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Final

WORK PLAN FOR DATA GAP INVESTIGATION, FOCUSED FEASIBILITY STUDY, AND SUBSEQUENT PRE-DESIGN & DESIGN TASKS FOR SITE 15 AT HANCOCK FIELD SYRACUSE, NEW YORK

Prepared For:

National Guard Bureau

1411 Jefferson Davis Highway
Arlington, VA 22202-3231

and

Air National Guard

Environmental Restoration Branch
3500 Fetchet Avenue
Andrews AFB, MD 20762-5157

Prepared By:

PARSONS ENGINEERING SCIENCE, INC.

290 Elwood Davis Road, Suite 312
Liverpool, New York 13088

December 2000

PARSONS

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INTRODUCTION

1.1 PROJECT BACKGROUND

The 174th Fighter Wing (FW) of the New York Air National Guard (NYANG) is based at Hancock Field, a former Air Force Base located approximately two miles north-northeast of Syracuse in Onondaga County in central New York (Figure 1.1). An ANG facility is currently operating within the southern portion of the former Hancock Air Force Base.

The Department of Defense is evaluating its facilities within the framework of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Superfund Amendment and Reauthorization Act (SARA) to determine if there are sites that warrant further evaluation and possible remediation. The Air National Guard Readiness Center (ANGRC) at Andrews AFB in Maryland manages CERCLA/SARA-related efforts for Air National Guard installations. The ANGRC has identified two sites at Hancock Field requiring potential action, Sites 1 and 15, based on previous investigation work. Site 1 has been addressed with the exception of a remaining soil pile. For Site 15, additional investigation work is warranted, and an evaluation of the most appropriate form of remediation needs to be completed and documented to include State and public input. The additional investigation work will focus on data needed to complete the evaluation of remediation needs.

Site 15 is a 2.5-acre plot of land and the site of a former petroleum, oil, and lubricant (POL) storage area near the southern boundary of Hancock Field. Soil and groundwater have been impacted by past fueling activities and the storage of polychlorinated biphenyl (PCB)-containing transformers, as evidenced by the presence of jet fuel-related compounds, PCBs, and free product (Lockheed, 1997). Benzene, toluene, ethylbenzene, and xylene (BTEX) in groundwater appears to extend from the northern area of the site to East Molloy Road, south of the site. PCBs and free product appear to be concentrated around the northern central area of the site.

Site 1 is located about one-half mile northeast of Site 15. Currently staged on a concrete pad at this site is a pile of soil that contains PCBs, which will be included in the removal of any PCB-impacted soil from Site 15.

1.2 PROJECT OBJECTIVES

This Work Plan addresses the five components of this project for Site 15: a Data Gap Investigation, a Focused Feasibility Study (FFS), a Proposed Remedial Action Plan (PRAP), a Record of Decision (ROD), and a Remedial Design (RD). All necessary reports and documentation will be prepared in accordance with the provisions of the respective New York State regulations; the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended; the National Oil and Hazardous Substances Pollution Contingency Plan (NCP); the procedure set forth in the *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (EPA/540/G-89/004); the Air National Guard Site

Investigation Protocol (June 1998); the basic Statement of Work (SOW); and the National Guard Bureau SOW.

The objectives of the Site 15 activities described in this Work Plan are as follows:

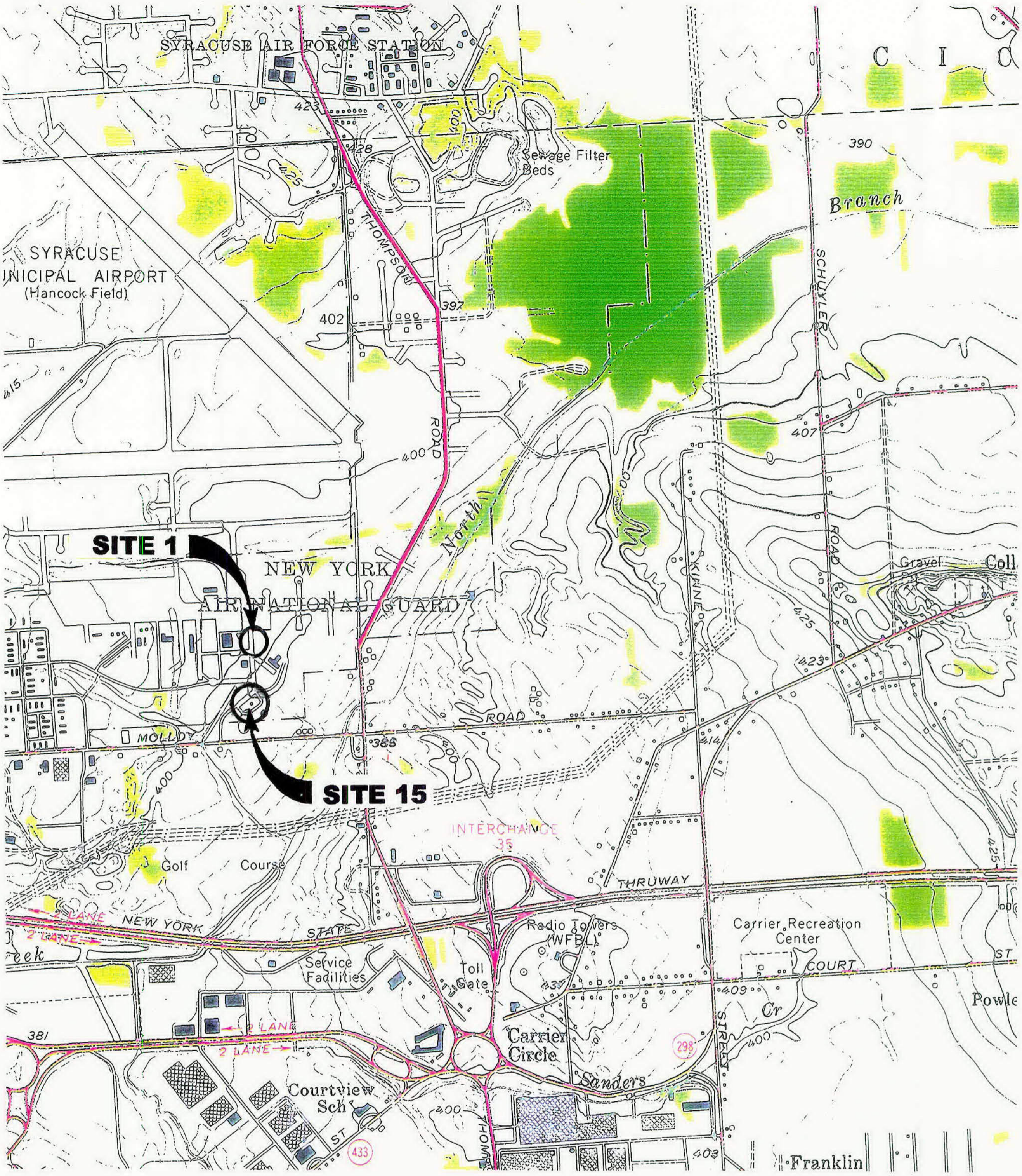
- to complete the delineation of contaminant extent and potential migration pathways and to assess site conditions for potential remediation alternatives
- to evaluate potential human health and environmental risks
- to identify applicable or relevant and appropriate requirements (ARARs) for establishing the need for remedial action
- to develop and evaluate a range of site remediation alternatives and their associated costs
- to prepare the PRAP and the ROD and to facilitate public and regulatory review of these documents
- to support and complete a comprehensive remedial design

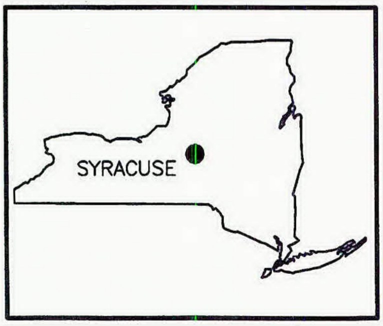
1.3 REPORT ORGANIZATION

This Work Plan describes the tasks that constitute the Site 15 remediation effort and consists of the task documentation (Sampling and Analysis Plan, etc.) needed to complete the effort:

- a brief review of current site conditions, site history, and results of previous investigations (Section 2)
- a description of the following project tasks: the Data Gap Investigation, the FFS, the PRAP, meetings, the ROD, and the Remedial Design (Section 3)
- project organization and schedule (Section 4)
- a list of references (Section 5)
- a Sampling and Analysis Plan, which consists of a Field Sampling Plan and a Quality Assurance Plan (Appendix A)
- a Site Health and Safety Plan (Appendix B)

The Field Sampling Plan provides procedures and forms to be used during field activities. The Quality Assurance Plan specifies methods to be used to ensure that data from the proposed site investigation are analyzed properly and are precise, accurate, representative, comparable, and complete. The Site Health and Safety Plan was written in compliance with Occupational Safety and Health Administration Standards 29 CFR Parts 1910.120 and 1926 to protect personnel conducting field activities.





QUADRANGLE LOCATION
NEW YORK

LATITUDE: N43° 06' 01"
LONGITUDE: W76° 06' 06"

SOURCE: USGS 7.5 MINUTE SERIES (TOPOGRAPHIC) SYRACUSE EAST QUADRANGLE 1957

FIGURE 1.1

NATIONAL GUARD BUREAU
SITE 15 AT HANCOCK FIELD
SYRACUSE, NEW YORK

SITE LOCATION MAP

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PARSONS ENGINEERING SCIENCE, INC.
290 ELWOOD DAVIS ROAD, SUITE 312, LIVERPOOL, N.Y. 13088, PHONE: 315-451-9560

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SECTION 2

SECTION 2

SECTION 2
SITE DESCRIPTION AND BACKGROUND

2.1 SITE LOCATION AND DESCRIPTION

Sites 1 and 15 are located at the 174th Fighter Wing (FW) of the New York Air National Guard (NYANG) at Hancock Field near Syracuse, New York. Hancock Field is bordered by the Town of Dewitt to the east and south, the Town of Salina to the west, and the Town of Cicero to the north. Syracuse International Airport is located to the north-northeast.

Site 15 is a 2.5-acre plot of land and the site of a former petroleum, oil, and lubricant (POL) storage area located near the southern boundary of Hancock Field (Figure 2.1). The site was used to transfer and store JP-4 until the 1980s when the ANG began using JP-8. A 215,000-gallon aboveground storage tank (AST), which has been removed, was located within a diked area near the center of the site. A concrete pad is located adjacent to the diked area. Northwest of the concrete pad is the location of a former pumphouse. The foundation remains, and underneath this are six 25,000-gallon underground storage tanks (USTs), which have been closed in-place. Three of the USTs are located under the northeast side of the pumphouse, and three are under the southwest side. On the southeast side of the pumphouse was a transformer pad. Most of the site is covered with unmaintained vegetation. One drainage swale borders the site on its north-northeast side, and another drainage swale is located near the west side of the site. The entire site is surrounded by a barbed wire fence.

Site 1 is located about one-half mile northeast of Site 15. A pile of soil with PCBs has been placed on a concrete pad at this site, a former fire training area. This soil will be included in the removal of any PCB-impacted soil from Site 15.

2.2 SITE HISTORY

The POL area at Site 15 was constructed in 1951 and used until 1999 when it was decommissioned and a new POL area was constructed. When the area was actively used, it was the site of the Jet Fuel Transfer Pumphouse (Building 602), a transformer pad, an AST, six USTs, and equipment for transferring jet fuel (JP-4 until the 1980s, JP-8 thereafter) to the tanks. In 1999, the pumphouse was demolished, the AST was cleaned and removed, and the USTs were cleaned and filled in place.

Three spills at the site have been documented:

- In the 1980s, PCBs were released, possibly from the transformers located in front of the pumphouse (Radian, 1994).
- In April 1990, 3,850 gallons of JP-4 were released inside the pumphouse. Some of the fuel reportedly flowed out of the building before it could be recovered (Radian, 1994, and M&E, 1995).

- In June 1994, 150 gallons of JP-8 overflowed onto the ground from USTs under the northeast side of the building. The spill was reportedly contained with absorbent pads before it was able to exit through the drainage ditch on the east side of the site (M&E, 1995, and Aneptek, 1999).

Following the April 1990 release, contaminated surface soil was removed from the area around the pump house and staged on the concrete pad at Site 1 (as stated in Section 1.1, this soil will be included in the removal of any PCB-impacted soil from Site 15). The excavation area was then backfilled with crushed stone. During the cleanup, three area drainage sumps with PCB-contaminated sediment were discovered. Spilled fuel had entered the sumps and mixed with the PCB-contaminated sediment, which is believed to have accumulated in the sumps before 1971. According to as-built drawings, an oil-water separator was supposedly installed in the 1950s, but one was never found during the soil excavation (Radian, 1994).

2.3 RESULTS OF PREVIOUS INVESTIGATIONS

At least five investigations or studies of Site 15 have taken place over the years. Locations of the samples that have been collected during these investigations are shown in Figure 2.1

Spill Investigation (June 1990)

Site 15 was not evaluated in any of the investigations previously conducted at Hancock Field. In June 1990, investigation of the spill that occurred in April 1990 consisted the installation and sampling of four monitoring wells (MW-1, MW-2, MW-3, MW-4) and the collection of 15 soil samples. PCBs were detected at a maximum concentration of 23 milligrams per kilogram (mg/kg) or parts per million in the soil. No PCBs were detected in the groundwater samples, but benzene was found at a maximum concentration of 510 µg/L (Radian, 1994).

First Site Investigation (November and December 1990)

Following a New York State Department of Environmental Conservation (NYSDEC) request for further study of Site 15, field work for a Base POL Area Site Investigation Report was conducted in November and December 1990. Six soil borings were drilled and completed as groundwater monitoring wells (MEMW-5 through MEMW-10, later referred to as MW-5 through MW-10), and groundwater samples were collected from these and the four previously-installed monitoring wells. Sixteen shallow soil, several sump seepage water, two surface water, and two sediment samples were also collected. The soil samples were taken from the west, south, and east sides of the pumphouse while the sump seepage water samples came from groundwater allowed to seep into a clean, dry sump in the pumphouse. Sediment and surface water samples were collected from the drainage swale located on the northeast side of the site. All of the samples were analyzed for PCBs and/or petroleum hydrocarbons (Radian, 1994, and M&E, 1995).

Soil and sump seepage water samples were analyzed for PCBs. PCB concentrations in soil samples from the area in front of (on the southeast side of) the pumphouse ranged from "not detectable" to 240 mg/kg. PCB concentrations in the sump seepage water were as high as 120 ppm for Aroclor-1260 and 15 ppm for Arclor-1254 (M&E, 1995).

Groundwater, sump seepage water, surface water, and sediment samples were analyzed for petroleum hydrocarbons. Groundwater samples at the site contained up to 700 mg/L of benzene, 520 mg/L of ethylbenzene, 1,800 mg/L of xylenes, and 2.3 mg/L of total petroleum hydrocarbons (TPH). Hydrocarbons did not appear to be present beneath the pumphouse, based on results of the sump seepage water analysis. No benzene, toluene, ethylbenzene, and xylene (BTEX) or TPH compounds were detected in surface water or in sediment samples collected near the site (Radian, 1994).

Second Site Investigation (June and July 1994)

In June and July of 1994, another site investigation was performed. Groundwater samples were collected from nine of the ten monitoring wells (MW-5 was damaged) and analyzed for volatile organic compounds (VOCs), TPH, and PCBs. Concentrations in groundwater samples from the monitoring wells had not changed by more than a factor of 2 or 3 since 1990. Petroleum hydrocarbons were detected at increased levels at MW-7 and MW-2, but were not detected at the outermost monitoring wells (MW-8, MW-9, and MW-10). The detection of PCB, Aroclor-1260, in groundwater from MEMW-6 was consistent with the detection of PCBs in shallow soil samples that were collected from the area in front of the pumphouse during the previous investigation (M&E, 1995).

Remedial Investigation (1995 and 1996)

A remedial investigation (RI) was performed in 1995 and 1996 with the purpose of defining the nature and extent of PCB and jet fuel-related impacts on the soil and groundwater. During the course of the investigation, phenol was unexpectedly encountered, so the investigation was expanded to evaluate the potential sources of phenol (Lockheed, 1997).

Several new monitoring wells were installed during the RI:

- MW-5R was installed to replace MW-5, which had been found to be damaged during the last investigation.
- MW-6S was installed to replace MW-6, because its surface integrity had been compromised.
- Three new shallow wells were installed: MW-11, MW-12S, and MW-13.
- Two deep monitoring wells were installed: one paired with MW-6S and one paired with MW-12S.

Groundwater samples were collected from all of the previously-installed, intact wells and all of the newly-installed wells. A total of 98 soil samples were collected from across the entire site and in areas around the site. Four sediment samples were also collected: three from the southwestern drainage swale and one from the northeastern drainage swale. Borings for the soil and sediment samples were advanced using a hand auger or a Geoprobe.

VOCs were observed in the soil at three areas: northeast, southwest, and in front of the pumphouse. VOCs extended from two feet below ground surface to the water table (at 10.5 to

16 feet). Semi-volatile organic compounds (SVOCs) were restricted mainly to an area on the northeast side of the pumphouse (Lockheed, 1997).

VOCs and SVOCs were also present in groundwater. The horizontal extent of the plume in a downgradient direction extended to the wooded area southeast of the site, approximately 100 feet beyond the base boundary. A localized area of free product, about six inches thick, was found at the leading edge of the plume. Based on samples from two deep wells, product in the groundwater did not appear to have migrated vertically (Lockheed, 1997).

PCBs were found in the soil in front of and on either side of the pumphouse. For the most part, the vertical extent of the PCBs was limited to the top four feet of soil. Groundwater, however, did not appear to have been impacted by PCBs (Lockheed, 1997).

During the RI, phenol was detected in many of the soil samples. The phenol impacts appeared to be random and unrelated to jet fuel; the highest concentrations were found in background samples. According to the RI report, the most likely source of the phenols is an herbicide application that took place in May 1995, three months before the RI sampling began (Lockheed, 1997).

Treatability Study (May 1998 and September-October 1999)

The initial investigation for the Product Recovery/Treatability Study (PR/TS) was conducted primarily because of the presence of free product in MW-12S, which had been installed during the RI. Free product had been found during the RI and in August 1997, when MW-12S was checked again. The purpose of the investigation for the PR/TS was to delineate the free product plume and to initiate a product recovery program. Four monitoring wells (MW-14 through MW-17) and one recovery well (RW-1) were installed, but no free product was found in any of these wells, in MW-12S, or in any of the pre-existing wells in the area of MW-12S. The recovery well and MW-12S were gauged five more times within a year, and no product was found. Based on these results, no product recovery pump was installed (Aneptek, 1999).

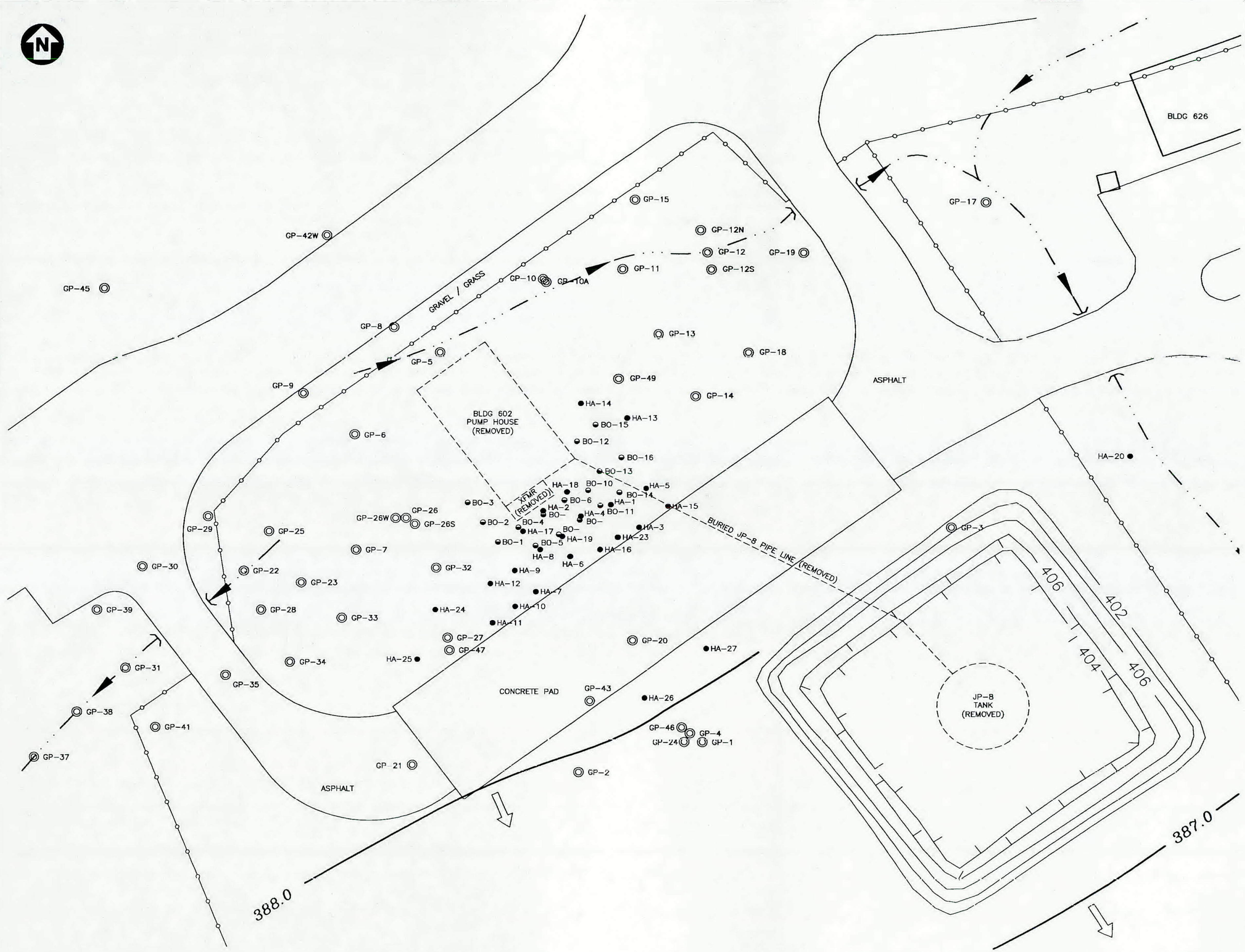
At the request of the NYSDEC, an investigation of BTEX in groundwater was conducted. In May 1998, groundwater samples were collected from the four new monitoring wells and analyzed for VOCs. Benzene and/or ethylbenzene were found in MW-14 and MW-15. In the fall of 1999, 24 temporary groundwater sampling points were installed to delineate the dissolved phase BTEX in the groundwater. Three permanent groundwater monitoring wells (MW-18, MW-19, MW-20) were also installed. Groundwater samples from 21 temporary points, 16 monitoring wells, and RW-1 were screened onsite for VOCs. BTEX compounds were found in 24 of the sample locations.

During the September-October 1999 sampling event, free product was recovered in bailers at three of the temporary sampling points and one of the wells. Product samples from these four locations were analyzed for PCBs, and PCBs were detected in two of the samples (Aneptek, 1999).

Also in September and October of 1999, two rounds of samples were collected from MW-18, MW-19, and MW-20 and were analyzed for VOCs, SVOCs, TPH, PCBs, and metals. The extent of the free product plume and the PCB plume were found to be nearly the same, covering an area from the pumphouse under the concrete pad to the area southeast of the former AST. BTEX compounds, however, were found in groundwater as far south as MW-19 (Aneptek, 1999).

2.4 CURRENT MONITORING WELL STATUS

A total of 20 monitoring wells exist on and around the site. These wells, installed during previous investigations, as described above, had been planned for use in the natural attenuation evaluation (see Section 3). However, some of the wells located within the wooded area south of the site were damaged during recent brush clearing by the ANG. It appears that up to three monitoring wells may require repair so that they can be used for the natural attenuation evaluation: MW-8, MW-11, and MW-12D. Inspection and repair or possible replacement of these wells is discussed in Section 3.1.2.



LEGEND:

◎ GP-1	GEOPROBE LOCATION (1995, 1996)
● HA-1	HAND AUGER BORING LOCATION (1995, 1996)
◒ BO-1	HAND AUGER BORING LOCATION (1990)
— · · · —	INTERMITTENT DRAINAGE SWALES
-o-o-o-	FENCE LINE
388.0 ——	GROUNDWATER CONTOUR AND ELEVATION (SEPTEMBER 25, 1999)
⇨	DIRECTION OF GROUNDWATER FLOW

NOTE:

TWELVE (12) SOIL SAMPLES WERE COLLECTED OFF-SITE. (1995, 1996)

40 20 0 40 80

SCALE: 1"=40'

FIGURE 2.1B

SITE 15, HANCOCK FIELD
SYRACUSE, NEW YORK

SOIL SAMPLE LOCATIONS FROM 1990 SI AND 1995-1996 RI

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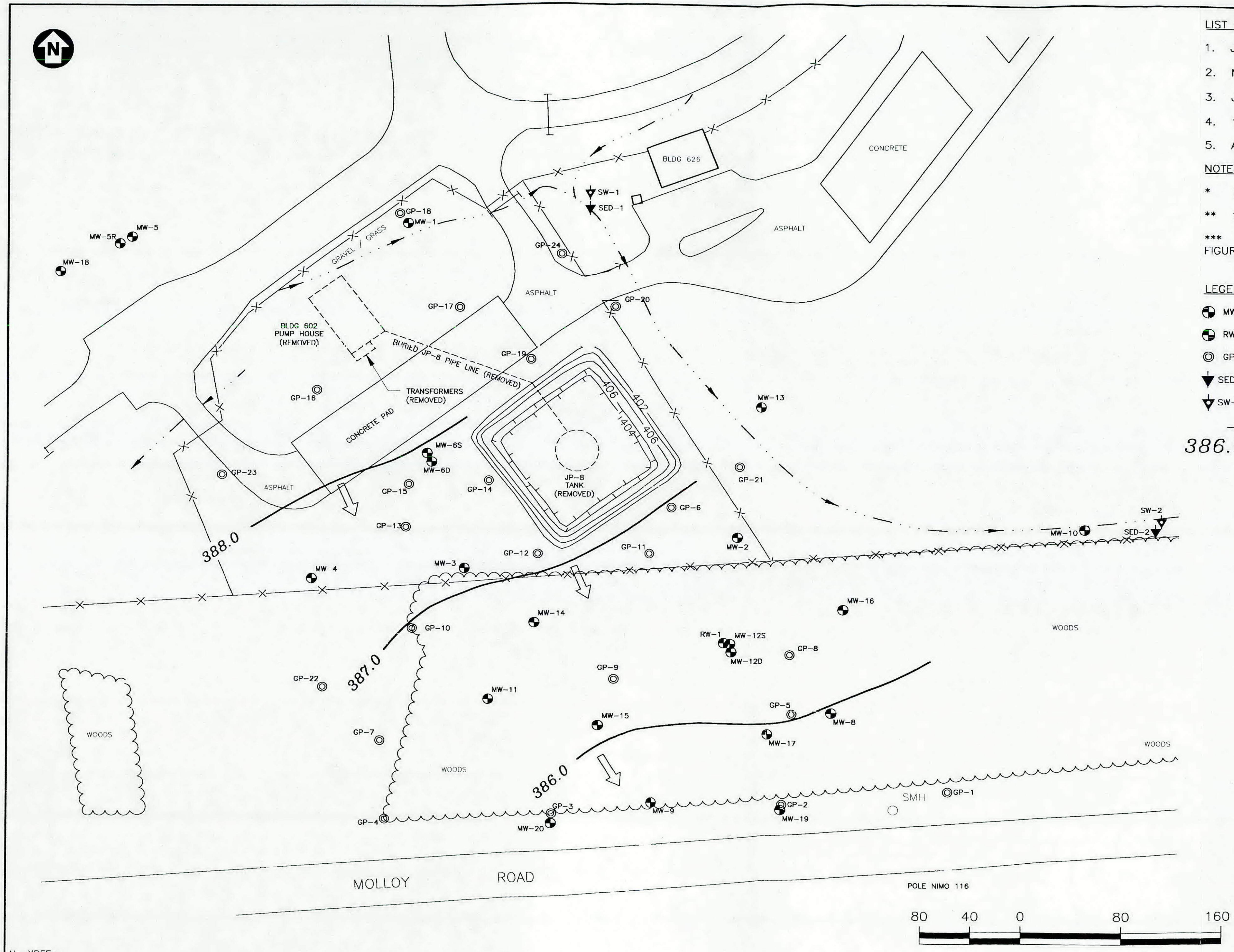

LIST OF INVESTIGATIONS:

1. JUNE 1990 SPILL INVESTIGATION*
2. NOVEMBER/DECEMBER 1990 SITE INVESTIGATION (SI)**
3. JUNE/JULY 1994 SITE INVESTIGATION (SI)
4. 1995–1996 REMEDIAL INVESTIGATION (RI)***
5. APRIL 1998 TREATABILITY STUDY

NOTES:

* LOCATION OF 15 SOIL SAMPLES NOT KNOWN

** 16 SOIL SAMPLE LOCATIONS SHOWN ON FIGURE 2.1B

*** 98 SOIL AND 4 SEDIMENT SAMPLE LOCATIONS SHOWN ON FIGURE 2.1B

LEGEND:

● MW-1	MONITORING WELL LOCATION
● RW-1	RECOVERY WELL LOCATION
◎ GP-1	GEOPROBE LOCATION
▼ SED-1	SEDIMENT SAMPLE LOCATION
▽ SW-1	SURFACE WATER SAMPLE LOCATION
→ · · · →	INTERMITTENT DRAINAGE SWALES
386.0 ———	GROUNDWATER CONTOUR AND ELEVATION (SEPTEMBER 25, 1999)
⇨	DIRECTION OF GROUNDWATER FLOW

FIGURE 2.1A

SITE 15, HANCOCK FIELD
SYRACUSE, NEW YORK

SAMPLE LOCATIONS FROM PREVIOUS INVESTIGATIONS

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PARSONS ENGINEERING SCIENCE, INC.
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SECTION 3

SECTION 3

SECTION 3
TASK DESCRIPTIONS

This section describes the work effort that will constitute the Data Gap Investigation, FFS, PRAP, ROD, and RD for Site 15. The overall objective of this work effort is to make the site available for future use by the NYANG.

Previous site investigations have identified past spills and other source areas at the site and have partially delineated the extent of impacted soil and groundwater, as discussed in Section 2. The Data Gap Investigation has been designed to complete the delineation of the extent of impacted soil and groundwater and to evaluate the potential of several remedial alternatives proposed for the site.

Based on the results of the Data Gap Investigation and previous investigations of the site, an FFS will be prepared in accordance with applicable federal and state CERCLA guidance. The FFS will address Site 15 soil and groundwater impacted by PCBs and/or petroleum-related VOCs and SVOCs at Site 15. The soil to be addressed in the FFS will also include a soil pile that is currently staged on a concrete pad at Site 1.

Following submittal of the FFS to the NYSDEC, the recommended alternative for Site 15 and the basis for its recommendation will be presented in a Proposed Remedial Action Plan (PRAP). Comments on the PRAP will be solicited from the public and the NYSDEC. Upon satisfactory response to these comments, a ROD will be prepared, describing the selected final remedial action and including a summary of the comments. Once the final ROD is issued by the NYSDEC, design efforts will begin, culminating in a 100% (final) design that will be ready to bid for construction.

Project activities will be carried out in conformance with the applicable regulations and guidance. Each of the tasks is discussed separately in this section below.

3.1 TASK 1 – DATA GAP INVESTIGATION

Based on the investigation work that has been conducted at Site 15, it appears that soil in front of and on either side of the former pumphouse building has been impacted by PCBs. A concrete pad in front of the building was used for outdoor storage of transformers, and a 1980 release of PCBs from these transformers appears to have been the source of the PCBs.

The presence of PCBs in the soil adjacent to the pumphouse has been identified in previous investigations. However, the extent of the PCBs beyond the immediate vicinity of the pumphouse has not been clearly defined, particularly in the area on the southeastern side of the concrete pad. Also, it is not known if PCBs may have migrated into the soil of the two nearby drainage swales. Therefore, supplemental soil sampling will be conducted.

3.1.1.1 Soil Sampling

During the RI, which was conducted in 1995 and 1996, soil samples were collected from the area around the pumphouse and from two locations on the opposite (southeast) side of the concrete pad (Figure 3.1). Analysis of these two samples indicated the presence of PCBs at concentrations above 1 mg/kg. Thus, six more surface soil samples will be collected from 0 to 1 foot below ground surface.

The soil will be obtained using hand-driven augers and will be submitted to a laboratory for analysis of total PCBs using USEPA SW-846 Method 8082. A rapid turnaround time for sample analysis will be used so that results can be obtained while the Parsons team is still mobilized in the field. Based on these analytical results, soil samples may be collected from additional locations and from depths below 1 foot below ground surface.

In addition, surface soil from the two drainage swales near the site will be sampled and analyzed for PCBs to determine if the contaminants have migrated into the swales and possibly offsite. Sampling locations were chosen based on their proximity to the site (Figure 3.2). At each proposed sampling location, two surface (0 to 1 foot) soil samples will be obtained using a hand-driven auger. Initially, samples will be collected from three locations in the northeastern swale. If PCBs are detected at concentrations above 1 mg/kg in these samples, then samples from three additional locations will be collected. Similarly, in the southwestern swale, soil samples will at first be collected from only two locations and then from three additional locations if necessary. Thus, up to 12 samples from the northeastern swale and up to 10 samples from the southwestern swale may be collected and analyzed.

As part of the soil sampling program, PCB analysis of QA/QC samples (duplicate, MS, MSD, and field blank) will also be conducted. The number of each of the QA/QC samples will depend on the number of soil samples collected: one duplicate for every 10 samples, one MS/MSD for every 20 samples, and one field blank for every 10 samples.

3.1.2 Groundwater Pathway Investigation

Existing monitoring wells, installed during previous investigations, will be used for the groundwater pathyway investigation. Due to unexpected damage to several wells south of the site, inspection of three wells will be completed. Based on what is observed, the wells will be repaired, as described below, or replaced if there is any doubt about the well's integrity.

- MW-8 – The riser has been sheared at ground level, leaving the well open to the atmosphere. The well can be protected with a flush-mounted cover, or additional lengths of PVC pipe and new protective casing with a concrete pad can be added to make it a stick-up well.
- MW-11 – This well appears to have been knocked over and set upright; there is a large dent in the protective casing, and the riser has been pulled up. The well must be inspected further to determine if the riser was pulled up enough to affect the seal and to see if the riser itself has been broken. If both the seal and riser are intact, only the protective casing and concrete pad need to be replaced. If not, the entire well may need to be replaced.

- MW-12D – This well also appears to have been knocked over; there is a dent in the protective casing, and both the casing and the riser are at an angle. If the riser is bent above ground surface, the casing can be removed and the riser can be cut just below the bend. The well can then be protected with a flush-mounted cover, or additional lengths of PVC pipe and new protective casing with a concrete pad can be added to make it a stick-up well.

3.1.2.1 Evaluation of Natural Attenuation

Natural attenuation is one potential remedial alternative, or component of a remedial alternative, for the site. Groundwater parameters will be measured to assess the viability of natural attenuation, which will be evaluated with other alternatives during the feasibility study process. For this groundwater sampling, well development will not be conducted unless purged water is excessively turbid. The assessment will consist of collecting one round of groundwater samples from 17 wells for analysis of pH, conductivity, dissolved oxygen, alkalinity, carbon dioxide, ferrous iron, total iron, nitrate, sulfate, methane, and BTEX (see Figure 3.2 for locations of wells). Ferrous iron, total iron, nitrate, methane, and BTEX will be measured in a laboratory; all other parameters will be quantified in the field using test kits or meters.

Water generated due to decontamination activities and the purging and sampling of the monitoring wells will be characterized prior to off-site disposal. Two samples will be collected and analyzed for CERCLA Target Analyte List metals and CERCLA Target Compound List organic compounds.

3.1.2.2 Assessment of Free Product Recovery

Free product has been found on several occasions in some of the monitoring wells at the site. A baildown test will be conducted to estimate the rate of free product recovery in one existing monitoring well (MW-6S) and in three proposed wells, based on previous investigation results.). These three wells will be installed because, during the site visit/kick-off meeting in August 2000, it was found that previously-installed Geoprobe monitoring points – GP-6, GP-16, and GP-17 – had been plugged and covered. The proposed wells will be placed at the following locations: between the former location of the pumphouse and the concrete pad, between the concrete pad and the diked area, and near the location of GP-6 (see Figure 3.2).

The borings for the three proposed wells will be advanced using a truck-mounted drill rig equipped with hollow-stem augers. Each well will be constructed of two-inch diameter polyvinyl chloride (PVC), machine-slotted screen (10 slot) and riser. The screen and riser will be set through the hollow stem augers so that the bottom of the screen is approximately five feet below the water table, which ranges from 10.5 to 16 feet below ground surface. Thus, the well screens will extend over 10 vertical feet to depths from 15.5 to 21 feet below ground surface.

The wells will be completed with silica sand packs surrounding the screen, bentonite slurry seals around the riser, and bentonite/cement grout above the seals. Four-inch steel protective casings will be installed over the wells.

The baildown test will consist of gauging the four monitoring wells for free product. The thickness of product returning to these wells will be measured for a period of two days. Two free product samples will also be collected, and density, viscosity, and interfacial tension will be measured to help assess free product mobility.

3.1.2.3 Assessment of PCB Contamination

In all of the previous investigations, PCBs in groundwater have been detected, if at all, in onsite wells only, particularly at MW-6. The leading edge of the PCB plume appears to end at MW-2, which is in the southeastern corner of the site. Analysis of groundwater samples from downgradient wells (MW-12S, MW-12D, MW-16, MW-17, MW-8, and MW-19) will be performed to assess the lateral extent of the PCB plume. Samples will be collected during the sampling for the evaluation of natural attenuation described above and then sent offsite for laboratory analysis. One field duplicate, one MS/MSD, and one field blank will also be collected and analyzed.

3.1.3 Summary of Data Gap Investigation Results

Laboratory data will be validated by a chemist using the EPA Region II Standard Operating Procedures (SOPs). Results of the activities performed under the Data Gap Investigation will be assessed and summarized in letter report form as an appendix in the FFS and will be considered in the FFS analysis in the body of the report.

3.2 TASK 2 – FOCUSED FEASIBILITY STUDY

An FFS will be conducted to address the impacted soil and groundwater at Site 15. PCB-impacted soil at Site 1 will also be addressed.

The FFS effort is divided into the following five subtasks:

Subtask 1. Data Evaluation

Subtask 2. Development of Remedial Action Objectives

Subtask 3. Development and Screening of Remedial Alternatives/Completion of Field Sampling Report

Subtask 4. Detailed Analysis of Alternatives

Subtask 5. Completion of FFS Report

3.2.1 Subtask 1 - Data Evaluation

Results of historical investigations and the Data Gap Investigation (Task 1) will be reviewed to summarize the extent and significance of impacted media and to present an assessment of impacts upon which the need for site remediation can be based. This information will be used to develop the Remedial Action Objectives (RAOs) under Subtask 2 and to screen the remedial alternatives compiled under Subtask 3.

3.2.2 Subtask 2 – Development of Remedial Action Objectives

This task includes the identification of ARARs. Federal and state criteria, advisories, and guidance that are applicable to the site will be identified. This will include identification of chemical-specific, action-specific and location-specific ARARs.

RAOs will be developed for soil and groundwater, specifying the compounds of potential concern, exposure pathways, and remediation goals. It is anticipated that the site RAOs will be developed based primarily on consideration of chemical-specific ARARs and will take into consideration background concentrations.

Risk assessment work for the FFS will be a streamlined, qualitative assessment of individual remedial action alternatives and will be carried out for each alternative according to EPA FS guidelines. A baseline risk assessment is not planned for inclusion in the FFS. Instead, groundwater quality standards and NYSDEC action levels for PCBs in soil will be used to assess the need for remedial action.

Following development of RAOs, general response actions, which have the potential to satisfy the RAOs, will be developed. General response actions may include treatment, containment, excavation, disposal and institutional controls. An initial estimate will then be made of the areas and volumes of media to which the general response actions may be applied.

3.2.3 Subtask 3 - Development and Screening of Remedial Alternatives/Completion of Field Sampling Report

The first step in developing remedial alternatives will be to identify remedial technologies and process options that may satisfy each clean-up objective identified. Technologies and process options will be compared and screened based on effectiveness, implementability, and cost in order to retain the technologies that are most likely to satisfy the RACs.

Retained technologies will be assembled into preliminary alternatives that have the potential to satisfy the RACs. The alternatives to be developed may include no-action, media treatment, media containment, media removal, and combinations thereof. The alternatives will then be screened, so that only those with the most favorable combination of effectiveness, implementability, and cost will be retained for further evaluation.

The Field Sampling Report will be prepared to present the information collected and assessed under this subtask and Subtasks 1 and 2. The purpose of this report will be to summarize available data on the extent and significance of impacted media, present an assessment of impacts upon which the need for site remediation can be based, present the site RAOs, present the initial list of remedial alternatives developed, and to narrow this list to those alternatives that will be evaluated further.

The report will be submitted to the NYSDEC for review and comment. Comments generated by NYSDEC will be incorporated into the remaining efforts. The Field Sampling Report will not be revised or reissued.

3.2.4 Subtask 4 - Detailed Analysis of Alternatives

The information required to more completely refine the alternatives that remain after preliminary screening will be developed in this task. The information required to refine alternatives at this stage of the process may consist of preliminary design calculations, process flow diagrams, sizing of key process components, preliminary site layouts, and a knowledge of limitations, assumptions, and uncertainties concerning each alternative.

Individual alternatives will be evaluated using the criteria of compliance with ARARs, protection of human health and the environment, implementability, cost, short-term impacts and effectiveness, long-term effectiveness and performance, and reduction of toxicity, mobility, and volume. Following the individual evaluations, a comparative analysis will be conducted to evaluate the relative performance of each alternative in relation to each specific evaluation criterion. This analysis is in contrast to the preceding analysis in which each alternative was analyzed independently without the consideration of interrelationships among alternatives. This comparative analysis will identify the advantages and disadvantages of each alternative relative to one another so that that the key differences to be evaluated by the decision-maker can be identified.

Based on the detailed evaluation, a remedy will be recommended that is protective of public health and the environment, achieves the ARARs and clean-up objectives that have been identified, is cost-effective, and is considered the remedy that best meets all the evaluation criteria.

3.2.5 Subtask 5 – Completion of FFS Report

An FFS report will be prepared to document the activities completed under Subtasks 1 through 4 in accordance with applicable federal and state CERCLA guidance. This report is expected to consist of the following sections:

- Section 1 - Introduction (project objectives, site background, and summary of previous investigations)
- Section 2 - Remedial Action Objectives
- Section 3 - Development and Screening of Remedial Alternatives
- Section 4 - Detailed Analysis of Alternatives
- Section 5 - Recommended Alternative
- Appendix A - Data Gap Investigation Results
- Appendix B - Cost Estimates of Remedial Alternatives

Three versions of the FFS report will be prepared:

1. A draft report for ANG review
2. A draft final report, including a response to ANG comments, for NYSDEC review

3. A final report, including a response to NYSDEC comments, for submittal to ANG and NYSDEC

3.3 TASK 3 – PROPOSED REMEDIAL ACTION PLAN

A PRAP will be prepared to describe the recommended alternative for Site 15 and the basis for its recommendation. Each of the nine EPA CERCLA evaluation criteria will be addressed in the assessment of the recommended alternative. In accordance with regulatory guidance, the PRAP will also include a description and history of the site, a summary of available information, the remedial action objectives, and a description of the remedial alternatives that were evaluated. Three versions of the plan will be prepared:

1. A draft report for ANG review
2. A draft final report, including a response to ANG comments, for NYSDEC review
3. A final report, including a response to NYSDEC comments, for submittal to ANG and NYSDEC

3.4 TASK 4 – MEETINGS

The public (including the NYSDEC) will be invited to a two-hour, evening meeting (held on a weekday), which will consist of a presentation of the project findings followed by an organized discussion. Two Parsons ES engineers will give the presentation and facilitate the discussion, and a stenographer will record the presentation and discussion. A public address system, a projection screen, visual aids, signage, and refreshments will be provided. Public comments on the PRAP will be documented in a Responsiveness Summary prepared by Parsons ES.

An optional regulatory review meeting with NYSDEC may be held. A meeting agenda and paper copies of visual aids would be prepared for ANG review prior to the meeting. Two engineers would attend the two- to three-hour meeting to make a presentation, answer questions, and take notes.

3.5 TASK 5 – RECORD OF DECISION (ROD)

The selected remedial action for Site 15 will be presented and evaluated in a Record of Decision (ROD). In accordance with regulatory guidance, the ROD will include a summary ROD declaration, a regulatory determination, a description and history of the site, a summary of available information, the remedial action objectives, the alternatives that were evaluated, the basis for selecting the preferred alternative, a summary of community participation, and a listing or index of project documents. The Responsiveness Summary will also be included as an appendix. Three versions of the plan will be prepared:

1. A draft report for ANG review
2. A draft final report, including a response to ANG comments, for NYSDEC review
3. A final report, including a response to NYSDEC comments, for submittal to ANG and NYSDEC

3.6 TASK 6 – REMEDIAL DESIGN

The remedial design will proceed in three phases: 35% design, 95% design, and 100% design. It is anticipated that the design documents will consist of the following:

- Brief description of the site
- Description of the scope of work and project management
- Three civil design drawings: a site plan showing excavation areas, a final grade plan, and a cross-section or profile
- Technical specifications
- Bid schedule

3.6.1 Task 6a – 35% Design

The preliminary (35%) design submittal will be prepared in accordance with the basic Statement of Work (Part I, page 16, paragraph 3.2.3.7.1). The submittal will include narrative descriptions of the basis of design, typical sketches, typical specification language, preliminary layouts, outlines for the project plans, and, for ANG review only, an updated cost estimate. All of the items except for the cost estimate will be sent to NYSDEC for review.

Under this task, a topographic survey will be conducted; a New York state-licensed land surveyor will survey the site and prepare a CAD-generated topographic map. The topographic information will be used for preparing design drawings.

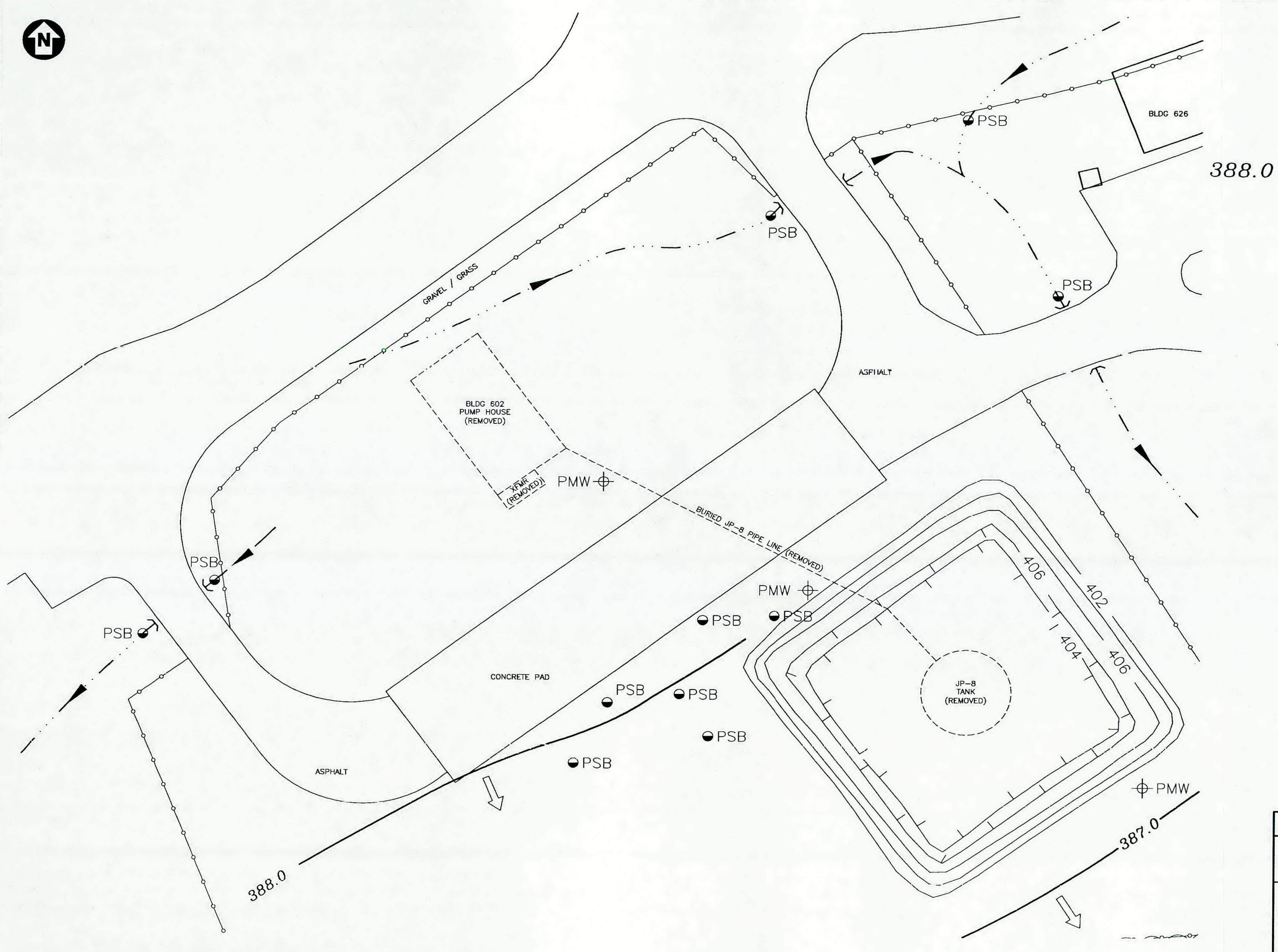
3.6.2 Task 6b – 95% Design

The pre-final (95%) design will incorporate comments from both the ANG and the NYSDEC. The design will include detailed drawings and specifications, a construction schedule, a final cost estimate, and project plans addressing health and safety, quality assurance and control, stormwater pollution prevention, and sampling and analysis. As with the preliminary design, all of the items, except for the cost estimate, will be sent to NYSDEC for review.

3.6.3 Task 6c – 100% Design

ANG and NYSDEC comments on the pre-final design will be incorporated into the final (100%) design, and updates to any elements of the pre-final design will be made. Specifications anticipated for inclusion in the design package are as follows:

Specification Number	**Specification Title**
Division 1 – General Requirements	
01010	Summary of the Work
01025	Measurement and Payment
01051	Grades, Lines, and Levels
01105	Health and Safety
01300	Submittals
01310	Progress Schedule
01400	Quality Assurance/Quality Control
01500	Temporary Facilities and Field Office
01564	Erosion Control
01600	Material and Equipment
01630	Substitutions
01650	Facility Startup
01700	Project Closeout
01720	Project Record Drawings
01730	Operations and Maintenance Data
Division 2 – Site Work	
(to be determined)	



LEGEND:

⌖ PMW	PROPOSED MONITORING WELL LOCATION
◒ PSB	PROPOSED SOIL BORING LOCATION
➛ · · · ➛	INTERMITTENT DRAINAGE SWALES
-o-o-o-	FENCE LINE
388.0 ———	GROUNDWATER CONTOUR AND ELEVATION (SEPTEMBER 25, 1999)
⇨	DIRECTION OF GROUNDWATER FLOW

40 20 0 40 80

SCALE: 1"=40'

FIGURE 3.2

SITE 15, HANCOCK FIELD
SYRACUSE, NEW YORK

PROPOSED SOIL SAMPLE
AND MONITORING WELL
LOCATION MAP

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PARSONS ENGINEERING SCIENCE, INC.
290 ELWOOD DAVIS ROAD, SUITE 312, LIVERPOOL, N.Y. 13088, PHONE: 315-451-9560

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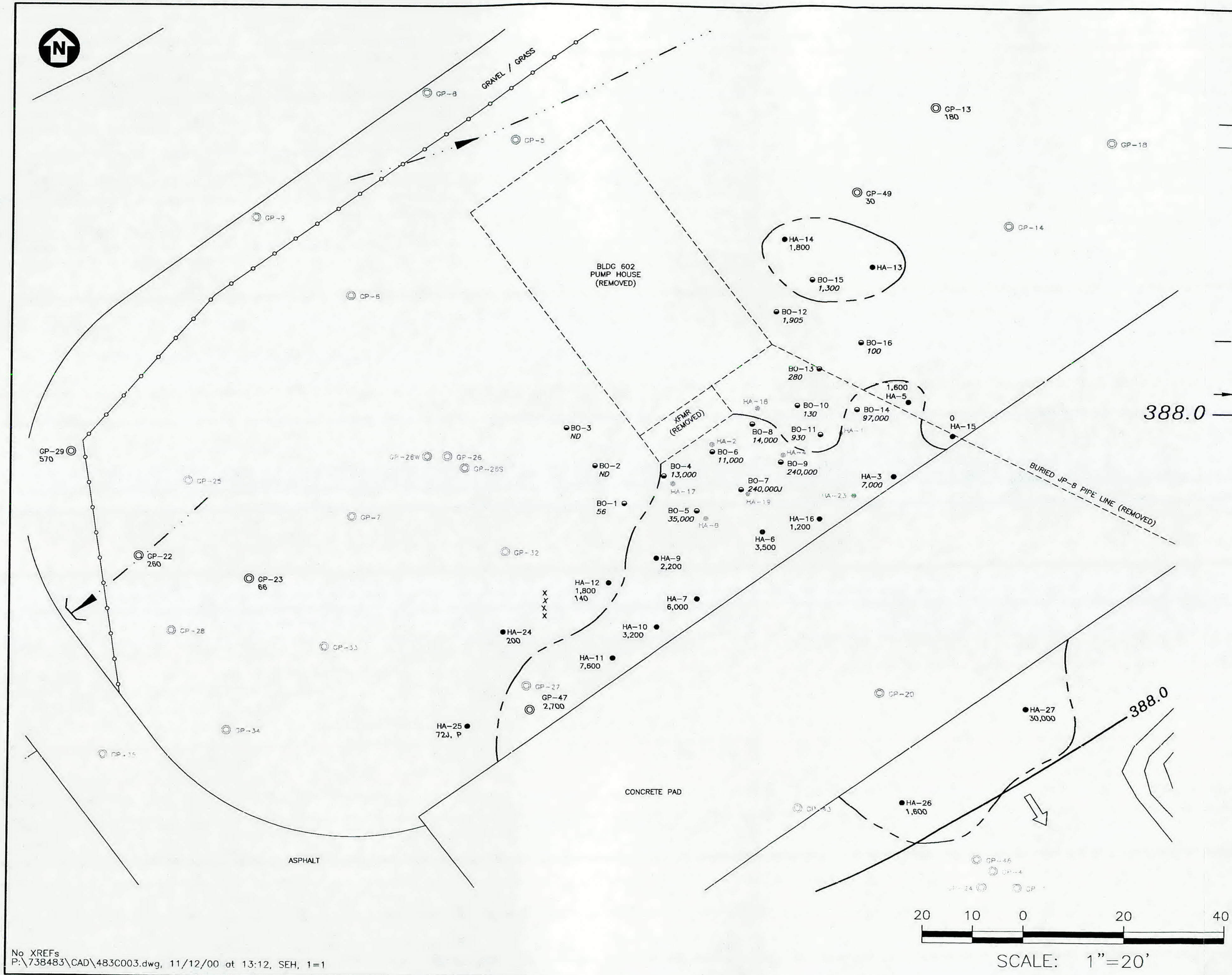

LEGEND:

○ GP-1	GEOPROBE LOCATION (1995, 1996)
● HA-1	HAND AUGER BORING LOCATION (1995, 1996)
◒ BO-1	HAND AUGER BORING LOCATION (1990)
— · · · —	INTERMITTENT DRAINAGE SWALES
—o—o—o—	FENCE LINE
250	FIXED BASE LAB AROCLOR 1260 CONCENTRATION, SI (1992) IN µg/Kg
570	FIXED BASE LAB AROCLOR 1260 CONCENTRATION, RI (1995/1996) IN µg/Kg
3,500	FIELD SCREEN LAB AROCLOR 1260 CONCENTRATION, RI (1995) IN µg/Kg
ND	NON DETECT
J	ESTIMATED VALUE
P	>25% CONCENTRATION BETWEEN GC COLUMNS
—·—·—·—	APPROXIMATE OUTLINE OF AREA OF SURFICIAL (0-2') PCB CONTAMINATION EXCEEDING NYSDEC ACTION LEVEL OF 1000 µg/Kg
→· · ·→	INTERMITTENT DRAINAGE SWALES
388.0 ———	GROUNDWATER CONTOUR AND ELEVATION (SEPTEMBER 25, 1999)
⇨	DIRECTION OF GROUNDWATER FLOW

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FIGURE 3.1

SITE 15, HANCOCK FIELD
SYRACUSE, NEW YORK

PCB CONCENTRATIONS IN SURFACE SOIL SAMPLES

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SECTION 4

SECTION 4

SECTION 4
PROJECT ORGANIZATION AND SCHEDULE

4.1 PROJECT ORGANIZATION

The management and technical staff required to execute this project and their areas of responsibility are identified in Figure 4.1. The responsibilities of key personnel are further described as follows:

Technical Director (E. Glaza, P.E.)

The Project Technical Director will provide technical support to the Project Manager and Team and will complete technical reviews of all documents.

Project Manager (D. Babcock, P.E.)

The Project Manager is responsible for maintaining the schedule, keeping the project within budget, and ensuring the technical adequacy of the work performed.

Health and Safety Officer (B. Powell, CIH)

The Health and Safety Officer is responsible for the preparation of the Health and Safety Plan and for verifying that all subcontractors have adequate H&S Plans. If the Health and Safety Officer observes unsafe conditions, the Officer will have the authority to halt work.

Quality Assurance/Quality Control Officer and Laboratory Data Validator (M. Kosciewicz)

The Quality Assurance/Quality Control (QA/QC) Officer is responsible for verifying that all QA requirements are followed by the field teams, laboratory, and other subcontractors.

Project Geologist (S. Dillman)

The Project Geologist is responsible for leading the Field Team and for controlling activities at the site, including the activities of the surveying subcontractor, and will be responsible for preparation of the Data Gap Investigation summary.

Project Engineer (J. Park)

The Project Engineer is responsible for the development, screening, and detailed analysis of alternatives and for the recommendation of a remedy and the preparation of the FFS report.

Field Team

The Field Team will participate in and assist with the field activities, such as sample collection, monitoring well installation, and real-time sample analysis.

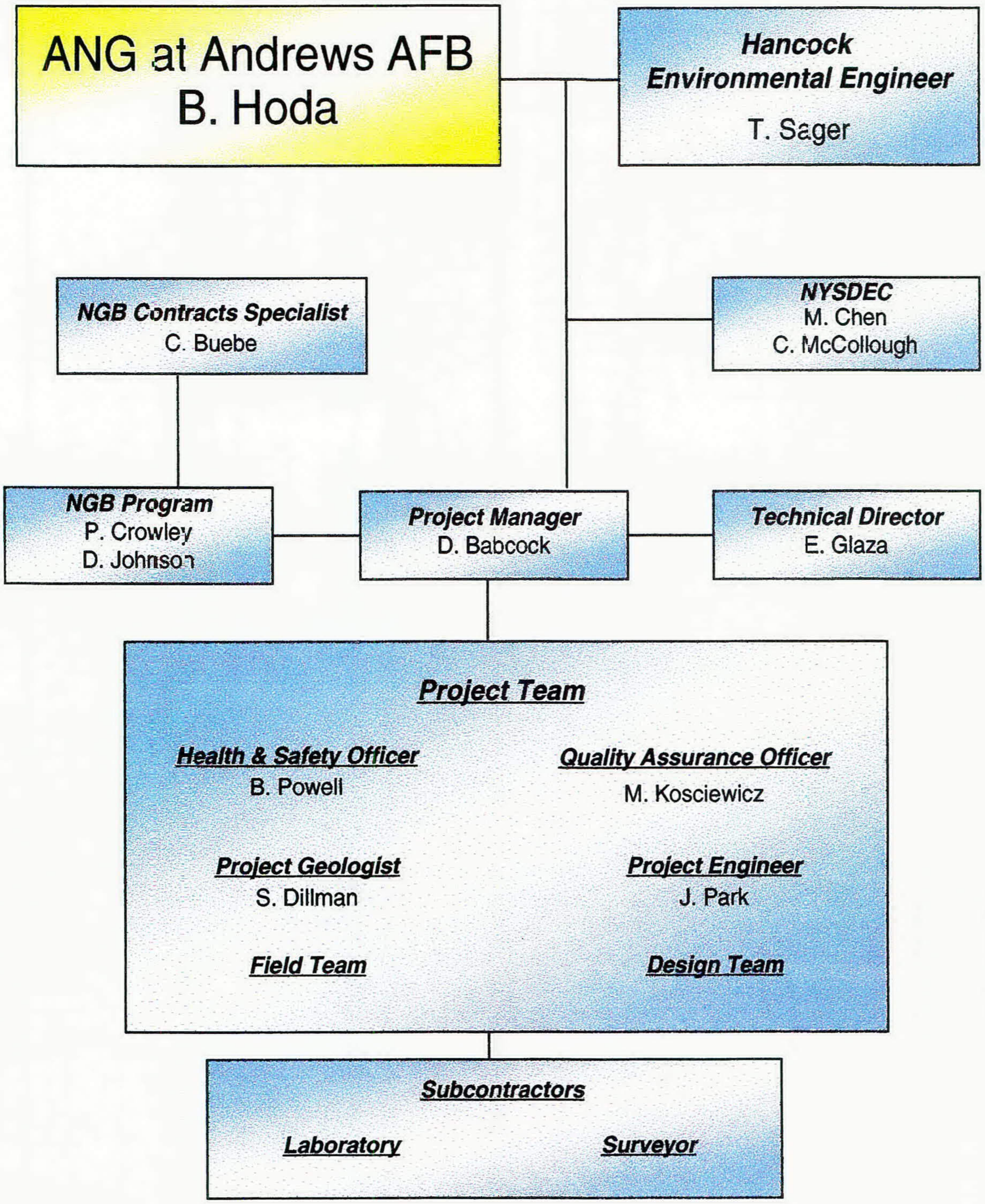
Design Team

The Design Team will be responsible for compiling the remedial design and associated documents.

4.2 PROJECT SCHEDULE

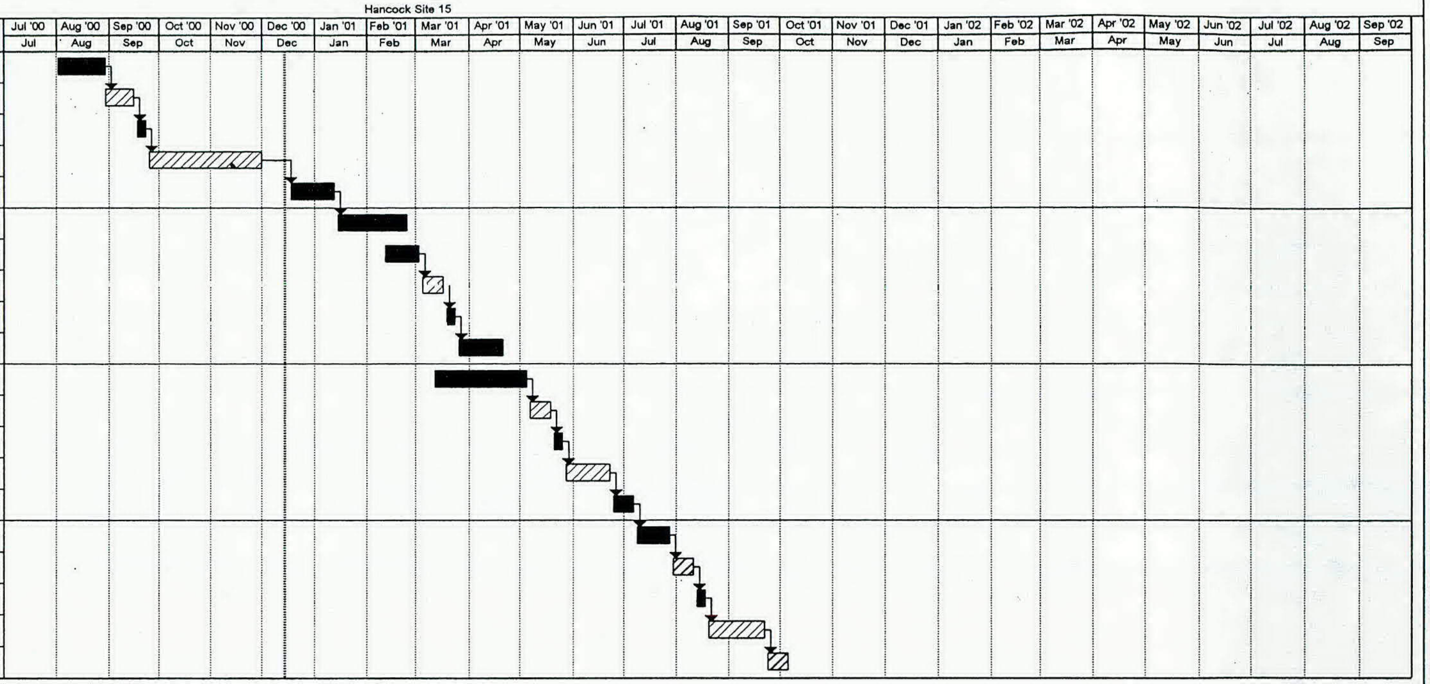
The entire scope of work, from draft work plan to final design, is expected to take nearly two years. A complete schedule is presented as Figure 4.2.

Figure 4.1
Hancock Site 15
Data Gap Investigation, Focused Feasibility Study and Design
Project Organization Chart



Air National Guard
Hancock Site 15

ID	Task Name	Duration	Start	Finish
1	Draft Work Plan to ANG	20 days	Wed 8/2/00	Tue 8/29/00
2	ANG Review of Draft Work Plan	2.6 wks	Wed 8/30/00	Fri 9/15/00
3	Final Work Plan to NYSDEC	1 wk	Mon 9/18/00	Fri 9/22/00
4	NYSDEC Review of Final Work Plan	9.8 wks	Mon 9/25/00	Thu 11/30/00
5	Field Work	4 wks	Mon 12/18/00	Fri 1/12/01
6	Lab Analyses and Data Validation of Field Samples	6 wks	Mon 1/15/01	Fri 2/23/01
7	Draft Field Sampling Report to ANG (to include first part of Focused FS)	3 wks	Mon 2/12/01	Fri 3/2/01
8	ANG Review of Draft Field Sampling Report	2 wks	Mon 3/5/01	Fri 3/16/01
9	Final Field Sampling Report to NYSDEC	1 wk	Mon 3/19/01	Fri 3/23/01
10	NYSDEC Review of Final Field Sampling Report	4 wks	Mon 3/26/01	Fri 4/20/01
11	Draft Focused FS to ANG	8 wks	Mon 3/12/01	Fri 5/4/01
12	ANG Review of Draft Focused FS	2 wks	Mon 5/7/01	Fri 5/18/01
13	Draft Final Focused FS to NYSDEC	1 wk	Mon 5/21/01	Fri 5/25/01
14	NYSDEC review of Draft Final Focused FS	4 wks	Mon 5/28/01	Fri 6/22/01
15	Final Focused FS	2 wks	Mon 6/25/01	Fri 7/6/01
16	Draft PRAP to ANG	3 wks	Mon 7/9/01	Fri 7/27/01
17	ANG Review of DraftPRA to ANG	2 wks	Mon 7/30/01	Fri 8/10/01
18	Draft Final Proposed Plan to NYSDEC	1 wk	Mon 8/13/01	Fri 8/17/01
19	NYSDEC Review of Proposed Plan	5 wks	Mon 8/20/01	Fri 9/21/01
20	Meeting Notice/Public Review (first portion)	2 wks	Mon 9/24/01	Fri 10/5/01



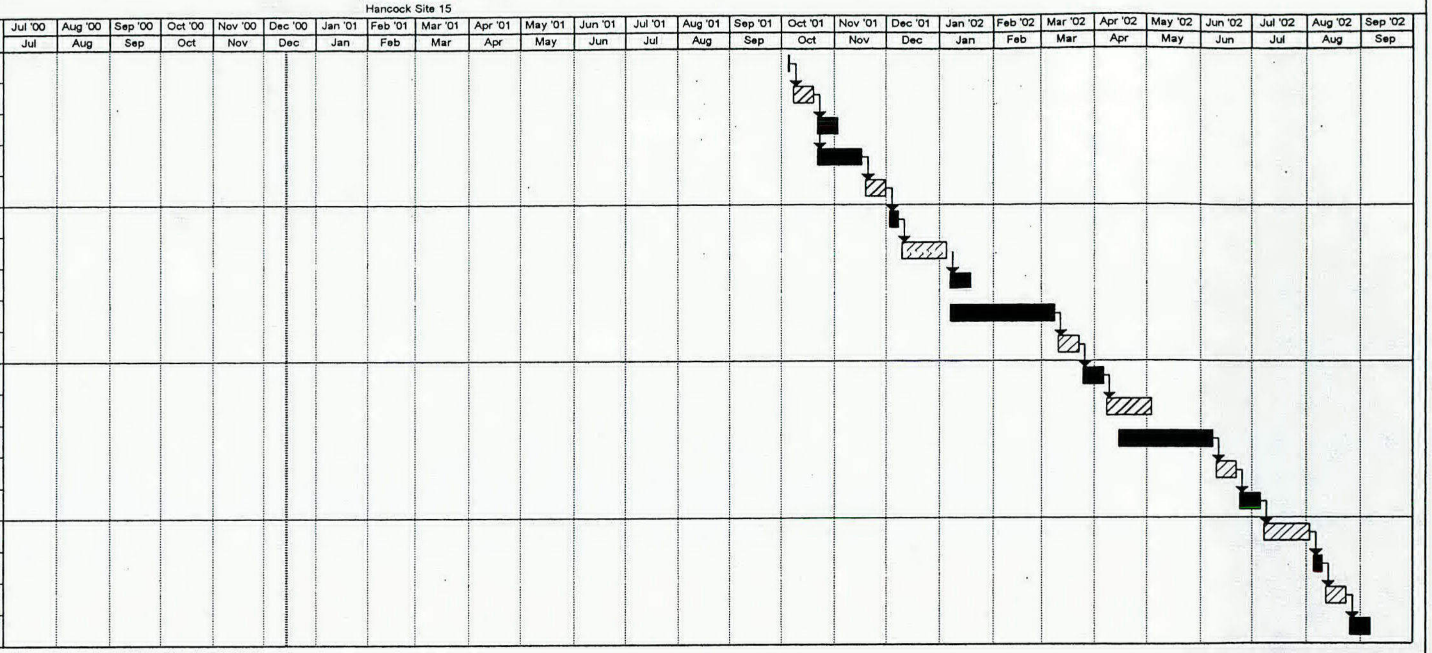
Project: 38483sch
Date: Thu 12/14/00

Review Task ■ Parsons Task ■

Figure 4.2 Project Schedule

Air National Guard
Hancock Site 15

ID	Task Name	Duration	Start	Finish
21	Public Meeting	1 day	Fri 10/5/01	Fri 10/5/01
22	Public Review (second portion)	2 wks	Mon 10/8/01	Fri 10/19/01
23	Final Proposed Plan	2 wks	Mon 10/22/01	Fri 11/2/01
24	Draft Record of Decision to ANG	4 wks	Mon 10/22/01	Fri 11/16/01
25	ANG Review of Draft Record of Decision	2 wks	Mon 11/19/01	Fri 11/30/01
26	Draft Final Record of Decision to NYSDEC	1 wk	Mon 12/3/01	Fri 12/7/01
27	NYSDEC Review of Record of Decision	4 wks	Mon 12/10/01	Fri 1/4/02
28	Final Record of Decision	2 wks	Mon 1/7/02	Fri 1/18/02
29	35% Design to ANG	9 wks	Mon 1/7/02	Fri 3/8/02
30	ANG Review of 35% Design	2 wks	Mon 3/11/02	Fri 3/22/02
31	35% Design to NYSDEC	2 wks	Mon 3/25/02	Fri 4/5/02
32	NYSDEC Review of 35% Design	4 wks	Mon 4/8/02	Fri 5/3/02
33	95% Design to ANG	8 wks	Mon 4/15/02	Fri 6/7/02
34	ANG Review of 95% Design	2 wks	Mon 6/10/02	Fri 6/21/02
35	95% Design to NYSDEC	2 wks	Mon 6/24/02	Fri 7/5/02
36	NYSDEC Review of 95% Design	4 wks	Mon 7/8/02	Fri 8/2/02
37	Final Design to ANG	1 wk	Mon 8/5/02	Fri 8/9/02
38	ANG Review of Final Design	2 wks	Mon 8/12/02	Fri 8/23/02
39	Final Design to NYSDEC	2 wks	Mon 8/26/02	Fri 9/6/02



Project: 38483sch
Date: Thu 12/14/00

Review Task ▨ Parsons Task ■

SECTION 5

SECTION 5

SECTION 5
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APPENDIX A

APPENDIX A

APPENDIX A
SAMPLING AND ANALYSIS PLAN

FINAL

APPENDIX A.1

FIELD SAMPLING PLAN FOR DATA GAP INVESTIGATION AT SITE 15, HANCOCK FIELD SYRACUSE, NY

PROJECT No. HAAW20007054

Prepared For:

National Guard Bureau

1411 Jefferson Davis Highway
Arlington, VA 22202-3231

and

Air National Guard

Environmental Restoration Branch
3500 Fetchet Avenue
Andrews AFB, MD 20762-5157

Prepared By:

PARSONS ENGINEERING SCIENCE, INC.

290 Elwood Davis Road, Suite 312
Liverpool, New York 13088

December 2000

PARSONS

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LIST OF FIGURES AND TABLES

SECTION 1

INTRODUCTION

1.1 INTRODUCTION

The procedures that will be used to conduct field activities for the Data Gap Investigation at Site 15 at Hancock Field near Syracuse, New York, are presented in this Field Sampling Plan. The quality assurance and quality control procedures that will be used by subcontractor analytical laboratories are presented in the Quality Assurance Plan (Appendix A2).

1.2 GENERAL GUIDELINES FOR FIELD WORK

1.2.1 Surface Hazards

Potential on-site surface hazards, such as sharp objects, overhead power lines, and building hazards, will be identified prior to initiation of field work. Generally, such hazards will be identified during a site reconnaissance or scoping visit that precedes the first day of field work. For a detailed listing of potential chemical and physical hazards at the site, see the site Health and Safety Plan (Appendix B).

1.2.2 Underground Utilities

All underground utilities, including electric lines, gas lines, and communication lines, will be identified prior to initiation of drilling and other subsurface work. This may be accomplished by contacting the Underground Facilities Protective Organization (UFPO) at (800) 962-7962. A UFPO representative will mark all buried utility lines in the work area. UFPO will be notified at least two working days, and not more than 10 working days, before subsurface work is conducted.

1.2.3 Field Log Books

All field activities will be carefully documented in field log books. Entries will be of sufficient detail that a complete daily record of significant events, observations, and measurements is obtained. The field logbooks will provide a legal record of the activities conducted at the site. Thus, the field logbooks will be maintained according to the following guidelines:

- Field books will be assigned a unique identification number.
- Field books will be bound with consecutively numbered pages.
- Field books will be controlled by the Field Team Leader while field work is in progress.

- Entries will be written with waterproof ink.
- Entries will be signed and dated at the conclusion of each day of field work.
- Erroneous entries made while field work is in progress will be corrected by the person who made the entries. Corrections will be made by drawing a line through the error, entering the correct information, and initialing the correction.
- Corrections made after departing the field will be made by the person who made the original entries. The correction will be made by drawing a line through the error, entering the correct information, and initialing and dating the time of the correction.
- The Parsons ES Project Manager will control field books when field work is not in progress.

At a minimum, daily field book entries will include the following information:

- Location of field activity
- Date and time of entry
- Names and titles of field team members
- Names and titles of any site visitors and site contacts
- Weather information: temperature, cloud coverage, wind speed and direction
- Purpose of field activity
- A detailed description of the field work conducted

SECTION 2

FIELD EQUIPMENT DECONTAMINATION, CALIBRATION, AND MAINTENANCE

2.1 FIELD EQUIPMENT CHECKLIST

Equipment checklists for the field activities described in this plan are provided in Attachment 1.

2.2 EQUIPMENT DECONTAMINATION

2.2.1 Decontamination Pad

A temporary decontamination pad will be constructed of high-density polyethylene (HDPE) sheeting and plywood to prevent tearing of the liner. Wash buckets and rinse fluids will be placed on the decontamination pad. Decontamination will be conducted on the decontamination pad. A wading pool may be substituted for the HDPE sheeting. The location of the decontamination pad will be determined in the field.

2.2.2 Drill Rig Decontamination

All drilling equipment, including drill rigs, augers, bits, rods, tools, split-spoon samplers, and tremie pipe, will be cleaned with a high-pressure steam-cleaning unit and scrubbed with a wire brush to remove dirt, grease, and oil before beginning work at the site. Tools, drill rods, and augers will be placed on sawhorses or polyethylene plastic sheets following steam-cleaning. Direct contact with the ground will be prevented. The back of the drill rig and all augers, rods, and tools will be decontaminated at the conclusion of drilling each monitoring well.

2.2.3 Well Materials Decontamination

PVC monitoring well casing and screens will be decontaminated by the procedures described in Section 2.2.1 immediately before installation. The screen and casing will be wrapped in polyethylene plastic following decontamination and transported from the designated decontamination area to the well location. If the PVC well casings and screens are in factory-sealed plastic sleeves, field decontamination will not be necessary. If appropriate, a decontamination pad will be constructed of high-density polyethylene sheeting on a prepared surface sloped to a sump. The sump must also be lined and provide sufficient quantity to contain at least 20 gallons of decontamination water. The size of the pad shall be sufficient to drive the drill rig on without tearing the sides or bottom of the plastic sheet. Sides of the pad will be bermed so that all decontamination water is contained.

2.2.4 Sampling Equipment Decontamination

Prior to sampling, all bowls, spoons, augers, bailers, and filtering equipment will be washed in potable water and phosphate-free detergent (*e.g.*, Alconox). The sampling equipment will then be rinsed with methanol followed by three distilled-water rinses. Between rinses, equipment will be placed on polyethylene sheets or aluminum foil if necessary. Sampling equipment may also be steam-cleaned, if appropriate. Sampling equipment will be wrapped in aluminum foil for storage or transportation from the designated decontamination area to the sample locations. Decontaminated equipment will not be placed directly on the ground surface. In order to minimize the time spent in the field and reduce the opportunity for cross contamination, the sampling team will have sufficient clean equipment available to complete a sampling round without excessive delays. Decontamination water will be placed in containers and stored in a location specified by the Hancock Environmental Engineer.

2.3 FIELD INSTRUMENT CALIBRATION

All field screening and sampling instruments (*e.g.*, temperature-conductivity-pH probes) and field test kits that require calibration prior to operation will be calibrated daily in accordance with the manufacturer's instructions. All instrument calibrations will be documented in the project field book and in an instrument calibration log. Instrument operating manuals will be maintained on-site by the field team.

2.4 MAINTENANCE PROCEDURES

2.4.1 Non-Routine Maintenance Procedures

Field equipment will be inspected prior to initiation of field work to determine whether or not it is operational. If it is not operational, it will be serviced or replaced. Batteries will be fully charged or fresh, as applicable.

2.4.2 Routine Maintenance Procedures and Schedules

Field equipment requiring preventive maintenance will be serviced in accordance with written procedures based on the manufacturer's instructions or recommendations. Maintenance will be performed in accordance with the schedule specified by the manufacturer, in order to minimize the downtime of the measurement system. Maintenance work will be performed by qualified personnel.

2.4.3 Spare Parts

A list of critical spare parts will be developed prior to the initiation of field work. Field personnel will have ready access to critical spare parts in order to minimize downtime while field work is in progress. In lieu of maintaining an inventory of spare parts, access to critical spare parts may be provided by firms capable of rapid repair or replacement. These firms must be identified prior to initiation of field work.

2.4.4 Maintenance Records

Equipment maintenance logs will be maintained to document maintenance activities and schedules. All maintenance logs will be traceable to a specific piece of equipment. These records may be audited by the Quality Assurance Officer to verify compliance.

SECTION 3

DRILLING AND MONITORING WELL INSTALLATION

3.1 DRILLING METHOD

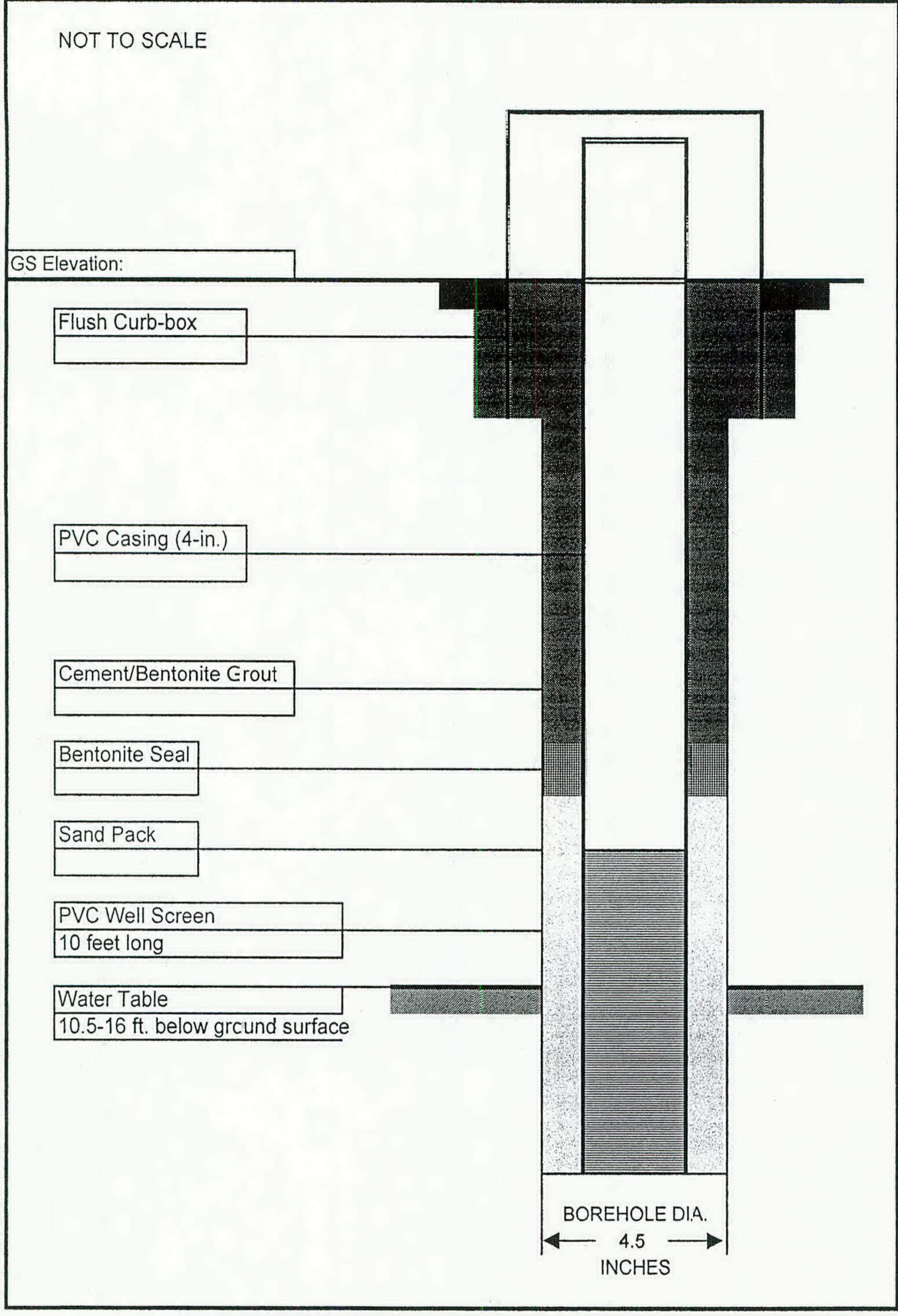
The borings for the three proposed wells will be advanced using a truck-mounted drill rig equipped with hollow-stem augers. Each well will be constructed of two-inch diameter polyvinyl chloride (PVC), machine-slotted screen (10 slot) and riser. The screen and riser will be set through the hollow stem augers so that the bottom of the screen is at least five feet below the water table, which ranges from 10.5 to 16 feet below ground surface. Thus, the well screens will extend over 10 vertical feet to 15.5 to 21 feet below ground surface (Figure 3.1). All drilling equipment will be decontaminated between each boring in accordance with methods specified in Section 2.

3.2 MONITORING WELL DEVELOPMENT

- Monitoring well development will not commence until 24 hours after installation, or full water level recovery is achieved, whichever is greater.
- Monitoring wells will be developed by using a submersible pump and dedicated tubing.
- Each monitoring well will be developed by pumping and surging until conductivity, pH, and temperature have stabilized and the water in the well is reasonably free of visible sediment (50 NTU if possible). The driller will develop the wells.
- Water level measurements will be taken before and after development.
- All monitoring well development will be supervised by an experienced field geologist and will be documented in the field book and on the Well Development Form shown in Figure 3.2.
- Following development, wells will be allowed to recover for at least 24 hours before groundwater is purged and sampled.
- Following development, all equipment coming in contact with development water will be decontaminated by methods described in Section 2.

FIGURE 3.1 BEDROCK WELL CONSTRUCTION LOG (PVC WELL)

WELL NO.:	FACILITY/SITE NAME:
PROJ. NO.:	CLIENT:
INSPECTOR:	DRILLING CONTACTOR:
DATE START:	DATE END:
LOCATION:	DRILLING METHOD:



PROTECTIVE CASING	
Material:	
Diameter:	
Depth BGS:	
Water Tight Seal:	
Flushmount:	NO
Weep hole:	
GUARD POSTS	
Material:	N/A
No. & Size:	N/A
SURFACE PAD	
Composition:	Concrete
Size:	
RISER PIPE	
Material:	PVC
Schedule:	SCH 40
Joint Type:	THREADED
O-ring:	
Diameter:	2 inches
GROUT	
Amt cement:	94 lbs
Amt bentonite:	3 lbs
Amt water:	6.5 gal
Tremied:	
Interval:	
SEAL	
Material:	BENTONITE
Type:	GRANULAR
Amount Used:	
Interval:	
FILTER PACK	
Material:	SAND
Brand Name:	AMERICAN FILTER
Amount Used:	
Grain Size Dist.:	
Interval:	
Tremied:	
SCREEN	
Material:	PVC
Diameter:	2 inches
Slot Size & Type:	10 slot
Interval BGS:	11 to 21 feet
SUMP	
Interval BGS:	N/A
Bottom Cap:	YES
BACKFILL PLUG	
Material:	N/A
Setup/Hydration Time:	N/A

FIGURE 3.2

PARSONS ENGINEERING SCIENCE, INC.
WELL DEVELOPMENT OBSERVATIONS

SITE NAME:
PROJECT NUMBER:

WELL NUMBER: **WEATHER:**
DATE: **TIME:**

DEVELOPER: of
of

DESCRIPTION OF WELL

Total Depth: Diameter:
Screen Depth:
Development Method:

GROUNDWATER PURGING

Initial Static Water Level:
One Well Volume: 3 Volumes
2-Inch Casing: Feet of Water x 0.16 Gallons/Foot = Gallons
3-Inch Casing: Feet of Water x 0.36 Gallons/Foot = Gallons
4-Inch Casing: Feet of Water x 0.65 Gallons/Foot = Gallons

Volume of groundwater purged: Gallons
Purging Device:
Purge Water Disposition (e.g., contained):

FIELD MEASUREMENTS

Time	Temp. (Degrees C)	pH	Conductivity (uS/cm)	Turbidity (NTUs)	Comments

SECTION 4

FIELD SAMPLING PROCEDURES

4.1 INTRODUCTION

Procedures for obtaining samples of various environmental media are in this section. Sample handling procedures are described in Section 5. Sampling equipment checklists are provided in Attachment 1.

At a minimum, sampling procedure standards will be in accordance with the most recent U.S. Environmental Protection Agency (USEPA) guidelines and/or regulations. The procedures described here are derived primarily from the following guidance documents:

- USEPA - 600-4-83-040, *Characterization of Hazardous Waste Sites - A Methods Manual: Volume II. Available Sampling Methods*
- USEPA - OSWER - 9950.1, *RCRA Groundwater Monitoring Technical Enforcement Guidance Document*
- USEPA - 600-4-79-020, *Methods for Chemical Analysis of Water and Wastes*
- National Water Well Association, *Manual of Groundwater Sampling Procedures*

4.2 SOIL SAMPLING

Six soil samples will be collected from the area southeast of the concrete pad (Figure 4.1). The soil will be collected using a hand-driven auger from a depth of 0 to 1 foot below ground surface. The samples will be submitted to a laboratory for analysis of total PCBs using USEPA SW-846 Method 8082.

Soil from the two drainage swales near the site will be collected and analyzed for PCBs to determine if the contaminants have migrated into the swales and possibly offsite. At each proposed sampling location (Figure 4.1), two surface (0 to 1 foot) soil samples will be obtained using a hand-driven auger. Initially, samples will be collected from three locations in the northeastern swale. If PCBs are detected in these samples, then samples from three additional locations will be collected. Similarly, in the southwestern swale, surface soil samples will at first be collected from only two locations and then from three additional locations if necessary. Thus, up to 12 samples from the northeastern swale and up to 10 samples from the southwestern swale may be collected and analyzed.

For all of the soil sampling, PCB analysis of six quality assurance/quality control samples (two duplicates, one matrix spike, one matrix spike duplicate, and two field blanks) will also be conducted.

4.3 GROUNDWATER SAMPLING

4.3.1 Water Level and Total Depth Measurements

Prior to removing any water from a monitoring well, the static water level will be measured. An electrical water level probe will be used to measure the depth to groundwater below the datum to the nearest 0.01 foot. If the total depth of the well is not known or is suspected to be inaccurate, total well depth will be measured to the nearest 0.01 foot by slowly lowering the water level probe to the bottom of the well. Total depth will only be measured when absolutely necessary to minimize the amount of sediment disturbance in the well. The wells will also be checked for the presence of free product using an interface probe.

4.3.2 Well Purging

The static groundwater inside each well will be purged using an adjustable rate, positive displacement pump with (1/4-inch or 3/8-inch inner diameter) Teflon® or Teflon®-lined polyethylene tubing. The pump intake must be kept at least two feet above the bottom of the well. At least 24 hours following well development, each well to be sampled will be purged at a very low flow rate [200 millimeters per minute (ml/min) to 500 ml/min]. The objective of micropurging is to remove a small volume of water at a low flow rate from a discrete portion of the screened interval of the well without disturbing sediment within the casing. Therefore, the well purge rate must never be greater than the recharge rate of the well.

During purging, the water level in the well will be monitored at least every five minutes so that the maximum allowable drawdown of 0.3 feet for low flow groundwater sampling is not exceeded (USEPA, 1998b). Water level monitoring during purging will allow the sampling technician to control pumping rates to minimize drawdown. As long as no drawdown is observed during pumping, it may be assumed that the low pumping rate is removing water from within the desired, discrete, screened portion of the well. In wells with insufficient yield, purging shall be discontinued prior to dewatering of the well.

pH, temperature, dissolved oxygen, redox potential and specific conductivity will be continuously monitored during well purging using a flow-through cell. The flow-through cell will be attached directly to the discharge tubing of the positive displacement pump using Teflon®-lined polyethylene tubing. New tubing will be used at each well. Purging will continue until the parameters have stabilized to within 0.1 pH units, 10 millivolts for redox potential, a 3 percent change for specific conductance, and a 10 percent change for dissolved oxygen and turbidity. If such stabilization can not be achieved, USEPA's *Groundwater Sampling Procedure* (Attachment 2) will be consulted and an alternate plan of action will be developed.

Purge water will be temporarily placed in clean five-gallon buckets. After sample collection, the purge water will be containerized and managed properly off site.

4.3.3 Groundwater Sample Extraction

Sample collection will commence at the well that is known or believed to have the least contaminated groundwater and shall proceed systematically to the well with the most contaminated groundwater. Immediately following purging, a positive displacement pump with new Teflon tubing for each well will be used to collect groundwater samples (A low-flow sampling method is recommended by USEPA; a copy of the procedure can be found in Attachment 2). Tubing will be lowered into the water gently to prevent splashing and the sample will then be extracted gently to prevent creation of a vacuum in the well. Water from the positive displacement pump may be directly discharged into the sample container. The water will be carefully poured down the inner walls of the sample bottle to minimize aeration of the sample. Sample containers for volatile organics will be filled at approximately 200 ml/min and all other sample collection rates will not exceed 400 ml/min. Samples for volatile organics will be collected first, followed by samples for other chemical laboratory analyses, followed in turn by samples for on-site field analyses.

Unless specified otherwise by the analytical laboratory, sample containers will be completely filled so that no air space remains in the container. Excess water collected during sampling will be containerized and managed properly off-site.

4.3.4 Onsite Chemical Parameter Measurements

Because many chemical parameters of a groundwater sample can change significantly within a short period of time following sample acquisition, certain parameters will be measured in the field using Hach® or CHEMetrics® test kits. Table 4.1 lists the chemical analytical protocol for groundwater samples. The following discussion describes the field procedures for obtaining the onsite chemical parameter measurements.

Groundwater quality measurements such as temperature, pH, specific conductivity, dissolved oxygen, and redox potential will be monitored during well purging using a flow-through cell. The flow-through cell will be attached directly to the discharge tubing of the positive displacement pump using Teflon®-lined polyethylene tubing. A new piece of tubing will be used for each well. Groundwater quality measuring equipment will be decontaminated following the procedures described in Section 2.2. The measurements observed immediately before groundwater sampling begins will be considered the final measurements for the sample and will be recorded in the field book and on the point-specific sampling form.

Groundwater quality measurements such as carbon dioxide, ferrous iron, and alkalinity will be measured in the field using HACH® or CHEMetrics® field analysis methods. All appropriate equipment and glassware associated with the field analysis of groundwater samples will be decontaminated following the procedures in Section 2.2. Groundwater samples for these measurements will be collected after all samples for laboratory analyses have been collected. The field analysis of groundwater samples should begin immediately after collection. Direct sunlight, contact with air, and high temperatures may greatly affect the concentrations of the analytes in question. If possible, analyses will be run indoors or in the shade, and groundwater samples will be capped and stored in a cooler with a temperature maintained at four degrees C.

Duplicate analyses will be run at a frequency of 10 percent, or at least one duplicate sample for every ten field analyses. One trip blank (capped distilled water for each volatile aqueous sample shipment) and one field blank (distilled water passed over clean sampling equipment) will be collected and analyzed during each sampling round at a minimum rate of one set of blanks for every 20 samples.

4.4 BAILDOWN TEST

The following procedures will be used to remove free product from wells during the baildown test:

- Prior to collecting product samples from monitoring wells, the product thickness will be measured with an oil-water interface probe. The measurements will be noted in the field book.
- Free product present in monitoring wells will be removed with a dedicated bottom-loading polyethylene bailer lowered by dedicated polypropylene rope. Observed product thickness in the first bailer removed will be noted in the field book for comparison to the data obtained with the oil-water interface probe. Bailers will be lowered to a depth below the measured bottom of the product layer, but not submerged completely in order to minimize the volume of extraneous groundwater removed.
- Some of the small-diameter monitoring points at the site may not accommodate an oil-water interface probe or even small-diameter bailers. In the past, commercial product detector pastes have been proven ineffective due to the nature of the product at the site. The thickness of product will be estimated by lowering a water level meter into the monitoring points and visually assessing the length of staining above the point at which water is detected. This method will be biased high as any product covering the sensor will inhibit detection of the groundwater interface until the sensor is lowered far enough into groundwater to dilute the product. The bias will be reduced by noting the total depth of submergence of the probe and by measuring upwards from below the water table until groundwater is no longer detected. Care must be taken so that the water level probe and tape are thoroughly decontaminated after this procedure to prevent cross-contamination with other wells.
- The wells will be bailed until free product can no longer be effectively recovered. A peristaltic pump will be utilized in monitoring points which cannot be bailed. The wells will again be measured with an oil-water interface probe to confirm the removal of the product. The volume of product removed as well as the total volume of groundwater purged will be recorded in the field book.
- The wells will then be left to recover. Pressurized well caps, if present, will not be sealed during the recovery process. The bailers used will be dedicated to each well for subsequent tests, if needed. Full decontamination of the bailers will not be necessary.

Any product on the bailers will be removed with deionized water, and the bailers will be hng inside the wells just above the product/water level.

- Approximately one hour after bailing, each well will be checked with an oil-water interface probe for product recovery. If the product thickness is greater than or equal to the original measured thickness, the baildown test will be repeated. Monitoring for product recovery will be conducted at 15-minute intervals for one hour or until complete recovery.
- Approximately four hours after bailing, each well will again be checked with an oil-water interface probe for product recovery. If the product thickness is greater than or equal to the original measured thickness, the baildown test will be repeated. Monitoring for product recovery will be conducted at 1-hour intervals for four hours or until complete recovery.
- No well will be bailed down more than twice on the first day of testing. Following the measurements after four hours have elapsed, the wells will be left overnight. Periodic recovery checks and measurement rounds at the end of the day and the start of the next day will be conducted, but no actions will be taken based on the findings.
- Approximately twenty-four hours after bailing, each well will again be checked with an oil-water interface probe for product recovery. If the product thickness is greater than or equal to the original measured thickness, the baildown test will be repeated. The monitoring frequency for product recovery will be determined based on a review of the data from the initial baildown test.
- All wells will then be checked for product daily for three days. After three days, a decision will be made on whether to extend the measurement period, repeat any tests, or leave the wells until the next round of periodic monitoring. If product recovery is slow, as anticipated, a program of monthly monitoring will be initiated.
- At the completion of the baildown test, all bailers and polypropylene rope will be disposed of in accordance with the Work Plan.

The following equipment will be utilized during the baildown test:

- Oil-water interface probe
- Disposable polyethylene bailers
- Polypropylene rope
- Pails or other containers calibrated for volume measurement
- Personal protective equipment in accordance with the project Health and Safety Plan (Appendix B)
- Camera
- PID
- Decon supplies

4.5 AIR MONITORING

Air monitoring will be conducted with a photoionization detector (PID) during all field activities. The PID will be used to monitor for VOCs in the breathing zone and in boreholes. PID readings will be recorded in the field book and on the boring log during drilling activities.

The PID will be a Photovac MicroTip HL-2000 (or equivalent) equipped with a 10.6 eV lamp. The Photovac MicroTip is capable of ionizing and detecting compounds with an ionization potential of less than 10.6 eV. This accounts for roughly 54 percent to 73 percent of the VOCs on the Target Compound List. The detailed procedure for the PID operation is included in the project Health and Safety Plan (Appendix B).

Calibration will be performed at the beginning and end of each day of use with a standard calibration gas of a concentration within the expected range of use. The calibration gas to be used will have 100 ppm of isobutylene. If abnormal or erratic readings are observed, additional calibration will be required. All calibration data will be recorded in field books and on calibration log sheets to be maintained on-site. A battery check will be completed at the beginning and end of each working day, and the battery will be checked for proper voltage.

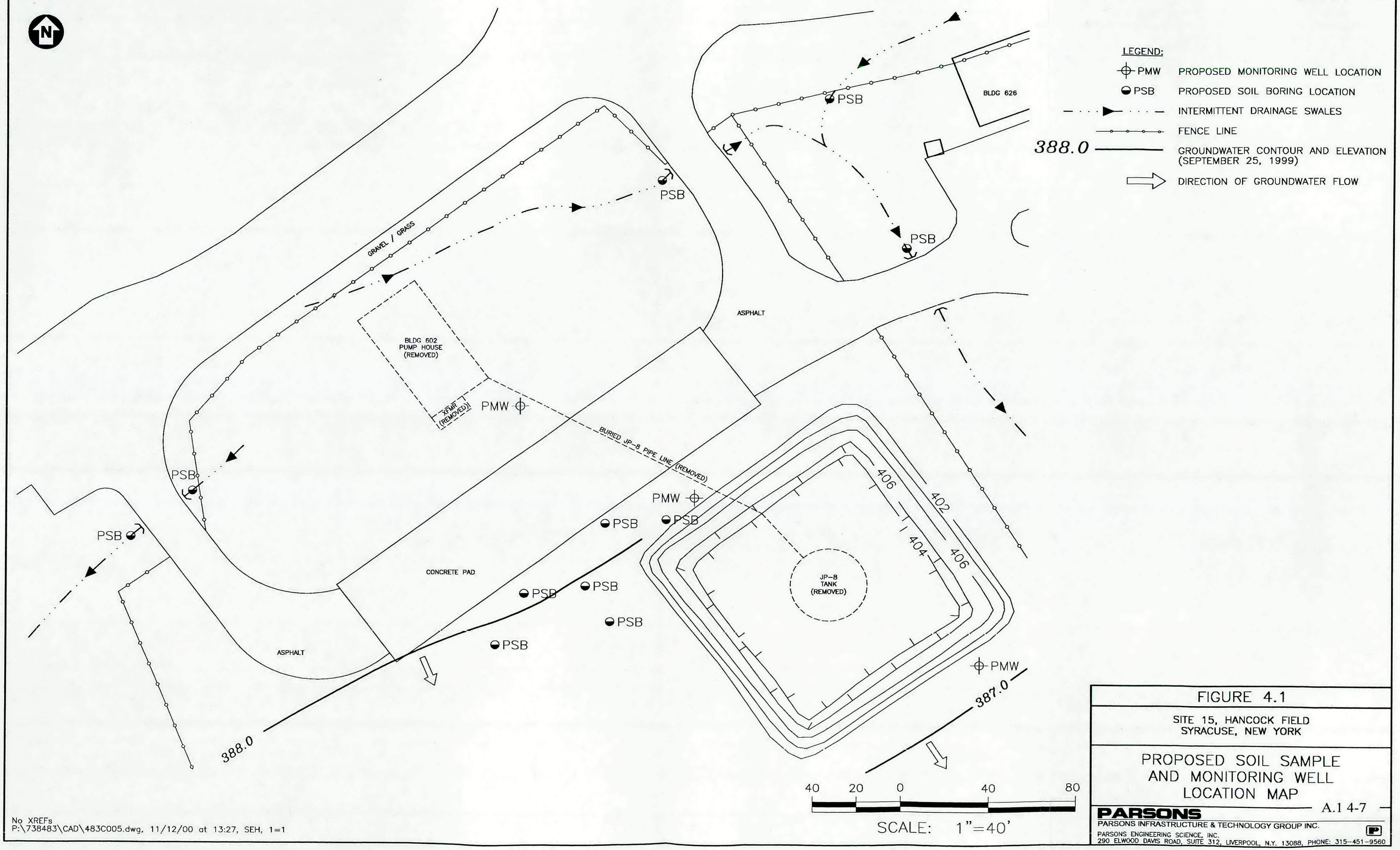


FIGURE 4.1

SITE 15, HANCOCK FIELD
SYRACUSE, NEW YORK

PROPOSED SOIL SAMPLE
AND MONITORING WELL
LOCATION MAP

A.1 4-7

PARSONS
PARSONS INFRASTRUCTURE & TECHNOLOGY GROUP INC.
PARSONS ENGINEERING SCIENCE, INC.
290 ELWOOD DAVIS ROAD, SUITE 312, LIVERPOOL, N.Y. 13088, PHONE: 315-451-9560

TABLE 4.1
GROUNDWATER MONITORING ANALYTICAL PROTOCOL

Analyte	Method/Reference	Data Use	Sample Volume Sample Container, Sample Preservation	Maximum Allowable Detection Limit	Field or Fixed-Base Laboratory
Volatile Organic Compounds (VOCs)	CLP or Method 8260 (GC/MS)	Volatile organic compounds have been identified as groundwater contaminants of concern.	Collect water samples in a 40 mL VOA vial with zero headspace; cool to 4°C; add hydrochloric acid to pH 2.	1 µg/L	Fixed-Base
Semivolatile Organic Compounds (SVOCs)[1]	CLP or Method 8270 (GC/MS)	A semi-volatile organic compound has been identified as a groundwater contaminant of concern.	Collect water samples in a 1000 mL VOA vial with zero headspace; cool to 4°C; add hydrochloric acid to pH 2.	1 µg/L	Fixed-Base
Redox Potential	Direct-reading meter (Orion Model 290A with Orion Combination Redox 9678BN probe or similar)	The redox potential of groundwater influences and is influenced by biologically mediated reactions. It can be used as an indicator of the terminal electron acceptor process involved in contaminant biodegradation.	Measure directly using a flow-through cell with probe portals. Probe should be standardized against Zobel solution.	NA	Field
Dissolved Oxygen	Direct-reading meter (YSI Model 50B with YSI 5739 probe or similar)	Reduced concentrations of dissolved oxygen indicate that microorganisms are facilitating oxygen reduction to biodegrade contaminants of concern.	Measure directly using a flow-through cell with probe portals. Probe should be calibrated with zero dissolved oxygen solution.	0.2 mg/L	Field
Carbon Dioxide (CO_2)	Colorimetric HACH 8223	CO_2 is a byproduct of biological respiration.	Collect 100 mL of water in a glass container; and use 10 mL aliquot for analysis.	5 mg/L	Field
Nitrate (NO_3^{-1})	IC Method E300	Depleted nitrate indicates microorganisms are facilitating biodegradation.	Collect 100 mL of water in a glass container; and use 10 mL aliquot for analysis.	0.1 mg/L	Fixed-Base

TABLE 4.1 (CONT'D)
GROUNDWATER MONITORING ANALYTICAL PROTOCOL

Analyte	Method/Reference	Data Use	Sample Volume Sample Container, Sample Preservation	Maximum Allowable Detection Limit	Field or Fixed-Base Laboratory
Ferrous Iron (Fe^{2+})	Colorimetric HACH 8146	Elevated ferrous iron concentrations indicate that microorganisms are facilitating ferric iron reduction to biodegrade contaminants of concern.	Collect 100 mL of water in a glass container; and use 10 mL aliquot for analysis.	0.1 mg/L	Field
Sulfate (SO_4^{2-})	IC Method E300	Reduced concentrations of sulfate indicate that microorganisms are facilitating sulfate reduction to biodegrade contaminants of concern.	Collect 100 mL of water in a glass container; and use 10 mL aliquot for analysis.	2.0 mg/L	Fixed-Base
Methane (CH_4), ethane, and ethene	USEPA National Risk Management Research Lab Method 175 Modified or SW 3810 Modified	Elevated methane concentrations indicate biodegradation via methanogenesis. Ethane and ethene are produced during reductive dechlorination.	Collect water samples in 50 mL glass serum bottles with butyl gray/Teflon-lined caps; add H_2SO_4 to pH ≤ 2; cool to 4°C.	0.1 mg/L	Fixed-Base
Chloride (Cl^-)	HACH Chloride Test Kit Model 8-P, or IC Method E300	Final product of chlorinated solvent reduction.	Collect 250 ml of water in a glass container.	1 mg/L	Field (HACH Test Kit) Fixed-base (Method E300)
pH	Direct-reading meter (Orion Model 140, or similar)	Aerobic and anaerobic processes are pH-sensitive.	Measure directly using a contained flow-through cell with probe portals. Probe should be calibrated using at least three pH standards.	0.1 pH unit	Field

TABLE 4.1 (CONT'D)

GROUNDWATER MONITORING ANALYTICAL PROTOCOL

Analyte	Method/Reference	Data Use	Sample Volume Sample Container, Sample Preservation	Maximum Allowable Detection Limit	Field or Fixed-Base Laboratory
Temperature	Direct-reading meter	Metabolism rates for microorganisms depend on temperature.	Measure directly using a contained flow-through cell with probe portals.	1 degree C	Field
Conductivity	Direct-reading meter (Orion Model 140 with Conductivity Cell 014050, or similar)	General water quality parameter used as a marker to verify that site samples arc obtained from the same groundwater system.	Measure directly using a contained flow-through cell with probe portals. Probe is factory calibrated.	NA	Field
Alkalinity (as $CaCO_3$)	HACH AL-AP MG-L.	Secondary indicator of biological activity.	Collect 100 mL of water in a glass container; and use 10 mL aliquot for anlaysis.	20 mg/L	Field
Total Organic Carbon	SW9060	Used to determine if anarobic metabloism is possible in the absence of anthropogenic carbon.	Collect 100 mL of water in a glass container, and cool to 4 °C.	0.1 mg/L	Fixed-base

SECTION 5

FIELD SAMPLE CUSTODY

5.1 SAMPLE IDENTIFICATION

Each sample will be given a unique alpha-numeric identifier. Duplicate samples will be assigned identifiers that do not allow the laboratory to distinguish them as duplicates. Each sample container will be labeled prior to packing for shipment. The sample identifier, site name, date and time of sampling, and analytical parameters will be written on the label in waterproof ink and recorded in the field book.

5.2 CHAIN OF CUSTODY

A Chain-of-Custody (COC) record (Figure 5.1) will accompany the sample containers during selection and preparation at the laboratory, during shipment to the field, and during return shipment to the laboratory. The COC will identify each sample container and the analytical parameters for each, and will list the field personnel that collected the samples, the project name and number, the name of the analytical laboratory that will receive the samples, and the method of sample shipment. If samples are split and sent to different laboratories, a copy of the COC record will be sent with each sample shipment.

The COC will be completed by field personnel as samples are collected and packed for shipment. Erroneous markings will be crossed out with a single line and initialed by the author. The REMARKS space will be used to indicate if the sample is a matrix spike, matrix spike duplicate, or matrix duplicate. Trip and field blanks will be listed on separate rows. After the samples have been collected and sample information has been listed on the COC form, the method of shipment, the shipping cooler identification number(s), and the shipper airbill number will be entered on the COC. Finally, a member of the sampling team will write his/her signature, the date, and time on the first RELINQUISHED BY space. Duplicate copies of each COC must be completed. One copy of the COC will be retained by sampling personnel. The other copy and the original will be sealed in a plastic bag and taped inside the lid of the shipping cooler. Sample shipments will be refrigerated at 4°C, typically by packing with ice, to preserve the samples during shipment.

After the shipping cooler is closed, custody seals provided by the laboratory will be affixed to the latch and across the front and back of the cooler lid, and signed by the person relinquishing the samples to the shipper. The seal will be covered with clear tape, and the cooler lid will be secured by wrapping with packing tape. Then the cooler will be relinquished to the shipper, typically an overnight carrier. The COC seal must be broken to open the container. Breakage of the seals before receipt at the laboratory may indicate tampering. If tampering is apparent, the laboratory will contact the Parsons ES Project Manager, and the samples will not be analyzed. The samples will be delivered to the laboratory within 48 hours of collection.

5.3 SAMPLE DOCUMENTATION

The field team leader will retain a copy of the COC, and, in addition, the field team leader will ensure that the following information about each sample is recorded in the field book:

- Sample identifier
- Identification of sampled media (*e.g.*, soil, groundwater)
- Sample location with respect to known reference point
- Physical description of sample location
- Field measurements, (*e.g.*, pH, temperature, conductivity, and water levels)
- Date and time of collection
- Sample collection method
- Volume of groundwater purged before sampling
- Number of sample containers
- Analytical parameters
- Preservatives used
- Shipping information:
    - Dates and method of sample shipments
    - Chain-of-Custody Record numbers
    - FedEx Air Bill numbers
    - Sample recipient (*e.g.*, laboratory name)

5.4 PARSONS ES SAMPLE TRACKING SYSTEM

Parsons ES will use an in-house tracking system to monitor sampling schedules, and the progress of laboratory analytical work and reporting, and to assist in performing contract compliance screening and data validation. The system tracks the following information for each sample: sample identifier, sample medium, sampling date, analytical parameters, sample delivery group (SDG) designations for samples, and laboratory report due date.

The sample tracking system consists of the following procedures:

1. A Data Tracker (DT) will be assigned to each sampling event. The DT will provide sequentially numbered COC forms to the field sampling team (FT), and maintain a COC log. The FT will sign out the COC forms prior to sampling.
2. The FT will ship the white (original) and yellow copy of the completed COCs to the laboratory with the field samples. The serial numbers of all the COCs that were either sent to the laboratory or voided will be recorded in the field book.
3. The FT will return: (1) pink copies of the COC forms that were sent to the lab; (2) voided COCs; and (3) any unused COCs to the DT. The DT will maintain a file of the completed COCs for each project, and will keep an inventory of all the numbered COCs.
4. The DT will enter the following information into the COC log: (1) all COC numbers (including voided or unused numbers); (2) names of FT members; (3) site name; (4) project number; (5) sampling date; (6) shipping date; (7) number of samples per matrix; (8) analytical parameters requested; and (9) the laboratory name, address, and phone number.
5. The DT will call the laboratory on the work day following receipt of the COCs to confirm the time, date, and condition of the samples shipped, to determine laboratory SDG identifiers, and to confirm the contract-required due date for receipt of analytical results.
6. The DT will use an electronic spreadsheet and database program to generate a Sample Tracking Report every two weeks, or more frequently if necessary. The database allows sampling data to be sorted by site name, project number, sampling dates, project number, laboratory, and laboratory name.
7. The Project Manager or a designated representative will maintain day-to-day contact with the laboratory to monitor the progress of analytical work.
8. The DT will contact the Parsons ES Project Manager every Friday to determine the status of analytical work, and to confirm the dates for contract compliance screening and data validation.
9. The Project Manager will deliver sample analytical results received from the laboratory to the DT for contract compliance. The Project Manager will retain the shipping receipt to document the date of receipt.

CHAIN OF CUSTODY RECORD

NO:

CLIENT:	PROJECT NO.	PROJECT MGR:	ANALYSES REQUIRED	Send results to: PARSONS ENGINEERING SCIENCE, INC. 290 Elwood Davis Road-Suite 312 Liverpool, NY 13088 Telephone: (315) 451-9560 Fax: (315) 451-9570
PROJECT NAME: SAMPLERS:	NOTES - (Reference QAPP and/or analytical protocols to be used):			Lab Submitted to:

FIELD SAMPLE ID	LOCATION DESCRIPTION	DATE	TIME	GRAB	COMP	MATRIX	NUMBER OF BOTTLES										REMARKS

Relinquished by: (Signature)	Date:	Time:	Shipped via:	Airbill #:	Received by:(Signature)	Date:	Time:	Cooler Temp: ________°C Samples Intact: ____Yes ____No
Relinquished by: (Signature)	Date:	Time:	Shipped via:	Airbill #:	Received by:(Signature)	Date:	Time:	Cooler Temp: ________°C Samples Intact: ____Yes ____No
Relinquished by: (Signature)	Date:	Time:	Shipped via:	Airbill #:	Received by:(Signature)	Date:	Time:	Cooler Temp: ________°C Samples Intact: ____Yes ____No

TYPE CODES: SOLID

SD- Sediment
SS- Surface Soil
SB- Subsurface Soil
MW- Monitoring Well Boring

TP- Test Pit/Tank Pit
DR- Drum Waste
WA- Solid Waste
OS- Other Solid
WP- Wipe Sample

WATER

MW- Monitoring Well
LC- Leachate
SW- Surface Water
DW- Drill Water

FD- Fuel Dispenser
MH- Manhole
OW- Oil Water Separator
PR- Piping Run

ST- Storm Water
WW- Waste Water
OL- Other Liquid (eg. Drum liquid)

MATRIX

WG - Ground Water
WS - Surface Water
SO - Soil
SW-Swab or Wipe

QUALITY CONTROL

FB- Field Blank (number each)
TB- Trip Blank (number each)
WB- Wash Blank (number each)

NO:

Figure 5.1

SECTION 6

SAMPLING QA AUDITS

6.1 SAMPLING QA AUDITS

Sampling QA audits may be conducted to verify that field work is conducted in accordance with the procedures specified in this document. The QA audits will be performed by the Quality Assurance Officer (QAO) or a qualified designee under the direction of the QAO. The designee will not have responsibility for the project work associated with the audit.

Sampling QA audits will include, but will not be limited by, review of the following items:

- Decontamination procedures
- Sampling procedures
- Sample container cleanliness, size, and material
- Sample identification (labels and COC)
- Sample handling, preservation, and shipping
- Sample tracking
- Maintenance and calibration of sampling equipment
- Corrective action

An audit report must be submitted to the Parsons ES Project Manager within 15 days of completion of the audit. Serious deficiencies will be reported to the Project Manager within 24 hours. This may be accomplished by issuing a Corrective Action Request (CAR) (Figure 6.1). The CAR identifies the out-of-compliance condition, reference documents, and recommended corrective action. The CAR will be issued to the individual(s) responsible for the noncompliance and to the Project Manager. The individual to whom the CAR is addressed will respond by writing a brief description of the cause and corrective action required in the appropriate area on the CAR, sign and date the response, and return the CAR to the QAO.

The Project Manager will be responsible for ensuring that all required corrective actions identified during an audit are acted upon promptly and satisfactorily. The QAO or a qualified designee will verify and document that satisfactory corrective action has been taken. All audit checklists, audit reports, audit findings, and acceptable resolutions will be approved by the QAO. Then the QAO will close the audit. The QAO will maintain a status log for CARs, and the CARs will be retained in the project file.

6.2 RECORD MAINTENANCE

A project file will be established to retain the documents and records generated during the work assignment. Field records will be stored in the project file when not in use. At the conclusion of the work assignment the project file will be archived by Parsons ES for the period specified in the work assignment contract agreement.

Field records that must be retained in the project files include:

- Field books
- Chain-of-Custody forms
- Site photographs
- QA audit reports

Equipment calibration and maintenance records will be retained by a designated Parsons ES equipment manager for at least as long as the project files are retained.

Figure 6.1

PARSONS

CORRECTIVE ACTION REQUEST

Log Number__________

☐ CORRECTIVE ACTION REQUEST

☐ "I COULD DO MY JOB BETTER IF"

PART "A" TO PART "C" TO BE COMPLETED BY ORIGINATOR

PART A – Statement of problem and impact – – identify any work processes or measurable items:

PART B – Suggested solution:

PART C – How I can participate in the suggested solution:

Originator:____________________ Ext:____________ Location:____________

Please print or type this CAR Form. Submit the completed form to your Project / Department / Division Quality Coordinator.

PRO-QIP-01(8/92)

HRD/CAR (8/92) FT

PARSONS

CORRECTIVE ACTION REQUEST DISPOSITION

(To be completed by Project/Department/Division Quality Coordinator)

____

____

____

Please print name of originator's supervisor

Date CAR Logged: __________
Date CAR Closed: __________

Log of activity and steps taken to resolve this CAR:

If a Root Cause was identified, please describe:

Describe the resolution of this CAR:

Please identify any individuals who contributed to the resolution of this CAR:

☐ This CAR is applicable to this Project / Department/Division only.
☐ This CAR is being flagged for wider company distribution.

ATTACHMENT 1

GENERAL FIELD EQUIPMENT CHECKLIST

ATTACHMENT 1

PARSONS ENGINEERING SCIENCE, INC.
FIELD EQUIPMENT CHECK LIST

The following is a general list of equipment necessary for sample collecton:

Stainless steel spoons and bowls for compositing soil and seciment samples
Appropriate sample containers
Sample bottles and coolers
Reagent-grad preservatives and pH paper
Chain-of-custody labels, tags, seals, and record forms
Log book, field sample records, and indelible ink markers
Laboratory-grade decontamination soap, reagent-grade solvents, and deionized, organic-free water to be used for decontamination of equipment
Buckets, plast wash basins, and scrub brushes
Camera and film
Stakes to identify sampling locations
Shipping labels and forms
Knife
Vermiculite or other packing/shipping material
Strapping tape
Clear plastic tape
Duct tape
Aluminum foil
Resealable plastic bags
Portable field instruments, including PID, pH meter, conductivity meter, and water level indicator

ATTACHMENT 2

USEPA REGION II
GROUNDWATER SAMPLING PROCEDURE
LOW-STRESS (LOW-FLOW) PURGING AND SAMPLING

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION II

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

I. SCOPE & APPLICATION

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

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

II. METHOD SUMMARY

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

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

III. ADDRESSING POTENTIAL PROBLEMS

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

Insufficient Yield

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

Failure to Stabilize Key Indicator Parameters

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

Cascading

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

Cross-Contamination

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

Equipment Failure

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

IV. PLANNING DOCUMENTATION AND EQUIPMENT

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

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

* Polyethylene sheeting.

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

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

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

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

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

* Flow measurement supplies (e.g., graduated cylinder and stop watch or in-line flow meter).

* Power source (generator, nitrogen tank, etc.).

* Monitoring instruments for indicator parameters. Eh and dissolved oxygen must be monitored in-line using an instrument with a continuous readout display. Specific conductance, pH, and temperature may be monitored either in-line or using separate probes. A nephalometer is used to measure turbidity.

* Decontamination supplies (see Section VII, below).

* Logbook (see Section VIII, below).

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

- Sample tags or labels, chain of custody.

V. SAMPLING PROCEDURES

Pre-Sampling Activities

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

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

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

4. Remove well cap.

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

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

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

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

Sampling Procedures

9. Install Pump: Slowly lower the pump, safety cable, tubing and electrical lines into the well to the depth specified for that well in the EPA-approved QAPP or a depth otherwise approved by the EPA hydrogeologist or EPA project scientist. The pump intake must

be kept at least two (2) feet above the bottom of the well to prevent disturbance and resuspension of any sediment or NAPL present in the bottom of the well. Record the depth to which the pump is lowered.

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

11. Purge Well: Start pumping the well at 200 to 500 milliliters per minute (ml/min). The water level should be monitored approximately every five minutes. Ideally, a steady flow rate should be maintained that results in a stabilized water level (drawdown of 0.3 ft or less). Pumping rates should, if needed, be reduced to the minimum capabilities of the pump to ensure stabilization of the water level. As noted above, care should be taken to maintain pump suction and to avoid entrainment of air in the tubing. Record each adjustment made to the pumping rate and the water level measured immediately after each adjustment.

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

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

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

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

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

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

resampling by hanging the tubing inside the well.

15. Measure and record well depth.

16. Close and lock the well.

I. FIELD QUALITY CONTROL SAMPLES

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

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

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

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

II. DECONTAMINATION

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

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

17. **<u>Daily Decon</u>**
A) Pre-rinse: Operate pump in a deep basin containing 8 to 10 gallons of potable water for 5 minutes and flush other equipment with potable water for 5 minutes.

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

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

D) Disassemble pump.

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

F) Rinse pump parts with potable water.

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

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

I) Rinse impeller assembly with potable water.

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

K) Rinse impeller assembly with distilled/deionized water.

18. **Between-Well Decon**

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

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

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

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

VIII. FIELD LOG BOOK

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

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

X. REFERENCES

Cohen, R.M. and J.W. Mercer, 1993, DNAPL Site Evaluation, C.K. Smoley Press, Boca Raton, Florida.

Puls, R.W. and M.J. Barcelona, 1996, Low-Flow (Minimal Drawdown) Ground-water Sampling Procedures, EPA/540/S-95/504.

U.S. EPA, 1993, RCRA Ground-Water Monitoring: Draft Technical Guidance, EPA/530-R-93-001.

U.S. EPA Region II, 1989, CERCLA Quality Assurance Manual.

FINAL

APPENDIX A.2

QUALITY ASSURANCE PLAN
FOR SITE 15 AT HANCOCK FIELD
SYRACUSE, NY

Project No. HAAW20007054

Prepared For:

National Guard Bureau

1411 Jefferson Davis Highway
Arlington, VA 22202-3231

and

Air National Guard

Environmental Restoration Branch
3500 Fetchet Avenue
Andrews AFB, MD 20762-5157

Prepared By:

PARSONS ENGINEERING SCIENCE, INC.

290 Elwood Davis Road, Suite 312
Liverpool, New York 13088

DECEMBER 2000

PARSONS

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SECTION 1

PROJECT DESCRIPTION

1.1 INTRODUCTION

The 174th Fighter Wing (FW) of the New York Air National Guard (NYANG) is based at Hancock Field in Syracuse, New York (Figure 1.1). Hancock Field is located approximately two miles north-northeast of Syracuse in Onondaga County in central New York.

Site 15 is a 2.5-acre plot of land and the site of a former petroleum, oil, and lubricant (POL) storage area near the southern boundary of the base. Soil and groundwater have been impacted by past fueling activities and the storage of polychlorinated biphenyl (PCB)-containing transformers, as evidenced by the presence of jet fuel-related compounds, PCBs, and free product. Benzene, toluene, ethylbenzene, and xylene (BTEX) contamination in groundwater appears to extend from the northern end of the site to East Molloy Road, south of the site. PCBs and free product appear to be concentrated around the northern central area of the site.

Site 1 is located about one-half mile northeast of Site 15. Currently staged on a concrete pad at this site is a volume of PCB-impacted soil, which will be considered along with any PCB-impacted soil to be removed from Site 15.

The Site 15 remediation will consist of a Data Gap Investigation, a Focused Feasibility Study (FFS), a Proposed Plan (PP), a Record of Decision (ROD), and a Remedial Design (RD).

1.2 PROJECT OBJECTIVES

This QA Plan addresses the data gap investigation to be carried out at the Hancock Field Site 15. All necessary reports and documentation will be prepared in accordance with the provisions specified in the Work Plan for this effort.

The objectives of the Site 15 remediation are as follows:

- to complete the delineation of contaminant migration pathways and to assess site conditions for potential remediation alternatives
- to determine potential human health and environmental risks
- to identify applicable or relevant and appropriate requirements (ARARs) for establishing the need for remedial action
- to develop and evaluate a range of site remediation alternatives and their associated costs

- to prepare the PP and the ROD and to facilitate public and regulatory review of these documents
- to support and complete a comprehensive remedial design

1.3 SCOPE OF WORK

The scope of work to be conducted under the Data Gap Investigation is as follows:

- Collect soil samples from locations southeast of the concrete pad and at the two nearby drainage swales, and analyze the samples for PCBs.
- Collect one round of groundwater samples from 17 monitoring wells and analyze the samples for BTEX and various natural attenuation indicators.
- Install three monitoring wells and conduct a baildown test at these wells and one existing well to assess free product mobility.
- Collect groundwater samples from MW-12S, MW-12D, MW-16, MW-17, MW-8, and MW-19 and analyze for PCBs.

SECTION 2

PROJECT ORGANIZATION

The organization of the project team is described in Section 4 of the Work Plan.

SECTION 3

DATA QUALITY OBJECTIVES

3.1 INTRODUCTION

The data produced during the Site 15 investigation will be compared with the defined Quality Assurance (QA) objectives and criteria for precision, accuracy, representativeness, completeness, and comparability (PARCC). The primary goal of these procedures is to ensure that the data reported are representative of actual conditions at the site.

This data assessment activity is an on-going coordinated process with data production and is intended to assure that all data produced during the project are acceptable for use in subsequent evaluations. Both statistical and qualitative evaluations will be used to assess the quality of the data. The primary evaluation of the data will be based upon the control samples described in Section 8. The blank samples will be used to evaluate whether or not the laboratory represents a possible source of sample contamination and duplicate sample results will be used to evaluate data precision.

3.2 DATA QUALITY OBJECTIVES

Data Quality Objectives (DQOs) are based on the premise that different data uses require different levels of data quality. Data quality refers to a degree of uncertainty with respect to PARCC. Specific objectives are established to develop sampling protocols and identify applicable documentation, sample handling procedures, and measurement system procedures. These DQOs are established on site conditions, objectives of the project, and knowledge of available measurement systems.

A wide range of data quality is achieved through the use of various analytical methods. The following data quality levels are widely accepted as descriptions of the different kinds of data that can be generated for various purposes:

- Level I: Field screening or analysis using portable instruments (e.g., photoionization detector [PID]). Results are often not compound specific and not quantitative but results are available in real time.
- Level II: Field analysis using more sophisticated portable analytical instruments (e.g., on-site mobile laboratory). There is a wide range in the quality of data that can be generated depending on the use of suitable calibration standards, reference materials, and sample preparation equipment. Results are available in real-time or typically within hours of sample collection.
- Level III: All analyses performed in an off-site analytical laboratory using USEPA approved analytical methods other than the Contract Laboratory Program (CLP) Routine Analytical Service (RAS) Protocols. These data are

typically used for engineering studies (e.g., treatability testing), risk assessment, and site investigations. Results are both qualitative and quantitative.

- Level IV: These data are generated using the USEPA CLP methods and supported by a rigorous QA program, supporting documentation, and data review procedures. These data are suitable for use in site characterizations, risk assessments, enforcement/litigation activities, and design of remedial alternatives.

The Site 15 project will obtain level I data quality for field screening with portable instruments such as pH meters, temperature probes, and PIDs which will be used for health and safety and field operational monitoring. In addition, these instruments or field test kits may be used to produce data for determining where to collect a sample to assess the presence of contamination; field screening of samples to be designated for laboratory confirmation analyses; and/or monitoring additional field operational parameters. This project will also obtain level III data quality for the analyses of BTEX, PCBs, methane, nitrate, and sulfate. All analyses will be conducted in accordance with the New York State Department of Environmental Conservation (NYSDEC) Analytical Services Protocol (ASP) dated December 1995 (NYSDEC, 1995), USEPA SW-846 Test Methods for Evaluating Solid Waste, Physical and Chemical dated December 1996 (USEPA, 1996), and the project Work Plan.

3.3 PRECISION

Precision is an expression of the reproducibility of measurements of the same parameter under a given set of conditions. Specifically, it is a quantitative measurement of the variability of a group of measurements compared to their average value (USEPA, 1987). Precision is usually stated in terms of standard deviation, but other estimates such as the coefficient of variation (relative standard deviation), range (maximum value minus minimum value), relative range, and relative percent difference (RPD) are common.

For this project, field sampling precision will be determined by analyzing coded duplicate samples (labeled so that the laboratory does not recognize them as duplicates) for the same parameters, and then, during data validation (Section 7), calculating the RPD for duplicate sample results. Field duplicate precision for soil analytical parameters (PCBs) should be ≤50% RPD. Field duplicate precision for aqueous analytical parameters should be ≤35% RPD.

Analytical precision will be determined by the laboratory by calculating the RPD for the results of the analysis of internal QC duplicates and matrix spike duplicates. The formula for calculating RPD is as follows:

$$\mathrm{RPD} = \frac{|V1 - V2|}{(V1 + V2)/2} \times 100$$

where:

RPD = Relative Percent Difference.

V1, V2 = The two values to be compared.

|V1 - V2| = The absolute value of the difference between the two values.

(V1 + V2)/2 = The average of the two values.

The data quality objectives for analytical precision, calculated as the RPD between spiked duplicate analyses, are presented in Table 3.1.

3.4 ACCURACY

Accuracy is a measure of the degree of agreement of a measured value with the true or expected value of the quantity of concern (Taylor, 1987), or the difference between a measured value and the true or accepted reference value. The accuracy of an analytical procedure is best determined by the analysis of a sample containing a known quantity of material, and is expressed as the percent of the known quantity that is recovered or measured. The recovery of a given analyte is dependent upon the sample matrix, method of analysis, and the specific compound or element being determined. The concentration of the analyte relative to the detection limit of the analytical method is also a major factor in determining the accuracy of the measurement. Concentrations of analytes which are close to the detection limits are less accurate because they are more affected by such factors as instrument "noise". Higher concentrations will not be as affected by instrument noise or other variables and thus will be more accurate.

Sampling accuracy may be determined through the assessment of the analytical results of field blanks and trip blanks for each sample set. Analytical accuracy is typically assessed by examining the percent recoveries of surrogate compounds that are added to each sample (organic analyses only), and the percent recoveries of matrix spike compounds added to selected samples and laboratory blanks. Additionally, initial and continuing calibrations must be performed and accomplished within the established method control limits to define the instrument accuracy before analytical accuracy can be determined for any sample set.

Accuracy is normally measured as the percent recovery (%R) of a known amount of analyte, called a spike, added to a sample (matrix spike) or to a blank (blank spike). The %R is calculated as follows:

$$\%R = \frac{SSR - SR}{SA} \times 100$$

where:

%R = Percent recovery.

SSR = Spike sample result: concentration of analyte obtained by analyzing the sample with the spike added.

SR = Sample result: the background value, i.e., the concentration of the analyte obtained by analyzing the sample.

SA = Spiked analyte: concentration of the analyte spike added to the sample.

The acceptance limits for accuracy for each parameter are presented in Table 3.1.

3.5 REPRESENTATIVENESS

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter which is most concerned with the proper design of the sampling program (USEPA, 1987). Samples must be representative of the environmental media being sampled. Selection of sample locations and sampling procedures will incorporate consideration of obtaining the most representative sample possible.

Field and laboratory procedures will be performed in such a manner as to ensure, to the degree that is technically possible, that the data derived represents the in-place quality of the material sampled. Every effort will be made to ensure chemical compounds will not be introduced into the sample via sample containers, handling, and analysis. Decontamination of sampling devices and digging equipment will be performed between samples as outlined in the Field Sampling Plan. Laboratory sample containers will be thoroughly cleaned in accordance with procedures outlined in Section 4.2. Analysis of field blanks, trip blanks, and method blanks will also be performed to monitor for potential sample contamination from field and laboratory procedures.

The assessment of representativeness also must consider the degree of heterogeneity in the material from which the samples are collected. Sampling heterogeneity will be evaluated during data validation through the analysis of coded field duplicate samples. The analytical laboratory will also follow acceptable procedures to assure the samples are adequately homogenized prior to taking aliquots for analysis, so the reported results are representative of the sample received.

Chain-of-custody procedures will be followed to document that contamination of samples has not occurred during container preparation, shipment, and sampling. Details of blank, duplicate, and chain-of-custody procedures are presented in the Field Sampling Plan (Appendix A.1).

3.6 COMPLETENESS

Completeness is defined as the percentage of measurements made which are judged to be valid (USEPA, 1987). The QC objective for completeness is generation of valid data for at least 90 percent of the analyses requested. Completeness is defined as follows for all sample measurements:

$$\%C = \frac{V}{T} \times 100$$

where:

%C = Percent completeness.

V = Number of measurements judged valid.

T = Total number of measurements.

3.7 COMPARABILITY

Comparability expresses the degree of confidence with which one data set can be compared to another (USEPA, 1987). The comparability of all data collected for this project will be ensured by the following:

- Using identified standard methods for both sampling and analysis phases of this project
- Requiring traceability of all analytical standards and/or source materials to the U.S. Environmental Protection Agency (USEPA) or National Institute of Standards and Technology (NIST)
- Requiring that all calibrations be verified with an independently prepared standard from a source other than that used for calibration (if applicable)
- Using standard reporting units and reporting formats including the reporting of QC data
- Performing a complete data validation on a representative fraction of the analytical results, including the use of data qualifiers in all cases where appropriate
- Requiring that all validation qualifiers be used any time an analytical result is used for any purpose

These steps will ensure all future users of either the data or the conclusions drawn from them will be able to judge the comparability of these data and conclusions.

TABLE 3.1
QUALITY CONTROL LIMITS FOR SOIL AND GROUNDWATER SAMPLES

Analytical Parameter	Analytical Method[a]	Matrix Spiking Compounds	Accuracy (MS/MSD[b] % Recovery)	Precision (MS/MSD RPD[c])
SOIL				
PCBs	SW 8082	Aroclor-1016 Aroclor-1260	49-138 59-164	24 26
WATER				
Aromatic Volatile Organics - Benzene, Toluene, Ethylbenzene, Xylene (BTEX)	SW 8260B	Benzene Toluene	69-123 57-139	20 20
Methane/Ethane/Ethene	RSKSOP 175	Methane Ethane Ethene	50-100 45-95 25-75	≤30 ≤30 ≤32
Nitrate	EPA 353.3	Nitrate	70-130	≤30
Sulfate	EPA 375.4	Sulfate	75-120	≤25
Iron	SW6010B	Iron	75-125	≤20

a) Analytical Methods: SW-846. 3rd edition, Updates I, II, IIA, IIB, December 1996, for bench-scale testing.

b) Matrix Spike/Matrix Spike Duplicate

c) Relative Percent Difference

SECTION 4

SAMPLING PROGRAM

4.1 INTRODUCTION

The sampling program will provide data concerning the presence and the nature and extent of contamination of groundwater and soil, if any. This section presents sample container preparation procedures, sample preservation procedures, sample holding times, and field QC sample requirements. Sample locations, and the number of environmental and QC samples to be collected are specified in the project Work Plan. The sampling procedures are described in detail in the Field Sampling Plan (FSP).

4.2 SAMPLE CONTAINER PREPARATION AND SAMPLE PRESERVATION

Sample containers will be properly washed and decontaminated prior to their use by either the analytical laboratory or the container vendor to the specifications required by the USEPA SW-846 and NYSDEC ASP. Copies of the sample container QC analyses will be provided by the laboratory for each container lot used to obtain samples. The containers will be tagged, the appropriate preservatives will be added. The types of containers are shown in Tables 4.1 and 4.2.

Samples shall be preserved according to the preservation techniques given in Tables 4.1 and 4.2. Preservatives will be added to the sample bottles by the laboratory prior to their shipment in sufficient quantities to ensure that proper sample pH is met. Following sample collection, the sample bottles should be placed on ice in the shipping cooler, cooled to 4°C with ice, and delivered to the laboratory within 48 hours of collection. Chain-of-custody procedures are described in the Field Sampling Plan (Appendix A.1).

4.3 SAMPLE HOLDING TIMES

The sample holding times for organic and inorganic parameters are given in Tables 4.1 and 4.2. Holding times for Toxicity Characteristic Leaching Procedure (TCLP) samples are given in Table 4.3. These holding times must be strictly adhered to by the laboratory. Any holding time exceedances must be reported to the Project Quality Assurance Officer.

4.4 FIELD QC SAMPLES

To assess field sampling and decontamination performance, two types of "blanks" will be collected and submitted to the laboratory for analyses. In addition, the precision of field sampling procedures will be assessed by collecting coded field duplicates and matrix spike/matrix spike duplicates (MS/MSDs). The blanks will include:

Table 4.1

Water Sample Containerization, Preservation, and Holding Times

Analysis	Bottle Type	Preservation [(a)]	Holding Time [(b)]
Volatile Organic Compounds (VOCs)	two 40-mL glass vials with Teflon septum	Cool to 4°C HCl to pH<2	10 days
Methane	two 40-mL glass vials with Teflon septum	Cool to 4°C HCl to pH<2	14 days
Nitrate/Nitrite		Cool to 4°C	
nitrate	one 250-mL plastic bottle	Sulfuric acid to pH<2	28 days
nitrite	one 250-mL plastic bottle	No preservative	48 hours
Sulfate	500-mL plastic bottle	Cool to 4°C No preservative	28 days

(a) All samples to be preserved in ice during collection and transport.

(b) Days from verified time of sample receipt (VTSR).

Table 4.2
Soil Sample Containerization, Preservation, and Holding Times

Analysis	Bottle Type	Preservation [(a)]	Holding Time [(b)]
PCBs	Wide-mouth glass w/ teflon-lined cap	Cool to 4°C	10 days*

(a) All samples to be preserved in ice during collection and transport.

(b) Days from verified time of sample receipt (VTSR).

* Sohxlet or sonication procedures for extraction and concentration of soil samples for PCBs must be completed within ten (10) days of sample collection. Extracts of samples must be analyzed within 40 days of sample collection.

Table 4.3
TCLP Sample Holding Times

Analytical Parameter	From: Sample Collection To: TCLP Extraction	From: TCLP Extraction To: Preparative Extraction	From: Preparative Extraction To: Determinative Analysis
Volatiles	14 days	NA	14 days
Semivolatiles	14 days	7 days	40 days
Pesticides	14 days	7 days	40 days
Mercury	28 days	NA	28 days
Metals (except mercury)	180 days	NA	180 days

TCLP - Toxicity Characteristic Leaching Procedure

NA - Not Applicable

- Trip Blanks - A Trip Blank will be prepared before the sample containers are sent by the laboratory. The trip blank will consist of a 40-ml VOC vial containing distilled, deionized water that accompanies the other sample bottles into the field and back to the laboratory. A trip blank will be included with each shipment of samples for target compound list (TCL) volatiles analysis. The Trip Blank will be analyzed for TCL volatile organic compounds to access any contamination from sampling and transport, and internal laboratory procedures.
- Field Blanks - Field Blanks will be taken at a minimum frequency of one per 10 field samples per sample matrix. Field blanks are used to determine the effectiveness of the decontamination procedures for sampling equipment. It is a sample of deionized, distilled water provided by the laboratory that has passed through a decontaminated bailer or other sampling apparatus. It is usually collected as a last step in the decontamination procedure, prior to taking an environmental sample. The field blank may be analyzed for all or some of the parameters of interest.

The duplicates will consist of:

- Coded Field Duplicate - To determine the representativeness of the sampling methods, coded field duplicates will be collected. The samples are termed "coded" because they will be labeled in such a manner that the laboratory will not be able to determine that they are a duplicate sample. This will eliminate any possible bias that could arise.
- Matrix Spike/Matrix Spike Duplicate (MS/MSD) - MS/MSD samples (MS/MSD for organics; MS and laboratory duplicate for inorganics) will be taken at a frequency of one pair per 20 field samples. These samples are used to assess the effect of the sample matrix on the recovery of target compounds or target analytes. The percent recoveries and RPDs are given in Table 3.1.

SECTION 5

SAMPLE TRACKING AND CUSTODY

5.1 INTRODUCTION

This section presents sample custody procedures for both the field and laboratory. Implementation of proper custody procedures for samples generated in the field is the responsibility of field personnel. Both laboratory and field personnel involved in the Chain-of-Custody (COC) and transfer of samples will be trained as to the purpose and procedures prior to implementation.

Evidence of sample traceability and integrity is provided by COC procedures. These procedures document the sample traceability from the selection and preparation of the sample containers by the laboratory, to sample collection, to sample shipment, to laboratory receipt and analysis. The sample custody flowchart is shown in Figure 5.1. A sample is considered to be in a person's custody if the sample is:

- In a person's possession
- Maintained in view after possession is accepted and documented
- Locked and tagged with Custody Seals so that no one can tamper with it after having been in physical custody
- In a secured area that is restricted to authorized personnel

5.2 FIELD SAMPLE CUSTODY

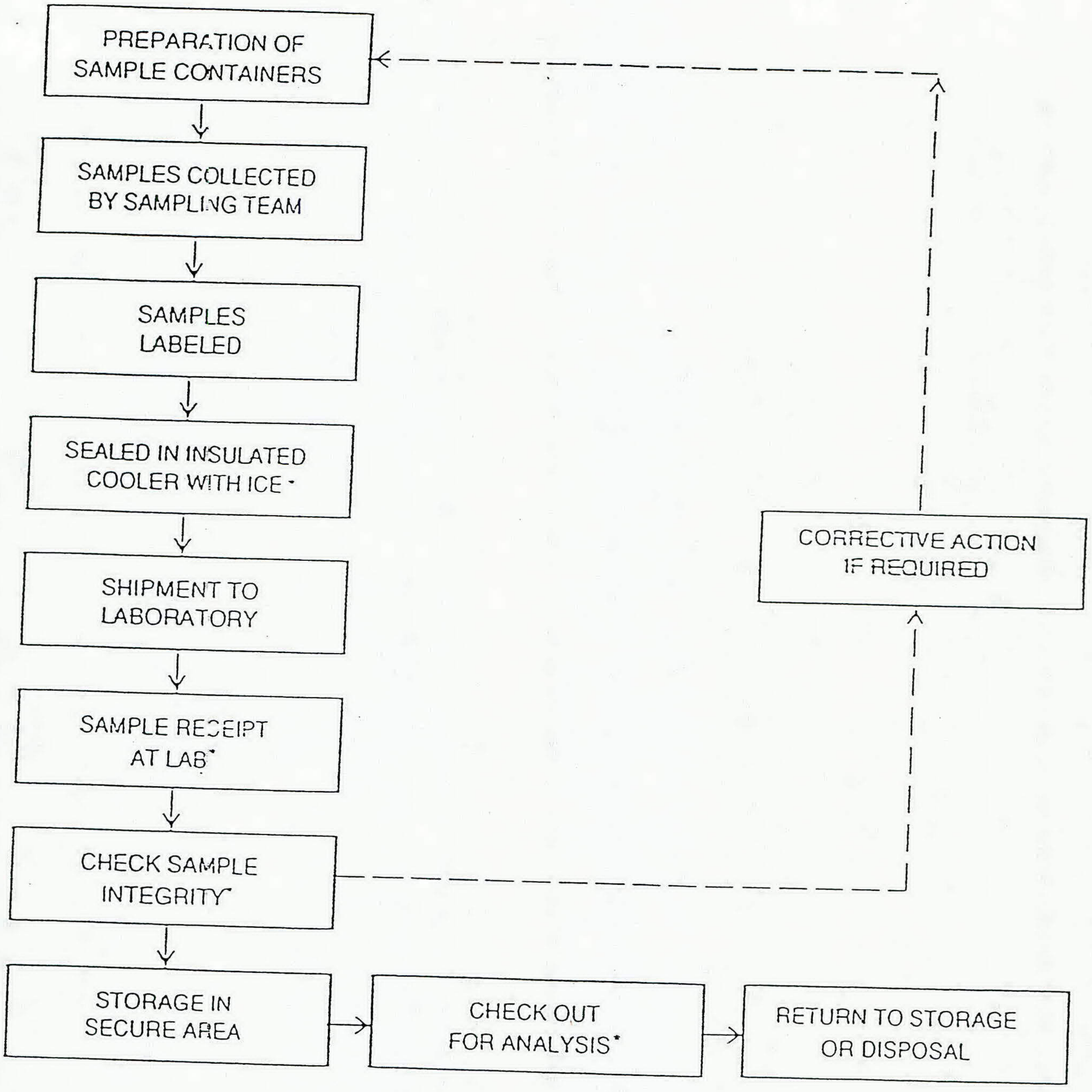
A COC record (Figure 5.2) accompanies the sample containers from selection and preparation at the laboratory, during shipment to the field for sample containment and preservation, and during return to the laboratory. Triplicate copies of the COC must be completed for each sample set collected.

The COC lists the field personnel responsible for taking samples, the project name and number, the name of the analytical laboratory to which the samples are sent, and the method of sample shipment. The COC also lists a unique description of every sample bottle in the set. If samples are split and sent to different laboratories, a copy of the COC record will be sent with each sample.

The REMARKS space on the COC is used to indicate if the sample is a matrix spike, matrix spike duplicate, or any other sample information for the laboratory. Since they are not specific to any one sample point, trip and field blanks are indicated on separate rows. Once all bottles are properly accounted for on the form, a sampler will write his or her signature and the date and time on the first RELINQUISHED BY space. The sampler will also write the method of shipment, the shipping cooler identification number, and the shipper airbill number on the top of the COC. Mistakes will be crossed out with a single line in ink and initialed by the author.

FIGURE 5.1

SAMPLE CUSTODY



* REQUIRES SIGN-OFF ON CHAIN OF CUSTODY FORM.

CHAIN OF CUSTODY RECORD

NO:

CLIENT:	PROJECT NO.	PROJECT MGR:	Send results to: PARSONS ENGINEERING SCIENCE, INC. 290 Elwood Davis Road-Suite 312 Liverpool, NY 13088 Telephone: (315) 451-9560 Fax: (315) 451-9570
PROJECT NAME:	NOTES - (Reference QAPP and/or analytical protocols to be used):		Lab Submitted to:
SAMPLERS:			

FIELD SAMPLE ID	LOCATION DESCRIPTION	DATE	TIME	GRAB	COMP	MATRIX	Number of Bottles	ANALYSES REQUIRED									REMARKS

Relinquished by: (Signature)	Date:	Time:	Shipped via:	Airbill #:	Received by:(Signature)	Date:	Time:	Cooler Temp: ____ °C Samples Intact: ____Yes ____No
Relinquished by: (Signature)	Date:	Time:	Shipped via:	Airbill #:	Received by:(Signature)	Date:	Time:	Cooler Temp: ____ °C Samples Intact: ____Yes ____No
Relinquished by: (Signature)	Date:	Time:	Shipped via:	Airbill #:	Received by:(Signature)	Date:	Time:	Cooler Temp: ____ °C Samples Intact: ____Yes ____No

TYPE CODES: SOLID		WATER			MATRIX	QUALITY CONTROL
SD- Sediment	TP- Test Pit/Tank Pit	MW- Monitoring Well	FD- Fuel Dispenser	ST- Storm Water	W - Water	FB- Field Blank (with date)
SS- Surface Soil	DR- Drum Waste	LC- Leachate	MH- Manhole	WW- Waste Water	S - Soil	TB- Trip Blank (with date)
SB- Subsurface Soil	WA- Solid Waste	SW- Surface Water	OW- Oil Water Separator	OL- Other Liquid (eg. Drum liquid)		WB- Wash Blank (with date)
MW- Monitoring Well Boring	OS- Other Solid	DW- Drill Water	PR- Piping Run			

NO:

Parsons Engineering Science, Inc.

Revised: 8/25/2000

DBASE/CHAIN.XLS

Figure 5.2 Chain-of-Custody Record

One copy of the COC is retained by sampling personnel and the other two copies are put into a sealable plastic bag and taped inside the lid of the shipping cooler. The cooler lid is closed, custody seals provided by the laboratory are affixed to the latch and across the back and front lids of the cooler, and the person relinquishing the samples signs their name across the seal. The seal is taped, and the cooler is wrapped tightly with clear packing tape. It is then relinquished by field personnel to personnel responsible for shipment, typically an overnight carrier. The COC seal must be broken to open the container. Breakage of the seals before receipt at the laboratory may indicate tampering. If tampering is apparent, the laboratory will contact the Project Manager, and the sample will not be analyzed.

5.3 LABORATORY SAMPLE CUSTODY

The Project Manager or Field Team Leader will notify the laboratory of upcoming field sampling activities, and the subsequent shipment of samples to the laboratory. This notification will include information concerning the number and type of samples to be shipped as well as the anticipated date of arrival.

The following laboratory sample custody procedures will be used:

- The laboratory will designate a sample custodian who will be responsible for maintaining custody of the samples, and for maintaining all associated records documenting that custody.
- Upon receipt of the samples, the custodian will check cooler temperature, and check the original COC documents and compare them with the labeled contents of each sample container for correctness and traceability. The sample custodian will sign the COC record and record the date and time received.
- Care will be exercised to annotate any labeling or descriptive errors. In the event of discrepant documentation, the laboratory will immediately contact the Project Manager or Field Team Leader as part of the corrective action process. A qualitative assessment of each sample container will be performed to note any anomalies, such as broken or leaking bottles. This assessment will be recorded as part of the incoming chain-of-custody procedure.
- The samples will be stored in a secured area at a temperature of approximately 4 degrees Celsius until analyses commence.
- A laboratory tracking record will accompany the sample or sample fraction through final analysis for control.
- A copy of the tracking record will accompany the laboratory report and will become a permanent part of the project records.

SECTION 6

CALIBRATION PROCEDURES

6.1 FIELD INSTRUMENTS

All field analytical equipment will be calibrated immediately prior to each day's use. The calibration procedures will conform to manufacturer's standard instructions and are described in the Field Sampling Plan. This calibration will ensure that the equipment is functioning within the allowable tolerances established by the manufacturer and required by the project. Records of all instrument calibration will be maintained by the Field Team Leader and will be subjected to audit by the project Quality Assurance Officer (QAO). Copies of all the instrument manuals will be maintained on-site by the Field Team Leader.

Calibration procedures for instruments used for monitoring health and safety hazards (e.g., photoionization detector and explosimeter) are provided in the Health and Safety Plan.

6.2 LABORATORY INSTRUMENTS

The laboratory will follow all calibration procedures and schedules as specified in the sections of the USEPA SW-846 that apply to the instruments necessary for the analytical methods given in Section 3.

SECTION 7

DATA REDUCTION, VALIDATION, AND REPORTING

7.1 INTRODUCTION

Data collected during the field investigation will be reduced, reviewed, and a report on the findings will be tabulated in a standard format. The criteria used to identify and quantify the analytes will be those specified for the applicable methods USEPA SW-846. The data packages provided by the laboratory will contain all items specified in USEPA SW-846 for QA Level III reporting with a full data package.

The completed copies of the chain-of-custody records (both external and internal) accompanying each sample from time of initial bottle preparation to completion of analysis shall be attached to the analytical reports.

7.2 DATA REDUCTION

Two copies of the analytical data packages and an electronic disk deliverable will be provided by the laboratory. The Project Manager will immediately arrange for filing one package; a second copy, and the disk deliverable, will be used to generate summary tables. These tables will form the database for assessment of the site contamination condition. The Parsons ES QA reviewer, who will check the package to ensure all deliverables have been provided by performing a contract compliance screening (CCS) and validation. If problems are identified during CCS, the laboratory will be alerted, and corrective actions will be requested.

The electronic deliverable format required is an ASCII comma delimited file with the fields and character lengths summarized in Table 7.1.

Each diskette deliverable must be formatted and copied using an MS-DOS operating system. To avoid transcription errors, data will be loaded directly into the ASCII format from the laboratory information management system (LIMS). If this can not be accomplished, then Parsons ES should be notified via letter of transmittal indicating that manual entry of data is required for a particular method of analysis. All diskette deliverables must also undergo a QC check by the laboratory before delivery. The original data, tabulations, and electronic media are stored in a secure and retrievable fashion.

The Project Manager or Task Manager will maintain close contact with the QA reviewer to ensure all non-conformance issues are acted upon prior to data manipulation and assessment routines. Once the QA review has been completed, the Project Manager may direct the Team Leaders or others to initiate and finalize the analytical data assessment.

Table 7.1

Field and Character Lengths for Disk Deliverable

Description	Length	Format
Field Sample ID (as shown on COC)	15	Character
Cas. No. (including -'s)	10	Character
Parameter Name	31	Character
Concentration	13	Numeric
Qualifier	4	Character
Units	8	Character
SDG	8	Character
Lab Sample ID	15	Character
Date Sampled (from COC)	D	Date
Matrix (soil/water/air)	5	Character
Method Detection Limit	13	Numeric
Method Code	8	Character
Lab Code	6	Character

7.3 DATA VALIDATION

The analytical data generated during the field investigation will be reviewed and validated (if required) by a data evaluation staff. Data validation will be performed in accordance with guidance provided by USEPA documents (USEPA 1992a and 1992b), adapted to the QA/QC criteria in the USEPA SW-846 and this QA/QC plan. Validation will include the following:

- Contract Compliance Screening,
- Verification of 100% of all QC sample results (both qualitative and quantitative),
- Verification of the identification of 100% of all sample results (both positive hits and non-detects),
- Recalculation of 10% of all investigative sample results, and

This work will be performed by trained and experienced data evaluation staff.

A data validation report will be prepared and reviewed by the Parsons ES QAO before issuance. The data validation report will present the results of data validation, including a summary assessment of laboratory data packages, sample preservation and COC procedures, and a summary assessment of precision, accuracy, representativeness, comparability, and completeness for each analytical method. A detailed assessment of each SDG will follow. For each of the organic compound analytical methods, the following will be assessed:

- Holding times
- Instrument tuning
- Instrument calibrations
- Blank results
- System monitoring compounds or surrogate recovery compounds (as applicable) and internal standard recovery results
- MS and MSD results
- Target compound identification
- Pesticide cleanup (if applicable)
- Compound quantitation and reported detection limits
- System performance

For each of the inorganic compounds, the following will be assessed:

- Holding times
- Calibrations

- Blank results
- Interference check sample
- Laboratory check samples
- Duplicates
- Matrix Spike
- Furnace atomic absorption analysis QC
- ICP serial dilutions
- Results verification and reported detection limits

Based on the results of data validation, the validated analytical results reported by the laboratory will be assigned one of the following usability flags:

- "U" - Not detected at given value
- "UJ" - Estimated not detected at given value
- "J" - Estimated value
- “N” – Presumptive evidence at the value given
- "R" - Result not useable
- No Flag - Result accepted without qualification

SECTION 8

INTERNAL QUALITY CONTROL CHECKS AND FREQUENCY

8.1 QUALITY ASSURANCE BATCHING

Each set of samples will be analyzed concurrently with calibration standards, method blanks, matrix spikes (MS), matrix spike duplicates (MSD) or laboratory duplicates, and QC check samples (if required by the protocol). The MS/MSD samples will be designated by the field personnel. If no MS/MSD samples have been designated, the laboratory will contact the project Quality Assurance Officer (QAO) for corrective action.

8.2 CALIBRATION STANDARDS AND SURROGATES

All organic standard and surrogate compounds are checked by the method of mass spectrometry for correct identification and gas chromatography for degree of purity and concentration. All standards are traceable to a source of known quality certified by the USEPA or NIST, or other similar program. When the compounds pass the identity and purity tests, they are certified for use in standard and surrogate solutions. Concentrations of the solutions are checked for accuracy before release for laboratory use. Standard solutions are replaced monthly or more frequently, based upon data indicating deterioration.

8.3 ORGANIC BLANKS AND MATRIX SPIKE

Analysis of blank samples verifies that the analytical method does not introduce contaminants or detect "false positives." The blank water can be generated by reverse osmosis and Super-Q filtration systems, or distillation of water containing $KMnO_4$. The matrix spike is generated by addition of surrogate standard to each sample.

8.4 TRIP AND FIELD BLANKS

Trip blanks and field blanks will be utilized in accordance with the specifications in Section 4. These blanks will be analyzed to provide a check on sample bottle preparation and to evaluate the possibility of atmospheric or cross contamination of the samples.

SECTION 9

QUALITY ASSURANCE PERFORMANCE AUDITS AND SYSTEM AUDITS

9.1 INTRODUCTION

Quality assurance audits may be performed by the project Quality Assurance Officer (QAO). These audits will be implemented to evaluate the capability and performance of project and subcontractor personnel, items, activities, and documentation of the measurement system(s). Functioning as an independent body and reporting directly to Parsons ES corporate quality assurance management, the QAO may plan, schedule, and approve system and performance audits based upon Parsons ES procedure customized to the project requirements. At times, the QAO may request additional personnel with specific expertise from company and/or project groups to assist in conducting performance audits. However, these personnel will not have responsibility for the project work associated with the performance audit.

9.2 SYSTEM AUDITS

System audits, performed by the QAO or designated auditors, will encompass a qualitative evaluation of measurement system components to ascertain their appropriate selection and application. In addition, field and laboratory quality control procedures and associated documentation may be system audited. These audits may be performed once during the performance of the project. However, if conditions adverse to quality are detected or if the Project Manager requests, additional audits may occur.

9.3 PERFORMANCE AUDITS

The laboratory will be required to conduct an analysis of Performance Evaluation (PE) samples or provide proof that Performance Evaluation samples submitted by USEPA or a state agency have been analyzed within the past twelve (12) months.

9.4 FORMAL AUDITS

Formal audits refer to any system or performance audit that is documented and implemented by the QA group. These audits encompass documented activities performed by qualified lead auditors to a written procedure or checklists to objectively verify that quality assurance requirements have been developed, documented, and instituted in accordance with contractual and project criteria. Formal audits may be performed on project and subcontractor work at various locations.

Audit reports will be written by auditors who have performed the site audit after gathering and evaluating all data. Items, activities, and documents determined by lead auditors to be in noncompliance shall be identified at exit interviews conducted with the involved management. Noncompliances will be logged, and documented through audit findings which are attached to and are a part of the integral audit report. These audit finding forms are directed to management to satisfactorily resolve the noncompliance in a specified and timely manner.

The Project Manager has overall responsibility to ensure that all corrective actions necessary to resolve audit findings are acted upon promptly and satisfactorily. Audit reports must be submitted to the Project Manager within fifteen days of completion of the audit. Serious deficiencies will be reported to the Project Manager within 24 hours. All audit checklists, audit reports, audit findings, and acceptable resolutions are approved by the QAO prior to issue. Verification of acceptable resolutions may be determined by re-audit or documented surveillance of the item or activity. Upon verification acceptance, the QAO will close out the audit report and findings.

SECTION 10

PREVENTIVE MAINTENANCE PROCEDURES AND SCHEDULES

10.1 PREVENTIVE MAINTENANCE PROCEDURES

Equipment, instruments, tools, gauges, and other items requiring preventive maintenance will be serviced in accordance with the manufacturer's specified recommendations and written procedure developed by the operators.

A list of critical spare parts will be established by the operator. These spare parts will be available for use in order to reduce the downtime. A service contract for rapid instrument repair or backup instruments may be substituted for the spare part inventory.

10.2 SCHEDULES

Written procedures will establish the schedule for servicing critical items in order to minimize the downtime of the measurement system. The laboratory will adhere to the maintenance schedule, and arrange any necessary and prompt service. Required service will be performed by qualified personnel.

10.3 RECORDS

Logs shall be established to record and control maintenance and service procedures and schedules. All maintenance records will be documented and traceable to the specific equipment, instruments, tools, and gauges. Records produced shall be reviewed, maintained, and filed by the operators at the laboratories. The QAO may audit these records to verify complete adherence to these procedures.

SECTION 11

PROCEDURES FOR ASSESSING DATA

The data collected during this project will undergo a systematic review for compliance with the DQOs and performance objectives as stated in Section 3. In particular, laboratory and field data will be reviewed for compliance with the method QC criteria for performance and accuracy. As noted in Section 8, the chemical data will be qualified according to USEPA Region II SOPs and reported. These data will be evaluated as to usability. In particular, data outside QC criteria, but not rejected, will be reviewed for the magnitude of possible positive and negative bias.

A data usability report that summarizes the implications of the use of any data out of criteria will be written for each round of data. In addition, the data usability report will include the percentage of sample completeness for critical and noncritical samples and a discussion of any issues in representativeness of the data that may develop as a result of validation. The data usability report will address overall data quality and achievement of PARCC and assess issues associated with the overall data.

After data validation, the data will be evaluated as to consistency with site conditions and developed conceptual models.

SECTION 12

CORRECTIVE ACTION

12.1 INTRODUCTION

The following procedures have been established to ensure that conditions adverse to quality, such as malfunctions, deficiencies, deviations, and errors, are promptly investigated, documented, evaluated, and corrected.

12.2 PROCEDURE DESCRIPTION

When a significant condition adverse to quality is noted at site, laboratory, or subcontractor location, the cause of the condition will be determined and corrective action will be taken to preclude repetition. Condition identification, cause, reference documents, and corrective action planned to be taken will be documented and reported to the QAO, Project Manager, Field Team Leader and involved subcontractor management, at a minimum. Implementation of corrective action is verified by documented follow-up action.

All project personnel have the responsibility, as part of the normal work duties, to promptly identify, solicit approved correction, and report conditions adverse to quality. Corrective actions will be initiated as follows:

- When predetermined acceptance standards are not attained
- When procedure or data compiled are determined to be deficient
- When equipment or instrumentation is found to be faulty
- When samples and analytical test results are not clearly traceable
- When quality assurance requirements have been violated
- When designated approvals have been circumvented
- As a result of system and performance audits
- As a result of a management assessment
- As a result of laboratory/field comparison studies
- As required by USEPA SW-846

Project management and staff, such as field investigation teams, remedial response planning personnel, and laboratory groups, monitor on-going work performance in the normal course of daily responsibilities. Work may be audited at the Parsons ES office, sites, laboratories, or subcontractor locations. Activities, or documents ascertained to be noncompliant with quality assurance requirements will be documented. Corrective actions will be mandated through audit finding sheets attached to the audit report. Audit findings are logged, maintained, and controlled by the Task Manager.

Personnel assigned to quality assurance functions will have the responsibility to issue and control Corrective Action Request (CAR) Forms (Figure 12.1). The CAR identifies the out-of-compliance condition, reference document(s), and recommended corrective action(s) to be administered. The CAR is issued to the personnel responsible for the affected item or activity. A copy is also submitted to the Project Manager. The individual to whom the CAR is addressed returns the requested response promptly to the QA personnel, affixing his/her signature and date to the corrective action block, after stating the cause of the conditions and corrective action to be taken. The QA personnel maintain the log for status of CARs, confirms the adequacy of the intended corrective action, and verifies its implementation. CARs will be retained in the project file for the records.

Any project personnel may identify noncompliance issues; however, the designated QA personnel are responsible for documenting, numbering, logging, and verifying the close out action. The Project Manager will be responsible for ensuring that all recommended corrective actions are implemented, documented, and approved.

FIGURE 12.1

CORRECTIVE ACTION REQUEST

CAR NO.

DATE

PROJECT NO./TITLE

TASK NO./TITLE

REFERENCE(S)

REPLY DUE DATE

SUBJECT

PREPARED BY

DESCRIPTION OF CONDITION

APPROVED BY

PROJECT MANAGER

CAUSE AND CORRECTIVE ACTION (Include Effective Date)

TASK MANAGER	DATE	PROJECT QA OFFICER	DATE	PROJECT MANAGER	DATE

CLOSEOUT ACTION

PROJECT QA OFFICER	DATE	PROJECT MANAGER	DATE	SEE REVERSE SIDE FOR INSTRUCTIONS

SECTION 13

REPORTS TO MANAGEMENT

Parsons ES management personnel receive QA reports appropriate to their level of responsibility. The PM receives copies of all QA documentation. QC documentation is retained within the department which generated the product or service except where this documentation is a deliverable for a specific contract. QC documentation is also submitted to the QAO for review and approval. Previous sections detailed the QA activities and the reports which they generate. A final audit report for each project may also be prepared. The reports may include:

- periodic assessment of measurement data accuracy, precision, and completeness;
- results of performance audits and/or system audits;
- significant QA problems and recommended solutions for future projects; and
- status of solutions to any problems previously identified.

Additionally, any incidents requiring corrective action will be fully documented.

SECTION 14

REFERENCES

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USEPA, 1996. *USEPA SW-846 Test Methods for Evaluating Solid Waste, Physical and Chemical*, dated December 1996. U.S. Environmental Protection Agency, Washington, D.C.

APPENDIX B

APPENDIX B
HEALTH AND SAFETY PLAN

FINAL

APPENDIX B

HEALTH AND SAFETY PLAN FOR SITE 15 AT HANCOCK FIELD SYRACUSE, NY

PROJECT No. HAAW20007054

Prepared For:

National Guard Bureau

1411 Jefferson Davis Highway
Arlington, VA 22202-3231

and

Air National Guard

Environmental Restoration Branch
3500 Fetchet Avenue
Andrews AFB, MD 20762-5157

Prepared By:

PARSONS ENGINEERING SCIENCE, INC.

290 Elwood Davis Road, Suite 312
Liverpool, New York 13088

DECEMBER 2000

PARSONS

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ATTACHMENT 1 DRILLING SAFETY GUIDE

FIGURES

TABLES

LIST OF ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
AMSL	Above Mean Sea Level
ANG	Air National Guard
CFR	Code of Federal Regulations
CRC	Contamination Reduction Corridor
CRZ	Contamination Reduction Zone
EPA	Environmental Protection Agency
FID	Flame Ionization Detector
HSP	Health and Safety Plan
IDLH	Immediately Dangerous to Life or Health
IRP	Installation Restoration Plan
KV	Kilovolts
LEL	Lower Explosive Limit
MSDS	Material Safety Data Sheets
NFPA	National Fire Protection Association
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
PAH	Polynuclear Aromatic Hydrocarbon
PEL	Permissible Exposure Limit
PID	Photoionization Detector
PPE	Personal Protective Equipment
SCBA	Self-Contained Breathing Apparatus
SIC	Standard Industrial Classification
SVOC	Semivolatile Organic Compound
TLV	Threshold Limit Value
TPH	Total Petroleum Hydrocarbons
UV	Ultraviolet
VOC	Volatile Organic Compound
WBGT	Wet Bulb Globe Temperature

SECTION 1

INTRODUCTION

1.1 PURPOSE AND SCOPE

This document is a site-specific Health and Safety Plan (HSP) for a data gap investigation at Site 15 at Hancock Field in Syracuse, New York (Figure 1.1). This plan describes rules and procedures that Parsons ES (contractor) personnel will follow to perform their duties safely, competently, and in compliance with all applicable federal, state, and local statutes and regulations. Nothing in this plan operates to relieve the contractor or its subcontractors of its responsibilities for the safety and health of its workers and compliance with this plan. Subcontractors are required to provide their own HSP, which must meet the requirements outlined in this HSP at a minimum.

This plan provides the health and safety guidance for protecting workers during operations governed by the Occupational Safety and Health Administration (OSHA) contained in the 29 Code of Federal Regulations (CFR) Section 1910.120. Managerial, professional, and technical personnel should use this plan as a guide to proper health and safety procedures while working at this former Air National Guard base.

1.2 HEALTH AND SAFETY PLAN OVERVIEW

This Health and Safety Plan has the following objectives:

- Promote a safe and healthful work environment.
- Minimize the risk of human, environmental, and economic losses resulting from accidents.
- Comply with safety and health laws, regulations, and policies.
- Perform health and safety tasks efficiently.
- Satisfy ANG program needs.

Successful implementation of this plan requires cooperation between contractor personnel and ANG staff. All contractor personnel are expected to accept the responsibility to use all materials and equipment properly, to follow work procedures and rules, and to aid field supervisors in identifying and correcting unsafe conditions.

All Parsons Engineering Science, Inc. (Parsons ES) personnel are required to read and abide by this project specific HSP and sign a plan acceptance form (Figure 1.3). This form will be kept in the project files.

1.3 HAZARD IDENTIFICATION

Unsafe and unhealthy conditions at Site 15 will be identified through one or more of the following:

- Investigating and observing work areas and work practices and looking for present or potential health and safety problems
- Investigating work-related injuries and illness (or near-misses) to identify problems that need correction
- Evaluating worker suggestions or complaints

This site-specific HSP includes the following sections:

- A description of the site and tasks to be performed
- A description of the site or work area history
- A route to the hospital
- A site-specific or task-specific hazard assessment that includes identification and characterization of potential physical and chemical hazards
- Monitoring requirements and establishment of exposure limits for specific chemical parameters
- Personal protective equipment for each task
- Work site safety requirements
- Site control guidelines
- Exposure precautions
- Site entry guidelines
- Decontamination guidelines
- Waste handling and disposal guidelines
- Contingency plans
- Specific task guidelines (such as confined space entry)
- An approval statement
- HSP acceptance forms
- Attachments

This site-specific HSP is subject to review and approval by the site manager.

1.4 PROJECT WORK SCOPE OVERVIEW

Parsons ES will conduct the data gap investigation, which will consist of sediment sample collection, groundwater monitoring well sample collection, and a baildown test. Quality assurance/quality control (QA/QC) samples will be collected (refer to FSP and QAP). Sediment and water samples shall be submitted for laboratory analysis at EPA QA Level III. Laboratory analysis shall include standard turn-around time.

Soil samples will be collected from the area southeast of the concrete pad and from the two nearby drainage swales and will be analyzed for PCBs. Groundwater samples from 17 monitoring wells will be analyzed for BTEX and natural attenuation indicators. A baildown test will be performed, following installation of three wells within the area of the plume. Sample and monitoring well installation locations are shown on Figure 1.2.

1.5 SITE DESCRIPTION

Site 15 is located at the 174th Fighter Wing (FW) of the New York Air National Guard (NYANG) at Hancock Field in Syracuse, New York. Hancock Field is located approximately two miles north-northeast of Syracuse in Onondaga County in central New York. The NYANG base is bordered by the Town of Dewitt to the east and south, the Town of Salina to the west, the Town of Cicero to the north, and Syracuse International Airport to the northeast.

Site 15 is a 2.5-acre plot of land and the site of a former petroleum, oil, and lubricant (POL) storage area located near the southern boundary of the base. Currently located at the site are a diked area, a concrete pad, and six 25,000-gallon underground storage tanks (USTs), which are closed. An aboveground storage tank (AST) containing JP-4 was once located within the diked area. Most of the site is covered with unmaintained vegetation. One drainage swale borders the site on its north-northeast side, and another drainage swale is located near the west side of the site. The entire site is surrounded by a barbed wire fence.

Site 1 is located about one-half mile northeast of Site 15. A volume of PCB-impacted soil has been placed on a concrete pad at this site, a former fire training area. This soil will be considered along with any PCB-impacted soil to be removed from Site 15.

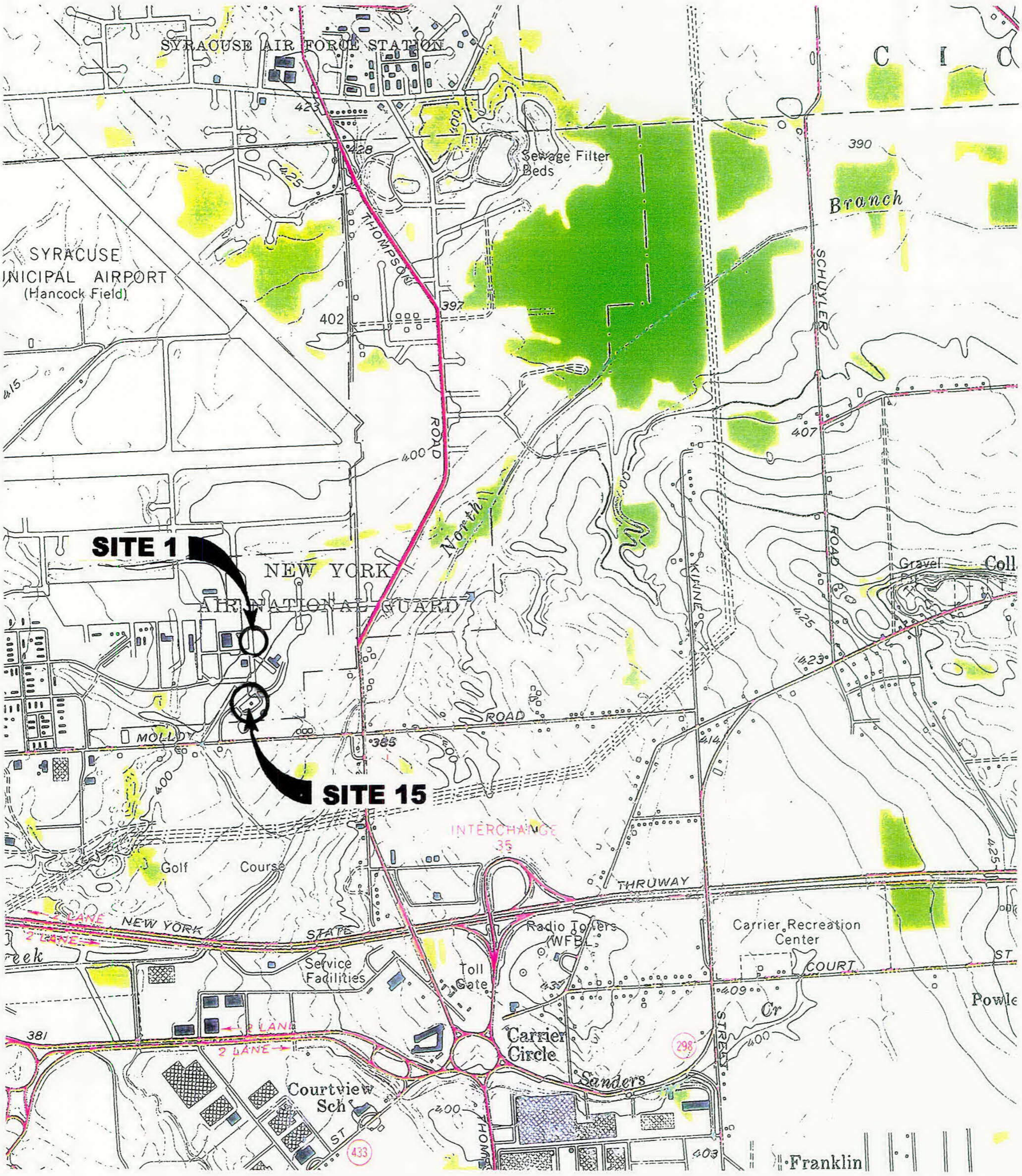
1.6 SITE HISTORY

The POL area at Site 15 was constructed in 1951 and used until 1999 when it was decommissioned and a new POL area was constructed. When the area was actively used, it was the site of the Jet Fuel Transfer Pumphouse (Building 602), a 215,000-gallon AST, six 25,000 USTs, and equipment for transferring JP-4 to the tanks. In 1999, the pumphouse was demolished, the AST was cleaned and removed, and the USTs were cleaned and filled in place.

Three spills have reportedly occurred at the site:

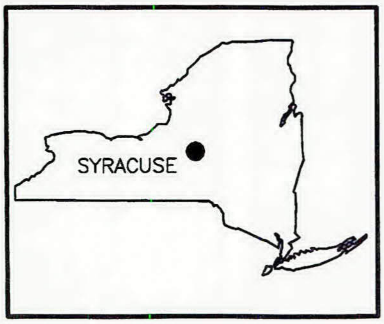
- In the 1980s, PCBs were released, possibly from the transformers located in front of the pumphouse (Radian, 1994).
- In April 1990, 3,850 gallons of JP-4 were released inside the pumphouse. Some of the fuel reportedly flowed out of the building (Radian, 1994, and M&E, 1995).
- In June 1994, 150 gallons of JP-8 overflowed onto the ground from USTs under the northeast side of the building. The spill was reportedly contained with absorbent pads before it was able to exit through the drainage ditch on the east side of the site (M&E, 1995, and Aneptek, 1999).

Following the April 1990 release, contaminated surface soil was removed and the excavation area was backfilled with crushed stone. During cleanup, an oil-water separator and three area drainage sumps with PCB-contaminated sediment were discovered. The oil-water separator was installed in the 1950s, but was never connected to a holding tank. Product emptied into a drywell and eventually drained into the underlying soil. Spilled fuel had entered the sumps and mixed with the PCB-contaminated sediment, which is believed to have accumulated in the sumps before 1971 (Radian, 1994).



SITE 1

SITE 15



QUADRANGLE LOCATION
NEW YORK

LATITUDE: N43° 06' 01"
LONGITUDE: W76° 06' 06"

SOURCE: USGS 7.5 MINUTE SERIES (TOPOGRAPHIC) SYRACUSE EAST QUADRANGLE 1957

FIGURE 1.1

NATIONAL GUARD BUREAU
SITE 15 AT HANCOCK FIELD
SYRACUSE, NEW YORK

SITE LOCATION MAP

PARSONS
PARSONS INFRASTRUCTURE & TECHNOLOGY GROUP INC.
PARSONS ENGINEERING SCIENCE, INC.
290 ELWOOD DAVIS ROAD, SUITE 312, LIVERPOOL, N.Y. 13088, PHONE: 315-451-9560

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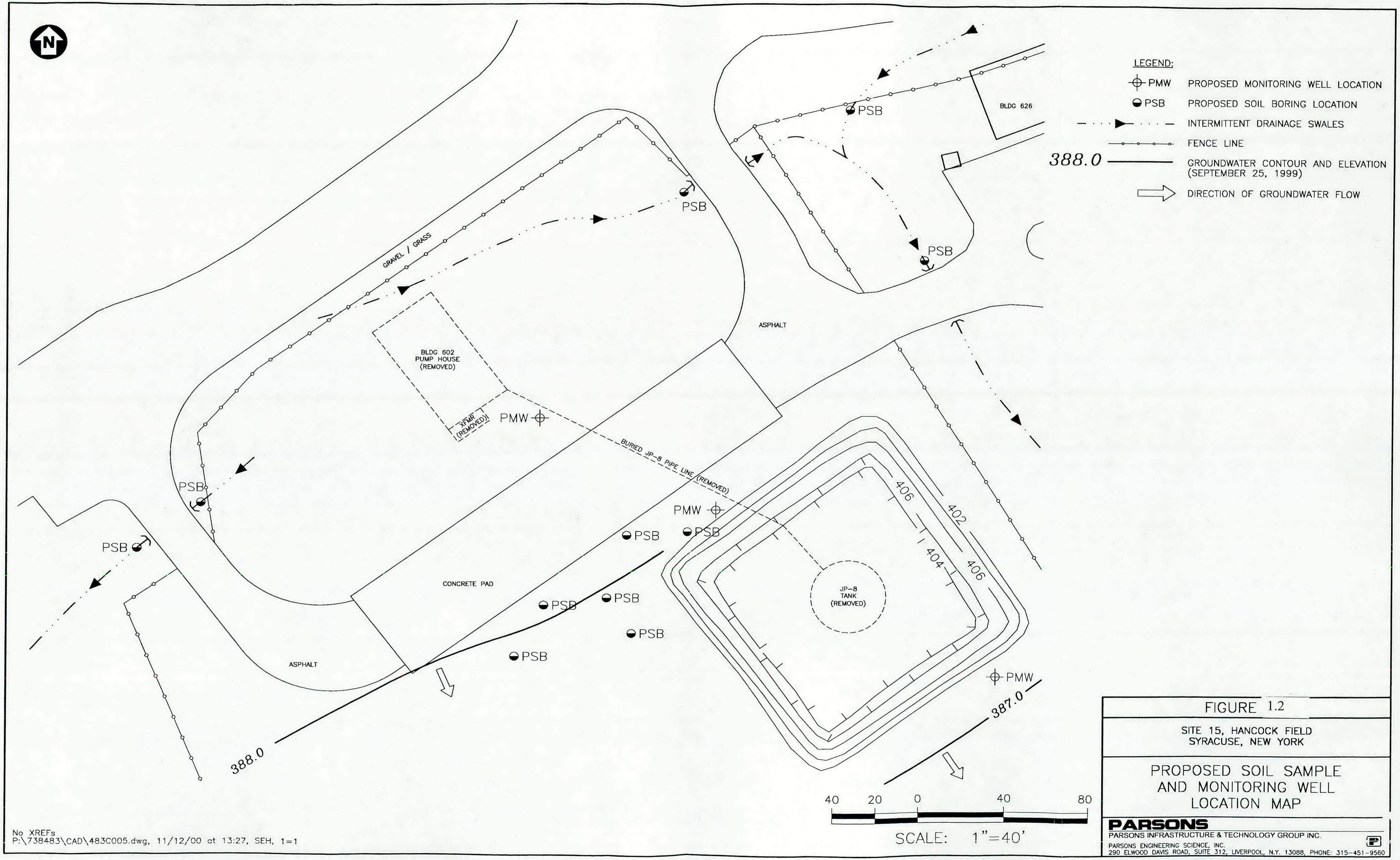

FIGURE 1.2

SITE 15, HANCOCK FIELD
SYRACUSE, NEW YORK

PROPOSED SOIL SAMPLE
AND MONITORING WELL
LOCATION MAP

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PARSONS ENGINEERING SCIENCE, INC.
290 ELWOOD DAVIS ROAD, SUITE 312, LIVERPOOL, N.Y. 13088, PHONE: 315-451-9560

Figure 1.3
Plan Acceptance Form
Project Health and Safety Plan

(For Parsons ES employees only)

I have read and agree to abide by the contents of the Work Plan and Health and Safety Plan for the following project:

(Project Title) (Project Number)

Furthermore, I have read and am familiar with the work plan or proposal which describes the field work to be conducted and the procedures to be utilized in the conduct of this work.

Name (print)	Signature	Date

Place in project Health and Safety File as soon as possible.

SECTION 2

PROJECT ORGANIZATION AND RESPONSIBILITIES

2.1 ORGANIZATION

This section describes the responsibilities of all onsite personnel associated with the New York Air National Guard (ANG) at Hancock Field. Principal Contractor personnel associated with this project are listed in Table 2.1.

2.2 RESPONSIBILITIES

The Program Manager designates a Health and Safety Program Manager to establish and implement a Health and Safety Plan (HSP). The Program Manager and ANG shall review and approve this site-specific HSP. The Program Manager shall ensure that the Health and Safety Program Manager updates the plan annually, at a minimum. The Program Manager and the ANG must approve any revisions to this plan.

2.2.2 Project Manager

The Project Manager reports to the Program Manager, has authority to direct response operations, and assumes total control over project activities.

The Project Manager is responsible for the following:

- Obtaining permission for site access and coordinating activities with appropriate officials
- Briefing the field teams on their specific assignments
- Using the Program Health and Safety Manager and the Site Health and Safety Coordinator to ensure that safety and health requirements are met
- Serving as the liaison with public officials
- Ensuring that the project budget is adequate for the necessary health and safety procedures and equipment
- Ensuring that the plan satisfies all federal, state, and local statutes, regulations, and ordinances concerning health and safety
- Developing training materials
- Setting up and conducting necessary training programs
- Conducting audits to ensure compliance with the health and safety program

- Updating the health and safety plan and program to meet new requirements and technologies
- Maintaining program records
- Reviewing and approving project health and safety plans for certain hazardous operations (e.g., Levels A and B activities, drum opening operations, etc)
- Reviewing subcontractor HSPs

2.2.3 Site Health and Safety Coordinator

The Site Health and Safety Coordinator reports to the Program Health and Safety Manager and advises the Field Manager and Program Health and Safety Manager of all unusual aspects of health and safety on site. The Site Health and Safety Coordinator is authorized to stop work if any operation threatens worker and/or public health or safety. The Site Health and Safety Coordinator is also responsible for the following:

- Inspecting protective clothing and equipment periodically
- Ensuring that protective clothing and equipment are properly stored and maintained
- Controlling entry and exit at the access points
- Coordinating safety and health program activities with the Program Health and Safety Manager
- Monitoring the work parties for signs of stress such as cold exposure and heat stress
- Implementing the site safety plan
- Conducting periodic inspections to determine if the site safety plan is being followed
- Knowing emergency procedures and evacuation routes;
- Posting telephone numbers of emergency medical help, local hospitals, the poison control center, the fire department, and the police department
- Notifying, when necessary, local public emergency officials
- Coordinating emergency medical care
- Setting up decontamination solutions appropriate for the type of chemical contamination onsite
- Controlling the decontamination of all equipment, personnel, and samples
- Assuring the proper disposal of contaminated clothing and materials
- Ensuring that all required equipment is available
- Advising medical personnel of potential exposures and consequences

- Notifying emergency response personnel by telephone or radio in the event of an emergency

2.2.4 Field Team

All work parties must consist of a minimum of two people. All field team members must comply with the Program HSP as well as this site-specific HSP. Field team members are to report any suspected unsafe conditions to the site health and safety coordinator and stop working if emergency conditions arise.

2.2.5 Subcontractors

Subcontractors must be trained in accordance with 29 CFR Section 1910.120 prior to their admittance to the site and must comply with the training requirements specified in Section 6 of this HSP to the extent they will be performing work under the contractor's direction. **As with all subcontractors, the responsibility for protecting the health and safety of subcontractor employees rests with the subcontractor; therefore, the subcontractor must submit an HSP to the Health and Safety Manager that identifies safety procedures for the field activities to be performed. Before beginning any field activity, the subcontractor must provide to the site health and safety coordinator documentation of necessary training and proof of participation in a medical monitoring program.** This documentation will be kept in the project file.

TABLE 2.1

CONTRACTOR IRP PERSONNEL

Client Sponsor	Dave G. Johnson (315) 451-9560 Peter Crowley (703) 591-7575
Project Manager	David B. Babcock (315) 451-9560
Program Health and Safety Manager	Brian J. Powell (315) 451-9560
Field Manager	Scott B. Dillman (315) 451-9560
Site Health and Safety Coordinator	Scott B. Dillman (315) 451-9560

SECTION 3

EMERGENCY RESPONSE PLAN

3.1 PERSONNEL ROLES AND LINES OF AUTHORITY

The Site Health and Safety Coordinator or Program Health and Safety Manager supervises the field team to ensure they are meeting health and safety requirements. If deficiencies are noted, work is stopped and corrective action is taken (e.g., purchase of additional safety equipment). Reports of health and safety deficiencies and the corrective action taken is forwarded to the Project Manager and Program Health and Safety Manager.

All contractor personnel receive site-specific health and safety training before starting any site activities. On a day-to-day basis, workers should watch for indicators of potentially hazardous situations and for signs and symptoms in themselves and others that warn of hazardous conditions and exposures. Emergencies can be averted by rapid recognition of dangerous situations. Before assigning daily tasks, tailgate safety meetings will be held by the Site Health and Safety Coordinator. Discussion should include:

- Tasks to be performed
- Time constraints (e.g., work period duration and rest breaks)
- Hazards that may be encountered, including their effects, how to recognize symptoms or monitor them, and danger signals
- Emergency procedures
- Communication

3.2 EMERGENCY CONTACTS

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

Contingency Contacts	Phone Number
Nearest phone located onsite	(315) 454-6111 (Tim Sager)
Fire Department	911
Sheriff	911
Ambulance Service	911

Poison Control Center (Syracuse, PA)	(315) 476-4766 (800) 252-5655
Parsons ES Contract Physician (IMA)	(315) 478-1977
Pollution Toxic Chemical Oil Spills	(800) 424-8802

Medical Emergency

Hospital Name	SUNY Upstate Medical University Hospital
Hospital Phone Number	(315) 464-5611, Emergency (adult)
Hospital Address	750 East Adams Street Syracuse, NY 13210
Travel Time from Site	15 minutes
Map to Hospital	Figure 1.3

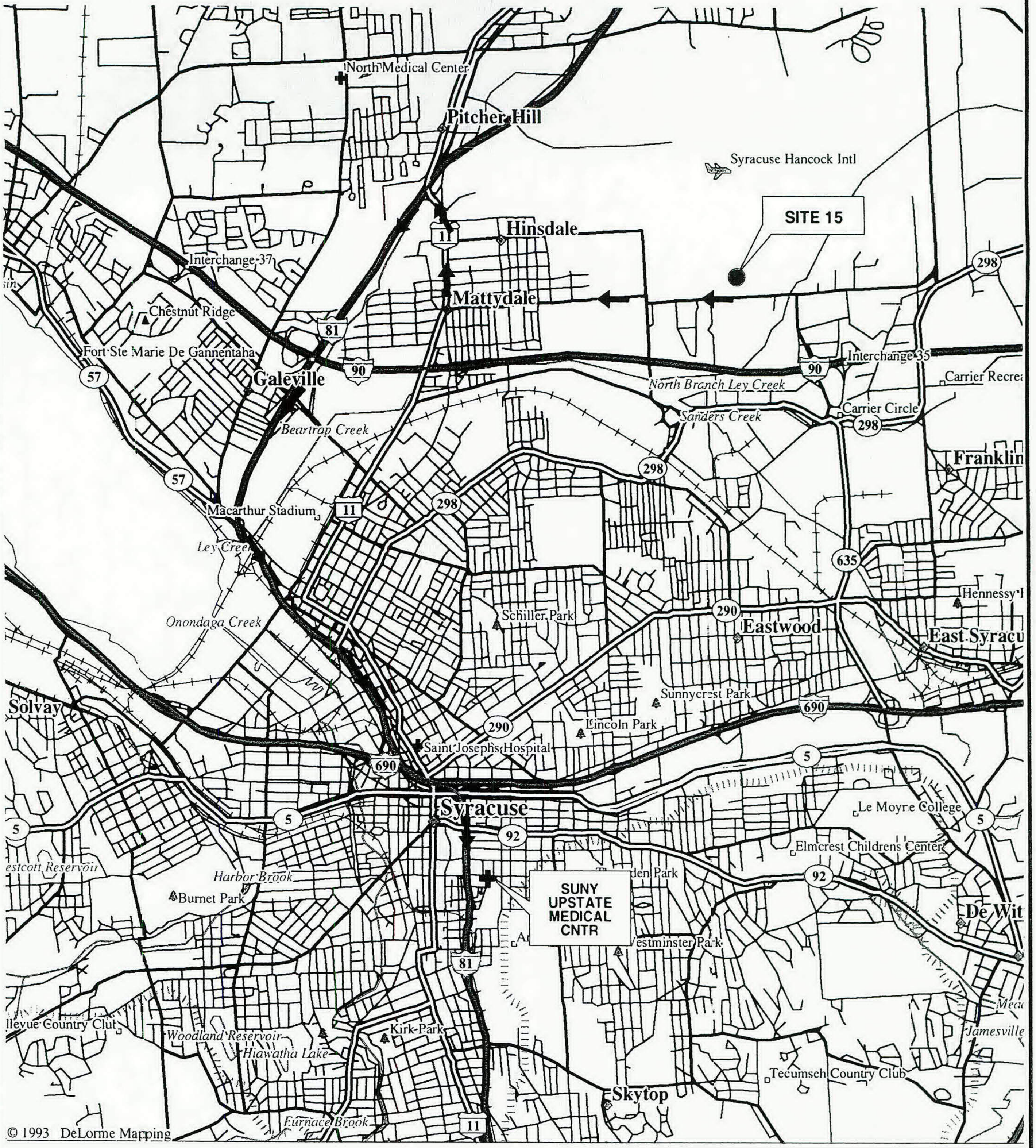
3.3 HOSPITAL EMERGENCY ROUTE

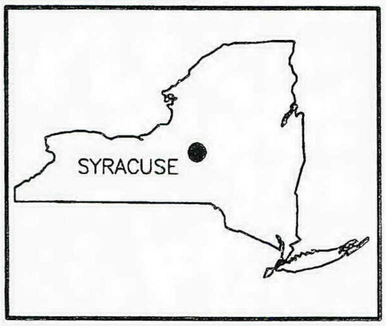
Directions to the hospital are shown on Figure 3.1 and are as follows:

- Turn right out of ANG base onto MOLLOY ROAD, heading west
- Turn left onto ROUTE 11
- Turn right at Cooper Industries onto SEVENTH NORTH STREET
- Proceed approximately ¾ mile to the west
- Take exit onto ROUTE 81
- Take the TOWNSEND ST. exit
- Turn LEFT onto N. TOWNSEND ST.
- Turn RIGHT onto NY-5 (Erie Blvd)
- Turn LEFT onto ROUTE 11
- Turn LEFT onto E. ADAMS ST.

Parsons ES Contacts

Project Manager: David Babcock	(315) 451-9560
Health & Safety Officer: Brian Powell	(315) 451-9560





QUADRANGLE LOCATION
NEW YORK

LATITUDE: N43° 06' 01"
LONGITUDE: W76° 06' 06"

Scale 1:62,500 (at center)

1 Miles

2 KM

FIGURE 3.1

NATIONAL GUARD BUREAU
SITE 15 AT HANCOCK FIELD
SYRACUSE, NEW YORK

ROUTE TO HOSPITAL MAP

PARSONS
PARSONS INFRASTRUCTURE & TECHNOLOGY GROUP INC.
PARSONS ENGINEERING SCIENCE, INC.
290 ELWOOD DAVIS ROAD, SUITE 312, LIVERPOOL, N.Y. 13088, PHONE: 315-451-9560

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3.4 EMERGENCY PROCEDURES

3.4.1 Introduction

If an emergency develops on site, the procedures delineated in this site-specific HSP are to be immediately followed. This site-specific HSP adheres to procedures established in the program health and safety plan. Emergency conditions exist if:

- Any member of the field crew is involved in an accident or experiences any adverse effects or symptoms of exposure
- A condition occurs that is more hazardous than anticipated
- Fires, explosions, structural collapses/failures, and/or unusual weather conditions (thunderstorms, lightning, high winds, etc.) occur.

If an emergency occurs, direct voice communication is used to sound the alarm. If personnel are out of range of direct voice communication, an emergency warning signal will be sounded. General emergency procedures and specific procedures for personal injury are described within this section. A list of emergency contacts are provided above and must be posted conspicuously on site.

3.4.2 General Emergency Procedures

The emergency procedures are as follows:

- Notify the contact identified in the emergency contact table of this HSP when an emergency occurs. This list is should be posted prominently at the site.
- Use the "buddy" system (pairs).
- Maintain visual contact between "pairs." Each team member should remain close to the other to assist in case of emergencies.
- If any member of the field crew experiences any adverse effects or symptoms of exposure, the entire field crew will immediately halt work and act according to the instructions provided by the Site Health and Safety Coordinator.
- Any condition that suggests a situation more hazardous than anticipated will result in evacuating the field team and re-evaluating the hazard and the level of protection required.
- If an accident occurs, the Site Health and Safety Coordinator is to complete an Accident Report Form (See Figure 3.2). Follow-up action will be taken to correct the situation that caused the accident.

3.4.3 Injuries and Illnesses

In case of personal injury at the site, follow the procedures listed below:

- Field team members or onsite emergency medical technicians trained in first aid will administer treatment to an injured worker if appropriate.

- The victim will be transported to the nearest hospital or medical center if necessary. An ambulance will be called to transport the victim if needed.
- The Site Health and Safety Coordinator is responsible for the completion of an Accident Report Form.

3.4.4 Fire or Explosion

Health and Safety Coordinator shall:

- Notify the paramedics and/or fire department, as necessary.
- Signal the evacuation procedure outlined in this HSP and implement the entire procedure.
- Isolate the area.
- Stay upwind of any fire.
- Keep area surrounding the problem source clear after the incident occurs.

3.4.5 Hazardous Materials Release

In the event of a spill, immediately contact the local hazardous response team. Emergency contacts, numbers, lines of authority, and evacuation routes are provided above. Federal, state, and local planning or response groups must also be notified.

3.4.6 Standard Safe Work Practices

The following are considered standard safe work practices:

1. Eating, drinking, chewing tobacco, smoking and carrying matches or lighters are prohibited in a contaminated or potentially contaminated area or where the possibility for the transfer of contamination exists.
2. Avoid contact with potentially contaminated substances. Do not walk through puddles, pools, mud, etc. Avoid, whenever possible, kneeling on the ground, leaning or sitting on equipment or ground. Do not place monitoring equipment on potentially contaminated surfaces (i.e., ground, etc.).
3. Acknowledge crew member senses which alert to potentially dangerous situations in which they should not become involved (i.e., presence of strong and irritating or nauseating odors).
4. Prevent spills to the extent possible. In the event that a spill occurs, contain liquid if possible.
5. Field crew members shall be familiar with the physical characteristics of investigations, including:
    - Wind direction in relation to nearby buildings
    - Accessibility to associates, equipment, vehicles communication

- Hot zone (areas of known or suspected contamination)
- Site access
- Nearest water sources

6. All wastes generated during activities onsite should be disposed of as directed by the project manager or onsite Health and Safety Coordinator.
7. Protective equipment as specified in Section 7 will be utilized by workers during the excavation and confirmatory sampling procedures.

3.4.7 Personal Protective Equipment Failure

Before donning PPE, workers should fully inspect all PPE. If PPE fails during site work, evacuate the area, remove and dispose of equipment, and replace it with new equipment.

3.5 ACCIDENT/INCIDENT REPORTING

Reporting and investigation of accidents are important parts of any health and safety program. They provide safety personnel with the means for objective evaluation of the progress and effectiveness of the health and safety program. Additionally, they allow the safety officer to identify problem areas where preventive measures can be taken. For corrective or preventive measures to be effective, reports on the causes of the accident must be unbiased. The purpose of an accident report is to obtain information, not to affix blame.

The Occupational Safety and Health Act (OSHA) requires that certain elements be included in all accident reports (29 CFR Part 1094). These elements are met by the contractor's Accident Report Form (Figure 3.2). The Project Manager or Project Health and Safety Manager is responsible for the documentation of all field injuries. Information concerning a field injury must be reported to the Contractor Program Health and Safety Manager as soon as possible.

Figure 3.2
Accident Report Form

Project Name:____

INJURED OR ILL EMPLOYEE

1. Name __________________________ Social Security #__________________
   (First) (Middle) (Last)
2. Home Address ____
   (No. and Street) (City or Town) (State and Zip)
3. Age _____ 4. Sex: Male ( ) Female ( )
5. Occupation ____
   (Specific job title, not the specific activity employee was performing at time of injury)
6. Department ____
   (Enter name of department in which injured person is employed, even though they may have been temporarily working in another department at the time of injury)

EMPLOYER

7. Name ____
8. Mailing Address ____
   (No. and Street) (City or Town) (State and Zip)
9. Location (if different from mailing address):________________________
   ____

THE ACCIDENT OR EXPOSURE TO OCCUPATIONAL ILLNESS

10. Place of accident or exposure ________________________________
    (No. and Street) (City or Town) (State and Zip)
11. Was place of accident or exposure on employer's premises? _(Yes/No)

FIGURE 3.2 (CONT'D)
ACCIDENT REPORT FORM

12. What was the employee doing when injured?____________________________

____

(Be specific - was employee using tools or equipment or handling material?)

____

13. How did the accident occur? ______________________________________

(Describe fully the events that resulted in the injury or

____

occupational illness. Tell what happened and how. Name objects and

____

substances involved. Give details on all factors that led to accident. Use separate sheet if needed)

14. Time of accident: ______________

15. Date of injury or initial diagnosis of occupational illness ____________
(Date)

16. WITNESS TO ACCIDENT

______________	______________	______________
(Name)	(Affiliation)	(Phone No.)
______________	______________	______________
(Name)	(Affiliation)	(Phone No.)
______________	______________	______________
(Name)	(Affiliation)	(Phone No.)

OCCUPATIONAL INJURY OR OCCUPATIONAL ILLNESS

17. Describe the injury or illness in detail; indicate part of body affected.

____

____

FIGURE 3.2 (CONT'D)
ACCIDENT REPORT FORM

18. Name the object or substance which directly injured the employee. (For example, object that struck employee; the vapor or poison inhaled or swallowed; the chemical or radiation that irritated the skin; or in cases of strains, hernias, etc., the object the employee was lifting, pulling, etc.)

____

____

19. Did the accident result in employee fatality? ________ (Yes or No)

20. Number of lost workdays ____/restricted workdays _____ resulting from injury or illness?

OTHER

21. Did you see a physician for treatment? ________ (Yes or No) ________ (Date)

22. Name and address of physician ____________________________________

____

(No. and Street) (City or Town) (State and Zip)

23. If hospitalized, name and address of hospital ___________________________

____

(No. and Street) (City or Town) (State and Zip)

Date of report __________________ Prepared by ____________________

Official position _________________________

SECTION 4
TASK HAZARD ANALYSIS

4.1 TASK HAZARD ANALYSIS

While working on hazardous waste sites on ANG bases, contractor personnel are likely to encounter chemical and physical hazards. These hazards are associated primarily with preparation for sampling and/or remediation activities. The chemical and physical hazards are detailed in Section 5. The site-specific activity analysis for the proposed soil sampling and monitoring well installation and sampling is provided below.

4.1.1 Soil and Groundwater Sampling

Hazards of handling soil or groundwater while sampling include potential exposure to chemicals. Employees may be working next to an active drill rig, so drilling safety applies to their activities. Other hazards include risk of slip, trip and fall, lacerations and contusions, noise-induced hearing loss from exposure to excessive noise from a drill rig or generator. Employees shall keep clothing dry with adequate rain gear. Use proper personal protective clothing, to include splash protection if baling by hand during sampling. Inspect equipment to ensure that it is proper working order. All handling of potentially contaminated soils or groundwater will begin in Level D with careful monitoring of the sampler's breathing zone using the Photoionization Detector (PID). Outer nitrile and inner latex gloves will be included in standard Level D requirements whenever handling samples.

Refer to the following references:

29 CFR 1926.200	Accident Prevention Signs and Tags
29 CFR 1926.201	Signaling
29 CFR 1926.202	Barricades
29 CFR 1926.600	Equipment
29 CFR 1926.601	Motor Vehicles
29 CFR 1926.602	Material Handling Equipment

4.1.2 Drilling/Monitoring Well Installation

Chemical exposure typically occurs as drill cuttings are brought to the surface. Drill cuttings and split spoon samples will be screened with a PID. If contaminant levels reach action limits as specified in Section 8, upgrades in personal protection will be initiated. Drill cuttings may be containerized as they accumulate in order to control volatile emissions in the driller's breathing zone and to prevent release of chemical vapors off site. Drillers and geologists on site within 50 feet of the drill rig shall start work in Level D PPE and will include use of hearing protection when the rig is operational. Refer to Attachment 1 (Drilling Safety Guide) for detailed safety procedures.

SECTION 5
SAFETY AND HEALTH ANALYSIS

5.1 CHEMICAL HAZARDS

The chemicals of primary concern that may be encountered and may be associated with Site 15 will be those originating from previous jet fueling activities and storage of PCB-containing transformers. Compounds of primary concern include BTEX, several SVOCs, and PCBs. Other compounds were also detected, but did not exceed soil criteria. These compounds can be taken into the body by oral ingestion, by absorption through the skin, and by inhalation. The toxicological chemical of concern table is presented in Table 5.1 and includes any compounds detected over 1 ppm in both investigations. Action Levels for Site 15 are discussed in Section 8.11.

In addition to the chemicals that may be present on site, personnel may bring chemicals onto the site (e.g., for equipment decontamination) that could pose health hazards. Material Safety Data Sheets (MSDSs) for these chemicals will be brought on site when used.

5.2 PHYSICAL HAZARDS

5.2.1 Subsurface Hazards

Before any excavation or drilling operations are performed, efforts must be made to determine if underground installations (e.g., sewers, telephone, water, fuel, electrical lines or liners) will be encountered, and, if so, where such underground installations are located. Utility companies and/or facility engineering shall be contacted before starting any subsurface activities and information concerning buried utilities shall be obtained.

5.2.2 Motor Vehicles and Heavy Equipment

Working adjacent to heavy equipment can be a major hazard at a site. Injuries can result from equipment hitting or running over personnel, or from the overturning of vehicles. Vehicles and heavy equipment design and operation will be according to 29 CFR Subpart O, 1926.600 through 1926.602. In particular, the following precautions shall be used by the subcontractor to help prevent injuries and accidents:

- Brakes, hydraulics lines, light signals, fire extinguishers, fluid levels, steering, tires, horn, and other safety devices will be checked and recorded on a log sheet at the beginning of each week.
- Heavy equipment will not be backed up unless the vehicle has a reverse signal alarm audible above the surrounding noise level or a signal man is present.

Because heavy equipment can be an ignition source, spark arrestors will be included on all heavy equipment as standard equipment. These will prevent sparks from the engine igniting potentially explosive atmospheres. All heavy equipment will be inspected for the presence of spark arrestors prior to performing work on the site.

5.2.3 Overhead Electrical Lines

Precautions will be exercised when drilling near any overhead electrical lines. The minimum clearance between overhead electrical lines of 50 kilovolts (KV) or less and the drill rig is 10 feet. For line rated over 50 KV, the Field Manager will verify that the minimum clearance between the line and any part of the rig is 10 feet plus 0.4 inch for each KV over 50 KV. The site Health and Safety Coordinator will contact the utility company to determine the kilovolts of electrical lines.

5.2.4 Noise-Induced Hearing Loss

Planned activities at Site 15 involve the use of heavy equipment. The unprotected exposure of site workers to this noise during activities can result in noise-induced hearing loss. The site Health and Safety Coordinator will ensure that either earmuffs or disposal foam earplugs are made available to all personnel near sources of high intensity noise.

5.2.5 Slip, Trip, and Fall Hazard

Site 15 may contain slip, trip, and fall hazards for site workers, such as:

- Holes, pits or ditches
- Slippery surfaces
- Steep grades
- Uneven grades
- Sharp object, such as nails, metal shards, and broken glass

Site personnel will be instructed to look for potential safety hazards and immediately inform the site Health and Safety Coordinator or the Field Manager about any new hazards. If the hazards cannot be immediately removed, actions must be taken to warn site workers about the hazard.

5.2.6 Rigging Equipment for Material Handling

Ropes, u-bolts, wires, and clamps used in drilling must be inspected prior to use and periodically during the course of the project to ensure the equipment is safe. Defective equipment must be removed from service. Rigging equipment must never exceed its recommended safe working load. The manufactures' recommendations shall be followed in determining the safe working loads of the various size and types of hooks used during drilling.

5.2.7 Electric and Energized Lines

All electrical equipment and energized lines shall be considered energized until isolated, tested or otherwise determined to be de-energized and grounded. A qualified electrician will verify all electrical lines that may interfere with work activities are locked out and tagged. To prevent physical contact with energized power lines, equipment or machines shall not be operated within 10 feet of any power line rated at 50 KV or below. This 10-foot rule will strictly be enforced at all times.

Daily inspections on all electrical equipment prior to distribution to employees will be performed by a competent person. Tools that do not pass inspection will be removed from service until repaired or replaced. All tools, cords and receptacles will be tested monthly for ground continuity, correct conductor termination and inspected for defects. All repairs to be made on electrical tools and equipment will be performed by a certified electrician. Records detailing the inspection and repair of electrical equipment will be kept with tool number, type, date inspected, repairs, and other comments.

5.2.8 Cranes and Lifting Devices

All lifting activities conducted will comply with all federal, state, and local laws; safe practices prescribed by the manufacturer of crane; and generally followed by the construction industry.

All contractors will use only those cranes and other hoisting equipment which are maintained in safe working conditions. All hoisting equipment brought onto the project site will be inspected for structural integrity, smooth operations performance, and proper functioning of all critical safety devices. The site Health and Safety Coordinator will conduct the inspection in conjunction with the crane operator. Any piece of equipment found not to be in compliance with these operation and safety requirements will not be put into service until all necessary repairs have been made.

Only qualified crane operators familiar with their equipment are permitted to operate the crane. Subcontractors are required to present proof of their operators' capability and experience to operate the crane in a safe manner.

All hooks, slings, and other fittings shall be the correct size for the task being performed. The use of defective or damaged hooks, pins, shackles, or other fitting attachments is prohibited. Chain or wire rope shall be free of kinks, sharp bends, or twists. All such items must have sufficient strength (including an ample margin of safety) to safely hoist the anticipated load. All rigging equipment shall be inspected prior to use to verify good working conditions.

No one is allowed to stand or walk beneath crane booms. No one is permitted to ride loads, hooks, medicine balls, or slings suspended from hoisting equipment. Booms will not be permitted to operate within 10 feet of an energized power line.

Side pulls should be avoided in all cases. The load must be directly under the hoist. The safety "throat" latch must be in the closed position at all times during a lift. Accessible areas within the swing radius will be barricaded to prevent injury. No crane will operate in a heavy lift mode without its outriggers fully extended to assure maximum stabilization of the equipment.

5.2.9 Biological Hazards

The planned field activities may bring contractor personnel into contact with snakes, spiders, ticks, chiggers, mosquitoes and poisonous plants (poison ivy and poison oak). The following precautions will be taken as necessary by field personnel to avoid contact with biological hazards:

- Hat to ward off insects
- Snake guards
- Insect/tick spray, especially on hat, ankles, wrist, and waist (may only be used when not operating a photoionization detector (PID) and not collecting samples)
- Use of Tyvek ™ suit sealed with duct tape at ankles and wrist
- Use of Oak-N-Ivy™ cleanser or equivalent at field hand-wash station
- Wash hands, face, and other exposed skin after each work period, and take a hot shower at the end of each day.

5.2.10 Sunburn

Sunscreen and/or sun visors should be worn when work must be performed in the heat of the day and where no shelter is available. Shade or air conditioned areas must be available on site for rest periods to reduce the likelihood of heat stress.

5.2.11 Fire or Explosion

Several flammable materials (e.g., fuels, cutting gases, waste oils, etc.) may be stored at or brought onto the site. To reduce the risk of fire and explosion, small quantities of flammable liquids must be stored in approved "safety" cans and labeled according to contents. Bulk storage of flammable materials should only be allowed in areas designated for this purpose. Open flames must be prohibited within 50 feet of flammable storage areas. Flammable materials in confined spaces can produce an explosive atmosphere which can be ignited by a spark or other energy source. OSHA standards for fire protection and prevention, and welding and cutting are contained in 29 CFR, Subpart F, 1926.150 through 1926.154 and 29 CFR, Subpart J, 1926.350 through 1926.354, respectively. Of particular concern are:

- Proper storage of flammable chemicals
- Adequate numbers and types of fire extinguishers
- Proper handling of cutting equipment, cylinders, and hoses
- Allowing open flames or cutting only in certain locations and with appropriate precautions
- Proper use of mechanical or local exhaust ventilation

Gasoline vapors can be highly explosive, having a flash point of about -40°F. Diesel oil is combustible, with a flash point of 110°F to 190°F, and is considered to be a moderate fire hazard. Ethylene glycol is considered to be a slight fire hazard (flash point of 232°F) and a moderate explosion hazard.

5.2.12 Other Hazards

Other physical hazards at Site 15 may include vehicular traffic, overhead powerlines, and underground utilities. Safe work practices will be used to avoid all unnecessary hazards.

TABLE 5.1
HEALTH HAZARD QUALITIES OF HAZARDOUS SUBSTANCES OF CONCERN AT SITE 15

Compound	PEL [a] (ppm)	TLV [b] (ppm)	IDLH [c] (ppm)	Odor Threshold[d] (ppm)	Ionization Potential[e] (eV)	Physical Description/Health Effects/Symptoms
Benzene	1 (29 CFR 1910.1028) [f]	0.1	500	4.7	9.24	Colorless to light-yellow liquid (solid<42°F) with an aromatic odor. Eye, nose, skin, and respiratory system irritant. Causes giddiness, headaches, nausea, staggered gait, fatigue, anorexia, exhaustion, dermatitis, bone marrow depression, and leukemia. Mutagen, experimental teratogen, and carcinogen.
Ethylbenzene	100	100	800	0.25-200	8.76	Colorless liquid with an aromatic odor. Irritates eyes, skin, and mucous membranes. Causes dermatitis, headaches, narcosis, and coma. Mutagen and experimental teratogen.
Toluene	100	50 (skin)	500	0.2-40 [g]	8.82	Colorless liquid with sweet, pungent, benzene-like odor. Irritates eyes and nose. Causes fatigue, weakness, dizziness, headaches, hallucinations or distorted perceptions, confusion, euphoria, dilated pupils, nervousness, tearing, muscle fatigue, insomnia, skin tingling, dermatitis, bone marrow changes, and liver and kidney damage. Mutagen and experimental teratogen.
Xylene (o-, m-, and p-isomers)	100	100	900	0.05-200 [k]	8.56 8.44 (p)	Colorless liquid with aromatic odor. P-isomer is a solid <56°F. Irritates eyes, skin, nose, and throat. Causes dizziness, drowsiness, staggered gait, incoordination, irritability, excitement, corneal irregularities, conjunctivitis, dermatitis, anorexia, nausea, vomiting, abdominal pain, and olfactory and pulmonary changes. Also targets blood, liver, and kidneys. Mutagen and experimental teratogen.
Benzo(a)anthracene	0.2 mg/m^3 [h]	0.2 mg/m^3 [h]	80 mg/m^3 [h]	NA	7.53	Colorless, crystalline solid with greenish-yellow fluorescence. Irritates eyes, respiratory tract, and skin. Causes dermatitis, bronchitis, and lung, kidney, and skin cancer. Carcinogen.
Benzo(b)fluoranthene	0.2 mg/m^3 [h]	0.2 mg/m^3 [h]	80 mg/m^3 [h]	NA	NA	Colorless, needle-like crystals. Irritates eyes, respiratory tract, and skin. Causes dermatitis, bronchitis, and lung, kidney, and skin cancer.

TABLE 5.1
HEALTH HAZARD QUALITIES OF HAZARDOUS SUBSTANCES OF CONCERN AT SITE 15

Compound	PEL [a/] (ppm)	TLV [b/] (ppm)	IDLH [c/] (ppm)	Odor Threshold[d/] (ppm)	Ionization Potential[e/] (eV)	Physical Description/Health Effects/Symptoms
						Carcinogen.
Benzo(k)fluoranthene	0.2 mg/m^3 [h/]	0.2 mg/m^3 [h/]	80 mg/m^3 [h/]	NA	NA	Pale-yellow, needle-like crystals. Irritates eyes, respiratory tract, and skin. Causes dermatitis, bronchitis, and lung, kidney, and skin cancer. Carcinogen.
Benzo(a)pyrene	0.2 mg/m^3 [h/]	0.2 mg/m^3 [h/]	80 mg/m^3 [h/]	NA	NA	Pale-yellow, crystalline solid with a faint aromatic odor. Irritates eyes, respiratory tract, and skin. Causes dermatitis, bronchitis, thickening and discoloration of the skin, and lung, kidney, and skin cancer. Mutagen, experimental teratogen, and carcinogen.
Chrysene	0.2 mg/m^3 [h/]	0.2 mg/m^3 [h/]	80 mg/m^3 [h/]	NA	7.75	Colorless, crystalline solid with blue to red fluorescence. Irritates eyes, skin, and respiratory tract. Causes burns to skin and eyes, dermatitis, bronchitis and lung, skin, and kidney cancer. Mutagen and carcinogen.
2-Methylnaphthalene	NA	NA	NA	0.003-0.04	7.96	Colorless gas or solid with a disagreeable garlic or rotten cabbage odor. Irritates eyes, skin, nose, and throat.
Naphthalene	10	10	250	0.3	8.1	Colorless to brown solid (shipped as a molten liquid) with a mothball-like odor. Irritates eyes, skin, and bladder. Causes headaches, confusion, excitement, convulsions, coma, vague discomfort, nausea, vomiting, abdominal pain, profuse sweating, jaundice, hematoma, hemoglobin in the urine, renal shutdown, dermatitis, optic nerve disorders, and corneal and liver damage. Experimental teratogen and questionable carcinogen.
Phenol	5 (skin)	5 (skin)	250	0.05-5	8.50	Colorless to light-pink, crystalline solid with a burning taste and a sweet acrid odor. Irritates eyes, nose, and throat. Causes anorexia, low-weight, weakness, muscle aches and pain, dark urine, blue skin, skin burns, dermatitis, tremors, twitching, convulsions, and damage to the liver, kidneys, pancreas, spleen, and lungs. Ingestion can cause gangrene and corrosion of the lips, mouth, throat, esophagus, and stomach. Mutagen, experimental teratogen, and questionable

TABLE 5.1
HEALTH HAZARD QUALITIES OF HAZARDOUS SUBSTANCES OF CONCERN AT SITE 15

Compound	PEL [a] (ppm)	TLV [b] (ppm)	IDLH [c] (ppm)	Odor Threshold[d] (ppm)	Ionization Potential[e] (eV)	Physical Description/Health Effects/Symptoms
						carcinogen.
Aroclor®-1254 (PCB, Chlorodiphenyl with 54% Chlorine)	0.5 mg/m^3 (skin)	0.5 mg/m^3 (skin)	5 mg/m^3	NA	NA	Colorless to pale-yellow, viscous liquid or solid (<50°F) with a mild, hydrocarbon odor. Irritates eyes and skin. Causes chloracne, liver damage, gastrointestinal disturbances, and reproductive effects. In animals, causes leukemia and tumors of the pituitary gland and liver. Carcinogen.

NOTES

a/ PEL = Permissible Exposure Limit. OSHA-enforced average air concentration to which a worker may be exposed for an 8-hour workday without harm. Expressed as parts per million (ppm) unless noted otherwise. PELs are published in the *NIOSH Pocket Guide to Chemical Hazards*, 1994. Some states (such as California) may have more restrictive PELs. Check state regulations.

b/ TLV = Threshold Limit Value - Time-Weighted Average. Average air concentration (same definition as PEL, above) recommended by the American Conference of Governmental Industrial Hygienists (ACGIH), *1994-1995 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.*

c/ IDLH = Immediately Dangerous to Life or Health. Air concentration at which an unprotected worker can escape without debilitating injury or health effects. Expressed as ppm unless noted otherwise. IDLH values are published in the *NIOSH Pocket Guide to Chemical Hazards*, 1994.

d/ When a range is given, use the highest concentration.

e/ Ionization Potential, measured in electron volts (eV), used to determine if field air monitoring equipment can detect substance. Values are published in the *NIOSH Pocket Guide to Chemical Hazards*, June 1994.

f/ Refer to expanded rules for this compound.

g/ Olfactory fatigue has been reported for the compound and odor may not serve as an adequate warning property.

h/ Based on coal tar pitch volatiles.

SECTION 6

TRAINING AND MEDICAL MONITORING REQUIREMENTS

Training is the foundation upon which all other protective measures depend. All contractor health and safety training programs will cover:

- The contractor health and safety policy
- Understanding of the hazards of the work
- Safe work practices
- Standard health and safety procedures
- Protective clothing, equipment, or engineering controls (where appropriate)
- Emergency procedures
- Contractor's personnel rights and responsibilities under OSHA

The content and extent of health and safety training will depend on the nature of the work and the responsibilities of the personnel performing the work. At a minimum, all contractor personnel must be given training in the overall contractor health and safety program. Additionally, all onsite personnel are required to read and abide by this site-specific HSP.

The medical surveillance program is a major element in the contractor health and safety program. The two major components of the program are (1) routine monitoring of the health of contractor personnel whose work may expose them to health hazards and (2) arrangements for emergency medical care in the event of work-related health emergencies.

6.1 SITE SAFETY TRAINING REQUIREMENTS

All onsite personnel must have received 40 hours of initial training in hazardous waste operations before participating in IRP projects, as required by 29 CFR Part 1910.120(e). All onsite personnel must be up to date on their annual 8-hour refresher training. Prior to beginning site activities, all contractor and subcontractor personnel must present certificates of the above training and evidence of participation in an annual medical monitoring program to the Site Health and Safety Coordinator or Project Manager. Additionally, CPR and first aid certification will be required for onsite personnel. This information will be kept in the project files.

Prior to beginning work on a site, the Site Health and Safety Coordinator will provide a briefing that covers the following topics:

- History of site
- Hazards at the site

- Proper use of personal protective equipment
- Work practices by which the employee can minimize risk from hazards
- Work zones and their locations, and the level of protection to be used in each zone on the site
- Acute effects of compounds at the site
- Decontamination procedures
- Emergency procedures, evacuation routes, and emergency telephone numbers

Tailgate safety meetings will be held daily and as appropriate as site tasks or safety conditions change (i.e., PPE upgrade, weather condition change). Topics covered will include a review of the anticipated activities, the appropriate safety procedures, and any associated physical or chemical hazards. The meeting will be recorded on the tailgate safety meeting form (Figure 6-1). All personnel attending the meeting must sign the form. Records of this training will be maintained in the project files.

6.2 MEDICAL MONITORING REQUIREMENTS

Personnel engaged in hazardous waste operations are required to be enrolled in a medical monitoring program as required by 29 CFR Part 1910.120(f). The medical monitoring program is conducted using the services of licensed, local occupational physicians. All examinations will include tests and analyses appropriate to the nature of the work the employee will be required to perform.

6.2.1 Pre-placement Screening

All contractor personnel who will be involved in the medical monitoring program must have an initial physical examination before assignment to work requiring regular health monitoring. The pre-placement screening has two major functions: (1) to determine contractor personnel's fitness for duty, including the ability to work while wearing protective equipment and (2) to establish a baseline physiological profile for comparison with future medical data.

6.2.2 Periodic Medical Examinations

Periodic medical examinations will be given. Comparison of sequential medical reports with baseline data is essential to determine physiological changes that may mark early signs of adverse health effects and, thereby, may facilitate appropriate protective measures.

The frequency and content of examinations will vary, depending on the nature of the work and exposure. Generally, medical examinations have been recommended annually. More frequent examinations may be necessary, depending on the extent of potential or actual exposure, the duration of the work assignment, and the individual worker's profile.

6.2.3 Termination Examination

A physical examination shall be performed as a part of the checkout procedure for terminating contractor personnel.

6.2.4 Special Examination

Special medical examinations, care, and counseling will be provided in cases of known exposures to toxic substances. Any special tests performed would depend on the substance to which the person was exposed.

6.2.5 Subcontractor's Medical Certification

Subcontractors that are to work at hazardous waste sites must furnish to the Project Manager or Site Health and Safety Coordinator a doctor's certification of each assigned worker's ability to wear personal protective equipment. The certification should be dated not more than one year before subcontractor personnel begin onsite work.

6.2.6 Medical Records

The contractor will keep in a locked file the physician's opinion on specific findings or diagnoses. When a worker terminates employment, the medical file should be archived for 30 years.

Figure 6.1
Tailgate Health and Safety Meeting

Date:

Specific Location:

Safety Topics Presented:

Protective Clothing/Equipment:

Chemical Hazards:

Physical Hazards:

Other:

Attendees: Name Printed:	Signature

MEETING CONDUCTED BY

Name Printed	Signature

SECTION 7

PROTECTIVE EQUIPMENT

7.1 PURPOSE

These guidelines are provided to establish a personal protective equipment and safety equipment program for hazardous waste operations.

7.2 GUIDELINE

Personal protective equipment (PPE) is needed to ensure the health and safety of field personnel involved with hazardous substances. It can only provide a high degree of protection if it is used properly. Clothing is selected by evaluating the performance characteristics of the clothing against the requirements and limitations of the site- and task-specific conditions. The following areas must be addressed for an effective PPE program:

- Training
- Work duration
- Fit testing
- Donning of equipment
- In-use monitoring
- Doffing of equipment
- Inspection
- Storage

7.3 CONSIDERATIONS FOR CHOICE OF PROTECTIVE CLOTHING

7.3.1 Performance Requirement

Clothing must be able to withstand a variety of physical abuses. The advantages and disadvantages of reusable versus disposable clothing must be considered.

7.3.2 Construction Requirements

The construction requirements of any garment depend on the intended use of the garment. The material that the garment is made of has been selected because of its effectiveness as a barrier against specific hazards there is no such thing as "universal" protection.

1. The physical construction of the garment must prevent penetration (e.g., location of seams and zippers, size of clothing).

2. The material that the garment is constructed of must resist penetration. In some instances, it may be necessary to layer protective clothing to achieve the desired protection.

7.3.3 Permeation Rate

Permeation rate is affected by a combination of the base material, the nature of the chemicals to which the material is exposed, and the duration and nature of exposure. Most materials allow some degree of permeation.

7.3.4 Ease and Cost of Decontamination

Considerations that should be made upon purchasing garments are the ability and degree to which the garment can be decontaminated and the cost of decontamination. Disposable clothing may be advantageous in some situations; however, such clothing is rather expensive in the long run. In most instances, field personnel will use a combination of disposable and reusable clothing.

7.3.5 Protective Materials

The following materials are generally available for a number of garments:

1. Cellulose or paper
2. Natural and synthetic fibers
    - Tyvek™
    - Nomex™
3. Elastomers
    - Polyethylene
    - Saran ™-Dow-product
    - Polyvinyl chloride
    - Neoprene
    - Butyl rubber
    - Chlorapel™
    - Viton™

Materials such as Tyvek™ or paper offer little or no protection against hazardous contaminants. Such materials can, however, protect against particulate contaminants. Tyvek™ should be used as an outer covering over the primary protective gear such as splash or fully encapsulating suits. Although Tyvek™ provides little chemical resistance, it does limit the amount of direct contamination on the primary protective gear. Tyvek™ garments are disposable.

Elastomers (polymeric materials that, after being stretched, return to about their original length) provide the best protection against chemical degradation, permeation, and penetration from toxic and corrosive liquids or gases. Elastomers are used in boots, gloves, overalls, and fully encapsulating suits. They are sometimes combined with a flame-resistant fabric called Nomex™ to enhance durability and protection.

The abilities of elastomers to resist degradation and permeation range from poor to excellent. The selection of a particular material should be based on its resistance to chemical degradation, as well as on its ability to resist permeation.

Protective clothing containing significant amounts of polyester or other synthetic fibers have the ability to build a static electricity charge from the wearer's movements. If the project site requires non-sparking uniforms due to explosion hazards, cotton/polyester blends for coveralls should be avoided. Zippers manufactured from brass which is non-sparking, should be used on projects where explosion hazards are a concern.

7.3.6 Types of Protective Clothing

Each type of protective clothing has a specific purpose; many, but not all, are designed to protect against chemical exposure. Table 7.1 describes the types of protective clothing available, details the protection they offer, and lists factors to consider in their selection and use.

7.4 SELECTION OF WORK ENSEMBLE

7.4.1 Protection Level

The individual components of clothing and equipment must be assembled into a full protective ensemble that both protects the worker from the site-specific hazards and minimizes the hazards and drawbacks of the personal protective equipment ensemble itself. Protective clothing selected should provide the maximum chemical protection available while allowing flexibility, dexterity, and visibility. These benefits of protective clothing must often be weighed and compared against increased risk of heat stress. Protective equipment selection must be coordinated with the site Health and Safety Coordinator or Program Health and Safety Manager.

7.4.2 Training

Training in PPE use is required as part of the initial training for all working at the site. This training allows the user to become familiar with the equipment in a non-hazardous environment. As a minimum, the PPE training portion should delineate the user's responsibilities and explain the following:

1. OSHA requirements as delineated in 29 CFR Part 1910 Subparts I and Z
2. The proper use and maintenance of the selected PPE, including capabilities and limitations

3. Instruction in inspecting, donning, checking, fitting, and using PPE
4. Individualized respirator fit testing to ensure proper fit
5. The user's responsibility (if any) for decontamination cleaning, maintenance, and repair of PPE
6. Emergency procedures and self-rescue in the event of PPE failure

7.4.3 Work Mission Duration

Before entering a hazardous waste site in personal protective equipment, the anticipated work mission duration must be established in the project health and safety plan. Several factors limit the work mission length. These are:

1. Air supply
2. The permeation and penetration rates of chemical contaminants
3. Ambient temperature

7.4.4 Donning of Equipment

Periodic practice for donning chemical resistant clothing and respirators are required. Assistance should be provided because donning and doffing operations are difficult to perform alone.

After the equipment has been donned, the fit should be evaluated. Clothing that is too small will restrict movement, thus increasing the possibility of tearing the suit and increasing worker fatigue. Clothing that is too large increases the possibility of snagging the suit and the worker's dexterity and coordination may be compromised. In each instance, the worker should be recalled and refitted.

7.4.5 In-Use Monitoring

The wearer of protective clothing must understand all aspects of the clothing's operation and limitation. This is particularly important for fully-encapsulating ensembles where misuse could result in suffocation.

Worker should report any perceived problems or difficulties with equipment to their Project Health and Safety Officer. These malfunctions include, but are not limited to:

- Degradation of protective clothing
- Perception of odor while wearing a respirator
- Skin irritation
- Resistance in breathing during respirator use
- Fatigue because of respirator use
- Vision or communication difficulties

- Personal responses such as rapid pulse, chest pain, and nausea

If a supplied-air respirator is being used, all hazards that might endanger the integrity of the air line should be removed from the working area before use. During use, air lines should be kept as short as possible and other workers and vehicles should be excluded from the area.

7.4.6 Doffing of Equipment

Procedures for removing chemically-resistant suit/SCBA ensembles must be developed and followed precisely to prevent the spread of contaminants from the work area to the wearer's body, and to decontamination personnel. Doffing should be performed in concert with the decontamination of the suited worker. Throughout the doffing procedure, both the worker and decontamination personnel should avoid direct contact with the outside surface of the suit.

7.4.7 Inspection

An effective PPE program will consist of three different inspections:

1. Inspection of equipment as it is issued to workers
2. Inspection after use in training
3. Periodic inspection of stored equipment

Each inspection will cover different areas in varying degrees of detail. Explicit inspection procedures are usually available from the manufacturer. The inspection checklists provided in Table 7.2 will also be an aid. It is the responsibility of the field worker to inspect the integrity of his or her equipment before use on a site.

Records must be maintained of all inspection procedures. Identification numbers should be assigned to all reusable pieces of equipment (ID numbers) and records should be kept by that number. As a minimum, each inspection should record the ID number, date, inspector, findings, and any future actions to be taken. Periodic review of these records may indicate an item or type of item with excessive maintenance costs or a high level of down time.

7.4.8 Storage

Clothing and respirators must be properly stored to prevent damage or malfunction due to exposure to dust, moisture, sunlight, temperature extremes, and impact. Procedures should be developed for pre-issuance warehousing and post-issuance (in-use) storage. Improper storage can cause equipment failures.

7.5 PROTECTION LEVELS

7.5.1 Level A

Level A protection should be used when percutaneous hazards exist or where there is no known data to rule out percutaneous hazards. Because wearing a fully encapsulated suit is physiologically and psychologically stressful, the decision to use this protection must be carefully considered. The following conditions suggest a need for Level A protection.

1. The hazardous substance has been identified and requires the highest level of protection for skin, eyes, and the respiratory system based on either the measured (or potential for) high concentration of atmospheric vapors, gases, or particulates; or based on the site operations and work functions involve a high potential for splash, immersion, or exposure to unexpected vapors, gases, or particulates of materials that are harmful to skin or capable of being absorbed through the intact skin.
2. Substances with a high degree of hazard to the skin are known or suspected to be present, and skin contact is possible.
3. Operations must be conducted in confined, poorly ventilated areas and the absence of conditions requiring Level A have not yet been determined.

The following items constitute Level A protection:

1. Pressure-demand, full-face piece, self-contained breathing apparatus (SCBA), or pressure-demand supplied-air respirator with escape SCBA, approved by the National Institute for Occupational Safety and Health (NIOSH)
2. Totally-encapsulating chemical-protective suit
3. Coveralls
4. Long underwear*
5. Gloves, outer, chemical resistant
6. Gloves, inner, chemical resistant
7. Boots, chemical-resistant, steel toe and shank
8. Hard hat (under suit)*
9. Disposable protective suit, gloves, and boots (depending on suit construction, may be worn over totally-encapsulating suit)
10. Two-way radios (worn inside encapsulating suit)

Before a fully encapsulated suit can be worn into a hazardous situation the suit must be properly inspected. The following is a checklist for visually inspecting all types of fully encapsulated suits.

1. Spread suit out on flat surface.
2. Examine the following:
    a. Fabric and seams for abrasions, cuts, or holes
    b. Zippers and other connecting devices for proper sealing
    c. Visor for dirt and cracks

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* Optional, as applicable

   d. Exhaust valves (if applicable) for inhibiting debris and prcper functioning

3. If air source is available, seal the suit and inflate it. Check for any leaks on surface and seams using a mild soap solution.
4. Record each suit's inspection, use, and repair status.

7.5.2 Level B

Level B protection should be worn when the highest level of respiratory protection is necessary, but a lesser level of skin protection is needed. The following conditions constitute a need for Level B protection.

1. Atmospheres with concentrations of known substance greater than protective factors associated with full-face, air-purifying respirators
2. The atmosphere contains less than 19.5 percent oxygen.
3. Site operations make it highly unlikely that the small, exposed areas of the head or neck will be contacted by splashes of extremely hazardous substances.
4. Type(s) and concentration(s) of vapors in air do not present a cutaneous or percutaneous hazard to the small, unprotected areas of the body.

The following items constitute Level B protection:

1. Pressure-demand, full-face piece, self-contained breathing apparatus (SCBA), or pressure-demand supplied air respirator with escape SCBA (NIOSH approved)
2. Hooded chemical-resistant clothing (overalls and long-sleeved jacket, coveralls, one or two-piece chemical splash suit; disposable chemical-resistant overalls)
3. Coveralls*
4. Gloves, outer, chemical-resistant
5. Gloves, inner, chemical-resistant
6. Boots, outer, chemical-resistant, steel toe and shank
7. Boot covers, outer, chemical-resistant (disposable)*
8. Hard hat
9. Two-way radios*
10. Face shield*

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* Optional, as applicable

7.5.3 Level C

Level C protection should be worn when the type(s) of airborne substance(s) is measured, and the criteria for using air-purifying respirators are met. The following conditions suggest a need for Level C protection:

1. The atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect or be absorbed through any exposed skin.
2. The types of air contaminants have been identified, concentrations measured, and a canister or cartridge respirator is available that can remove the contaminants.
3. All criteria for the use of air-purifying respirators are met.

The following items constitute Level C protection:

1. Full-face or half-mask, air-purifying canister or cartridge equipped respirators (NIOSH approved)
2. Hooded chemical-resistant clothing (overalls; two-piece, chemical-splash suit; disposal, chemical-resistant overalls)
3. Coveralls*
4. Gloves, outer, chemical-resistant
5. Gloves, inner, chemical-resistant
6. Boots (outer), chemical-resistant, steel toe and shank*
7. Boot covers, outer, chemical-resistant (disposable)*
8. Hard hat*
9. Escape mask*
10. Two-way radios*
11. Face shield*

7.5.4 Level D

Level D protection should not be worn on any site where respiratory or skin hazard exist. Level D protection should be used when:

1. The atmosphere contains no known hazard.
2. Work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.

The following items constitute Level D protection:

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* Optional, as applicable.

1. Coveralls
2. Gloves*
3. Boots/shoes, chemical-resistant, steel toe and shank
4. Boots, outer, chemical-resistant (disposable)*
5. Safety glasses or chemical splash goggles*
6. Hard hat*
7. Escape mask*
8. Face shield*

The type of clothing used and the overall level of protection should be reevaluated periodically as information about the site increases and as workers perform different operations. The Project Health and Safety Officer will determine when to upgrade or downgrade the level of protection for site personnel.

Reason to upgrade:

1. Known or suspected presence of dermal hazards
2. Occurrence or likely occurrence of gas or vapor emission
3. Change in work task that will increase contact or potential contact with hazardous materials
4. Request of the individual performing the task

Reasons to downgrade:

1. New information indicating that the situation is less hazardous than was originally thought
2. Change in site conditions that decreases the hazard
3. Change in work task that will reduce contact with hazardous materials

7.6 SAFETY EQUIPMENT

Additional safety equipment should be located in the support zone (discussed in Section 10) for use in the event of an emergency. This equipment should be centrally located with respect to the project site and kept free of all obstructions for ease of access. This is a general list of safety equipment to be used at the site.

- Portable fire extinguisher (Type ABC)
- Industrial first aid kit
- Additional eye and face protection (glasses, goggles, face shields)
- Hearing protection

- Additional PPE (Tyvek®, over-boots, duct tape, hard hats)
- Decontamination water
- Drinking water
- Spill kit (sorbent pads or equivalent)

7.7 SITE-SPECIFIC PPE REQUIREMENTS

All field work performed as part of the soil, sediment, and groundwater data gap investigation will begin in Level D PPE as described above. If soil or sediment samples must be handled directly by personnel, outer nitrile and inner latex gloves shall be used.

Higher levels of PPE are not anticipated for the investigation; however, an upgrade of protection levels will be completed if conditions warrant as described in Section 7.5.4. or as prescribed in air monitoring requirements as specified in the action level table in Section 8.11

TABLE 7.1

PROTECTIVE CLOTHING AND ACCESSORIES

Type of Clothing or Accessory	Description	Type of Protection
Fully encapsulating suit	One-piece garment. Boots and gloves may be integral; attached and replaceable, or separate.	Protects entire body against splashes, dust, gases, and vapors.
Non-encapsulating suit	Jacket, hood, pants, or bib overalls, and one-piece coveralls.	Protects body against splashes, dust, and other materials but not against gases and vapors. Does not protect parts of head or neck.
Aprons, leggings, and sleeve protectors	Fully sleeved and gloved apron. Separate coverings for arms and legs. Commonly worn over no-encapsulating suit.	Provides additional splash protection of chest, forearms, and legs.
Firefighters' protective clothing	Gloves, helmet, running or bunker coat, running or bunker pants (NFPA No. 1971, 1972, 1973), and boots.	Protective against heat, hot water, and some particles. Does not protect against gases and vapors, or chemical permeation or degradation. NFPA Standard No. 1971 specifies that a garment consist of an outer shell, an inner liner, and a vapor barrier with a minimum water penetration of 25 lb/in^2 (1.3 kg/cm^2) to prevent the passage of hot water.
Safety helmet	Hard plastic or rubber hat.	Protects the head from blows. Helmets shall meet OSHA Standard 29 CFR
Face Shield	Full-face coverage, eight-inch minimum.	Protects face and eyes against chemical splashes.
Safety glasses	Plastic or glass lenses with side shields.	Protects eyes against large particles and projectiles. Safety glasses shall meet OSHA Standard 29 CFR Part 1910.133.

TABLE 7.1 (continued)

PROTECTIVE CLOTHING AND ACCESSORIES

Type of Clothing or Accessory	Description	Type of Protection
Goggles	Plastic lenses, flexible fitting.	Depending on their construction, goggles can protect against vaporized chemicals, splashes, large particles, and projectiles (if constructed with impact-resistant lenses). Goggles shall meet OSHA Standard 29 CFR Part 1910.133.
Gloves and sleeves	May be integral, attached, or separate from other protective clothing.	Protects hands and arms from chemical contact.
	Overgloves.	Provides supplemental protection to the wearer and protects more expensive undergarments from abrasions, tears, and contamination.
Safety Boots	Boots constructed of chemical-resistant materials (i.e., neoprene, nitrile, butyl rubber, etc.).	Protects feet from contact with chemicals.
	Boots constructed with some steel materials (e.g., toes, shanks, insoles).	Protects feet from compression, crushing, or puncture by falling, moving, or sharp objects. All boots must meet specifications required by OSHA (29 CFR Part 1910.136:).
	Boots constructed from nonconductive, spark-resistant materials or coatings.	Protects the wearer against electrical hazards and prevents ignition of combustible gases or vapors.
Disposable shoes or boot covers	Made of a variety of materials. Slip over the shoe or boot.	Protects safety boots from contamination. Protects feet from contamination.

SOURCE: NIOSH, OSHA, USCG, EPA. 1985. Occupational Safety and Health Guidance Manual For Hazardous Waste Site Activities.

TABLE 7.2

SAMPLE PPE INSPECTION CHECKLIST

Clothing

To be done before use:

- Determine that the clothing material is correct for the specific task at hand.
- Visually inspect for:
  - imperfect seams
  - non-uniform coatings
  - tears
  - malfunctioning closures
- Hold up to light and check for pinholes.
- Flex product:
  - observe for cracks
  - observe for other signs of shelf deterioration
- If the project has been used previously, inspect inside and out for signs of chemical attack:
  - discoloration
  - swelling
  - stiffness

To be done during the work task:

- Evidence of chemical attack (e.g., discoloration, softening, etc.). Chemical permeation can occur without visible signs.
- Tears
- Punctures
- Seam discontinuities

TABLE 7.2 (Continued)

SAMPLE PPE INSPECTION CHECKLIST

Gloves

To be done before use:

- Pressurize the gloves to check for holes. Either flow into glove, then roll gauntlet towards fingers or inflate glove and hold under water. In any event, no air should escape.

Air-Purifying Respirator

The respirator shall be inspected after each cleaning and before each use. The following items, at a minimum, must be addressed in the course of each inspection:

- Cartridges are fresh and of the appropriate type for the contaminant(s) encountered (check before use).
- Cartridge receptacle gaskets are present (two each).
- Inhalation valve seats and flapper valves are in place (two each).
- Exhalation flapper valve is in place.
- The speaking diaphragm and gasket are in place.
- The lens ring is secure with two nuts.
- The respirator is capable of maintaining a negative and positive pressure seal when fully assembled.

Self-Contained Breathing Apparatus (SCBA)

The following list of items must be addressed by the user immediately before donning of SCBAs. Any malfunction found should be cause to set the unit aside until it can be repaired by a certified repair person.

- Check all connections for tightness.
- Check material conditions for:
  - signs of pliability.
  - signs of deterioration.
  - signs of distortion.

TABLE 7.2 (Continued)

SAMPLE PPE INSPECTION CHECKLIST

- Check for proper setting and operation of regulators and valves (according to manufacturer's instructions).
- Check operation of low pressure alarm.
- Check face shield and lense for:
  - cracks
  - crazing
  - fogginess

SCBAs shall be inspected once a month by the Health and Safety Manager or site H&S coordinator to ensure that they are working properly. Monthly inspection involve the following:

- The routine checkout procedure used by personnel before every use of an SCBA must be repeated.
- A complete physical examination must be made of all external working parts on a monthly basis.
- Gaskets, seals, and rubber parts are examined for pliability and signs of deterioration.
- A physical examination of the diaphragm, diaphragm spring, and lever assembly must be made.

SCBAs must be checked twice a year on a portable regulator tester to ensure that the regulator is mechanically sound. Checks on the regulator tester must include the following:

- Static Pressure check.
- Airflow performance test.
- A test for excess aspiration of the regulator.

Air tanks must also be hydrostatically tested to ensure soundness. Aluminum cylinders wound in fiberglass must be tested every three years, steel cylinder need only be tested every five years. All test dates must be recorded in the inspection log book for SCBAs.

TABLE 7.2 (Continued)

SAMPLE PPE INSPECTION CHECKLIST

Clothing

- Contaminated clothing should be stored in an area separate from street clothing.
- Contaminated clothing should be stored in a well-ventilated area.
- Different types of materials of clothing and gloves should be stored separately to prevent issuing the wrong material by mistake.

Respirators

- SCBAs and air-purifying respirators should be dismantled, washed, and disinfected after each use.

SECTION 8

HEALTH HAZARD ASSESSMENT

8.1 PURPOSE

OSHA, in 29 CFR Part 1910.120 (h), requires air monitoring to be used to identify and quantify airborne concentrations of hazardous substances. The purpose of this guideline is to establish fundamental air monitoring principles that can be used to evaluate potential risks at a site. Section 8.2 through 8.10 provide general information regarding monitoring, instruments, and training. Section 8.11 provides site-specific monitoring requirements for the Site 15 investigation.

8.2 GUIDELINE

Various dangers may exist when working at a hazardous waste site. Explosive vapors, oxygen deficient atmospheres, and a variety of toxic gases and vapors can be encountered with lethal properties.

When first approaching a waste site, the potential hazards must be recognized and exposure risks evaluated. This can be done by a methodical initial site survey. To perform initial site surveys and subsequent monitoring, various portable instruments must be available. The following sections describe the types of air monitoring that can be performed and how to interpret monitoring results.

8.3 INITIAL SITE SURVEY AIR MONITORING

Site surveys provide the information needed to identify potential site hazards and to select worker respiratory protection methods and equipment. Site surveys generally proceed in three phases:

- Conduct off-site characterization before site entry. Gather information away from the site by consulting or inspecting site owner's files, agency personnel and files, former site employees, and other applicable literature and personnel. (The off-site characterization effort has been completed for Hancock Site 15.) Conduct a reconnaissance from the site perimeter.
- Next, conduct onsite surveys. During this phase, restrict site entry to reconnaissance personnel.
- Once the site has been determined safe for beginning other activities, perform ongoing monitoring to provide a continuous source of information about site conditions.

It is important to recognize that site characterization is a continuous process. At each phase of site characterization, information shall be obtained and evaluated to define the potential hazards of the site.

The following information (to the extent it is available) shall be obtained before perimeter reconnaissance or initial site entry:

- Location and approximate size of the site;
- Description of the response activity or the job task to be performed;
- Duration of the planned employee activity;
- Site topography;
- Meteorologic data such as prevailing wind direction, precipitation levels, and temperature profiles;
- Site accessibility by air and roads;
- Pathways for hazardous substance dispersion;
- Present status and capabilities of emergency response teams (including contact names and phone numbers) that would provide emergency assistance to onsite employees;
- Hazardous substances and health hazards present or expected at the site and their chemical and physical properties; and
- All suspected conditions that may pose inhalation or skin absorption hazards that are immediately dangerous to life or health (IDLH) or other conditions that may cause death or serious harm shall be identified during the preliminary site characterization and carefully evaluated during the initial site entry and subsequent site surveys.

8.3.1 Perimeter Reconnaissance

Following the data-gathering exercise, and at a site where the hazards are largely unknown, a perimeter reconnaissance should be conducted. Reconnaissance personnel should use Level D or C protection as appropriate. Portable air monitoring instruments should be used, particularly when working downwind of the site. The perimeter reconnaissance should be conducted by at least two individuals. The Project Health and Safety Coordinator should be present. The perimeter reconnaissance should involve the following actions:

- Develop a preliminary site map and review available aerial photography;
- Note any labels, markings, or placards on containers or vehicles;
- Note the amount of deterioration or damage of containers;
- Note any biological indicators, such as dead animals or plants;
- Note any unusual conditions such as clouds or vapors, discolored liquids, or soil staining;
- Note any unusual odors; and
- Collect and analyze offsite soil, water, or air samples as appropriate.

8.3.2 Initial Site Entry

OSHA requires that an ensemble of PPE shall be selected and used during the initial site entry that will provide protection to a level of exposure below established PELs for known or suspected hazardous substances and other safety and health hazards identified during the preliminary site evaluation (29 CFR Part 1910.120[c]).

In the rare instance when the preliminary site evaluation does not produce sufficient information to identify the hazards or suspected hazards of the site, Level B respiratory protection (SCBA) and appropriate protective clothing shall be used as minimum protection for the initial site entry. Direct reading instruments shall be used for identifying IDLH conditions. If available information indicates that Level B protection is not required for initial site entry, and if respiratory protection is warranted by the potential hazards identified during the initial site investigation, an escape SCBA of at least five minutes duration shall be carried by each employee or kept at their immediate work station (29 CFR Part 1910.120[c][5]).

The initial site entry team should consist of three persons: two workers who will enter the site and one outside support person, suited in PPE and prepared to enter the site in case of emergency. It is important that the Project Health and Safety Coordinator be present as one of the team members. Entry personnel should:

- Use monitoring instruments to monitor the air for IDLH and other safety or health conditions that may cause death or serious injury;
- Note the types and condition of containers, impoundments, or other storage systems;
- Note the physical condition of the hazardous substances;
- Determine potential pathways for dispersion; and
- Collect air, water, and soil samples.

8.4 AIR MONITORING INSTRUMENTS

Airborne contaminants may pose a significant threat to worker health and safety, and identification and quantification of airborne contaminants is essential for a good health and safety program at a hazardous waste site. Reliable measurements of airborne contaminants are needed for:

- Selecting personal protective equipment;
- Delineating areas where protection is needed;
- Assessing the potential health effects of exposure; and
- Determining the need for specific medical monitoring.

8.4.1 Measuring Instruments

The purpose of air monitoring is to identify and quantify airborne contaminants to determine the level of worker protection needed. Two principal approaches are available for identifying and quantifying airborne contaminants:

- The onsite use of direct-reading instruments; and
- Laboratory analysis of air samples obtained by gas sampling bag, filter, sorbent, or wet-contaminant collection methods.

8.4.2 Direct-Reading Instruments

Direct-reading instruments are used for rapid detection of flammable or explosive gases, oxygen deficiency, and specific gases and vapors. The information provided by these instruments must be used to institute appropriate protective measures.

It is important that direct-reading instruments be operated by trained individuals who are familiar with the device's operating principles and limitations. At hazardous waste sites where unknown and multiple contaminants are usually the rule, instrument readings should be interpreted conservatively. The following guidelines should be used to facilitate accurate recording and interpretations:

- Calibrate instruments according to the manufacturer's instructions;
- Develop chemical response curves if these are not provided by the instrument manufacturer;
- A reading of zero should be reported as "no instrument response" rather than "clean" because quantities of chemicals may be present that are not detectable by the instrument; and
- The survey should be repeated with several detection systems to maximize the number of chemicals detected.

A description of the direct reading instruments is presented below.

8.4.2.1 Oxygen-Deficient Atmospheres

At sites where oxygen depletion or displacement is anticipated, oxygen levels must be monitored by the use of a portable oxygen detector. A typical oxygen detector measures the percent oxygen in the immediate atmosphere using a galvanic cell. Terrain variations in the land and unventilated rooms or areas often do not contain enough oxygen to support life, making these instruments invaluable to response personnel. The normal ambient oxygen concentration is 20.8 percent.

NIOSH requires that if oxygen levels in the ambient air become less than 19.5 percent, supplied air respirators must be worn. Oxygen-enriched atmospheres (oxygen greater than 25 percent) increase the potential for fire or explosion; no work or testing should ever be performed under such conditions.

The operation of oxygen detectors depends on the absolute atmospheric pressure. The concentration of natural oxygen (not manufactured or generated oxygen) is a function of the atmospheric pressure at a given altitude.

At sea level, where the weight of the atmosphere is greatest, more oxygen molecules are compressed into a given volume than at higher elevations. As elevation increases, this compression decreases, resulting in fewer oxygen molecules being "squeezed" into a given volume. Consequently, an oxygen indicator calibrated at sea level and operated at an altitude of several thousand feet will falsely indicate an oxygen-deficient atmosphere (less than 19.5 percent).

8.4.2.2 Combustible Gases/Vapors

The presence or absence of combustible vapors or gases must be evaluated at a waste site. A typical combustible gas detector determines the concentration of combustible vapors and gases present in an atmosphere. The level is recorded as a percentage of the lower explosive limit (LEL), which is measured as the change in electrical resistance in a wheatstone bridge circuit.

The LEL of a combustible gas or vapor is the lowest concentration by volume in air that will explode, ignite, or burn when there is an available ignition source. NIOSH has established the following guidelines concerning working in an explosive environment:

1. If combustible gas is detected between 10 to 25 percent LEL, work activities in the area should be limited to those that do not generate sparks.
2. If the explosivity reading on the combustible gas indicator is above 25 percent, operations will stop and the onsite area must be immediately evacuated until appropriate action can be taken to eliminate the hazard.

Once a site has been evacuated, onsite activities cannot resume until project contractor personnel have consulted with personnel experienced in fire or explosion hazards. Onsite activities around enclosed spaces and material containers should be carefully monitored for the presence of combustible gases and vapors. Around well drilling and welding operations, the air above the borehole and around the work area also needs to be monitored for combustible/explosive gases and vapors.

The combustible gas detector cannot be used to test the vapors of leaded gasoline, halogens, and sulfur compounds. These substances interfere with the filament unit, reducing the instrument's sensitivity. Compounds containing silicone will also destroy the platinum filament.

The combustible gas detector can only be used in normal atmospheres, not oxygen-enriched or -deficient. Oxygen concentrations that are less than or greater than normal may cause erroneous readings.

8.4.2.3 Organic Vapor/Gases

The initial survey of a site should always include measurements for organic vapors. Sufficient data should be obtained during the initial entry to screen the site for various levels of organic vapors. These gross measurements can be used on a preliminary basis to (1) determine levels of personnel protection, (2) establish site work zones, and (3) select candidate areas for more thorough qualitative and quantitative studies.

Organic vapor concentrations at a site can be determined by the use of a photoionization detector (PID) or a flame-ionization detector (FID).

8.4.2.3.1 Photoionization Detector

Photoionization instruments (HNU® for example) use an ultraviolet (UV) light to ionize chemical compounds. The photoionization process can be illustrated as:

$$RH + hv \text{ ---> } RH^{+} + e-$$

where: RH is an organic or inorganic molecule and hv represents a photon of UV light.

The photon has energy equal to or greater than the molecules ionization potential and causes the emission of an electron, "e-".

The PID consists of a chamber containing a pair of electrodes. When a positive potential is applied to one electrode, the field created drives any ions formed by the absorption of UV light to the collector electrode, where the current (proportional to the concentration) is measured.

Compounds with high ionization potentials will not be detected if the lamp used does not have the sufficient energy required to ionize the compound (HNU® manufactures three UV lamps with different ionization energies).

The response to a gas or vapor may radically change when the gas or vapor is mixed with other materials. As an example, a PID calibrated to ammonia and surveying an atmosphere containing 100 ppm ammonia would indicate 100 on the meter. Likewise, an instrument calibrated to benzene would record 100 in an atmosphere containing 100 ppm benzene. However, in an atmosphere containing 100 ppm of each compound, the instrument could indicate considerably less or more than 200 ppm, depending on how it was calibrated.

8.4.2.3.2 Flame Ionization Detector

The flame ionization detector (FID) uses ionization as the detection method much the same as in the PID, except that the ionization is caused by a hydrogen flame, rather than UV light. The flame has enough energy to ionize any organic molecule with an ionization potential of 15.4 ev or less.

Inside the instrument's detection chamber, the sample is exposed to a hydrogen flame that ionizes the organic vapors. As the organic vapors burn, positively charged, carbon-containing ions are produced and collect on a negatively charged electrode. As the positive ions accumulate, a current proportional to the hydrocarbon concentration is generated on the input electrode.

Flame ionization detectors do not detect inorganic gases and vapors and many synthetic compounds. Similar to the PID, the FID responds differently to different compounds. For example, an FID that has been calibrated to methane will read 100 ppm methane in an atmosphere containing 100 ppm methane. However, this instrument may only register 10 ppm of carbon tetrachloride in an atmosphere actually containing 100 ppm of that compound. The relative sensitivity to various compounds must be considered when using this instrument.

8.4.2.3.3 Colorimetric Indicator Tubes

Often, while evaluating a hazardous waste site, the need arises to quickly measure a specific gas. Direct-reading colorimetric indicator tubes can successfully fill that need. These tubes are usually calibrated in parts per million (ppm) or percent concentration for easy interpretation.

Colorimetric indicator tubes consist of a glass tube impregnated with an indicator chemical. A known volume of contaminated air is drawn through the tube at a predetermined rate. The contaminant reacts with the indicator chemical in the tube, producing a discoloration that is proportional to the chemical's concentration. Detector tubes are chemical specific and must be selected before leaving for the site.

Several indicator chemicals may be able to measure the concentration of a particular gas or vapor. Each chemical operates on a different chemical principle and is affected in varying degrees by temperature, air volume pulled through the tube, and interference from other gases or vapors. A "true" concentration versus the "measured" concentration may vary considerably among and between tube manufacturers.

A major limitation of this apparatus involves the process by which the operator "reads" the endpoint. The jagged edge where contaminant meets indicator chemical makes it difficult to get accurate results from this seemingly simple test. However, a diligent and experienced operator should be able to accurately read the endpoint.

8.5 PERSONAL MONITORING

Selective monitoring of high risk workers (i.e., those closest to the source of contamination generation) is recommended during cleanup activities. This methodology is based on the rationale that the probability of significant exposure varies with distance from the source. If workers closest to the source of contamination are not significantly exposed, then all other workers are supposedly not exposed and do not need to be monitored.

Personal monitoring samples should be collected in the breathing zone. These samples represent the inhalation exposure of workers who are not wearing respiratory protection. "Full shift" or 8-hour air samples are analyzed in a laboratory. Full shift air samples may be collected using passive dosimeters, or by a pump that draws air onto a sorbent or filter. It is best to use pumps that maintain a constant flow rate to collect samples, because it is difficult to adjust the pump with protective equipment on.

8.6 PERIODIC MONITORING

The monitoring surveys made during the initial site entry phase are for a preliminary evaluation of atmospheric hazards. In some situations, the information obtained may be sufficient to preclude additional monitoring. However, because site activities and weather conditions change during the course of a day, a program to periodically monitor atmospheric changes must be implemented (see Table 8.1 for action levels and recommendations). At a minimum, periodic monitoring of air quality during excavation sampling will be conducted every 15 minutes.

8.7 TRAINING

It is imperative that personnel using monitoring instruments be thoroughly familiar with their use, limitations, and operating characteristics. All instruments have inherent constraints in their ability to detect and/or quantify the hazard for which they were designed. Unless trained personnel use the instruments properly and accurately assess the data readout, air hazards can be grossly misinterpreted, endangering the health and safety of field personnel.

8.8 INSTRUMENT SENSITIVITY

Although the measurement of total vapor/gas concentrations can be a useful adjunct to professional judgment in the selection of an appropriate level of protection, caution should be used in the interpretation of the readout of the measuring instrument. The response of an instrument to a gas or vapor cloud containing two or more substances does not provide the same sensitivity as measurements involving the individual, pure constituents. Hence, the instrument readout may overestimate or underestimate the concentration of an unknown composite cloud. This same type of inaccuracy could also occur in measuring a single unknown substance with the instrument calibrated to a different substance. The idiosyncrasies of each instrument must be considered in conjunction with the other parameters in selecting the protection equipment needed. Using the total vapor/gas concentration to determine levels of protection should provide protection against concentrations greater than the readout of the instrument. However, when the upper limits of Levels C and B are approached, serious consideration should be given to selecting a higher level of protection. Cloud constituents must be identified as rapidly as possible and levels of protection based on the toxic properties of the specific substances identified.

8.9 HEAT STRESS MONITORING

Sweating does not cool the body unless moisture is removed from the body. The use of PPE reduces the body's ability to eliminate large quantities of heat because the evaporation of sweat is decreased. The body's effort to maintain an acceptable temperature may become impaired and this may cause heat stress. Increased body temperature and physical discomfort also promote irritability and a decreased attention to the performance of hazardous tasks.

Heat related problems include heat rash, fainting, heat cramps, heat exhaustion and heat stroke. Heat rash occurs because sweat isn't evaporating, making the skin wet most of the time. Standing erect and immobile in the heat allows blood to pool in the lower extremities. As a result, blood does not return to the heart to be pumped back to the brain and fainting may occur. Heat cramps are painful spasms of the muscles due to excessive salt loss from profuse sweating. Heat exhaustion occurs due to the large fluid and salt loss from profuse sweating. A person's skin is clammy and moist. Nausea, dizziness and headache may also be exhibited.

Heat stroke occurs when the body's temperature regulatory system has failed. Skin is hot, dry red, and spotted. The affected person may be mentally confused and delirious, and convulsions may occur. A person exhibiting signs of heat stroke should be removed from the work area to a shaded area immediately. The person should be soaked with water and fanned to promote evaporation. Medical attention should be obtained immediately. Early recognition and treatment of heat stroke are the only means of preventing brain damage or death.

Monitoring of personnel wearing PPE should commence when the ambient temperature is 70°F or above. Table 8.2 presents the suggested frequency for such monitoring. Monitoring frequency should increase as the ambient temperature increases or as slow recovery rates are observed. Heat stress monitoring should be performed by a person with a current first aid certification who is trained to recognize heat stress symptoms. For monitoring the body's recuperative abilities to excessive heat, one or more of the following techniques should be used. Other methods for determining heat stress monitoring, such as the wet bulb globe temperature (WBGT) index from American Conference of Governmental Industrial Hygienist (ACGIH) threshold limit value (TLV) booklet can be used.

8.9.1 Early Symptoms of Heat Related Problems:

1. Decline in task performance;
2. Incoordination;
3. Decline in alertness;
4. Unsteady walk;
5. Excessive fatigue;
6. Muscle cramps; or
7. Dizziness.

8.9.2 Susceptibility to Heat Stress Increases

The following conditions may make one susceptible to heat stress:

1. Lack of physical fitness;
2. Lack of acclimatization to the ambient temperature;
3. Increased age;
4. Dehydration;
5. Obesity;
6. Drug or alcohol use;
7. Sunburn; or
8. Infection.

To monitor the worker, measure:

- Heart rate. Count the radial pulse during a 30-second period as early as possible in the rest period;
    - If the heart rate exceeds 100 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period the same;
    - If the heart rate still exceeds 100 beats per minute at the next rest period, shorten the following work cycle by one-third.
- Oral temperature. Use a clinical thermometer (3 minutes under the tongue) or similar device to measure the oral temperature at the end of the work period (before drinking).
    - If oral temperature exceeds 99.6°F (37.6°C), shorten the next work cycle by one-third without changing the rest period;
    - If oral temperature still exceeds 99.6°F (37.6°C) at the beginning of the next rest period, shorten the following cycle by one-third;
    - Do not permit a worker to wear a semi-permeable or impermeable garment when oral temperature exceeds 100.6°F (38.1°C).

8.9.3 Prevention of Heat Stress

Proper training and preventive measures will aid in averting loss of worker productivity and serious illness. Heat stress prevention is particularly important because once a person suffers from heat stroke or heat exhaustion, that person may be predisposed to additional heat related illness. To avoid heat stress the following steps should be taken:

- Adjust work schedules;
    - Modify work/rest schedules according to monitoring requirements,
    - Mandate work slowdowns as needed, and

  - Perform work during cooler hours of the day, if possible, or at night if adequate lighting can be provided;
- Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods;
- Maintain worker's body fluids at normal levels. This is necessary to ensure that the cardiovascular system functions adequately. Daily fluid intake must approximately equal the amount of water lost in sweat, i.e., eight fluid ounces (0.23 liters) of water must be ingested for approximately every eight ounces (0.23 kg) of weight lost. The normal thirst mechanism is not sensitive enough to ensure that enough water will be drunk to replace lost sweat. When heavy sweating occurs, encourage the worker to drink more. The following strategies may be useful:
  - Maintain water temperature at 50°-60°F (10°-16.6°C),
  - Provide small disposable cups that hold about four ounces (0.1 liter),
  - Have workers drink 16 ounces (0.5 liters) of fluid (preferably water or dilute drinks) before beginning work, and
  - Urge workers to drink a cup or two every 15 to 20 minutes, or at each monitoring break. A total of 1 to 1.6 gallons (4 to 6 liters) of fluid per day are recommended, but more may be necessary to maintain body weight;
- Train workers to recognize the symptoms of heat-related illnesses;
- Rotate personnel and alternate job functions; and
- Avoid double shifts and/or overtime.

8.10 COLD STRESS MONITORING

Exposure to low temperatures presents a risk to employee safety and health both through the direct effect of the low temperature on the body and collateral effects such as slipping on ice, decreased dexterity and reduced dependability of equipment. All personnel must exercise increased care when working in a cold environment to prevent accidents that may result from the cold. The symptoms of cold exposure include frostbite and hypothermia. Wind increases the impact of cold on a person's body.

Frostbite is both a general and a medical term given to areas of local cold injury. Unlike systemic hypothermia, frostbite rarely occurs unless the ambient temperatures are less than freezing and usually less than 20°F. Symptoms of frostbite are: a sudden blanching or whitening of the skin; the skin has a waxy or white appearance and is firm to the touch; tissues are cold, pale, and solid. Superficial frostbite occurs when the skin is white but the underlying tissue is firm. The skin will return to shape when depressed. Deep frostbite causes the underlying tissues to freeze. The skin will either not depress when pressed by the finger or it will depress but not return to the original contour. Deep frostbite is a serious injury.

Hypothermia is defined as a decrease in a person's core temperature below 96°F. The body temperature is normally maintained by a combination of central (brain and spinal cord) and peripheral (skin and muscle) activity. Interferences with any of these mechanisms can result in hypothermia, even in the absence of "cold" ambient temperatures. The first symptom of systemic hypothermia is shivering. Maximum shivering starts when the core body temperature drops below 95°F. The next set of symptoms as the body's cooling progresses is apathy, listlessness, and sleepiness. The person remains conscious and responsive with normal blood pressure and a core temperature of 93.2°F. The person must be immediately removed to a facility with heat. As hypothermia advances beyond this point, the person has a glassy stare, slow pulse, slow respiratory rate and may lose consciousness. Severe hypothermia starts when the core body temperature reaches 91.4°F. Finally, the extremities start to freeze hard and death could result.

8.10.1 Prevention of Cold-Related Illnesses

- Educate worker to recognize the symptoms of frostbite and hypothermia;
- Identify and limit known risk factors;
  - Prohibit phenothiazine (a sedative) use.
  - Identify/warn/limit beta blocker use.
- Assure the availability of an enclosed, heated environment on or adjacent to the site;
- Assure the availability of dry changes of clothes;
- Develop capability for temperature recording at the site; and
- Assure the availability of warm drinks.

8.10.2 Monitoring

Start (oral) temperature recording at the job site:

- At the Field Team Leader's discretion when suspicion is based on changes in worker's performance or mental status;
- At worker's request;
- As a screening measure, two times per shift, under unusually hazardous conditions (e.g., wind-chill less than 20°F, or wind-chill less than 30°F with precipitation); and
- As a screening measure whenever any one worker on the site develops hypothermia.

Any person developing moderate hypothermia (a core temperature of 92°F) cannot return to work for 48 hours.

8.11 SITE-SPECIFIC RISK ANALYSIS

8.11.1 Chemical Hazards

All intrusive activities at Site 15 property should be considered to have potentially impacted soil. The primary chemical hazards have been identified in Table 5.1. These compounds are most likely to have adverse effects if encountered in a significant quantity during field activities.

8.11.1.2 Direct Contact

Level D personal protective equipment, will be used by all personnel in areas potentially impacted by past activities. Level D equipment will require steel toed rubber boots, or boot covers that prevent contamination of steel toed boots. Nitrile outer and latex inner gloves should provide adequate protection from direct contact hazards.

8.11.1.3 Volatile Compounds (Vapor Pressure >10 mm Hg)

Of the listed volatile chemicals, benzene has the lowest PEL as set by OSHA and hence sets the action limit for monitoring with a PID. For any activities taking place in areas of potential site contaminants, continuous measurements shall be taken in the breathing zone with a PID equipped with a 10.6 eV lamp.

Background PID levels should be taken initially upwind from planned site activities. If, during site activities, PID readings reach 5 ppm above background levels in the breathing zone (and are sustained for 15 minutes), then all personnel must upgrade to Level C personal protective gear. Upon upgrading to Level C, a Draeger, benzene 2/a color detector tube (part number 8101231) should be used to verify the absence of benzene. If benzene is greater than 5 ppm, all personnel must upgrade to Level B or retreat until air monitoring shows that concentrations have fallen below 5 ppm so that work may continue in a lower level of protection.

Furthermore, if PID readings reach 25 ppm above background (sustained for 15 minutes), then personnel should retreat and consult the Parsons Health and Safety Officer before deciding to upgrade to Level B equipment.

An upper limit of 5 ppm for PID readings for Level D work is specified in this health and safety plan. It is our experience that this upper limit will prevent over-exposures to benzene. Due to the calibration to isobutylene, the Photovac MicroTIP 2000 PID benzene response will be twice as high as the actual benzene concentrations. Thus, a pure benzene vapor of 2.5 ppm will cause the PID to read 5 ppm. Futhermore, based on experience at other sites, detectable levels of total organic vapors typically consist of other volatile constituents such as xylene, toluene and ethyl benzene in addition to benzene. The PID will detect the sum total of these volatiles.

When 5 ppm is reached on the PID response, actual benzene levels should remain below occupational limit values. To verify that this is the case, workers are to use the specified

Draeger tube to check for the presence of benzene. It is our experience that Draeger tube screening with the 2/a benzene tube has not shown measurable levels of benzene in worker breathing zones or downwind from drilling areas when PID readings have reached 5 ppm. The Draeger benzene 2/a tube is specified for this use as it is the only Draeger-manufactured tube which does not respond positively to the presence of ethyl benzene, toluene or xylenes vapors. The 2/a tube has a limit of detection of 2 ppm.

8.11.1.4 Semivolatile and Nonvolatile Compounds (Vapor Pressure <10 mm Hg)

Polynuclear aromatic hydrocarbons (PAHs) could pose significant health threats if ingested or inhaled as a dust. On-site personnel will avoid activities that could generate potentially contaminated dust, and work upwind of soils and groundwater during excavation activities. Should visible dust emissions occur in potentially contaminated areas, real time aerosol monitoring or upgrading to level C may be warranted for affected personnel. Consult the Parsons ES Health and Safety Officer.

8.11.2 Summary of Work Area Action Levels

Based on a review of the potential chemical hazards at the site, the following conditions will determine the level of protective equipment that will be used by personnel while on-site:

Conditions for Level D: - All areas

- PID readings < 5 ppm.

Conditions for Level C: - All areas

- PID readings > 5 ppm and < 25 ppm

and · Draeger, benzene 2/a tube readings < 2 ppm

or · Any visible fugitive dust emissions from site activities that disturb contaminated soil.

Conditions for Level B (or retreat): - All areas

- PID readings > 25 ppm.

or · Draeger, Benzene 2/a Tube readings > 2 ppm

TABLE 8.1

ATMOSPHERIC HAZARD GUIDELINES

Monitoring Equipment	Hazard	Ambient Level	Action
Combustible gas indicator	Explosive atmosphere	<10% LEL	Continue investigation.
		>10% LEL	Explosion hazard; withdraw from are immediately.
Oxygen concen-ration meter	Oxygen	<19.5%	Monitor, wearing self-contained breathing apparatus (SCBA). Note: Combustible gas readings are not valid in atmospheres with < 19.5% oxygen.
		19.5% to 21%	Continue investigation with caution. SCBA not needed, based on oxygen content only.
		>22.5%	Discontinue inspection; fire hazard potential.
Radiation	Radiation	<1 mR/hr	Continue investigation. If radiation is detected above background levels, this signifies the presence of possible radiation sources; at this level, more thorough monitoring is advisable. Consult with the Project Health and Safety Officer.
		>1.0 mR/hr	Potential radiation hazard; evacuate site.
Colorimetric tubes	Organic and inorganic vapors/ gases	Depends on species	Consult standard reference manuals for air concentrations/ toxicity data.

TABLE 8.1 (Continued)

ATMOSPHERIC HAZARD GUIDELINES

Monitoring Equipment	Hazard	Ambient Level	Action
Photoionization Detector	Organic vapors/ gases	Depends on species	Consult standard reference manuals for air concentrations/toxicity data.
		Total response mode	Consult Parsons ES Guidelines for the selection of appropriate level of protection.
Flame Ionization Detector	Organic	Depends on species	Consult standard reference manuals for air concentrations/ toxicity data.
		Total response mode.	Consult Parsons ES Guidelines for the selection of appropriate level of protection.

TABLE 8.2

SUGGESTED FREQUENCY OF PHYSIOLOGICAL MONITORING FOR FIT AND ACCLIMATED WORKERS [a]

Adjusted Temperature [b]	Normal Work Ensemble [c]	Impermeable Ensemble
90°F or above	After each 45 minutes of work	After each 15 minutes of work
87.5-90°F (30.8-32.3°C)	After each 60 minutes of work	After each 30 minutes of work
82.5-87.5°F (28.1-30.8°C)	After each 90 minutes of work	After each 60 minutes of work
77.5-82.5°F (25.3-28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5-77.5°F (22.5-25.3°C)	After each 150 minutes of work	After each 120 minutes of work

[a] For work levels of 250 kilocalories/hour

[b] Calculate the adjusted air temperature (ta adj) by using this equation:

$$\text{TA ADJ °F} = \text{TA °F} + (13 \times \%\ \text{Sunshine}).$$

Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow.

(100 percent sunshine = no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows.)

[c] A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.

SECTION 9

SITE PREPARATION, ZONES, AND SECURITY

9.1 PURPOSE

OSHA requires (29 CFR Part 1910.120[d]) that a site control program be developed before the initiation of hazardous waste operations. The purpose of this guideline is to establish site control principles that will minimize potential contamination for contractor personnel and protect the public from the site's hazards.

9.2 GUIDELINE

The activities required during hazardous waste operations involve the movement of materials (contaminants) from the site to unaffected areas. Contractor personnel and equipment may become contaminated and carry the materials into clean areas. Contaminants may become airborne because of their volatility, or the disturbance of contaminated soil may cause it to become wind blown. Contamination control procedures are needed and will reduce the transfer of hazardous substances from the site.

Several site control procedures can be implemented to reduce worker and public exposure to chemical, biologic, physical, and safety hazards:

- Compile a site map;
- Establish work zones;
- Use the buddy system when necessary;
- Establish and strictly enforce decontamination procedures for both personnel and equipment (see Section 10);
- Establish site security measures as needed;
- Set up communication networks;
- Enforce safe work practices;
- When contaminants other than those previously identified are handled;
- When different operations are begun;
- When employees are handling leaking drums or working with obvious liquid contamination; and
- When weather conditions change.

Field operations are to be conducted with a minimum of two persons on site. For operations requiring Level B personal protective equipment a minimum of three people will be required.

9.3 SITE WORK ZONES

One method of preventing or reducing the migration of contamination is to delineate zones on the site where prescribed operations occur. Movement of personnel and equipment between zones and onto the site itself would be limited by access control points. By these means, contamination would be expected to be contained within certain relatively small areas on the site and its potential for spread minimized. Three contiguous zones (Figure 9.1) are recommended.

9.3.1 Exclusion Zone

The Exclusion Zone is an area where contamination does or could occur. Major activities that are performed in the Exclusion Zone include:

- Site characterization, such as mapping, photographing, and sampling;
- Installation of wells for groundwater monitoring; and
- Cleanup work, such as drum movement, drum staging, and materials bulking.

Everyone entering the Exclusion Zone must wear prescribed levels of protection. An entry and exit check point must be established at the periphery of the Exclusion Zone to regulate the flow of contractor personnel and equipment in and out of the zone and to verify that the procedures established to exit and enter are followed.

The outer boundary of the Exclusion Zone, the Hotline, is initially established by visually surveying the immediate environs of the incident and determining where the hazardous substances involved are located; where any drainage, leachate, or spilled material is; and whether any discolorations are visible. Guidance in determining the boundaries is also provided by data from the initial site survey indicating the presence of organic or inorganic vapors/gases or particulates in air, combustible gases, and radiation, or the results of water and soil sampling.

Additional factors that should be considered include the distances needed to prevent fire or an explosion from affecting contractor personnel outside the zone, the physical area necessary to conduct site operations, and the potential for contaminants to be blown from the area. Once the Hotline has been determined, it should be physically secured, fenced, or well-defined by landmarks. During subsequent site operations, the boundary may be modified and adjusted as more information becomes available.

9.3.2 Contamination Reduction Zone

The Contamination Reduction Zone (CRZ) is located between the contaminated area and clean area. This zone is designed to reduce the probability that the clean Support Zone will become contaminated and/or affected by other hazards on site. The distance between the Exclusion Zone and Support Zone provided by the CRZ, together with decontamination of workers and equipment, limits the physical transfer of hazardous chemicals into clean areas.

The degree of contamination in the CRZ decreases as one moves from the Exclusion Zone to Support Zone because of the distance and the decontamination procedures.

The boundary between the Support Zone and the CRZ, the Contamination Control Line, separates the possibly low contamination area from the clean Support Zone. Access to the CRZ from the Support Zone is through a control point. Contractor personnel entering through the control point must wear the prescribed PPE, for working in the CRZ. Entering the Support Zone requires removal of any protective equipment worn in the CRZ.

9.3.3 Support Zone

The Support Zone, the outermost part of the site, is considered noncontaminated or clean area. The Support Zone is the location of the administrative and other support functions necessary to maintain smooth operations in the Exclusion Zone and CRZ. Contractor personnel may wear normal work clothes in this area. Any potentially contaminated equipment or clothing must be decontaminated before entry into this area.

The location of the Support Zone depends on a number of factors including:

- Accessibility: topography; open space available; locations of highways, railroad tracks; or other limitations;
- Wind direction: preferably the support facilities should be located upwind of the Exclusion Zone. However, shifts in wind direction and other conditions may be such that an ideal location based on wind direction along does not exist;
- Resources: adequate roads, power lines, water, and shelter.

9.4 SITE SECURITY

Site security at a hazardous waste site is necessary to:

- Prevent the exposure of unauthorized, unprotected people to the site hazards;
- Prevent theft;
- Avoid interference with safe working procedures.

During the work day, site security can consist of:

- Assign responsibility for enforcing authority for entry and exit requirements;
- Maintain security in the Support Zone and at Access Control Points;
- If the site is not fenced, post signs around the perimeter;
- Have the Field Team Leader approve all visitors to the site. Make sure they have a valid purpose for entering the site. Have trained site personnel accompany visitors at all times.

During off-duty hours, site security can consist of:

- If needed, use security guards to patrol the site boundary. Guards must be fully apprised of the hazards at the site; and
- Secure the equipment.

9.5 SITE COMMUNICATION

Two communication systems should be established during hazardous waste operations; an internal communication among contractor personnel on site, and an external communication between onsite and off-site contractor personnel.

Internal communication at site is used to:

- Alert personnel to emergencies;
- Convey safety information (e.g., amount of time left in air tanks, heat stress check, etc.);
- Communicate changes in the work to be performed; and
- Maintain site control.

Often at a site, communications can be impeded by background noise and the use of PPE. For communications to be effective, commands must be prearranged. In addition, audio or visual cues can aid in conveying the message. Some common internal communication devices are: two-way radios, noisemakers (e.g., bells, whistles, compressed air horns, etc.), and visual signals (e.g., flags, hand signals, and lights). Radios used in the Exclusion Zone must be intrinsically safe and not capable of sparking.

An external communication system between onsite and off-site contractor personnel is necessary to:

- Report to management;
- Coordinate emergency response; and
- Maintain contact with essential off-site contractor personnel.

The primary means of external communication is the telephone. If a telephone is not present at the site, all team members must know where the nearest phone is located. The correct change and necessary phone number should be readily available.

9.6 SAFE WORK PRACTICES

To ensure a strong safety awareness during hazardous waste operations, a list of standing orders stating the practices that may never occur in contaminated areas should be developed. Sample standing orders for contractor personnel entering an Exclusion Zone may include:

- No smoking, eating, drinking, or application of cosmetics in this zone;
- No matches or lighters in this zone;

- Check in at the entrance Access Control Point before you enter this zone;
- Check out at the exit Access Control Point before you leave this zone;
- Always have your buddy with you in this zone;
- Wear an air purifying respirator in this zone; and
- If you discover any signs of radioactivity, explosivity, or unusual conditions such as dead animals at the site, exit immediately and report this finding to your supervisor.

Standing orders should be posted conspicuously at the site.

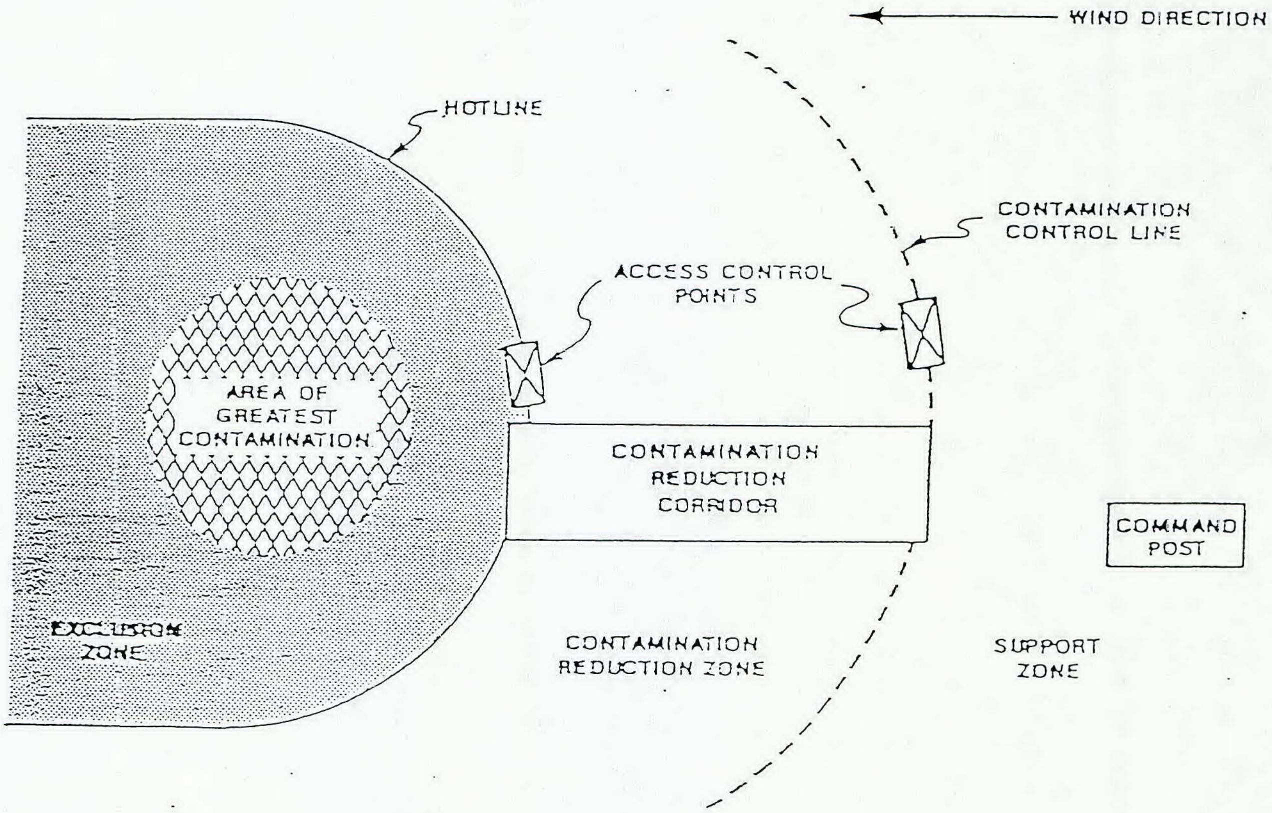
In addition to standing orders, contractor personnel should be briefed on the chemical information of the site contaminant at the beginning of the project. Daily site safety meetings should be held for field team members and any other site contractor personnel.

Working with tools and heavy equipment is a major hazard at sites. Injuries can result from equipment hitting personnel, impacts from flying objects, burns from hot objectives, and damage to protective equipment such as supplied-air respirator systems. The following precautions will help prevent injuries because of such hazards:

- Keep all heavy equipment that is used in the Exclusion Zone in that zone until the job is done. Completely decontaminate such equipment before moving it into the clean zone;
- Train personnel in proper operating procedures;
- Install appropriate equipment guards and engineering controls on tools and equipment;
- Where portable electric tools and appliances can be used (i.e., where there is no potential for flammable or explosive conditions), use three-wire grounded extension cords to prevent electric shocks;
- Keep all non-essential people out of the work area;
- Prohibit loose-fitting clothing around moving machinery;
- Do not exceed the rated load capacity of a vehicle; and
- Do not operate cranes or derricks within 10 feet of power lines.

FIGURE 9.1

DIAGRAM OF SITE WORK ZONES



SECTION 10

DECONTAMINATION PROCEDURES

10.1 PURPOSE

To establish fundamental decontamination principles to be used as a guide on developing site and activity specific decontamination procedures.

10.2 GUIDELINE

Contractor personnel responding to hazardous substance incidents may become contaminated during the course of their work at a site. Protective clothing and respirators help to prevent the wearer from becoming contaminated or inhaling contaminants. Good work practices help reduce the contamination of protective clothing, instruments, and equipment. Even with these safeguards, contamination may occur. Harmful materials can be transferred into clean areas, exposing unprotected personnel. In removing contaminated clothing, personnel may come into direct contact with and/or inhale contaminants. To prevent such occurrences, contamination reduction and decontamination procedures must be developed and implemented. Such procedures are to be in place before anyone enters a hazardous area and must continue (modified if necessary) throughout the period of operation.

Decontamination consists of physically removing contaminants and/or converting them chemically into innocuous substances. The extent of decontamination depends on a number of factors, the most important being the type of contaminants involved. The more harmful the contaminant, the more extensive and thorough the decontamination required. Combining decontamination, the correct donning of protective equipment, and the zoning of site work areas minimizes the possibility of cross-contamination from protective clothing to wearer, or from equipment to workers. Only general guidance can be given on methods and techniques for decontamination. The exact procedure is determined by evaluating several factors specific to the site.

10.3 INITIAL PLANNING

The initial decontamination plan is based on the assumption that all contractor personnel and equipment leaving the Exclusion Zone (area of potential contamination) are grossly contaminated. The plan includes a system for washing and rinsing, at least once, all of the protective equipment worn. The washing and rinsing are done in combination with a sequential doffing of clothing, starting at the first station with the most heavily contaminated article and progressing to the last station with the least contaminated article.

10.4 CONTAMINATION AVOIDANCE

Contamination avoidance is the best method for preventing the spread of contamination from a hazardous waste site. While planning site operations, methods are to be developed to prevent the contamination of personnel and equipment. Each person involved in site operations must regularly practice the basic methods of site contamination avoidance listed below.

- Know the limitations of all protective equipment being used;
- Do not enter a contaminated area unless it is necessary to carry out a specific objective;
- Avoid touching anything unnecessarily when in a contaminated area;
- Walk around pools of liquids, discolored areas, or any area that shows evidence of possible contamination;
- Walk upwind of contamination, if possible;
- Do not sit or lean against anything in a contaminated area. If you have to kneel (e.g., to take samples), use a plastic ground sheet;
- Before sampling any hazardous waste, read the label and manifest (if available) for all containers to determine the identity of the substance to be sampled and the potential contamination hazard;
- Check for potential incompatibility of wastes while checking for waste contents. These conditions might be caused by heat, fire, or gas; an explosion; the contact of water and alkali metals; violent polymerization; or solubilization of toxic substances. Check waste containers for evidence of these conditions such as bulged drums, blistered paint, exploded drums, bubbles, dead vegetation, or melted plastic;
- Avoid setting sampling equipment directly on contaminated areas. Place equipment on a protective cover such as a ground cloth; and
- Use the proper tools necessary to safely conduct the study.

Where possible, plan very specific methods to reduce the risk of contamination. Using remote sampling techniques, opening containers by non-manual means, bagging monitoring instruments, using drum grapplers, watering down dusty areas, and avoiding areas of obvious contamination reduces the possibility of contamination and precludes elaborate decontamination procedures.

10.5 SITE ORGANIZATION

An area within the CRZ (Figure 10.1) is designated the Contamination Reduction Corridor (CRC). The CRC controls access into and out of the Exclusion Zone and confines personnel decontamination activities to a limited area. The size of the corridor depends on the number of stations in the decontamination procedure, the overall dimension of work controls zones, and the amount of space available at the site. A corridor of 75 feet by 15 feet should be adequate for full decontamination. Whenever possible, it should be a straight path. The CRC boundaries should be conspicuously marked, with entry and exit restricted. The boundary between the Exclusion Zone and the CRZ is referred to as the hotline. Contractor personnel exiting the Exclusion Zone must go through the CRC. Anyone in the CRC should be wearing the level of protection designated for the decontamination crew. Within the CRC, distinct areas are set aside for decontamination of personnel, portable field equipment, and clothing. These areas must be marked and restricted to those workers wearing the appropriate protection. All activities within the corridor are confined to decontamination. The level of decontamination must be spelled out in the project health and safety plan.

Protective clothing, respirators, monitoring equipment, sampling supplies, and other equipment are all maintained in a support area outside of the CRC. Contractor personnel don their protective equipment (dressout) away from the CRC and enter the Exclusion Zone through a separate access control point at the hotline.

10.6 DECONTAMINATION GUIDANCE

The protection selected for an investigation and the specific pieces of clothing worn in the exclusion zone dictate the items required and layout of the decontamination line. Different degrees of protection present a different situation with respect to the type of decontamination procedure required. Figures 10.2, 10.3, 10.4, 10.5, and 10.6 outline the decontamination line organization for standard levels of protection. Level C and D protection and decontamination procedures are anticipated for Site 15.

The reason for leaving the Exclusion Zone determines the need for and extent of decontamination. Also, the time required for worker decontamination must be determined and incorporated in the scheduling of site activities. A worker leaving the Exclusion Zone to pick up or drop off tools or instruments and immediately returning may not require full decontamination. A worker leaving to get a new air cylinder or change a respirator or canisters, however, would require some degree of decontamination. Contractor personnel wearing self-contained breathing apparatuses must leave their work areas with sufficient air to walk to the CRC and go through decontamination. Contractor personnel departing the CRC at breaktime, lunchtime, or the end of the day must be thoroughly decontaminated.

The type of decontamination equipment, materials, and supplies are generally selected on the basis of availability. The ease of equipment decontamination and disposability are also considered. Most equipment and supplies are easily procured. Soft-bristle scrub brushes or long-handle brushes are used to remove contaminants. Buckets of water or garden sprayers are used for rinsing. Large galvanized wash tubs, stock tanks, or children's wading pools can be used as containers for wash and rinse solutions. Large plastic garbage cans or containers lined with plastic bags are useful for the storage of contaminated clothing and equipment, and metal or plastic cans or drums are useful for the storage of contaminated liquids. Other gear includes paper or cloth towels for drying protective clothing and equipment.

Heavy equipment such as bulldozers, trucks, backhoes, and drilling equipment are difficult to decontaminate. The method generally used is to wash them with water under high pressure and scrub accessible parts with detergent/water solution, also under pressure if possible. Particular attention should be given to tires, scoops, and other components that directly contact contaminated areas. Provisions should be made to collect rinsate for treatment or disposal.

Protective equipment is usually decontaminated by scrubbing with detergent water using a soft-bristle brush followed by rinsing with copious amounts of water. While this process may not be fully effective in removing some contaminants (in some instances the contaminants may react with water), it is a relatively safe option compared to the use of a decontaminating solution. The contaminant must be identified before a decontamination chemical is used, and reactions of such a chemical with unidentified substances or mixtures could be especially troublesome

Sampling devices and tools may required special cleaning depending on the specific contaminants found at the site. General decontamination procedures should typically be followed.

10.7 EXTENT OF DECONTAMINATION REQUIRED

The project health and safety plan must be adapted to specific conditions. These conditions may require more or less personnel decontamination than was incorporated into the initial plan, depending on the following factors:

- Type of contaminant. The extent of personnel decontamination depends on the effects the contaminants have on the body. Whenever it is known or suspected that personnel can come in contact with highly toxic or skin-destructive substances, full decontamination procedures should be followed. If less hazardous materials are involved, the procedure can be downgraded;
- Amount of contamination. The amount of contamination on the protective clothing is usually determined visually. If the clothing is badly contaminated, a thorough decontamination is generally required. Gross materials remaining on the protective clothing for any extended period of time may degrade or permeate it. This likelihood increases with higher air concentrations and greater amounts of liquid contamination. Gross contamination also increases the probability of personnel contact;
- Level of protection. The level of protection and specific pieces of clothing worn determine, on a preliminary basis, the layout of the decontamination line. Each level of protection incorporates different problems in decontamination such as the harness straps and backpack assembly of the self-contained breathing apparatus. A butyl rubber apron worn over the harness makes decontamination easier. Clothing variations and different levels of protection may require adding or deleting stations in the original decontamination procedure;
- Work function. The work each person does determines the potential for contact with hazardous materials. In turn, this dictates the layout of the decontamination line. For example, observers, photographers, operators of air samplers, or others in the Exclusion Zone performing tasks that will not bring them in contact with contaminants may not need to have their garments washed and rinsed. Others in the Exclusion Zone with a potential for direct contact with the hazardous material will require a more thorough decontamination. Different decontamination lines could be set up for

different job functions, or certain stations in a line could be omitted for personnel performing certain tasks; and

- Location of contamination. Contamination on the upper areas of the protective clothing poses a greater risk to the worker because volatile compounds may generate a hazardous breathing concentration both for the worker and for the decontamination personnel. There is also an increased probability of contact with skin when removing clothing from the upper body.

10.8 TESTING THE EFFECTIVENESS OF DECONTAMINATION

Decontamination methods vary in their effectiveness for removing chemicals. The decontamination method chosen for a site should be assessed at the beginning of the program and periodically throughout the program by the Project Health and Safety Manager. If contaminants are not being removed or are permeating protective clothing, the decontamination program should be changed. The following methods may be useful in assessing the effectiveness of decontamination:

- Natural light. Discolorations, stains, corrosive effects, visible dirt, or alterations in clothing fabric may indicate that contaminants have not been removed. Not all contaminants leave visible traces; many contaminants can permeate clothing and are not easily observed;
- Ultraviolet light. Certain contaminants, such as polycyclic aromatic hydrocarbons, which are common in many refined oils and solvent wastes, fluoresce and can be visually detected when exposed to ultraviolet light. Ultraviolet light can be used to observe contamination of skin, clothing, and equipment. However, the use of ultraviolet light can increase the risk of skin cancer and eye damage; therefore, a qualified health professional should assess the benefits and risks associated with ultraviolet light before its use at a waste site;
- Photoionization detector. A photoionization detector can be used to determine the effectiveness of the decontamination procedure in removing many volatile organic compound. However, this method would be ineffective in determining the extent of residual pesticides or metal on personal protective equipment because these substances are not volatile; and
- Wipe testing. This method provides after-the-fact information on the effectiveness of decontamination. In this procedure, a dry or wet cloth, glass fiber filter paper, or swab is wiped over the surface of a contaminated object and then analyzed in a laboratory. Both the inner and outer surfaces of protective clothing should be tested. Skin may also be tested using wipe samples.

10.9 DECONTAMINATION DURING MEDICAL EMERGENCIES

The project health and safety plan should establish methods for decontaminating personnel with medical problems and injuries. It is possible that decontamination may aggravate or cause more serious health effects. If prompt life-saving first aid and medical treatment is required, decontamination procedures should be omitted. Whenever possible, response personnel should accompany contaminated victims to the medical facility to advise on matters involving decontamination.

10.9.1 Physical Injury

Physical injuries can range from a sprained ankle to a compound fracture, from a minor cut to massive bleeding. Depending on the seriousness of the injury, treatment may be given at the site by trained response personnel. For more serious injuries, additional assistance may be required at the site or the victim may have to be transported to a medical facility.

Life-saving care should be started immediately, without considering decontamination. The outside garments can be removed if they do not cause delays, interfere with treatment, or aggravate the problem. Respirators and backpack assemblies must always be removed. Fully encapsulating suits or chemical-resistant clothing can be cut away. If the outer contaminated garments cannot be safely removed, the individual should be wrapped in plastic, rubber, or blankets to help prevent contaminating medical personnel and the inside of ambulances. Outside garments are then removed at the medical facility. No attempt should be made to wash or rinse the victim at the site. One exception would be if it is known that the individual has been contaminated with an extremely toxic or corrosive material that could also cause severe injury or loss of life. For minor medical problems or injuries, the normal decontamination procedure should be followed.

10.9.2 Heat Stress

Heat-related illnesses range from mild heat fatigue to a serious heat stroke. Heat stroke requires prompt treatment to prevent irreversible damage or death. Unless the victim is obviously contaminated, decontamination should be omitted or minimized and treatment begun immediately. Protective clothing may have to be cut off. Less serious stages of heat stress require prompt attention because they can lead to heat stroke.

10.9.3 Chemical Exposure

Exposure to chemicals can be divided into two categories:

1. Injuries from direct contact, such as acid burns or inhalation of toxic chemicals;
2. Potential injury caused by gross contamination on clothing or equipment.

For inhaled contaminants, treatment can only be performed by qualified physicians. If the contaminant is on the skin or in the eyes, immediate measures must be taken to counteract the substance's effect. First aid treatment generally includes flooding the affected area with water. For a few chemicals, water may cause more severe problems.

When protective clothing is grossly contaminated, contaminants may be transferred to treatment personnel or the wearer and cause injuries. Unless severe medical problems have occurred simultaneously with splashes, the protective clothing should be washed off as rapidly as possible and carefully removed.

10.10 CLOSURE OF THE CRC

When the CRC is no longer needed, it must be closed down by the operators. All disposable clothing and plastic sheeting used during the operation must be double-bagged and either contained on site or removed to an approved off-site disposal facility. Decontamination and rinse solutions should be discarded on site if approved by regulatory agencies or it must be removed to an approved disposal facility. Reusable rubber clothing should be dried and prepared for future use (if gross contamination had occurred, additional decontamination of these items may be required). Cloth items must be bagged and removed from the site for final cleaning. Commercial laundries or cleaning establishments that decontaminate protective clothing or equipment shall be informed of the potentially harmful effects of exposures to hazardous substances. All wash tubs, pails, containers, etc., must be thoroughly washed, rinsed, and dried before removal from the site.

10.11 NECESSARY EQUIPMENT

Based on the expected levels and types of contaminants at the site, modifications to the OSHA-specified modifications, the equipment listed below may be necessary for personnel decontamination.

10.12 EQUIPMENT DECONTAMINATINO

Sampling equipment such as split spoon samplers, probes, and stainless steel bowls and spoons will be decontaminated before each use and at the end of the day. Decontamination procedures include:

- Rinse with potable water;
- Wash with phosphate-free detergent;
- Rinse with potable water;
- Rinse with technical grade methanol;
- Rinse with deionized water; and
- Allow to air dry.

10.13 DRILL RIG DECONTAMINATION

The drill rig will be steam-cleaned and sampling equipment will be decontaminated prior to moving offsite. The equipment will be decontaminated in the following manner:

- The drill rig will be steam cleaned to remove gross contamination;
- Downhole equipment will be steam cleaned to remove gross contamination; and
- Equipment will be air-dried.

A drilling sequence hierarchy (from less-likely to more-likely contaminated locations) will be imposed tc reduce the potential for cross contamination.

All sampling equipment will be decontaminated prior to use at each sampling location. The sampling equipment will be decontaminated in the following manner:

- The sampling spoon and bowl will be washed with Alconox, rinsed with methanol, and rinsed with deionized water.

FIGURE 10.1

CONTAMINATION REDUCTION ZONE LAYOUT

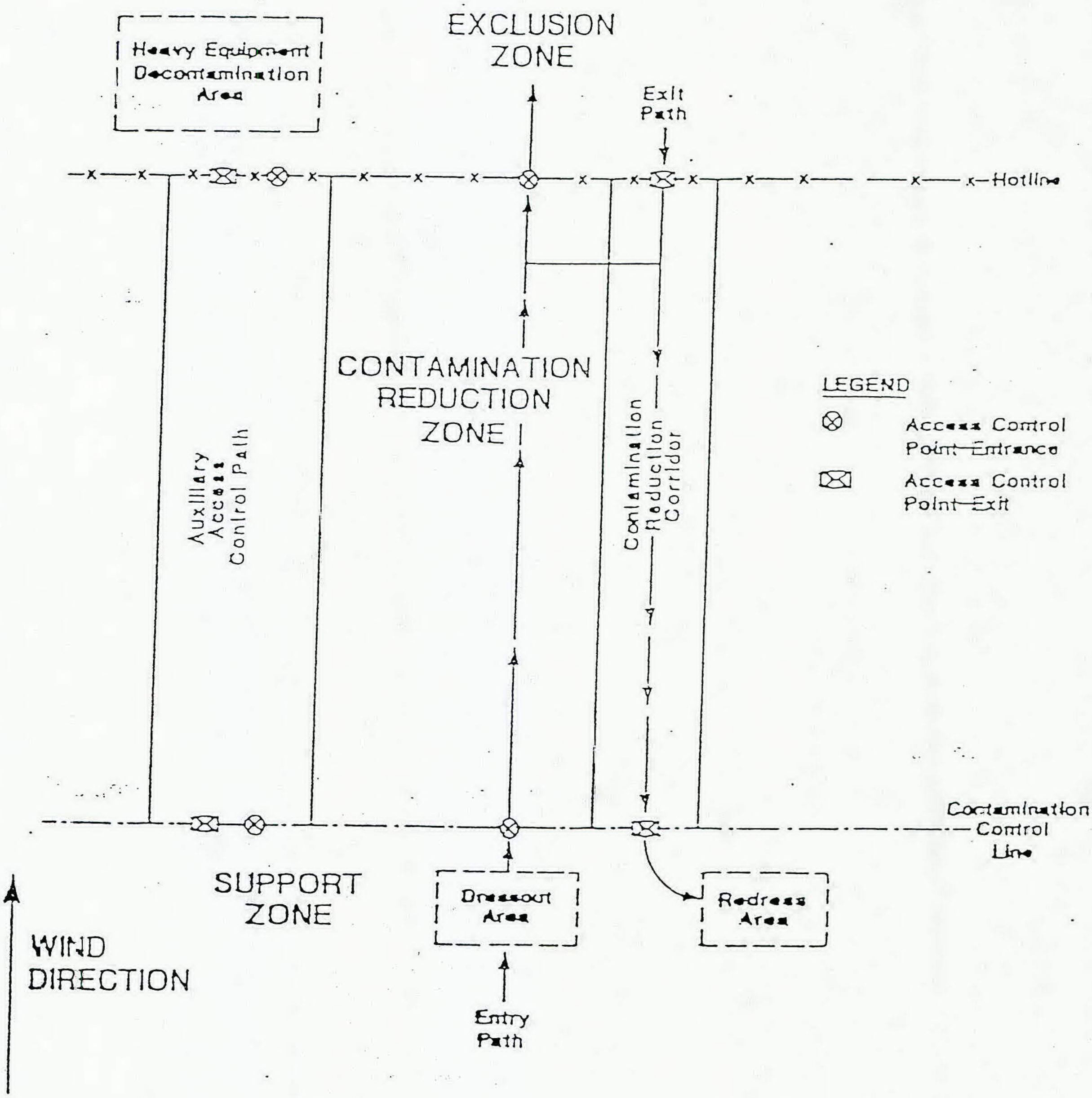
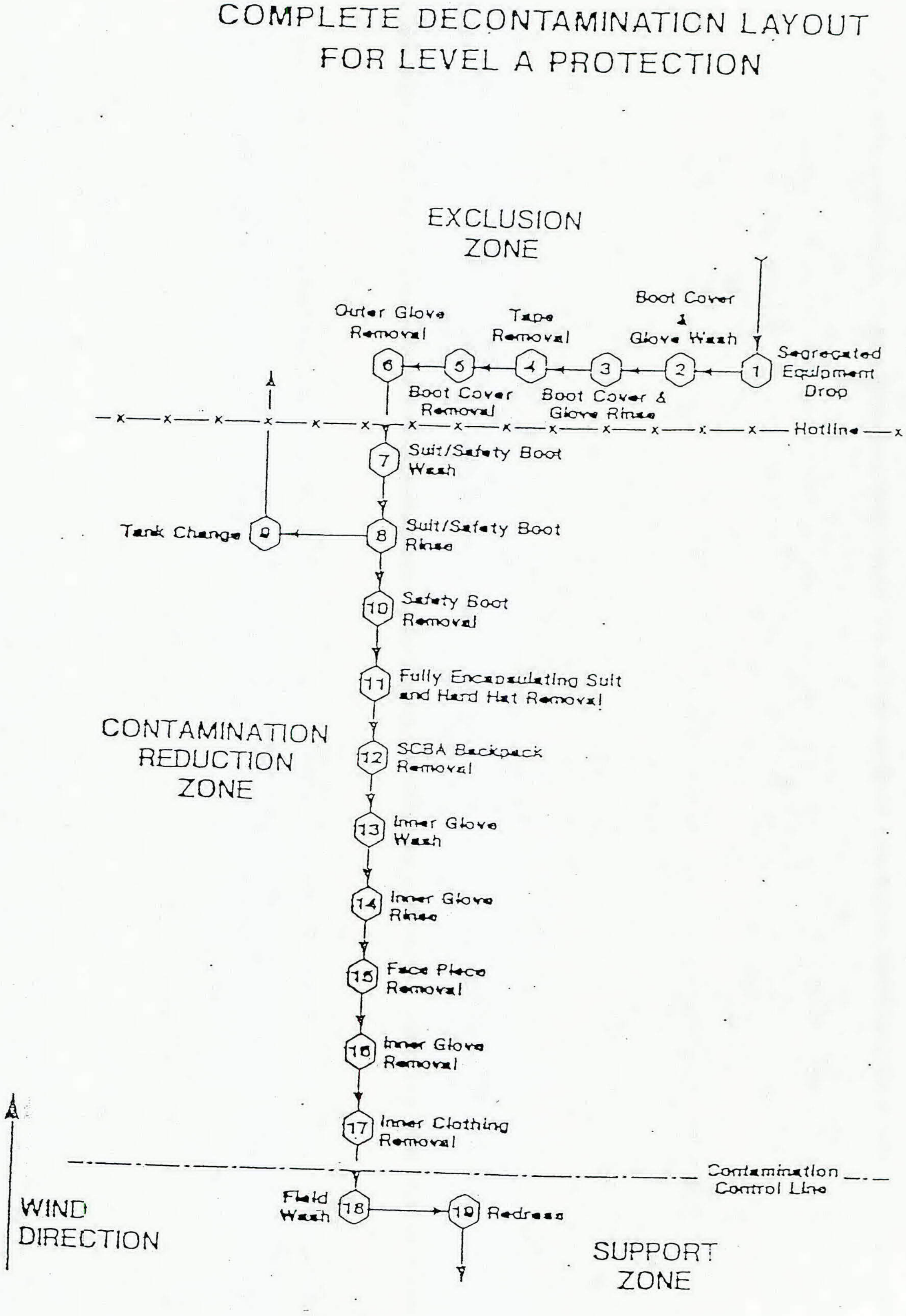


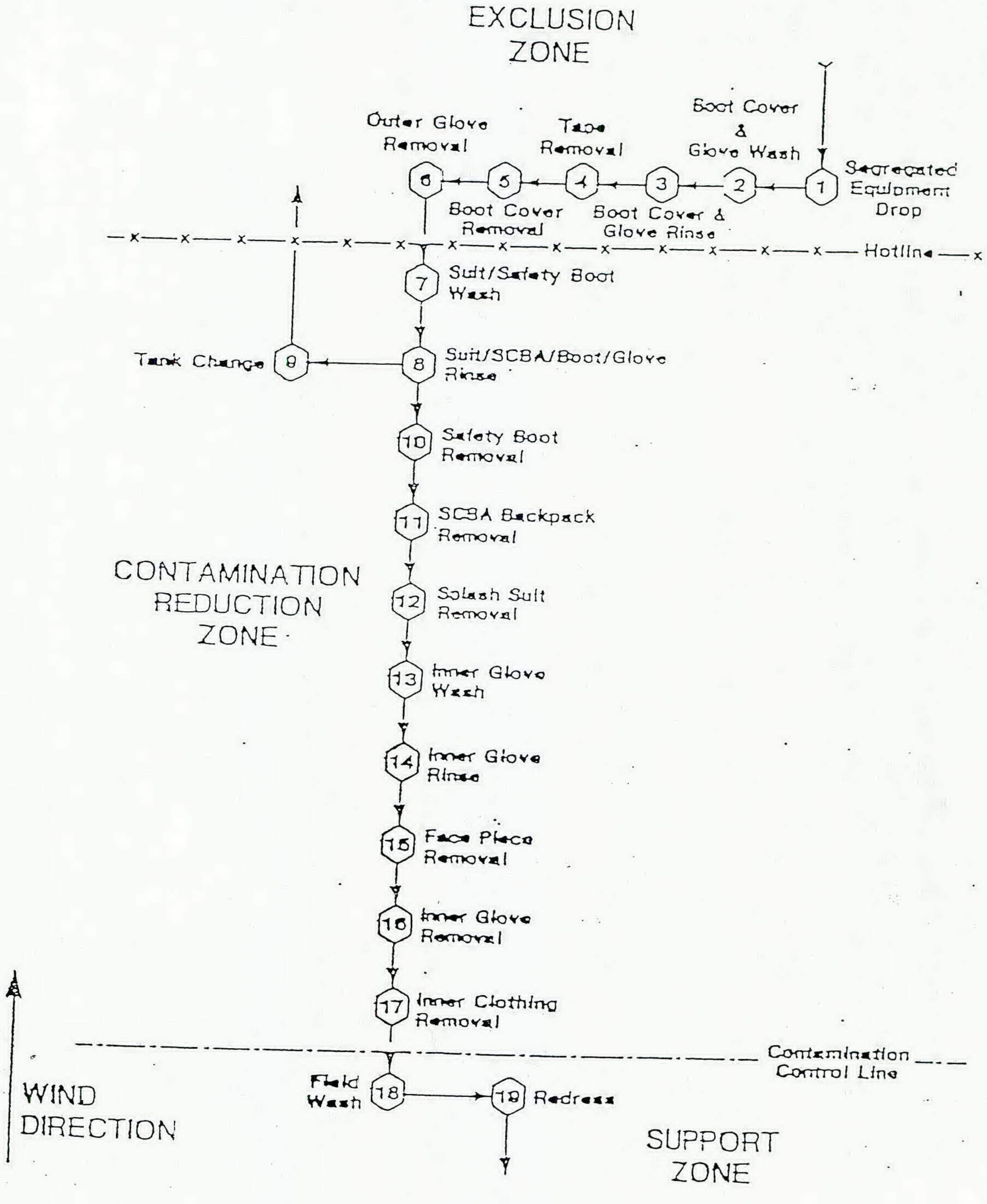
FIGURE 10.2



SOURCE: USEPA 1983. Material Hazards Incidents Training Manual.

FIGURE 10.3

COMPLETE DECONTAMINATION LAYOUT FOR LEVEL B PROTECTION



SOURCE: USEPA 1983. Material Hazards Incidents Training Manual.

FIGURE 10.4

MINIMUM DECONTAMINATION LAYOUT FOR LEVELS A AND B PROTECTION

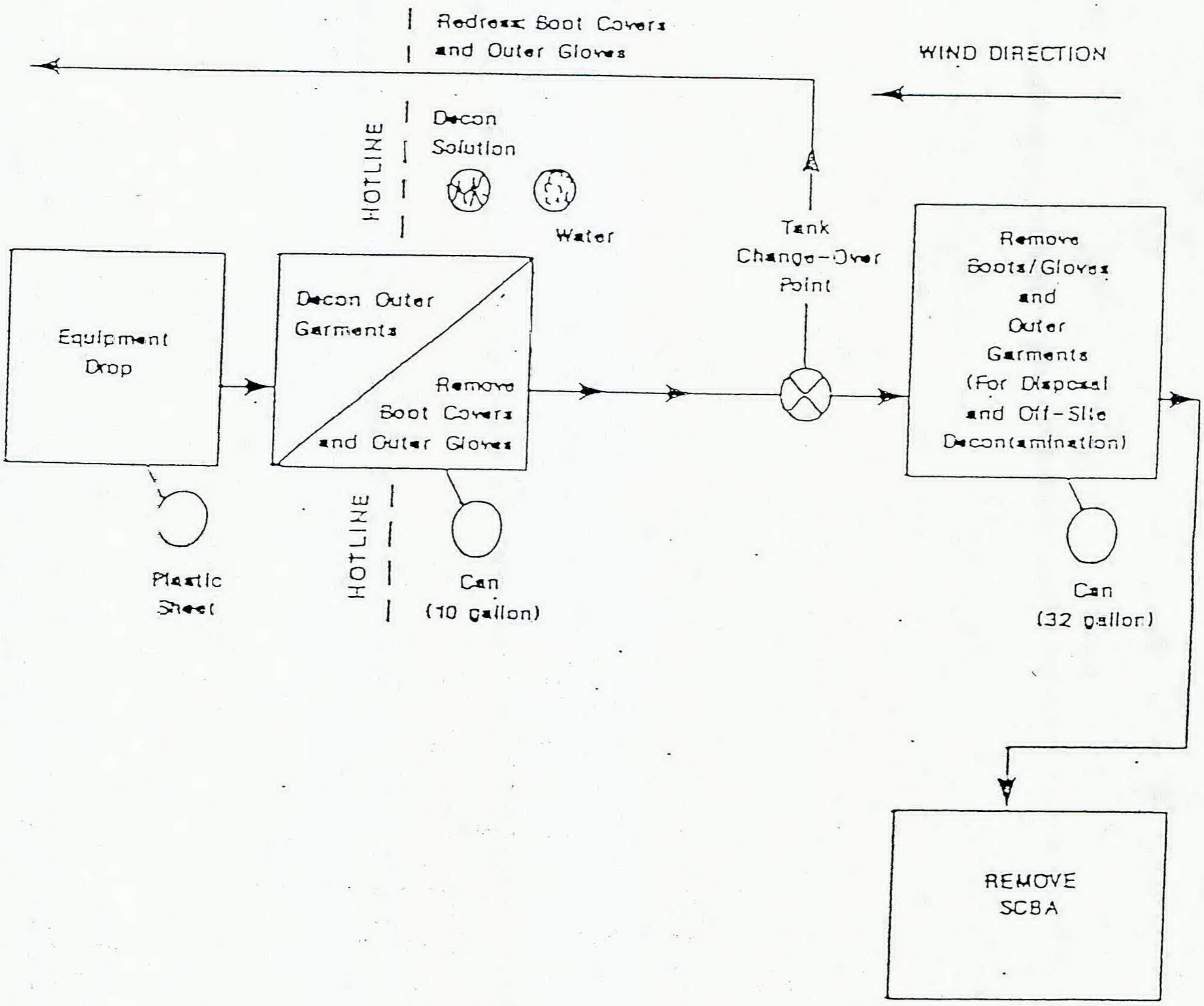
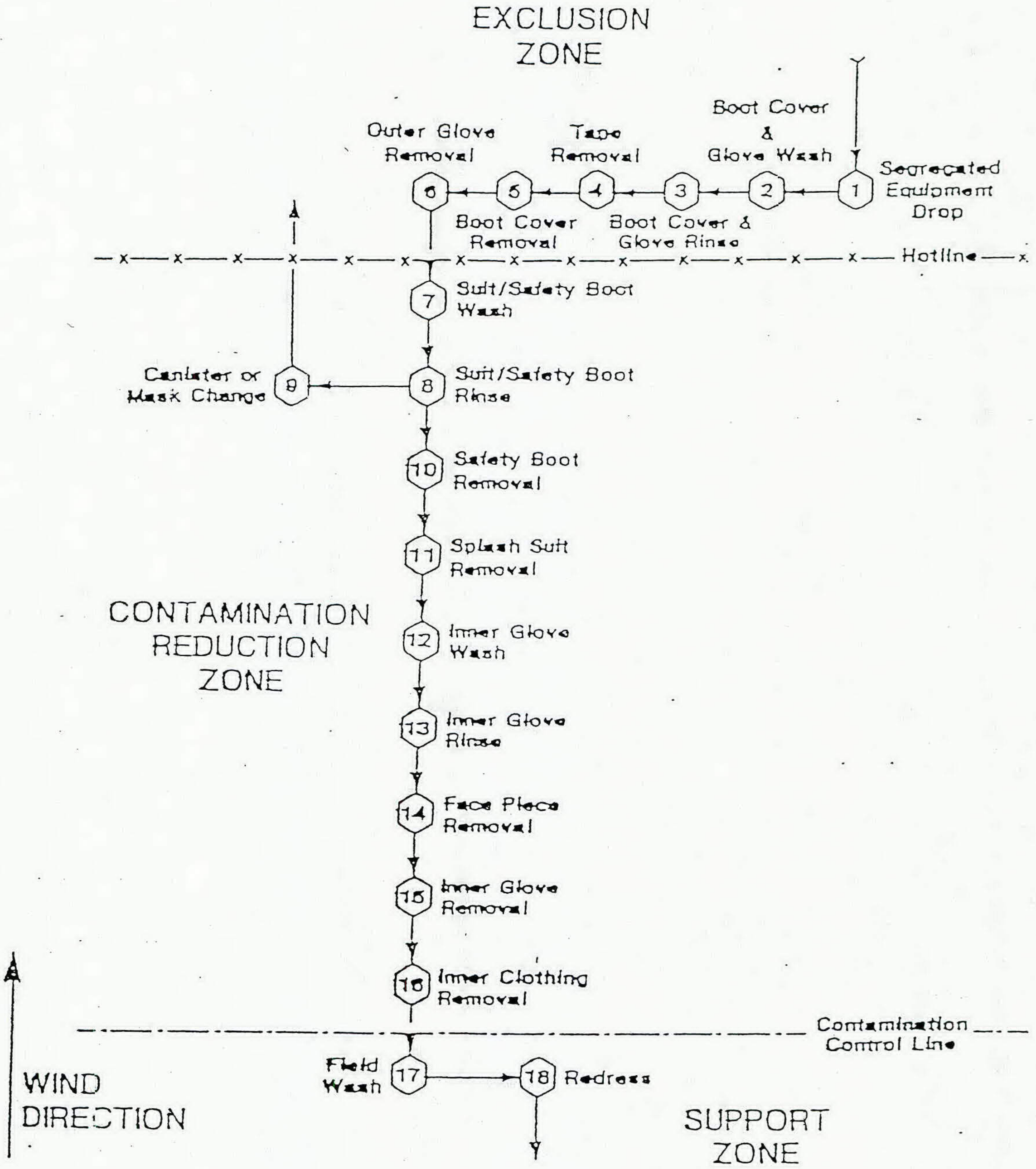


FIGURE 10.5 –

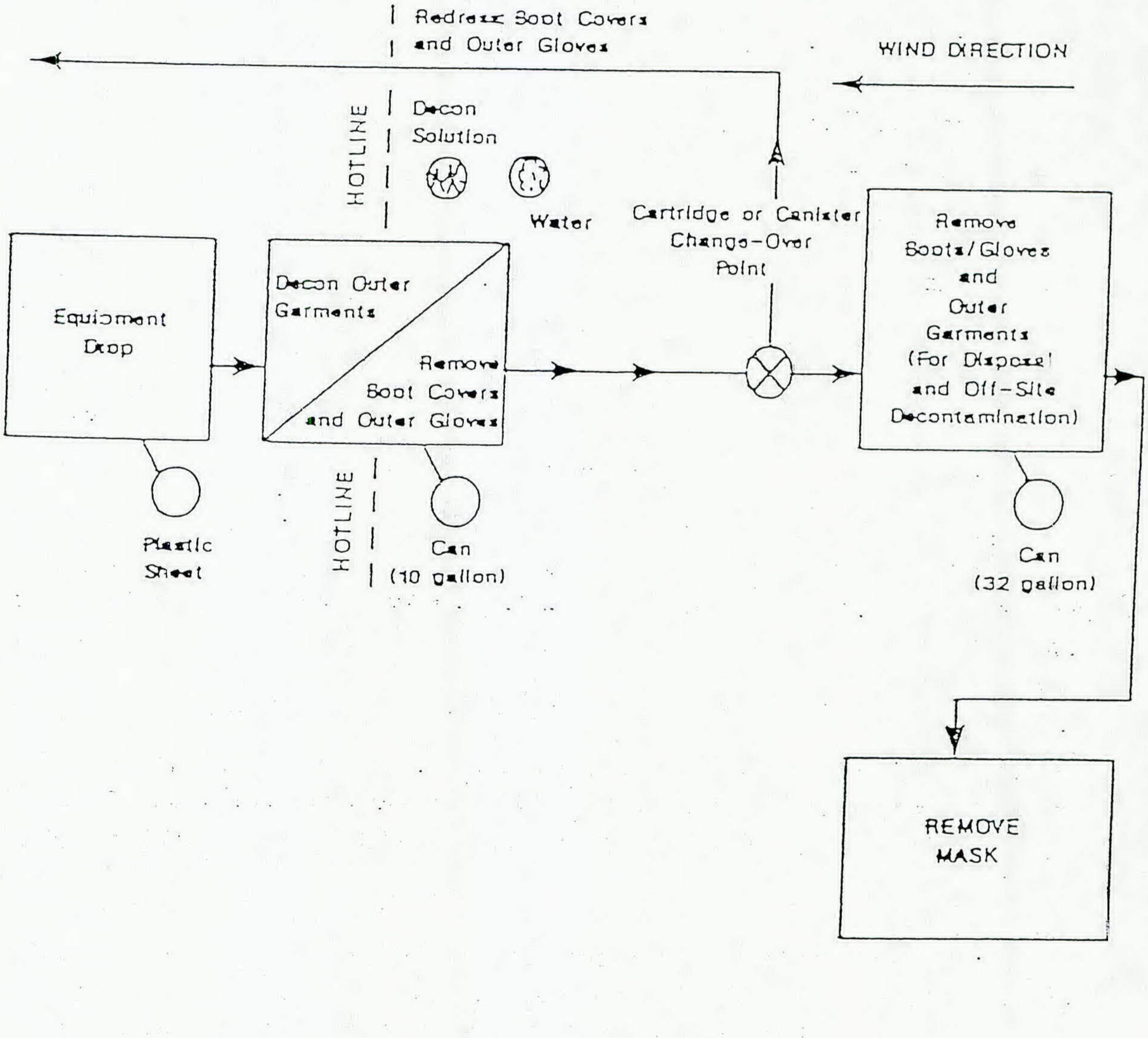
COMPLETE DECONTAMINATION LAYOUT FOR LEVEL C PROTECTION



SOURCE: USEPA 1983. Material Hazards Incidents Training Manual.

FIGURE 10.6

MINIMUM DECONTAMINATION LAYOUT FOR LEVEL C PROTECTION



SECTION 11

RECORDKEEPING

Good record keeping is essential for an effective health and safety program that will meet the needs of the contractor and the requirements of state and federal laws and regulations. The following subsections describe the health and safety records that must be maintained.

11.1 HEALTH AND SAFETY TRAINING RECORDS

Document all formal training of contractor personnel and have these records kept by the Program Health and Safety Manager. Retain these records in the contractor's project health and safety file separate from the normal personnel records.

Each record of training must contain:

- Name and ID number of the person trained;
- Date of training;
- Content or scope of training provided;
- Names of the trainers; and
- Results of certification test (for 40-hour hazardous waste operations training).

Where it is required, field training (level B, instrumentation training, etc.) will be performed and documented by the Program Health and Safety Manager. These records will then be transferred to the contractor's health and safety files for permanent storage.

When an employee terminates, his or her training records are forwarded to the Corporate Health and Safety Manager. Each employee's training records are maintained during his or her employment with the contractor and for a period of 30 years after termination of employment with contractor.

11.2 MEDICAL SURVEILLANCE RECORDS

Two types of medical surveillance records must be kept: (1) The medical reports furnished by the physician to the Program Health and Safety Manager and (2) the clinical records of the employee's past medical history and the results of medical examinations.

11.2.1 Archival Storage of Medical Records

OSHA requires that the employer maintain and preserve medical records on potentially exposed workers for 30 years after they leave employment. The contractor Corporate Health and Safety Manager will maintain the medical surveillance records of terminated employees in a locked file separate from other personnel records. The sealed files shall not be opened by or released to anyone except: (a) on express authorization by the employee - in which case copies of the records will be provided to the employee, (b) on direct order of a court, or (c) by order of an authorized federal or state OSHA representative.

11.2.2 Confidential Information

The physician's opinion report must be treated as confidential information. A separate, locked file is to be maintained for the segregation and storage of these reports. This information can only be made available to the site Health and Safety Coordinator, and the employee. The employee may request to review the medical opinion. The Program Health and Safety Manager will then transfer the physician's statement to the employee. The Program Health and Safety Manager must properly record the transfer of the document. The medical information must be returned to the locked file at the conclusion of each day. Copies of the report cannot be issued to unauthorized personnel or organizations without the employee's written consent. Copies of all confidential information must be sent with an accompanying transmittal form.

11.3 OSHA 200 FORM

The contractor is not required by federal law to maintain and post the OSHA No. 200 form (log and summary of occupational injuries and illnesses) because the contractor is classed under S.I.C (Standard Industrial Classification) code 8711, Engineering Services. (Our laboratories would be S.I.C. code 8734.) Under federal law, facilities with S.I.C. codes 87xx are exempt from the reporting requirements. However, several states have their own occupational safety and health programs qualified under federal OSHA. These state program requirements differ in some respects from the federal requirements.

The contractor maintains an up-to-date OSHA 200 log. The Program Health and Safety Manager is responsible for maintaining the log and summary of **all** occupational injuries and illnesses occurring at the site.

Each injury or illness shall be recorded on the log as soon as practicable (but no later than six working days) after receiving information that an injury or illness has occurred. The OSHA 200 form is recommended for recording of this information.

The OSHA 200 form states that only 'recordable' (as defined on the form) injuries and illnesses be entered. However, all injuries and illnesses should be entered so that we have better information for evaluation of the contractor's health and safety program. Each recordable entry on the OSHA 200 form should be so marked. Injury and illness records shall be kept on a calendar year basis. The OSHA 200 form shall be retained in the contractor's corporate office for five years following the end of the year to which they pertain.

11.4 AUDIT REPORTS

A health and safety project audit refers to the auditing of project activities for compliance with the project health and safety plan, applicable contractor health and safety guidelines, and federal and state OSHA requirements. A project specific audit checklist will be developed based on the in the project health and safety plan. An example of areas that will be addressed in an audit checklist for hazardous waste site investigations include:

- Decontamination procedures;
- Air-monitoring procedures;
- Emergency planning;
- Completeness of Site Health and Safety Plan;
- Choice of level of protection;
- Documentation of respirator fit-testing; and
- Documentation of health and safety training.

Audit reports will be prepared by the Program Health and Safety Manager after gathering and evaluating all available data. Items, activities, or documents determined to be deficient shall be identified at the post-audit meeting with the audited team. Deficiencies will be logged, documented, and controlled through Health and Safety Audit Notices that should be attached as part of the audit report. Project audit reports are sent to the Program and Project Manager.

Responses to audit findings must be addressed in a specified and timely manner. The adequacy of the response shall be evaluated by the Program health and Safety Manager. For a response to be considered adequate, it must:

1. Correct the situation that created the deficient conditions;
2. Provide a mechanism for preventing recurrence of the situation;
3. Identify the target date for the completion of these activities.

If the response is satisfactory, this fact will be noted on the Health and Safety Audit Notice form. After all notices have been accepted, the Program Health and Safety Manager will close out the audit report. Copies of the audit report and responses may be distributed to the appropriate levels of management.

11.5 ACCESS TO OTHER HEALTH AND SAFETY RECORDS

The majority of health and safety documents (accident reports, audit reports, etc.) shall be stored and maintained in a file with controlled access. Entry into the file shall be restricted to personnel designated by the Program Health and Safety Manager.

SECTION 12

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ATTACHMENT 1
DRILLING SAFETY GUIDE

Drilling Safety Guide

IDF
INTERNATIONAL DRILLING FEDERATION

DCDMA
The Drilling Equipment Manufacturers Association

NDCA
National Drilling Contractors Association

CDDA
Canadian Diamond Drilling Association

MOBILE DRILL

DRILLING SAFETY GUIDE

The *Drilling Safety Guide* has been prepared through the combined efforts of member delegations of the Diamond Core Drill Manufacturers Association (DCDMA), the National Drilling Contractors Association (NDCA) and the National Water Well Association-Drill Rig/Heavy Equipment Products Group (NWWA) and is published by the International Drilling Federation for the benefit of the drilling industries.

This guide contains suggested safety procedures. It is not intended to set forth any standard industry procedures or requirements. This manual is to be used as a guideline for the safe operation of drilling equipment. IDF, DCDMA, NDCA, NWWA, their officers, and members deny any liability for any injury to people or property that may occur even if these procedures are properly followed. Further, the IDF, DCDMA, NDCA, NWWA, their officers, and members do not accept responsibility for the completeness of the guide or the applicability of the statements or procedures to the use of all drilling machines and tools in all environments. Many aspects of drilling safety cannot be expressed in detail and cannot be met by mechanical means; drilling safety can only be accomplished with the exercise of intelligence, care, and common sense.

DRILLING SAFETY GUIDE

Table of Contents

DRILLING SAFETY GUIDE

1. An Introduction To Drilling Safety

The organization for which you work is interested in your safety. Your employer cares about your safety not only when you are working on or around a drill rig, but also when you are traveling to and from a drilling site, moving the drill rig and tools from location to location on a site, or providing maintenance on a drill rig or drilling tools. This safety guide is for your benefit. Failure to heed the safety procedures contained in this manual could result in serious injury or death.

Every drill crew should have a designated safety supervisor who has the authority to enforce safety on the drilling site. A rig worker's first safety responsibility is to obey the directions of the safety supervisor.

2. Governmental Regulations

All local, state, and federal regulations or restrictions, currently in effect or effected in the future, take precedence over the recommendations and suggestions which follow. Government regulations will vary from country to country and from state to state.

3. The Safety Supervisor

The safety supervisor for the drill crew will, in most cases, be the drill rig operator. The safety supervisor must:

- Consider the "responsibility" for safety and the "authority" to enforce safety to be a matter of first importance.
- Be the leader in using proper personal safety gear and set an example in following the rules that are being enforced on others.
- Enforce the use of proper personal protective safety equipment and take appropriate corrective action when proper personal protective safety equipment is not being used.
- Understand that proper maintenance of tools and equipment and general "housekeeping" on the drill rig will provide an environment that will promote and enforce safety.
- Before drilling is started with a particular drill, ensure that anyone who operates the drill has had adequate training and is thoroughly familiar with the drill rig, its controls, and its capabilities.
- Inspect the drill rig at least daily for structural damage, loose bolts and nuts, proper tension in chain drives, loose or missing guards or protective covers, fluid leaks, damaged hoses, and/or damaged pressure gauges and pressure relief valves.
- Check and test all safety devices, such as emergency shutdown switches, at least daily and preferably at the start of a drilling shift. Drilling must not be permitted until all emergency shutdown and warning systems are working correctly. Do not allow any emergency device to be bypassed or removed.
- Check that all gauges, warning lights, and control levers are functioning properly and listen for unusual sounds each time an engine is started.
- Ensure that every drill rig worker is informed of safe operat-

ing practices on and around the drill rig. Provide every drill rig worker with a copy of the organization's drilling operations safety manual, and when appropriate, the drill rig manufacturer's operations and maintenance manual. Ensure that every employee reads and understands the safety manual.

- Carefully instruct a new worker in drilling safety and observe the new worker's progress towards understanding safe operating practices.
- Assess the mental, emotional, and physical capability of each worker to perform the assigned work in a proper and safe manner. Remove any worker from the drill site whose mental and physical capabilities might cause injury to the worker or coworkers.
- Ensure that a first-aid kit and a fire extinguisher, which are properly maintained, are on each drill rig and each additional vehicle.
- Be well trained in and capable of using first-aid kits, fire extinguishers, and all other safety devices and equipment. Train crew members.

- Maintain a list of addresses and telephone numbers of emergency assistance units (ambulance services, police, hospitals, etc.) and inform other members of the drill crew of the existence and location of the list.

4. Individual Protective Equipment

For most geotechnical, mineral, and/or groundwater drilling projects, individual protective equipment must include a safety hat, safety shoes, safety glasses, and close-fitting gloves and clothing. The clothing of the individual drill rig worker is not generally considered protective equipment; however, the worker's clothing should be comfortable but must be close fitting, without loose ends, straps, draw strings, belts or otherwise unfastened parts that might catch on some rotating or translating component of the drill rig. Rings and jewelry must not be worn during a work shift.

- *Safety Head Gear.* Safety hats (hard hats) must be worn by everyone working or visiting at or near a drilling site. All safety hats must meet the requirements of ANSI Z89.1. All safety hats must be kept clean and in good repair with the headband and crown straps properly adjusted for the individual drill rig worker or visitor.
- *Safety Shoes or Boots.* Safety shoes or boots must be worn by all drilling personnel and all visitors to the drill site that observe drilling operations within close proximity of the drill rig. All safety shoes or boots must meet the requirements of ANSI Z41.1.
- *Gloves.* All drilling personnel must wear gloves for protection against cuts and abrasions that could occur while handling wire rope or cable and from contact with sharp edges and burrs on drill rods and other drilling or sampling tools. All gloves must be close fitting and not have large cuffs or loose ties that can catch on rotating or translating components of the drill rig.
- *Safety Glasses.* All drilling personnel must wear safety glasses. All safety glasses must meet the requirements of ANSI Z87.1.
- *Other Protective Equipment.* For some drilling operations, the environment or regulations may dictate that other protective equipment be used. The requirement for such equipment must

be determined jointly by the management of the drilling organization and the safety supervisor. Such equipment might include face or ear protection or reflective clothing. Each drill rig worker must wear noise-reducing ear protectors when appropriate.

When drilling is performed in chemically or radiologically contaminated ground, special protective equipment and clothing may, and probably will, be required. The design and composition of the protective equipment and clothing must be determined jointly by the management and the client who requests the drilling services, and under some circumstances, with the concurrence of a health and safety professional.

5. Housekeeping On and Around the Drill Rig

The first requirement for safe field operations is that the safety supervisor understand and fulfill the responsibility for maintenance and "housekeeping" on and around the drill rig. The safety supervisor must:

- Provide suitable storage locations for all tools, materials, and supplies so that these items can be conveniently and safely handled without hitting or falling on a member of the drill crew or a visitor.
- Avoid storing or transporting tools, materials, or supplies within or on the mast (derrick) of the drill rig, unless designed for this purpose.
- Stack pipe, drill rods, casing, augers, and similar drilling tools in orderly fashion on racks or sills to prevent spreading, rolling, or sliding.
- Place penetration or other driving hammers at a safe location on the ground or secure them to prevent movement when not in use.
- Keep work areas, platforms, walkways, scaffolding, and other accessways free of materials, debris, obstructions, and substances such as ice, grease or oil that could cause a surface to become slick or otherwise hazardous.
- Keep all controls, control linkages, warning and operation lights and lenses free of oil, grease, and/or ice.
- Store gasoline only in a non-sparking, red container with a flame arrester in the fill spout and having the word "gasoline" easily visible.

6. Maintenance

Good maintenance will make drilling operations safer. Also, maintenance must be performed safely. The following points are essential to safety:

- Wear safety glasses when performing maintenance on a drill rig or on drilling tools.
- Shut down the drill rig engine to make repairs or adjustments to a drill rig or to lubricate fittings (except repairs or adjustments that can only be made with the engine running). Take precautions to prevent accidental starting of an engine during maintenance by removing or tagging the ignition key.

- Block the wheels or lower the leveling jacks or both and set hand brakes before working under a drill rig.
- Release all pressure on the hydraulic systems, the drilling fluid system and the air pressure systems of the drill rig — when possible and appropriate — prior to performing maintenance. In other words, reduce the drill rig and operating systems to a "zero energy state" before performing maintenance. Use extreme caution when opening drain plugs and radiator caps and other pressurized plugs and caps.
- Do not touch an engine or the exhaust system of an engine following its operation until the engine and exhaust system have had adequate time to cool.

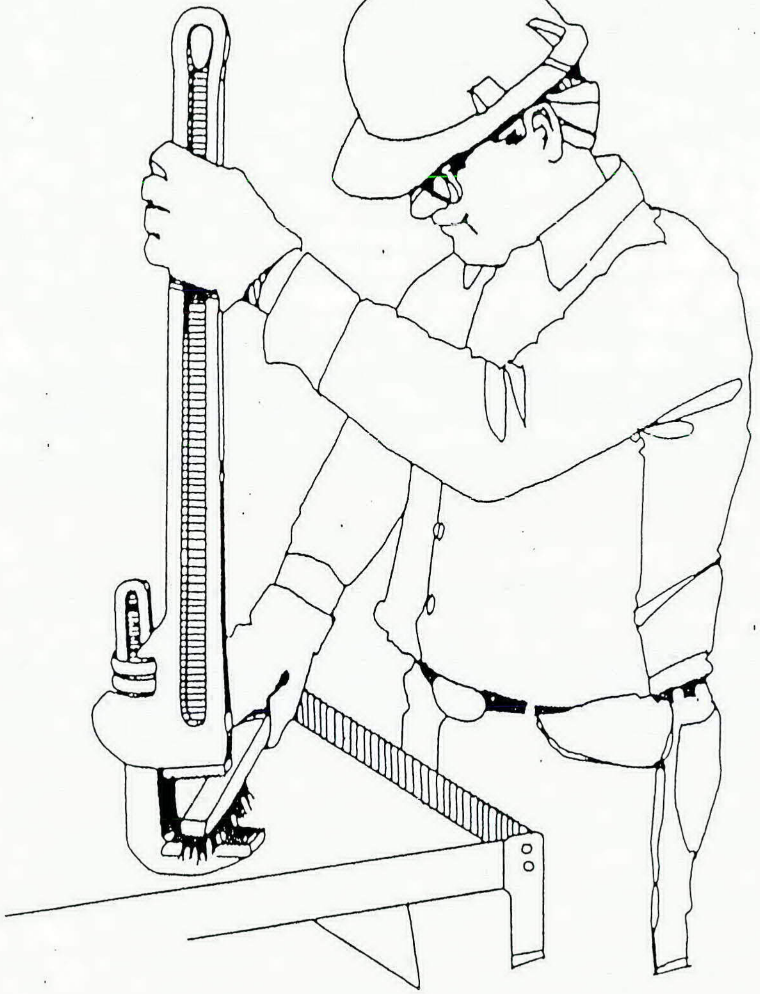
- Never climb the mast (derrick) to do maintenance or make repairs. Lower mast, stop engine and deenergize rig before starting maintenance or repair on mast.
- Never weld or cut on or near a fuel tank.
- Do not use gasoline or other volatile or flammable liquids as a cleaning agent on or around a drill rig.

- Follow the manufacturer's recommendations for ap ng the proper quantity and quality of lubricants, hydraulic oils and/or coolants.
- Replace all caps, filler plugs, protective guards or panels, and high pressure hose clamps and chains or cables that have been removed for maintenance before returning the drill rig to service.

7. Hand Tools

Since there are almost an infinite number of hand tools that can be used on or around a drill rig and in repair shops, there are an equal number of instructions for proper use. "Use the tool for its intended purpose" is the most important rule. The following suggestions apply to safe use of several hand tools that frequently are used on and around drill rigs:

- When a tool becomes damaged, either repair it before using it again or get rid of it.
- When using a hammer, any kind of hammer for any purpose, wear safety glasses and require all others around you to wear safety glasses.
- When using any kind of chisel or punch, for any purpose, wear safety glasses and require all others around you to wear safety glasses.
- Keep all tools cleaned and stored appropriately when not in use.
- Use wrenches — not pliers — on nuts.
- Use screwdrivers with blades that fit the screw.
- When using a wrench on a tight nut, first use some penetrating oil and then use the largest wrench available that fits the nut. When possible pull on the wrench handle rather than push on it; apply force to the wrench with both hands when possible and with both feet firmly placed. Always assume that you may lose your footing; check the place that you may fall for sharp objects.
- Keep all pipe wrenches clean and in good repair. Use a wire brush frequently to clean the jaws of pipe wrenches. An accumulation of dirt and grease can cause wrenches to slip.
- Never use pipe wrenches in place of a rod-holding device.
- Replace hook and heel jaws when they become visibly worn.



- When breaking tool joints on the ground or on a drilling platform, position your hands so that your fingers will not be smashed between the wrench handle and the ground or the platform if the wrench should slip or the tool joint suddenly let go.

8. Clearing the Work Area

Prior to drilling, adequately clear and level the site to accommodate the drill rig and supplies and provide a safe working area.

Do not begin drilling if tree limbs, unstable ground, or site obstructions cause unsafe tool handling conditions.

9. Start-Up

Instruct all drill rig personnel and visitors to "stand clear" of the drill rig immediately prior to starting the engine.

- Make sure all brakes are set, all gear boxes are in neutral, all hoist levers are disengaged, all hydraulic levers or air controls are in the correct positions, and the cathead rope is not on the cathead before starting a drill rig engine.
- Start all engines according to the manufacturer's manual.

10. Drilling Operations

Safety requires the attention and cooperation of every worker and site visitor.

- Do not drive the drill rig from hole to hole with the mast (derrick) in the raised position.
- Before raising the mast (derrick), look up to check for overhead obstructions. (Refer to Section 11 on Overhead and Buried Utilities.)
- Before raising the mast (derrick), clear all drill rig personnel (with exception of the operator) and visitors from the areas immediately to the rear and the sides of the mast. Inform all drill rig personnel and visitors that the mast is being raised prior to raising it.
- Before the mast (derrick) of a drill rig is raised and drilling is begun, the drill rig must first be leveled and stabilized with leveling jacks and/or solid cribbing. Relevel the drill rig if it settles after initial set up. Lower the mast (derrick) only when the leveling jacks are down and do not raise the leveling jack pads until the mast (derrick) is lowered completely.
- Before starting drilling operations, secure, and/or lock the mast (derrick) if required, according to the drill manufacturer's recommendations.
- Do not stand on the elevated deck of a truck-mounted or all-terrain-mounted drill rig while the drill rig is in operation unless necessary for special tasks and the operator has been notified.
- Only operate a drill rig from the position of the controls. Before leaving the area of the controls, shift the transmission

controlling the rotary drive into neutral and place the feed lever in neutral. Before leaving the vicinity of the drill, shut down the drill engine.

- Throwing or dropping tools must not be permitted. Carefully pass tools by hand between personnel or use a hoist line.
- Do not consume alcoholic beverages, other depressants, or chemical stimulants prior to starting work on a drill rig or while on the job.
- If it is necessary to drill within an enclosed area, make certain that exhaust fumes are conducted out of the area. Exhaust fumes are toxic and some cannot be detected by smell.
- Clean mud and grease from boots before stepping on a drill platform and use hand holds and railings. Watch for slippery ground when stepping down from the platform.
- During freezing weather, do not touch any metal parts of the drill rig with exposed flesh. Freezing of moist skin to metal can occur almost instantaneously.
- Drain all air and water lines and pumps when not in use if freezing weather is expected.
- Adequately cover or protect all unattended boreholes to prevent drill rig personnel, site visitors, or animals from stepping or falling into the hole. Cover, protect or backfill all open boreholes according to local or state regulations on completion of the drilling project.
- Never allow "horsing around" within the vicinity of the drill rig and tool and supply storage areas — even when the drill rig is shut down.
- When using a ladder on a drill rig, face the ladder and grasp either the side rails or the rungs with both hands while ascending or descending. Do not attempt to use one or both hands to carry a tool while on a ladder. Use a hoist line and a tool "bucket" or a safety hook to raise or lower hand tools.
- Terminate drilling operations during an electrical storm and move the complete crew away from the drill rig.

An elevated derrick platform should be used with the following precautions:

- When working on a derrick platform, use a safety belt and a lifeline. The safety belt must be at least 4 in. (100 mm) wide and should fit snugly but comfortably. The lifeline, when attached to the derrick, must be less than 6 ft. (2 m) long. The safety belt and lifeline must be strong enough to withstand the dynamic force of a 250 lb. (115 kg) weight (contained within the belt) falling 6 ft. (2 m).

- Use a safety device when climbing to a derrick platform that is higher than 20 ft. (6 m).
- When on a derrick platform, fasten the lifeline to the derrick just above the derrick platform and to a structural member that is not attached to the platform or to other lines or cables supporting the platform.
- When first arriving at a derrick platform, immediately inspect for broken members, loose connections, loose tools, or other loose materials.
- Securely attach tools to the platform with safety lines. Do not attach a tool to a line attached to one's wrist or any other part of the body.
- When working on a derrick platform, do not guide drill rods or pipe into racks or other supports by taking hold of a moving hoist line or a traveling block.
- Do not leave loose tools and similar items on the derrick platform or on structural members of the derrick.
- A derrick platform over 4 ft. (1.2 m) above ground surface must have toe boards and safety railing that are in good condition.
- Avoid being under rig workers on elevated platforms whenever possible.

If heavy objects must be manually lifted, exercise care to avoid injury.

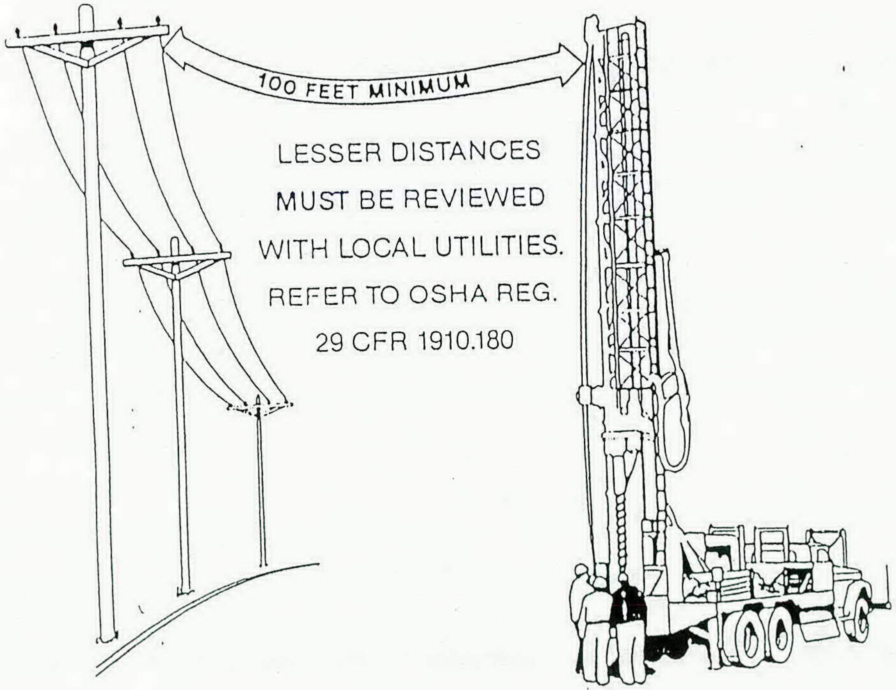
- Before lifting an object without using a hoist, make sure that the load is within your personal lifting capacity. If it is too heavy, ask for assistance.
- Before lifting a relatively heavy object, approach the object by bending at the knees, keeping the back vertical and unarched while obtaining a firm footing. Grasp the object firmly with both hands and stand slowly and squarely while keeping the back vertical and unarched. In other words, perform the lifting with the muscles in the legs, not with the muscles in the lower back.
- If a heavy object must be moved some distance without the aid of machinery, keep the back straight and unarched. Change directions by moving the feet, not by twisting the body.

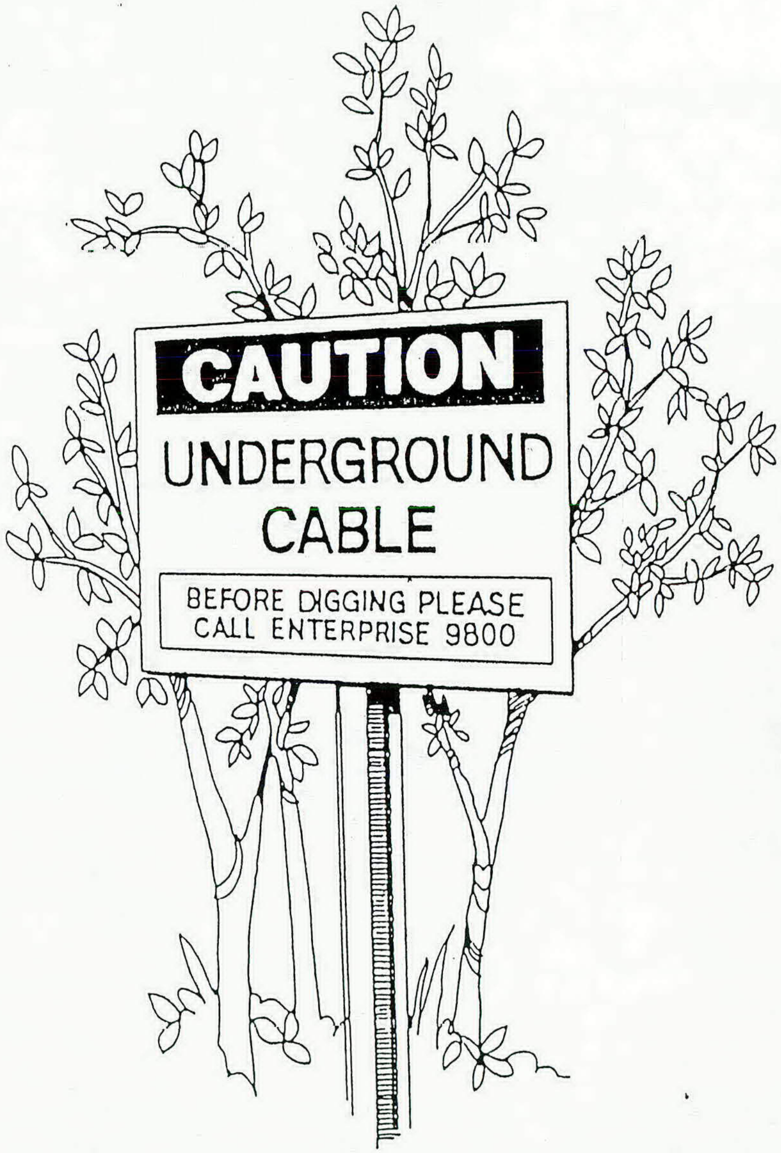
- Move heavy objects with the aid of hand carts whenever possible.

11. Overhead and Buried Utilities

Both supervisors and members of the exploration crew must take special precautions when a drill rig will be used on a site or project within the vicinity of electrical power lines and other utilities. Electricity can shock, it can burn, and it can cause death.

- Locate, note, and emphasize overhead and buried utilities on all boring location plans and boring assignment sheets.
- When overhead electrical power lines exist at or near a drilling site or project, consider all wires to be alive and dangerous.





- Watch for sagging power lines before entering a site. Do not lift power lines to gain entrance. Call the utility and ask them to lift or raise the lines or deenergize (turn off) the power.
- Before raising the drill rig mast (derrick) on a site in the vicinity of power lines, walk completely around the drill rig. Determine the minimum horizontal distance from any point on the drill rig

to the nearest power line when the mast is raised and/or being raised. If this horizontal distance is less than 100 ft. (30 m), first consult the local utility company and refer to OSHA REG 29 CFR 1910.180 before commencing operations.

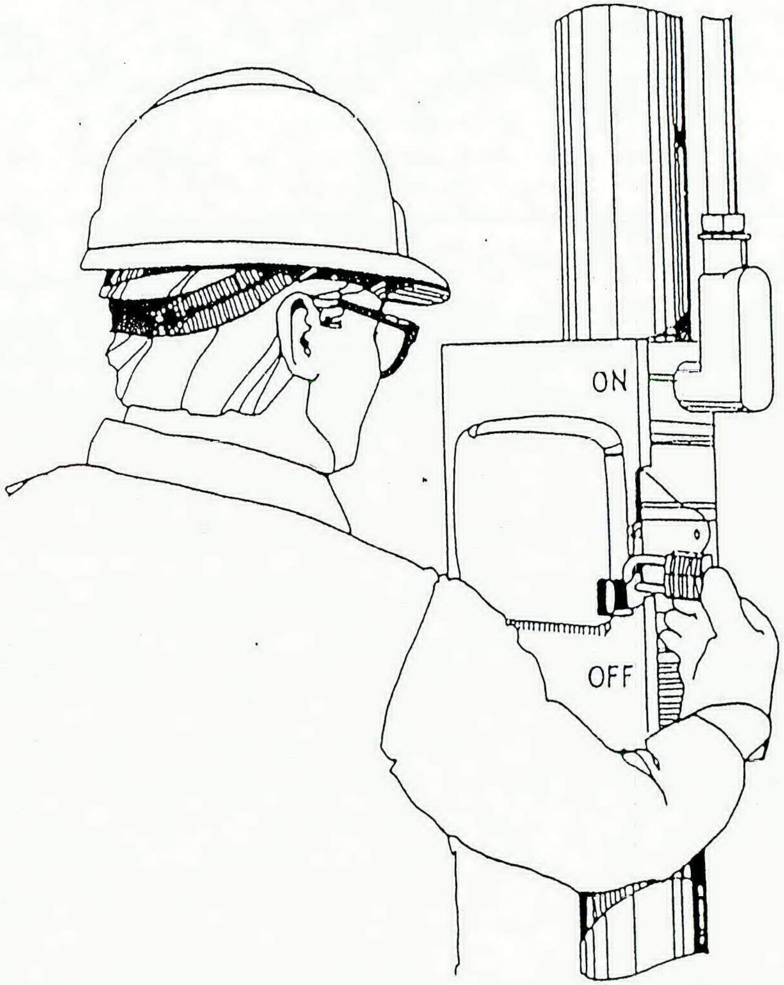
- Keep in mind that both hoist lines and overhead power lines can be moved toward each other by the wind.
- In order to avoid contact with power lines, only move the drill rig with the mast (derrick) down.
- If there are any questions concerning the safety of drilling on sites in the vicinity of overhead power lines, call the power company. The power company will provide expert advice at the drilling site as a public service and at no cost.

Electricity is as dangerous underground as overhead. Be aware of and always suspect the existence of underground utilities such as electrical power, gas, petroleum, telephone, sewer and water:

- If a sign warning of underground utilities is located on a site boundary, do not assume that underground utilities are located on or near the boundary or property line under the sign. Call the utility and check it out. The underground utilities may be a considerable distance away from the warning sign.
- Always contact the owners of utility lines or the nearest underground utility location service before drilling. Determine jointly with utility personnel the precise location of underground utility lines, mark and flag the locations, and determine jointly with utility personnel what specific precautions must be taken to ensure safety.

12. Supplying Power to the Job Site

Drilling projects sometimes require around-the-clock operations and, therefore, require temporary electrical lighting. In general, all wiring and fixtures used to provide electricity for drilling operations should be installed by qualified personnel in accordance with the National Electrical Code (NFPA70-1984) with consideration of the American Petroleum Institute's recommended practices for electrical installations for production facilities (API-RP-500B). Lights should be installed and positioned so that the work area and operating positions are well lighted without shadows or blind spots. The following are specific recommendations for land-based drilling operations:



- Before working on an electrical power or lighting system, lock-out the main panel box with your own lock and keep the key on your person at all times.
- Install all wiring using high quality connections, fixtures and wire. Be sure that the wiring is insulated and protected with consideration for the drilling environment. Do not use makeshift

wiring and equipment.

- Place all lights positioned directly above working areas in cages or similar enclosures to prevent loose or detached lamps or vaportight enclosures from falling on workers.
- Install lights so as to eliminate glare or "blind spots" on tools, ladders, walkways, platforms, and the complete working area.
- Locate and guard electrical cables to prevent damage by drilling operations or by the movement of personnel, tools, or supplies.
- Use only three-prong, U-blade, grounded type plug receptacles and have adequate current carrying capacity for the electrical tools that may be used.
- Use only electrical tools that have three-prong, U-blade, ground wire plugs and cords.
- Do not use electrical tools with lock-on devices.
- Provide adequate grounding for all electrical welders, generators, control panels, and similar devices.
- Provide secure protective enclosures on control panels, fuse boxes, transformers, and similar equipment.
- Avoid attaching electrical lighting cables to the derrick or other components of the drill rig. If this must be done, use only approved fasteners. Do not "string" wire through the derrick.
- Do not use poles used to hold wiring and lights for any other purpose.
- Turn power off before changing fuses or light bulbs.
- Require all workers in a drilling area illuminated with electrical lighting to wear safety head gear that protects the worker's head, not only against falling or flying objects, but also against limited electrical shock and burns according to ANSI Z89.1 and Z89.2.
- Allow only trained, designated personnel to operate electrical equipment.
- Do not permit unqualified field personnel to work on or near electric lines or devices.

13. Contact with Electricity

If a drill rig makes contact with electrical wires, it may or may not be insulated from the ground by the tires of the carrier. Under either circumstance, if the human body simultaneously comes in contact with the drill rig and the ground, electrocution can result, causing death or serious injury. If a drill rig or a drill rig carrier makes contact with overhead or underground electrical lines:

- Under most circumstances the operator and other personnel on the seat of the vehicle should remain seated and not leave the vehicle. They should not move or touch any part, particularly a metallic part, of the vehicle or the drill rig.
- If it is determined that the drill rig should be vacated, all personnel must jump clear and as far as possible from the drill. Personnel must not step off — but must jump off. Do not hang on to the vehicle or any part of the drill when jumping clear.
- If you are on the ground, stay away from the vehicle and the drill rig; do not allow others to get near the vehicle and the drill rig. Seek assistance immediately from local emergency personnel such as the police or a fire department.
- When an individual is injured and in contact with the drill rig or with power lines, attempt rescue with extreme caution. If a rescue is attempted, use a long, dry, unpainted piece of wood or a long, dry, clean rope. Keep as far away from the victim as possible and do not touch the victim until the victim is completely clear of the drill rig or electrical lines.
- Do not attempt to administer first aid unless the victim is completely clear of the electrical source. Begin cardiopulmonary resuscitation (CPR) immediately if a heart beat (pulse) cannot be detected.

14. Wire Line Hoists, Wire Rope, and Hoisting Hardware

Use wire line hoists, wire rope, and hoisting hardware only as stipulated by the American Iron and Steel Institute *Wire Rope Users Manual*.

- Visually inspect all wire ropes and fittings during use and thoroughly inspect them at least once a week for abrasion, broken wires, wear, reduction in rope diameter, reduction in wire diameter, fatigue, corrosion, damage from heat, improper reeving, jamming, crushing, bird caging, kinking, core protrusion, and/or damage to lifting hardware. Replace wire ropes when inspection indicates excessive damage, as described in the *Wire Rope Users Manual*.

- Thoroughly inspect all wire ropes that have not been used for a period of a month or more.
- Install all connections and end fittings, which consist of spliced eyes and various manufactured devices, according to the manufacturer's specifications. Do not exceed ratings specified by manufacturer.
- If a ball-bearing type hoisting swivel is used to hoist drill rods, inspect and lubricate swivel bearing daily to assure that the swivel freely rotates under load.
- If a rod slipping device is used to hoist drill rods, do not drill through or rotate drill rods through the slipping device; do not hoist more than 1 ft. (0.3 m) of the drill rod column above the top of the mast (derrick); do not hoist a rod column with loose tool joints; and do not make, tighten, or loosen tool joints while the rod column is being supported by a rod slipping device. If drill rods should slip back into the borehole, do not attempt to break the fall of the rods by hand or by tensioning the slipping device.
- Most sheaves on exploration drill rigs are stationary with a single part line. Never increase the number of parts of line without first consulting with the manufacturer of the drill rig.
- Wire ropes must be properly matched with each sheave. If the rope is too large, the sheave will pinch the wire rope. If the rope is too small, it will groove the sheave. Once the sheave is grooved, it will severely pinch and damage larger-sized wire ropes.

The following procedures and precautions must be understood and implemented for use of wire ropes and rigging hardware:

- Use tool handling hoists only for vertical lifting of tools (except when angle hole drilling). Do not use tool handling hoists to pull on objects away from the drill rig; however, drills may be moved using the main hoist of the drill if the wire rope is spooled through proper sheaves according to the manufacturer's recommendations.
- When stuck tools or similar loads cannot be raised with a hoist, disconnect the hoist line and connect the stuck tools directly to the feed mechanism of the drill. Do not use hydraulic leveling jacks for added pull to the hoist line or to the feed mechanism of the drill.

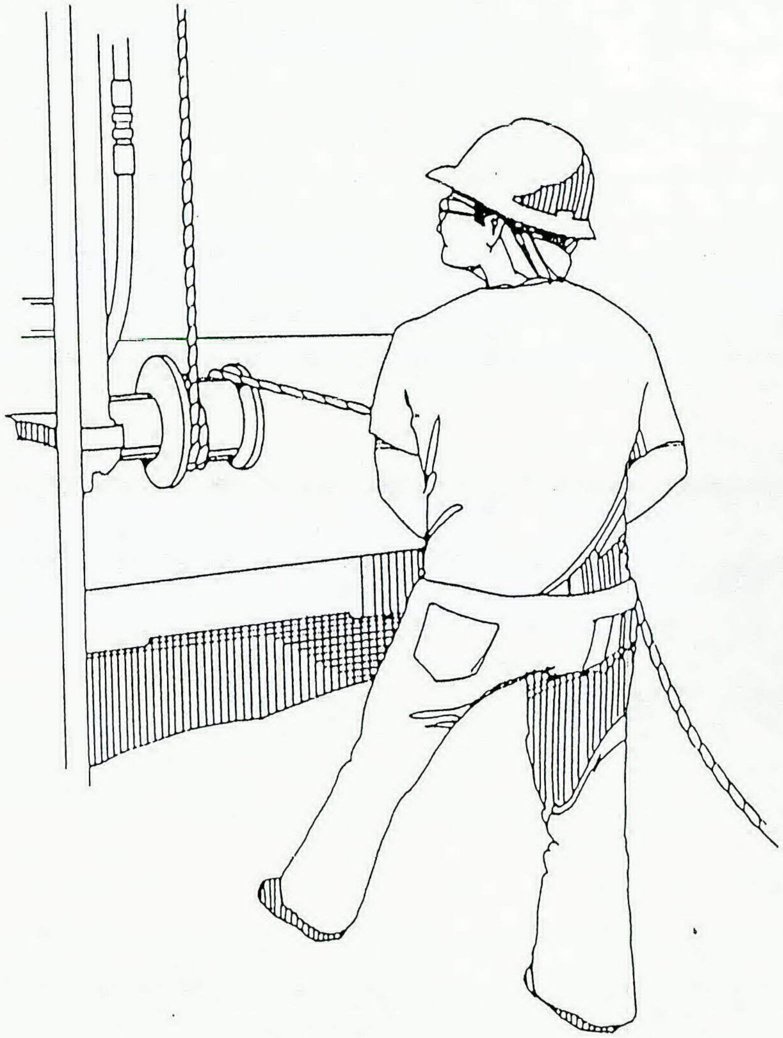
- When attempting to pull out a mired down vehicle or drill rig carrier, only use a winch on the front or rear of the vehicle and stay as far as possible away from the wire rope. Do not attempt to use tool hoists to pull out a mired down vehicle or drill rig carrier.
- Apply loads smoothly and steadily to minimize shock loading of a wire rope.
- Avoid sudden loading in cold weather.
- Never use frozen ropes.
- Protect wire rope from sharp corners or edges.
- Replace faulty guides and rollers.
- Replace worn sheaves or worn sheave bearings.
- Replace damaged latches on hooks before using.
- Know the working load of the equipment and tackle being used. Never exceed this limit.
- Periodically inspect and test hoist clutches and brakes.
- Know and do not exceed the rated capacity of mast hooks, rings, links, swivels, shackles, and other lifting aids.
- Always wear gloves when handling wire ropes.
- Do not use hands to guide wire rope on hoist drums.
- Following the installation of a new wire rope, first lift a light load to allow the wire rope to adjust.
- Never conduct any hoisting operations when the weather conditions are such that hazards to personnel, the public, or property are created.
- Never leave a load suspended in the air when the hoist is unattended.
- Keep hands away from hoists, wire rope, hoisting hooks, sheaves, and pinch points while slack is being taken up or when the load is being hoisted.
- Never hoist the load over the head, body, or feet of any personnel.
- Never use a hoist line to "ride" up the mast (derrick) of a drill rig.
- Use replacement wire ropes that conform to the drill rig manufacturer's specifications.

15. Cathead and Rope Hoists

Follow these procedures when using a cathead hoist:

- Keep the cathead clean and free of rust, oil and grease. Rust should be removed from the cathead with a wire brush having a handle.
- Check the cathead periodically, when the engine is not running, for rope wear grooves. If a rope groove forms to a depth greater than 1/8 in. (3 mm), replace the cathead.
- Always use a clean, dry, sound rope. A wet or oily rope may "grab" the cathead and cause drill tools or other items to be rapidly hoisted to the top of the mast.
- Should the rope "grab" the cathead or otherwise become tangled in the drum, release the rope and sound an appropriate alarm for all personnel, including the operator, to rapidly back away and stay clear. If the rope "grabs" the cathead, and tools are hoisted to the sheaves at the top of the mast, the rope will often break, releasing the tools. If the rope does not break, stay clear of the drill rig until the operator cautiously returns to turn off the drill rig engine and appropriate action is taken to release the tools. Keep careful watch on the suspended tools and quickly back away after turning off the engine.
- Always protect the rope from contact with chemicals. Chemicals can cause deterioration of the rope that may not be detected visibly.
- Never wrap the rope from the cathead (or any other rope, wire rope, or cable on the drill rig) around a hand, wrist, arm, foot, ankle, legs, or any other part of the body.
- Always maintain a minimum of 18 inches of clearance between the operating hand and the cathead drum when driving samplers, casing, or other tools with the cathead and rope method. Be aware that the rope advances toward the cathead with each hammer blow as the sampler or other drilling tool advances into the ground.
- Never operate a cathead (or perform any other task around a drill rig) with loose, unbuttoned, or otherwise unfastened clothing or when wearing gloves with large cuffs or loose straps or lacings.
- Do not use a rope that is any longer than necessary. A rope that is too long can form a ground loop or otherwise become entangled with the operator's legs.
- Do not use more rope wraps than are required to hoist a load.

- Do not leave a cathead unattended with the rope wrapped on the drum.
- Position all other hoist lines to prevent contact with the operating cathead rope.



- When using the cathead and rope for driving or back-driving, make sure that all threaded connections are tight and stay as far away as possible from the hammer impact point.

- Only operate the cathead standing on a level surface with good, firm footing conditions without distraction or disturbance.

16. Augers

Follow these general procedures when starting a boring with continuous flight or hollow-stem augers:

- Start an auger boring with the drill rig level, the clutch or hydraulic rotation control disengaged, the transmission in low gear, and the engine running at low RPM.
- Apply an adequate amount of down pressure prior to rotation to seat the auger head below the ground surface.
- Look at the auger head while slowly engaging the clutch or rotation control and starting rotation. Stay clear of the auger.
- Slowly rotate the auger and auger head while continuing to apply down pressure. Keep one hand on the clutch or on the rotation control at all times until the auger has penetrated about one foot or more below ground surface.
- If the auger head slides out of alignment, disengage the clutch or hydraulic rotation control and repeat the hole starting process.
- An auger guide can facilitate the starting of a straight hole through hard ground or a pavement.

Establish a system of responsibility for the operator and tool handler to follow during the series of various activities required for auger drilling, such as connecting and disconnecting auger sections, and inserting and removing the auger fork. The operator must ensure that the tool handler is well away from the auger column and that the auger fork is removed before starting rotation. In addition:

- When rotating augers, stay clear of the rotating auger and other rotating components of the drill rig. Never reach behind or around a rotating auger for any reason whatever.
- Only use the manufacturer's recommended method of securing the auger to the power coupling. Do not use an over-length pin or bolt. Do not touch the coupling or the auger with hands, a wrench, or any other tools during rotation.
- Whenever possible, use tool hoists to handle auger sections.
- Never place hands or fingers under the bottom of an auger section when hoisting the auger over the top of the auger section in the ground or other hard surfaces such as the drill rig platform.

- Never allow feet to get under the auger section that is being hoisted.
- Use a long-handed shovel to move auger cuttings away from the auger. Never use hands or feet to move cuttings away from the auger.
- Do not attempt to remove earth from rotating augers. Clean augers only when the drill rig is in neutral and the augers are stopped from rotating.

17. Rotary and Core Drilling

Check rotary drilling tools prior to drilling:

- Lubricate and check for frozen bearings before using water/air swivels and hoisting plugs. Water/air swivel bearings must be free before using, and stay clear of water/air swivel hose when rotating.
- Check drill rod chuck jaws periodically and replace when necessary.
- Check the capacities of hoists and sheaves against the anticipated weight to the drill rod string plus other expected hoisting loads.

During rotary or core drilling, follow these special precautions that involve chucking, joint break, hoisting, and lowering of drill rods:

- Only the operator of the drill rig should be allowed to brake or set a manual chuck so that rotation of the chuck will not occur prior to removing the wrench from the chuck.
- Drill rods should not be braked during lowering into the hole with drill rod chuck jaws.
- Do not lower drill rods into the hole with pipe wrenches.
- If a string of drill rods is accidentally or inadvertently released into the hole, do not attempt to grab the falling rods by hand or with a wrench.
- In the event of a plugged bit or other circulation blockage, relieve the high pressure in the piping and hose between the pump and the obstruction before breaking the first tool joint.

- When drill rods are hoisted from the hole, clean them only with a wiper made of rubber or other suitable material. Do not use hands to clean drilling fluid from drill rods.
- If work must progress above a portable drilling fluid (mud) pit, do not attempt to stand on narrow sides or cross members. Equip the mud pit with rough surfaced, fitted cover panels of adequate strength to hold drill rig personnel.
- Do not lift or lean unsecured drill rods against the mast. Either provide some method of securing the upper ends of the drill rod sections for safe vertical storage or lay the rods down.

18. Transporting a Drill Rig

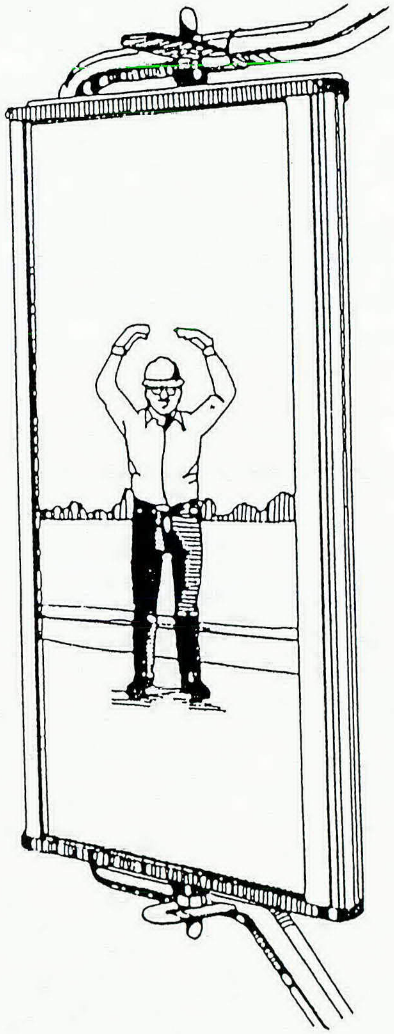
When transporting a drill rig on and off a drilling site:

- Allow only licensed individuals to operate the vehicle. Comply with all federal, state, and local regulations.
- Know the traveling height (overhead clearance), width, length, and weight of the drill rig with carrier and know the highway and bridge load, width, and overhead limits. Allow adequate margins and make sure that they are not exceeded.
- Never move a drill rig unless the vehicle brakes are in sound working order.
- Allow for mast overhang when cornering or approaching other vehicles or structures.
- Be aware that the canopies of service stations and motels are often too low for a drill rig mast to clear with the mast in the travel position.
- Watch for low hanging electrical lines, particularly at the entrances to drilling sites, restaurants, motels, or other commercial sites.
- Never travel on a street, road, or highway with the mast (derrick) of the drill rig in the raised or partially raised position.
- Remove all ignition keys when a drill rig is left unattended.

19. Loading and Unloading

When loading or unloading a drill rig on a trailer or a truck:

- Use ramps of adequate design that are solid and substantial enough to bear the weight of the drill rig with carrier — including tooling.
- Load and unload on level ground.
- Use the assistance of someone on the ground as a guide.
- Check the brakes on the drill rig carrier before approaching loading ramps.



- Distribute the weight on the drill rig, carrier, and tools on the trailer so that the center of weight is approximately on the centerline of the trailer and so that some of the trailer load is transferred to the hitch of the pulling vehicle. Refer to the trailer manufacturer's weight distribution recommendations.

- Secure the drill rig and tools to the hauling vehicle with ties, chains, and/or load binders of adequate capacity.

20. Off-Road Movement

Follow these procedures during off-road movement:

- Before moving a drill rig, first walk the route of travel, inspecting for depressions, stumps, gulleys, ruts, and similar obstacles.
- Always check the brakes of a drill rig carrier before traveling, particularly on rough, uneven, or hilly ground.
- Check the complete drive train of a carrier at least weekly for loose or damaged bolts, nuts, studs, shafts, and mountings.
- Discharge all passengers before moving a drill rig on rough or hilly terrain.
- Engage the front axle (for 4 x 4, 6 x 6, etc. vehicles or carriers) when traveling off highway on hilly terrain.
- Use caution when traveling side-hill. Conservatively evaluate side-hill capability of drill rigs because the arbitrary addition of drilling tools may raise the center of mass. When possible, travel directly uphill or downhill. Increase tire pressures before traveling in hilly terrain (do not exceed rated tire pressure).
- Attempt to cross obstacles such as small logs and small erosion channels or ditches squarely rather than at an angle.
- Use the assistance of someone on the ground as a guide when lateral or overhead clearance is close.
- Set all brakes and/or locks after the drill has been moved to a new drilling site. When grades are present, block the wheels.
- Never travel off-road with the mast (derrick) of the drill rig in the raised or partially raised position.

21. Tires, Batteries, and Fuel

Check tires on the drill daily for safety and, during extended travel, for loss of air. Maintain air pressures for travel on streets, roads, and highways according to the manufacturer's recommendations. Only repair truck and off-highway tires with the required special tools and follow the recommendations of a tire manufacturer's repair manual.

If tires on all-terrain drills are deflated to reduce ground pressure for movement on soft ground, reinflate the tires to normal pressures before movement on firm or hilly ground or on streets, roads, and highways. Underinflated tires are not stable on firm ground.

During air pressure checks, inspect for:

- Missing or loose wheel lugs.
- Objects wedged between duals or embedded in the tire casing.
- Damaged or poorly fitting rims or rim flanges.
- Abnormal or uneven wear and cuts, breaks, or tears in the casing.

Batteries contain strong acid. Use extreme caution when servicing batteries.

- Service batteries only in a ventilated area and while wearing safety glasses.
- When a battery is removed from a vehicle or service unit, disconnect the battery ground clamp first.
- When installing a battery, connect the battery ground clamp last.
- When charging a battery with a battery charger, turn off the power source to the battery before either connecting or disconnecting charger leads to the battery posts. Loosen cell caps before charging to permit the escape of gas.
- Spilled battery acid can burn skin and should be immediately flushed with lots of water. If battery acid gets into someone's eyes, flush immediately with large amounts of water and see a medical physician at once.
- To avoid battery explosions, keep the cells filled with electrolyte, use a flashlight (not an open flame) to check electrolyte levels and avoid creating sparks around the battery by shorting across a battery terminal. Keep lighted or smoking materials and flames away from batteries.

Take special precautions for handling fuel and refueling the drill rig or carrier.

- Only use the type and quality of fuel recommended by the engine manufacturer.
- Refuel in a well-ventilated area.

- Do not fill fuel tanks while the engine is running. Turn off all electrical switches.
- Do not spill fuel on hot surfaces. Clean any spills before starting an engine.
- Wipe up spilled fuel with cotton rags or cloths; do not use wool or metallic cloth.
- Keep open lights, lighted smoking materials, flames, or sparking equipment well away from the fueling area.
- Turn off heaters in carrier cabs when refueling the carrier or the drill rig.
- Do not fill portable fuel containers completely full to allow expansion of the fuel during temperature changes.
- Keep the fuel nozzle in contact with the tank being filled to prevent static sparks from igniting the fuel.
- Do not transport portable fuel containers in the vehicle or carrier cab with personnel.
- During travel store fuel containers and hoses so they are in contact with a metal surface. This should prevent the buildup of static charge.

22. First Aid

Train at least one member of the drill crew, and if only one, preferably the drilling and safety supervisor, to perform first aid. First aid must be taught on a person-to-person basis, not by providing or reading a manual. Manuals should only provide continuing reminders and be used for reference. Courses provided or sponsored by the American Red Cross or a similar organization best satisfy the requirements of first aid training for drill crews.

For drilling operations it is particularly important that those responsible for first aid should be able to recognize the symptoms of and be able to provide first aid for electrical shock, heart attack, stroke, broken bones, eye injury, snake bite, and cuts or abrasions to the skin. Again, first aid for these situations is best taught to drill crew members by instructors qualified by an agency such as the American Red Cross.

Keep first aid kit available and well maintained on each drill site.

23. Drill Rig Utilization

Do not attempt to exceed manufacturers' ratings of speed, force, torque, pressure, flow, etc. Only use the drill rig and tools for the purposes for which they are intended and designed.

24. Drill Rig Alterations

Alterations to a drill rig or drilling tools must only be made by qualified personnel and only after consultation with the manufacturer.

APPENDIX C

APPENDIX C
SAMPLING DATA FROM PREVIOUS SITE INVESTIGATIONS

JUNE 1990 SPILL INVESTIGATION

from Radian, 1994

2.15 Site 15 - POL Area

Site 15 (POL Area) is located at the Jet Fuel Transfer Pumphouse, Building 602, south of Kesel Road. The site covers 2.5 acres and includes one 215,000-gallon aboveground storage tank (AST) and six 25,000-gallon underground storage tanks (USTs) that contain JP-4, and associated equipment for transferring fuel to the tanks. Site 15 has been in use since 1980 to store petroleum, oil, and lubricants (POL) and is scheduled to be decommissioned in 1995, after a new POL Area is constructed. Two spills have reportedly occurred at Site 15. The first spill was a release of PCBs, possibly from transformers located at the front of the pumphouse, that occurred before the 1980s. The second spill was a release of an estimated 3,850 gallons of JP-4 inside the pumphouse in April 1990. Following the April 1990 spill, contaminated surface soil was removed, and the area was backfilled with crushed stone. During the course of the spill cleanup, three area drainage sumps containing PCB-contaminated sediment, as well as an OWS, were discovered. The spilled fuel entered the sumps and mixed with the PCB-contaminated sediment. The contaminated sediment is believed to have collected in the sumps before 1971. The OWS was installed in the 1950s, but was never connected to a holding tank; instead, all product emptied into a dry well and eventually entered the soil.

Site 15 was not evaluated in any of the investigations previously conducted at the Base. However, four groundwater monitoring wells were installed and fifteen soil samples were collected as part of a spill investigation conducted in June 1990. PCBs were detected in soil samples at a maximum concentration of 23 mg/kg. No PCBs were detected in groundwater samples; however, benzene was detected at a maximum concentration of 510 μg/L. In a letter dated June 6, 1990, the New York State DEC requested further study of Site 15 to determine the nature and extent of groundwater and soil contamination resulting from the April 1990 spill, as well as from previous spills at this site.

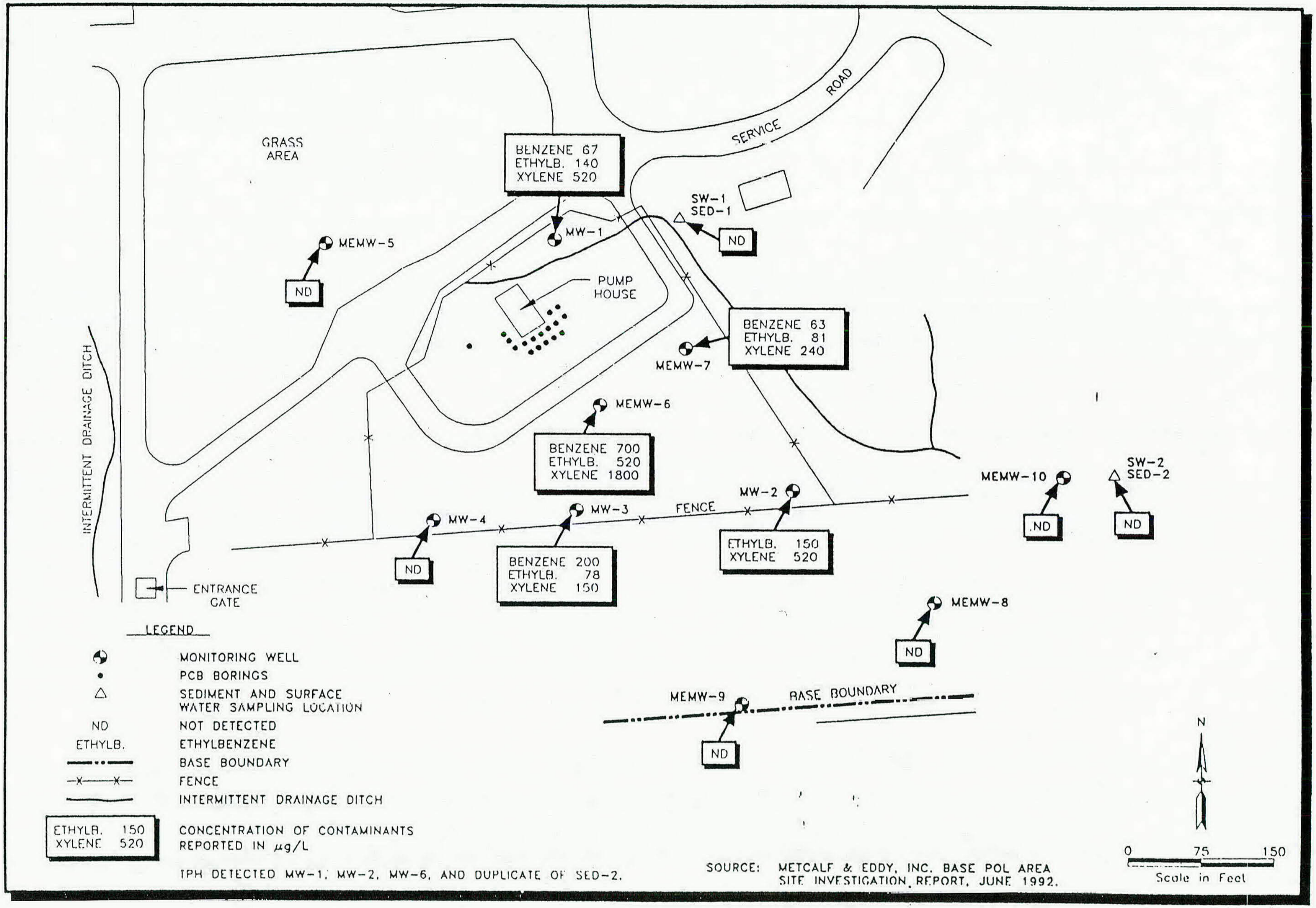
NOVEMBER-DECEMBER 1990 SITE INVESTIGATION

from Radian, 1994

According to DoD policy, investigations to identify, confirm, and determine risks to human health and the environment; FSs; RA plans and designs; and removal actions or RAs conducted under CERCLA are eligible for DERA funding; therefore, investigation and remediation activities for this site are eligible for DERA funding.

A Base POL Area Site Investigation Report was completed in June 1992. Six soil borings were drilled and completed as groundwater monitoring wells. Samples were collected from all ten groundwater monitoring wells at the site, and sixteen shallow soil, two surface water, and two sediment samples were also collected. Analytical results indicated that soil samples collected from the area in front of the south side of the pumphouse contained a maximum concentration of 240 mg/kg of PCBs. Soil samples were not analyzed for TPH or benzene, toluene, ethylbenzene, and xylenes (BTEX). Groundwater samples collected at Site 15 contained up to 700 µg/L of benzene; 520 µg/L of ethylbenzene; 1,800 µg/L of xylenes; and 2.3 mg/L of TPH. These concentrations exceed drinking water standards. No TPH or BTEX compounds were detected in surface water or sediment samples collected at the site. The report recommended that contact with, and disturbance of, PCB-contaminated soil be restricted as much as possible until the site can be remediated. The SI will be finalized in May 1994 by including comments made by the New York State DEC. Site 15 was assigned a score of 15.8 using the DPM. A RI kickoff meeting for Site 15 was conducted in March 1992. RI field work is anticipated to begin at Site 15 in June 1994.

HANCCK33.DWG DEN MRL DC DDD 05/24/94



TPH DETECTED MW-1, MW-2, MW-6, AND DUPLICATE OF SED-2.

SOURCE: METCALF & EDDY, INC. BASE POL AREA SITE INVESTIGATION REPORT, JUNE 1992.

CONCEPTUAL SITE MODEL

Site 15

BTEX in Groundwater, Surface Water, and Sediment from M&E, 1995

of a Site Investigation (SI) performed by M&E, was undertaken in the fall of 1990. The results of the 1990 SI are summarized below.

In November and December 1990, PCBs were detected in samples of seepage water taken from inside the pump house and in near-surface soil samples collected from soil borings in the vicinity of the pump house. In the sump seepage water, which was groundwater that was allowed to seep into a cleaned and dr~~y~~ied sump in the pump house, levels of PCBs detected were as high as 120 μg/Kg for Aroclor-1260 and 15 μg/Kg for Aroclor-1254. These results suggested that PCBs were present beneath the pump house. Results for the subsurface soils ranged from non-detectable to 240,000 μg/Kg for Aroclor-1260. PCB contamination was greatest in the areas immediately south and west of the pumphouse. The horizontal and vertical extent of the PCB contamination to the south and east of the pump house were not established, nor was the extent of the PCB-contaminated soil beneath the building determined.

Also in 1990, samples of groundwater, sump seepage water, surface water, and sediment were analyzed for jet fuel contamination. Samples of groundwater, sediment and sump water revealed the presence of petroleum hydrocarbons consistent with a jet fuel source. No hydrocarbons were detected in the surface water. The results obtained from sump seepage water samples indicated that there were hydrocarbons beneath the pump house. Groundwater contamination was greatest in monitoring well MEMW-06, approximately 100 feet down-gradient of the pump house. Concentrations in MEMW-06 included 2.3 mg/L for total petroleum hydrocarbons (TPH), and 3,020 μg/L total for benzene, toluene, ethylbenzene, and xylene (BTEX). Hydrocarbons were also detected in downgradient monitoring wells MW-02 and MW-03, but not in MEMW-09 or MEMW-10. The contemporary horizontal extent of the petroleum contamination in groundwater was thereby defined (Refer to Figure 1-4).

A short-term risk evaluation was performed as part of the SI to determine whether remediation of the site could be postponed until after the POL Area was decommissioned,

JUNE-JULY 1994 SITE INVESTIGATION

TABLE 3-4. ANALYTICAL RESULTS: POL AREA – GROUNDWATER

MONITORING WELL ID: M&E SAMPLE ID: COMPOUND	CRQL (µg/L)	MW-1 MW-001-06-30-NX-101	MW-2 MW-002-06-30-NX-102	MW-3 MW-003-06-29-NX-103	MW-4 MW-004-06-29-NX-104	MW-6 MEMW-006-06-29-NX-106
VOLATILE ORGANICS						
Methylene Chloride	10	--	--	--	--	--
1,2-Dichloroethene(total)	10	--	--	19 J	--	--
Chloroform	10	--	--	--	--	--
2-Butanone	10	--	--	--	--	--
Bromodichloromethane	10	--	--	--	--	--
Dibromochloromethane	10	--	--	--	--	--
Benzene	10	--	--	180	--	460
Toluene	10	--	--	--	--	7 J
Ethylbenzene	10	--	480	47 J	--	150
Total Xylenes	10	--	1200	30 J	--	390
PESTICIDES AND PCBs						
Aroclor 1260	1	--	--	--	--	0.62 J
JETFUEL	100	--	3130	--	--	1550
Tentatively Identified Fuel Oil	--	--	--	30**	100**	200**
DATE SAMPLED:		06/30/94	06/30/94	06/29/94	06/29/94	06/29/94
REMARKS:						

MONITORING WELL ID: M&E SAMPLE ID: COMPOUND	CRQL (µg/L)	MW-7 *MEMW-007-06-28-NX-107	MW-7 DUP MEMW-007-06-28-FD-125	MW-8 MEMW-008-06-30-NX-108	MW-9 MEMW-009-07-01-NX-109	MW-10 MEMW-010-06-30-NX-110
VOLATILE ORGANICS						
Methylene Chloride	10	--	--	--	--	--
1,2-Dichloroethene(total)	10	--	--	--	--	--
Chloroform	10	--	--	--	--	--
2-Butanone	10	--	10	--	--	--
Bromodichloromethane	10	--	--	--	--	--
Dibromochloromethane	10	--	--	--	--	--
Benzene	10	140	160	--	--	--
Toluene	10	6 J	6 J	--	--	--
Ethylbenzene	10	400	420 *	--	--	--
Total Xylenes	10	300	320 *	--	--	--
PESTICIDES AND PCBs						
Aroclor 1260	1	--	--	--	--	--
JETFUEL	100	2890	3150	--	--	--
Tentatively Identified Fuel Oil	--	--	--	--	--	--
DATE SAMPLED:		06/28/94	06/28/94	06/30/94	07/01/94	06/30/94
REMARKS:			Field Duplicate			

Footnotes:

CRQL – Contract Required Quantitation Limit.

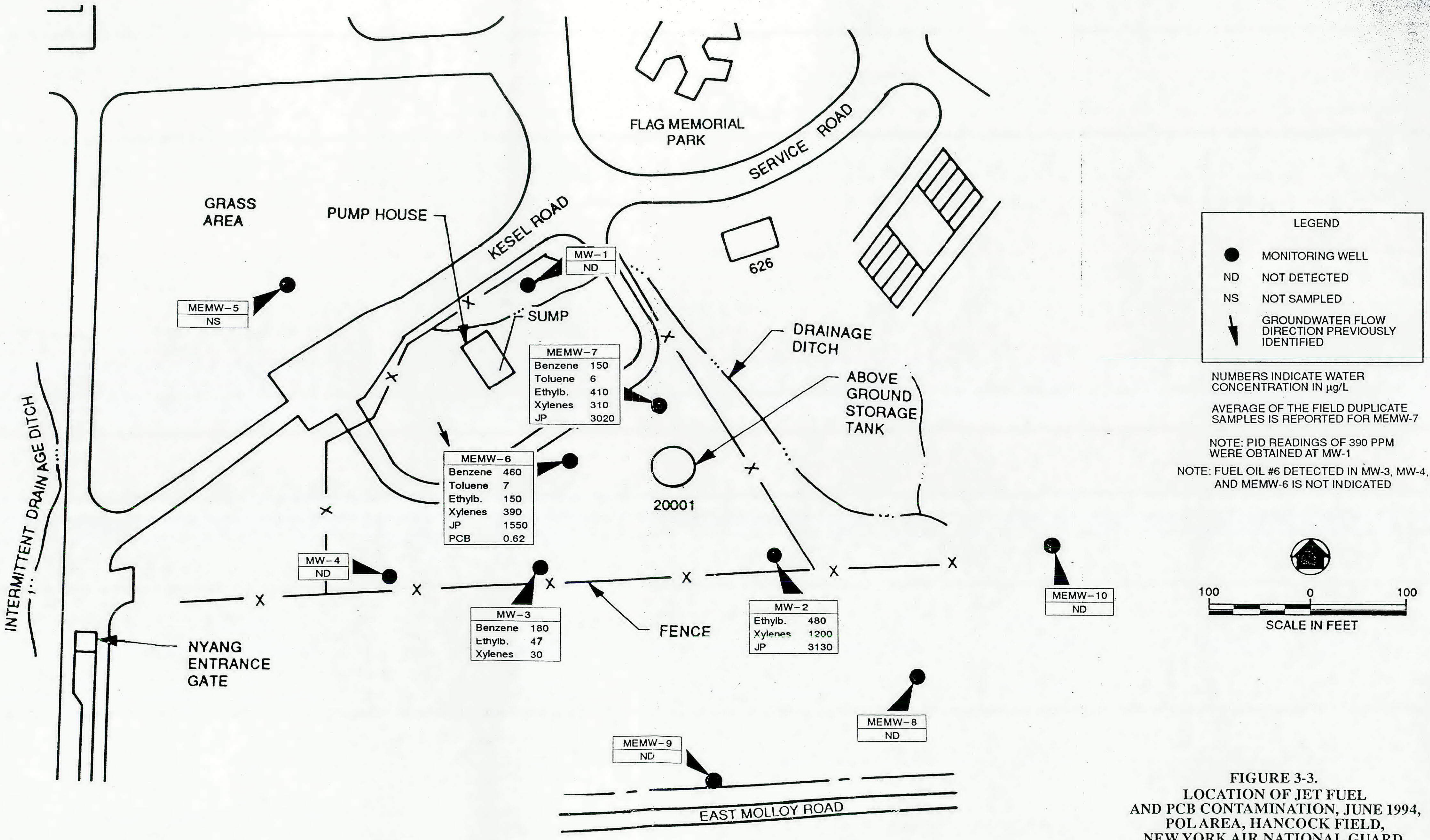
J – Quantitation is approximate due to limitations identified in the quality control review.

NA – Not Analyzed

* – Value is reported from the diluted analysis.

** – Concentrations are estimated.

from M&E, 1995



NUMBERS INDICATE WATER CONCENTRATION IN µg/L

AVERAGE OF THE FIELD DUPLICATE SAMPLES IS REPORTED FOR MEMW-7

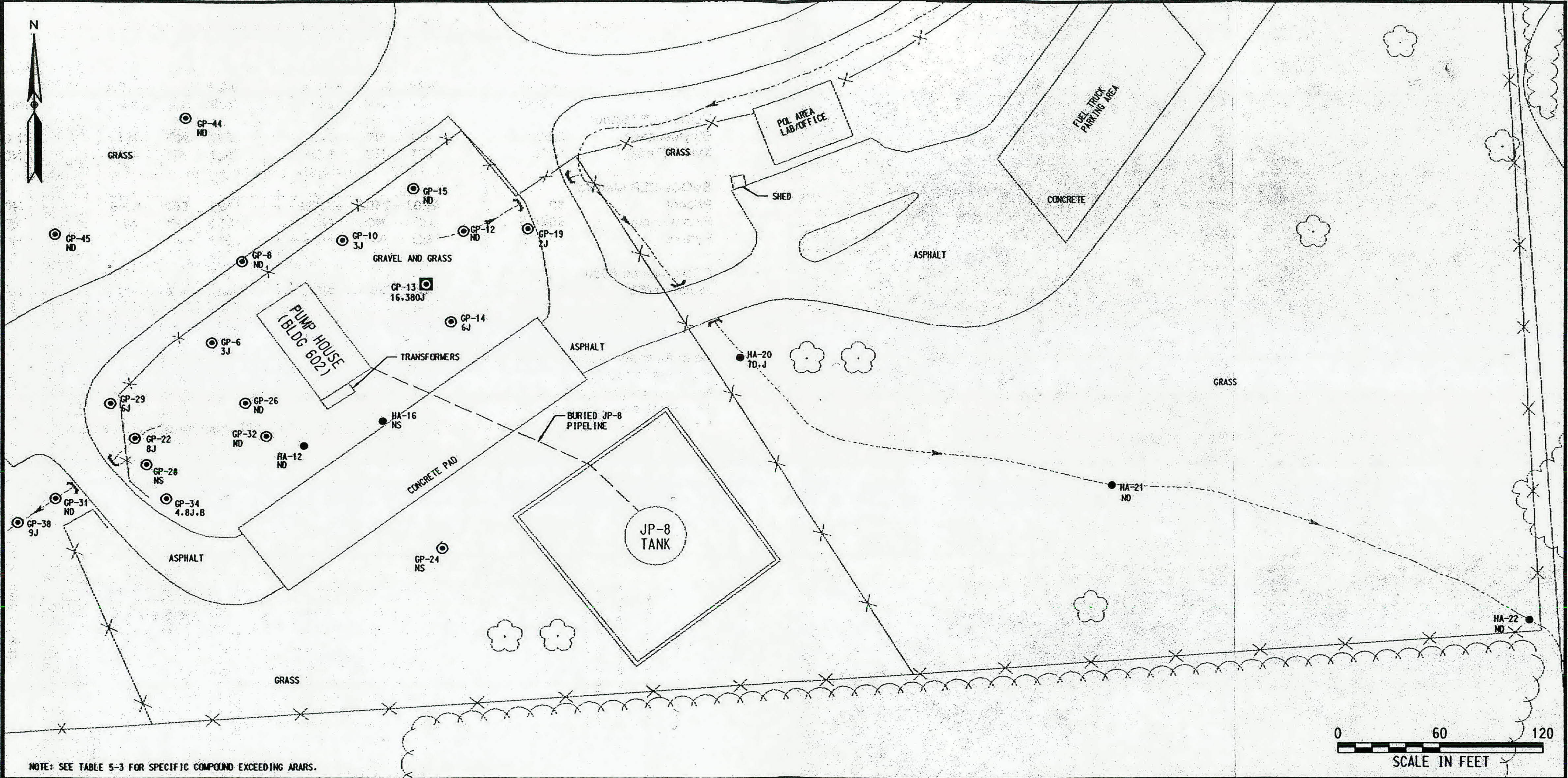
NOTE: PID READINGS OF 390 PPM WERE OBTAINED AT MW-1

NOTE: FUEL OIL #6 DETECTED IN MW-3, MW-4, AND MEMW-6 IS NOT INDICATED

FIGURE 3-3.
LOCATION OF JET FUEL AND PCB CONTAMINATION, JUNE 1994,
POL AREA, HANCOCK FIELD,
NEW YORK AIR NATIONAL GUARD,
SYRACUSE, NEW YORK

1995-1996 REMEDIAL INVESTIGATION

from Lockheed, 1997



NOTE: SEE TABLE 5-3 FOR SPECIFIC COMPOUND EXCEEDING ARARS.

LEGEND

✿ TREE	◉ GEO-PROBE SAMPLING LOCATION	NS - NOT SAMPLED AT THIS DEPTH	J - ONE OR MORE BTEX CONCENTRATIONS ESTIMATED
—] [— CULVERT	● HAND AUGER BORING LOCATION	ND - NON DETECT	B - ONE OR MORE BTEX CONCENTRATIONS FOUND IN BLANK
—X—X— FENCE		8 - TOTAL BTEX (µG/KG)	D - BTEX COMPOUND IDENTIFIED AT A SECONDARY DILUTION FACTOR
- - -➤- - - DRAINAGE DITCH/SWALE AND FLOW DIRECTION		▣ - ONE OR MORE BTEX COMPOUND EXCEEDS ARARS	

HAZWRAP
HAZARDOUS WASTE REMEDIAL ACTIONS PROGRAM
DEPARTMENT OF ENERGY MANAGED BY LOCKHEED MARTIN ENERGY SYSTEMS, INC

SCALE: 1"= 60' - 0"
DATE: 02-24-97
FILENAME: HANH029.DGN

Fig. 5-5a. Soils Analytical Data Map, Total BTEX Concentrations-Surficial (0 - 2 ft), POL Area, 174th FW, NYANG, Hancock Field, Syracuse, NY.

Table 5-2. Summary of Background Soil and Groundwater Analytical Data

		GP-44			GP45			MW-5R
	ARARs (Soil)	0-2 ft soil	5-7 ft soil	8-10 ft soil	0-2 ft soil	5-7 ft soil	8-10 ft soil	water
VOCs-CLP Method								
Ethylbenzene	5,500	ND	ND	ND	ND	ND	1J	ND
Xylene(Total)	1200	ND	ND	ND	ND	ND	4JB	ND
SVOCs-CLP Method								
Phenol	30	220J	240J	6000D	40J	500	1200	ND
Fluoranthene	50,000	ND	ND	ND	35J	ND	ND	ND
Pyrene	50,000	ND	ND	ND	26J	ND	ND	ND
PCBs-Method 8080								
Aroclor 1260	*	44	NS	ND	NS	NS	NS	NS

Note: All concentrations are in ug/kg
ND = Not Detected
NS = Not Sampled at this depth
J = Result is an estimated value
* = NYSDEC ARARs for PCBs in surface soils is 1000 ug/kg and 10,000 ug/kg for subsurface soils

Table 5-3. Summary of Results for Petroleum Indicator Compounds in Groundwater

SAMPLE INFORMATION																																
LOCATION			MW-1		MW-2		MW-3		MW-4		MW-5R		MW-6D		MW-6S		MW-7		MW-8		MW-9		MW-10		MW-10		MW-11		MW-12D		MW-13	
SAMPLE DEPTH (ft.)			6.6-16.6		3.6-13.6		3.6-13.6		8.5-18.5		5.8-15.8		31.0-36.0		4.6-14.6		4.6-14.6		5-15		3.5-13.5		6.6-16.6		6.6-16.6 dup		8.8-18.8		35.9-40.9		7.3-17.3	
SAMPLE NUMBER:			MW-1X		MW-2X[a]		MW-3X		MW-4X		MW-5X		MW-6D		MW-6S[a]		MW-7X		MW-8X		MW-9X		MW-10		MW10D		MW-11[a]		MW12D		MW-13	
DATE SAMPLED:			08/24/95		08/26/95		08/26/95		08/26/95		08/28/95		08/25/95		08/26/95		08/26/95		08/27/95		08/27/95		08/26/95		826/1995		08/25/95		08/25/95		08/25/95	
ANALYTICAL INFORMATION																																
VOCs																																
DATE ANALYZED:			08/29/95		08/30/95		08/30/95		08/30/95		08/30/95		08/30/95		08/29/95		08/30/95		08/30/95		08/30/95		08/30/95		08/30/95		08/29/95		08/29/95		08/29/95	
Analyte	**CRQL[b]**	**ARAR[c]**	**Result**	**Q[d]**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**
Benzene	10	0.7	ND[e]		ND		130		ND		ND		ND		48	D	21		ND		ND		ND		ND		230	D	ND		ND	
Toluene	10	5	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		1	J	ND		ND	
Ethylbenzene	10	5	ND		400	D	42		2	J	ND		5	J	81		85		ND		ND		ND		ND		84		ND		ND	
Xylene (total)	10	5	ND		1200	D	6	J	2	J	ND		14		240	D	170		ND		2	J	ND		ND		140		1	J	ND	
Units	ug/L	ug/L	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
SVOCs																																
DATE EXTRACTED			8/30/95		8/30/95		8/30/95		8/30/95		8/30/95		8/30/95		8/30/95		8/30/95		8/30/95		8/30/95		8/30/95		8/30/95		8/30/95		8/30/95		8/30/95	
DATE ANALYZED:			9/15/95		9/15/95		9/15/95		9/14/95		9/15/95		9/15/95		9/18/95		9/15/95		9/15/95		9/15/95		9/14/95		9/14/95		9/15/95		9/15/95		9/15/95	
Analyte	**CRQL**	**ARAR**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**
Phenol	10	NS[f]	ND		10		2	J	ND		ND		ND		ND		ND		ND		ND		ND		ND		6	J	ND		ND	
Naphthalene	10	10	ND		56		ND		ND		ND		0.6	J	30		1	J	ND		ND		ND		ND		30		ND		ND	
2-Methylnaphthalene	10	NS	ND		34		ND		ND		ND		0.4	J	26		5	J	ND		ND		ND		ND		0.8	J	ND		ND	
Acenaphthene	25	20	ND		ND		ND		ND		ND		ND		1	J	ND		ND		ND		ND		ND		ND		ND		ND	
Fluorene	25	50	ND		ND		ND		ND		ND		ND		0.7	J	ND		ND		ND		ND		ND		ND		ND		ND	
Phenanthrene	10	50	ND		ND		ND		ND		ND		ND		1	J	ND		ND		ND		ND		ND		ND		ND		ND	
Anthracene	10	NS	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Fluoranthene	10	50	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Pyrene	10	50	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Benzo(a)Anthracene	10	NS	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Chrysene	10	NS	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Benzo(b)fluoranthene	10	NS	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Benzo(k)fluoranthene	10	NS	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Benzo(a)pyrene	10	STND[g]	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Units	ug/L	ug/L	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	

▨ 500 Result = or exceed NYSDEC ARARs

[a] This sample was rerun, or diluted and rerun for VOCs. The reported result is the result obtained from the diluted/undiluted analyses with the highest degree of confidence.

[b] CRQL = Contract Required Detection Limit

[c] ARAR=Applicable or Relevant and Appropriate Requirement
The ARAR applied is the NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water Quality Standards and Guidance Values

[d] Data Qualifiers
J=Reported result is an estimated value (falls between the established MDL and CRQL)
D=compounds identified at a secondary dilution factor

[e] ND=Not Detected Above the MDL (Method Detection Limit)

[f] NS=No standard is defined for that compound

[g] STND=The standard is non-detect

Table 5-4. Summary of Results for Petroleum Indicator Compounds in Soil

SAMPLE INFORMATION																						
LOCATION			GP06		GP06		GP06		GP08		GP08		GP10		GP10		GP10		GP12		GP12	
DEPTH			0-2 ft		10-12 ft		10-12 ft dup		0-2 ft		10-12 ft		0-2 ft		5-7 ft		10-12 ft		0-2 ft		4-6 ft	
SAMPLE NUMBER:			G0602		G0610		G061D		G0802		G0810		G1002		G1057		G1010		G1202		G1246	
DATE SAMPLED:			08/08/95		08/08/95		08/08/95		08/08/95		08/08/95		08/07/95		08/07/95		08/07/95		08/07/95		08/07/95	
ANALYTICAL INFORMATION																						
VOCs																						
DATE ANALYZED:			08/15/95		8/18/1995		08/12/95		08/11/95		08/14/95		08/08/95		08/09/95		08/14/95		08/09/95		08/08/95	
Analyte	**CRQL**	**ARAR**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**
Benzene	10	60	ND		1500		53		ND		1400	U	ND		ND		1500	U	ND		ND	
Toluene	10	1500	ND		2000		4	J	ND		1400	U	1	J	ND		1500	U	ND		ND	
Ethylbenzene	10	5500	3	J	63000	D	60		ND		1400	U	ND		400		200	J	ND		480	
Xylene (total)	10	1200	ND		28000	D	220		ND		1400	U	2	J	1100		1500	U	ND		1000	
Units	ug/Kg	ug/Kg	ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg	
SVOCs																						
DATE EXTRACTED			8/23/95		8/11/95		8/11/95		8/11/95		8/11/95		8/16/95		8/16/95		8/10/95		8/9/95		8/9/95	
DATE ANALYZED:			8/28/95		8/23/95		8/24/95		8/22/95		8/22/95		8/23/95		8/24/95		8/15/95		8/15/95		8/14/95	
Analyte	**CRQL**	**ARAR**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**
Phenol	330	30	500		1600		1000		24	J	390		300	J	ND		12000	U	170	J	5200	D
Naphthalene	330	1300	350		420		48	J	ND		ND		35	J	3800		12000	U	ND		420	DJ
2-Methylnaphthalene	330	3640	530		700		71	J	ND		ND		41	J	9800		600	J	ND		990	D
Acenaphthene	330	50000	ND		150	J	ND		ND		ND		59	J	ND		12000	U	ND		ND	
Fluorene	330	50000	76	J	180	J	ND		ND		ND		110	J	160	J	12000	U	ND		36	DJ
Phenanthrene	330	50000	88	J	1300		250	J	20	J	ND		1100		150	J	640	J	ND		12	J
Anthracene	330	50000	ND		390	J	76	J	ND		ND		210	J	ND		12000	U	ND		ND	
Fluoranthene	330	50000	100	J	1300		330	J	170	J	90	J	1600		140	J	560	J	ND		ND	
Pyrene	330	50000	82	J	1000		320	J	170	J	51	J	1400		ND		720	J	ND		ND	
Benzo(a)Anthracene	330	224	ND		590		94	J	120	J	ND		1100		ND		12000	U	ND		ND	
Chrysene	330	400	53	J	470		100	J	120	J	ND		1100		ND		12000	U	ND		ND	
Benzo(b)fluoranthene	330	1100	69	J	480		ND		130	J	ND		1500		ND		12000	U	ND		ND	
Benzo(k)fluoranthene	330	1100	23	J	130	J	ND		45	J	ND		490		ND		12000	U	ND		ND	
Benzo(a)pyrene	330	61	ND		290	J	ND		130	J	ND		1100		ND		12000	U	ND		ND	
Units	ug/Kg	ug/Kg	ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg	

500 Results > or = to NYSDEC ARARs

ND=Not Detected Above the MDL (Method Detection Limit)

Data Qualifiers

J=Reported result falls between the established MDL and CRQL
D=compounds identified at a secondary dilution factor
U=compound not detected at the medium level method CRQL shown

Table 5-4. Summary of Results for Petroleum Indicator Compounds in Soil

SAMPLE INFORMATION																								
LOCATION			GP12		GP13		GP14		GP14		GP15		GP15		GP19		GP19		GP19		GP22		GP22	
DEPTH			8-10 ft		0-2 ft		0-2 ft		8-10 ft		0-2 ft		10-12 ft		0-2 ft		0-2 ft dup		10-12 ft		0-2 ft		4-6 ft	
SAMPLE NUMBER:			G1281		G1302		G1402		G1481		G1502		G1510		G1902		G192D		G1910		G2202		G2246	
DATE SAMPLED:			08/07/95		08/07/95		08/07/95		08/07/95		08/07/95		08/07/95		08/07/95		08/07/95		08/08/95		08/08/95		08/08/95	
ANALYTICAL INFORMATION																								
VOCs																								
DATE ANALYZED:			08/11/95		08/11/95		08/09/95		08/09/95		08/09/95		08/09/95		08/09/95		08/09/95		08/15/95		08/10/95		08/10/95	
Analyte	**CRQL**	**ARAR**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**
Benzene	10	60	1400	U	1400	U	ND		4	J	ND		ND		ND		ND		ND		ND		1500	U
Toluene	10	1500	1400	U	1400	U	ND		ND		ND		ND		ND		ND		0.9	J	ND		1500	U
Ethylbenzene	10	5500	840	J	380	J	ND		6	J	ND		1	J	ND		ND		ND		3	J	4100	
Xylene (total)	10	1200	2200		16000		6	J	2	J	ND		ND		2	J	1	J	ND		5	J	5200	
Units	ug/Kg	ug/Kg	ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg	
SVOCs																								
DATE EXTRACTED			8/10/95		8/10/95		8/9/95		8/9/95				8/16/95		8/16/95		8/9/95		8/11/95		8/11/95		8/11/95	
DATE ANALYZED:			8/16/95		8/16/95		8/15/95		8/15/95		8/15/95		8/23/95		8/23/95		8/15/95		8/23/95		8/21/95		8/21/95	
Analyte	**CRQL**	**ARAR**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**
Phonol	330	30	2700	J	12000	U	53	J	84	J	130	J	280	J	68	J	49	J	150	J	ND		ND	
Naphthalene	330	1300	1900	J	13000		4	J	ND		ND		ND		ND		ND		ND		ND		940	
2-Methylnaphthalene	330	3640	8900	J	28000		9	J	ND		ND		ND		ND		11	J	ND		ND		1900	
Acenaphthene	330	50000	12000	U	12000	U	ND		ND		ND		ND		18	J	11	J	ND		ND		ND	
Fluorene	330	50000	260	J	580	J	ND		ND		ND		ND		32	J	19	J	ND		ND		29	J
Phenanthrene	330	50000	12000	U	12000	U	48	J	22	J	ND		ND		600		120	J	24	J	29	J	18	J
Anthracene	330	50000	12000	U	12000	U	ND		ND		ND		ND		86	J	22	J	ND		ND		ND	
Fluoranthene	330	50000	12000	U	12000	U	150	J	ND		ND		ND		940		92	J	30	J	70	J	410	J
Pyrene	330	50000	12000	U	12000	U	160	J	ND		ND		ND		940		110	J	300	J	50	J	410	J
Benzo(a)Anthracene	330	224	12000	U	12000	U	87	J	ND		ND		ND		560		56	J	ND		ND		ND	
Chrysene	330	400	12000	U	12000	U	110	J	ND		ND		ND		820		58	J	ND		ND		ND	
Benzo(b)fluoranthene	330	1100	12000	U	12000	U	140	J	ND		ND		ND		760		38	J	ND		49	J	410	J
Benzo(k)fluoranthene	330	1100	12000	U	12000	U	60	J	ND		ND		ND		240	J	14	J	ND		27	J	410	J
Benzo(a)pyrene	330	61	12000	U	12000	U	86	J	ND		ND		ND		490		ND		240	J	ND		ND	
Units	ug/Kg	ug/Kg	ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg	

▨ 500 Results > or = to NYSDEC ARARs

ND=Not Detected Above the MDL (Method Detection Limit)

Data Qualifiers

J=Reported result falls between the established MDL and CRQL

D=compounds identified at a secondary dilution factor

U=compound not detected at the medium level method CRQL shown

Table 5-4. Summary of Results for Petroleum Indicator Compounds in Soil

SAMPLE INFORMATION																						
LOCATION			GP22		GP24		GP26		GP26		GP26		GP28		G29		GP29		GP31		GP31	
DEPTH			8-10 ft		2-4 ft		0-2 ft		10-12 ft		5-7 ft		10-12 ft		0-2 ft		10-12 ft		0-2 ft		3-5 ft	
SAMPLE NUMBER:			G2281		G2424		G2602		G2610		G2657		G2810		G2902		G2910		G3102		G3135	
DATE SAMPLED:			08/08/95		08/08/95		08/08/95		08/08/95		08/08/95		08/10/95		08/08/95		08/08/95		08/08/95		08/08/95	
ANALYTICAL INFORMATION																						
VOCs																						
DATE ANALYZED:			08/10/95		08/12/95		08/11/95		08/11/95		08/11/95		08/21/95		08/12/95		08/11/95		08/11/95		08/10/95	
Analyte	**CRQL**	**ARAR**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**
Benzene	10	60	ND		ND		ND		1400	U	1300	U	1400	U	ND		ND		ND		ND	
Toluene	10	1500	ND		ND		ND		1400	U	1300	U	1400	U	ND		ND		ND		ND	
Ethylbenzene	10	5500	200		ND		ND		▨ 7400		450	BJ	1300	J	2	J	ND		ND		1	J
Xylene (total)	10	1200	250		ND		ND		▨ 28000		▨ 1800	J	▨ 4800		4	J	ND		ND		1	J
Units	ug/Kg	ug/Kg	ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg	
SVOCs																						
DATE EXTRACTED			8/11/95		8/11/95		8/11/95		8/11/95		8/11/95		8/16/95		8/11/95		8/11/95		8/11/95		8/11/95	
DATE ANALYZED:			8/21/95		8/22/95		8/21/95		8/21/95		8/21/95		8/25/95		8/23/95		8/22/95		8/22/95		8/21/95	
Analyte	**CRQL**	**ARAR**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**
Phenol	330	30	▨ 160	J	12	J	▨ 140	J	ND		ND		ND		▨ 3200	J	▨ 280	J	▨ 94	J	ND	
Naphthalene	330	1300	54	J	ND		ND		▨ 1800		1200		610		260	J	ND		ND		ND	
2-Methylnaphthalene	330	3640	98	J	ND		ND		3000		2100		1500	D	160	J	ND		ND		ND	
Acenaphthene	330	50000	ND		ND		ND		350	J	280	J	91	DJ	410	J	ND		ND		ND	
Fluorene	330	50000	ND		ND		ND		360	J	280	J	75	DJ	630	J	ND		ND		ND	
Phenanthrene	330	50000	ND		ND		140	J	1700		1400		230	DJ	7600		ND		110	J	ND	
Anthracene	330	50000	ND		ND		ND		640		480		53	J	970	J	ND		ND		ND	
Fluoranthene	330	50000	ND		ND		410		2100		1600		200	J	9000		ND		270	J	ND	
Pyrene	330	50000	ND		ND		210	J	1200		1100		170	DJ	8100		ND		140	J	ND	
Benzo(a)Anthracene	330	224	ND		ND		140	J	▨ 680		▨ 560		62	J	▨ 5000		ND		96	J	ND	
Chrysene	330	400	ND		ND		180	J	▨ 570		▨ 440		52	J	▨ 5100		ND		110	J	ND	
Benzo(b)fluoranthene	330	1100	ND		ND		230	J	510		480		46	J	▨ 6000		ND		150	J	ND	
Benzo(k)fluoranthene	330	1100	ND		ND		72	J	200	J	150	J	24	J	▨ 1800	J	ND		44	J	ND	
Benzo(a)pyrene	330	61	ND		ND		▨ 140	J	▨ 360	J	▨ 290	J	ND		▨ 3000	J	ND		▨ 97	J	ND	
Units	ug/Kg	ug/Kg	ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg	

▨ 500 Results > or = to NYSDEC ARARs

ND=Not Detected Above the MDL (Method Detection Limit)

Data Qualifiers

J=Reported result falls between the established MDL and CRQL

D=compounds identified at a secondary dilution factor

U=compound not detected at the medium level method CRQL shown

Table 5-4. Summary of Results for Petroleum Indicator Compounds in Soil

SAMPLE INFORMATION																								
LOCATION			GP31		GP32		GP32		GP34		GP34		GP38		GP38		GP38		GP44		GP44		GP44	
DEPTH			7-9 ft		0-2 ft		8-10 ft		0-2 ft		8-10 ft		0-2 ft		0-2 ft dup		8-10 ft		0-0.5 ft		0-2 ft		5-7 ft	
SAMPLE NUMBER:			G3179		G3202		G3281		G3402		G3481		G3802		G382D		G3881		G4406		G4402		G4457	
DATE SAMPLED:			08/08/95		08/08/95		08/08/95		08/08/95		08/08/95		08/08/95		08/08/95		08/08/95		08/10/95		08/10/95		08/10/95	
ANALYTICAL INFORMATION																								
VOCs																								
DATE ANALYZED:			08/10/95		08/11/95		08/11/95		08/15/95		08/11/95		08/11/95		08/15/95		08/11/95		08/21/95		08/15/95		08/15/95	
Analyte	**CRQL**	**ARAR**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**
Benzene	10	60	ND		ND		27		ND		ND		ND		ND		ND		1500	U	ND		ND	
Toluene	10	1500	ND		ND		ND		0.8	J	ND		ND		ND		ND		1500	U	ND		ND	
Ethylbenzene	10	5500	5	J	ND		85		ND		ND		ND		2	J	1	J	1400	J	ND		ND	
Xylene (total)	10	1200	16		ND		86		4	JB	0.9	J	0.9	J	7	J	4	J	5000		ND		ND	
Units	ug/Kg	ug/Kg	ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg	
SVOCs																								
DATE EXTRACTED			8/11/95		8/11/95		8/11/95		8/11/95		8/11/95		8/11/95		8/11/95		8/11/95		8/16/95		8/16/95		8/16/95	
DATE ANALYZED:			8/21/95		8/22/95		8/21/95		8/22/95		8/22/95		8/21/95		8/22/95		8/21/95		8/25/95		8/24/95		8/24/95	
Analyte	**CRQL**	**ARAR**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**
Phenol	330	30	200	J	310	J	1100		820		ND		1800		930		380	J	ND		220	J	240	J
Naphthalene	330	1300	ND		ND		100	J	16	J	ND		ND		9	J	ND		1000		ND		ND	
2-Methylnaphthalene	330	3640	ND		21	J	240	J	28	J	ND		ND		8	J	ND		2200		ND		ND	
Acenaphthene	330	50000	ND		ND		32	J	ND		ND		ND		ND		ND		120	J	ND		ND	
Fluorene	330	50000	ND		ND		34	J	ND		ND		ND		ND		ND		120	J	ND		ND	
Phenanthrene	330	50000	ND		ND		210	J	ND		ND		ND		190	J	ND		410		ND		ND	
Anthracene	330	50000	ND		ND		80	J	ND		ND		ND		31	J	ND		110	J	ND		ND	
Fluoranthene	330	50000	ND		ND		310	J	38	J	ND		ND		470		ND		420		ND		ND	
Pyrene	330	50000	ND		26	J	190	J	ND		ND		ND		180	J	ND		260	J	ND		ND	
Benzo(a)Anthracene	330	224	ND		ND		120	J	ND		ND		ND		160	J	ND		130	J	ND		ND	
Chrysene	330	400	ND		ND		110	J	ND		ND		ND		230	J	ND		100	J	ND		ND	
Benzo(b)fluoranthene	330	1100	ND		ND		91	J	ND		ND		ND		330	J	ND		110	J	ND		ND	
Benzo(k)fluoranthene	330	1100	ND		ND		22	J	ND		ND		ND		110	J	ND		30	J	ND		ND	
Benzo(a)pyrene	330	61	ND		ND		ND		ND		ND		ND		100	J	ND		ND		ND		ND	
Units	ug/Kg	ug/Kg	ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg	

▨ 500 Results > or = to NYSDEC ARARs

ND=Not Detected Above the MDL (Method Detection Limit)

Data Qualifiers

J=Reported result falls between the established MDL and CRQL

D=compounds identified at a secondary dilution factor

U=compound not detected at the medium level method CRQL shown

Table 5-4. Summary of Results for Petroleum Indicator Compounds in Soil

SAMPLE INFORMATION																						
LOCATION			GP44		GP45		GP45		GP45		HA12		HA16		HA16		HA20		HA21		HA22	
DEPTH			8-10 ft		0-2 ft		5-7 ft		8-10 ft		0-2 ft		2-4 ft		8-10 ft		0-0.5 ft		0-0.5 ft		0-0.5 ft	
SAMPLE NUMBER:			G4481		G4502		G4557		G4581		H1202		H1624		H1681		H2006		H2106		H2206	
DATE SAMPLED:			08/10/95		08/10/95		08/10/95		08/10/95		08/10/95		08/10/95		08/10/95		08/10/95		08/10/95		08/10/95	
ANALYTICAL INFORMATION																						
VOCs																						
DATE ANALYZED:			08/15/95		08/17/95		08/18/95		08/15/95		08/21/95		08/21/95		08/21/95		08/18/95		08/20/95		08/21/95	
Analyte	**CRQL**	**ARAR**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**
Benzene	10	60	ND		ND		ND		ND		ND		1200	U	1500	U	ND		1400	U	1700	U
Toluene	10	1500	ND		ND		ND		ND		ND		1200	U	1500	U	ND		1400	U	1700	U
Ethylbenzene	10	5500	ND		ND		ND		1	J	ND		210	J	810	J	ND		1400	U	1700	U
Xylene (total)	10	1200	ND		ND		ND		4	JB	ND		3700		2800		7	DJ	1400	U	1700	U
Units	ug/Kg	ug/Kg	ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg	
SVOCs																						
DATE EXTRACTED			8/16/95		8/16/95		8/16/95		8/16/95		8/16/95		8/22/95		8/16/95		8/16/95		8/16/95		8/16/95	
DATE ANALYZED:			8/24/95		8/24/95		8/24/95		8/24/95		8/25/95		8/25/95		8/25/95		8/25/95		8/25/95		8/25/95	
Analyte	**CRQL**	**ARAR**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**		**Q**
Phenol	330	30	6000	D	40	J	500		1200		ND		11000	U	ND		ND		ND		ND	
Naphthalene	330	1300	ND		ND		ND		ND		ND		11000	U	400	J	ND		ND		15	J
2-Methylnaphthalene	330	3640	ND		ND		ND		ND		ND		2600	J	830		ND		ND		ND	
Acenaphthene	330	50000	ND		ND		ND		ND		ND		620	J	75	J	ND		ND		90	J
Fluorene	330	50000	ND		ND		ND		ND		ND		480	J	78	J	ND		26	J	140	J
Phenanthrene	330	50000	ND		ND		ND		ND		76	J	1900	J	340	J	75	J	250	J	1200	
Anthracene	330	50000	ND		ND		ND		ND		ND		470	J	83	J	ND		42	J	290	J
Fluoranthene	330	50000	ND		35	J	ND		ND		150	J	1600	J	360	J	150	J	460		1600	
Pyrene	330	50000	ND		26	J	ND		ND		87	J	1400	J	200	J	92	J	280	J	1300	
Benzo(a)Anthracene	330	224	ND		ND		ND		ND		51	J	11000	U	96	J	57	J	200	J	780	
Chrysene	330	400	ND		ND		ND		ND		73	J	11000	U	74	J	68	J	190	J	740	
Benzo(b)fluoranthene	330	1100	ND		ND		ND		ND		90	J	11000	U	77	J	85	J	250	J	860	
Benzo(k)fluoranthene	330	1100	ND		ND		ND		ND		31	J	11000	U	25	J	23	J	84	J	270	J
Benzo(a)pyrene	330	61	ND		ND		ND		ND		85	J	11000	U	ND		ND		130	J	700	
Units	ug/Kg	ug/Kg	ug/Kg		ug/Kg		ug/Kg		g/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg	

▨ 500 Results > or = to NYSDEC ARARs

ND=Not Detected Above the MDL (Method Detection Limit)

Data Qualifiers

J=Reported result falls between the established MDL and CRQL

D=compounds identified at a secondary dilution factor

U=compound not detected at the medium level method CRQL shown

TABLE 5-5a. Summary of PCB Results in Surface Soil

Location Number	Sample Date	Sample Depth	Sample Number	Analyte	Result (ug/Kg)	CRQL (ug/Kg)	ARAR (ug/Kg)
SURFACE SAMPLES WITH PCBS GREATER THAN ARARS							
BO-4	1990	0-2 ft.	BO-4	PCB-1260	13,000	17	1,000
BO-5	1990	0-2 ft.	BO-5	PCB-1260	35,000	17	1,000
BO-6	1990	0-2 ft.	BO-6	PCB-1260	110,000	17	1,000
BO-7	1990	0-2 ft.	BO-7	PCB-1260	240,000	17	1,000
BO-8	1990	0-2 ft.	BO-8	PCB-1260	14,000	17	1,000
BO-9	1990	0-2 ft.	BO-9	PCB-1260	240,000	17	1,000
BO-14	1990	0-2 ft.	BO-14	PCB-1260	97,000	17	1,000
BO-15	1990	0-2 ft.	BO-15	PCB-1260	1,300	17	1,000
HA-26	6/11/96	0-2 ft.	HN HA26 0002	PCB-1260	1,600	71	1,000
HA-27	6/11/96	0-2 ft.	HN HA27 0002	PCB-1260	3,000	71	1,000
GP47	8/11/95	0-2 ft.	G4702*	PCB-1260	2,700	17	1,000
SURFACE SAMPLES WITH PCBS LESS THAN ARARS							
BO-1	1990	0-2 ft.	BO-1	PCB-1260	56	17	1,000
BO-2	1990	0-2 ft.	BO-2	PCB-1260	ND	17	1,000
BO-3	1990	0-2 ft.	BO-3	PCB-1260	ND	17	1,000
BO-10	1990	0-2 ft.	BO-10	PCB-1260	130	17	1,000
BO-11	1990	0-2 ft.	BO-11	PCB-1260	930	17	1,000
BO-12	1990	0-2 ft.	BO-12	PCB-1260	190	17	1,000
BO-13	1990	0-2 ft.	BO-13	PCB-1260	280	17	1,000
BO-16	1990	0-2 ft.	BO-16	PCB-1260	100	17	1,000
HA12	8/10/95	0-2 ft.	H1202	PCB-1260	140	17	1,000
HA20	8/10/95	0-0.5 ft.	H2006	PCB-1260	27	17	1,000
HA21	8/10/95	0-0.5 ft.	H2106	PCB-1260	ND*	17	1,000
HA22	8/10/95	0-0.5 ft.	H2206	PCB-1260	ND*	17	1,000
HA24	6/11/96	0-2 ft.	HN HA24 0002	PCB-1260	200	71	1,000
HA 25	6/11/96	0-2 ft.	HN HA25 0002	PCB-1260	72	71	1,000
GP13	8/11/95	0-2 ft.	G1302	PCB-1260	180	17	1,000
GP22	8/11/95	0-2 ft.	G2202	PCB-1260	260	17	1,000
GP23	8/11/95	0-2 ft.	G2302	PCB-1260	66	17	1,000
GP29	8/11/95	0-2 ft.	G2902	PCB-1260	570	17	1,000
GP31	8/11/95	0-2 ft.	G3102	PCB-1260	ND*	17	1,000
GP44	8/10/95	0-2 ft.	G4402	PCB-1260	44	17	1,000
GP45	8/10/95	0-2 ft.	G4502	PCB-1260	ND*	17	1,000
GP48	8/11/95	0-2 ft.	G4802	PCB-1260	400	17	1,000
GP48	8/11/95	0-2 ft.	G482D	PCB-1260	150	17	1,000
GP49	8/11/95	0-2 ft.	G4902	PCB-1260	30	17	1,000

*ND=Not Detected at concentrations greater than the established MDLs for target compounds

*Sample was diluted because of high concentrations of compounds in sample, therefore target compounds at low concentrations may not be identified

TABLE 5-5b. Summary of PCB Results in Subsurface Soil

Sample Information				Analytical Information			
Location Number	Sample Date	Sample Depth	Sample Number	Analyte	Results (ug/Kg)	CRQL (ug/Kg)	ARAR (ug/Kg)
SUBSURFACE SAMPLES WITH PCBS GREATER THAN ARARS							
HA8	8/10/95	2-4 ft.	H0824*	PCB-1260	62,000	17	10,000
HA4	8/10/95	4-6 ft.	H4406*	PCB-1260	21000	17	10,000
HA4	8/10/95	8-10 ft.	H4810*	PCB-1260	150,000	17	10,000
SUBSURFACE SAMPLES WITH PCBS LESS THAN ARARS							
HA16	8/10/95	2-4 ft.	H1624	PCB-1260	2600	17	10,000
HA16	8/10/95	8-10 ft.	H1681	PCB-1260	320	17	10,000
HA28	8/10/95	8-10 ft.	H2810	PCB-1260	360	17	10,000
HA26	6/11/96	2-4 ft.	HN HA26 0204	PCB-1260	210	82	10,000
HA27	6/11/96	2-4 ft.	HN HA27 0204	PCB-1260	80	80	10,000
GP10	8/11/95	2-4 ft.	G1024	PCB-1260	230	17	10,000
GP12N	8/11/95	2-4 ft.	G12N2	PCB-1260	ND*	17	10,000
GP12S	8/11/95	2-4 ft.	G12S2	PCB-1260	ND*	17	10,000
GP13	8/11/95	2-4 ft.	G1324	PCB-1260	ND*	17	10,000
GP26W	8/11/95	2-4 ft.	G26W2	PCB-1260	ND*	17	10,000
GP26S	8/11/95	2-4 ft.	G26S2	PCB-1260	ND*	17	10,000
GP26S	8/11/95	2-4 ft.	G26SD	PCB-1260	ND*	17	10,000
GP29	8/11/95	2-4 ft.	G2924	PCB-1260	ND*	17	10,000

*ND=Not Detected at concentrations greater than the established MDLs for target compounds

*Sample was diluted because of high concentrations of compounds in sample, therefore target compounds at low concentrations may not be identified

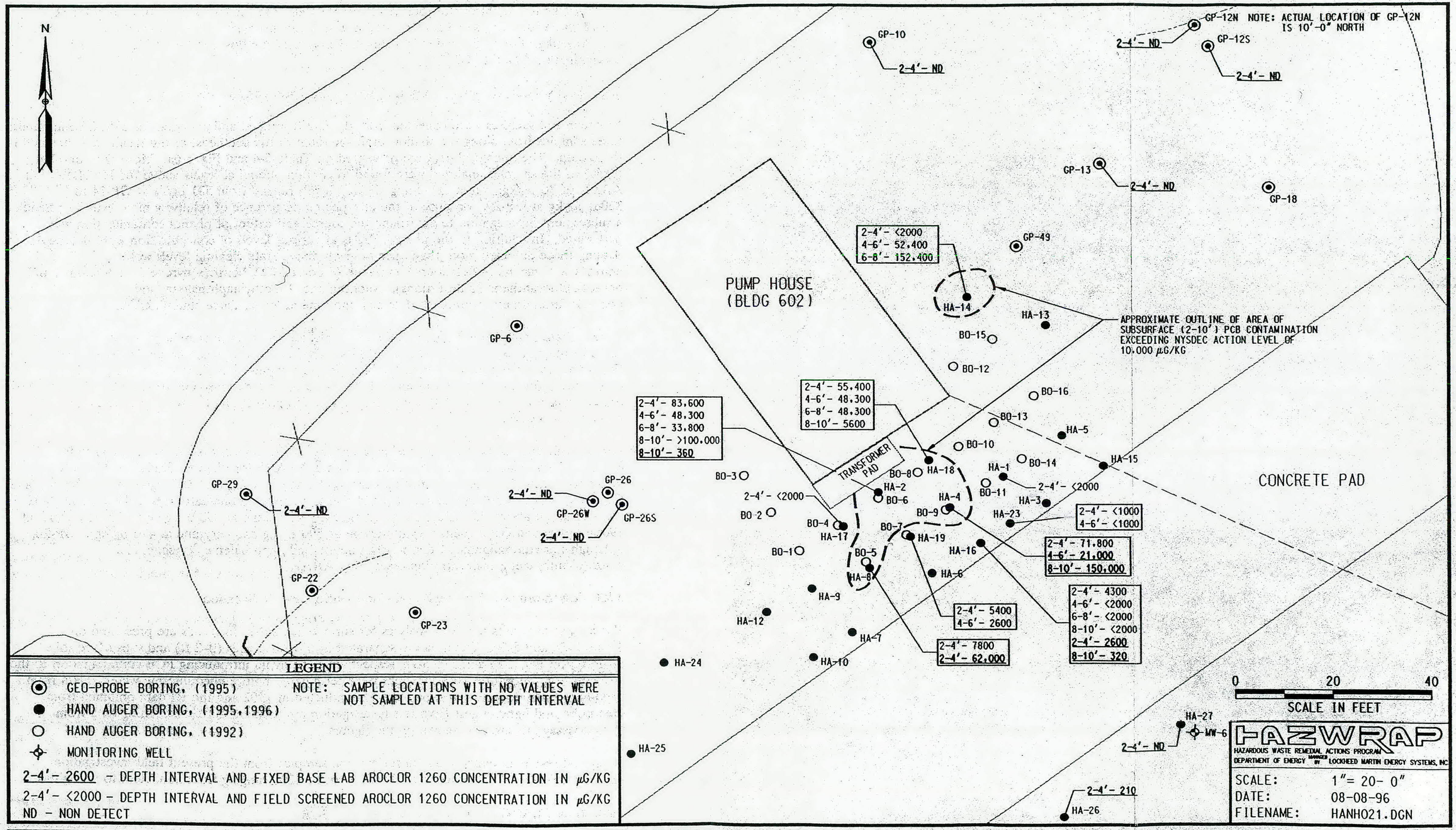


Fig. 5-7b. PCB Concentrations Subsurface Soils (2-10 ft), Fixed Base Lab Data from RI (1995) and Field Screening Data RI (1995), POL Area, 174th FW, NYANG, Hancock Field, Syracuse, NY.

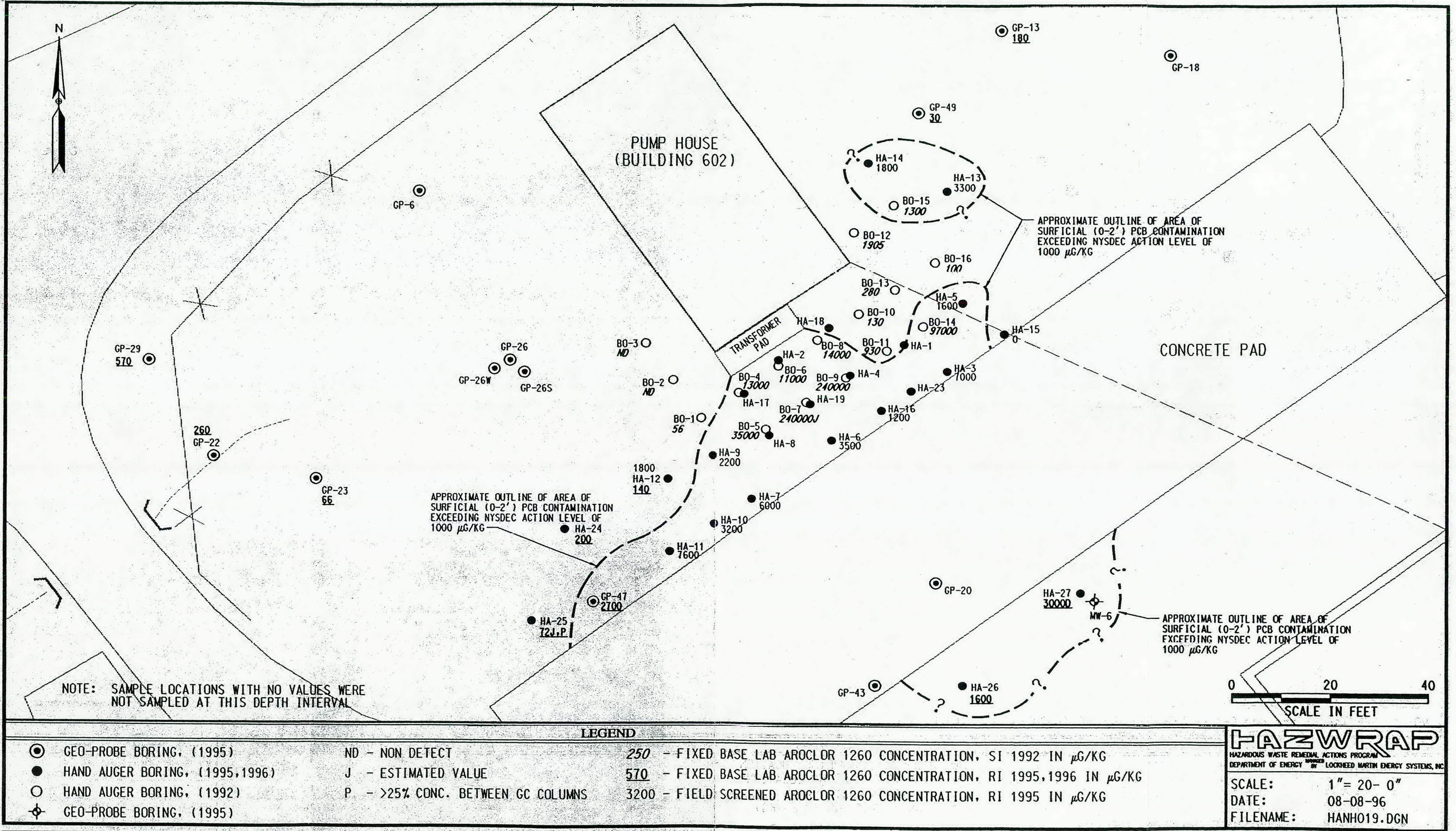
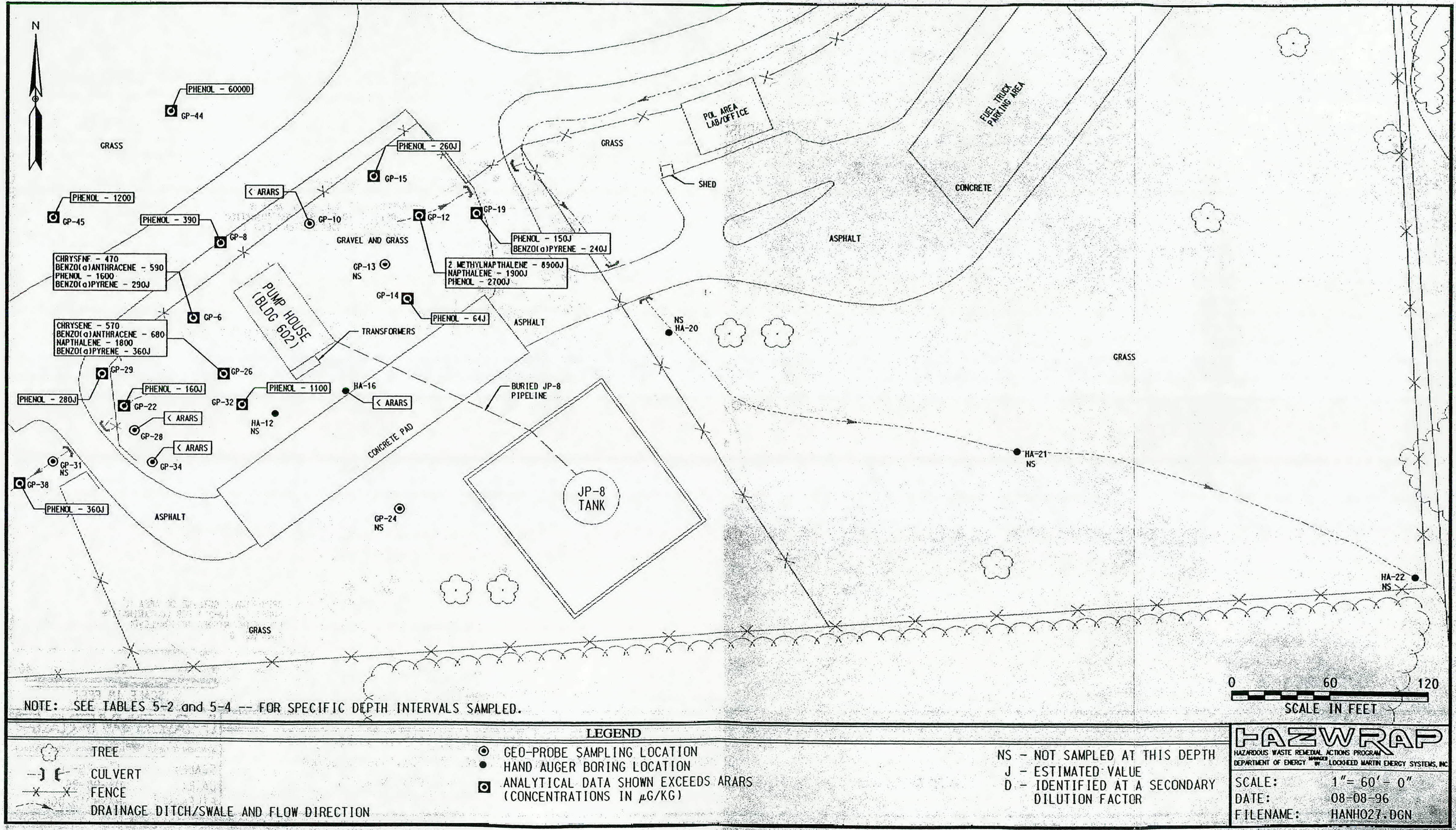
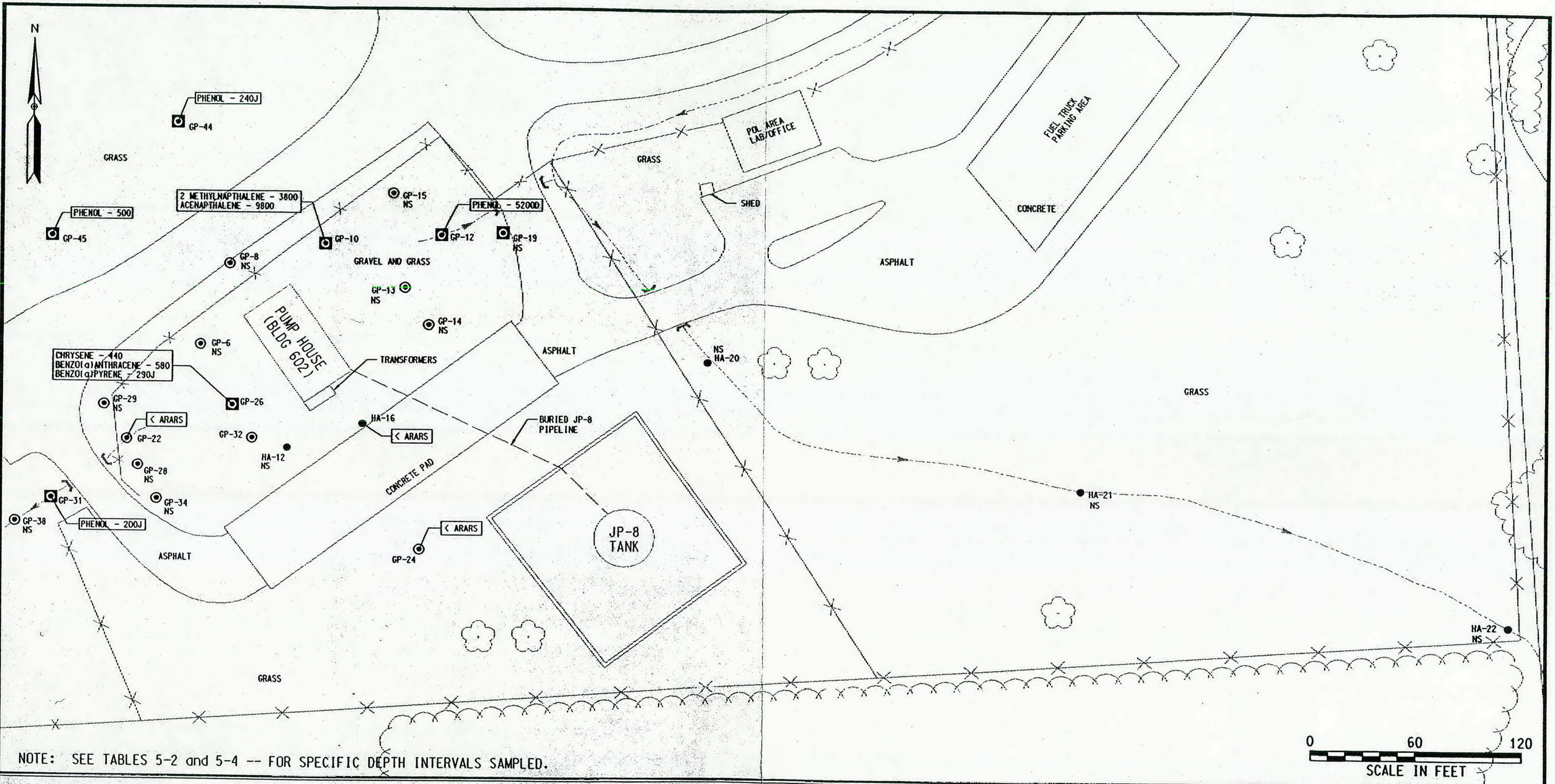


Fig. 5-7a. PCB Concentrations Surface Soils (0-2 ft), Fixed Base Lab Data From SI (1992), RI (1995) and Field Screening Data RI (1995), POL Area, 174th FW, NYANG, Hancock Field, Syracuse, NY.



NOTE: SEE TABLES 5-2 and 5-4 -- FOR SPECIFIC DEPTH INTERVALS SAMPLED.

Fig. 5-6c. Soils Analytical Data Map, Semivolatile Concentrations-Approximate Capillary Fringe, POL Area, 174th FW, NYANG, Hancock Field, Syracuse, NY.



NOTE: SEE TABLES 5-2 and 5-4 -- FOR SPECIFIC DEPTH INTERVALS SAMPLED.

LEGEND

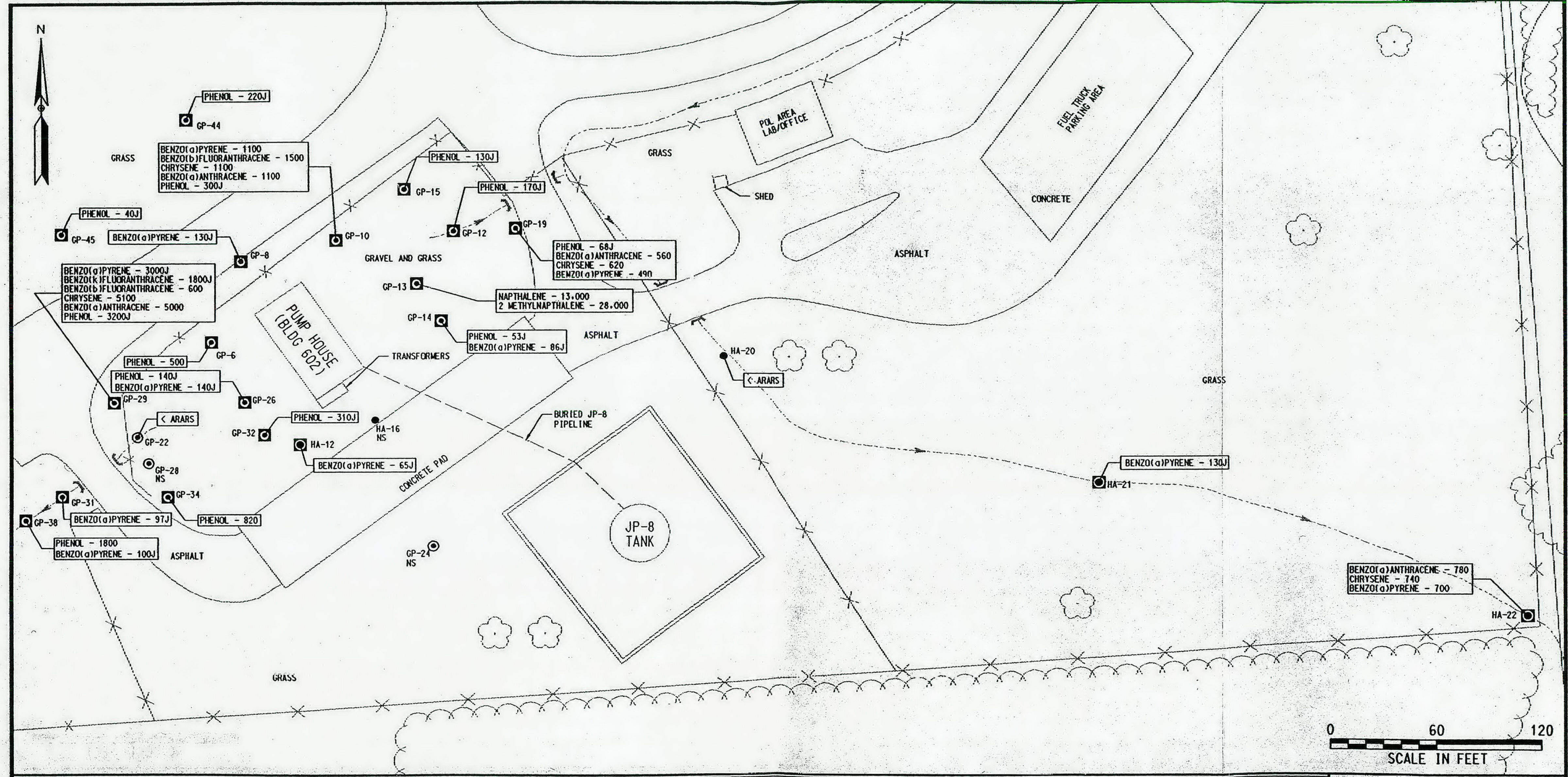
✿	TREE	◉	GEO-PROBE SAMPLING LOCATION
—] [—	CULVERT	●	HAND AUGER BORING LOCATION
—×—×—	FENCE	▣	ANALYTICAL DATA SHOWN EXCEEDS ARARS (CONCENTRATIONS IN μG/KG)
---→---	DRAINAGE DITCH/SWALE AND FLOW DIRECTION		

NS - NOT SAMPLED AT THIS DEPTH
J - ESTIMATED VALUE
D - IDENTIFIED AT A SECONDARY DILUTION FACTOR

HAZWRAP
HAZARDOUS WASTE REMEDIAL ACTIONS PROGRAM
DEPARTMENT OF ENERGY MANAGED BY LOCKHEED MARTIN ENERGY SYSTEMS, INC

SCALE: 1″= 60′- 0″
DATE: 02-24-97
FILENAME: HANH028.DGN

Fig. 5-6b. Soils Analytical Data Map, Semivolatile Concentrations-Intermediate Depths, POL Area, 174th FW, NYANG, Hancock Field, Syracuse, NY.



LEGEND

✿	TREE
–] [–	CULVERT
–×–×–	FENCE
---→---	DRAINAGE DITCH/SWALE AND FLOW DIRECTION
◎	GEO-PROBE SAMPLING LOCATION
●	HAND AUGER BORING LOCATION
▣	ANALYTICAL DATA SHOWN EXCEEDS ARARS; (CONCENTRATIONS IN µG/KG)

NS - NOT SAMPLED AT THIS DEPTH
J - ESTIMATED VALUE

HAZWRAP
HAZARDOUS WASTE REMEDIAL ACTIONS PROGRAM
DEPARTMENT OF ENERGY MANAGED BY LOCKHEED MARTIN ENERGY SYSTEMS, INC.

SCALE: 1″= 60′- 0″
DATE: 02-24-97
FILENAME: HANH026.DGN

Fig. 5-6a. Soils Analytical Data Map, Semivolatile Concentrations-Surficial (0-2 ft), POL Area, 174th FW, NYANG, Hancock Field, Syracuse, NY.

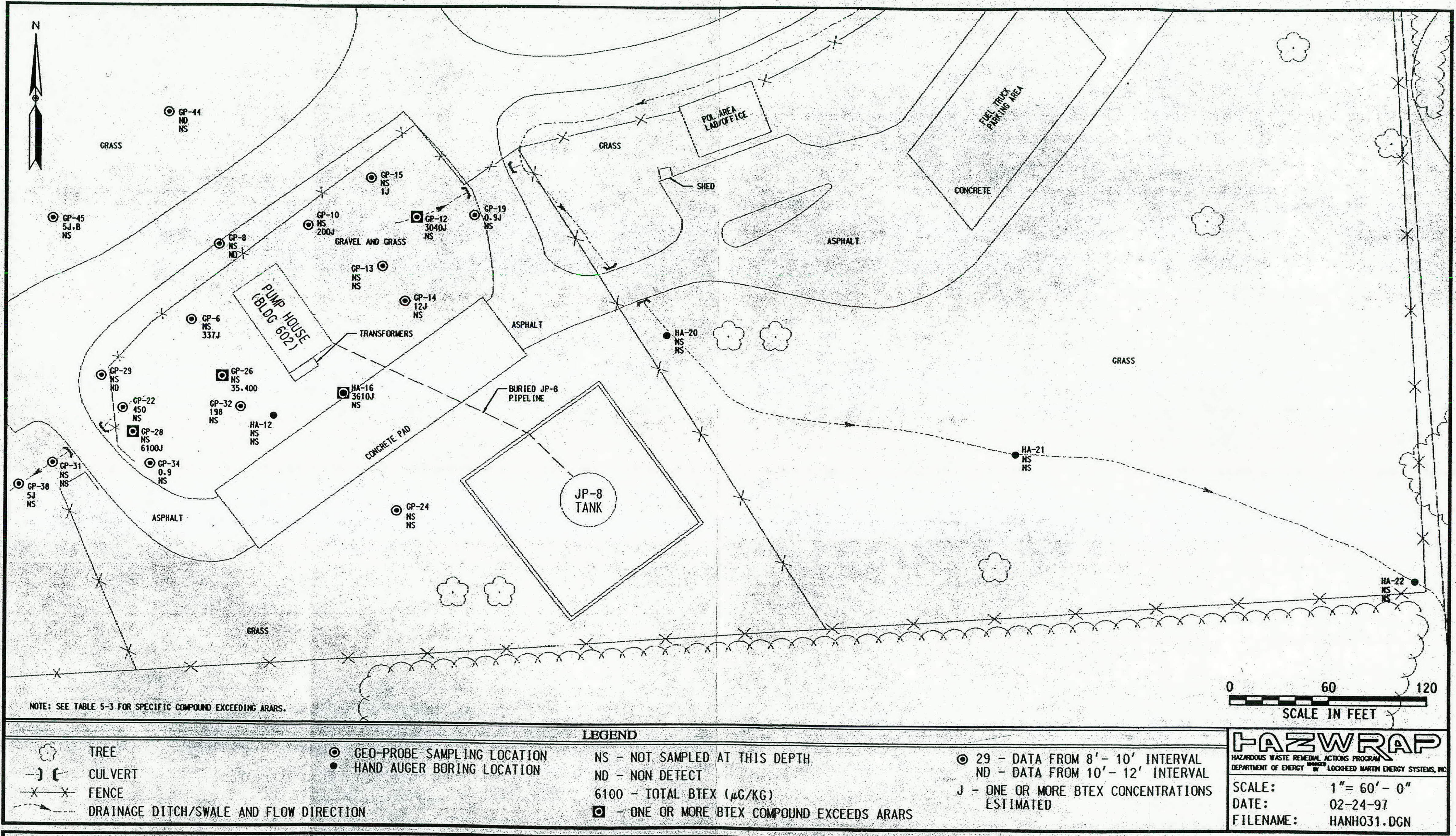


Fig. 5-5c. Soils Analytical Data Map, Total BTEX Concentrations-Capillary Fringe, POL Area, 174th FW, NYANG, Hancock Field, Syracuse, NY.

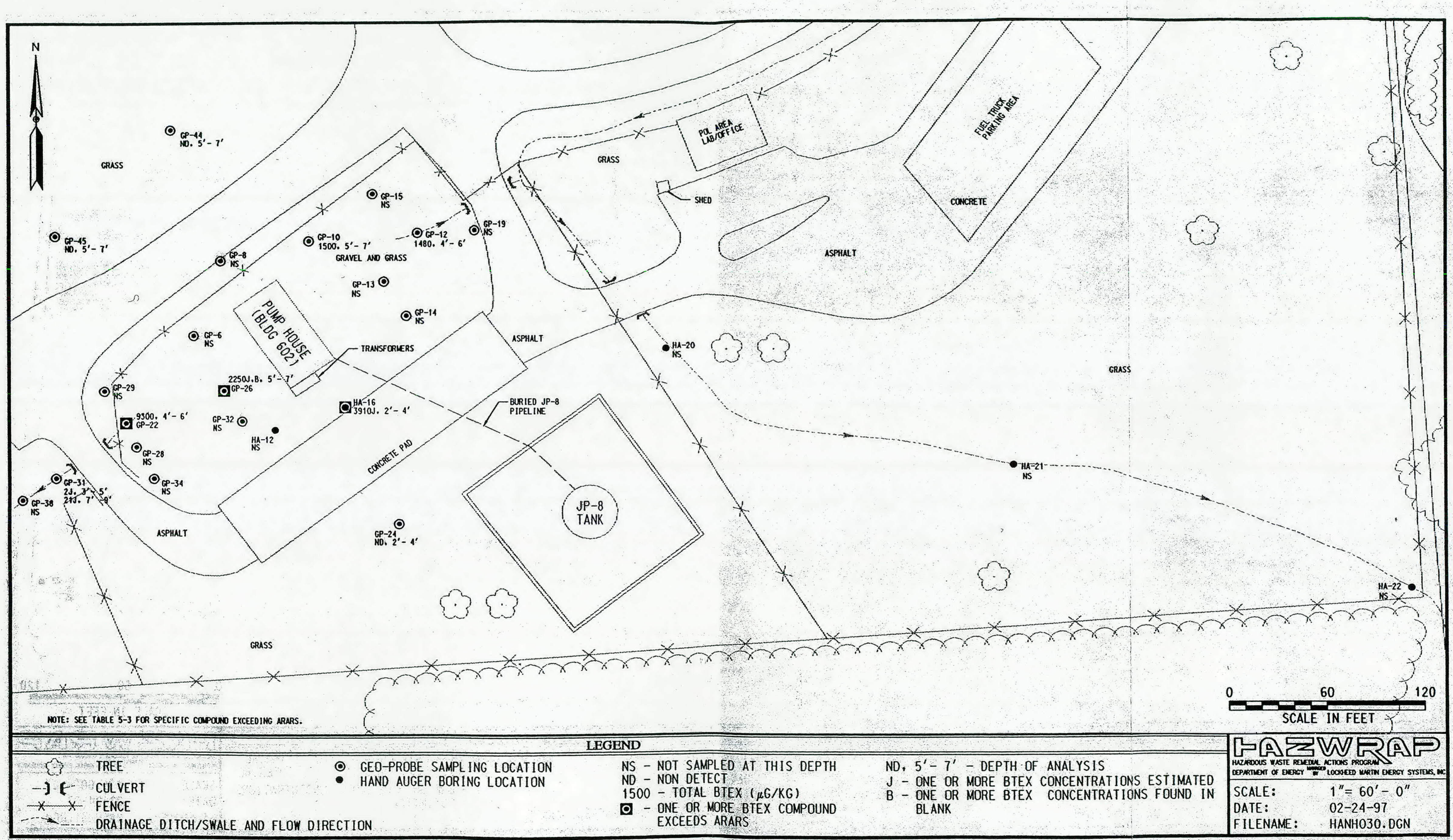
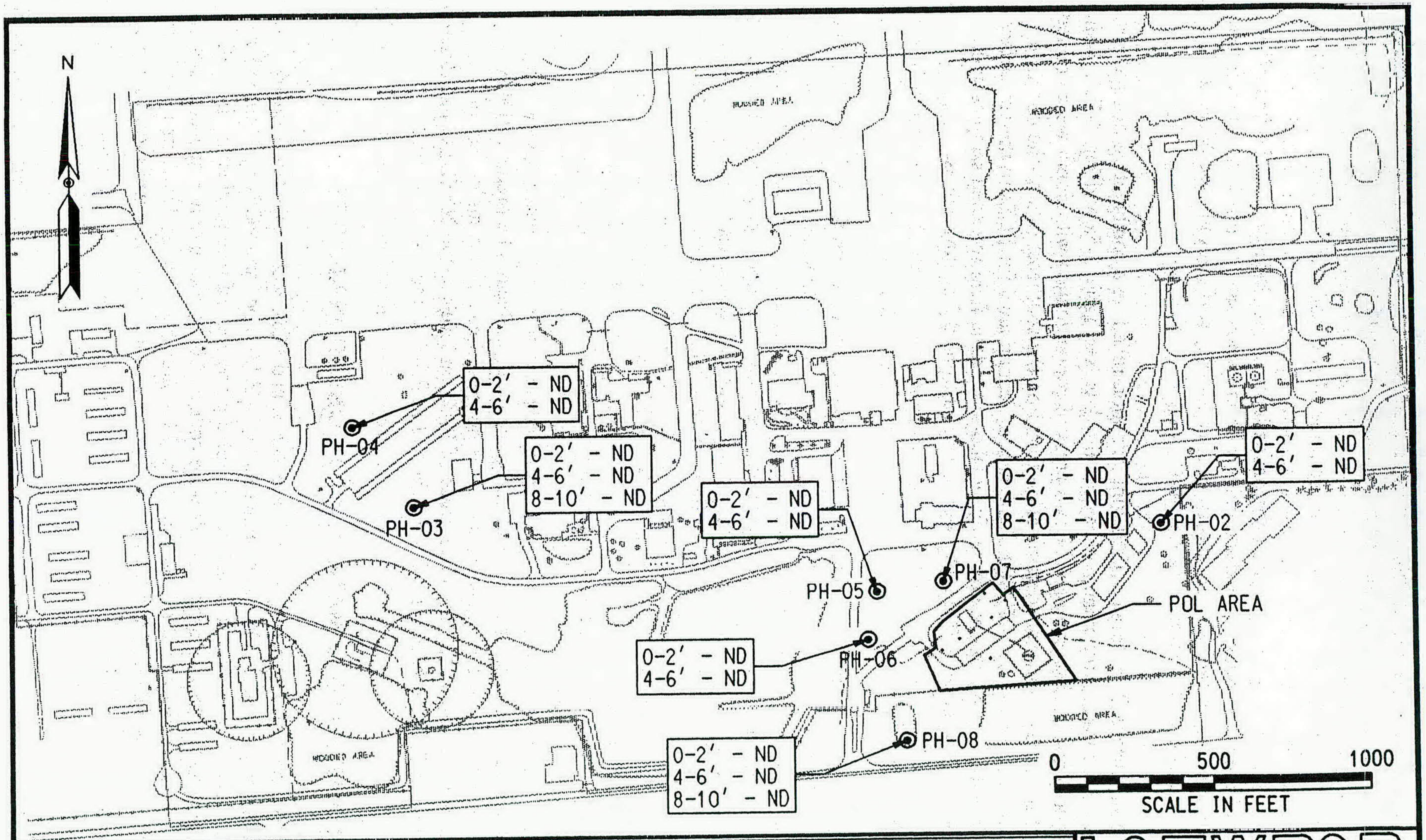


Fig. 5-5b. Soils Analytical Data Map, Total BTEX Concentrations-Intermediate Depths, POL Area, 174th FW, NYANG, Hancock Field, Syracuse, NY.



LEGEND

⦿ PH-04	GEO-PROBE SAMPLING LOCATION
ND	NON DETECT
2-4′ - ND	SAMPLE DEPTH AND PHENOL DATA

HAZWRAP
HAZARDOUS WASTE REMEDIAL ACTIONS PROGRAM
DEPARTMENT OF ENERGY MANAGED BY MARTIN MARIETTA ENERGY SYSTEMS, INC.

SCALE: 1″= 500 ′ - 0″
DATE: 06-04-97
FILENAME: HANH035.DGN

Fig. 5-8. Sampling Locations and Soils Analytical Data Map, Phenol Concentrations, 174th FW, NYANG, Hancock Field, Syracuse, NY.

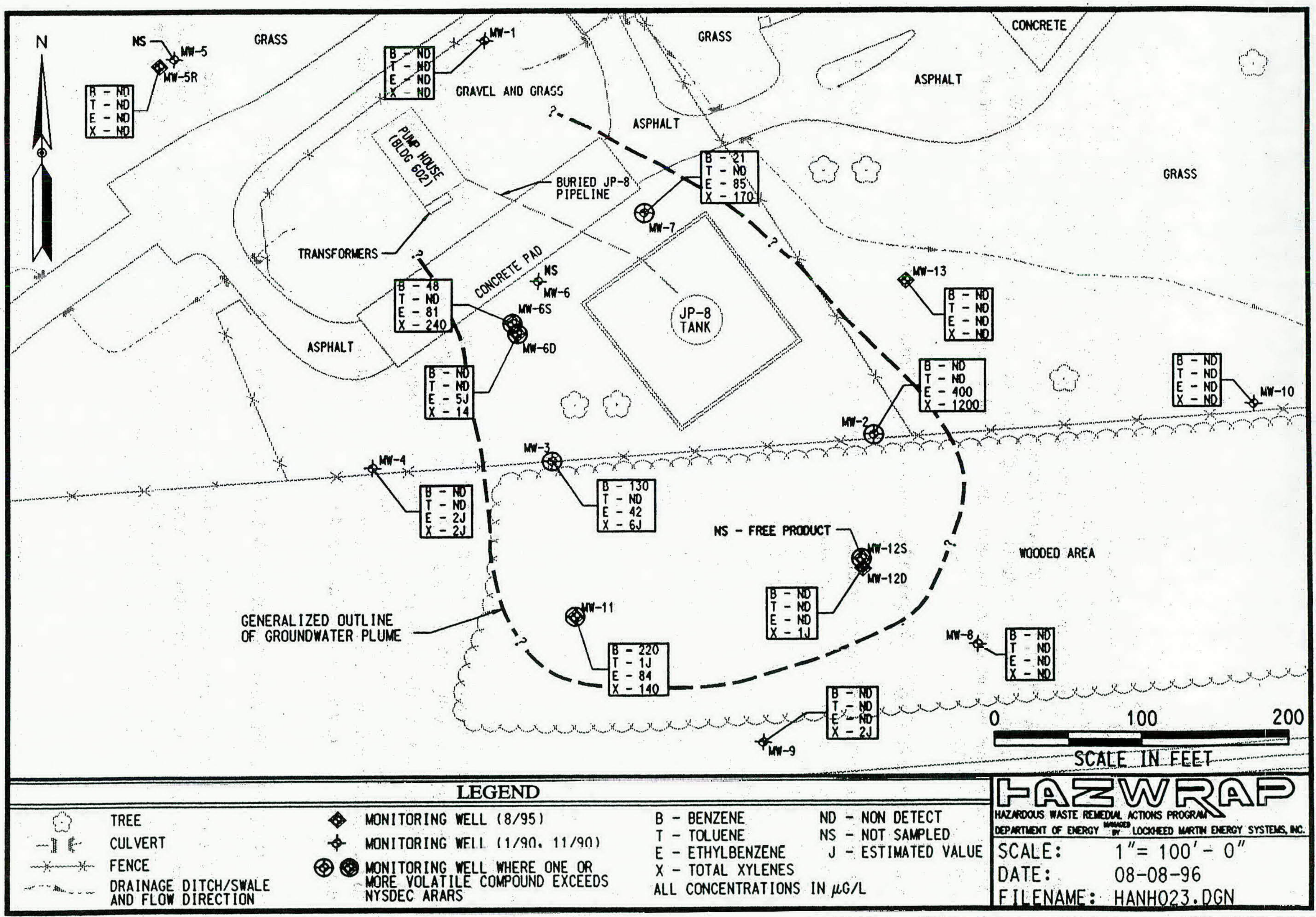


Fig. 5-9. Groundwater Sampling Results for Volatile Compounds - 1995, POL Area, 174th FW, NYANG, Hancock Field, Syracuse, NY.

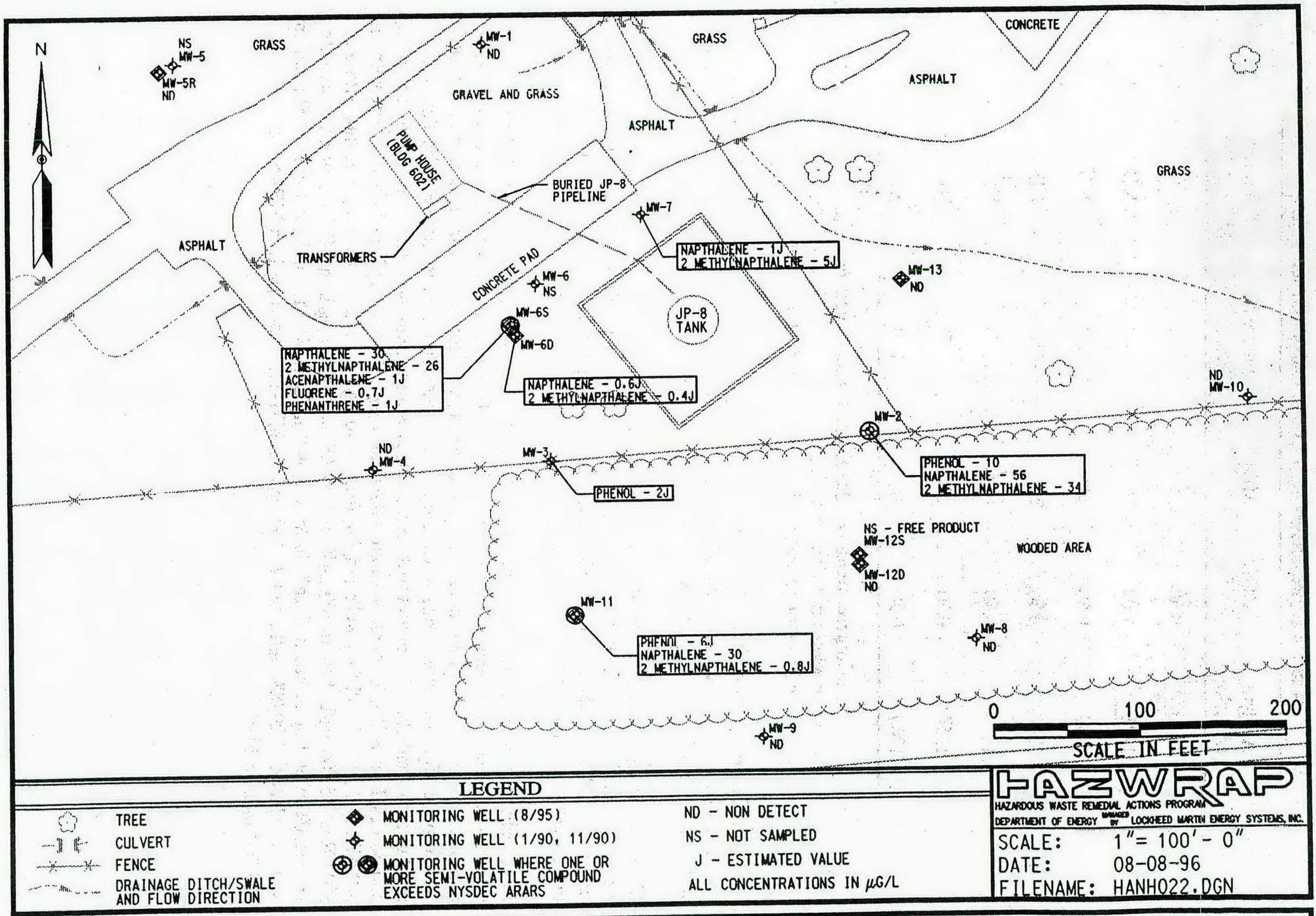


Fig. 5-10. Groundwater Sampling Results for Semivolatile Compounds - 1995, POL Area, 174th FW, NYANG, Hancock Field, Syracuse, NY.

Table 5-6. Results of PCB Compounds in Groundwater

Analyte (Aroclor)	CRQL[a]	MDL[b]	Filtered MWs 1–13[c]	Unfiltered MWs 1–13[c]
1016	0.50	21	ND	ND
1221	1.00	66	ND	ND
1232	0.50	31	ND	ND
1242	0.50	20	ND	ND
1248	0.50	16	ND	ND
1254	0.50	25	ND	ND
1260	0.50	20	ND	ND

a Contract-required Quantitation Limit; units in μg/L.
b Method detection limit.
c Monitoring wells MW-5, MW-6, and MW-12S not sampled.

BOD for the groundwater from four representative monitoring wells was determined by EPA Method 405.1. The data are presented on Table 5-9 and show values 6.0 mg/L in three of the wells (MW-6S, MW-7, MW-11) and 10 mg/L in one well (MW-2).

TDS were analyzed for by Method 160.2 in the same four wells. Results varied from a low of 62 mg/L in MW-6S to a high of 350 mg/L for MW-7. The TOC of the groundwater was analyzed using Method 415.1; the results for the wells analyzed ranged from 3.0 mg/L in MW-7 to 5.3 mg/L in MW-6S (see Table 5-9).

Four wells were sampled to determine the presence and/or concentration of metals that might be detrimental to potential remediation systems. Although metals are not considered a site-related problem, concentrations of six metals in the four wells sampled for inorganics exceeded ARARS (see Table 5-10). The monitoring wells sampled are considered representative of background conditions for metals. The metals with exceedances were aluminum, with an ARAR of 100 μg/L, had 300 μg/L in MW-11; cobalt, with an ARAR of 5 μg/L, had 7.3 μg/L in MW-6S; iron, with an ARARs 300 μg/L, in all four wells ranging from 1440 μg/L to 14,200 μg/L; magnesium, with an ARAR of 35,000 μg/L, had 36,200 μg/L in MW-6S and 44,500 μg/L in MW-11; manganese, with an ARAR of 300 μg/L, had 376 μg/L in MW-7, 449 μg/L in MW-11, and 1490 in MW-6S; sodium, with an ARAR of 20,000 μg/L, had 23,100 μg/L in MW-11, 24,500 μg/L in MW-6S, and 219,300 μg/L in MW-7.

Table 5-10. Summary of Target Analyte Metals in Groundwater

SAMPLE INFORMATION														
LOCATION			MW-2			MW-6S			MW-7			MW-11		
SCREENED INTERVAL (ft.)			3.6-13.6			4.6-14.6			4.6-14.6			8.8-18.8		
SAMPLE NUMBER:			MW-2X			MW-6S			MW-7X			MW-11		
DATE SAMPLED:			08/26/95			08/25/95			08/26/95			08/25/95		
ANALYTICAL INFORMATION														
TAL METALS														
DATE ANALYZED:			09/13/95			09/13/95			09/13/95			09/13/95		
Analyte	**CRDL**	**ARAR**[a]	**Result**	**C**[b]	**Q**[c]	**Result**	**C**	**Q**	**Result**	**C**	**Q**	**Result**	**C**	**Q**
Aluminum	200	100	ND			82.1	E		14.5			300		
Antimony	60	NS[d]	ND[e]		N	ND		N	ND		N	ND		N
Arsenic	10	NS	38		N*	3.8	B	N*	ND		N*	52	B	N*
Barium	200	1000	61.6	B		71	B		202			314		
Beryllium	5	11 or 1100[f]	ND			ND			0.12			ND		
Cadmium	5	10	ND			ND			ND			ND		
Calcium	5000	NS	82700			116000			ND			119000		
Chromium	10	11	ND			ND			0.54			ND		
Cobalt	50	5	ND			7.3	B		3.2	B		4.3	B	
Copper	25	200	1.2	B		4.4	B		ND			16.7	B	
Iron	100	300	4610		N*	1440		N*	14200		N*	9670		N*
Lead	3	25	ND			2.7	B		ND		W	6.3		
Magnesium	5000	35000	11300		N	36200		N	19400		N	44500		N
Manganese	15	300	282		N	1490		N	376		N	449		N
Mercury	0.2	2	ND			ND			ND			ND		
Nickel	40	NS	ND			ND			ND			ND		
Potassium	5000	NS	525	B		1090	B		408	B		672	B	
Selenium	5	10	ND		N	0.83	B	WN	ND		N	ND		WN
Silver	10	50	ND			ND			ND			ND		
Sodium	5000	20000	8580		N	24500		N	29300		N	23100		N
Thallium	10	NS	ND			ND		W	ND			ND		
Vanadium	50	14	ND			0.72	B		ND			0.76	B	
Zinc	20	300	2.1	B		ND			ND			18.7	B	
Units	ug/L	ug/L	ug/L			ug/L			ug/L			ug/L		

▨ 500 Results > or = to NYSDEC ARARs

[a] ARAR=Applicable or Relevant and Appropriate Requirements
The ARAR applied is the NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water Quality Standards and Guidance Values for Drinking Water

[b] "C" Laboratory Data Qualifiers
B=reported value is less than the CRDL, but greater than the IDL

[c] "Q" Laboratory Data Qualifiers
E=the reported value is estimated due to interference
M=duplicate injection precision not met
N=spiked sample recovery not within control limits
S=the reported value was determined by the method of standard additions
W=post-digestion spike for the furnace AA analysis is out of control limits
*=duplicate analysis is not within control limits
+correlation coefficient for the MSA is less than 0.995

[d] NS=No Standard

[e] ND=Not Detected

[f] The ARAR for Be is 11 ug/L when water hardness is less than or equal to 75 ppm, and 1100 ug/L when the hardness exceeds 75 ppm.

MAY 1998, SEPTEMBER-OCTOBER 1999 TREATABILITY STUDY

TABLE 5-1
ANALYTICAL RESULTS - SITE 15
GEOPROBE GAS CHROMATOGRAPH SCREENING RESULTS
HANCOCK AIR NATIONAL GUARD BASE
SYRACUSE, NEW YORK

PARAMETER	NEW YORK DWQS(1)	DETECTION LIMITS	GP-01	GP-02(3)	GP-02(4)	GP-03	GP-04	GP-05	GP-07(4)	GP-08	GP-09	GP-10
VOCs (µg/L)												
Vinyl Chloride	2	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	1	1	ND	38	ND	27	ND	ND	32	1.3	1.1	3.1
Toluene	5	1	ND	3.9	ND	1.6	ND	ND	ND	2.2	ND	ND
Ethylbenzene	5	1	ND	410(2)	570	2.5	ND	25	120	19	4.7	ND
Xylene (Total)	5	1	ND	871.7(2)	1300	ND	ND	50	100	37	6.3	ND

Abbreviations:

DWQS - Drinking Water Quality Standard
NA - Not Analyzed
ND - Not Detected
µg/L - micrograms per liter
VOCs - Volatile Organic Compounds

Notes:

1. NYDWQS - New York Drinking Water Quality Standards and Guidance Values, June 1998.
2. Estimated value. Amount detected exceeds range.
3. Detection limit - 1.0 mg/L
4. Detection limit - 50 mg/L

▨ 38 Indicates concentration has exceeded State regulatory limit.

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from Aneptek, 1999

TABLE 5-1 (Continued)
ANALYTICAL RESULTS - SITE 15
GEOPROBE GAS CHROMATOGRAPH SCREENING RESULTS
HANCOCK AIR NATIONAL GUARD BASE
SYRACUSE, NEW YORK

PARAMETER	NEW YORK DWQS(1)	DETECTION LIMITS	GP-11(4)	GP-12(4)	GP-13(2)	GP-14(3)	GP-15	GP-17(4)	GP-18	GP-20	GP-21	GP-22
VOCs (μg/L)												
Vinyl Chloride	2	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	1	1	ND	510	46	250	9.9	ND	ND	ND	ND	ND
Toluene	5	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.3
Ethylbenzene	5	1	790	350	ND	150	3.7	480	1.8	ND	ND	11
Xylene (Total)	5	1	2760	800	ND	505	4.9	1400	3.8	ND	ND	9.2

Abbreviations:

DWQS - Drinking Water Quality Standard
ND - Not Detected
μg/L - micrograms per liter
VOCs - Volatile Organic Compounds

Notes:

1. NYDWQS - New York Drinking Water Quality Standards and Guidance Values, June 1998.
2. Detection limit - 5 μg/L
3. Detection limit - 20 μg/L
4. Detection limit - 50 μg/L

▨ 510 Indicates concentration has exceeded State regulatory limit.

TABLE 5-2
ANALYTICAL RESULTS - SITE 15
MONITORING WELL GAS CHROMATOGRAPH SCREENING RESULTS
HANCOCK AIR NATIONAL GUARD BASE
SYRACUSE, NEW YORK

PARAMETER	NEW YORK DWQS(1)	DETECTION LIMITS	MW-02(3)	MW-03(2)	MW-04	MW-05(3)	MW-5R	MW-6D	MW-08	MW-09	MW-9B
VOCs (μg/L)											
Vinyl Chloride	2	1	ND	ND	ND	ND	ND	ND	1	ND	ND
Benzene	1	1	ND	62	ND	ND	ND	ND	ND	ND	ND
Toluene	5	1	ND	ND	ND	320	ND	ND	ND	ND	ND
Ethylbenzene	5	1	230	ND	ND	ND	ND	ND	ND	ND	ND
Xylene (Total)	5	1	630	ND	ND	ND	ND	ND	ND	ND	ND

Abbreviations:

DWQS - Drinking Water Quality Standard
ND - Not Detected
μg/L - micrograms per liter
VOCs - Volatile Organic Compounds

Notes:

1. NYDWQS - New York Drinking Water Quality Standards and Guidance Values, June 1998.
2. Detection limit - 5 μg/L
3. Detection limit - 50 μg/L

▨ 62 Indicates concentration has exceeded State regulatory limit.

TABLE 5-2 (Continued)
ANALYTICAL RESULTS - SITE 15
MONITORING WELL GAS CHROMATOGRAPH SCREENING RESULTS
HANCOCK AIR NATIONAL GUARD BASE
SYRACUSE, NEW YORK

PARAMETER	NEW YORK DWQS(1)	DETECTION LIMITS	MW-11(2)	MW-12D	MW-12S(3)	MW-13	MW-14	MW-15(2)	MW-16	MW-17	RW-1
VOCs (μg/L)											
Vinyl Chloride	2	1	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	1	1	250	ND	ND	ND	14	400	ND	3.1	18
Toluene	5	1	ND	ND	ND	ND	ND	ND	ND	ND	6.3
Ethylbenzene	5	1	53	ND	1500	ND	3.1	390	ND	49	40
Xylene (Total)	5	1	170	ND	5900	ND	ND	790	ND	7.7	140

Abbreviations:

DWQS - Drinking Water Quality Standard

ND - Not Detected

μg/L - micrograms per liter

VOCs - Volatile Organic Compounds

Notes:

1. NYDWQS - New York Drinking Water Quality Standards and Guidance Values, June 1998.
2. Detection limit - 10 μg/L
3. Detection limit - 500 μg/L

▨ 250 Indicates concentration has exceeded State regulatory limit.

TABLE 5-3
GROUNDWATER ANALYTICAL RESULTS - SITE 15 (May, 1998)
HANCOCK AIR NATIONAL GUARD BASE
SYRACUSE, NEW YORK

PARAMETER	NEW YORK DWQS[1]	DETECTION LIMITS	MW-14	MW-15	MW-16	MW-17
TCL VOCs (µg/L)						
Benzene	1	0.2	9.8	135	ND	0.6
Bromodichloromethane	50	0.5	ND	ND	ND	0.6
sec-Butlylbenzene	5	0.5	ND	ND	ND	1.2
Chlorodibromomethane	NL	0.5	ND	ND	ND	1
Chloroform	7	0.5	1	0.7	1.8	3
cis-1,2-Dichloroethylene	5	0.5	ND	1	1	ND
Ethylbenzene	5	0.5	ND	6.9	ND	1.9
Isopropylbenzene	5	0.5	ND	1.9	ND	ND
Methyl Tert-Butyl Ether (MTBE)	NL	0.5	ND	5.5	ND	ND
1,2,4-Trimethylbenzene	5	0.5	ND	0.6	ND	ND

Abbreviations:

DWQS - Drinking Water Quality Standard

µg/L - micrograms per liter

ND - Not Detected

NL - Not Listed

VOCs - Volatile Organic Compounds

Notes:

1. NYDWQS - New York Drinking Water Quality Standards and Guidance Values, June 1998.

0.69 Indicates concentration has exceeded State regulatory limit.

TABLE 5-4
GROUNDWATER ANALYTICAL RESULTS - SITE 15 (September, 1999)
HANCOCK AIR NATIONAL GUARD BASE
SYRACUSE, NEW YORK

PARAMETER	NEW YORK DWQS(1)	DETECTION LIMITS	MW-18	MW-19	MW-29(2)	MW-20
TCL VOCs (µg/L)						
Methylene Chloride	5	3	<3	34	<15(3)	5
Acetone	50	10	<10	230	<50(3)	<10
Ethylbenzene	5	3	<3	410	440	<3
Xylene (Total)	5	3	<3	630	640	<3
TCL SVOCs (µg/L)						
n-Nitrosodi-n-propylamine	NL	5	<5	<5	<5	26
Naphthalene	10	5	<5	17	16	<5
TPH (mg/L)	5	NA	ND	ND	ND	ND
PCBs (µg/L)	0.09	0.05	<0.05	<0.05	<0.05	<0.05
METALS (mg/L)						
Arsenic	25	0.001	0.005	0.035	0.038	0.015
Beryllium	3	0.005	<0.005	<0.005	<0.005	<0.005
Cadmium	5	0.005	<.005	0.009	0.006	<.005
Chromium	50	0.05	<.05	0.06	<.05	<.05
Copper	200	0.02	0.04	0.33	0.25	0.04
Lead	25	0.001	0.013	0.051	0.041	0.008
Nickel	100	0.03	0.05	0.11	0.08	0.03
Silver	50	0.05	<.05	0.05	<.05	<.05
Thallium	0.05	0.003	<0.003	<0.003	<0.003	<0.003
Zinc	2000	0.01	0.06	0.15	0.13	0.17

Abbreviations:

DWQS - Drinking Water Quality Standard
mg/L milligrams per liter
µg/L - micrograms per liter
NA – Not Applicable
ND - Not Detected
NL - Not Listed
PCBs - Poly Chlorinated Byphenyls
SVOCs - Semi-Volatile Organic Compounds
TPH - Total Petroleum Hydrocarbons
VOCs - Volatile Organic Compounds

Notes:

1. NYDWQS - New York Drinking Water Quality Standards and Guidance Values, June 1998.
2. MW-29 is a duplicate of MW-19
3. Presence of other target analyte(s) precludes lower detection limits.

▨ 0.69 Indicates concentration has exceeded State regulatory limit.

TABLE 5-5
GROUNDWATER ANALYTICAL RESULTS - SITE 15 (October, 1999)
HANCOCK AIR NATIONAL GUARD BASE
SYRACUSE, NEW YORK

PARAMETER	NEW YORK DWQS(1)	DETECTION LIMITS	MW-18	MW-19	MW-20	MW-20D(2)
TCL VOCs (µg/L)						
Methylene Chloride	5	3	<3	<30(3)	5	<3
Acetone	50	10	<10	<100(3)	<10	<10
Ethylbenzene	5	3	<3	460	<3	<3
Xylene (Total)	5	3	<3	780	<3	<3
TCL SVOCs (µg/L)						
n-Nitrosodi-n-propylamine	NL	5	<5	<5	<5	<5
Naphthalene	10	5	<5	26	<5	<5
TPH (mg/L)	5	NA	ND	ND	ND	ND
PCBs (µg/L)	0.09	0.05	<.05	<.05	<.05	<.05
METALS (mg/L)						
Arsenic	25	0.001	<.001	0.022	0.016	0.016
Beryllium	3	0.005	0.007	<.005	<.005	<.005
Cadmium	5	0.005	0.011	0.008	0.006	0.005
Chromium	50	0.05	<.05	0.06	<.05	<.05
Copper	200	0.02	0.09	0.18	0.07	0.05
Lead	25	0.001	0.004	0.018	0.007	0.007
Nickel	100	0.03	0.08	0.08	0.05	0.04
Silver	50	0.05	0.06	<.05	<.05	<.05
Thallium	0.05	0.003	0.004	<0.003	<0.003	<0.003
Zinc	2000	0.01	0.21	0.59	0.14	0.15

Abbreviations:

DWQS - Drinking Water Quality Standard
mg/L milligrams per liter
µg/L - micrograms per liter
NA – Not Applicable
ND - Not Detected
NL - Not Listed
PCBs - Poly Chlorinated Byphenyls
SVOCs - Semi-Volatile Organic Compounds
TPH - Total Petroleum Hydrocarbons
VOCs - Volatile Organic Compounds

Notes:

1. NYDWQS - New York Drinking Water Quality Standards and Guidance Values, June 1998.
2. MW-20D is a duplicate of MW-20.
3. Presence of other target analyte(s) precludes lower detection limits.

▨ 0.69 Indicates concentration has exceeded State regulatory limit.

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TABLE 5-6
GROUNDWATER ANALYTICAL RESULTS, PCB'S - SITE 15
GEOPROBE/MONITORING WELL LOCATINS
HANCOCK AIR NATIONAL GUARD BASE
SYRACUSE, NEW YORK

PARAMETER	NEW YORK DWQS(1)	DETECTION LIMITS	GP-14	GP-15	MW-02	MW-6S(2)
PCBs (µg/L)						
Aroclor 1260	0.09	0.05	0.69	<.05	0.062	810

Abbreviations:

DWQS - Drinking Water Quality Standard

µg/L - microgram per liter

Notes:

1. NYDWQS - New York Drinking Water Quality Standards and Guidance Values, June 1998.
2. Detection limit - 50 µg/L

0.69 Indicates concentration has exceeded State regulatory limit.

TABLE 5-7
GROUNDWATER ANALYTICAL RESULTS, VOC'S - SITE 15
GEOPROBE LOCATIONS
HANCOCK AIR NATIONAL GUARD BASE
SYRACUSE, NEW YORK

PARAMETER	NEW YORK DWQS[1]	DETECTION LIMITS	GP-19	GP-23	GP-24
VOCs (μg/L)					
Benzene	1	0.5	**21**	<0.5	<0.5
Ethylbenzene	5	0.5	**74**	<0.5	<0.5
Xylene (Total)	5	0.5	**95**	<0.5	1.3
Isopropylbenzene	5	0.5	**29**	<0.5	<0.05
n-Propylbenzene	5	0.5	**26**	<0.5	<0.5
p-Isopropyltoluene	5	0.5	**7**	<0.5	<0.5
1,2,4-Trimethylbenzene	5	0.5	**96**	<0.5	<0.5
1,3,5-Trimethylbenzene	5	0.5	**180**	<0.5	<0.5
n-Butylbenzene	5	0.5	**43**	<0.5	<0.5
sec-Butylbenzene	5	0.5	**8**	<0.5	<0.5

Abbreviations:

DWQS - Drinking Water Quality Standard
μg/L - micrograms per liter
VOCs - Volatile Organic Compounds

Notes:

1. NYDWQS - New York Drinking Water Quality Standards and Guidance Values, June 1998.

0.69 Indicates concentration has exceeded State regulatory limit.

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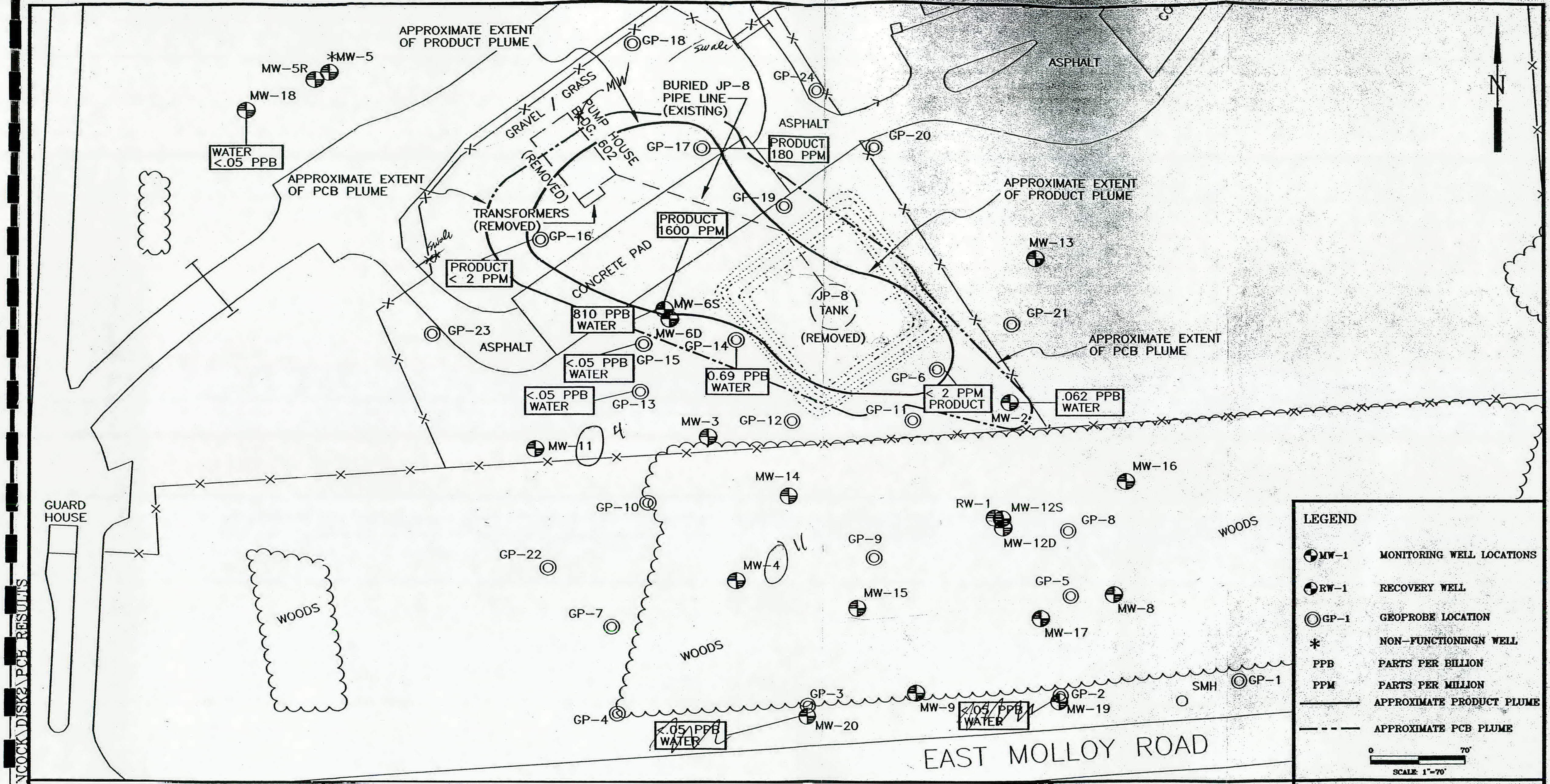
TABLE 5-8
FREE PRODUCT ANALYTICAL RESULTS, PCB'S - SITE 15
GEOPROBE/MONITORING WELL LOCATIONS
HANCOCK AIR NATIONAL GUARD BASE
SYRACUSE, NEW YORK

PARAMETER	DETECTION LIMITS	GP-6	GP-16	GP-17	MW-6S
PCBs (mg/kg)					
Aroclor 1260	2	<2	<2	180	1,600

Abbreviations:

mg/kg - milligrams per kilogram

PCBS - Poly Chlorinated Biphenyls



HANCOCK AIR NATIONAL GUARD BASE – SITE 15
CONTAMINANT DISTRIBUTION–PCB's
GROUNDWATER/FREE PRODUCT
SYRACUSE, NEW YORK

ANEPTEK CORPORATION
Analytic, Environmental and Process Technologies

FIGURE: 5–2

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~~* Baildown test locations (proposed)~~