Final Remedial Investigation Report for Sites 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, and 12,* June.

SAIC (Science Applications International Corporation) 2006. *Draft Final Proposed Remedial Action Plan for the Installation Restoration Program Sites 4, 7, and 9. 106th Rescue Wing New York Air National Guard, Francis S. Gabreski Airport, Westhampton Beach, New York*, September.

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FIGURES

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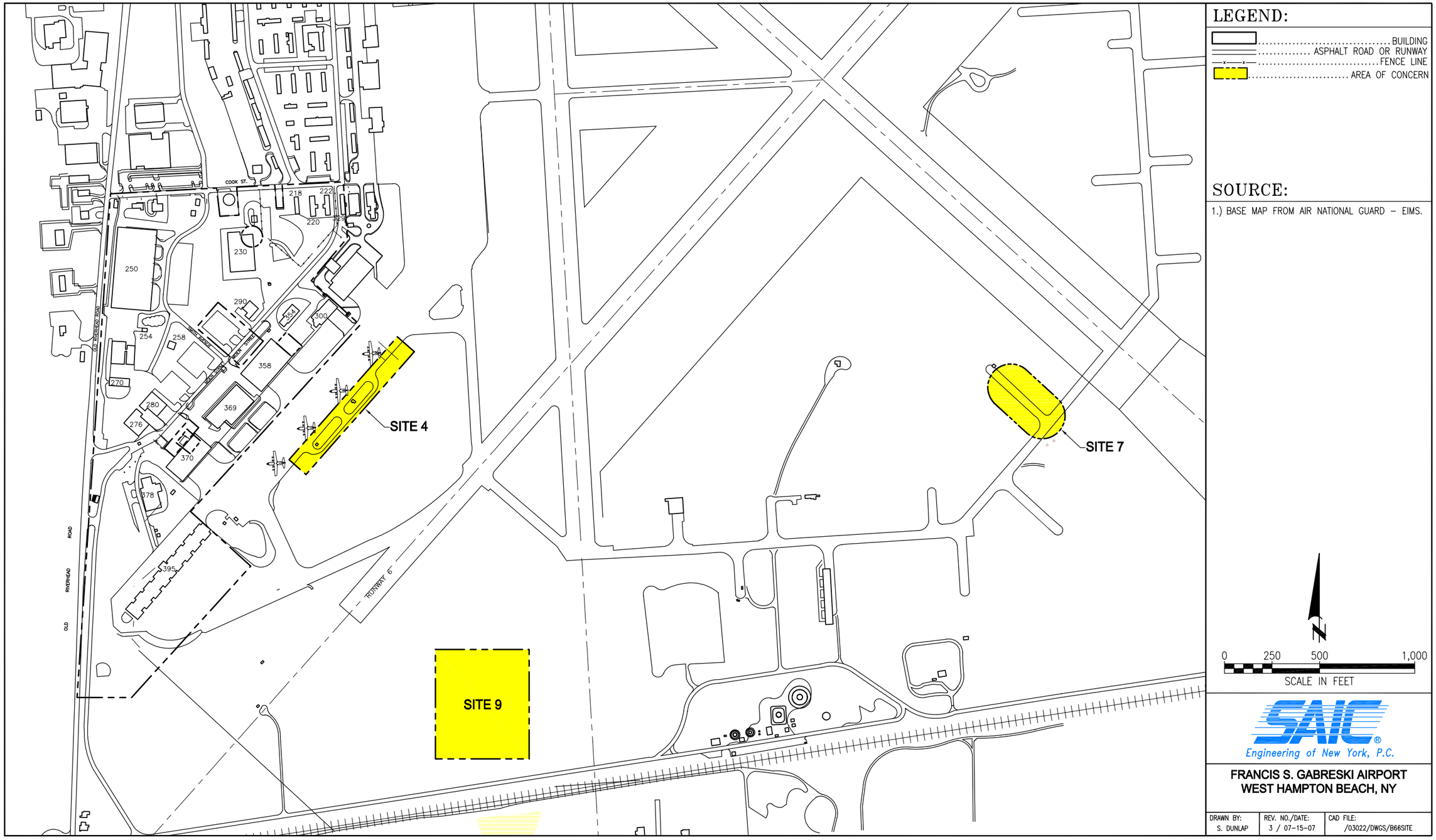


Fig. 1-1. IRP Sites 4, 7, and 9 at the 106th Rescue Wing, New York Air National Guard

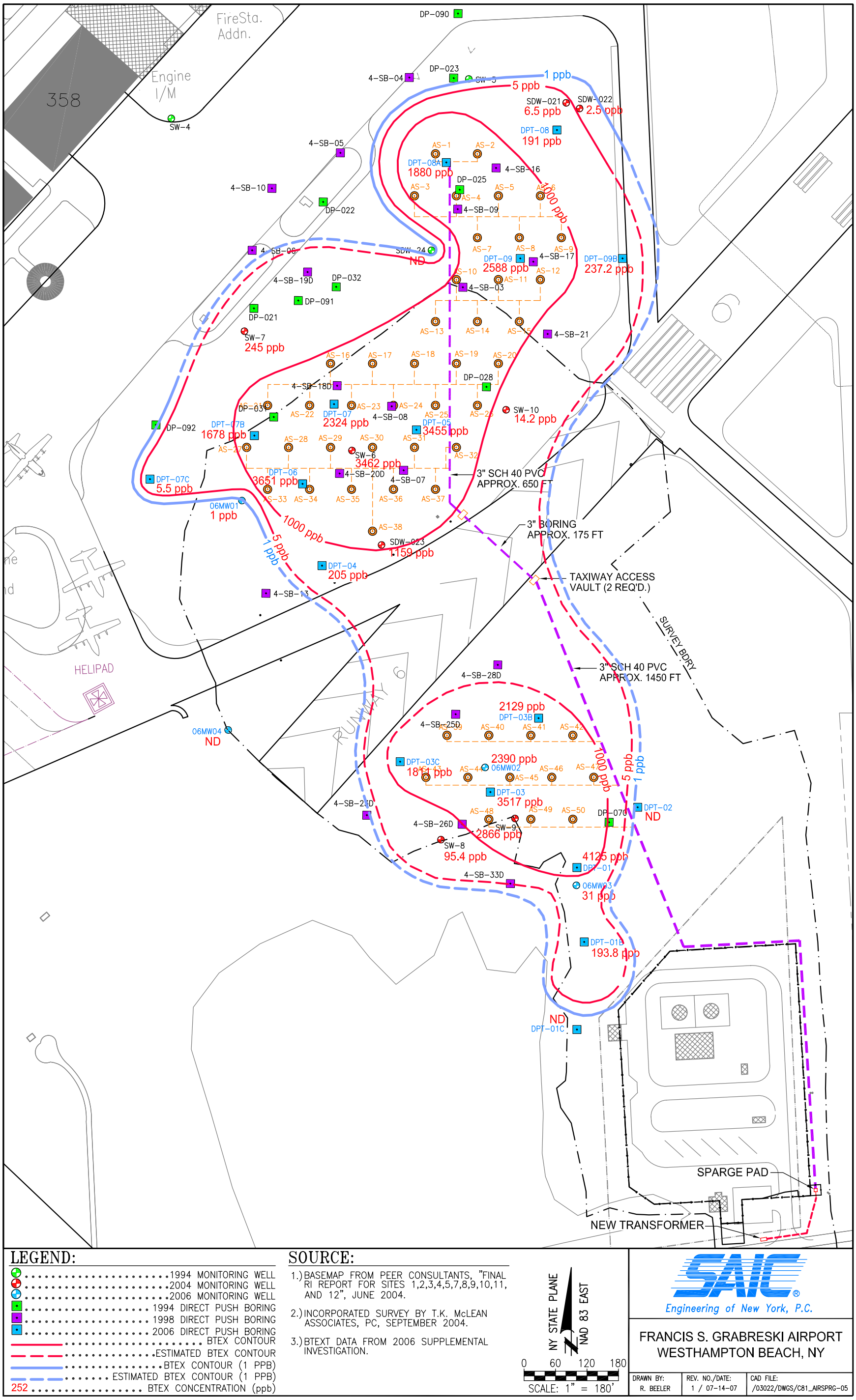


Fig. 6-1. Air Sparge Layout

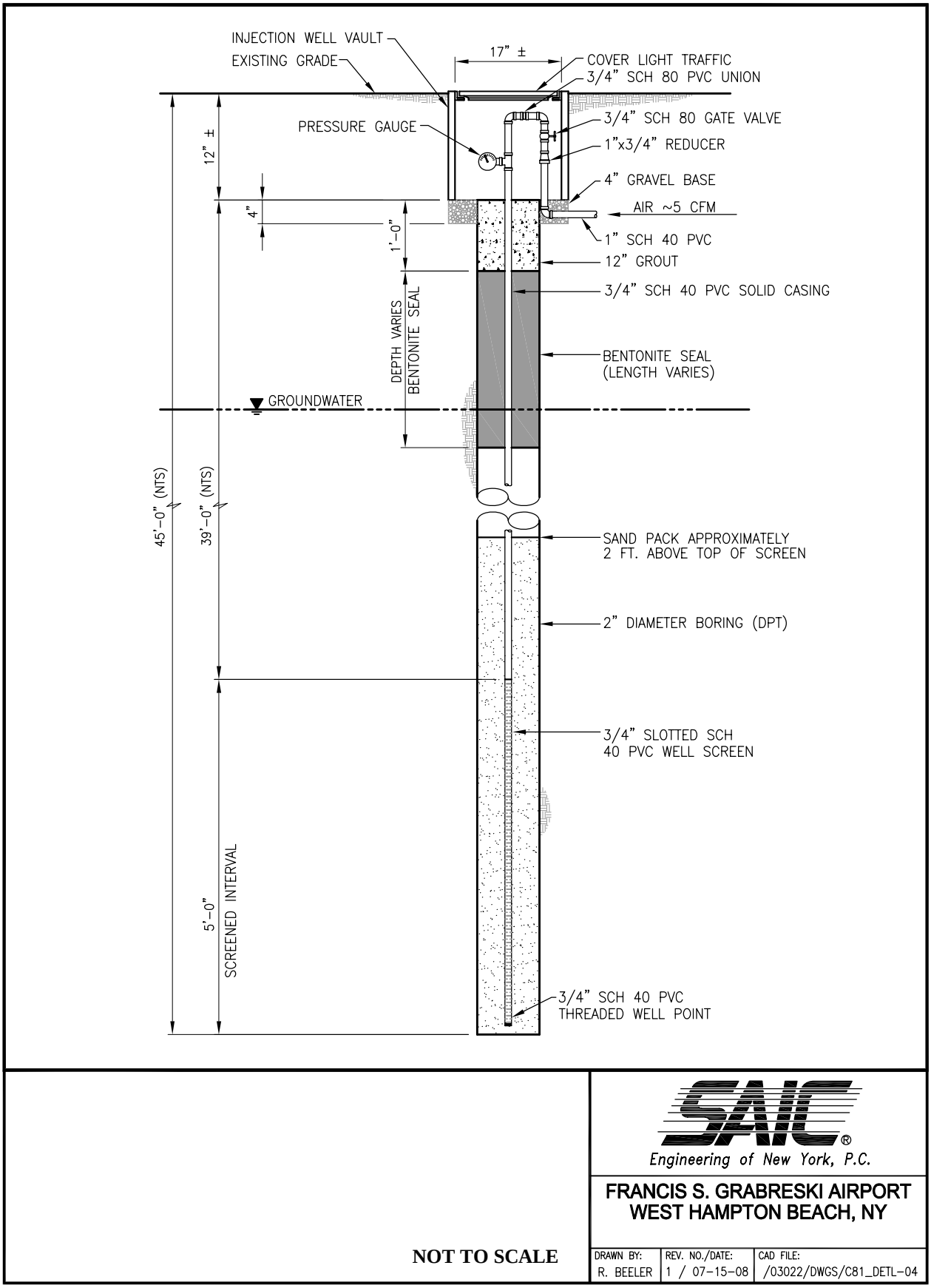


Fig. 6-2. Sparge Point Detail

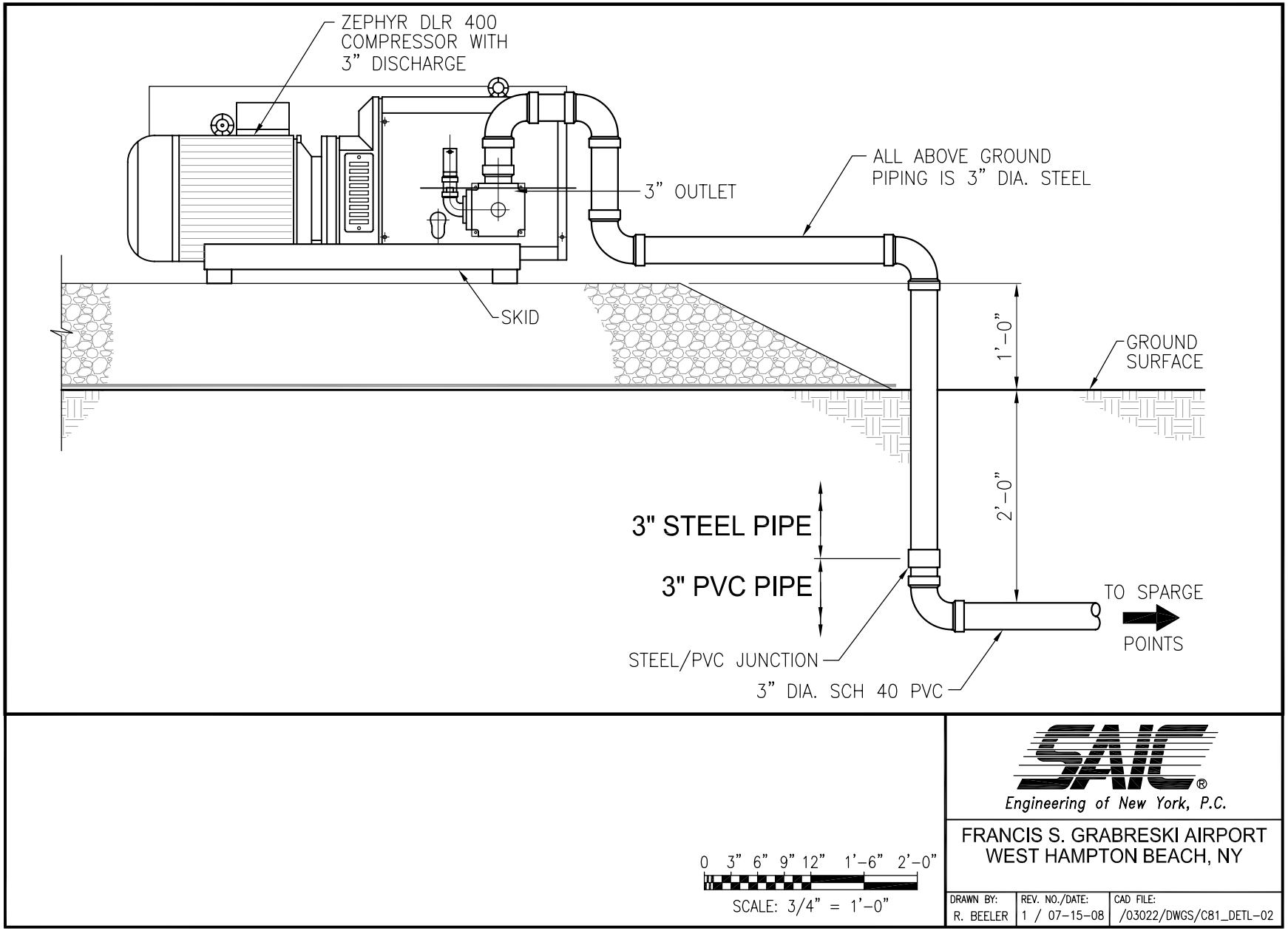
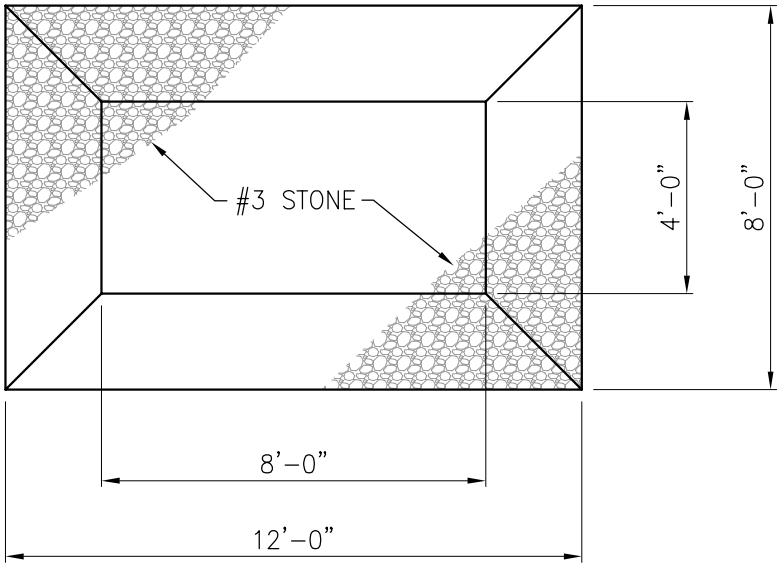
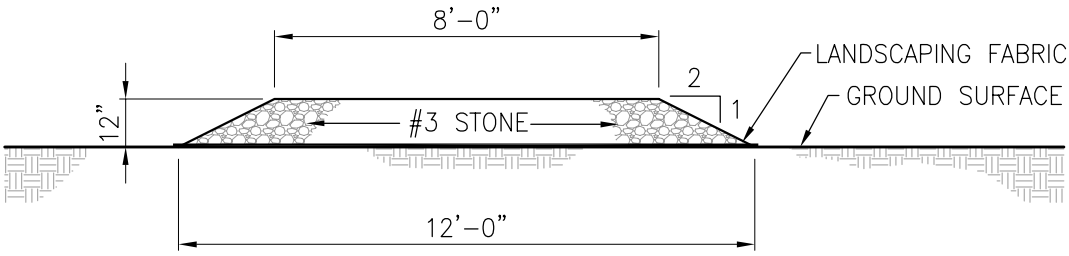


Fig. 6-3. Above Ground/Below Ground Connection Detail



PLAN



SECTION

0 1 2 3 4 6 8

SCALE: 1/4" = 1'

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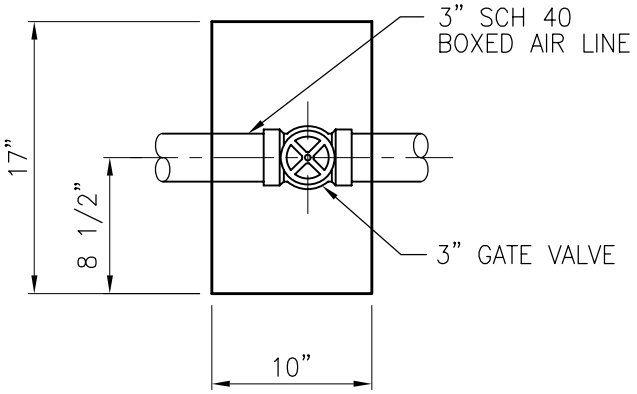
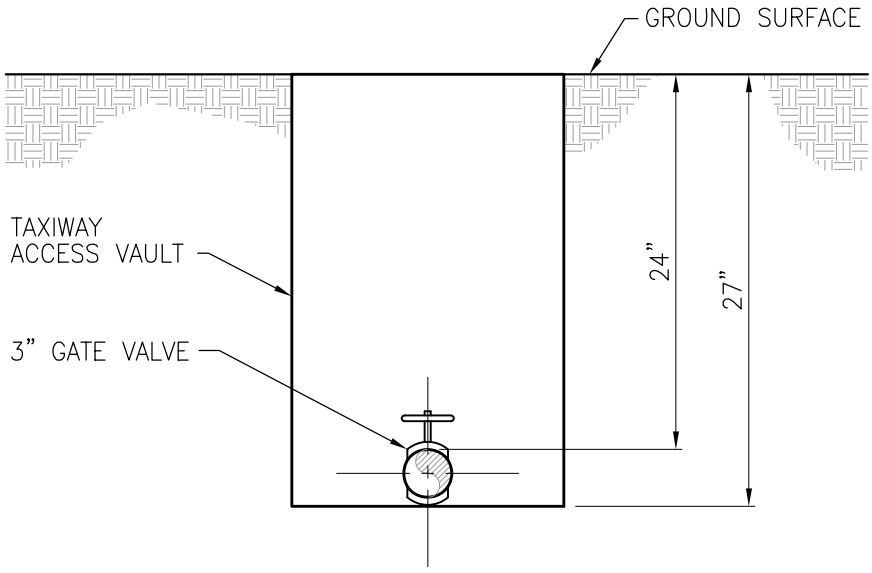
Fig. 6-4. Sparge Pad Detail



PLAN



SECTION

0 3" 6" 9" 12" 1'-6" 2'-0"

SCALE: 3/4" = 1'-0"

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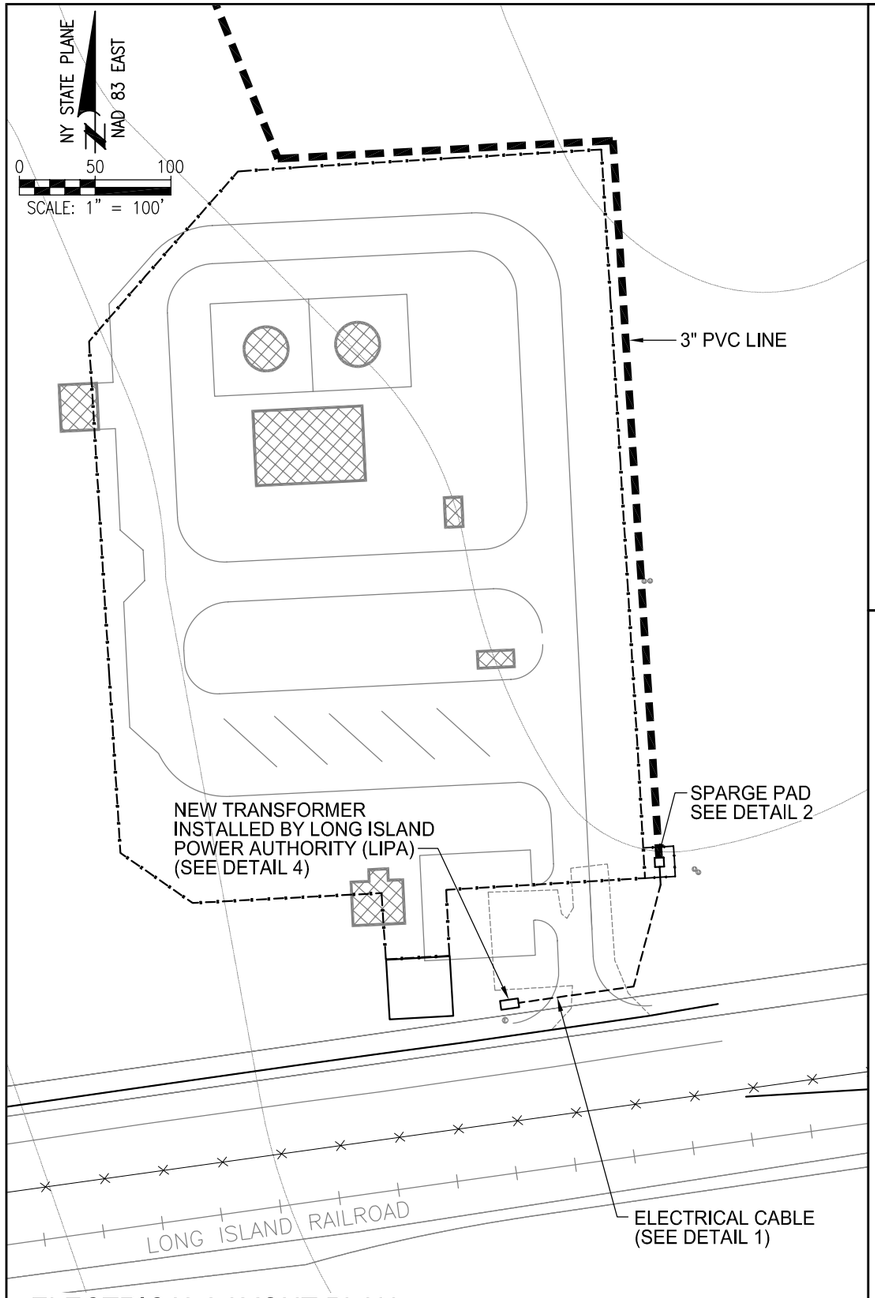
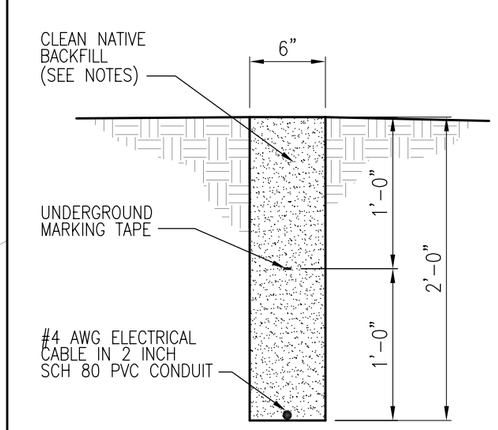
Fig. 6-5. Taxiway Access Vault Detail



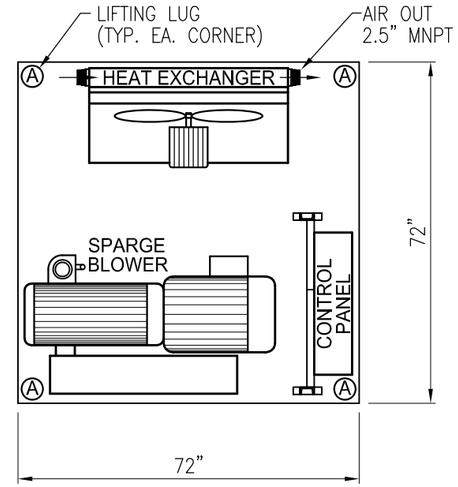
ELECTRICAL LAYOUT PLAN

SCALE: 1" = 100'



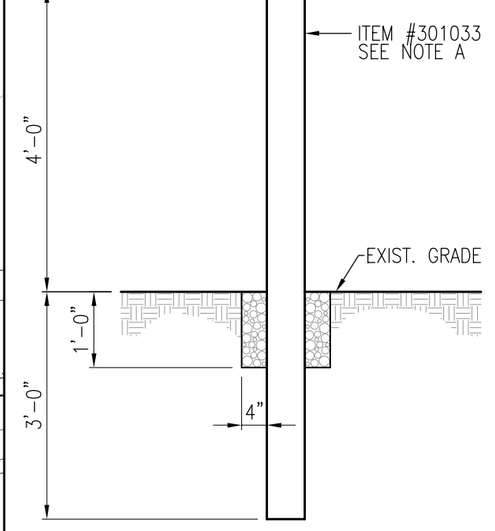
1 - ELECTRICAL TRENCH DETAIL

SCALE: 1"=1'



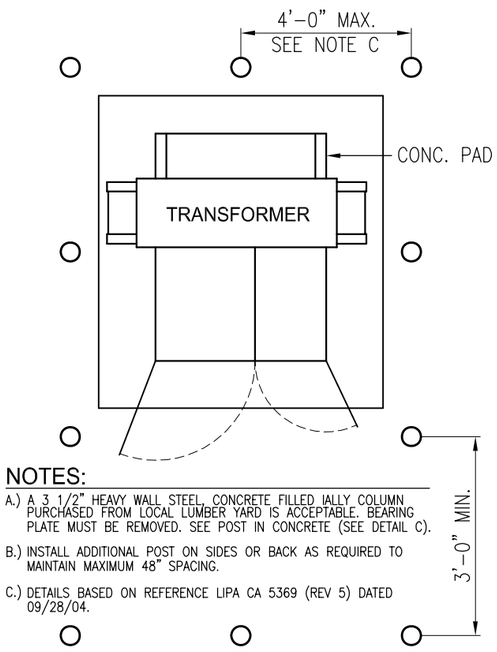
2 - SPARGE PAD DETAIL

SCALE: 3/8"=1'



3 - BOLLARD DETAIL

SCALE: 1/2"=1'



NOTES:

A.) A 3 1/2" HEAVY WALL STEEL, CONCRETE FILLED IALLY COLUMN PURCHASED FROM LOCAL LUMBER YARD IS ACCEPTABLE. BEARING PLATE MUST BE REMOVED. SEE POST IN CONCRETE (SEE DETAIL C).

B.) INSTALL ADDITIONAL POST ON SIDES OR BACK AS REQUIRED TO MAINTAIN MAXIMUM 48" SPACING.

C.) DETAILS BASED ON REFERENCE LIPA CA 5369 (REV 5) DATED 09/28/04.

4 - TRANSFORMER PAD DETAIL

SCALE: 3/8"=1'

LEGEND:

BUILDING

#4 AWG ELECTRICAL CABLE

NOTES:

1.) EXCAVATE UTILIZING RIDE-ON TRENCHER.

2.) BACKFILL COMPACTED WITH RIDE-ON TRENCHER.

3.) ALL ELECTRICAL WORK SHALL CONFORM TO LIPA SPECIFICATIONS.

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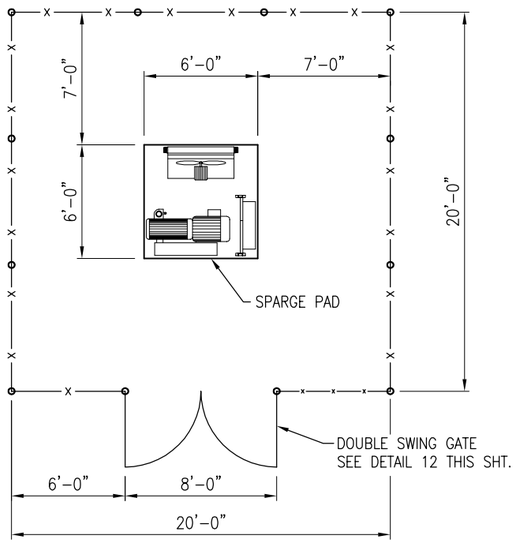
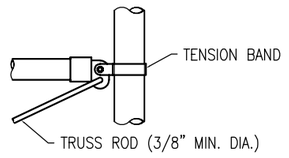
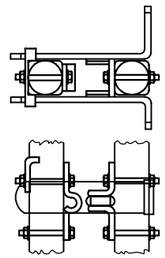
Fig. 6-6. Electrical Layout and Details.



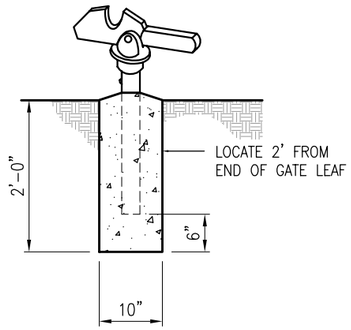
5 - SPARGE PAD FENCE DETAIL
SCALE: 1/8" = 1'-0"



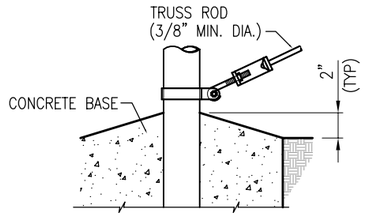
6 - BRACE RAIL CLAMP DETAIL
NOT TO SCALE



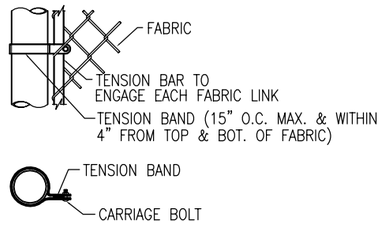
7 - LATCH ASSEMBLY DETAIL
NOT TO SCALE



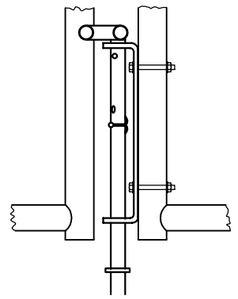
8 - GATE KEEPER DETAIL
NOT TO SCALE



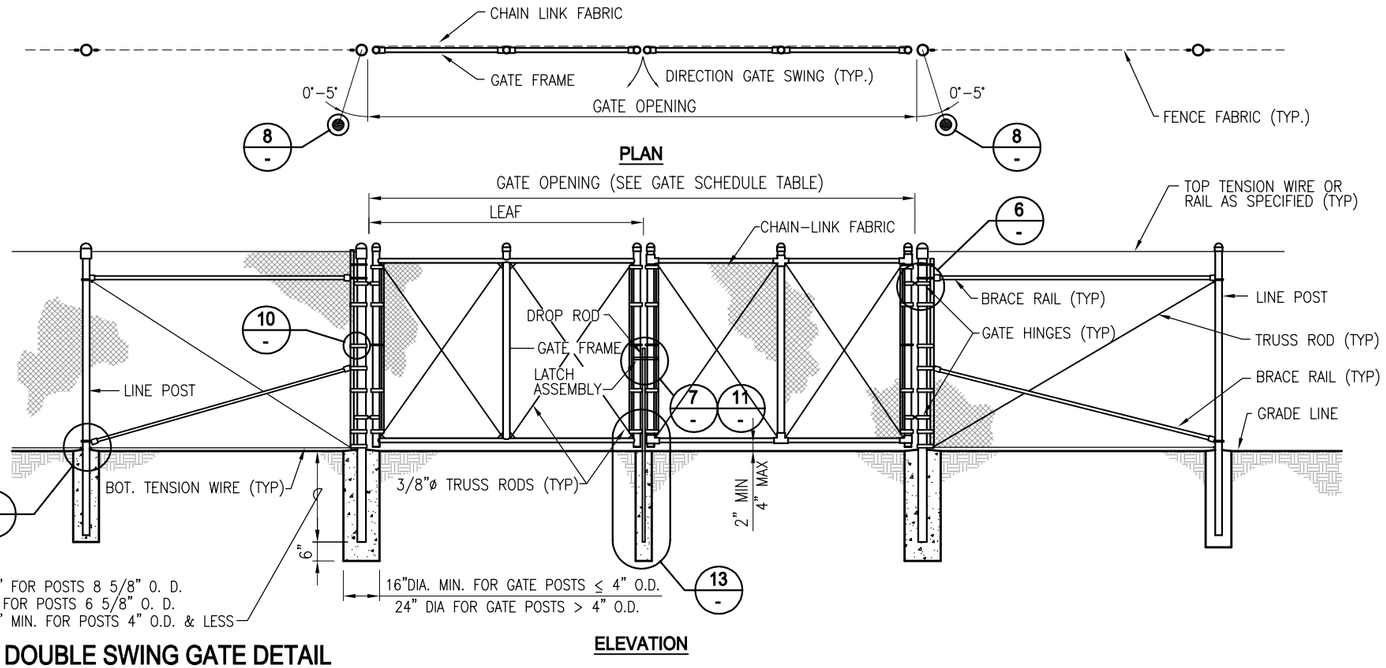
9 - TRUSS ROD/BAND DETAIL
NOT TO SCALE



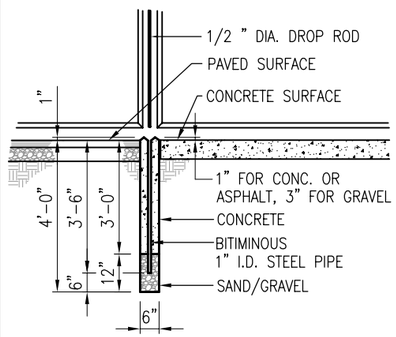
10 - END FASTENING DETAIL
NOT TO SCALE



11 - DROP ROD DETAIL
NOT TO SCALE



12 - DOUBLE SWING GATE DETAIL
SCALE: 1/4" = 1'-0"



13 - DROP ROD FOUNDATION
NOT TO SCALE

NOTES:

1.) THE FENCE WILL CONSIST OF 72" WIRE FABRIC.

2.) WIRE TIES, RAILS, POST AND BRACES SHALL BE CONSTRUCTED ON THE SECURE SIDE OF THE FENCE ALIGNMENT. CHAIN-LINK FABRIC SHALL BE PLACED ON THE OPPOSITE SIDE OF THE SECURE AREA.

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Fig. 6-7. Fence Details

APPENDIX A – QUALITY ASSURANCE PROJECT PLAN

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FINAL
QUALITY ASSURANCE PROJECT PLAN FOR THE ENVIRONMENTAL RESTORATION PROGRAM SERVICES WORK PLAN FOR GROUNDWATER SAMPLING AND MONITORING WELL INSTALLATION FOR INSTALLATION RESTORATION PROGRAM SITES 4, 7, AND 9 AT NEW YORK AIR NATIONAL GUARD (106TH RESCUE WING) GABRESKI INTERNATIONAL AIRPORT WESTHAMPTON BEACH, NEW YORK

July 2008

Contract No. DAHA90-01-D-0008
Delivery Order 27

Prepared for
ANG/CEVR
New York Air National Guard,
West Hamptonbeach, New York

Prepared by
Science Applications International Corporation
Oak Ridge, Tennessee

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CONTENTS

FIGURES

TABLES

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ACRONYMS

ANG	Air National Guard
ANG/CEVR	Air National Guard Environmental Restoration Branch
CLP	Contract Laboratory Program
COC	chain-of-custody
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
EPH	extractable petroleum hydrocarbon
ERP	Environmental Restoration Program
FOM	Field Operations Manager
FCO	Field Change Order
FCR	Field Change Request
FSP	field sampling plan
GC	gas chromatograph
HSP	health and safety plan
IRP	Installation Restoration Program
MS	matrix spike
MSD	matrix spike duplicate
NIST	National Institute of Standards and Testing
NYANG	New York Air National Guard
OVA	organic vapor analyzer
PARCCS	precision accuracy, representativeness, comparability, completeness, and sensitivity
PID	photoionization detector
PgM	program manager
PM	project manager
QA	quality assurance
QC	quality control
QAPP	quality assurance project plan
RAC	Remedial Action Construction
RPD	relative percent difference
SAIC	Science Applications International Corporation
SVOC	semivolatile organic compound
TPH	total petroleum hydrocarbon
VOC	volatile organic compound
WP	Work Plan

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1.0 PROJECT DESCRIPTION

The sampling activities associated with the remedial action construction (RAC) are to perform five rounds of groundwater sampling at three Installation Restoration Program (IRP) sites (i.e., Site 4 – Aircraft Refueling Apron Ditch, Site 7 – Former Fire Training Area, and Site 9 – Ramp Drainage Outfall).

Development of the RAC Work Plan (WP) will provide an overall technical strategy and approach to the sites requiring investigation based on the project closeout activities. The WP also summarizes the potential federal and state applicable or relevant and appropriate requirements, including state policy and procedures, the rationale for all field and analytical work, and the approach for acquiring field data. The RAC WP includes a field sampling plan (FSP), quality assurance project plan (QAPP), and health and safety plan (HSP). As part of the RAC WP, this QAPP provides information regarding data collection and quality assurance (QA) activities and procedures to ensure valid data are collected during the RAC.

This site-specific QAPP presents the overall policies, data quality objectives (DQOs), and specific QA and quality control (QC) requirements that will be employed during the field effort for RAC at the 106th Rescue Wing, West Hamptonbeach, New York. The QAPP establishes guidelines for field sampling, documentation, laboratory analysis, QA/QC procedures, and reporting requirements that will result in data of known quality. Qualitative and quantitative goals for precision, accuracy, representativeness, comparability, completeness, and sensitivity (PARCCS) are defined in the QAPP to ensure that the data will meet the needs of the end user.

The specific objectives of the field effort include the following:

- initiate a remedial action to treat volatile organic compound (VOC) contamination in the groundwater,
- perform five rounds of groundwater sampling, and
- operate and maintain the remedial actions for a period of 1 year and determine the system effectiveness.

Data collected to meet the above objectives will be analyzed at a fixed-base analytical laboratory for definitive data.

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2.0 ORGANIZATION AND RESPONSIBILITIES

2.1 ORGANIZATION

The contractor will conduct an RAC at the sites to remediate contamination at IRP Sites 4, 7, and 9. This work will be performed under the direction of the Air National Guard (ANG). Air National Guard Environmental Restoration Branch (ANG/CEVR) manages the Environmental Restoration Program (ERP) and related activities.

2.2 AUTHORITY AND RESPONSIBILITY

2.2.1 Air National Guard

The ANG/CEVR ERP Coordinator is responsible for the implementation of the ERP and related activities at the installation, including technical and contractual direction of activities performed at the site.

2.2.2 Science Applications International Corporation

Science Applications International Corporation (SAIC) is responsible for all activities involved in conducting the RAC. SAIC is responsible for day-to-day execution of the project, programmatic decisions, meeting milestones, and transmitting deliverables. The project team will include the following key personnel.

- *The Program Manager* (PgM) will be responsible for the overall execution of this project, for contract negotiation or modification, for organizational coordination, and for maintaining an open line of communication with the New York ANG (NYANG) project manager (PM).

- *The Project Manager* will directly supervise the project team, direct field operations, and coordinate contractor and subcontractor support. The PM will be the technical interface between NYANG and the project team.

- *The Field Operations Manager* (FOM) is responsible for direct supervision of all field operations including planning, conducting, and overseeing all field personnel, including subcontractors.

- *The Manager of QA/QC* will be responsible for ensuring that effective procedures and controls are implemented to achieve a high level of project accuracy. Details of the QA/QC Manager's duties are provided in other sections of this QAPP.

- *The Health and Safety Manager* will be responsible for assuring that threats from physical and chemical hazards are mitigated through effective execution of the HSP.

- *The Analytical Services Manager* is responsible for all subcontracted laboratory and data validation performance including data management; reviewing analytical data from field and fixed-base laboratories; and determining compliance with appropriate analytical QA/QC requirements, DQOs, and turn around-time requirements; and data verification. The data verification and validation process is performed independently of the laboratory program to assist in determining whether the data meet the DQOs.

- *The Site Geologist* will be an experienced geologist present at each operating rig. The site geologist is responsible for logging samples, monitoring drilling operations, recording soil and groundwater data, monitoring and recording the well installation procedures of that rig, and preparing the boring logs and well diagrams. Each geologist will have sufficient tools and professional equipment on-site and in operable condition to efficiently perform his/her duties.

2.2.3 Subcontractor Requirements

SAIC is responsible for the cost, schedule, and quality of all work performed under this contract delivery order, including the work of subcontractors. SAIC will hire subcontractors to provide services in any area where support to contractor efforts is required. SAIC's PM will maintain oversight of the subcontractors' completion of specific tasks with respect to technical performance, quality, and adherence to cost and schedule. All subcontractor activity will adhere to applicable site procedures, policies, and the project QAPP. This requirement will be included in all contracts between the contractor and subcontractor. Failure of a subcontractor to comply with requirements of the QAPP, or other contractual requirements, may be viewed as a breach of contract and grounds for contract termination. The fixed-base analytical laboratory selected for this project is Chemtech Environmental Laboratories.

Procurement of laboratory subcontractors for analyzing environment samples shall be strictly controlled. Only fixed-based laboratories approved by the state of New York, which have a demonstrated capability to provide the level of data quality required for this project, will be employed.

Elements of analytical services procurement criteria for the fixed-based laboratory include the following.

- Demonstrated ability to perform the analyses required at a specific capacity.
- Ability to handle the types of material to be analyzed, including all applicable licenses and permits.
- Demonstrated ability to perform the types of analysis and QC required.
- Demonstrated ability to produce documentation and deliverables required for this project, including analytical results, and electronic data.
- Capability and availability of laboratory equipment and personnel.

3.0 DATA QUALITY OBJECTIVES

DQOs are quantitative and qualitative statements specified to ensure that data of known and appropriate quality are obtained during the RAC activities. To ensure that data generated during field activities are adequate to support decisions regarding the objectives and the method by which decisions will be made, DQOs must be established in the project planning process. DQOs are based on the specific use of the data collected. Data obtained during this RAC will provide the basis for decisions on future actions at the site and to ensure sites are within compliance standards. Specifically, the data collected during this investigation will be used to

- Characterize sources of contamination and pathways.
- Determine the nature and extent of contamination.
- Make recommendations for additional investigation or decision documents.

The quantitative measurements that estimate the true value or actual concentration of a physical property always involve some level of uncertainty. The uncertainty associated with a sample generally results from: (1) natural variability (heterogeneity) of the sample, (2) sample handling operations and conditions, (3) spatial and temporal patterns, and (4) analytical variability. These uncertainties must be estimated in order to obtain reliable data and to make appropriate decisions about remediation alternatives. If the level of uncertainty can be quantified, then it can be compared to standard quantitative indicators, the DQOs, for data quality. By quantifying the level of uncertainty, a decision maker will be able to use the results derived from the data collected.

3.1 QUALITY MANAGEMENT

SAIC has overall responsibility for QA activities during this project. The QA/QC Manager or a designee will be responsible for ensuring all QC procedures are followed. The QA/QC Manager or their designee will be responsible for conducting audits to verify that the QA Program is implemented in compliance with project-specific requirements and U.S. Environmental Protection Agency (EPA) regulations. Immediate corrective actions will be taken at any time it is deemed necessary, and verification of corrective actions shall be provided. All QC procedures will be performed in accordance with this QAPP.

3.2 DATA QUALITY OBJECTIVE LEVELS

DQOs are divided into two data quality levels. These levels express the uncertainty level a decision maker is willing to accept when considering analytical data results derived from environmental investigation activities. They are a management tool used to decrease the probability of data leading to an incorrect conclusion.

Fixed-base laboratory data for this RAC will encompass all QC elements required for definitive level data with summary form deliverables.

3.2.1 Screening Level Data

Screening level data are generated by rapid, less precise methods of analysis with less rigorous sample preparation. Sample preparation steps may be restricted to simple procedures such as dilution with a solvent, instead of elaborate extraction/digestion and cleanup or direct matrix introduction. Screening data

provide analyte identification and potentially supply limited quantitation, although the quantitation may be relatively imprecise.

This level is characterized by the use of hand-held instruments that may identify the presence of a class of compounds, without actually identifying or quantifying a specific compound. This level of data may be used for (1) delineation of contaminated zones, (2) gross determination of analytes in samples, or (3) health and safety screening.

Field-grade analytical instruments that allow identification of compounds and, in some instances, quantification with moderate accuracy and precision limits are also considered to produce field screening data. Normally, field-grade analytical instruments are used in a mobile or temporary laboratory on-site.

Screening level data for the field effort at NYANG will be required for field measurement data. Field measurement data are specified for the following activities:

- Health and Safety Monitoring – Health and safety monitoring will be performed with portable hand-held instruments or calorimetric response levels. The intended use of the data is to identify the presence or absence of contaminants during site activities. Since extensive QC is not required for health and safety monitoring, definitive confirmation is not required.

- Field Measurements – Routine field measurements, such as water level measurements, pH, and conductivity measurements may also provide input for site characterization. Definitive confirmation is not required because the intended use of data is primarily for monitoring site conditions.

- Field Screening – Field screening of soil and groundwater samples using a photoionization detector (PID) or an organic vapor analyzer (OVA) provides preliminary qualitative data and helps prioritize samples for further analysis or disposal. These data are for semi-quantitative screening purposes only and will not require definitive confirmation.

3.2.2 Definitive Level Data

Definitive data are generated using rigorous analytical methods, such as approved EPA reference methods. Data are analyte-specific, with confirmation of analyte identity and concentrations. Methods produce tangible raw data (e.g., chromatograms, spectra, digital values) in the form of paper printouts or computer-generated electronic files. Data may be generated at the site or at an off-site location, as long as the QA/QC requirements are satisfied.

This level is characterized by fixed-base laboratory analysis or sample analysis at sophisticated mobile laboratories. Analytical protocols provide data at lower detection limits, information on a wide range of calibrated analytes, matrix recovery information, laboratory process control information, and produce analytical data at known levels of precision and accuracy. EPA accepted methods, such as those in Solid Waste Method 846 (SW-846) (EPA 1998), the National Pollution Discharge Elimination System, and Contract Laboratory Program (CLP) are utilized for definitive data.

4.0 QUALITY CONTROL FOR SAMPLE COLLECTION AND ANALYSIS

The overall QC objective is to develop and implement procedures that will ensure sufficient quality in field sample collection, field gas chromatographs (GCs) analysis, fixed-base laboratory analysis, and reporting that will meet the needs of end users of the data. Documentation requirements, including field logbooks, chain-of-custody (COC) forms, and Field Change Order (FCO) requests are located in other sections of the QAPP. This chapter presents overall analytical QC from the time of collection through analysis. DQOs expressed and PARCCS objectives of the analytical data are discussed in Chapter 5.0.

4.1 SAMPLE COLLECTION

Procedures for collecting soil and groundwater samples will follow the WP and will conform to the *Final Air National Guard Installation Restoration Program Investigation Protocol (ANG 1998)* and EPA protocols. The FOM is responsible for ensuring that samples are collected using properly decontaminated equipment and contained in properly cleaned sample containers. The steps required for sample control and identification, data recording, and COC documentation are discussed in Chapter 6.0 of this QAPP.

Prior to beginning each type of sampling event, the FOM will meet with the assigned sampling personnel and review the purpose and objectives of the event. This meeting will provide final clarification of the sampling event details. Topics of review and discussion will include items such as sampling locations, types of samples to be collected, number of samples to be collected, sample numbering, parameter(s) to be analyzed, sampling procedures, equipment decontamination procedures, and COC requirements.

Equipment decontamination is an integral part of the data collection and QA process. The implementation of proper decontamination practices and procedures will begin in the field prior to the use of sample collection equipment. All field sampling equipment will be decontaminated before use and after each sample location.

4.2 FIELD QUALITY CONTROL SAMPLES

Field duplicate samples, field blanks, equipment rinsates, and trip blanks will be submitted to the analytical laboratories to provide the means to assess the quality of the data resulting from the field sampling program. Field and trip blank samples will be analyzed to check for procedural contamination and ambient conditions at the site that may have caused sample contamination. Duplicate samples will be submitted under a non-indicative sample identification to provide a QA check on analytical procedures and results. The QC samples and associated frequencies for this project are described below.

- **Trip Blanks** – Trip blanks are used to detect contamination by VOCs during shipping and handling. Trip blanks are 40-mL vials of analyte-free water and are preserved with hydrochloric acid (HCL) to a pH of ≤2. The laboratory performing the analysis will supply trip blanks. Trip blanks must have zero headspace and should not be opened in the field. One trip blank set will be placed in each cooler containing samples for VOC analysis and be submitted to the fixed-base laboratory. The number of 40-mL vials comprising a trip blank is laboratory dependent. The number of vials required will be specified by the selected fixed-base laboratory. Trip blanks will be analyzed for the definitive dataset and not as screening data.

- **Field Blanks** – Field blanks are QA/QC samples intended to determine if any of the water used during the field investigation contains detectable concentrations of any organic or inorganic analytes

that may impact the quality of the samples. Field blanks are samples of the source of water used for decontamination and steam cleaning. At a minimum, one sample for each source of water will be collected. Field blanks will be analyzed for the same parameters as the original samples of interest by the fixed-base laboratory. Field blanks will be collected and analyzed at a frequency of one per mobilization per source. American Society for Testing and Materials Type II water used for final rinsing, and the tap water used for initial cleaning, are sources of water that are commonly sampled.

- **Equipment Blanks** – Equipment blanks are used as a measure of the effectiveness of the decontamination process. Equipment blanks are samples of the final analyte-free water rinse from equipment cleaning and are submitted to the fixed-base laboratory for analysis. The equipment blanks will be analyzed for the same analytes as the primary samples that are collected. Samples will be collected for every major type or piece of sampling equipment at a frequency of 1 for every 10 investigative samples collected per sample matrix per site for fixed-base laboratory analysis.

- **Field Duplicates** – Field duplicates are used to assess the precision of sampling techniques and to provide checks on laboratory and field procedures. Field duplicates will be collected at a 10% frequency for fixed-base confirmation analysis of all samples.

- **Matrix Spike/Matrix Spike Duplicate (MS/MSD)** – MS and MSD samples are samples from a specific media that have been spiked at the laboratory with known quantities of analytes. MS and MSDs are used to determine the accuracy and precision of the laboratory analyses as well as matrix interferences. Data from MS and MSD sample recovery supply percentage recovery information so the laboratory can evaluate its measurement accuracy and precision. MS and MSD samples are equal portions of a single initial sample that have been spiked with specific analytes in known quantities and must meet certain laboratory requirements to be acceptable. The total number of MS/MSD samples will be at a frequency of 1 per 20 samples collected per sample matrix or every 14 days, whichever is more frequent, for fixed-base laboratory analysis. Field GC analysis will require one MS/MSD per matrix at the beginning of the project.

4.3 ANALYTICAL PARAMETERS

Analysis of soil and groundwater samples, taken in accordance with the FSP for the site, will be performed in accordance with analytical procedures that conform to EPA guidelines published in the *Test Methods of Evaluating Solid Waste, Physical/Chemical Methods-SW-846)(*EPA 1998*)*. Analytical results will be reported using CLP-type documentation. The analyte list will consist of VOCs, semivolatile organic compounds (SVOCs), and total petroleum hydrocarbons (TPHs). CLP-type summary forms without raw data will be required to meet fixed-base laboratory analytical data quality levels required for the RAC. Analytical QA/QC requirements are discussed in Chapter 5.0 of this QAPP.

4.3.1 Fixed-Base Laboratory

All fixed-base laboratory analysis will require 30-day turn-around for data package deliverables. Fixed-base laboratory analysis of water samples for VOCs will be analyzed using SW-846 Method 8260B with purge and trap sample preparation Method 5030. Soil samples for VOCs will be analyzed using SW-846 Method 8260B with sample preparation Method 5035. Water and soil samples for SVOC analysis at the fixed-base laboratory will be analyzed using SW-846 Method 8270C with sample preparation for water samples by preparation Method 3510, separatory funnel extraction, or Method 3520, liquid-liquid extraction. Soil sample preparations will be extracted utilizing Method 3550, sonication. No tentatively identified compounds will be reported for any GC/mass spectroscopy method. TPH will be analyzed using SW-846 modified Method 8015. Extraction preparation methods of soil and water samples

will be required. Soils will be extracted for extractable petroleum hydrocarbons (EPHs) using Method 3550, sonication. Waters will be extracted for EPH using Method 3510 or Method 3520.

All soil samples for the RAC will be reported on a dry weight basis. Tables 4-1 and 4-2 list soil quantitation limits on a wet weight basis. Actual quantitation limits will be higher for environmental soil/sediment samples based on the moisture content for each sample.

4.4 SAMPLE PRESERVATION AND HOLDING TIMES

Sample containers and preservatives used to maintain samples designated for chemical analysis will be provided by the laboratory performing the analysis. The preferred container types will be I Chem Series 300 bottles or equivalent. The bottles must be pre-cleaned and traceable to the laboratory that performed the cleaning. The lot number of the containers and reagents used for preservatives must be traceable to the laboratory (or supplier) that performed the initial assay. Certificates of cleanliness must be provided by the laboratory (or supplier) and kept in the project file.

All samples for chemical analysis will be placed on ice as soon as possible following collection. All samples will be chilled to 4 ± 2°C and maintained at that temperature through transport and subsequent storage at the analytical laboratory. Holding times, sample volumes, and preservative requirements for fixed-base and field laboratories are shown in Table 4-3. Samples analyzed by the field GC will not require acid preservation but will be maintained at 4 ± 2°C.

Table 4-1. Practical Quantitation Limits for Volatile Organic Compounds in Soil and Water Using SW-846 GC/MS Method 8260B

Volatiles	CAS Number	Practical Quantitation Limits	
		Water (µg/L)	Soil (µg/kg)
Chloromethane	74-87-3	1	10
Bromomethane	74-83-9	1	10
Vinyl Chloride	75-01-4	1	10
Chloroethane	75-00-3	1	10
Methylene Chloride	75-09-2	2	10
Acetone	67-64-01	5	10
Carbon Disulfide	75-15-0	1	10
1,1-Dichloroethane	75-35-3	1	10
1,1-Dichloroethane	156-59-4	1	10
trans-1,2-Dichloroethane	156-60-5	1	10
Chloroform	67-66-3	1	10
1,2-Dichloroethane	107-06-2	1	10
2-Butanone	78-93-3	5	10
1,1,1-Trichloroethane	71-55-6	1	10
Carbon Tetrachloride	56-23-5	1	10
Bromodichloromethane	75-27-4	1	10
1,2-Dichloropropane	78-87-5	1	10
cis-1,3-Dichloropropene	10061-01-5	1	10
Trichloroethene	79-01-6	1	10
Dibromochloromethane	124-48-1	1	10
1,1,2-Trichloroethane	79-00-5	1	10
Benzene	71-43-2	1	10
trans-1,3-Dichloropropene	10061-02-6	1	10
Bromoform	75-25-2	1	10
4-Methyl-2-pentanone	108-01-1	5	10
2-Hexanone	591-78-6	5	10
Tetrachloroethene	127-18-4	1	10
1,1,2,2-Tetrachloroethane	79-34-5	1	10
Toluene	108-88-3	1	10
Chlorobenzene	108-90-7	1	10
Ethylbenzene	100-41-4	1	10
Styrene	100-42-5	1	10
cis-1,2-Dichloroethene	156-59-4	1	10
Vinyl Acetate	108-05-4	5	10
Xylenes (total)	1330-20-7	1	10

Sample quantitation limits are highly matrix-dependant. The quantitation limits listed herein are provided for guidance and may not always be achievable.
Quantitation limits listed for soil/sediment are based on wet weight. Normally, data are reported on a dry weight basis; therefore, quantitation limits will be higher based on the % dry weight in each sample.
CAS = Chemical Abstract Service.
GC/MS = Gas chromatograph/mass spectroscopy.

Table 4-2. Practical Quantitation Limits for Semivolatile Organic Compounds in Soil and Water Using SW-846 (GC/MS) Method 8270C

Semivolatiles	CAS Number	Practical Quantitation Limits	
		Groundwater (µg/L)	Low Soil/Sediment (µg/kg)
Phenol	108-95-2	10	330
bis(2-Chloroethyle)ether	111-44-4	10	330
2-Chlorophenol	95-57-8	10	330
1,3-Dichlorobenzene	541-73-1	10	330
1,4-Dichlorobenzene	106-46-7	10	330
1,2-Dichlorobenzene	95-50-1	10	330
2-Methylphenol	95-48-7	10	330
2,2'-oxybis (1-Chloropropane)	108-60-1	10	330
4-Methylphenol	106-44-5	10	330
N-Nitroso-di-n-propylamine	621-64-7	10	330
Hexachloroethane	67-72-1	10	330
Nitrobenzene	98-95-3	10	330
Isophorone	78-59-1	10	330
2-Nitrophenol	88-75-5	10	330
2,4-Dimethylphenol	105-67-9	10	330
bis(2-Chloroethoxy)methane	111-91-1	10	330
2,4-Dichlorophenol	120-83-2	10	330
1,2,4-Trichlorobenzene	120-82-1	10	330
Naphthalene	91-20-3	10	330
4-Chloroaniline	106-47-8	10	330
Hexachlorobutadiene	87-68-3	10	330
4-Chloro-3-methylphenol	59-50-7	10	330
2-Methylnaphthalene	91-57-6	10	330
Hexachlorocyclopentadiene	77-47-4	10	330
2,4,6-Trichlorophenol	88-06-2	10	330
2,4,5-Trichlorophenol	95-95-4	25	800
2-Chloronaphthalene	91-58-7	10	300
2-Nitroaniline	88-74-4	25	800
Dimethylphthalate	131-11-3	10	330
Acenaphthylene	208-96-8	10	330
2,6-Dinitrotoluene	606-20-2	10	330
3-Nitroaniline	99-09-2	25	800
Acenaphthene	83-32-9	10	330
2,4-Dinitrophenol	51-28-5	25	800
4-Nitrophenol	100-02-7	25	800
Dibenzofuran	132-64-9	10	330
2,4-Dinitrotoluene	121-14-2	10	330
Diethylphthalate	84-66-2	10	330
4-Chlorophenyl-phenyl-ether	7005-72-3	10	330
Fluorene	86-73-7	10	330
4-Nitroaniline	100-01-6	25	800
4,6-Dinitro-2-methylphenol	534-52-1	25	800
N-nitrosodiphenylamine	86-30-6	10	330
4-Bromophenol-phenylether	101-55-3	10	330
Hexachlorobenzene	118-74-1	10	330
Pentachlorophenol	87-86-5	25	800
Phenanthrene	85-01-8	10	330

Table 4-2. Practical Quantitation Limits for Semivolatile Organic Compounds in Soil and Water Using SW-846 (GC/MS) Method 8270C (continued)

Semivolatiles	CAS Number	Practical Quantitation Limits	
		Groundwater (µg/L)	Low Soil/Sediment (µg/kg)
Anthracene	120-12-7	10	330
Carbazole	86-74-8	10	330
Di-n-butylphthalate	84-74-2	10	330
Fluoranthene	206-44-0	10	330
Pyrene	129-00-0	10	330
Butylbenzylphthalate	85-68-7	10	330
3,3'-Dichlorobenzidine	91-94-1	10	330
Benzo(*a*)anthracene	56-55-3	10	330
Chrysene	218-01-9	10	330
bis(2-Ethylhexyl)phthalate	117-81-7	10	330
Di-n-octylphthalate	117-84-0	10	330
Benzo(*b*)fluoranthene	205-899-2	10	330
Benzo(*k*)fluoranthene	207-08-9	10	330
Benzo(*a*)pyrene	50-32-8	10	330
Indeno(1,2,3-*cd*)pyrene	193-39-5	10	330
Dibenz(*a,h*)anthracene	53-70-3	10	330
Benzo(*g,h,i*)perylene	191-24-2	10	330
TPH	N/A	100	100

Notes: Sample quantitation limits are highly matrix-dependant. The quantitation limits listed herein are provided for guidance and may not always be achievable.
Quantitation limits listed for soil/sediment are based on wet weight. Normally, data are reported on a dry weight basis; therefore, quantitation limits will be higher based on the % dry weight in each sample.
CAS = Chemical Abstract Service.
GC/MS = Gas chromatograph/mass spectroscopy.
TPH = Total petroleum hydrocarbon.

Table 4-3. Sample Volumes, Containers, Preservation, and Holding Times

Analyte Group Soils	Container	Minimum Sample Size	Preservative	Holding Time
VOCs	4-oz glass jar with Teflon®-lined cap	100 g	Cool, 4ºC preserve at laboratory	14 d
SVOCs or TPH	8-oz glass jar with Teflon®-lined cap	200 g	Cool, 4ºC	14 d (extraction) 40 d (analysis)
Waters				
VOCs	Two 40-mL glass vials with Teflon®-lined septum (no headspace)	80 mL	HCl to pH <2 Cool, 4ºC	14 d
SVOCs	Two L amber glass bottle with Teflon®-lined lid	1,000 mL	Cool, 4ºC	7 d (extraction) 40 d (analysis)

Note: One investigative water sample in 20 will be tripled in volume for the laboratory to perform appropriate laboratory quality control analysis.
TPH = Total petroleum hydrocarbon.
SVOC = Semivolatile organic compound.
VOC = Volatile organic compound.

5.0 PRECISION, ACCURACY, REPRESENTATIVENESS, COMPARABILITY, COMPLETENESS, AND SENSITIVITY OBJECTIVES

This chapter presents general objectives for the level of QC expressed as PARCCS for the analytical data. The accuracy, precision, and sensitivity of laboratory analytical data must satisfy the QC acceptance criteria of the analytical protocols for approved EPA methods in the fixed-base laboratory and project specific requirements for the field GC.

5.1 QUALITY ASSURANCE OBJECTIVE FOR ACCURACY

Accuracy is defined as the degree of difference between measured or calculated values and the true value. The closer the numerical value of the measurement comes to the true value, or actual concentration, the more accurate the measurement. Analytical accuracy is expressed as the percent recovery of a compound or element that has been added to the environmental sample at a known concentration before analysis. The following is used to calculate percent recovery:

$$\text{Accuracy} = \text{Percent recovery} = \frac{A_r - A_0}{A_f} \times 100\%$$

where

A_r = Total amount detected in spiked sample,
A_0 = Amount detected in unspiked sample,
A_f = Amount of spike added to sample.

5.1.1 Organic Analysis Accuracy

Analytical accuracy will be ensured by performing all method-specified and project-modified QC steps. Surrogate recoveries will be monitored for method compliance for all analysis in the fixed-base laboratory with the exception of TPH. Table 5-1 lists the surrogate recovery acceptance criteria for all organic parameters requiring surrogate additions (SVOCs and VOCs).

In addition to surrogate recoveries, fixed-base laboratory accuracy for VOC, SVOC, and TPH analysis will be evaluated by analyzing an MS/MSD sample at a minimum frequency of 1 per 20 samples of similar matrix. Table 5-2 lists spike compounds and recovery criteria for MS/MSD samples in the fixed-base laboratory for SVOCs and VOCs. TPH advisory limits will be established by the fixed-base laboratory through the use of control charting.

The general objective for analytical accuracy for organic analysis is to meet 90% of all surrogate compound recoveries (Table 5-1) and MS/MSD recoveries (Table 5-2).

Table 5-1. EPA Quality Assurance Fixed-Base Laboratory Objectives for Accuracy of Surrogate Spike Analysis

Fraction	Surrogate Compound	Water % Recovery Limits	Low/Med Soil % Recovery Limits
VOA	4-Bromofluorobenzene	86-115	74-121
VOA	Dibromofluoromethane	86-118	80-120
VOA	Toluene-d_8	88-110	81-117
SVOA	Nitrobenzene-d_5	35-114	23-120
SVOA	2-Fluorobiphenyl	43-116	30-115
SVOA	p-Terphenyl-d_{14}	33-141	18-137
SVOA	Phenol-d_5	10-110	24-113
SVOA	2-Fluorophenol	21-110	25-121
SVOA	2,4,6-Tribromophenol	10-123	19-122
SVOA	2-Chlorophenol-d_4	33-110 (Advisory)	20-130 (Advisory)
SVOA	1,2-Dichlorobenzene-d_4	16-110 (Advisory)	20-130 (Advisory)

Note: These limits are for advisory purposes only. They are not used to determine if a sample should be re-analyzed.
EPA = U.S. Environmental Protection Agency.
SVOA = Semivolatile organic analysis.
VOA = Volatile organic analysis.

Table 5-2. EPA Quality Assurance Objectives for Laboratory Accuracy and Precision of Matrix Spike/Matrix Spike Duplicate Analysis

		Water		Soil	
Fraction	Matrix Spike Compound	Duplicate RPD	Percent Recovery Limits	Duplicate RPD	Percent Recovery Limits
VOA	1,1-Dichloroethene	19	60-136	50	36-161
VOA	Trichloroethene	20	66-136	27	43-140
VOA	Chlorobenzene	17	68-136	33	54-138
VOA	Benzene	22	73-144	27	48-150
VOA	Toluene	17	68-138	27	51-141
SVOA	Acenaphthene	31	46-118	19	31-137
SVOA	1,4-Dichlorobenzene	28	36-97	27	28-104
SVOA	2,4-Dinitrotoluene	38	24-96	47	28-89
SVOA	n-Nitroso-di-propylamine	38	41-116	38	41-126
SVOA	Pyrene	31	26-127	33	35-142
SVOA	1,2,4-Trichlorobenzene	28	39-98	23	38-107
SVOA	4-Chloro-3-methylphenol	42	23-97	33	26-103
SVOA	2-Chlorophenol	40	27-123	50	25-102
SVOA	4-Nitrophenol	50	10-80	50	11-114
SVOA	Pentachlorophenol	50	9-103	47	17-109
SVOA	Phenol	42	12-110	35	26-90

EPA = U.S. Environmental Protection Agency.
SVOA = Semivolatile organic analysis.
RPD = Relative percent difference.
VOA = Volatile organic analysis.

5.2 QUALITY ASSURANCE OBJECTIVE FOR PRECISION

Precision is defined as the reproducibility, or degree of agreement, among duplicated (collocated) sample measurements of the same quantity. The closer the numerical values of the measurements come to each other, the more precise the measurement is. Analytical precision is expressed as a percentage of the difference between results of duplicate samples for a given compound. Relative percent difference (RPD) is calculated as:

$$RPD = \frac{|C_1 - C_2|}{\frac{C_1 + C_2}{2}} \times 100$$

where

C_1 = Concentration of the compound in the sample,
C_2 = Concentration of the compound in the duplicate/replicate.

Sample collection precision will be measured by the analysis of field duplicate samples. Sample collection precision criteria will be twice the analytical precision criteria. The overall goal for precision is 90% of all data generated by laboratory methods to be within required or method-recommended control limits.

5.2.1 Organic Analysis Precision

Precision of fixed-base laboratory SVOCs and VOCs will be monitored using MS/MSD RPD values (Table 5-2). TPH precision will be monitored using MS and MSD analysis of a fuel standard. The advisory precision limits should not exceed 15% RPD for TPH.

5.3 QUALITY ASSURANCE OBJECTIVE FOR SENSITIVITY

Sensitivity is the limit of detection for instrumental and chemical analysis. The achievement of method detection limits depends partially on instrument sensitivity to ensure the data quality through constant instrument performance. Quantitation limits for SVOCs, VOCs, and TPH are listed in Tables 4-1 and 4-2 for fixed-base laboratory analysis. All soil/sediment samples will be reported on a dry weight basis. The quantitation limits presented in Tables 4-1 through 4-3 for soils/sediments will be adjusted based on the moisture content of each sample.

5.4 QUALITY ASSURANCE OBJECTIVES FOR COMPLETENESS, REPRESENTATIVENESS, AND COMPARABILITY

Completeness is defined as the amount of valid (useable) data obtained as compared to the planned amount and is expressed as a percentage of measurements judged to be valid. The percent of completeness for analytical data can be expressed by the following formula:

$$\text{Completeness} = \frac{\text{Number of useable valid data points reported}}{\text{Total number of analysis for each parameter analyzed}} \times 100$$

The completeness goal for the fixed-base and field analysis is 90%.

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is a qualitative parameter dependent on the proper design of the sampling program and proper laboratory protocol. The sampling networks are designed to provide data

representative of facility conditions. During development of these networks, consideration was given to past waste disposal practices, existing analytical data, physical setting, and site processes. Representativeness will be ensured by using proper sampling techniques, and using analytical procedures. Representativeness is ensured in the laboratory by proper sample storage, analysis, extraction, and digestion within the proper required holding times and acceptable instrument calibration and operation.

Comparability is a qualitative parameter that expresses the confidence with which one dataset can be compared with another, and is limited to the other parameters because only when precision and accuracy are known, can data be compared with confidence. The extent to which existing and planned analytical data will be comparable depends on the similarity of sampling and analytical methods. The procedures used to obtain the planned analytical data, as documented in this QAPP, are expected to provide comparable data. Field and laboratory procedures greatly affect comparability. To optimize comparability, only specific methods and protocols that have been selected, specified as appropriate, and modified as necessary for the RAC will be used. By using consistent sampling and analysis procedures, all datasets will be comparable within a specific site and between sites at the installation to ensure that remedial action decisions and priorities are based on a consistent database. Comparability will be further ensured by the analysis of EPA standard reference materials, establishing that analytical procedures are generating valid data.

6.0 SAMPLE IDENTIFICATION AND CHAIN-OF-CUSTODY REQUIREMENTS

Sample COC procedures require that the possession and handling of samples from the moment of collection through analysis be documented by written record. The record must clearly reflect the movement of the samples through the COC to ensure the sample has been controlled and has not been tampered with in any way. A sample is judged in custody when one of the following criteria has been met:

- The sample is in one's actual physical possession.
- The sample is in one's clear field of view after being in one's physical possession.
- The sample is in one's physical possession and is then locked up in a secure container so that no one can tamper with it.
- The sample is kept in a secured area that is restricted to authorized personnel only.

6.1 SAMPLE IDENTIFICATION

A standardized numbering system will be used to identify all samples collected during water and soil sampling activities. The numbering system provides a tracking procedure to ensure accurate data retrieval of all samples taken. A listing of the sample identification numbers will be maintained by the FOM who will be responsible for enforcing the use of the standardized numbering system during all sampling activities. Sample identification for all samples collected during the RAC will follow the following format.

This code consists of eight alphanumeric characters in four information groups

- Station type (two characters),
- IRP site identifier (two characters),
- Sample type, and
- Sample sequence.

Examples:

IRP Site 7 Soil Boring = SB07-SU01
IRP Site 7 Monitoring Well = MW07-GW01

6.1.1 Station Type

The third segment will consist of a two-digit sampling method identifier. MW and SB will be used to identify monitoring wells and soil borings, respectively.

6.1.2 Environmental Restoration Program Site Designator

All samples collected during this field effort will be identified by an eight-character code, beginning with the two-digit code that signifies the IRP site number (i.e., 04, 07, and 09).

6.1.3 Sample Type

The two-character sample type code identifies the general source type and media of the sample. Sample type codes that may be applicable to this field project are as follows:

- DS Soil sample from drum containing cuttings,
- DW Decontamination water,
- EB Equipment blank,
- FB Field blank,
- GW Groundwater,
- RS Field duplicates,
- SS Surface soil,
- SU Subsurface soil,
- TB Trip blank, and
- BG Background sample.

6.1.4 Sample Sequence Qualifier

The last set of two digits will sequentially identify the vertical samples taken from a single location.

6.1.5 Soil Boring and Monitoring Well Identification

Soil borings will be sequentially numbered and include the IRP site number as follows:

IRP Site 7 Soil Boring = SB07-SU01
IRP Site 7 Monitoring Well = MW07-GW01

6.2 SAMPLE LABELS

All samples will be identified with a label attached directly to the container. Sample label information will be completed using waterproof black ink and will contain the following information:

- Company name and site,
- Sample number,
- Parameters to be analyzed, and
- Preservative (if any).

6.3 CHAIN-OF-CUSTODY RECORD

To maintain a record of sample collection, a COC record will be filled out for each sample destined for field and fixed-base analysis at each sampling location, for the transfer of samples between sample custodians, shipment, and receipt by the laboratory. A copy of the standard contractor's COC record is shown in Figure 6-1. Sample COC procedures require that the possession and handling of the sample from the moment of its collection through analysis be documented by written record. The record must clearly reflect the movement of the sample through the COC to ensure the sample has been controlled and has not been tampered with in any way. Each time the samples are transferred, the signatures of the person relinquishing and receiving the samples, as well as the date and time of transfer, will be documented.

Chain-of-Custody

COC NO:

PROJECT NAME:				REQUESTED PARAMETERS												LABORATORY NAME:	
PROJECT NUMBER:																LABORATORY ADDRESS:	
PROJECT MANAGER:																PHONE NO:	
Sampler (Signature)		(Printed Name)														OVA SCREENING	OBSERVATIONS, COMMENTS, SPECIAL INSTRUCTIONS
Sample ID	Date Collected	Time Collected	Matrix												No. of Bottles/Vials:		
RELINQUISHED BY:		Date/Time	RECEIVED BY:		Date/Time	TOTAL NUMBER OF CONTAINERS:										Cooler Temperature:	
COMPANY NAME:			COMPANY NAME:			Cooler ID:											
RECEIVED BY:		Date/Time	RELINQUISHED BY:		Date/Time												
COMPANY NAME:			COMPANY NAME:														
RELINQUISHED BY:		Date/Time	RECEIVED BY:		Date/Time												
COMPANY NAME:			COMPANY NAME:														

Figure 6-1. Chain-of-Custody Form

6.4 TRANSFER OF CUSTODY AND SHIPMENT

Prior to the shipment of samples, the COC record will be signed and dated by a member of the field team who has verified that those samples indicated on the COC record are indeed being shipped. After packaging has been completed, the samples will be sealed within the cooler, and custody seals, signed and dated by a member of the field team, will be place over the lid edge of each cooler. Field samples will be delivered without custody seals.

All samples will be shipped by courier (such as Federal Express) to the fixed-base laboratory. Field screening samples will be hand delivered to the field GC. Fixed-base samples will be transported, generally each day, by field personnel from the installation to the courier location for subsequent shipment to the laboratory. Upon receipt of the samples at the laboratory, the receiver will complete the transfer by dating and signing the COC record. If shipped by commercial courier, the air bill number and shipping data will be transcribed to the COC in the appropriate signature/date block. A copy of the air bill is to be kept with the field copy of the COC form to reflect specific shipping information.

6.5 LABORATORY SAMPLE RECEIVING AND STORAGE

- Upon receipt, the sample custodian will inspect sample containers for integrity. The presence of leaking or broken containers will be noted on the laboratory's Sample Receipt Form and communicated to the field sampling representative. The sample custodian will sign the COC record with the date and time of receipt, thus assuming custody of the samples.

- The information on the COC record will be compared with the information on the sample tags and labels to verify exact sample identity. Any inconsistencies will be immediately resolved with the field sampling representative before sample analysis proceeds.

- Samples will be moved to a locked restricted access sample storage refrigerator maintained at 4 ± 2°C. The laboratory is required to document all internal custody transfers.

- The laboratory will submit copies of appropriate COCs with each data package and return original COCs at the end of the project.

7.0 DOCUMENTATION PROCEDURES

Logbooks will be bound notebooks with water-resistant or waterproof pages, and sequentially numbered by either mechanical overprint or handwritten entry. All entries will be legible and made with black, waterproof ink. No pages will be removed from a logbook. For any page partially filled with an entry, a line will be drawn diagonally from below the last line entry to the bottom of the page. Blank pages will be identified by writing "page intentionally left blank." Individuals making entries will sign and date the bottom of each page of their respective logbooks. Corrections will be marked through with a single line, initialed, and dated. No "white-out," erasure, or other obliteration will be accepted. At the end of each day, all logbooks are to be turned in to the FOM so that he/she may assess the entries for completeness.

7.1 FIELD OPERATIONS MANAGER LOGBOOK

The FOM will maintain a site logbook that summarizes daily field activities but does not contain the same level of detail as the field sampling logbooks. The site logbook will be used to record daily weather conditions, personnel, activities, and references the appropriate field logbooks and data forms for various field activities. It will be used to record all field changes in scope with supporting rationale.

The following entries, as minimum, will be included in the site logbook:

- Day, date, time arrived on-site, time daily activities completed, weather conditions, names, titles, organizations of personnel present on-site, and individuals responsible for maintaining respective field logbooks.
- Name, title, and organization of visitors on-site.
- Reference to other logbooks or field data forms maintained for documentation of field activities.
- Brief description of daily site activities, (i.e., locations, volume, number, amount, etc.).
- Record all custody and transfer details, including air bill numbers, analytical request forms, COC forms, sample label numbers, and laboratories to which samples were shipped, or reference to applicable field logbooks containing specific information.
- List of equipment decontaminated, number of decontamination events, and exceptions to approved procedures, if necessary. In lieu of recording this information, specific field logbook(s) documenting these activities will be referenced.
- List of instrument calibrations, calibrating personnel, and page number(s) of the calibration log.
- List of equipment malfunctions or breakdowns occurring along with disposition, (i.e., repair, replacement, etc.), with effect on overall project.
- Record deviations from scope of WP. If a Field Change Request (FCR) is used, record the number; otherwise, record details and effect on overall project.
- Record of all telephone calls relating to field activities.

7.2 FIELD SAMPLING LOGBOOKS

The field sampling logbooks will detail the specific activities of the sampler(s) or sampling teams. The following entries, as minimum, will be included in the field logbook:

- Day; date; time arrived on-site; time daily activities completed; weather conditions; and names, titles, and organizations of personnel involved in the task.
- Name, title, and organization of visitors on-site.
- Specific description of all activities in detail, or reference to forms used to record applicable information.
- Specific details of field tests conducted with references to field data forms or other data records completed.
- Volumes of water purged, number of drums filled, etc.
- Specific descriptions of samples collected, listing label numbers, sample containers, and volumes, preservation methods, packaging, COC form number(s), and any other pertinent information available.
- List of decontamination events, including personnel, time, equipment, and procedures.
- List of instrument calibrations, including a description of any problems encountered.
- List of equipment malfunctions, including a brief description of dispositions (i.e., repair or replacement).

7.3 FINAL EVIDENCE FILE DOCUMENTATION

Records will be kept by the PM to document the QA/QC activities and to provide support for possible evidential proceedings. The following outline of project file requirements applies:

- Communications
  - Internal
  - External
- QA/QC
  - Procedures
  - COC
  - Audit Reports
  - FCR Forms
  - Nonconformance/Corrective Action Reports
- Technical Information
  - Analytical Data
  - Field Data
  - Site Logbook
  - Field Sampling Logbooks

  - Field Data Record Forms
  - Graphic Resources
  - Data Quality Acceptance
  - Calculations/Evaluations
  - Regulatory Compliance

- Project Management
  - Project Schedule
  - Budget
  - Site Database Information

- Health and Safety
  - Plans/Procedures
  - Audits Reports

- Documents
  - Plans
  - Reports
  - Relevant Publications

All evidential file documentation will be maintained by the contractor under its internal project file system. Copies of all records will be maintained by the contractor for the project continuity. The PM will ensure that the QA/QC control records are properly stored and retrievable.

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8.0 CALIBRATION PROCEDURES AND FREQUENCY FOR MEASUREMENT DATA

8.1 FIELD MEASUREMENTS

Groundwater sample measurements such as specific conductance, temperature, turbidity, pH, survey data, and health and safety monitoring will be performed and recorded in the field. The primary QA objectives of field activities where measurements will be taken are to verify that QC checks are performed, verify that measurements were obtained to the degree of accuracy consistent with their intended use, and provide documentation of adherence to the measurement procedures.

Measurement data will be generated in many field activities including:

- Documenting measurement times and weather conditions;
- Locating and determining elevations of sampling locations;
- Using a PID or OVA to make qualitative organic vapor screening measurements from samples prior to disposal segregation or health and safety monitoring;
- Measuring pH, conductivity, turbidity, and temperature; and
- Field GC screening.

The instruments will be calibrated according to manufacturers' specifications before and after each field use, or as otherwise required. Where necessary, instruments will be calibrated each day during field use.

8.1.1 Surveying

Surveying of all well and soil boring locations at the Installation will be conducted to provide a common frame of reference for RAC activities. All proposed sample locations will be flagged prior to the beginning of the sampling effort. All sample collection locations, including soil and groundwater, will be surveyed. Surveying will be completed to an accuracy of ± 0.1 ft horizontally and ± 0.01 ft vertically. All benchmarks used will be traceable to a United States Geological Survey marker.

8.1.2 Organic Vapor Analyzer

The OVA or PID is calibrated daily to an isobutylene standard following manufacturer specifications. The instrument's operation and calibration are checked periodically each sampling day using a solvent-base magic marker, or flammable organic, noting needle deflection (Table 8-1).

8.1.3 Specific Conductance Meter

Calibration is performed at the start of each sampling day using a standard solution of potassium chloride. Adjustment knobs on the meter will be used to set the meter to read the value of the standard. The meter must read within 10% of the standard to be considered in control and should read within 5% (7% is considered a

Table 8-1. Field Measurement Equipment Calibration Frequency

Instrument	Calibration Standard	Frequency	Tolerance
OVA	10 ppm methane	Daily	NA
Specific Conductance Meter	KCI	Daily	±10%
pH Meter	NIST-traceable standards	Minimum of twice daily	0.1 pH units
Temperature Meter	NIST-traceable thermometer	Prior to first measurement after mobilization of field effort	1°C
Turbidity Meter	Standard turbidity suspension	Prior to first measurement and after every well	±3 NTU
Field GC	Three-point calibration	One per cycle	± 10%
	One-point calibration	Daily	N/A

GC = Gas chromatograph.
KCI = Potassium chloride.
NA = Not applicable.
NIST = National Institute of Standards and Testing.
NTU = Nephelometric turbidity unit.
OVA = Organic Vapor Analysis.
ppm = Parts per million.

warning level). If the calibration indicates the meter is out of control, a backup unit should be employed; if one is not available, the data will be flagged to note the percent difference between the meter and the standard calibration solution. Readings from conductivity meters lacking calibration adjustments are normally stable; thus, calibration checks are usually limited to checks at the beginning and the end of the sampling day.

8.1.4 pH Meter

Calibration is performed at the start of each sampling day using National Institute of Standards and Testing (NIST)-traceable buffer solutions, which bracket the pH range expected in the samples. Calibration knobs are used to set the meter to read the value of the standard. The meter is then checked during the sampling period, using at least one standard. If the reading varies more than one-tenth of a unit between calibration checks, the frequency of the checks must be increased.

8.1.5 Temperature Meter

Temperature is measured either using a thermistor built into the specific conductance meter, or by a separate thermometer unit. The frequency of calibration; however, is a minimum; should the unit experience erratic or out-of-tolerance readings, additional checks will be performed. Technicians should be especially mindful of subjecting the unit to harsh conditions (e.g., shock, extreme cold, etc.).

8.1.6 Turbidity Meter

Calibration is performed at the start of each day's sampling event and confirmed before the start of each new well. Calibration is achieved by immersing the probe of the turbidity meter into a clean beaker three quarters full of turbidity suspension standard and adjusting the turbidity meter readout to the known standard turbidity. Should a calibration check fail to indicate a correct reading, the turbidity probe must be decontaminated again and a fresh turbidity suspension standard used.

8.2 ANALYTICAL DATA

Analytical data for RAC includes all data generated by the fixed-base laboratory. Before any laboratory instrument is used as a measuring device, the instrument response to known reference materials traceable

to NIST or other EPA-approved standards must be determined. The manner in which various instruments are calibrated is dependent on the particular type of instrument and its intended use. All sample measurements will be made within the calibrated range of the instrument.

Laboratory calibrations typically consist of two types, initial and continuing calibration. Initial calibration procedures establish the calibration range of the instrument and determine instrument response over that range. Typically, three to five analyte concentrations are used to establish instrument response over a concentration range. The instrument response over its range is expressed as a correlation coefficient or by a response factor (e.g., for GC and GC/mass spectroscopy).

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9.0 DATA REDUCTION, VERIFICATION, AND REPORTING

Data reduction is the process of converting raw data to a useable format. Data verification is the process of evaluation procedures, which assess the usability of data at an intended data quality level or DQO.

9.1 FIELD DATA

The field data that will be collected during RAC can generally be characterized as either objective or subjective data. Objective data include all direct measurements, such as field screening/analytical parameters and water level measurements. Subjective data include activity descriptions and observations.

9.1.1 Field Data Reduction

All field data will be recorded by field personnel in bound field notebooks and on standard forms. For example, during RAC field activities, the field team member supervising the drilling and/or sampling activities will keep a chronological log of activities, a vertical descriptive log of lithologies encountered, other pertinent information (i.e., staining, odors, field screening, working conditions, water levels, etc.), and a labor and materials accounting in his/her bound notebook.

After checking the validity of data in the field notes and on standard forms, the PM will be responsible for entering pertinent data into data files. Where appropriate, the data files will be set up for direct input into the project database. Subjective data will be filed as hardcopies for later review by the PM and for incorporation into technical reports, as appropriate.

9.1.2 Field Data Substantiation

Substantiation of field activities is primarily a verification that proper procedures were followed while taking measurements related to samples, locations, and survey information, etc.

Typical measurements include:

- Soil sample location measurement;
- Water level measurements;
- OVA/PID readings; and
- pH, temperature, turbidity, and specific conductance.

Field measurements are considered valid provided that

- calibration records for field measurement equipment are properly maintained;
- training records exist which document that field personnel are familiar with standard procedures for taking measurements; and
- verification that calculations and observations are accurately recorded and transcribed.

Verification of objective field and technical data will be performed at two different levels. On the first level, data will be substantiated at the time of collection by following standard procedures and QC checks. At the second level, data will be substantiated by the PM, who will review the data to ensure that the correct codes and units have been included. After data reduction into tables or the project database, the

PM will review datasets for anomalous values. Any inconsistencies or anomalies discovered will be resolved immediately, if possible, by seeking clarification from field personnel responsible for collecting the data. Subjective field and technical data will be substantiated by the PM, who will review field reports for reasonableness and completeness. In addition, random checks of sampling and field conditions will be made by the PM and QA Manager who will check recorded data at that time to confirm the recorded observations. Whenever possible, peer review will also be incorporated into the data substantiation process, particularly for subjective data, to maximize the consistency among field personnel.

9.2 LABORATORY DATA VERIFICATION

All definitive data collected during RAC will be internally verified by the Analytical Services Manager. This will be accomplished by reviewing the data packages for method QC compliance, including calibration frequency and acceptance criteria, method blank analysis, and MS analysis. The Analytical Services Manager will also verify that the sample analysis was performed within the proper holding times, that turn-around time requirements were met, and that sample analysis are compared against the COC for completeness.

10.0 ANALYTICAL DATA REPORTING AND VALIDATION

10.1 FIXED-BASE LABORATORY DATA REPORTING AND VALIDATION

10.1.1 Fixed-Base Laboratory Data Reporting

Complete sample data packages from the fixed-base laboratory are required to be submitted to the Analytical Services Manager within 30 days of sample receipt. Data packages must contain the appropriate CLP-type forms for each analysis (Table 10-1). Analytical results will be required to be delivered electronically in commercial CLP-type Form 1 information for a summary database spreadsheet.

10.1.2 Fixed-Base Laboratory Data Validation

Validation will follow the general logic of *EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*, October 1999, (Organic Functional Guidelines). Because raw data will not be submitted by the laboratory, any reference to raw data review in the Functional Guidelines will not be required. The data packages will be forwarded to the data validators after initial verification by the Analytical Services Manager.

Table 10-1. Fixed-Base Laboratory Data Package Deliverables

Method Requirements	Deliverables
Holding time information and methods requested	Signed chain-of-custody forms
Discussion of laboratory problems	Case narratives
Organics	
Sample results	CLP Form 1 or equivalent
Surrogate recoveries. Surrogates to be used in VOCs and SVOCs. TPH will not require a surrogate spike	CLP Form 2 or equivalent
Matrix spikes/spike duplicate. One spike and spike duplicate per 20 samples of similar matrix for VOCs, SVOCs, and TPH	CLP Form 3 or equivalent
Method blank data	CLP 4 Form or equivalent
GC/MS tuning for VOCs/SVOCs	CLP 5 Form or equivalent
GC/MS or GC initial calibration data for VOCs, SVOCs, and TPH	CLP 6 Form or equivalent
TPH identification summary form	CLP 10 Form or equivalent
GC/MS or GC continuing calibration data	CLP 7 Form or equivalent
GC/MS internal standard area data and analytical sequence	CLP 8 Form or equivalent

CLP = Contract Laboratory Program.
GC/MS = Gas chromatograph/mass spectroscopy.
SVOC = Semivolatile organic compound.
TPH = Total petroleum hydrocarbon.
VOC = Volatile organic compound.

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11.0 PERFORMANCE AND SYSTEM AUDITS

Audits may consist of two types, system audits and performance audits. The purpose of a system audit is to determine whether appropriate project systems are in place. Performance audits are used to indicate whether those systems are functioning properly. Audits will be conducted by the Contractor's project QA Manager, as tasked by the PM, to verify the existence of an effective QC system. Additionally, the audit will evaluate the level of compliance of that system in terms of adherence to QC measures, standards, records, project documentation, and control.

11.1 PROJECT SYSTEM AUDITS

The QA Manager may periodically, on an unannounced basis, call for a system audit. The PM will respond by submitting the QAPP. When audits are conducted, they will determine whether the QAPP is in place and whether the operations called for by the QAPP have been performed. Results of project audits will be reported to the PM. External audits may be conducted in conjunction with, or at the direction of, NYANG or the regulatory authority.

11.2 TECHNICAL PERFORMANCE AUDITS

Technical performance audits will be conducted by the project QA Manager on an ongoing basis during the project. All numerical analyses, including manual calculations, mapping, and computer support activities, will be documented and will be subject to performance audits in the form of QC procedural reviews, mathematical re-analysis, and peer review. Technical peer review is the responsibility of the PM. All records of numerical analyses will be legible, reproduction quality, and complete enough to permit logical reconstruction by a qualified objective reviewer.

11.3 FIELD AUDITS

A field performance audit may be conducted by the Analytical Services Manager at the beginning of the field effort. The Analytical Services Manager will closely monitor the mobile laboratory's performance continually throughout the course of the fieldwork. The purpose of the field audit is to ensure that proper methods and protocols detailed in this QAPP are consistently practiced in the field. Audits will be performed using tailored checklists prepared by the QC Manager. The requirements and audit questions to be developed will be as specific as possible and will focus on significant investigation techniques. Checklists are encouraged to be completed to the maximum extent possible to give a complete picture of field techniques using a structured approach.

Field operation records will be reviewed to verify that field-related activities were performed in accordance with appropriate project procedures. Items reviewed will include, but are not limited to, field equipment calibration records, daily field logs, and COC documentation.

Upon audit completion, an audit report containing observations and findings and recommended corrective actions will be submitted to the PM.

11.4 LABORATORY AUDITS

The laboratory QA Manager has the responsibility of monitoring the internal QA Program. The contractor will verify that standardized QA Programs are in effect to provide objective oversight of laboratory procedures. Additionally, copies of internal QA reports will be requested to ensure standards of quality performance are in effect.

12.0 PREVENTIVE MAINTENANCE

Preventive maintenance is an organized program of actions taken to maintain proper instrument and equipment performance and to prevent instruments and equipment from failing during use. An adequate preventive maintenance program increases reliability of a measurement system and minimizes downtime of field and laboratory instruments.

12.1 FIELD EQUIPMENT

Field equipment will be properly calibrated, charged, and in good working condition before the beginning of each working day. Manufacturers' specifications define the required equipment checks for each type of field equipment used. Non-operational field equipment will be removed from service and a replacement will be immediately obtained within 24 h. Significant repairs to field equipment will not be performed in the field.

All field instruments will be properly protected against inclement weather during the field investigation. Each instrument is specially designed to maintain its operating integrity during variable temperature ranges that are representative of ranges that will be encountered during working conditions. At the end of each working day, all field equipment will be taken out of the field and placed in a cool, dry room for overnight storage.

All subcontractor equipment (e.g., drilling rig) will arrive at the site in proper working condition. All lubricating and hydraulic motor oils will be checked by the subcontractor before the start of each work day to ensure all fluid reservoirs are full and there are no leaks. Before the start of each work day, the FOM will also inspect all equipment for fluid leaks. If a leak is detected, the equipment will be removed from service for repair or replacement.

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13.0 CORRECTIVE ACTION PROTOCOLS

The QA Manger will prepare a formal report of all initial nonconformance issues. The programmatic impact of a nonconformance, such as the lack of or a failure to use an appropriate procedure, will be determined by the QA Manger and reported to the project management staff. A corrective action plan and implementation schedule will be required, and the PM will be responsible for ensuring that immediate action to correct the nonconformance has been initiated. The PM will be responsible for ensuring the successful implementation of the corrective action plan and ensuring that no additional work that is dependent on the nonconforming action is performed until the nonconformance is corrected. Corrective action may include re-analyzing samples if holding times permit, re-sampling, and evaluating and amending sampling and analytical processes.

The PM will be responsible for ensuring that the corrective action adequately addresses the nonconformance. The QA Manager will ensure that corrective actions for nonconformance are implemented by

- evaluating all reported nonconformances,
- controlling additional work on nonconforming items,
- maintaining the log on nonconformances, and
- ensuring nonconformance and corrective action reports are included in the site documentation files.

Following implementation of satisfactory corrective action, the QA Manager will conduct follow-up activities sufficient to verify implementation of the corrective action. Such confirmation will be documented, along with any other recommendations, in a formal close-out of the nonconformance. The closeout report will be distributed to all appropriate project management personnel.

13.1 FIELD CORRECTIVE ACTION

The initial responsibility for monitoring the quality of field measurements and observations lies with field personnel. The FOM and the PM are responsible for verifying that QC procedures are being followed. This requires that the FOM assess the correctness of field methods and the ability to meet QA objectives. If a problem occurs that might jeopardize the integrity of the project or cause some specific QA objective not to be met, it is the responsibility of all field project staff to report all suspected nonconformances by initiating a nonconformance report and submitting it to the PM.

The PM will submit a copy of the nonconformance report to the QA Manager for formal investigation. An appropriate corrective action will then be decided upon and implemented. The PM will document the problem, the corrective action, and the results, using the form shown in Figure 13-1. Copies of the documentation form will be provided to the PM and the QA Manager.

The SAIC PM or his/her designee is responsible for all site activities. In this role, he/she may, at times, be required to adjust the site activities to accommodate site-specific needs. When it becomes necessary to modify a program, the responsible person notifies the SAIC PM of the anticipated change and implements the necessary changes after obtaining the approval of the SAIC PgM and the ANG PM. All changes in the program will be documented on the FCO form that will be signed by the initiators and the SAIC PM (Figure 13-2). The FCO form for each document will be numbered serially, as required. The FCO form shall be attached to the file copy of the affected document. The SAIC PM must approve the change in writing or verbally before field implementation. If unacceptable, the action taken during the period of deviation will be evaluated in order to determine the significance of any departure from established practices and action taken.

NONCONFORMANCE REPORT	DATE OF NCR	NCR NUMBER
	LOCATION OF NONCONFORMANCE	PAGE ____OF ____
INITIATOR (NAME/ORGANIZATION/PHONE	FOUND BY	DATE FOUND
RESPONSIBLE ORGANIZATION / INDIVIDUAL		PROGRAM
		PROJECT
DESCRIPTION OF NONCONFORMANCE		CATEGORY ___ ___ ___ ___ ___

[A] INITIATOR: _____ DATE _____ QA/QC OFFICER DATE YES ❑ NO ❑ CAR REQ'D

DISPOSITION:

PROBABLE CAUSE:

ACTIONS TAKEN TO PREVENT RECURRENCE:

PROPOSED BY: _____ _____

[B] NAME DATE

JUSTIFICATION FOR ACCEPTANCE

INITIATOR: _____ _____

[C] NAME DATE

VERIFICATION OF DISPOSITION AND CLOSURE APPROVAL

REINSPECTION/RETEST REQUIRED YES ❑ NO ❑ IF YES: _____

RESULT DATE

QUALITY ASSURANCE: _____ _____

[D] NAME DATE

Figure 13-1. Nonconformance Report

Instructions for completion of the Nonconformance Report
COMPLETE THIS FORM USING BLACK INK ONLY

Date of NCR	Enter the current date.
NCR Number	Obtain the NCR number from the NCR Coordinator.
Location of Nonconformance	Enter the location of the nonconforming item.
Page ___ of ____	Enter the page of the total number of pages.
Initiator:	Enter the name, organization, and phone number of the person initiating the NCR.
Found by:	Enter the name of the person who identified the nonconformance.
Date found:	Enter the date the nonconformance was identified.
Responsible Organization / Individual:	Enter the name of the organization / individual that is responsible for correcting the nonconformance.
Description of Nonconformance:	Initiator will describe in detail the nonconforming item or service; sign, date, and return the NCR for the QA/QC Officer.
Category:	Write in the number(s) of the category which best describes the nonconformance.
Disposition, Probable Cause, and Actions Taken to Prevent Recurrence:	The responsible organization / individual will describe how the nonconformance is to be corrected, give the probable cause, if known; specify actions taken to prevent recurrence, if applicable; sign, date, and return to the initiator for signature.
Justification for Acceptance:	The initiator writes the reason for accepting the explanations given in Section B of the NCR form; and signs and dates the form where indicated. If not acceptable, the initiator returns the NCR to the NCR Coordinator.
Verification of Disposition and Closure Approval:	QA/QC Officer should mark the appropriate box and sign and date in the space allotted.

CATEGORIES

1. Logbook	2. Training	3. Sample Collection
4. Chain of Custody	5. Sample Handling /Packaging	6. Preservation
7. Hold Time	8. Calibration	9. Health and Safety
10. Regulatory Compliance	11. Laboratory Deliverable	12. Well Emplacement
13. Records Management	14. Document Control	15. Document Reviews
16. Milestone	17. Other (procedure, management)	

Figure 13-1. Nonconformance Report (continued)

FCO NO._____

PROJECT_____

CONTRACT NO._____

REQUESTER IDENTIFICATION

NAME _____ ORGANIZATION _____ PHONE _____

TITLE _____ SIGNATURE _____

BASELINE IDENTIFICATION

BASELINE(S) AFFECTED O COST O SCOPE O MILESTONE O METHOD OF ACCOMPLISHMENT

AFFECTED DOCUMENT (TITLE, NUMBER, AND SECTION)_____

DESCRIPTION OF CHANGE

JUSTIFICATION

IMPACT OF NOT IMPLEMENTING REQUEST

PARTICIPANTS AFFECTED BY IMPLEMENTING REQUEST

COST ESTIMATE $ _____ ESTIMATOR SIGNATURE_____

PHONE_____ DATE_____

PREVIOUS FCR AFFECTED O YES O NO; IF YES, FCR NO_____

CLIENT PROJECT MANAGER _____ DATE _____

CLIENT QA SPECIALIST _____ DATE _____

SAIC H&S MANAGER SIGNATURE_____ DATE _____

(IF APPLICABLE)

Figure 13-2. Example of a Field Change Order Form

The SAIC PM for the site is responsible for controlling, tracking, and implementing the identified changes. Reports on all changes will be distributed to all affected parties, including the ANG PM. ANG will be notified whenever program changes in the field are made.

13.2 LABORATORY CORRECTIVE ACTION

The initial responsibility to monitor the quality of an analytical system lies with the analyst. In this regard, the analyst will verify that all QC procedures are followed and that the results of analysis of QC samples are within acceptance criteria. This requires that the analyst assess the correctness of all of the following items, where appropriate:

- Sample preparation procedures,
- Initial calibration,
- Calibration verification,
- Method blank result, and
- Laboratory control standards.

If this assessment reveals that any of the QC acceptance criteria have not been met, as defined by the laboratory's most recent Laboratory QA Plan, CLP Standards, or EPA SW-846 standards, the analyst must immediately assess the analytical system to correct the problem. The analyst notifies his/her supervisor, section leader, or QA coordinator of the problem and, if possible, identifies the potential cause(s) and makes appropriate corrective action recommendations.

The identification of the corrective action obviously depends on the nature of the problem. For example, if a continuing calibration verification is determined to be out of process control, the corrective action may require recalibration of the analytical system and re-analysis of all samples since the last acceptable continuing calibration standard.

Sample-related QC samples (e.g., MS and MSD) provide an indication of matrix effects on analyses and do not require re-analysis if method-related QC samples (e.g., method blanks, MSs, and MSDs) indicate acceptable performance.

When the appropriate corrective action measures have been defined and the analytical system is determined to be in control, the analyst documents the problem, the corrective action, and the data, thereby clearly demonstrating that the analytical system is in control. Copies of the documentation are provided to appropriate management staff members and the QA Manager for eventual addition to the project files.

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14.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

The PM will rely on written reports and memoranda documenting data assessment activities, quality audits, nonconformances, corrective actions, and quality notices. A copy of all significant QA reports will be forwarded to the appropriate management levels for review and oversight.

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15.0 REFERENCES

Air National Guard (ANG) 1998. *Final Air National Guard Installation Restoration Program (IRP) Investigation Protocol*, Air National Guard Readiness Center, Andrews Air Force Base, MD, June.

EPA 1998. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846, 3rd Edition, Rev. 5, EPA, Office of Solid Waste, Washington, D.C., April.

EPA 1999. *Contract Laboratory Program National Functional Guidelines for Organic Data Review, EPA-540/R-99-008*, (NTIS PB99-963506), October.

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APPENDIX B – HEALTH AND SAFETY PLAN

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FINAL

HEALTH AND SAFETY PLAN

FOR THE REMEDIAL ACTION CONSTRUCTION, OPERATION AND MAINTENANCE

FOR INSTALLATION RESTORATION PROGRAM SITES 4, 7, AND 9

NEW YORK AIR NATIONAL GUARD (106TH RESCUE WING) GABRESKI INTERNATIONAL AIRPORT WESTHAMPTON BEACH, NEW YORK

July 2008

Contract No. DAHA90-01-D-0008
Delivery Order 27

Prepared for
ANG/CEVR
New York Air National Guard,
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Prepared by
Science Applications International Corporation
Oak Ridge, Tennessee

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CONTENTS

TABLES

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ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
ANG	Air National Guard
bgs	below ground surface
C	ceiling
CFR	*Code of Federal Regulations*
CHSM	Corporate Health and Safety Manager
DEET	N,N-diethyl-m-toluamide
FOM	Field Operations Manager
HSP	health and safety plan
IRP	Installation Restoration Program
JP	jet petroleum
MSDS	Materials Safety Data Sheet
NYANG	New York Air National Guard
OSHA	Occupational Safety and Health Administration
PEL	permissible exposure level
PID	photoionization detector
PM	project manager
PPE	personal protective equipment
PVC	polyvinyl chloride
RAC	Remedial Action Construction
RQW	Rescue Wing
SAIC	Science Applications International Corporation
SSO	Site Safety Officer
STEL	short-term exposure limit
TCE	trichloroethylene
TLV	threshold limit value
TWA	time-weighted average

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1.0 INTRODUCTION

1.1 PURPOSE AND POLICY

The purpose of this health and safety plan (HSP) is to establish personnel protection standards and mandatory safety practices and procedures for all work conducted at the 106th Rescue Wing (RQW) at the New York Air National Guard (NYANG), Westhampton Beach, New York. The HSP assigns responsibilities, establishes standard operating procedures, and provides for contingencies that may arise while performing the Environmental Restoration Program remedial action construction (RAC).

The provisions of the HSP are mandatory for all on-site field personnel. Any supplemental plans used by subcontractors must conform to this HSP. All personnel who engage in on-site project activities must be familiar with this HSP and comply with its requirements.

1.2 APPLICABILITY

This HSP, which was developed specifically for operations at the 106th RQW, is structured to assign responsibilities, establish personal protection standards and mandatory safety procedures, and provide for contingencies that may arise while operations are being conducted at the sites. This HSP complies with, but does not replace, federal health and safety regulations as set forth in 29 *Code of Federal Regulations* (*CFR*) 1910 and 1926.

The provisions of the HSP are mandatory for all on-site employees engaged in hazardous material management activities including, but not limited to, initial site reconnaissance, hydrogeologic investigation, mobilization, project operations, and demobilization. SAIC subcontractors will be informed of the requirements of this plan and will be provided with copies or unrestricted access to this plan and must comply with the requirements of this plan. This plan does not relieve subcontractors of the regulatory requirement to provide a safe workplace for their employees. SAIC subcontractors are required to provide trained, experienced personnel and to operate equipment as required by the manufacturer's procedures, or the subcontractor's standard operating procedures; and are required to supplement the requirements of this plan as necessary to ensure that their employees perform their specific tasks safely.

Changing and/or unanticipated site conditions may require modification of this site HSP to maintain a safe and healthy work environment. Any proposed changes to this HSP must be reviewed with the Engineering and Environmental Management Group Health and Safety Manager or designee, prior to change implementation. If this is not feasible, the project manager (PM) may modify the HSP and record all changes in the field notebook. Under no circumstances will modifications to this HSP conflict with federal, state, or local health and safety regulations.

1.3 LOCATIONS OF AREAS OF CONCERN

The sites are located at the 106th RQW, NYANG Base, Westhampton Beach, New York. The sites are described below.

- **Installation Restoration Program (IRP) Site 4 (Aircraft Refueling Apron Site)** – Site 4 encompasses a grassy area adjacent to the refueling apron, southeast of Building 358. The refueling apron was used from the 1950s through the 1980s. Fuel was pumped from the on-base Petroleum,

Oil, and Lubricant Tank Farm, located approximately 3,000 ft southeast of the refueling apron, to fuel outlets in a depressed concrete area at the apron. Spills of hydraulic oil, trichloroethylene (TCE), and unknown amounts of fuel have been reported at the site. Surface drainage from Site 4 discharges to a drainage ditch at an outfall located approximately 800 ft south of the refueling apron. This discharge location has been designated Site 9.

- **IRP Site 7 (Former Fire Training Area) –** The site was used for fire training exercises by the Air Force between 1943 and 1971. The area was an unlined pit where waste fuels, solvents, and jet fuel were poured directly over the ground and ignited for fire training exercises. Air National Guard (ANG) paved the area in 1971 and a concrete bermed area was constructed in 1978. Use of the site for fire training was discontinued by ANG in 1986. Groundwater contamination, in the form of volatile and semivolatile hydrocarbons, is present in low levels.

- **IRP Site 9 (Ramp Drainage Outfall) –** Site 9 is located approximately 1,100 ft south of the refueling apron (Site 4). The site consists of an outfall, which receives drainage from the refueling apron, several hangers, and a drainage ditch. The groundwater plume from Site 4 is migrating into the area of Site 9.

1.4 SCOPE OF WORK

This field effort addresses specific operations necessary to conduct RAC at the 106th RQW. Field activities to be conducted include installing subsurface soil borings for the installation of air sparge points and monitoring wells using direct push, and auger methods, trenching and horizontal boring to install air sparge lines, the installation and connection of an air sparge system air compressor; and the collection of groundwater samples. Potential contaminants, which have been identified, include TCE; jet petroleum (JP)-4; JP-8; waste oils; and benzenes, toluene, ethyl benzene, and xylenes compounds.

The objectives of the sampling activities at Sites 4, 7, and 9 are to determine the horizontal extent of groundwater contamination and to facilitate the design of the proposed remedial treatment systems.

A total of 17 monitoring wells will be purged and sampled. The samples will be analyzed for volatile organic compounds, semivolatile organic compounds, target analyte list metals, nitrate/nitrite, sulfate, and methane. Additional field parameters, such as dissolved oxygen, pH, temperature, and turbidity will be collected to determine degradation rates.

In addition to the sampling effort, the following activities will occur at Site 7. Install and develop two monitoring wells to a depth of 45 ft below ground surface (bgs) using conventional hollow stem auger drilling techniques (approximately 15 ft below the water table) consisting of 2-in., Schedule 40 polyvinyl chloride (PVC) and a 10-ft screen. Removal and abandonment of one monitoring well. This well was installed in 1984 to a depth of 40-ft and is constructed of 2-in galvanized steel. This well will be abandoned in accordance with state of New York requirements.

Installation of the air sparge system at Sites 4 and 9 will consist of installing multiple air sparge injection points at each site; 38 points at Site 4, and 12 points at Site 9. Each injection point will be installed using DPT or conventional hollow stem auger drilling techniques and will extend to a depth of approximately 45 to 65 ft bgs. The injection points will be PVC riser pipe and a 5-ft PVC pre-packed well screen. Each injection point will be completed in 2- by 2-ft vault for protection. One-inch diameter air supply lines will be installed to a depth of approximately 24-in bgs using a ride-on trencher. Air supply lines that must cross the taxiway or other permanent concrete or asphalt ways will be installed using horizontal boring. Air to the sparge injection points will be from a 30 horse power, 460 volt, skid-mounted air compressor to

be installed on a gravel pad at the south end of Site 9. Power to air compressor will be from a transformer installed by the Long Island Power Authority. A subcontracted certified electrician will make all electrical connections between the transformer and air compressor.

1.5 RESPONSIBILITIES

All contractors and subcontractors are required to ensure that on-site employees, visitors, and their suppliers/vendors comply with the minimum standards set forth by the Occupational Safety and Health Administration (OSHA), the contractor's or subcontractor's site HSP, and with applicable regulations issued by governmental entities. Contractor and subcontractor personnel are required to know, understand, and comply with the safety regulations that apply to their operations. The provisions of this HSP, along with the applicable regulations issued by governmental entities, will be strictly adhered to by the contractor(s) and their personnel involved in site investigation activities.

The Site Safety Officer (SSO) will determine the appropriate personal protective equipment (PPE) and ensure that it is properly worn at all times. The SSO has the right to upgrade PPE or to evacuate the site at any time.

1.6 STAFF ORGANIZATION, QUALIFICATIONS, AND RESPONSIBILITIES

This section presents the lines of authority, responsibilities, and communication procedures concerning site safety and health and emergency response. It includes key Science Applications International Corporation (SAIC) and subcontractor personnel. All fieldwork will be under the supervision of the SAIC Field Operations Manager (FOM). The SAIC FOM will oversee normal and emergency work and will perform any required emergency notification. Table 1-1 identifies the individuals who will fill key roles for the project field activities.

Table 1-1. Staff Organization

Position	Name	Phone
Program Manager, SAIC	Connie Samson	(703) 318-6991
Health and Safety Manager, SAIC	Steve Davis CIH, CSP	(865) 481-4755
Project Manager, SAIC	Michael Klosky	(770) 614-0729
Field Operations Manager, SAIC	Mike Klidzejs	(615) 867-3548
Site Safety and Health Officer, SAIC	Mike Klidzejs	(615) 867-3548

CIH = Certified Industrial Hygienist.
CSP = Certified Safety Professional.
SAIC = Science Applications International Corporation.

The key personnel assigned to the field activity positions presented in Table 1-1 represent those individuals who will work on the project. However, personnel availability will dictate the actual roster of individuals who will perform field activities. In the event that personnel other than those presented in Table 1-1 are assigned to the project, SAIC will provide the names of those individuals to the personnel responsible for ensuring conformance with SAIC Corporate, SAIC Engineering and Environmental Management Sector, and Air National Guard policies and procedures.

1.6.1 SAIC Program Manager

Specific health and safety responsibilities of the program manager include

- coordinating with ANG personnel,
- ensuring that PMs satisfy SAIC and ANG health and safety requirements,
- ensuring that project staff implement the project site HSP,
- ensuring that projects have the necessary resources to operate safely, and
- ensuring that project personnel have the appropriate regard for safe job performance.

1.6.2 SAIC Health and Safety Manager

The specific responsibilities of the Health and Safety Manager include

- coordinating with ANG health and safety personnel,
- reviewing and approving HSPs,
- approving downgrades in PPE or protective procedures, and
- interfacing with project personnel through routine communications and audits of selected projects.

1.6.3 SAIC Project Manager

The SAIC PM is responsible for overall project execution. The responsibilities of the PM include

- coordinating with ANG, including reporting accidents and incidents immediately and submitting written reports within 2 working days;
- ensuring implementation of the project HSP;
- ensuring adequate resources are allocated to fully implement the HSP in the field;
- maintaining auditable project documentation of all required records;
- ensuring that a qualified SSO is designated; and
- maintaining a current copy of the project HSP.

1.6.4 SAIC Field Operations Manager

The SAIC FOM will oversee the field activities associated with the project and will be responsible for site accessibility, safety, and quality assurance. The FOM's qualifications include, at a minimum, Hazardous Waste Operations and Emergency Response worker and supervisor training, experience with similar projects, and knowledge of and understanding of the project HSP. Specific responsibilities of the FOM are listed below

- enforcing compliance with the project HSP;
- coordinating on-site operations, including subcontractor activities;
- ensuring that subcontractors follow the requirements of this HSP;
- coordinating and controlling any emergency response actions; and
- maintaining current copies of the project HSP; *ANG Safety and Health Requirements Manual*; and the *SAIC Environmental Compliance and Health and Safety Program (EC&HS) Manual* on-site.

1.6.5 SAIC Site Safety Officer

The SAIC SSO is responsible for making health and safety decisions, for specific health and safety activities, and for verifying the effectiveness of the health and safety program. The SSO's qualifications include, at a minimum, Hazardous Waste Operations and Emergency Response worker and supervisor training, experience with similar projects, knowledge of and understanding of the project HSP, and the ability to use the required monitoring equipment. The SSO has primary responsibility for the following:

- implementing and verifying compliance with this HSP and reporting to the FOM, PM, and Health and Safety Manager any deviations from anticipated conditions;
- completing the health and safety debrief in Environmental Compliance and Health and Safety Procedure 20;
- documenting deficiencies identified in the daily inspections, procedures, and timetables for correction and notifying the responsible parties;
- stopping work or upgrading protective measures (including protective clothing) if uncontrolled health and safety hazards are encountered. The SSO must also authorize resumption of work following correction of the adverse condition(s);
- ensuring that site personnel have access to this plan and are aware of its provisions;
- conducting a site-specific pre-entry health and safety briefing covering potential chemical and physical hazards, safe work practices, and emergency procedures;
- maintaining on-site auditable record documentation;
- confirming that all on-site personnel have received the training listed in the "Training Requirements" chapter (Chapter 4.0) of this HSP;
- verifying that the project HSP's emergency points of contact are correct;
- ensuring that all monitoring equipment is operating according to the manufacturer's specifications and performing field checks of instrument calibration;
- ensuring that monitoring for potential on-site exposures is conducted in accordance with this HSP;
- updating the project HSP (field changes) to ensure that it adequately identifies all tasks and significant hazards at the site, and notifying project personnel and the SAIC Health and Safety Manager of changes;
- investigating accidents and near accidents and reporting (in concert with FOM) same to the PM and the Health and Safety Manager;

- conducting daily “tailgate” safety briefings; and

- controlling visitor access to the exclusion zone.

1.6.6 Subcontractor Field Manager

Subcontractor Field Managers will oversee the field activities of his/her employees. He/she is responsible for enforcing the field requirements of this HSP. The Subcontractor Field Manager’s qualifications include, at a minimum, Hazardous Waste Operations and Emergency Response worker and supervisor training, experience with similar projects, and knowledge of and understanding of the project HSP. Specific responsibilities are

- ensuring that his/her personnel on-site follow the requirements of the project HSP and any other applicable health and safety requirements (i.e., OSHA, equipment-specific controls, and state requirements);

- verifying that this HSP adequately addresses the hazards and controls of the subcontracted work, and supplementing the information in the HSP, if necessary;

- ensuring the safe operation of any subcontractor equipment;

- coordinating on-site operations of his/her personnel; and

- maintaining any required documentation (e.g., drill rig manual) specific to his/her operations.

2.0 SAFETY AND HEALTH RISK ANALYSIS

2.1 CHEMICAL HAZARDS

The nature of groundwater contamination at the sites has been characterized by sampling during the multiple historical investigations at each site. The list of chemicals is based on the comprehensive results of these historical investigations. The chemical toxicological properties and permissible exposure levels (PELs) are shown in Table 2-1. A hazards analysis has been prepared for each general task. The results of the hazards analysis are presented in Table 2-2.

From an occupational health standpoint, given that any potential exposure to site personnel will be only for a short period of time (intermittent for several days), the suspected low levels of contaminants are not a major concern. However, the groundwater is not characterized, so the potential for exposure to elevated levels of these contaminants may exist. Overviews of the hazards associated with exposure to the chemicals potentially on-site are presented below in terms of:

PEL	Permissible Exposure Limit
C	Ceiling
TLV	Threshold Limit Value [American Conference of Governmental Industrial Hygienists (ACGIH) Guidance]
STEL	Short-term Exposure Limit (ACGIH Guidance)
TWA	Time-Weighted Average

OSHA PELs, ACGIH TLVs, and TWAs are defined as concentrations for an 8-h work day, 40-h work week to which almost all workers may be repeatedly exposed, day after day, without adverse effects.

STEL is defined as the concentration to which workers can be exposed for short time periods without irritation, tissue damage, or narcosis sufficient to cause impairment of self-rescue of precipitate accidental injury. It is a 15-min TWA that should not be exceeded at any time during the workday. A C value is a concentration that should not be exceeded at any time in any workday.

The following potential exposures may exist at the site:

- skin contact with contaminated soil or water;
- inhalation of vapors; and
- ingestion of contaminated soil dusts, especially if poor personal hygiene is practiced.

Skin contact with potentially contaminated soil or water will be minimized by wearing personal protective clothing (as described in Chapter 3.0). Inhalation of vapors during excavation or water sampling will be minimized by air monitoring, engineering controls, and the use of respiratory protection if action levels are exceeded. To prevent ingestion of contaminants, proper decontamination and personal hygiene are required. Eating, drinking, chewing tobacco or gum, smoking, or applying cosmetics are prohibited, except as approved by the SSO.

A photoionization detector (PID) capable of detecting total volatile organic and chlorinated organic vapors will be used to monitor for organic and chlorinated organic vapors. The PID will be used on a continuous basis, typically every 5 to 10 min, to monitor the breathing zone in the immediate vicinity of the investigative operations.

Table 2-1. Recommended Exposure Limits and Other Properties of Hazardous Compounds Potentially Existing On-site

Organic Compounds	Exposure Limits	STEL (ppm)	IDLH[a] (ppm)	Odor Threshold (ppm)	MSDS Remark(s)
Trichloroethylene	50 ppm[b]	100 ppm	1,000 ppm	82	Inhalation of vapors may cause headache, nausea, vomiting, dizziness, drowsiness, irritation of respiratory tract, and loss of consciousness. Liquid may be irritating to skin and eyes. Prolonged skin contact may result in dermatitis. Eye contact may result in temporary corneal damage Ingestion may cause nausea, vomiting, headaches, dizziness, and gastrointestinal irritation Chronic effects of overexposure may include damage to kidneys, liver, lungs, blood, or central nervous system. Carcinogen. Colorless liquid with chloroform-like odor
Benzene	0.5 ppm	2.5 ppm	500 ppm	NA	Contact or inhalation may cause irritation to eyes, skin, respiratory system; dizziness, headache, nausea, staggered gate; anorexia; weakness; exhaustion. Potential occupational carcinogen.
Ethylbenzene	100 ppm	125 ppm	800 ppm	NA	Contact or inhalation may cause irritation to eyes, skin, respiratory system; headache; dermatitis; narcosis; coma.
Toluene	50 ppm	150 ppm	500 ppm	NA	Contact or inhalation may cause irritation to eyes, skin, respiratory system; weakness; exhaustion; confusion; euphoria; dizziness, headache, dilated pupils; discharge of tears; anxiety; liver or kidney damage.
Xylenes	50 ppm	100 ppm	1,000 ppm	NA	Contact or inhalation may cause irritation to eyes, skin, respiratory system; dizziness, excitement; drowsiness; incoordination; nausea, staggered gate; vomiting; abdominal pain.
Bentonite	0.05 mg/m^3	NA	NA	NA	Avoid breathing dusts (for minor silica component)
Gasoline	300 ppm	500 ppm	NA	NA	Contact or inhalation may cause irritation to eyes, skin, mucous membrane, respiratory system; dizziness, headache, blurred vision; slurred speech; confusion; convulsions; weakness; exhaustion. Possible liver and kidney damage. Potential occupational carcinogen.
Isopropyl alcohol (used for equipment decontamination)	400 ppm	500 ppm	2,000 ppm	NA	Contact or inhalation may cause irritation to eyes, respiratory system; drowsiness; dizziness; headache; dermatitis.
Liquinox (used for decontamination	NA	NA	NA	NA	Skin contact may prove locally irritating, causing drying and/or chapping. Ingestion may cause discomfort and/or diarrhea

Organic Compounds	Exposure Limits	STEL (ppm)	IDLH[a] (ppm)	Odor Threshold (ppm)	MSDS Remark(s)
Hydrochloric acid (used to preserve water samples)	5-ppm ceiling	NA	50 ppm	7 mg/m3	Eye: May cause irreversible eye injury. Vapor or mist may cause irritation and severe burns. Contact with liquid is corrosive to the eyes and causes severe burns. May cause painful sensitization to light. May cause conjunctivitis Skin: May be absorbed through the skin in harmful amounts. Contact with liquid is corrosive and causes severe burns and ulceration. May cause photosensitization in certain individuals Ingestion: May cause circulatory system failure. Causes severe digestive tract burns with abdominal pain, vomiting, and possible death. May cause corrosion and permanent tissue destruction of the esophagus and digestive tract Inhalation: Causes severe irritation of upper respiratory tract with coughing, burns, breathing difficulty, and possible coma. May cause pulmonary edema and severe respiratory disturbances
Nitric acid (used to preserve water samples)	2 ppm	4 ppm	25 ppm	NA	Eye: May cause irreversible eye injury. Vapor or mist may cause irritation and severe burns. Contact with liquid is corrosive to the eyes and causes severe burns. May cause painful sensitization to light. May cause conjunctivitis Skin: May be absorbed through the skin in harmful amounts. Contact with liquid is corrosive and causes severe burns and ulceration. May cause photosensitization in certain individuals Ingestion: May cause circulatory system failure. Causes severe digestive tract burns with abdominal pain, vomiting, and possible death. May cause corrosion and permanent tissue destruction of the esophagus and digestive tract Inhalation: Causes severe irritation of upper respiratory tract with coughing, burns, breathing difficulty, and possible coma. May cause pulmonary edema and severe respiratory disturbances

[a]National Institute for Occupational Safety and Health (NIOSH) *Pocket Guide to Chemical Hazards*, 2005
[b]*Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices for2008,* American Conference of Governmental Industrial Hygienists.
IDLH = Immediately dangerous to life and health.
MSDS = Material Safety Data Sheet.
NA = Not available.
ppm = Parts per million.
STEL = Short-term exposure level.

Table 2-2. Hazards Analysis

Soil Boring and Air Sparge Point/Monitroing Well Installation Using Hollow-Stem Auger and Direct-push Drilling Technology		
Personal Protective Equipment (PPE)	**Selected**	**Comments**
Safety Shoes	X	
Hard Hat	X	Within 25 feet of rig or other overhead hazards
Safety Glasses With Side Shields	X	
Fire Resistant Clothing		
Face Shields	X	If air excavating, grinding, pavement saw cutting or welding, or splash potential exists
Goggles	X	If splash potential exists
Lifeline/Body Harness		
Hearing Protection		When within 25 feet of operating air excavator or drill rig
Air Purifying Respirator		
Supplied Air Respirator – SCBA		
Welding Hood		If hot work performed
Welding/Pipe Clothing		If hot work performed
Welding Mask/Goggles		If hot work performed
Personal Floatation Device		If within 6 feet of unguarded water 3 feet or more in depth
Gloves	X	Nitrile or PVC for potentially contaminated material. Heavy duty work gloves for material handling. Leather for hot work. Class 0 or greater electrical protective gloves with leather cover for hand augering
Other	X	10.6 eV PID or equivalent monitor (calibration checked daily) during intrusive work that might generate hazardous airborne chemicals. Stop work if breathing zone readings exceed 5 ppm for more than 1 minute. CGI if combustible vapors possible above 100 ppm on PID.
Fall restraint/arrest PPE		If working from elevated surface $\geq$ 6 ft. above nest lower level
Safety Cones/Barricades	X	To control/alert traffic and exclude unauthorized personnel.
Safety Vest	X	If near active traffic areas
Knee Pads		
Caution/Danger Tape	X	As needed, to exclude unauthorized personnel
Work Activity: Soil Boring and Air Sparge Point/Monitoring Well Installation Using Hollow-Stem Auger and Direct-push Drilling Technology		
Job Steps	**Potential Hazards**	**Critical Actions**
Mobilize to work site	Traffic accident.	Compliance with EC&HS Procedure 110, Vehicle Operation (valid drivers license, seat belt use, routine vehicle inspections, no cell phone use while driving).

Rig set-up	Being struck by vehicles.	Traffic control by 36" + tall traffic cones, barricade tape, and/or sawhorse barricades (more substantial barriers required as traffic hazard increases). Vehicle(s) placed between workers and oncoming traffic. High visibility safety vests in traffic areas. Flashing rotating beacon in high traffic parking areas or brief roadwork. MUTCD compliant traffic control plan for work in road/street, roadside parking strip, sidewalk, shoulder. All required lane closure permits from local traffic control authority must be attached to individual site sheet for work in DOT right of way. Rig/fork truck equipped with functional back-up alarm. Artificial lighting provided for work after twilight.
	Contact with overhead structures or utilities.	FM will survey location and ensure absence of obstructions and overhead utilities prior to rig set-up. Rig will not be allowed to come within 10 feet of overhead power lines. At the time the mast is being towered up drill crew members should not be engaged in any other activity, the task at that time is to assist in towering up in the safest manner possible. At the time the mast is being towered down, other drill crew members should not be engaged in any other activity, the task at that time is to assist in towering down in the safest manner possible. The mast of the drill rig must be towered down before moving to the next location.
	Temperature stress.	If temperature is above 80°F or below 40°F, administrative controls will be implemented (cooled or warmed drinks, routine breaks in heated or shaded area, provisions for emergency heating or cooling).
	Lifting (musculoskeletal injuries) hazards.	Compliance with EC&HS Procedure 150, Manual Lifting. If equipment is to be moved, an evaluation of potential pinch points and/or weight strain will be conducted. Clear area of all unnecessary equipment and slip/trip hazards. Additional help will be obtained by workers or mechanical assistance used on-site if equipment to be moved is unwieldy, has a weight >50 lbs or has to be moved by maneuvering through awkward positioning.
	Falls from elevated surface ($\geq$6')	Compliance with ECHS 170, Fall Protection for working from elevated surfaces $\geq$ 6 ft. above next lower level
	Unauthorized personnel entering work zone	If structures or public access areas fall within radius of raised mast, establish a work schedule to minimize hazard to public, establish an exclusion zone boundary that unauthorized personnel cannot cross, and position drill rig so as to minimize inclusion of public access areas within work zone.
Boring and addition/ manipulation of drill string	Being struck by vehicles.	Traffic control by 36" + tall traffic cones, barricade tape, and/or sawhorse barricades (more substantial barriers required as traffic hazard increases). Vehicle(s) placed between workers and oncoming traffic. High visibility safety vests in traffic areas. Flashing rotating beacon in high traffic parking areas or brief roadwork. MUTCD compliant traffic control plan for work in road/street, roadside parking strip, sidewalk, shoulder. All required lane closure permits from local traffic control authority must be attached to individual site sheet for work in DOT right of way. Rig/fork truck equipped with functional back-up alarm. Artificial lighting provided for work after twilight.

	Rotating and/or moving equipment.	Only experienced operators. Rigs will be operated per subcontractor's standard procedures or per manufacturer's directions; all hoses and cables will be inspected daily. Rigs will have two functional kill switches or "dead-man" control. At no time should anyone work in close proximity to the rotating augers. Prior to coupling augers driller shall inspect auger joints to ensure no obvious defects that may affect auger performance. If burs are noticed on the auger ends, corrective measures must be taken, or the auger must be set aside and a different one must be used.
	Kickback	Cuttings should be removed only after drill string has come to a halt. If shoveling, long handled shovels should be used.
	Falling equipment.	No workers under suspended loads. Exclusion zone around rig. Drill string components shall be added or removed one section at a time as they are needed. Multiple drill string components shall not be added or removed from the drill string. Augers shall not be withdrawn from ground using wire rope and winch.
	Pinch	Keep hands from between drill string components. Keep fingers out of all openings.
	Unauthorized personnel entering work zone	If structures or public access areas fall within radius of raised mast, establish a work schedule to minimize hazard to public, establish an exclusion zone boundary that unauthorized personnel cannot cross, and position drill rig so as to minimize inclusion of public access areas within work zone.
	Subsurface utilities (electric shock, fire, damage to utilities)	FM will ensure that each boring location has been cleared to preclude contact with buried utilities through compliance with EC&HS Procedure 130.
	Noise	Hearing protection when within 25 ft unless equipment-specific monitoring indicates that noise levels are less than 85 decibels.
	Temperature Extremes	If temperature is above 80°F or below 40°F, administrative controls will be implemented (cooled or warmed drinks, routine breaks in heated or shaded area, provisions for emergency heating or cooling).

	Lifting (musculoskeletal injuries) hazards	Compliance with EC&HS Procedure 150, Manual Lifting. If equipment is to be moved, an evaluation of potential pinch points and/or weight strain will be conducted. Clear area of all unnecessary equipment and slip/trip hazards. Additional help will be obtained by workers or mechanical assistance used on-site if equipment to be moved is unwieldy, has a weight >50 lbs or has to be moved by maneuvering through awkward positioning.
	Fire	Fire extinguisher rated 2A and 5B (serviced annually and inspected monthly) in all fuel use areas. Hotwork controls if welding/cutting required. Treat all sewer grates/wells as possible source of flammable gas (move 35 feet away or check with PID or CGI and cover).
	Chemical exposure	Breathing zone monitoring with 10.6 eV PID; action level of 5 ppm sustained for over 1 minute. Medical clearance for hazardous waste work. 40hr HAZWOPER and current refresher for workers. 8hr additional supervisor for FM, SSHO, and all other on-site supervisors. Wash hands before eating or drinking. Nitrile gloves for chemical/contaminant contact. Chemical containers labeled with identity and hazard. MSDSs on site for all chemicals in use. Site-specific training must address chemicals, hazards, and proper handling.
Soil sampling	Being struck by vehicles.	Traffic control by 36" + tall traffic cones, barricade tape, and/or sawhorse barricades (more substantial barriers required as traffic hazard increases). Vehicle(s) placed between workers and oncoming traffic. High visibility safety vests in traffic areas. Flashing rotating beacon in high traffic parking areas or brief roadwork. MUTCD compliant traffic control plan for work in road/street, roadside parking strip, sidewalk, shoulder. All required lane closure permits from local traffic control authority must be attached to individual site sheet for work in DOT right of way. Rig/fork truck equipped with functional back-up alarm. Artificial lighting provided for work after twilight.
	Rotating and/or moving equipment.	Only experienced operators. Rigs will be operated per subcontractor's standard procedures or per manufacturer's directions; all hoses and cables will be inspected daily. Rigs will have two functional kill switches or "dead-man" control. At no time should anyone work in close proximity to the rotating augers. Prior to coupling augers driller shall inspect auger joints to ensure no obvious defects that may affect auger performance. If burs are noticed on the auger ends, corrective measures must be taken, or the auger must be set aside and a different one must be used.
	Falling equipment.	No workers under suspended loads. Exclusion zone around rig.
	Noise	Hearing protection when within 25 ft unless equipment-specific monitoring indicates that noise levels are less than 85 decibels.

	Temperature Extremes	If temperature is above 80°F or below 40°F, administrative controls will be implemented (cooled or warmed drinks, routine breaks in heated or shaded area, provisions for emergency heating or cooling).
	Lifting (musculoskeletal injuries) hazards	Compliance with EC&HS Procedure 150, Manual Lifting. If equipment is to be moved, an evaluation of potential pinch points and/or weight strain will be conducted. Clear area of all unnecessary equipment and slip/trip hazards. Additional help will be obtained by workers or mechanical assistance used on-site if equipment to be moved is unwieldy, has a weight >50 lbs or has to be moved by maneuvering through awkward positioning.
	Unauthorized personnel in work zone.	If structures or public access areas fall within radius of raised mast, establish a work schedule to minimize hazard to public, establish an exclusion zone boundary that unauthorized personnel cannot cross, and position drill rig so as to minimize inclusion of public access areas within work zone.
	Fire	Fire extinguisher rated 2A and 5B (serviced annually and inspected monthly) in all fuel use areas.
	Chemical exposure	Breathing zone monitoring with 10.2 eV PID; action level of 5 ppm sustained for over 1 minute. Medical clearance for hazardous waste work. 40hr HAZWOPER and current refresher for workers. 8hr additional supervisor for FM, SSHO, and all other on-site supervisors. Wash hands before eating or drinking. Nitrile gloves for chemical/contaminant contact. Chemical containers labeled with identity and hazard. MSDSs on site for all chemicals in use. Site-specific training must address chemicals, hazards, and proper handling.
Well construction or abandonment	Being struck by vehicles.	Traffic control by 36” + tall traffic cones, barricade tape, and/or sawhorse barricades (more substantial barriers required as traffic hazard increases). Vehicle(s) placed between workers and oncoming traffic. High visibility safety vests in traffic areas. Flashing rotating beacon in high traffic parking areas or brief roadwork. MUTCD compliant traffic control plan for work in road/street, roadside parking strip, sidewalk, shoulder. All required lane closure permits from local traffic control authority must be attached to individual site sheet for work in DOT right of way. Rig/fork truck equipped with functional back-up alarm. Artificial lighting provided for work after twilight.
	Particulate exposure	Visually monitor for dust and take action (wetting, etc.) to suppress if dust is visible in breathing zone.
	Unauthorized personnel in work zone	If structures or public access areas fall within radius of raised mast, establish a work schedule to minimize hazard to public, establish an exclusion zone boundary that unauthorized personnel cannot cross, and position drill rig so as to minimize inclusion of public access areas within work zone.

	Electric Shock	Portable electrical tools and all portable electrical equipment must be connected through ground fault circuit interrupters.
	Fire	Fire extinguisher rated 2A and 5B (serviced annually and inspected monthly) in all fuel use/hotwork areas. Clear 30 ft radius area of combustible/flammable materials during hotwork. Treat all drains/wells as possible sources of combustible/flammable materials (CGI monitor and cover).
	Temperature Stress	If temperature is above 80°F or below 40°F, administrative controls will be implemented (cooled or warmed drinks, routine breaks in heated or shaded area, provisions for emergency heating or cooling).
	Lifting (musculoskeletal injuries)	Compliance with EC&HS Procedure 150, Manual Lifting. If equipment is to be moved, an evaluation of potential pinch points and/or weight strain will be conducted. Clear area of all unnecessary equipment and slip/trip hazards. Additional help will be obtained by workers or mechanical assistance used on-site if equipment to be moved is unwieldy, has a weight >50 lbs or has to be moved by maneuvering through awkward positioning.
	Chemical Exposure	Breathing zone monitoring with 10.6 eV PID; action level of 5 ppm sustained for over 1 minute. Medical clearance for hazardous waste work. 40hr HAZWOPER and current refresher for workers. 8hr additional supervisor for FM, SSHO, and all other on-site supervisors. Wash hands before eating or drinking. Nitrile gloves for chemical/contaminant contact. Chemical containers labeled with identity and hazard. MSDSs on site for all chemicals in use. Site-specific training must address chemicals, hazards, and proper handling.
Containing and managing soil cuttings, decon fluids, purge water and other IDW	Forklift	Documented forklift training for forklift operators and daily forklift inspections. Only experienced operators will be allowed to operate equipment. No personnel under lifted loads.
	Unauthorized personnel in work zone	If structures or public access areas fall within radius of raised mast, establish a work schedule to minimize hazard to public, establish an exclusion zone boundary that unauthorized personnel cannot cross, and position drill rig so as to minimize inclusion of public access areas within work zone.
	Temperature stress	If temperature is above 80°F or below 40°F, administrative controls will be implemented (cooled or warmed drinks, routine breaks in heated or shaded area, provisions for emergency heating or cooling).
	Lifting (musculoskeletal injuries)	Compliance with EC&HS Procedure 150, Manual Lifting. If equipment is to be moved, an evaluation of potential pinch points and/or weight strain will be conducted. Clear area of all unnecessary equipment and slip/trip hazards. Additional help will be obtained by workers or mechanical assistance used on-site if equipment to be moved is unwieldy, has a weight >50 lbs or has to be moved by maneuvering through awkward positioning.

	Electric Shock	Portable electrical tools and all portable electrical equipment must be connected through ground fault circuit interrupters.
	Battery Fire/Explosion	Use only batteries that are not installed in vehicles and are not being charged during use for powering equipment. If no other battery available use vehicle battery by making the final connection away from the battery or using PTO.
	Exposure to chemicals	Breathing zone monitoring with 10.6 eV PID; action level of 5 ppm sustained for over 1 minute. Medical clearance for hazardous waste work. 40hr HAZWOPER and current refresher for workers. 8hr additional supervisor for FM, SSHO, and all other on-site supervisors. Wash hands before eating or drinking. Nitrile gloves for chemical/contaminant contact. Chemical containers labeled with identity and hazard. MSDSs on site for all chemicals in use. Site-specific training must address chemicals, hazards, and proper handling.
	IDW control	Label or mark IDW containers to indicate container number, contents (including physical state), investigation location, date of collection, and client name. Ensure that storage area provides adequate protection against physical damage or disturbance.
Work Activity: Trenching and Air Sparge Line Installation		
Personal Protective Equipment (PPE)	**Selected**	**Comments**
Safety Shoes	X	
Hard Hat	X	
Safety Glasses	X	
Fire Resistant Clothing		
Face Shields		
Goggles		
Lifeline/Body Harness		
Hearing Protection		
Air Purifying Respirator	X	If necessary
Supplied Air Respirator – SCBA		
Welding Hood		
Welding/Pipe Clothing		
Welding Mask/Goggles		
Personal Floatation Device		
Gloves	X	Nitrile or similar for potentially contaminated material. Heavy duty work gloves for material handling.
Other		
Safety Cones/Barricades	X	As necessary, to control/alert traffic and exclude unauthorized personnel

Safety Vest	X	
Knee Pads		
Caution Tape	X	As needed, to exclude unauthorized personnel
Work Activity: Trenching and Air Sparge Line Installation		
Job Steps	**Potential Hazard**	**Critical Actions**
Mobilize to work site	Traffic accident	Compliance with EC&HS Procedure 110, Vehicle Operation (valid drivers license, seat belt use, routine vehicle inspections, no cell phone use while driving).
Equipment set-up	Being struck by vehicles	Traffic control by 36" + tall traffic cones, barricade tape, and/or sawhorse barricades. Vehicle(s) placed between workers and oncoming traffic. Personnel will wear safety vests. Heavy equipment equipped with functional back-up alarm. Comply with traffic control plans
	Struck by moving/mobile equipment	Workers will maintain a safe distance equivalent to the full, extended reach of all moving/mobile equipment. Approach mobile/moving equipment only after getting permission of the operator. Maintain visual contact with equipment operators at all times. Functional backup alarms required on all mobile equipment.
	Temperature stress	If temperature is above 80°F or below 40°F, administrative controls will be implemented (cooled or warmed drinks, routine breaks in heated or shaded area, provisions for emergency heating or cooling).
	Noise	Hearing protection when within 25 ft of operating generators or heavy equipment unless equipment-specific monitoring indicates that noise levels are less than 85 decibels.
	Falls	Compliance with ECHS 170, Fall Protection. Prior to each use portable ladders shall be inspected to be free of defects and slippery contamination. The area shall be free of debris and surfaces shall not be slippery that ladders are set on. Ladders shall be of sufficient height to allow workers to perform required tasks without standing above the next to the last step below the top. Workers shall wear non-slip soled shoes/boots with separate heels when climbing on or working from ladders. Ladders shall be positioned to allow workers to perform tasks without reaching/leaning beyond the bounds of the ladder. If ladders must be repositioned to allow this workers must climb down before repositioning the ladder. Fall restraint/arrest PPE required for work off of ladders above 6 ft.
	Lifting (musculoskeletal injuries) hazards	Compliance with EC&HS Procedure 150, Manual Lifting. If equipment is to be moved, an evaluation of potential pinch points and/or weight strain will be conducted. Clear area of all unnecessary equipment and slip/trip hazards. Additional help will be obtained by workers or mechanical assistance used on-site if equipment to be moved is unwieldy, has a weight >50 lbs or has to be moved by maneuvering through awkward positioning.
Operations in excavation,	Falling equipment	No workers under suspended loads.

trenching and heavy equipment areas	Struck by moving/mobile equipment	Workers will maintain a safe distance equivalent to the full, extended reach of all moving/mobile equipment. Approach mobile/moving equipment only after getting permission of the operator. Maintain visual contact with equipment operators at all times. Functional backup alarms required on all mobile equipment.
	Noise	Hearing protection when within 25 ft of operating generators or heavy equipment unless equipment-specific monitoring indicates that noise levels are less than 85 decibels.
	Temperature Extremes	If temperature is above 80°F or below 40°F, administrative controls will be implemented (cooled or warmed drinks, routine breaks in heated or shaded area, provisions for emergency heating or cooling).
	Lifting (musculoskeletal injuries) hazards	Compliance with EC&HS Procedure 150, Manual Lifting. If equipment is to be moved, an evaluation of potential pinch points and/or weight strain will be conducted. Clear area of all unnecessary equipment and slip/trip hazards. Additional help will be obtained by workers or mechanical assistance used on-site if equipment to be moved is unwieldy, has a weight >50 lbs or has to be moved by maneuvering through awkward positioning.
	Pinch hazards	Keep hands clear of all articulated or moving parts. Guards shall be maintained for all machinery representing a pinch hazard. Maintenance on equipment with articulating or moving parts shall be performed only after control keys have been put under control by competent mechanics/operators only.
	Fire	Fire extinguisher rated 2A and 5B (serviced annually and inspected monthly) in all fuel use areas.
	Chemical exposure	Breathing zone monitoring with 10.6 eV PID if free product anticipated; action level of 5 ppm sustained for over 1 minute. Medical clearance for hazardous waste work. Wash hands before eating or drinking. Hazard communication labels on all chemical containers. MSDSs on site for all chemicals in use. Site-specific training must address chemicals, hazards, and proper handling. 40hr HAZWOPER and current refresher for workers. 8hr additional supervisor for FM, SSHO, and all other on-site supervisors. Nitrile gloves for chemical/contaminant contact.
	Excavation collapse	Compliance with ECHS 160, Excavation Safety. No SAIC personnel will enter any excavation or trenches deeper than 4 feet from ground surface. All equipment shall be kept away from the edge of the excavation to prevent cave-in. All personnel will remain a minimum of 6 feet from the edge of any excavation.
Work Activity: O&M of Air Sparge Remediation System		
Personal Protective Equipment (PPE)	**Selected**	**Comments**
Safety Shoes	X	
Hard Hat	X	As necessary
Safety Glasses With Side Shields	X	
Fire Resistant Clothing		
Face Shields	X	As needed if free product, water conditioning or bulk corrosives handling

Goggles	X	If splash potential, pouring corrosives or free product recovery
Lifeline/Body Harness		
Hearing Protection	X	When inside operating treatment enclosure
Air Purifying Respirator		
Supplied Air Respirator – SCBA		
Welding Hood		
Welding/Pipe Clothing		
Welding Mask/Goggles		
Personal Floatation Device		
Gloves	X	Nitrile or PVC for potentially contaminated material. Heavy duty work gloves for material handling.
Other	X	10.6 eV PID or equivalent monitor (calibration checked daily) to monitor the breathing zone inside the treatment building. Stop work if breathing zone readings exceed 5 ppm for more than 1minute.
Fall restraint/arrest PPE		If working from elevated surface $\geq$ 4 ft. ($\geq$ 6 ft. during construction) above nest lower level
Safety Cones/Barricades	X	As needed when checking monitoring points and wells.
Safety Vest	X	As necessary for traffic safety
Knee Pads		
Caution Tape		
Work Activity: O&M of Air Sparge Remediation System		
Job Steps	**Potential Hazard**	**Critical Actions**
Mobilize to work site	Traffic accident.	Compliance with EC&HS Procedure 110, Vehicle Operation (valid drivers license, seat belt use, routine vehicle inspections, no cell phone use while driving).
O&M of system:	General safety hazards (moving equipment, slips, falls, traffic, etc)	All equipment will be operated per contractor's standard procedures and/or manufacturer's directions. For set up of portable treatment systems: traffic control by 36" + tall traffic cones, barricade tape, and/or sawhorse barricades utilized to isolate work area; all vehicle(s) placed between workers and oncoming traffic; all vehicles equipped with functional back-up alarms. All portable equipment will be locked and blocked for the duration of the treatment event. For fixed systems, inspect and evaluate exterior and interior of work area for potential hazards prior to initiation of all work.
	Contact with overhead structures or utilities.	FM will survey location and ensure absence of obstructions and overhead utilities prior to portable equipment set-up; equipment will not be allowed to come within 10 feet of overhead power lines

	Fire/Explosion	Blowers must be explosion proof or otherwise certified as safe for this application. All monitoring equipment must be intrinsically safe, fire proof, or otherwise certified for this use. No ignition sources within treatment enclosures or near monitoring points. Treatment system areas will be equipped with clearly identified "no smoking or open flames" signage if there is any potential for unauthorized or untrained personnel to approach.
	Hazardous Energy (electrical/mechanical/ pressure)	Only qualified experienced personnel are authorized to perform all required work operations. Exercise caution around all operating equipment while conducting monitoring and maintenance operations on active systems; immediate hazards include hi-temp equipment, hi and lo pressure sources, rotating and belt driven equipment, and chemical exposures. Apply ECHS Procedure 11, LOTO, for control of hazardous energy (pressure, rotating machinery, etc.). Insure all equipment is completely secured, de-energized, and de-pressurized before initiating any maintenance activities. Replace all guards and secure all equipment panels prior to removal of lock out protection.
	Burns	Review manual to identify, and maintain vigilance for, high temperature components (e.g. thermal destruction systems, cat-ox burners, blower housings, exhaust stacks). Ensure warning signs in place on high temperature components. Wear long sleeves when working around hot high temperature components. Deenergize high temperature components and allow to cool before servicing.
	Temperature stress	If temperature is above 80°F or below 40°F, administrative controls will be implemented (cooled or warmed drinks, routine breaks in heated or shaded area, provisions for emergency heating or cooling).
	Electric shock	Portable electrical tools and all portable electrical equipment that poses a shock hazard must be connected through ground fault circuit interrupters. Deenergize and isolate sources of hazardous electrical energy per ECHS Procedure 11 if servicing electrical systems. Physical buddy system required if servicing electrical systems. If fuses are to replaced, the main breaker for the system will be turned off, and the circuit will be verified as off using a current detector (multimeter or otherwise). If electrical work beyond the scope of typical maintenance is required, an electrician will be obtained. . Only fiberglass ladders to be used.
	Lifting (muskuloskeletal injuries)	Compliance with EC&HS Procedure 150, Manual Lifting. If equipment is to be moved, an evaluation of potential pinch points and/or weight strain will be conducted. Clear area of all unnecessary equipment and slip/trip hazards. Additional help will be obtained by workers or mechanical assistance used on-site if equipment to be moved is unwieldy, has a weight >50 lbs or has to be moved by maneuvering through awkward positioning.
	Falls	Compliance with ECHS 170, Fall Protection. Use portable ladders instead of climbing on equipment. Prior to each use portable ladders shall be inspected to be free of defects and slippery contamination. The area shall be free of debris and surfaces shall not be slippery that ladders are set on. Ladders shall be of sufficient height to allow workers to perform required tasks without standing above the next to the last step below the top. Workers shall wear non-slip soled shoes/boots with separate heels when climbing on or working from ladders. Ladders shall be positioned to allow workers to perform tasks without reaching/leaning beyond bounds of ladder. If ladders must be repositioned to allow this workers must climb down before repositioning the ladder. Fall restraint/arrest PPE required for work off of ladders above 4 ft (6 ft. if construction).

	Falling materials	All tools and equipment shall be placed on tray of non-metalic step ladder. Materials shall be not be carried up ladders in the worker's hands. Heavy equipment, parts or tools shall be secured by a protective line attached to a sturdy anchorage so as to prevent items from falling on workers.Cones shall be placed on each side of ladders when working in walkways to warn passersby. Workers shall not walk under ladders.
	Noise	Hearing protection when within 25 ft of operating generators or heavy equipment unless equipment-specific monitoring indicates that noise levels are less than 85 decibels.
	Fire	Fire extinguisher rated 2A and 5B (serviced annually and inspected monthly) in all fuel use/hotwork areas. Clear 30 ft radius area of combustible/flammable materials during hotwork. Treat all drains as possible sources of combustible/flammable materials (CGI monitor and cover).
	Exposure to chemicals	Site training must include hazards and controls for site contaminants and all chemicals used on site. Current 40 hour and 8 hour refresher hazardous waste safety training and site-specific training. Additional 8 hour HAZWOPERR supervisor training for on site supervisory personnel. PPE (Level D) plus nitrile or equivalent gloves for contact with chemicals or contaminated materials. Washing hands prior to taking anything by mouth. MSDSs for chemicals on site. Chemical containers labeled to indicate contents and hazard. Breathing zone monitoring with 10.6 eV PID for initial entry. Stop work if breathing zone readings exceed 5 ppm for more than 1 minute. 15-minute eyewash must be within 20 feet if pouring/using corrosives. Eyewash bottle must be within 10 feet if adding water samples to pre-preserved containers.
Work Activity: Groundwater Sampling, Well Development		
Personal Protective Equipment (PPE)	**Selected**	**Comments**
Safety Shoes	X	
Hard Hat	X	If overhead hazards are present
Safety Glasses With Side Shields	X	
Fire Resistant Clothing		
Face Shields	X	As needed if free product or bulk corrosives handling
Goggles	X	If splash potential, pouring corrosives or free product recovery
Lifeline/Body Harness		
Hearing Protection	X	As necessary
Air Purifying Respirator		
Supplied Air Respirator – SCBA		
Welding Hood		
Welding/Pipe Clothing		
Welding Mask/Goggles		

Personal Floatation Device		
Gloves	X	Nitrile, PVC or similar for potentially contaminated material. Heavy duty work gloves for material handling.
Other	X	10.6 eV PID (calibration checked daily) monitoring if free product is encountered or anticipated. Stop work if breathing zone readings exceed 5 ppm for more than 1 minute.
Safety Cones/Barricades	X	To control/alert traffic and exclude unauthorized personnel
Safety Vest		As necessary for traffic safety
Knee Pads		
Caution Tape	X	As needed, to exclude unauthorized personnel
Work Activity: Groundwater Sampling, Well Development		
Job Steps	**Potential Hazard**	**Critical Actions**
Mobilize to work site	Traffic accident.	Compliance with EC&HS Procedure 110, Vehicle Operation (valid drivers license, seat belt use, routine vehicle inspections, no cell phone use while driving).
Groundwater monitoring and sampling	Being struck by vehicles.	Traffic control by 36" + tall traffic cones, barricade tape, and/or sawhorse barricades (more substantial barriers required as traffic hazard increases). Vehicle(s) placed between workers and oncoming traffic. High visibility safety vests in traffic areas. Flashing rotating beacon in high traffic parking areas or brief roadwork. MUTCD compliant traffic control plan for work in road/street, roadside parking strip, sidewalk, shoulder. All required lane closure permits from local traffic control authority must be attached to individual site sheet for work in DOT right of way. Rig/fork truck equipped with functional back-up alarm. Artificial lighting provided for work after twilight.
	Temperature stress.	If temperature is above 80°F or below 40°F, administrative controls will be implemented (cooled or warmed drinks, routine breaks in heated or shaded area, provisions for emergency heating or cooling).
	Lifting (musculoskeletal injuries)	Compliance with EC&HS Procedure 150, Manual Lifting. If equipment is to be moved, an evaluation of potential pinch points and/or weight strain will be conducted. Clear area of all unnecessary equipment and slip/trip hazards. Additional help will be obtained by workers or mechanical assistance used on-site if equipment to be moved is unwieldy, has a weight >50 lbs or has to be moved by maneuvering through awkward positioning.
	Electric shock.	Portable electrical tools and all portable electrical equipment that poses a shock hazard must be connected through ground fault circuit interrupters.
	Battery Fire/Explosion	Use only batteries that are not installed in vehicles and are not being charged during use for powering equipment. If no other battery available use vehicle battery by making the final connection away from the battery or using PTO.
	Fire	Fire extinguisher rated 2A and 5B (serviced annually and inspected monthly) in all fuel use areas.

	Chemical exposure	Breathing zone monitoring with 10.2 eV PID if free product is anticipated. Stop work if breathing zone readings exceed 5 ppm for more than 1 minute. Medical clearance for hazardous waste work. 40hr HAZWOPER and current refresher for workers. 8hr additional supervisor for FM, SSHO, and all other on-site supervisors. Wash hands before eating or drinking. Nitrile gloves for chemical/contaminant contact. Chemical containers labeled with identity and hazard. MSDSs on site for all chemicals in use. Site-specific training must address chemicals, hazards, and proper handling. 15-minute eyewash must be within 20 feet if pouring corrosives. Eyewash bottle must be within 10 feet if adding water samples to pre-preserved containers.
	IDW Control	Label or mark IDW containers to indicate container number, contents (including physical state), investigation location, date of collection, and client name. Ensure that storage area provides adequate protection against physical damage or disturbance.
	Hazardous material shipping	Samples of floating product must be shipped as DOT-regulated flammable materials. See FTP 651 for guidance.

dBA = Decibels as recorded on the A-weighted scale of a standard sound level meter.
DOT = U.S. Department of Energy.
EC&HS = Environmental Compliance and Health and Safety Program.
EEMG = Engineering and Environmental Management Group.
FM = Field Manager.
FTP = Field Technical Procedure.
GFCI = Ground fault circuit interrupter.
HAZWOPER = Hazardous Waste Operations and Emergency Response.
MSDS = Material Safety Data Sheet.
PID = Photoionization detector.
PPE = Personal protective equipment.
ppm = Parts per million.
PVC = Polyvinyl chloride.
SSO = Site Safety and Health Officer.

2.2 PHYSICAL HAZARDS

2.2.1 Construction Hazards

Employees must implement safe work practices in accordance with OSHA regulations while working on-site. In addition to the hazardous substances and environments present on-site, other physical hazards may exist from the drilling and sampling process, including risk of injury while working in or around heavy equipment. Work areas must be kept clear of stockpiled materials. Work areas will be barricaded to protect both public and operational personnel.

2.2.2 Heavy Equipment

Operation of heavy equipment in drilling activities presents potential physical hazards to personnel. Only experienced trained personnel shall operate heavy equipment. Affected personnel shall stay two times the greatest extended length of any piece of equipment away unless given specific permission to approach by the operator. PPE such as steel-toed shoes, safety glasses or goggles, and hard hats should be worn whenever such equipment is present. Personnel should, at all times, be aware of the location and operation of heavy equipment and take precautions to avoid getting in the way of their operation. Traffic safety vests should be worn by personnel working near heavy equipment.

2.2.3 Noise Hazards

The primary noise hazard at this site is from the heavy equipment. All personnel within 25 ft of operating equipment shall wear hearing protective devices (either muffs or plugs). The Site Manager or SSO will determine and enforce any other noise protection requirements deemed appropriate.

2.2.4 Fire/Explosion

Field activities could cause sparking. Flammable liquids are present in the form of diesel and gasoline for operation of equipment, and potential petroleum wastes and solvents. A PID will be used to monitor the work area atmosphere, as determined by the PM and SSO.

2.2.5 Temperature Extremes

The use of protective equipment, if required, may create heat stress. Monitoring of personnel wearing personal protective clothing should commence when the ambient temperature is 70°F or above. Monitoring requirements are presented in Section 3.4.2 of this HSP.

Cold stress may also be a hazard due to the time of year fieldwork is proposed. NYANG has multiple heated buildings and warm fluids available to offset cold-induced hazards. Unscheduled breaks in work will be taken on an as-needed basis to ensure site workers maintain a comfort level against cold conditions.

2.2.6 Severe Weather

Work will be stopped during sever weather which could include strong storms, lightening, or intense temperature extremes. A secure assembly point will be identified in health and safety briefings in the event that the site must be evacuated due to severe weather.

2.2.7 Hand and Power Tools

Portable electrical tools will be connected through a Ground Fault Circuit Interrupter. No energized electrical components will be exposed to potential personnel contact. Conductive materials (drill rigs, back hoes, ladders, etc.) will be kept at least 10 feet from overhead power lines. ECHS Procedure 11 Lock out/tag out procedures will be employed when servicing any energized systems.

2.2.8 Electrical Safety

Prior to any conducting electrical work, energized sources must be verified locked-out and tagged-out.. See EC&HS Procedure 190 for details.

2.2.9 Underground Utilities

Prior to any excavation or drilling, the location must be verified free of subsurface assets (tanks) or utilities. See EC&HS Procedure 130 and 170 for details.

2.3 BIOLOGICAL HAZARDS

2.3.1 Ticks and Lyme Disease

Lyme disease, associated with bites from deer ticks, is most prevalent in the eastern United States. These ticks are believed to be the main carriers of the disease and have been found on and spread by deer, household pets, birds, and other warm-blooded animals.

Prevention of Lyme disease consists of repelling ticks and preventing tick bites. The only recognized repellent is N,N-diethyl-m-toluamide (DEET). DEET is generally considered to be safe and is used in a variety of over-the-counter insect and tick repellents.

2.3.2 Poisonous Plants

Poison ivy and poison oak may be present at the site. Personnel should be educated on the appearance of these plants to reduce chance of contact.

2.3.3 Animals

Insects such as bees and wasps may be found on-site. Personnel who may have allergic reactions should keep their personal first aid kit on-site.

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3.0 PERSONNEL PROTECTION AND MONITORING

3.1 MEDICAL SURVEILLANCE

All personnel on the site will have successfully completed a pre-placement or periodic/update physical examination within the last 12 months. This examination will comply with EC&HS Procedure 20 and 29 *CFR* 1910.120 medical requirements for hazardous waste site workers. The contractor shall employ a licensed occupational health physician with knowledge and experience in the hazards associated with the project to provide the medical examinations and surveillance herein.

Subcontractors shall be responsible for medical surveillance of their employees and providing documentation to the SSO.

3.2 SITE-SPECIFIC TRAINING

The SSO will be responsible for ensuring required training is provided to employees. Documentation and certification must be provided to the SSO.

3.3 PERSONAL PROTECTIVE EQUIPMENT

Level D protection will be worn for initial entry of personnel into the site and initially for all activities. Level D protection consists of

- standard work clothes (Tyvek™ coveralls are recommended if there is a possibility of contact with contaminated soils);
- safety glasses;
- safety boots;
- nitrile, latex, or vinyl gloves – mandatory during all sampling activities;
- hard hat; and
- splash protection if contact with contaminated liquid is possible.

3.4 MONITORING REQUIREMENTS

3.4.1 Routine Monitoring for Organic Vapors

Monitoring for organic vapors in the breathing zone will be conducted with a PID with a 10.2 probe or a flame ionization detector instrument capable of detecting total volatile organic and chlorinated organic vapors. Readings will be taken under the following circumstances:

- upon initial entry onto the site,
- when weather conditions change,

- while work is in progress on the site, and
- when work begins on another portion of the site.

3.4.2 Monitoring for Temperature Extremes

Temperature stress hazards will be controlled, as required, by guidance from the ACGIH temperature stress guidelines (ACGIH 2008), modified to fit SAIC's activities.

It is the responsibility of the SSO and each crew member to ensure that temperature stress controls are adequate for the site conditions and tasks. All crew members (and specifically the SSO) are empowered and expected to stop or modify work and to take any necessary precautions to prevent temperature-related illnesses. This responsibility is in addition to the controls presented in this section.

The ambient temperature will be measured at 2-h intervals during the day using a dry-bulb thermometer or a wet-bulb globe temperature index monitor placed at the work location and in the same conditions experienced by the workers. If the temperatures reach or exceed 70ºF or reach or fall below 40ºF, temperature stress controls will be implemented. All temperature monitoring results, physiological monitoring results (e.g., pulse rates, oral temperature, ear canal temperature), and temperature stress controls (e.g., breaks, fluids, heated or cooled rest areas) will be documented in field records using logbooks, the inspection form in Attachment 1, or other equivalent method.

3.4.2.1 Heat stress

General controls for the prevention of heat-stress-induced illness include making fluids readily available, using the buddy system, taking scheduled or unscheduled breaks in a cooler area, providing shade, scheduling work during cooler parts of the day, providing forced ventilation, encouraging physical fitness, and application of prudent judgment by the SSO and crew. Specific requirements include those below, and are shown in Tables 3-1 and 3-2.

1. If ambient temperatures reach or exceed 70ºF, workers will be allowed to take unscheduled breaks, as needed, in a cooler area. A break is defined as minimal physical activity (sitting or standing) and should be accomplished in the shade, if possible.

2. If ambient temperatures reach or exceed, or are expected to reach or exceed, 70ºF, site-specific training will include heat-stress recognition and control and first aid for heat-stress-induced illnesses.

3. If ambient temperatures reach or exceed, or are expected to reach or exceed, 70ºF, cooled water and Gatorade® or equivalent drink will be made conveniently available to site workers, and site workers will be encouraged to drink frequently.

4. If personnel are required to use impermeable protective clothing at ambient temperatures exceeding 70ºF, a physiological monitoring (e.g., pulse rate, ear canal temperature, or oral temperature) protocol will be implemented, as specified in Table 3-1. Physiological monitoring will be performed within 1 min of stopping work. The action levels and appropriate actions are presented in Table 3-2.

Table 3-1. Maximum Intervals for Physiological Monitoring of Heat Strain

Dry-Bulb Temperature or WBGT (°F)	Work Time (minutes) Impervious Clothing – PPE		
	Light[a]	Moderate[b]	Heavy[c]
Less than 70	NL	NL	NL
70 to 74.9	120	90	60
75 to 79.9	90	60	45
80 to 84.9	60	45	30
85 to 89.9	45	30	15
90 to 94.9	30	15	10
95 to 99.9	15	10	5
100 to 104.9	Not allowed	Not allowed	Not allowed
105 or more	Not allowed	Not allowed	Not allowed

Note: The length of breaks associated with physiological monitoring will be determined by the results of physiological monitoring coupled with the Site Safety Officer's judgment of site conditions, worker fitness, other controls such as cooling systems or fans, and other relevant factors.

[a]Light work consists of performing light hand or arm work. Examples include preparing and packaging samples, classifying subsurface soil samples, supervising a sampling crew, operating a drill rig or other heavy equipment, and assisting the driller. The work performed by the driller, driller's helper, sample manager, and geologist during subsurface soil sampling is typically light work.

[b]Moderate work consists of walking, lifting, or pushing for more than 50% of the work period. Tasks such as those of the driller's helper during well installation meet this definition if the physical work occupies more than 50% of the work period.

[c]Heavy work consists of pick-and-shovel work or similar strenuous activity that takes place over more than 50% of the work period. Manual brush clearing, hand augering, manual drum moving, and similar tasks fall in this category if they meet the time requirement.

NL = No limit.

PPE = Personal protective equipment.

WBGT = Wet-bulb globe temperature.

Table 3-2. Action Levels for Physiological Monitoring of Heat Strain

Action Levels	Action
Monitoring results below action level: –pulse rate ≤110 beats per minute –ear canal temperature ≤100°F –oral temperature ≤ 99.6°F	Return to work
Monitoring results exceeding action level: –pulse rate >110 beats per minute –ear canal temperature >100°F –oral temperature > 99.6°F	Rest in shaded or air-conditioned area until monitoring results fall below action levels. Re-measure (pulse rate or temperature) after 5 min of rest
Monitoring results exceeding action level after 5 min of rest: –pulse rate >110 beats per minute –ear canal temperature >100°F –oral temperature > 99.6°F	Implement additional heat-stress controls, potentially including shading the work area, rearranging the task to share workload, providing personal cooling devices, modifying PPE, or shortening the work cycle by one-third

PPE = Personal protective equipment.

3.4.2.2 Cold stress

Critical factors in preventing cold stress disorders are adequate clothing and staying dry. The SSO and FOM will ensure the capability to quickly move individuals who become wet to a sheltered, warm area. The following specific steps will be taken [adapted from the ACGIH TLV booklet (ACGIH 2008)]:

- If ambient temperatures are 40ºF or below, site training will include prevention of cold injury, cold-injury symptoms, and cold-injury first aid.

- If ambient temperatures are 40ºF or below, and there is a potential for workers to become significantly wet (splashed or soaked), the SSO will ensure that at least one of the following controls is in place: (1) a sufficient supply of dry, warm clothing is immediately available; (2) employees wear clothing appropriate for water contact (e.g., immersion-survival suits, neoprene chest waders, wet suit); or (3) a heated break area is immediately available.

- A heated break area will be provided if ambient temperatures are below 32ºF.

- At a minimum, breaks will be taken in a warm area every 120 min if ambient temperatures are below 32ºF.

- Workers will be allowed to take unscheduled breaks, if needed, in a warm area.

If the equivalent chill temperature (temperature combined with the effect of wind) is less than -29ºF, outdoor work will be discontinued or effective engineering controls such as windscreens, temporary shelters, or portable heating units will be used.

3.5 DUST CONTROL

If drilling operations or other forms of excavation generate a sustained visible dust cloud, a water mist will be applied to reduce dust generation. If the mist is not effective in reducing dust generation, personnel will don N-95 respirators.

4.0 SITE CONTROL MEASURES, ACCIDENT PREVENTION, AND CONTINGENCY PLAN

4.1 SITE CONTROL MEASURES

The site control measures discussed in this section will be implemented to minimize potential contamination of workers, protect the public from potential site hazards, and to control access to the sites. Site control involves the physical arrangement and control of the operation zones and the methods for removing contaminants from workers and equipment.

Barricades and barricade tape will be used to delineate an exclusion zone around a drilling area. The barriers should be set in a 25-ft radius (as practical) around the work area. An opening in the barricades at the support zone (upwind of the equipment) will serve as the personnel and equipment exit point. All entries to and exits from the drilling work area will be made at this opening to control potential sources of contamination.

The SSO will ensure that all site visitors are logged in the project notebook and that all personnel who enter the work zone do so only with permission of the SSO after a field briefing of the current activities and potential site hazards.

4.2 SAFE WORK PRACTICES

To ensure a strong safety awareness program during all field activities, personnel must have adequate training, this HSP must be communicated to the employees, and standing orders must be developed and communicated to the on-site personnel. Standing orders for personnel entering the exclusion zone are as follows:

- Eating, drinking, chewing gum, or tobacco and smoking are prohibited in the contaminated or potentially contaminated area where the possibility for transfer of contamination exists.
- Matches or lighters are prohibited in the zone.
- No personal vehicles are allowed in either the exclusion or contamination reduction zones.
- Check in and check out are mandatory at access control points.
- The buddy system will be used at all times when performing sampling for hazardous material.
- All PPE will be used as specified.
- Discovery of unusual or unexpected conditions will result in immediate evaluation and reassessment of site conditions and health and safety practices.
- Conduct site-specific pre-entry safety briefings prior to on-site work.
- All field crew members should make use of their senses to alert them to potentially dangerous situations in which they should not become involved (i.e., presence of strong, irritating, or nauseating odors).

- Prevent, to the extent possible, spillages. In the event spillage occurs, contain liquid if possible.

- Prevent splashing of the contaminated materials.

The following guidelines will be followed while working on-site:

- Heavy equipment: Only qualified operators will be allowed to operate heavy equipment. Subcontractors will be required to use the safe work guidelines included in the OSHA General Industry (29 *CFR* 1910) and Construction Industry (29 *CFR* 1926) Standards.

- Power lines: When operating heavy equipment, such as direct-push rigs, near power lines, workers will take care to ensure that the boom or rigging is always kept at a safe distance from power lines (20-ft minimum). Any underground utility lines must also be located and appropriate precautions taken before any drilling is done.All operations will follow the requirements of E2I EC&HS Procedure 190.

- Electrical equipment: All electrical equipment will be properly grounded and class approved for the location. All operations will follow the requirements of E2I EC&HS Procedure 190.

- Machine guarding: All machinery on-site will be properly guarded to prevent contact with rotating shafts, blades, or gears. All operations will follow the requirements of E2I EC&HS Procedure 230.

- Flammable materials: When work involves flammable materials, adequate ventilating and control of all ignition sources will be maintained. This may include
  - nonsparking tools,
  - explosion-proof equipment (intrinsically safe),
  - class-approved electrical equipment,
  - no smoking or open lights, and
  - no welding.

  All operations will follow the requirements of E2I EC&HS Procedure 260.

4.3 HEAVY EQUIPMENT OPERATIONS

Before any drilling activity, efforts will be made to determine whether underground installations will be encountered and, if so, where these installations are located. Hard hats and safety boots, at a minimum, must be worn within 50 ft of the drill rig. The FOM or SSO will provide constant on-site supervision of the drilling subcontractor to ensure that all health and safety requirements are being met. If deficiencies are noted, work will be stopped and corrective action will be taken (i.e., retrain and purchase additional safety equipment). Reports of health and safety deficiencies and the corrective action taken will be forwarded to the PM.

4.4 COMMUNICATION

A communication network must be set up to alert site personnel of emergencies and to summon outside emergency assistance. Where voice communication is not feasible, an alarm system (i.e., sirens, horns, etc.) should be set up to alert employees of emergencies. Radio communication may also be used to communicate with personnel in the exclusion zone. Where phone service is not readily available, radios or portable phones should be used to communicate with outside agencies. Site personnel should be trained on the use

of the site emergency communication network. Emergency phone numbers should be posted on or near the phone or radio used for outside communication. The SSO is responsible for establishing the communication network before the start of work and for explaining it to all site personnel during the site safety briefing.

4.5 PERSONAL INJURY

In case of personal injury at the site, the following procedures will be followed:

- Another team member (buddy) will signal the field team leader that an injury has occurred.
- A field team member trained in first aid can administer treatment to an injured worker.
- The victim will then be transported to the nearest hospital or medical center. If necessary, an ambulance will be called to transport the victim.
- The FOM or SSO is responsible for making certain that an accident report form is completed. This form is to be submitted to the Corporate Health and Safety Manager (CHSM) and the Human Resources Director. Follow-up action must be taken to correct the situation that caused the accident.
- All personal injury must be reported in writing to the CHSM and the Human Resources Director. The SSO or FOM is responsible for completing the accident report form included in Attachment 1.
- Contact the appropriate personnel per the contact list (Attachment 2) and following the guidance in the Emergency Response Plan (Attachment 3).

4.6 INCIDENT REPORT

In the event of an injury or illness, work is to be stopped until the SSO and the CHSM have determined the cause of the incident and have taken the appropriate action. Any injury or illness, regardless of severity, is to be reported. Incidents will be reported and investigated following EC&HS Procedure 24 and E2I EC&HS Procedure 4.1.

4.7 SPILL OR HAZARDOUS MATERIALS RELEASE

Small spills are to be immediately reported to the SSO and dealt with according to the chemical manufacturer's recommended procedures. Spills or release of hazardous materials, which result in human exposure or off-site environmental contamination, are to be promptly reported by the SSO to the proper authorities and appropriate measures taken to contain and/or collect the material for approved storage and disposal.

4.8 RECORD KEEPING

All personnel will review the HSP before beginning field activities. The SSO and the PM are responsible for documenting training.

The SSO will conduct a Site Safety Briefing prior to each shift. All attendees shall sign the attendance sheet.

Any accident or exposure incident will be investigated and a report prepared according to Sections 4.5 through 4.7 of this HSP.

All instrument readings and calibrations, PPE use and changes, health and safety-related issues, and deviations from or problems with this HSP will be recorded in the Site Logbook.

4.9 MATERIAL SAFETY DATA SHEETS/EMPLOYEE "RIGHT-TO-KNOW"

As part of the Corporate Hazard Communication Program, Materials Safety Data Sheets (MSDSs) are to be kept on every hazardous material or wastes encountered at the work site. This will include any hazardous material purchased for calibration gas or decontamination purposes. The MSDSs are to be used to provide employees and subcontractors with information on the hazardous materials or wastes. The MSDSs for this work will be maintained in a central work area identified in the site-specific training.

5.0 REFERENCES

ACGIH (American Conference of Governmental Industrial Hygienists) 2008. *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.*

NIOSH (National Institute for Occupational Safety and Health) 2005. *Pocket Guide to Chemical Hazards*.

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ATTACHMENT 1
REPORTING FORMS

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EQUIPMENT CALIBRATION

PROJECT NAME: **PROJECT NO:**

IDENTIFIER	DESCRIPTION	BACKGROUND READING	PRE	ADJUSTMENT (IF NEEDED)	POST	NAME	DATE

TAILGATE SAFETY MEETING LOG		
PROJECT NAME:	**PROJECT NO:**	
DATE: M Tu W Th F Sa Su TIME:		
WEATHER:		
WORKING CONDITIONS:		
PPE:		
ITEMS DISCUSSED:		
THE FOLLOWING INDIVIDUALS ATTENDED THE DAILY TAILGATE SAFETY MEETING (SIGNATURES)		

_____

SITE SAFETY AND HEALTH OFFICER

ATTACHMENT 2
EMERGENCY CONTACTS AND
AIR MONITORING ACTION LEVELS

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EMERGENCY CONTACTS

In the event of any situation or unplanned occurrence requiring assistance, the appropriate contact(s) will be made from the list below. For emergency situations, contact will first be made with the Field Operations Manager, who will notify emergency personnel, and then contact the appropriate response teams. This emergency contacts list must be kept in an easily accessible location at the site.

106th Rescue Wing, New York Air National Guard

Contact	Phone Number
Jerry Webb, Lt. Col	(631) 288-7349
Fire Department	(631) 288-7534
Security	(631) 288-7478
Ambulance	(631) 288-7333

Medical Emergency

Contact	Phone Number
Peconic Bay Medical Center 1300 Roanoke Ave, Riverhead, NY	(631) 548-6200

Fastest route to hospital:

See directions on Figure Att. 2-1.

Travel time from site: 2 min.

Air Monitoring Action Levels

Concentration of Organic Vapor in Breathing Zone	Action
> 5 ppm total organics	Stop work until levels dissipate, or ventilate area

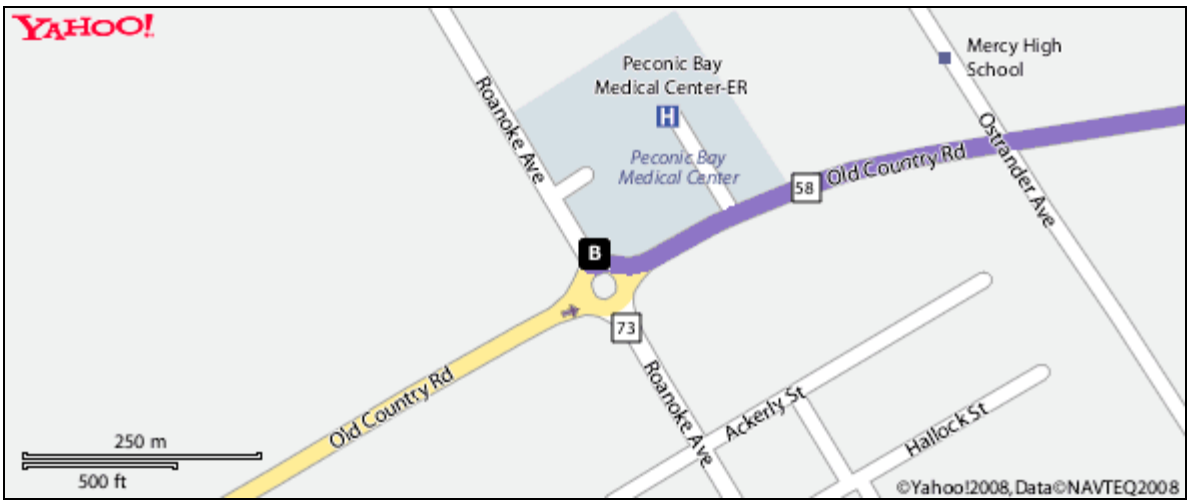

Figure Att-2-1. Hospital Route Map

ATTACHMENT 3
EMERGENCY RESPONSE PLAN

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EMERGENCY RESPONSE PLAN

Paramedics will be summoned in the event of a serious injury; they will arrange to transport the victim to the nearest appropriate facility. A first aid kit will be available at the site for use in case of minor injuries. If anyone receives a splash or particle in the eye, the portable eyewash will be used to irrigate the eye for 15 min. If direct contact with contaminants occurs, affected skin areas should be washed immediately with soap and water.

In the event of serious trauma or unknown chemical exposure, the affected employee will be stabilized by an employee(s) while others consult the emergency phone number list and telephone for immediate ambulance support.

Workers with suspected back or neck injuries are NOT to be moved until professional emergency assistance arrives.

At least one person at the site will have current certification in first aid and cardiopulmonary resuscitation.

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APPENDIX C – COMPRESSOR O&M INFORMATION

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Table C1: Operation, Maintenance and Inspections		
Item	**General Requirements**	**Typical Frequency**
Compressor Lubrication	Check oil level in the sight glass. The oil can only be filled up when the unit is off and vented to atmospheric pressure.	Monthly
	Change oil: Oil Requirements: Viscosity must be equivalent to manufacturer's specifications and is shown on attached plate. If the oil brand is changed, the old oil must be drained completely from the oil chamber.	Typically after 5,000 hours of operating service under normal ambient conditions.
	Grease Bearings	Approximately every 5,000 operating hours. This assumes operation at 20 degrees C and should be reduced by 50% at 40 degrees C.
Compressor Cleaning	The built in protective mesh must be cleaned regularly. The unit must be cleaned with compressed air.	At least monthly, depending on the amount of contamination.
Pressure Measurements	Compressor Pressure, Sparge System Flowrate and Pressure, Individual Sparge Well Flowrate and Pressure, Air Stripper Blower Back Pressure	Monthly
Piping Leakage	Spray the piping with soapy water and look for air bubble.	Monthly
Well Head Heads	Inspect well head construction, valves and gages for proper operation.	Monthly

Table C2: Trouble Shooting of Air Sparge Compressor	
Problem and Probable Cause	**Solution:**
A. Problem:Motor Starter Cuts Out	
1. Incoming voltage and frequency does not correspond with the motor data plate	Adjust the main voltage
2. Connections on the motor terminal block are incorrect	Check connections
3. Incorrect Setting on the starter	Check setting of the starter
4. Starter trips too fast	Use starter with time delay trip
5. Protection mesh is blocked	Clean the protection mesh
B. Problem: Insufficient Pressure Capacity	
1. Protection mesh is blocked	Clean the mesh
2. Pressure pipework is too long or is restricted	Use bigger pipe diameter, avoid restriction
3. Leak on the compressor or the system	Check the compressor and the pipework for pressure losses
C. Problem:Compressor Does not Reach Overpressure	
Leak on the Compressor or System	Check the Compressor and the pipework for pressure loss
Motor rating selected was too small	Use Bigger motor rating
D. Operates at Abnormally High Temperature	
Ambient and/or suction temperature too high	Keep Temperature between 5 and 40 Degrees C
Problem: Insufficient Pressure Capacity	The cooling air entries and exits must have minimum distance of 10cm from any obstruction
E. Abnormal Noises	
Contamination of the rotary lobes	Clean pumping chamber and rotary lobes
The regulating valve is noisy	Replace Valve